



GreenApple Canada 2007
SMART Transportation
Ranking Report
Methodology



Appendix A: Data methodology for CO₂ emissions per capita (tonnes) from retail fuel sales (2005).

Rationale

1. Anthropogenic greenhouse gas emissions need to be reduced in order to prevent changes in the Earth's climate that would irreparably and adversely alter human habitats and economies (Environment Canada, 2006a). In the period from 1951 to 1996, global carbon dioxide emissions grew almost fourfold (Environment Canada, 2006c). The transportation sector produces greenhouse gas emissions as the result of the burning of fossil fuels. (Environment Canada, 2006b) As a result, we measure the carbon dioxide emissions from the road transportation sector in order to compare the census metropolitan areas (CMAs).

2. We measure carbon dioxide emissions using independently observable data – gasoline sales per capita for each CMA. We chose not to use estimations derived from models which are based on assumptions that by their nature cannot be independently verified.

Caveats

3. We understand that there is an important limitation to the usefulness of our data. By capturing the per capita figure, we ignore total CO₂ emissions from retail gas and diesel sales. In future years, it could well be that the total figures are increasing due to an increasing population while the per capita figure is falling, particularly if there was a significant increase in the percent of the population under the age of 16. We will adjust our index in future years to measure total emissions.

4. Demand for gasoline is not perfectly inelastic. We believe that municipalities can lobby senior levels of government for gasoline taxing authority at the regional level: this would have the effect of allowing municipalities to price gasoline so as to reflect the externalities it causes with regard to the environment: a higher price, will, all other things being equal, cause gasoline demand to fall. We will attempt to devise in later versions of this index a measure of whether or not CMAs or some of their component municipalities have such a taxing authority.

Sources of data

5. We use retail gasoline and diesel sales volumes in liters for the calendar year 2005 collected by Kent Marketing Services Limited, London, ON, for stations located in each of the 27 census metropolitan areas [1]. We included in the data the ethanol blended gasoline; because ethanol constitutes at most 10% of this blend, and because most no market has more than 20% ethanol blended gasoline, only 2% at most of the gasoline sold is itself ethanol [1]. Most CMAs have no to little ethanol blend [1].

6. Stations were mapped to ensure conformity with the Statistics Canada definition of component municipalities for each CMA [3] (Statistics Canada, 2007a-d, 2007f-n, 2007p-r, 2007t, 2007v-ae).

7. Data include sales volumes at all retail gasoline and diesel fuel stations which were monitored by Kent Marketing Services Limited and which were located within the 2006 census metropolitan area component municipalities for each of the 27 CMAs included in our study [2]. Data for non-cooperating stations are estimated based on trends and prior data [2].

8. The data include figures only for those stations located within municipalities within a census metropolitan area that are significant to the local retail gasoline and diesel markets. Stations located within municipalities that are insignificant in this manner are not included. For some CMAs, this will mean that the municipalities covered constitute a perfect match to the component list of municipalities provided by Statistics Canada; in other CMAs, this will mean that some low-volume markets are not included [3].

9. Stations which lie slightly outside a municipal boundary defining the CMA but which have a competitive effect on the marketplace may be included [4].

10. We converted the carbon dioxide conversion factors per gallon of fuel burned

for both diesel and gasoline from gallons to litres (Environmental Protection Agency, 2007) (Natural Resources Canada, 2006a). We multiplied total litres of retail diesel and gasoline sold in each CMA by the conversion factor in litres. We divided the product by 1000 to obtain the amount in metric tonnes. This figure applies equally to Canada because Natural Resources Canada provides similar conversion factors.

11. We adjusted the tonnes of carbon dioxide in each CMA by the CMA's population to obtain the per capita amount (Statistics Canada, 2007).

Assignment of normalized scores

12. For relative rankings, we assigned the CMA with the lowest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$[\text{MIN}/\text{CMA}(i)] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

MIN = the minimum value among the 27 observed values.

13. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$[\text{IDEAL}/\text{CMA}(i)] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

IDEAL = the ideal level as described in the following paragraph

1. The ideal level is set to 25.5% of the lowest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006d). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol. (Environment Canada, 2006e). We believe that this magnitude of change represents an appropriate and attainable goal for the reduction of CO₂ emissions from retail fuel sales within a CMA when contemplating a 10 year timeframe.

Data verification

14. To verify that the mapping performed by Kent was accurate, we obtained from Kent a listing of the stations whose sales volumes it monitors in the cities of Richmond, BC and Surrey, BC [5]. We compared the listing to the list of business licensed by the cities of Richmond and Surrey in a variety of categories relating to gasoline sales; e.g. gasoline stores and convenience stores [6] [7] (City of Surrey, 2007). We furthermore compared the listing of stations in Richmond, BC in the Kent database with the list of business in Richmond, BC advertising at yellowpages.ca under the 'gasoline' category (Yellow Pages Group Company, 2007). In all of the three cases, we found no stations in the city license and yellow pages listings that were not also included in the Kent Directory. In all cases, the Kent listing included a significant number of stations not included in these listings; the reason for the additional entries in the Kent Directory may be that some business owners failed to keep their annual registrations current [7].

Works Cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable Sources

City of Surrey. (date unknown). Business Directory. Surrey: City of Surrey. Retrieved March, 2007, from http://www.surrey.ca/SurreyCMSCity/Surrey%20NET%20Template%20Files/Bus_Directory_Search_v2.aspx?NRMODE=Public&NRORIGINALURL=%2fInside%2bCity%2bHall%2f0n-line%2bServices%2fbus%2bdir%2bsearch&NRNODEGUID=%7b93B59FF0-DD9F-49E0-B564-F9D8E42B6F20%7d&NRCACHEINT=Guest

Environment Canada. (2006a, November 18). Why do we need to reduce greenhouse gas emissions? Retrieved September 3, 2007, from

http://www.ec.gc.ca/pdb/ghg/about/faq_e.cfm#reduce

Environment Canada. (2006b, November 18). What emissions result from Transportation? Retrieved September 3, 2007, from

http://www.ec.gc.ca/pdb/ghg/about/faq_e.cfm#transportation

Environment Canada. (2006c, November 17). Greenhouse Gases: Carbon dioxide. Retrieved September 3, 2007, from

http://www.ec.gc.ca/pdb/ghg/about/gases_e.cfm

Environment Canada. (2006d, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from

http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006e, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Environmental Protection Agency, Office of Transportation and Air Quality. (2007). Calculating CO₂ emissions. Retrieved April 26, 2007, from <http://www.epa.gov/otaq/climate/420f05001.htm#calculating>

Natural Resources Canada, Office of Energy Efficiency. (2006a, February 28). Conversion: L/100 km, mi./gal. and km/L. Retrieved April 26, 2007, from <http://oeenrncan.gc.ca/publications/transportation/fuel-guide/2004/conversion.cfm>

Natural Resources Canada, Office of Energy Efficiency. (2006b). Fuel Consumption Guide 2007. Ottawa: Minister of Natural Resources. Retrieved May, 2007 from: <http://oeenrncan.gc.ca/transportation/tools/fuel-consumption-guide/pdf/fuel-consumption-guide-2007.pdf>

Statistics Canada. (2007, March 29). Table 3: Population of census metropolitan areas in 2006. Ottawa. Retrieved April 26, 2007 from <http://www12.statcan.ca/english/census06/analysis/popdwell/tables/table3.htm>

Yellow Pages Group Company. (2007). YellowPages™: Richmond, BC gasoline, Complete Business Listings. Retrieved March, 2007, from <http://www.yellowpages.ca/search/?styp=si>

Appendix B: Data methodology for CO parts per million, median of daily maximum one-hour averages (2005).

Rationale

1. Ambient air concentrations of carbon monoxide can have deleterious effects on human health (Health Canada, 2006a). A notable source of outdoors anthropological carbon monoxide emissions is road transportation, which accounts for as much as 67% of national carbon monoxide emissions (Health Canada, 2006a). We measured ambient levels of carbon monoxide concentrations in each of the 27 census metropolitan areas (CMAs) included in our study to determine if concentrations were less than desirable (Health Canada, 2006b).

Sources of data

2. We obtained from Environment Canada the most current listing of all stations in the National Air Pollution Surveillance Network (NAPS) [1]. We examined each station on the list to see if it was sited within the 2006 geographical boundaries of one of the 27 census metropolitan areas (CMAs) using the following methodology.

3. We queried the Statistics Canada list of census metropolitan area component municipalities for the city name assigned to each the stations in the NAPS listing of stations (Statistics Canada, 2006a) (Statistics Canada, 2006b) (Statistics Canada, 2006c) (Statistics Canada, 2006d) (Statistics Canada, 2006e) (Statistics Canada, 2006f) (Statistics Canada, 2006g) (Statistics Canada, 2006h) (Statistics Canada, 2006i) (Statistics Canada, 2006j) (Statistics Canada, 2006k) (Statistics Canada, 2006l) (Statistics Canada, 2006m) (Statistics Canada, 2006n) (Statistics Canada, 2006o) (Statistics Canada, 2006p) (Statistics Canada, 2006q) (Statistics Canada, 2006r) (Statistics Canada, 2006s) (Statistics Canada, 2006t) (Statistics Canada, 2006u) (Statistics Canada, 2006v) (Statistics Canada, 2006w) (Statistics Canada, 2006x) (Statistics Canada, 2006y) (Statistics Canada, 2006z) (Statistics Canada, 2006aa) (Statistics Canada, 2006ab) (Statistics Canada, 2006ac) (Statistics Canada, 2006ad) (Statistics Canada, 2006ae) (Statistics Canada, 2006af). If there was a match, we deemed the station to lie within the CMA in question.

4. If the city name matched the name of the namesake city of one of the six census metropolitan areas not included in our study, we excluded the station. CMAs not included in our study were Saint John, Trois-Rivières, Peterborough, Brantford, Guelph and Thunder Bay (Statistics Canada, 2007af). We excluded these CMAs because their populations fall below our threshold of 150,000. We include the CMA of Moncton because no CMA in New Brunswick meets this threshold; Moncton is the largest New Brunswick CMA by 2006 population.

5. For stations whose city name as listed in the NAPS listing of stations found no match using the methodologies described in the preceding two paragraphs, we queried <http://www.mapquest.com> for the station's location using its longitude and latitude coordinates as listed in the NAPS listing of stations. We compared the location of the station with the census map for the census metropolitan area in question.

6. We furthermore searched a 1996 listing of NAPS stations to identify old stations situated within the 2006 geographical boundaries of the 27 census metropolitan areas which were not included on the 2007 listing of stations. This allowed us to determine if relevant older stations existed in the case that we needed to obtain data for prior years should data from existing stations not be available [2].

7. Using the list of stations devised through the methodology above, we queried the NAPS database for all 2005 one-hour average CO readings for all relevant stations within the network (Environment Canada, 2007b). We note that the publicly available NAPS data which we have reproduced with permission (Environment Canada, 2007a) (Environment Canada, 2001) is not yet quality assured; quality assurance is an on-going process [6] [7].

8. We identified for every relevant station the maximum observed one-hour average value for each day in 2005 (or for the days in 2005 for which data were available, where only partial data were available). We then obtained the median of these data for every station. We then identified the highest median among all stations situated within the geographic boundaries of a given CMA. We report this value as an ambient air mixing ratio, that is, in parts per million.

9. Table A1 shows the NAPS station identification number for the stations whose median maximum daily one-hour averages were used.

10. We note that no stations collecting CO data were situated in the CMAs of Sherbrooke, Saguenay and Kingston. We verified with the Ontario Ministry of the Environment and with the Québec Ministère du Développement durable, de l'Environnement et des Parcs that no stations existed in these areas due to a lack of need to monitor CO concentrations, which are presumed by both provincial governments to be very low in these areas [3] [4]. For the CMAs of Sherbrooke and Saguenay, we assigned the minimum value observed among the remaining 24 stations. For the city of Kingston, we assigned a value for the year 2004 for station located in Belleville, ON.

Assignment of normalized scores

11. For both ideal and relative normalized scores, we compared each of the 27 values reported and the maximum desirable level of 5 parts per million suggested by Health Canada (Health Canada, 2006b). Any value that fell below this threshold was assigned a score of 100 points on both the relative index and the ideal index. All reported values fell well below 5 parts per million.

Data verification

12. In order to verify the selection of stations used in our study, we utilized ArcView GIS to plot the 2007 and 1996 NAPS stations on a Census 2006 CMA map of Canada. We obtained the Digital boundary files (DBF) for the CMAs in Canada from Statistics Canada (Statistics Canada, 2006a). An alternative to the Digital boundary file, the Cartographic boundary file (CBF), does not include water bodies that may be a part of a CMA [5] (Statistics Canada, 2006b); as a consequence, the use of the DBF ensured that the mapping for a CMA included any stations located on or at the edge of a body of water.

13. Using the Universal Transverse Mercator (UTM) projection in ArcView GIS we plotted both lists of NAPS stations from 1996 and 2007 onto the CMA boundary file. Analyzing the 2007 stations by province, we eliminated those stations that did not reside in the selected CMAs for our study. Following this step, we compared our exclusion list of 2007 stations with the 1996 list to eliminate replicate stations. We then analyzed the remaining 1996 stations within ArcView GIS to verify whether the former stations had resided in the selected CMAs for our study. This process produced a conclusive list of 1996 and 2007 stations that were not utilized in our study.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Environment Canada. (2007a, August 31). The page you are seeking has changed. Retrieved September 13, 2007 from http://www.ec.gc.ca/default.asp?Error404=4C558CE5-F829-4130-AE2A-D52E7896B29C?404;http://www.ec.gc.ca/copy_e.html

Environment Canada, National Air Pollution Surveillance Network. (2007b, April 12). [CO Hourly Data for 2005] [Data file]. Available from National Air Pollution Surveillance Network website, http://www.etc-cte.ec.gc.ca/napsdata/main.aspx?dir=C%3a%5cWebsite%5cRiver%5cnapsdata%5cDATA%5c2005\co%2ccoh%2cno%2co3%2cpm25%2cpm10%2cso2_Hourly_Data

Health Canada. (2006a, March 3). Exposure to Carbon Monoxide. Retrieved September 4, 2007, from http://www.hc-sc.gc.ca/ewh-semt/pubs/air/naaq-onqaa/carbon-monoxide-carbone/index_e.html#3

Health Canada. (2006b, March 3) Exposure to Carbon Monoxide. Retrieved September 9, 2007, from http://www.hc-sc.gc.ca/ewh-semt/pubs/air/naaq-onqaa/carbon-monoxide-carbone/index_e.html#6

Statistics Canada. (2007a, March 13). St. John's, Newfoundland and Labrador (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007b, March 13). Halifax, Nova Scotia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007c, March 13). Moncton, New Brunswick (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007d, March 13). Montréal, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007e, March 13). Trois-Rivières, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007f, March 13). Sherbrooke, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007g, March 13). Saguenay, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007h, March 13). London, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007i, March 13). Windsor, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007j, March 13). Barrie, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007k, March 13). Hamilton, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007l, March 13). Ottawa-Gatineau, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007m, March 13). St. Catharines-Niagara, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007n, March 13). Toronto, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007o, March 13). Peterborough, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007p, March 13). Winnipeg, Manitoba (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007q, March 13). Regina, Saskatchewan (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007r, March 13). Saskatoon, Saskatchewan (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007s, March 13). Guelph, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007t, March 13). Greater Sudbury, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007u, March 13). Thunder Bay, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007v, March 13). Edmonton, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007w, March 13). Calgary, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007x, March 13). Abbotsford, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007y, March 13). Kelowna, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007z, March 13). Vancouver, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007aa, March 13). Victoria, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007ab, March 13). Québec, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007ac, March 13). Kingston, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007ad, March 13). Oshawa, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007ae, March 13). Kitchener, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007af, March 13). Population and dwelling counts, for census metropolitan areas, 2006 and 2001 censuses - 100% data. Retrieved March, 2007, from <http://www12.statcan.ca/english/census06/data/popdwel/Table.cfm?T=205&RPP=50>

Statistics Canada. (2006a). Census metropolitan areas and census agglomerations, 2006 Census (digital boundary file, gcma000a06a_e.zip). Arc Info Edition. System requirements: Arc Info Interchange for Windows. Retrieved August 15, 2007 from http://geodepot.statcan.ca/Diss2006/DataProducts/BoundaryFiles_e.jsp?language=E&format=A&fileType=CBF&geography=CMA&Agreed=Yes&fileName=http%3A%2F%2Fgeodepot.statcan.ca%2FDiss2006%2FTigerCan%2FArcInfo%2FDBF%2FNational%2FCMA-RMR%2Fgcma000a06a_e.zip#lang

Statistics Canada. (2006b). Census metropolitan areas and census agglomerations, 2006 Census (cartographic boundary file, gcma000b06a_e.zip). Arc Info Edition. System requirements: Arc Info Interchange for Windows. Retrieved August 15, 2007 from http://geodepot.statcan.ca/Diss2006/DataProducts/BoundaryFiles_e.jsp?language=E&format=A&fileType=CBF&geography=CMA&Agreed=Yes&fileName=http%3A%2F%2Fgeodepot.statcan.ca%2FDiss2006%2FTigerCan%2FArcInfo%2FDBF%2FNational%2FCMA-RMR%2Fgcma000a06a_e.zip#lang

Appendix C: Data methodology for O₃ parts per billion, median of daily maximum eight-hour averages (2005).

Rationale

1. Ambient air concentrations of ground-level ozone have demonstrable and deleterious effects on human health. (Environment Canada, 2002) There is no level of ozone at which we can say definitively that human health is unaffected by it. (Environment Canada, 2002) Ozone is a secondary pollutant formed by photochemical processes which combine volatile organic compounds and nitrogen oxide. (Health Canada, 2006) Transportation is a significant anthropological source of both volatile organic compounds and nitrogen oxide. (Health Canada, 2006) We therefore measured ambient levels of ozone concentrations in each of the 27 census metropolitan areas (CMAs) included in our study to determine the level of concentrations in each.

Caveats

2. Minimum ozone values are problematic because the North American observed ozone backgrounds are rising due to anthropogenic sources. (Vingarzan, 2004) As background levels rise, our relative ranked scores will continue to assign a high score to the cities with the lowest values, even though all values are higher than in previous years.
3. CMAs in the Windsor-Québec corridor and the Maritimes are subject to ozone formation caused by precursors emitted outside national boundaries; that is, from sources in the United States (Environment Canada, 2002). This causes an elevation of readings that is beyond the immediate control of local authorities. We believe that local authorities have a role to play in pressuring senior levels of government to bring to bear a political resolution to this adverse state of atmospheric conditions.
4. The Lower Fraser Valley in which Abbotsford CMA and parts of Vancouver CMA are situated is subject to unique geographical characteristics that encourage the formation of ozone. These characteristics will influence the ozone readings for Abbotsford and Vancouver CMAs.
5. CMAs near marine ports will be subjected to larger volumes of ozone precursor emissions as will CMAs which are heavily industrialized.
6. While industrial, marine and trans-border sources of ozone precursor emissions are significant, we cannot easily adjust for these due to the non-linear relationship between ozone and its precursor emissions [5].
7. Because emissions from road vehicles contain significant amounts of nitric oxide (NO) and because NO combines with ozone (O₃) to form nitrogen dioxide (NO₂), an ozone titration phenomenon occurs as a result; this phenomenon effectively results in low ozone levels in urban areas [4]. Because we identified all stations located within a CMA and not just those within its urban core, we may have partially remedied this problem by including stations sufficiently removed from the urban center so as to be less affected by this phenomenon. However, some CMAs have only one station each and, as a result, these may appear to have lower figures than would a CMA with stations located in the outer reaches of the CMA's geographic boundaries and therefore less affected by the ozone titration effect.
8. Ozone formation depends in part on photochemical processes. (Environment Canada, 2005) We attempted to correct for the photochemical effects that are necessary to induce ozone formation by restricting our observations to the period from May 1, 2005 to September 30, 2005 inclusive.
9. Dilution factors measure the volume of atmospheric space at given times and seasons in which air pollution may be dispersed; the higher is a dilution factor, the more there is atmospheric space in which a given level of pollution may be dispersed. The CMAs included in our study are subject to different dilution factors and this will influence the data [7].

10. In later iterations of this index, we will report the number of exceedences of a standard as opposed to the observed ambient concentrations reported.

Sources of data

11. We obtained from Environment Canada the most current list of all stations in the National Air Pollution Surveillance Network (NAPS). [1] We examined each station on the list to see if it was sited within the 2006 geographical boundaries of one of the 27 census metropolitan areas (CMAs) using the following methodology.
12. We queried the Statistics Canada list of census metropolitan area component municipalities for the city name assigned to each the stations in the NAPS listing of stations. (Statistics Canada, 2007a) (Statistics Canada, 2007b) (Statistics Canada, 2007c) (Statistics Canada, 2007d) (Statistics Canada, 2007e) (Statistics Canada, 2007f) (Statistics Canada, 2007g) (Statistics Canada, 2007h) (Statistics Canada, 2007i) (Statistics Canada, 2007j) (Statistics Canada, 2007k) (Statistics Canada, 2007l) (Statistics Canada, 2007m) (Statistics Canada, 2007n) (Statistics Canada, 2007o) (Statistics Canada, 2007p) (Statistics Canada, 2007q) (Statistics Canada, 2007r) (Statistics Canada, 2007s) (Statistics Canada, 2007t) (Statistics Canada, 2007u) (Statistics Canada, 2007v) (Statistics Canada, 2007w) (Statistics Canada, 2007x) (Statistics Canada, 2007y) (Statistics Canada, 2007z) (Statistics Canada, 2007aa) (Statistics Canada, 2007ab) (Statistics Canada, 2007ac) (Statistics Canada, 2007ad) (Statistics Canada, 2007ae) (Statistics Canada, 2007af) If there was a match, we deemed the station to lie within the CMA in question.
13. If the city name matched the name of the namesake city of one of the six census metropolitan areas not included in our study, we excluded the station. CMAs not included in our study were Saint John, Trois-Rivières, Peterborough, Brantford, Guelph and Thunder Bay. (Statistics Canada, 2007af) We excluded these CMAs because their populations fall below our threshold of 150,000. We include the CMA of Moncton because no CMA in New Brunswick meets this threshold; Moncton is the largest New Brunswick CMA by 2006 population.
14. For stations whose city name as listed in the NAPS listing of stations found no match using the methodologies described in the preceding two paragraphs, we queried Mapquest.com for the station's location using its longitude and latitude coordinates as listed in the NAPS listing of stations. We compared the location of the station with the census map for the census metropolitan area in question.
15. We furthermore searched a 1996 listing of NAPS stations to identify old stations situated within the 2006 geographical boundaries of the 27 census metropolitan areas which were not included on the 2007 listing of stations. This allowed us to determine if relevant older stations existed in the case that we needed to obtain data for prior years should data from existing stations not be available [2].
16. Using the list of stations which lie within the 27 census metropolitan areas devised through the methodology above, we queried the NAPS database for all eight-hour average O₃ readings during the period May 1, 2005 to September 30, 2005 for all relevant stations within the network. (Environment Canada, 2007b) We note that the publicly available NAPS data which we have reproduced with permission (Environment Canada, 2007a) (Environment Canada, 2001) is not yet quality assured; quality assurance is an on-going process [8] [9].
17. We identified for every relevant station the maximum observed eight-hour average value for each day in the period described above (or for the days in the period for which data were available, if only partial data were available for the period). We then obtained the median of these data for every station located within a CMA. We then identified the highest median among all stations situated within the geographic boundaries of a given CMA. We report this value as an ambient air mixing ratio, that is, in parts per billion.
18. Table A2 shows the NAPS station identification number for the stations whose median maximum daily eight-hour averages were used.

Assignment of normalized scores

19. For both the relative and the ideal rankings, we assigned the CMA with the lowest observed value a normalized score of 100. Scores for all other CMAs are assigned on the basis of the following formula:

$$[\text{MIN}/\text{CMA}(i)] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

MIN = the minimum value among the 27 observed values.

20. Our approach is consistent with the fact that exposure to ground-level ozone has no known safe level and that human health reacts to ozone in a manner consistent with the dose-response relationship (Health Canada, 2002).

21. We further note that the minimum observed value in this case is 25.625 parts per billion is in fact approximately equal to the tropospheric background level for North America [6].

Data verification

22. In order to verify the selection of stations used in our study, we utilized ArcView GIS to plot the 2007 and 1996 NAPs stations on a Census 2006 CMA map of Canada. We obtained the Digital boundary files (DBF) for the CMAs in Canada from Statistics Canada (Statistics Canada, 2006a). An alternative to the Digital boundary file, the Cartographic boundary file (CBF), does not include water bodies that maybe a part of a CMA [3] (Statistics Canada, 2006b); as a consequence, the use of the DBF ensured that the mapping for a CMA included any stations located on or at the edge of a body of water.

23. Using the Universal Transverse Mercator (UTM) projection in ArcView GIS we plotted both lists of NAPs stations from 1996 and 2007 onto the CMA boundary file. Analyzing the 2007 stations by province, we eliminated those stations that did not reside in the selected CMAs for our study. Following this step, we compared our exclusion list of 2007 stations with the 1996 list to eliminate replicate stations. We then analyzed the remaining 1996 stations within ArcView GIS to verify whether the former stations had resided in the selected CMAs for our study. This process produced a conclusive list of 1996 and 2007 stations that were not utilized in our study.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Environment Canada. (2007a, August 31). The page you are seeking has changed. Retrieved September 13, 2007 from http://www.ec.gc.ca/default.asp?Error404=4C558CE5-F829-4130-AE2A-D52E7896B29C?404;http://www.ec.gc.ca/copy_e.html

Environment Canada, National Air Pollution Surveillance Network. (2007b, April 12). [CO Hourly Data for 2005] [Data file]. Available from National Air Pollution Surveillance Network website, http://www.etc-cte.ec.gc.ca/napsdata/main.aspx?dir=C%3a%5cWebsite%5cRiver%5cnapsdata%5cDATA%5c2005\co%2ccoh%2cno%2c3%2c2cpm25%2cpm10%2cso2_Hourly_Data

Environment Canada. (2005, January 13). Fraser Valley Smog: an indicator of potential air quality health risk. Retrieved September 9, 2007 from http://www.ecoinfo.org/env_ind/region/smog/smog_e.cfm

Environment Canada. (2002, December 19). Ground-Level Ozone: The Science. Retrieved September 9, 2007 from <https://www.ec.gc.ca/cleanair-airpur/CAOL/air/qual/ground.html#science>

Environment Canada. (2001). Important notices. Retrieved September 13, 2007 from http://www.etc-cte.ec.gc.ca/help/notice_e.html

Health Canada. (2006, March 7). National Ambient Air Quality Objectives For Ground-Level Ozone- Summary - Science Assessment Document. Retrieved September 9, 2007 from http://www.hc-sc.gc.ca/ewh-semt/pubs/air/naaqo-onqaa/ground_level_ozone_tropospherique/summary-sommaire/sources_e.html

Statistics Canada. (2007a, March 13). St. John's, Newfoundland and Labrador (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007b, March 13). Halifax, Nova Scotia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007c, March 13). Moncton, New Brunswick (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007d, March 13). Montréal, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007e, March 13). Trois-Rivières, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007f, March 13). Sherbrooke, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007g, March 13). Saguenay, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007h, March 13). London, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007i, March 13). Windsor, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007j, March 13). Barrie, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

- Statistics Canada. (2007k, March 13). Hamilton, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007l, March 13). Ottawa-Gatineau, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007m, March 13). St. Catherines-Niagara, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007n, March 13). Toronto, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007o, March 13). Peterborough, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007p, March 13). Winnipeg, Manitoba (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007q, March 13). Regina, Saskatchewan (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007r, March 13). Saskatoon, Saskatchewan (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007s, March 13). Guelph, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007t, March 13). Greater Sudbury, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007u, March 13). Thunder Bay, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007v, March 13). Edmonton, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007w, March 13). Calgary, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007x, March 13). Abbotsford, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007y, March 13). Kelowna, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007z, March 13). Vancouver, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007aa, March 13). Victoria, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007ab, March 13). Québec, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007ac, March 13). Kingston, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007ad, March 13). Oshawa, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007ae, March 13). Kitchener, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>
- Statistics Canada. (2007af, March 13). Population and dwelling counts, for census metropolitan areas, 2006 and 2001 censuses - 100% data. Retrieved March, 2007, from <http://www12.statcan.ca/english/census06/data/popdwel/Table.cfm?T=205&RPP=50>
- Statistics Canada. (2006a). Census metropolitan areas and census agglomerations, 2006 Census (digital boundary file, gcma000a06a_e.zip). Arc Info Edition. System requirements: Arc Info Interchange for Windows. Retrieved August 15, 2007 from http://geodepot.statcan.ca/Diss2006/DataProducts/BoundaryFiles_e.jsp?language=E&format=A&fileType=CBF&geography=CMA&Agreed=Yes&fileName=http%3A%2F%2Fgeodepot.statcan.ca%2FDiss2006%2FTigerCan%2FArcInfo%2FDBF%2FNational%2FCMA-RMR%2Fgcma000a06a_e.zip#lang
- Statistics Canada. (2006b). Census metropolitan areas and census agglomerations, 2006 Census (cartographic boundary file, gcma000b06a_e.zip). Arc Info Edition. System requirements: Arc Info Interchange for Windows. Retrieved August 15, 2007 from http://geodepot.statcan.ca/Diss2006/DataProducts/BoundaryFiles_e.jsp?language=E&format=A&fileType=CBF&geography=CMA&Agreed=Yes&fileName=http%3A%2F%2Fgeodepot.statcan.ca%2FDiss2006%2FTigerCan%2FArcInfo%2FDBF%2FNational%2FCMA-RMR%2Fgcma000a06a_e.zip#lang
- Vingarzan, R. Environment Canada. (2004, May 4). A review of surface ozone background levels and trends. (Abstract published on Environment Canada website). Abstract retrieved September 9, 2007 from http://www.ecoinfo.org/reports/reports_AS_1_e.cfm

Appendix D: Data methodology for the number of registered vehicles per capita in the CMA (2005).

Rationale

1. Vehicle registrations measure the number of vehicles within a CMA licensed by provincial authorities. As the number of vehicles registered increases, so too must the amount of space devoted to accommodating them; even a vehicle that is stored must be housed in a garage or on a parking lot. Space devoted to vehicles can reach as much as 42% in urban cores and 18% for greater metropolitan areas (Smith, 2005). Since a municipality's key functions include making land use decisions and to meet needs created by past land use decisions, we can use vehicle registration data to gauge the degree to which municipalities are effective in reducing the dependence on automobiles [5].

Source of data

2. The data were compiled by Statistics Canada from provincial motor vehicle registries and reflect vehicle registrations for 2005 by place name provided by the provinces [1][3]. The vehicle registrations includes only vehicles with a curb weight under 4500kg; curb weight refers to the weight of the vehicle without passengers or cargo [2]. Light trucks are included as well as taxis and propane cars; motorcycles, motor homes, trailers and construction equipment are not included [2]. If a sport utility vehicle (SUV) or light truck has a curb weight greater than 4500kg, it is not included [2].

3. For each of the 27 census metropolitan areas (CMAs), we queried the Statistics Canada vehicle registration database for the names of the municipalities which are listed by Statistics Canada as being component municipalities [3]. All results returned were added to the total number of registered vehicles for the CMA in question. When no results were returned, we assumed that vehicles in those municipalities are registered as being located in neighboring municipalities.

4. In Québec, a number of vehicle registrations in outlying areas provided by the provincial motor vehicle authority are not classified according to municipal name; instead, vehicle registrations for these communities are aggregated by forward sorting postal code. These forward sorting codes include communities that fall both within and without the census metropolitan area's 2006 geographic boundaries. Accordingly, we do exclude such vehicle registrations. This does not have a material impact upon the Montréal, Ottawa-Gatineau and Sherbrooke CMAs but it may lead to a material understatement of vehicle registrations in the Québec and Saguenay CMAs.

5. The provincial place names are not a perfect match to census place names [1]. As a result, we examined census maps for each of the 27 census metropolitan areas and reconciled these maps to those which show the locations of places names that do not appear on the census list of component municipalities for each CMA. When we identified such places as lying within the 2006 geographic boundaries of a census metropolitan area map, we queried the Statistics Canada vehicle registration database for the names of these places. We included any results with the vehicle registrations for the CMA's major namesake municipality.

6. We note that Statistics Canada assigns names to Indian reserves. These names may not reflect the name of the first nation situated on the reserve. For example, the Musqueam first nation in Vancouver CMA is not listed in the Statistics Canada 2005 vehicle registration database [3]. The Musqueam first nation is adjacent to the municipality of Vancouver (Greater Vancouver Regional District, n.d.). In British Columbia, the provincial vehicle registry uses Canada Post records to determine the place name associated with the vehicle and as a result vehicles registered as residing on the first nation of Musqueam appear in the provincial registry's records as being in Vancouver [4]. We believe that since there are no entries in the provincial vehicle registries for any of the Indian reserve names noted by Statistics Canada that it is reasonable to infer that all of these vehicles have been registered under the name of a neighboring community within the CMA.

7. In the paragraphs that follow, we describe specifically the results of our queries of the vehicle registration database for registrations recorded for place names which are not identified in the Statistics Canada list of component municipalities. We detail below how many such vehicle registrations were identified.

Victoria CMA

8. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass place names not listed on the 2006 census metropolitan area lists of component municipalities (Statistics Canada, 2007aa; 2006ae). We therefore include in the vehicle count for the city of Victoria the vehicle counts for the following place names whose locations which fall within the Victoria CMA 2006 geographic boundaries: Brentwood Bay [3] (Statistics Canada, 2007aa; 2006ae) (Mapquest, 2007a).

9. We note the following discrepancies between the list of component municipalities for the Victoria CMA and the information found in the motor vehicle registration database. There was no entry for Becher Bay 1 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Capital H (Part I) Regional electoral district, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Cole Bay 3 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for East Saanich 2 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Esquimalt Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Esquimalt District municipality, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Highlands District municipality, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Langford, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Metchosin, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for New Songhees Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Oak Bay, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Saanich municipality, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for South Saanich Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for T'Sou-ke 1 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for T'Sou-ke 2 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for View Royal, BC in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2007aa; 2006ae) (Mapquest, 2007a).

Vancouver CMA

10. We include in the vehicle count for the City of Vancouver the vehicles listed as being registered at the Vancouver International Airport, BC [3] (Statistics Canada, 2007z; 2006ab; 2006ad).

11. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass place names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle counts for the city of Vancouver the vehicle counts for the following place names whose locations which fall within the Vancouver census metropolitan area's 2006 geographic boundaries: Aldergrove and Fort Langley [3] (Statistics Canada, 2007z; 2006ab; 2006ad) (Mapquest, 2007b).

12. There was no entry for Barnston Island 3 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Burrard Inlet 3 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Capilano 5 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Coquitlam 1 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Greater Vancouver A Regional district electoral area, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Katzie 1 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Katzie 2 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Langley district municipality, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Langley 5 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for McMillan Island 6 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Mission 1 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Musqueam 2 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Musqueam 4 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for North Vancouver District municipality, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Semiahmoo Indian reserve, BC in the Statistics Canada 2005 vehicle registration database.

There was no entry for Tsawwassen Indian reserve, BC in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2006ab; 2006ad) (MapQuest, 2007b).

13. We note that an entry for Matsqui, BC exists within the Statistics Canada 2005 vehicle registration database and shows 41 vehicles registered; however, because we could not identify Matsqui on the map and because there are multiple Indian reserves with the name Matsqui located both inside and outside the census metropolitan area geographic boundaries, we exclude Matsqui, BC from the vehicle count in Vancouver CMA [3] (Statistics Canada, 2007z; 2006ab; 2006ad) (Mapquest, 2007b).

14. We include the entry for 10 vehicles in Whonnock, BC because the Indian reserves and the locality associated with this place-name are all situated within the boundaries of Vancouver CMA [3] (Statistics Canada, 2007z; 2006ab; 2006ad) (Mapquest, 2007b).

Abbotsford CMA

15. We were not able to identify any localities within Abbotsford CMA that were not already included in the Statistics Canada listing of component municipalities for Abbotsford CMA [3] (Statistics Canada, 2006ab; 2007x) (MapQuest, 2007c).

16. There was no entry for Fraser Valley H Regional district electoral area, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Upper Sumas, BC in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2007x).

17. We note that an entry for Matsqui, BC exists within the Statistics Canada 2005 vehicle registration database and shows 41 vehicles registered; however, because we could not identify Matsqui on the map [1] and because there are multiple Indian reserves with the name Matsqui located both inside and outside the census metropolitan area boundaries [2], we exclude Matsqui, BC from the vehicle count in Abbotsford CMA [3] (Statistics Canada, 2007x; 2006ab; 2006ad) (MapQuest, 2007c).

Kelowna CMA

18. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Kelowna the vehicle counts for the following place names whose locations fall within the Kelowna census metropolitan area's 2006 geographic boundaries: Oyama, Okanagan Center Winfield and Westbank [3] (Statistics Canada, 2007y; 2006ac) (Mapquest, 2007d).

19. There was no entry for Central Okanagan Regional district electoral area, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Central Okanagan J Regional district electoral area, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Duck Lake 7 Indian reserve, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Tsinstikeptum 9 Indian reserve, BC, BC in the Statistics Canada 2005 vehicle registration database. There was no entry for Tsinstikeptum 10 Indian Reserve, BC, in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2007y).

Calgary CMA

20. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Calgary the vehicle counts for the following place names whose locations fall within the Calgary census metropolitan area's 2006 geographic boundaries: Madden (186), Bragg Creek, Redwood Meadow, Dalemead, Langdon, Kathryn, Balzac, Delcaour and Keoma [3] (Statistics Canada, 2007w; 2006aa) (MapQuest, 2007e).

21. There was no entry for Rocky View No. 44, AB in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2007w).

Edmonton CMA

22. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Edmonton the vehicle counts for the following place names whose locations fall within the Edmonton census metropolitan area's 2006 geographic boundaries: Lancaster Park, Namao, Alcomdale, Acheson, Riviere Qui Barre, Calahoo, Carvel, Duffield, Fallis, Gainford, Entwistle, Tomahawk, Rolly View, North Cooking Lake and Cooking Lake [3] (Statistics Canada, 2007v; 2006z) (MapQuest, 2007f).

23. We infer that registrations in Leduc County are included with the count for Leduc, there being no entries within the database for Leduc County. We infer that registrations in Pense No. 160 are included with the count for Pense, there being no entry within the database for Pense No. 160 [3] (Statistics Canada, 2007v).

24. We could not determine if the vehicle counts for Parkland were for Parkland County or Parkland, AB. Parkland, AB lies outside the Edmonton CMA. We therefore exclude vehicles for Parkland from our count for Edmonton CMA [3] (Statistics Canada, 2007v) (MapQuest, 2007g).

25. There was no entry for Betula Beach, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Golden Days, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Itaska Beach, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Lakeview, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Point Alison, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Stony Plain Indian Reserve, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Strathcona County, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Sturgeon County, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Sundance Beach, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Wabamun Indian Reserve 133A, AB in the Statistics Canada 2005 vehicle registration database. There was no entry for Wabamun Indian Reserve 133B, AB in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2007v).

26. There was an entry in the Statistics Canada 2005 vehicle registration database of zero vehicles for Alexander, AB [3] (Statistics Canada, 2007v).

Saskatoon CMA

27. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the city of vehicle count for the city of Saskatoon the vehicle counts in the city of Saskatoon's vehicle count for the following municipalities which fall in the Saskatoon census metropolitan area's 2006 geographic boundaries: Grandora, Furdale, Casa Rio, Riverside Estates, Grasswood [3] (Statistics Canada, 2007r; 2006v) (MapQuest, 2007h).

28. We infer that registrations in Colonsay No. 342 are included with the count for Colonsay, there being no entry within the database for Colonsay No. 342. We infer that registrations in Dundurn No. 314 are included with the count for Dundurn, there being no entry within the database for Dundurn No. 314. We infer that registrations in Vanscoy No. 345 are included with the count for Vanscoy, there being no entry within the database for Vanscoy No. 345 [3] (Statistics Canada, 2007r).

29. There was no entry for Shields in the Statistics Canada 2005 vehicle registration database. There was no entry for Thode in the Statistics Canada 2005 vehicle registration database. There was no entry for Whitecap in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2007r).

Regina CMA

30. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Regina the vehicle counts in the city of Regina's vehicle count for the following municipalities which fall in the Regina census metropolitan area's 2006 geographic boundaries: Zehner, Deer Valley, Richardson and Stony Beach [3] (Statistics Canada, 2007q; 2006u) (MapQuest, 2007i).

31. We infer that registrations in Edenwold No. 158 are included with the count for Edenwold, there being no entry within the database for Edenwold No. 158. We infer that registrations in Lumsden Beach and Lumsden No. 189 are included with the count for Lumsden, there being no entries within the database for Lumsden Beach nor for Lumsden No. 189. We infer that registrations in Pense No. 160 are included with the count for Pense, there being no entry within the database for Pense No. 160 [3] (Statistics Canada, 2007q).

32. There was no entry for Disley, SK in the Statistics Canada 2005 vehicle registration database. There was no entry for Grand Coulee, SK in the Statistics Canada 2005 vehicle registration database. There was no entry for Sherwood, SK in the Statistics Canada 2005 vehicle registration database [3] (Statistics Canada, 2007q).

Winnipeg CMA

33. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Winnipeg the vehicle counts in the city of Winnipeg's vehicle count for the following municipalities which fall in the Winnipeg census metropolitan area's 2006 geographic boundaries: Beaconsia, Scantbury, Grand Marais, East Selkirk, Hazelridge, Anola, Duffresne, Landmark, Dugald, Oakbank, Lorette, Ile-des-Chenes, Marquette, Grosse Isle, Starbuck, Sanford, Domain, LaSalle, St. Adolphe, Glenlea, Ste. Agathe, St. Germain and Vermette [3] (Statistics Canada, 2007p; 2006t) (MapQuest, 2007j).

34. There is no entry in the database for St. Clements. There is no entry in the database for Taché. There is no entry in the database for Macdonald Regional Municipality. There is no entry in the database for Ritchoy [3] (Statistics Canada, 2007p).

35. We believe that the entry for "Macdonald" is for the town of Macdonald, MB which is located outside Winnipeg CMA [3] (Statistics Canada, 2007p) (MapQuest, 2007k).

36. We did not include an entry for South St. Germain as we could not ascertain whether or not this was in fact a locality within the Winnipeg area; no match was found for such a locality on either Mapquest or Google maps [3] (Google Maps, 2007) (Mapquest, 2007l).

Greater Sudbury CMA

37. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Greater Sudbury the vehicle counts for the following place names whose locations which fall within the Greater Sudbury census metropolitan area's 2006 geographic boundaries: Skead, Capreol, Val Therese, Hanmer, Falconbridge, Sudbury, Garson, Coniston, Azilda, Copper Cliff, Lively, Chelmsford, Dowling, Worthington, Onaping, Levack, Whitefish Indian Reserve, Naughton and Bleazard Valley [3] (Statistics Canada, 2007t; 2006x) (MapQuest, 2007m).

Windsor CMA

38. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include vehicle counts for the following place names whose locations fall within the Windsor census metropolitan area's 2006 geographic boundaries: Emeryville, Maidstone, Oldcastle, St. Joachim, Pointe-Aux-Roches, Comber, Ruscom Station, Staples and South Woodslee [3] (Statistics Canada, 2007i; 2006j) (MapQuest, 2007n).

39. We exclude McGregor because it lies largely outside the CMA boundary (Statistics Canada, 2006j) (MapQuest, 2007n).

40. St. Clair and Tecumseh show vehicle registrations of zero each [3] (Statistics Canada (Statistics Canada, 2007i; 2006j) (MapQuest, 2007n).

London CMA

41. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of London the vehicle counts for the following place names whose locations fall within the London census metropolitan area's 2006 geographic boundaries: Dorchester, Putnam, Port Stanley, Delaware, Mossley, Harrietsville, Belmont, Sparta, Union, Fingal, Shedden, Iona Station, Talbotville Royal, Muncey, Arva, Komoka, Mount Brydges, Kerwood and Thorndale [3] (Statistics Canada, 2007h; 2006i) (MapQuest, 2007o).

Kitchener CMA

42. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Kitchener the vehicle counts for the following place names whose locations fall within the Kitchener census metropolitan area's 2006 geographic boundaries: Floradale, Conestogo, Elmira, Bloomingdale, West Montrose, St. Jacobs, Maryhill, Breslau, Branchton, Ayr and Heidelberg [3] (Statistics Canada, 2007ae; 2006n) (MapQuest, 2007p).

Hamilton CMA

43. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Hamilton the vehicle counts for the following place names whose locations fall within the Hamilton census metropolitan area's 2006 geographic boundaries: Waterdown, Kilbride, Carlisle, Sheffield, Lynden, Troy, Copetown, West Flamborough, Millgrove, Dundas, Ancaster, Jerseyville, Alberton, Mount Hope, Hannon, Fruitland, Stoney Creek, Vinemount, Freelon, Rockton, Winona and Grassie [3] (Statistic Canada, 2007k; 2006l) (MapQuest, 2007q).

Toronto CMA

44. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Toronto the vehicle counts for the following place names whose locations fall within the Toronto census metropolitan area's 2006 geographic boundaries: Alliston, Alton, Baldwin, Beeton, Belfountain, Bolton, Bradford, Ballinafad, Brougham, Caledon Village, Campbellville, Cedar Valley, Cheltenham, Cherrywood, Claremont, Concord, East York, Etobicoke, Georgetown, Goodwood, Greenwood, Holland Landing, Hornby, Huttonville, Limehouse, Inglewood, Keswick, King, Milton, Caledon, King City, Jacksons Point, Kettleby, Kleinburg, Leaksdale, Locust Hill, Maple, Meadowvale, Moffat, Mount Albert, Nobleton, North York, Norval, Palgrave, Pefferlaw, Queensville, River Drive Park, Roches Point, Sandford, Scarborough, Schomberg, Sharon, Stouffville, Streetsville, Sutton West, Thornhill, Tottenham, Udora, Unionville, Whitevale, Willow Beach, Woodbridge, York and Zephyr [3] (Statistics Canada, 2007n; 2006r) (MapQuest, 2007r).

Barrie CMA

45. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Barrie the vehicle counts for the following place names whose locations fall within the Barrie census metropolitan area's 2006 geographic boundaries: Churchill, Stroud, Midhurst, Minesing, Gilford, Cookstown, Phelpsston, Hillsdale, Elmvale, Lefroy and Bell Ewart [3] (Statistics Canada, 2007j; 2006k) (MapQuest, 2007s).

St. Catharine's-Niagara CMA

46. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass place names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of St. Catharine's the vehicle counts for the following place names whose locations fall within the St. Catharine's-Niagara census metropolitan area's 2006 geographic boundaries: Vineland Station, Vineland, Campden, Jordan Station, St. Davids, Virgil, Allanburg, Port Robinson, Ridgeville, Fenwick, Stevensville, Ridgeway, Crystal Beach and Sherston [3] (Statistics Canada, 2007m; 2006q) (MapQuest, 2007t).

47. We note that four vehicles were registered as being located in Saint Catharines instead of St. Catharine's [3].

Oshawa CMA

48. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Oshawa the vehicle counts for the following place names whose locations fall within the Oshawa census metropolitan area's 2006 geographic boundaries: Bowmanville, Courtice, Enniskillen, Hampton, Kendal, Newcastle, Newtonville and Orono [3] (Statistics Canada, 2007ad; 2006o) (MapQuest, 2007u).

Kingston CMA

49. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Kingston the vehicle counts for the following places which fall in the Kingston census metropolitan area's 2006 geographic boundaries: Amherstview, Bath, Wolfe Island, Battersea, Elginburg, Glenburnie, Harrowsmith, Hartington, Inverary, Joyceville, Perth Road, Sydenham, Westbrook and Verona [3] (Statistics Canada, 2007ac; 2006m) (MapQuest, 2007v).
Ottawa-Gatineau CMA

50. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Ottawa the vehicle counts for the following places which fall in the Ottawa census metropolitan area's 2006 geographic boundaries: Aylmer, QC, Masson-Angers, QC, Clarence Creek, ON, Cumberland, ON, Gloucester, ON, Kanata, ON, Nepean, ON, Osgoode Township, ON, Rockcliffe Park, ON, Vanier, ON, Bourget, ON, Carlsbad Springs, ON, Carp, ON, Dunrobin, ON, Embrun, ON, Fitzroy Harbour, ON, Greely, ON, Hammond, ON, Kars, ON, Kenmore, ON, Kinburn, ON, Manotick, ON, Mansfield, ON, Metcalfe, ON, Munster, ON, Navan, ON, North Gower, ON, Ramsayville, ON, Richmond, ON, St.-Pascal-Baylon, ON, Stittsville, ON, Orleans, ON, Sarsfield, ON, Edwards, ON, Burritts Rapids, ON, Vernon, ON and Woodlawn, ON [3] (Statistics Canada, 2007l; 2006p) (MapQuest, 2007x).

51. We included in the vehicle count for the city of Rockland-Clarence vehicles listed as registered in the following municipalities: Clarence Creek, ON and Rockland, ON [3] (Statistics Canada, 2007l; 2006p) (MapQuest, 2007x).

52. The Statistics Canada 2005 vehicle registration database appears to include vehicles registered in Buckingham, QC with those registered in L'Ange-Gardien, QC. Buckingham, QC falls within the geographical boundaries of the Ottawa-Gatineau CMA [3] (Statistics Canada, 2006p) (MapQuest, 2007w).

53. We do not include vehicle counts for Ashton, ON as it straddles the geographic boundary of Ottawa-Gatineau CMA [3] (Statistics Canada, 2006p) (MapQuest, 2007x).

Montréal CMA

54. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Montréal the vehicle counts for the following places which fall in the Montréal census metropolitan area's 2006 geographic boundaries: Anjou, Greenfield Park, L'Île-Bizard, La Plaine, LaSalle, Lachine, Montréal Nord, Montréal/Dorval (recorded on the Statistics Canada 2005 vehicle registration list as a separate entity from Dorval), Montréal/Mont-Royal (recorded on the Statistics Canada 2005 vehicle registration list as a separate entity from Mont-Royal), Outremont, Pierrefonds, Pierrefonds/Dorval (recorded on the Statistics Canada 2005 vehicle registration list as a separate entity from Dorval), Dorval/Pointe Claire (which was included under the Dorval entry), Pierrefonds/Kirkland/Sainte-Genève (recorded on the Statistics Canada 2005 vehicle registration list as a separate entity from Kirkland), Pierrefonds/Roxboro (recorded on the Statistics Canada 2005 vehicle registration list as a separate entity from Pierrefonds; there was no separate entry for Roxboro), Saint-Eustache, Saint-Hubert, Saint-Leonard, Saint-Léonard, Pointe-Aux-Trembles, and Verdun [3] (Statistics Canada, 2007d; 2006d) (MapQuest, 2007y).

55. Note that in Montréal CMA, some municipalities created in 2006 as a result of the municipal de-mergers would be reflected in the respective agglomerated municipalities to which they belonged prior to 2006. For example, Hampstead and Montréal-Est registrations do not appear in the Statistics Canada 2005 vehicle registration database. This is because the town of Hampstead and the city of Montréal-Est were in fact boroughs of the city of Montréal in 2005 [3] (Radio Canada, n.d.) (Statistics Canada, 2006d). We assume that vehicle registrations for Hampstead and Montréal-Est are included with those for the city of Montréal. We note that Côte Saint-Luc, also a borough in the city of Montréal during 2005, (Radio Canada, n.d.) (Statistics Canada, 2006d) shows a number of registrations in the database. This dichotomy in the treatment of motor vehicle registrations is not readily explainable.

56. For Léry, we assume that "Delery" is a typographical error and should read "Léry". We note that Léry is situated next to the town of Beauharnois and therefore it is plausible that the two would be bracketed together in the vehicle registration counts [3] (Statistics Canada, 2007d; 2006d) (MapQuest, 2007y).

Sherbrooke CMA

57. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Sherbrooke the vehicle counts for the following places which fall in the Sherbrooke census metropolitan area's 2006 geographic boundaries: Rock Forest/Deauville, Sherbrooke/Fleurimont (recorded on the Statistics Canada 2005 vehicle registration list as a separate entity from Sherbrooke) and Lennoxville [3] (Statistics Canada, 2007f; 2006g) (MapQuest, 2007z).

58. The following place names did not appear within the Statistics Canada 2005 vehicle registration database and do not have postal codes matching the rural postal codes. We assume that vehicle registrations for these municipalities are included with the vehicle registrations for neighboring municipalities: St.-Elie-D'orford (MapQuest, 2007z).

Saguenay CMA

59. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Saguenay the vehicle counts for the following places which fall in the Saguenay census metropolitan area's 2006 geographic boundaries: Shipshaw, LaBaie, Chicoutimi, Jonquière [3] (Statistics Canada, 2007g; 2006h) (MapQuest, 2007aa; 2007ab).

60. The following place names appear to fall within the 2006 geographic boundaries of Saguenay CMA but do not appear in the Statistics Canada 2005 vehicle registration database: Lac-Kénogami, Laterrière, Tremblay and St.-Honoré-de-Chicoutimi. We assume that vehicle counts for these place names are contained within the vehicle registrations for neighboring communities or are contained in vehicle counts for the relevant rural postal codes which cannot be included for reasons discussed in paragraph four [3] (Statistics Canada, 2007g; 2006h) (MapQuest, 2007aa).

Québec CMA

61. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Québec the vehicle counts for the following places which fall in the Québec census metropolitan area's 2006 geographic boundaries: Loretteville, Saint-Émile, Lac-St.-Charles, Sainte-Foy, Sillery, Beauport, Pintendre, Charny, St. Rédempteur, Saint-Nicolas, Charlesbourg, Val-Bélair, Bernières and St.-Jean-Chrysostome [3] (Statistics Canada, 2007ab; 2006f) (MapQuest, 2007ac).

62. We included the vehicle registration counts for both Lévis/Lauzon and Lévis/Saint Romuald [3] (Statistics Canada, 2007ab; 2006f).

63. The following place names and municipalities appear to fall within the 2006 geographic boundaries of Québec CMA but do not appear in the Statistics Canada 2005 vehicle registration database: Boischatel, Château-Richer, Fossambault-sur-le-Lac, L'Ange-Gardienn, Lac-Delage, Lac-St.-Joseph, Saint-François-de-l'Île-d'Orléans, Saint-Gabriel-de-Valcartier, Saint-Jean-de-l'Île-d'Orléans, Saint-Laurent-de-l'Île-d'Orléans, Saint-Pierre-de-l'Île-d'Orléans, Saint-Brigitte-de-Laval, Sainte-Catherine-de-la-Jacques-Cartier, Sainte-Famille, Sainte-Petronille, Shannon, Stoneham-et-Tewksbury, Wendake, Val-Bélair, St. Joseph-de-la-Pointe-de-Lévy, Saint-Lambert-de-Lauzon, Beaumont and Saint-Henri. We believe that vehicle counts for these areas may be included with vehicle counts for rural postal codes; for the reasons discussed in paragraph four we cannot include vehicle counts for rural postal codes [3] (Statistics Canada, 2007ab; 2006f) (MapQuest, 2007ac).

64. The following municipalities do not appear within the Statistics Canada 2005 vehicle registration database: Ste.-Hélène-de-Breakeyville [3] (Statistics Canada, 2007ab; 2006f) (MapQuest, 2007ac).

Moncton CMA

65. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Moncton the vehicle counts for the following places which fall in the Moncton census metropolitan area's 2006 geographic boundaries: Birch Ridge, Hébert, Gallagher Ridge, Steeves Mountain, Boundary Creek, Upper Coverdale, Colpitts Settlement, Parkindale, Prosser Brook, Rosevale, Caledonia Mountain, Albert Mines, Berryton, Baltimore, Turtle Creek, Dawson Settlement, Edgett's Landing, Shenstone, Weldon, Stoney Creek, Lower Coverdale, Pine Glen, Allison, Berry Mills, Greater Lakeburn, Lakeville-Westmoreland, Meadow Brook, Memramcook East, Upper Dorchester, Taylor Village, Middleton, Dorchester Cape, Scotch Settlement Westmoreland, Irishtown, Ammon, Osborne Corner, Calhoun, Stilesville and Indian Mountain [3] (Statistics Canada, 2007c; 2006c) (MapQuest, 2007ad).

Halifax CMA

66. We note that the geographic boundaries shown on the 2006 census map for this CMA encompass places names not listed on the 2006 census metropolitan area lists of component municipalities. We therefore include in the vehicle count for the city of Moncton the vehicle counts for the following places which fall in the Moncton census metropolitan area's 2006 geographic boundaries: Dartmouth, Hubbards, Black Point, Ingraport, Boutilliers Point, Head of St. Margaret's Bay, Upper Tantallon, Lewis Lake, Tantallon, Glen Haven, French Village, Seabright, Hacketts Cove, Indian Harbor, Peggy's Cove, West Dover, East Dover, McGrath's Cove, Bayside, Shad Bay, Prospect, White's Lake, Terence Bay River, Terence Bay, Lower Prospect, Brookside, West Pennant, Bald Rock, Sambro Head, Ketch Harbor, Duncan Cove, Portuguese Cove, Herring Cove, Ferguson's Cove, Armdale, Goodwood, Beechville, Lakeside, Bedford, Harrietsfield, Williamswood, Hatchet Lake, Hubley, Hammond's Plains, Stillwater Lake, Lower Sackville, Middle Sackville, Beaver Bank, Windsor Junction, Lakeview, Kinsac, Waverly, Upper Sackville, Oakfield, Grand Lake, Wellington, Montague Gold Mines, Cherry Brooke, Westphal, Shearwater, Eastern Passage, Lawrence town, East Preston, North Preston, Lake Echo, Porter's Lake, Middle Porter's Lake, Head of Chezzetcook, Oldham, Goffs, Dutch Settlement, Elderbank, Meagher's Grant, Musquodoboit Harbour, Middle Musquodoboit, Head of Jeddore, Lake Charlotte, Upper Musquodoboit, Waverley, Mooseland, Tangier, Port Dufferin and Moser's River [3] (Statistics Canada, 2007b; 2006b) (MapQuest, 2007ae).

St. John's CMA

67. We note that there are listings in the vehicle database for both Portugal Cove CB and Portugal Cove – St Philips. The number of registrants for Portugal Cove CB being only 29 vehicles, we assume that any omission of Portugal Cove CB has no significant bearing upon our results.

68. The place name Petty Harbour-Maddox did not appear in the Statistics Canada 2005 motor vehicle registration database (Statistics Canada, 2007a; 2006a) (MapQuest, 2007af).

Assignment of normalized scores

69. For relative rankings, we assigned the CMA with the lowest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{MIN} / \text{observed}(i)] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MIN = the minimum value of the 27 observed values.

70. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{IDEAL} / \text{observed}(i)] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

71. The ideal level is set to 25.5% of the lowest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol. (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the level of vehicle registrations within a CMA when contemplating a 10 year timeframe.

Data verification

72. To ensure accuracy, all data entered and all formulae were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory
A Summary of Trends. Retrieved August 31, 2007 from
http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Google Maps. (2007). South St. Germain, Manitoba, Canada. Retrieved July 31, 2007, <http://maps.google.ca/maps?f=q&hl=en&geocode=&q=South+St.+Germain,+manitoba,+canada&ll=49.77214,-97.12741&spn=0.214633,0.6427&ie=UTF8&ll=49.839034,-97.141027&spn=0.0-26792,0.080338&z=14&om=1>

Greater Vancouver Regional District. (n.d.). 2001 Aboriginal Population Distribution in the GVRD by census tracts. Burnaby: Greater Vancouver Regional District. Retrieved July 29, 2007, from <http://www.gvrd.bc.ca/growth/maps.htm>

MapQuest, Inc. (2007a). Map of Victoria, BC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=victoria&state=bc&zipcode=>

MapQuest, Inc. (2007b). Map of Vancouver, BC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=vancouver&state=bc&zipcode=>

MapQuest, Inc. (2007c). Map of Abbotsford, BC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=abbotsford&state=bc&zipcode=>

MapQuest, Inc. (2007d). Map of Kelowna, BC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=kelowna&state=bc&zipcode=>

MapQuest, Inc. (2007e). Map of Calgary, AB CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=calgary&state=ab&zipcode=>

MapQuest, Inc. (2007f). Map of Edmonton, AB CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=edmonton&state=ab&zipcode=>

MapQuest, Inc. (2007g). Map of Parkland, AB CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?formtype=address&country=US&popflag=0&latitude=&longitude=&name=&phone=&level=&addtohistory=&cat=&address=&city=parkland&state=ab&zipcode=>

MapQuest, Inc. (2007h). Map of Saskatoon, SK CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=saskatoon&state=sk&zipcode=>

MapQuest, Inc. (2007i). Map of Regina, SK CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=regina&state=sk&zipcode=>

MapQuest, Inc. (2007j). Map of Winnipeg, MB CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=winnipeg&state=mb&zipcode=>

MapQuest, Inc. (2007k). Map of Macdonald, MB CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?formtype=address&country=US&popflag=0&latitude=&longitude=&name=&phone=&level=&addtohistory=&cat=&address=&city=macdonald&state=mb&zipcode=>

MapQuest, Inc. (2007l). Map of MB CA. Retrieved July 31, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=south+st.+germain&state=mb&zipcode=>

MapQuest, Inc. (2007m). Map of Greater Sudbury, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=greater+sudbury&state=on&zipcode=>

MapQuest, Inc. (2007n). Map of Windsor, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=windsor&state=on&zipcode=>

MapQuest, Inc. (2007o). Map of Greater London, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=london&state=on&zipcode=>

MapQuest, Inc. (2007p). Map of Kitchener, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=kitchener&state=on&zipcode=>

MapQuest, Inc. (2007q). Map of Hamilton, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=hamilton&state=on&zipcode=>

MapQuest, Inc. (2007r). Map of Toronto, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=toronto&state=on&zipcode=>

MapQuest, Inc. (2007s). Map of Barrie, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=barrie&state=on&zipcode=>

MapQuest, Inc. (2007t). Map of St.Catharines, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=st.+catharines&state=on&zipcode=>

MapQuest, Inc. (2007u). Map of Oshawa, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=oshawa&state=on&zipcode=>

MapQuest, Inc. (2007v). Map of Kingston, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=kingston&state=on&zipcode=>

MapQuest, Inc. (2007w). Map of Buckingham, QC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=buckingham&state=qc&zipcode=>

MapQuest, Inc. (2007x). Map of Ottawa, ON CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=ottawa+&state=on&zipcode=>

MapQuest, Inc. (2007y). Map of Montréal, QC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=montreal&state=qc&zipcode=>

MapQuest, Inc. (2007z). Map of Sherbrooke, QC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=sherbrooke&state=qc&zipcode=>

MapQuest, Inc. (2007aa). Map of Saguenay, QC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=saguenay&state=qc&zipcode=>

MapQuest, Inc. (2007ab). Map of Chicoutimi, QC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=chicoutimi&state=qc&zipcode=>

MapQuest, Inc. (2007ac). Map of Québec, QC CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=quebec&state=qc&zipcode=>

MapQuest, Inc. (2007ad). Map of Moncton, NB CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=moncton&state=nb&zipcode=>

MapQuest, Inc. (2007ae). Map of Halifax, NS CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=halifax&state=ns&zipcode=>

MapQuest, Inc. (2007af). Map of St.John's, NL CA. Retrieved July 29, 2007, from <http://www.mapquest.com/maps/map.adp?searchtype=address&country=US&addtohistory=&searchtab=home&formtype=address&popflag=0&latitude=&longitude=&name=&phone=&level=&cat=&address=&city=st.+john%27+s+&state=nl&zipcode=>

Radio Canada. (n.d.). Fusion, défusion, À l'heure des referendums. Retrieved July 29, 2007, from <http://www.radio-canada.ca/nouvelles/dossiers/defusions/referendums/region-05.shtml>

Smith, Malcolm. (2005). Environmental Implications of the Automobile (SOE Fact Sheet No. 93-1 [Electronic version]. Environment Canada. Retrieved July 29, 2007, from <http://www.ec.gc.ca/soer-ree/English/products/factsheets/93-1.cfm>

Statistics Canada. (2007). Tables by metropolitan area. Retrieved August 10, 2007, from http://www40.statcan.ca/z01/cs0007_e.htm

Statistics Canada. (2007a, March 13). St. John's, Newfoundland and Labrador (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007b, March 13). Halifax, Nova Scotia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007ad, March 13). Oshawa, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007ae, March 13). Kitchener, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2006a, January 22). St. John's, N.L. (10), CMA/CA code 001, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/NL/CMAT001-B.pdf

Statistics Canada. (2006b, January 22). Halifax, N.S. (12), CMA/CA code 205, map 1 of 3 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/NS/CMAT205-B.pdf

Statistics Canada. (2006c, January 22). Moncton, N.B. (13), CMA/CA code 305, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/NB/CMAT305-B.pdf

Statistics Canada. (2006d, January 22). Montréal, Que. (24), CMA/CA code 462, map 1 of 10 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/QC/CMAT462-B.pdf

Statistics Canada. (2006e, January 22). Trois-Rivières, Que. (24), CMA/CA code 441, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/QC/CMAT442-B.pdf

Statistics Canada. (2006f, January 22). Québec, Que. (24), CMA/CA code 421, map 1 of 3 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/QC/CMAT421-B.pdf

Statistics Canada. (2006g, January 22). Sherbrooke, Que. (24), CMA/CA code 433, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/QC/CMAT433-B.pdf

Statistics Canada. (2006h, January 22). Saguenay, Que. (24), CMA/CA code 408, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/QC/CMAT408-B.pdf

Statistics Canada. (2006i, January 22). London, Ont. (35), CMA/CA code 555, map 1 of 3 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT555-B.pdf

Statistics Canada. (2006j, January 22). Windsor, Ont. (35), CMA/CA code 559, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT559-B.pdf

Statistics Canada. (2006k, January 22). Barrie, Ont. (35), CMA/CA code 568, map 1 of 1 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT568-B.pdf

Statistics Canada. (2006l, January 22). Hamilton, Ont. (35), CMA/CA code 537, map 1 of 4 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT537-B.pdf

Statistics Canada. (2006m, January 22). Kingston, Ont. (35), CMA/CA code 521, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT521-B.pdf

Statistics Canada. (2006n, January 22). Kitchener, Ont. (35), CMA/CA code 541, map 1 of 3 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT541-B.pdf

Statistics Canada. (2006o, January 22). Oshawa, Ont. (35), CMA/CA code 532, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT532-B.pdf

Statistics Canada. (2006p, January 22). Ottawa-Gatineau, Ont. (35), CMA/CA code 505, map 1 of 4 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT505-B.pdf

Statistics Canada. (2006q, January 22). St. Catharine-Niagara, Ont. (35), CMA/CA code 539, map 1 of 4 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT539-B.pdf

Statistics Canada. (2006r, January 22). Toronto, Ont. (35), CMA/CA code 535, map 1 of 10 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT535-B.pdf

Statistics Canada. (2006s, January 22). Peterborough, Ont. (35), CMA/CA code 529, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT529-B.pdf

Statistics Canada. (2006t, January 22). Winnipeg, Man. (47), CMA/CA code 602, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/MB/CMAT602-B.pdf

Statistics Canada. (2006u, January 22). Regina, Sask. (47), CMA/CA code 705, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/SK/CMAT705-B.pdf

Statistics Canada. (2006v, January 22). Saskatoon, Sask. (47), CMA/CA code 725, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/SK/CMAT725-B.pdf

Statistics Canada. (2006w, January 22). Guelph, Ont. (35), CMA/CA code 550, map 1 of 1 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT550-B.pdf

Statistics Canada. (2006x, January 22). Greater Sudbury/Grand Sudbury, Ont. (35), CMA/CA code 580, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT580-B.pdf

Statistics Canada. (2006y, January 22). Thunder Bay, Ont. (35), CMA/CA code 595, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT595-B.pdf

Statistics Canada. (2006z, January 22). Edmonton, Alta. (48), CMA/CA code 835, map 1 of 4 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/AB/CMAT835-B.pdf

Statistics Canada. (2006aa, January 22). Calgary, Alta. (48), CMA/CA code 825, map 1 of 5 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/AB/CMAT825-B.pdf

Statistics Canada. (2006ab, January 22). Abbotsford, B.C. (59), CMA/CA code 935, map 1 of 1 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/BC/CMAT932-B.pdf

Statistics Canada. (2006ac, January 22). Kelowna, B.C. (59), CMA/CA code 915, map 1 of 3 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/BC/CMAT915-B.pdf

Statistics Canada. (2006ad, January 22). Vancouver, B.C. (59), CMA/CA code 933, map 1 of 8 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/BC/CMAT933-B.pdf

Statistics Canada. (2006ae, January 22). Victoria, B.C. (59), CMA/CA code 935, map 1 of 2 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/BC/CMAT935-B.pdf

Appendix E: Data methodology for the percentage of the CMA population living under an anti-idling by-law (2007).

Rationale

1. Though they themselves do not contribute significantly to the reduction of emissions, anti-idling by-laws play an important role in increasing public awareness of the need to reduce harmful emission (Natural Resources Canada, 2004).

Caveats

2. First Nations may pass anti-idling bylaws only once they have received authority to do so by way of concluding an Environmental Management Agreement with the federal government [346]. As many First Nations have yet to conclude such agreements due to ongoing discussions in regard to the funding arrangements which accompany such agreements, it is not possible to expect First Nations to have passed anti-idling by-laws. We nonetheless include all First Nation located within the 27 census metropolitan areas (CMAs) surveyed in order to provide an accurate picture of the extent to which anti-idling by-laws have been passed. The fact that some First Nations cannot pass such by-laws is not itself a reason for not counting First Nations. In presenting the actual state of affairs we expect and hope that the parties negotiating such agreements will have greater impetus to reach accords.

3. A number of municipalities which lacked anti-idling by-laws advised us that the passage of relevant anti-idling measures was imminent at the time of our phone call. We made no allocation in such situations as we believe they will be properly reflected in future iterations of this index.

4. We note that anti-idling education campaigns, which may have some benefit, are not likely to be as effective as the passage of an anti-idling by-law (Natural Resources Canada, 2004). We believe the same is true of anti-idling policies.

5. Vehicles' catalytic converters do not perform at its peak until they reach a temperature of at least 400°C (Natural Resources Canada, 2006). However, idling need not be more than 30 seconds as the car warms up best when it is driven, even in cold winter conditions (Natural Resources Canada, 2006) (State of Utah, 2007). Therefore, an anti-idling by-law whose purpose is to reduce emissions is not counterproductive during wintertime.

6. We do not measure or capture the extent of anti-idling regulations that apply only to municipal or First Nations employees operating vehicles as part of their employment.

7. We do not measure or capture traffic regulations whose purpose is to that prohibit cars from being left unattended while the motor is running.

8. We do not measure or capture by-laws whose purpose is to prohibit the running of a passenger automobile's vehicle motor in such as way as to constitute an aural nuisance for residents and/or passers-by in the immediate vicinity of the offending vehicle since most vehicles do not cause such a disruption; we do, however, include by-laws which prohibit the running of a truck's vehicle motor in such as way as to constitute an aural nuisance for residents and/or passers-by in the immediate vicinity of the offending vehicle.

9. We do not measure or capture anti-idling by-laws which have been passed but whose implementation in whole has been delayed.

10. Because trucks and buses are very often left idling, we give credit to an anti-idling by-law which prohibits or limits idling by trucks and/or buses.

Sources of data

11. During the months of May, June and July 2007, we conducted primary research by contacting each of the 422 component municipalities and First Nations that together comprise the 27 CMAs included in our study.

12. We contacted each municipality by telephone and asked to speak with the appropriate person to determine if an anti-idling by-law was in place. If the person we spoke with informed us that there was a by-law in force, we noted this fact. If there was no by-law in force at the time of our call, we noted this fact [1-344], (City of Beaconsfield, 2006), (Ville de Beloeil, 2006), (Ville de Bois-des-Filion, n.d.), (Ville de Dorval, n.d.), (Town of East Gwillimbury, 2004), (Ville de Gatineau, 2006), (City of Hamilton, n.d.), (ibid, 2007), (Township of King, 1999), (City of London, 1999), (Town of Markham, 2005), (City of Montréal, 2007), (Town of Mount Royal, 2007), (Town of Newmarket, 2004), (Penney, 2005), (City of Pickering, 2004), (Town of Regina Beach, n.d.), (Town of Richmond Hill, 2002), (Ville de Saint-Lambert, 2006), (The Rural Municipality of West St. Paul, 2006), (City of Toronto, 1998), (City of Vaughan, 2004), (City of Westmount, 2006), (City of Windsor, 2001).

13. Municipalities that were unable to respond to our telephone inquiries were sent a letter by registered receipt mail and/or courier service. This letter set forth our request. Letters were addressed to elected head of the government (or appointed designate, where applicable). Municipalities that failed to respond were deemed not to have a by-law.

14. Once we obtained information for all 422 municipalities using the procedures set forth in the paragraphs above, we determined the percentage of the population living under an anti-idling by-law in a given CMA by summing the percentages of CMA living in the particular communities which had adopted such a by-law.

15. For municipalities and First Nations which did not respond to our phone calls and letters, we have retained on file copies of the delivery confirmation certificates for the letters.

Note concerning Montréal CMA

16. All municipalities on the island of Montréal are subject to enforcement of environmental standards set by the Communauté métropolitaine de Montréal [345]. These standards do include a provision for anti-idling. However, in practice there are only a handful of enforcement officers employed by the Communauté métropolitaine de Montréal; these officers have additional duties such as enforcing environmental standards at factories and in sensitive environmental sites. Consequently, it is not possible for these few officers to attend to incidences of cars idling [1]. As a result, we give no credit to the municipalities on the island of Montréal in regard to the standard passed by the Communauté métropolitaine de Montréal; instead, we look for the existence of an anti-idling by-law passed by each of the individual municipalities located on the island of Montréal.

17. The city of Montréal itself is composed of 19 boroughs, each of which has the ability to pass legislation to implement an effective by-law which can be enforced by police officers and municipal by-law officers [1]. All boroughs in Montréal have passed such a by-law in the form a regulation against nuisances posed by anti-idling (City of Montréal, 2007). We note that it is not relevant that this particular by-law requires police officers to serve the alleged offender with a ticket as opposed to leaving the ticket on the windshield [1].

Note concerning Moncton CMA

18. Moncton CMA consists of 14 component municipalities (Statistics Canada, 2007); six of these municipalities are designated by the provincial government as parishes. Parishes are organized as "local service districts" (LSDs) that depend on the provincial government to provide basic services [347]. Having noted this fact, we were further notified that the parishes in the Moncton CMA did not have any by-laws pertinent to idling of vehicles [347]. If such a by-law were to exist for the parishes in question, the by-law would have to be present as a provincial by-law [347]. Following various contacts with the provincial Department of Local Government, we verified that there was no by-law specific to anti-idling on a provincial level [347] [348] [349] [350].

Assignment of normalized scores

19. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

20. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i)/\text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

21. The ideal level is set to 100%. Anti-idling by-laws cost little if nothing to enact. A municipality can institute an anti-idling by-law within weeks or months and therefore this is a reasonable and attainable goal within a 10 year time frame.

Data verification

22. Because to verify the data in this case would mean effectively repeating our research, data verification consisted instead of a review of the data entered to ensure its apparent accuracy and completeness as well as the accuracy and completeness of the citations created for each entry.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Toronto

Town of East Gwillimbury, By-law No. 2004-80, By-Law to Control Noise, (2004), s.3. Retrieved June 4, 2007, from <http://www.eastgwillimbury.ca/Assets/Town+Hall/By-laws/Noise+%232004-80.pdf>

Township of King, By-Law No. 81-124, By-Law to Control Noise, (April 19, 1999), s.2(5). Retrieved June 4, 2007, from <http://www.township.king.on.ca/files/bylawdocuments/noise%20bylaw%2081-124.pdf>

Town of Markham, By-Law No. 2005-192. A By-law to prohibit unnecessary idling of vehicles in the Town of Markham, (September 29, 2006), Retrieved June 4, 2007, from http://www.markham.ca/NR/rdonlyres/195754FC-DA45-46F4-9968-49010977C9E1/384/bylaw_2005194.pdf

Penney, J. (2005). Cracking down on idling: A primer for Canadian municipalities on developing and enforcing idling control by-laws. Natural Resources Canada and The Greater Toronto Area Clean Air Council. Retrieved June 04, 2007, from http://www.repairourair.org/pdfs/IdlingByLaws_Canada.pdf

Town of Newmarket, By-law No. 2004-94, Noise Control By-law, (2004), s.3. Retrieved June 4, 2007, from [http://www.newmarket.ca/userfiles/page_attachments/library/1/1670_516342_2004-94_Noise_By-law_\(Repeals_1991-140\).pdf](http://www.newmarket.ca/userfiles/page_attachments/library/1/1670_516342_2004-94_Noise_By-law_(Repeals_1991-140).pdf)

City of Pickering. By-law No. 6297/04, Idling of Vehicles By-Law, (February 16, 2004). Retrieved June 04, 2007, from <http://www.cityofpickering.com/standard/cityhall/bylaws/images/IdlingOfVehicles.pdf>

Town of Richmond Hill, By-Law No. 1055, Noise By-law, (July 2002), s.2. Retrieved June 5, 2007, from <http://code.municipalworld.com/richmondhill/1055.pdf>

City of Toronto, By-Law No. 673-1998, To Prohibit Excessive Idling of Vehicles and Boats, (October 2, 1998). Retrieved June 1, 2007, from <http://www.toronto.ca/legdocs/bylaws/1998/law0673.htm>

City of Vaughan, Bylaw No. 170-2004, A By-law to provide for the control of the idling of vehicles, (June 14, 2004). Retrieved June 4, 2007, from <http://www.city.vaughan.on.ca/environment/pdf/anti-idling%20bylaw.pdf>

Montréal

City of Beaconsfield. By-law No. 780, By-law amending traffic, (September 25, 2006).

Ville de Beloeil, By-law No. 1529-00-2006, (May 23, 2006).

Ville de Bois-des-Filion, By-law No. 885, (n.d.).

Ville de Dorval, By-law No. 1308-87, (n.d.). s.33(4).

City of Montréal. (2007, April 3). Adoption des règlements concernant le ralenti inutile des véhicules moteur État de la situation au 3 avril 2007. Retrieved August, 2007 from, http://ville.montreal.qc.ca/pls/portal/docs/page/environnement_fr/media/documents/BILAN_REGL_MOTEUR_RALENTI_3avril2007.pdf

Town of Mount Royal. By-law No. 1407, Idling Control By-law, (April 26, 2007).

Ville de Saint-Lambert. By-law No. 2006-19, Règlement 2006-19 concernant les nuisances, (July 12, 2006). Retrieved June 18, 2007, from http://www.ville.saint-lambert.qc.ca/images_editlive/Nuisances2006-19.pdf

City of Westmount, By-Law 1324, (April 12, 2006), s.1. Retrieved June 18, 2007, from <http://www.westmount.org/admin/main/bylaws/documents/1324.pdf>

Ottawa-Gatineau

Ville de Gatineau. By-law No. 300-2006, (July 4, 2006), s.63.

Winnipeg

The Rural Municipality of West St. Paul, By-law No. 2-2006, Noise Control Bylaw, (May 11, 2006). Retrieved June 18, 2007, from http://www.weststpaul.com/data/policies/Noise_By-law_5-2006.pdf

Hamilton

City of Hamilton. (n.d.). Is there a by-law in the City of Hamilton limiting vehicles from idling? City of Hamilton FAQs. Retrieved June 4, 2007, from <http://www.myhamilton.ca/Hamilton.Portal/Templates/FaqDetail.aspx?NRMODE=Published&NRORIGINALURL=%2fmyhamilton%2fHelp%2fCity%2bOf%2bHamilton%2bFAQs%2fGeneral%2bFAQs&NRNODEGUID=%7b1702C846-49B5-4926-841D-FE23CC306CF8%7d&NRCACHEINT=Guest#14>

City of Hamilton, By-law Number 07-160, To Prohibit Unnecessary Idling of Vehicles within the City of Hamilton, (2007, May 16), s.6. Retrieved September 10, 2007 from <http://www.myhamilton.ca/NR/rdonlyres/3DA8F71F-A62D-4B97-ABE3-E72CA96E25A0/0/07160AntiIdling.pdf>

London

City of London, By-law No. PH-9, Idling Control Bylaw, (August 3, 1999). Retrieved June 5, 2007, from <http://www.london.ca/Cityhall/CorpServices/CityClerks/bylaws/idle.pdf>

Windsor

City of Windsor. By-law No. 233-2001, A by-law to prohibit excessive idling of vehicles and boats, (June 18, 2001). Retrieved June 11, 2007, from <http://www.citywindsor.ca/DisplayAttach.asp?AttachID=8342>

Regina

Town of Regina Beach. (n.d.). Town Information. Retrieved June 15, 2007, from http://www.lumsden.ca/reginabeach/pages/town_info.php

Other

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from

http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Natural Resources Canada, Office of Energy Efficiency. (2006, May 8). Ready to Use Facts. Retrieved September 10, 2007 from, <http://oee.nrcan.gc.ca/communities-government/transportation/municipal-communities/articles/idling-tips.cfm?attr=28>

Natural Resources Canada, Office of Energy Efficiency. (2004, November 18). Case Study: Implementing an Idling-Control By-Law in London, Ontario. Retrieved September 9, 2007 from, <http://oee.nrcan.gc.ca/transportation/idling/material/reports-research/london-by-law-report.cfm?attr=16>

State of Utah, Department of Environmental Quality. (2007). Winter Driving: Idling. Retrieved September 10, 2007 from, http://www.cleanair.utah.gov/winter_driving.htm#idling

Statistics Canada. (2007, March 13). Moncton, New Brunswick (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Appendix F: Data methodology for the percentage of housing starts within the CMA that were apartment or row units (2006).

Rationale

1. Sprawl can cause adverse environmental effects (Ontario College of Family Physicians, 2004). The more densely populated is an urban area, the less likely its residents are to drive cars (Sightline Institute, n.d.). We believe that municipalities can actively curb sprawl and increase density by channeling housing starts into high density housing, specifically, apartments and row houses.
2. We do not measure the percentage of the CMA lost to new development because some CMAs are already highly urbanized while others are relatively rural in nature.

Caveats

3. Where a census metropolitan area's (CMA) population growth is negative, future sprawl is not likely to develop and therefore such CMAs receive low scores on this variable even though by virtue of their negative population growth they do not face future sprawl.

Sources of data

4. We obtained cumulative housing start data for each of the 27 census metropolitan areas included in our study (Canada Mortgage and Housing Corporation, 2007). We summed the number of apartment and row housing units upon which construction was commenced in the year 2006 and divided by the total number of units started in 2006. We had then reported the resulting percentage.
5. The census metropolitan areas of Barrie, Kelowna and Moncton are new as of the 2006 census (Statistics Canada, 2007a; 2007b; 2007c). 2006 housing starts data for these census metropolitan areas appear under the table pertaining to the relevant census agglomerations (Canada Mortgage and Housing Corporation, 2007). In all cases the definitions of the relevant census agglomerations match either perfectly or very nearly perfectly the definitions of the newly created census metropolitan areas [1] [2] (Statistics Canada 2007a; 2007b; 2007c; n.d.a; n.d.b; n.d.c).

Assignment of normalized scores

6. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

7. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i) / \text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

8. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the level of housing starts within a CMA when contemplating a 10 year timeframe.

Data verification

9. To ensure accuracy, all data entered were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Ontario College of Family Physicians. (2005, September). The Health Impacts of Urban Sprawl, Volume One: Air Pollution. Retrieved September 9, 2007 from, <http://www.ocfp.on.ca/local/files/Urban%20Sprawl/UrbanSprawl-AirPollution.pdf>

Sightline Institute. (n.d.) The Cascadia Scorecard: Why These Measures Matter. Retrieved September 9, 2007 from,

http://www.sightline.org/research/cascadia_scorecard/design/seven_trends

Canada Mortgage and Housing Corporation. (2007, January) Housing Information Monthly, 24-25 (Publication number 61504). Retrieved June 19, 2007 from,

<https://www03.cmhc-schl.gc.ca/b2c/b2c/init.do?language=en&shop=Z01EN&areaID=0000000057&productID=0000000570000000001>

Statistics Canada. (2007a, March 13). Moncton, New Brunswick (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved September 9, 2007 from

http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=305__&Geo2=PR&Code2=13&ata=Count&SearchText=moncton&SearchType=Contains&SearchPR=01&B1=Al&Custom=

Statistics Canada. (2007b, March 13). Kelowna, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved September 10, 2007 from

http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=915__&Geo2=PR&Code2=59&Data=Count&SearchText=kelowna&SearchType=Begins&SearchPR=01&B1=All&Custom=

Statistics Canada. (2007c, March 13). Barrie, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved September 10, 2007 from

http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=568__&Geo2=PR&Code2=35&Data=Count&SearchText=toronto&SearchType=Contains&SearchPR=01&B1=All

Statistics Canada. (n.d.a). Population and Dwelling Counts, for Canada, Census Metropolitan Areas, Census Agglomerations and Census Subdivisions (Municipalities), 2001 and 1996 Censuses - 100% Data.

. Ottawa. Retrieved September 10, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=305>

Statistics Canada. (n.d.b). Population and Dwelling Counts, for Canada, Census Metropolitan Areas, Census Agglomerations and Census Subdivisions (Municipalities), 2001 and 1996 Censuses - 100% Data.

. Ottawa. Retrieved September 10, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=568>

Statistics Canada. (n.d.c). Population and Dwelling Counts, for Canada, Census Metropolitan Areas, Census Agglomerations and Census Subdivisions (Municipalities), 2001 and 1996 Censuses - 100% Data.

. Ottawa. Retrieved September 10, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=915>

Appendix G: Data methodology for the percentage discount on a local transit pass accorded employees of the CMA's largest city who purchase the pass at work (2007).

Rationale

1. Transit benefit programs increase ridership (Canadian Urban Transit Association, 2005). We believe that large municipalities can lead the private sector in introducing and expanding the participation rate of employers who offer transit benefits to their employees.

Sources of data

2. For each of the 27 census metropolitan areas (CMAs) included in our study, we contacted the CMA's namesake city. For Ottawa-Gatineau and St. Catharines- Niagara, we contacted the cities of Ottawa and St. Catharines. We obtained information about whether or not a discounted local service regular adult transit pass was available to city employees. Where such a pass was available to city employees, we collected information about the cost of the pass and the amount of the discount. Where the cost of the discounted pass was quoted, we compared this cost with the cost of such a pass with the relevant transit provider. In some cases, we obtained information directly from the transit operator, in which case we did not contact the namesake city (BC Transit, 2007a-b), (City of Edmonton, 2007), (City of Hamilton, 2007), (OC Transpo, n.d.a), (Toronto Transit Commission, 2007), (Toronto Transit Commission, 2006) [1-12] [14-32] [34-47].

3. Certain cities in our study are served by transit operators that offer discounted passes to individuals in exchange for prepayment. We do not compare the costs of these prepaid passes with the costs of employer-issued passes because the terms and conditions of each are not identical. Specifically, cancellation policies are not identical to the more flexible cancellation policies afforded to the employer pass holders: the OC Transpo pass for employees of the city of Ottawa, for example, provides for an employee's cancellation without penalty for any of a variety of reasons whereas the cancellation of a prepaid pass is subject to a variety of financial penalties and is permissible only in the first nine months after the pass was issued [13] (OC Transpo, n.d.b). The Toronto Transit Commission's employer pass leaves cancellation policies to the discretion of the employer whereas its prepaid pass is subject to a variety of penalties (Toronto Transit Commission, 2006) (Toronto Transit Commission, 2007b).

4. Further, because some individual annual pre-paid transit passes typically require pre-payment in full of a year's pass, (OC Transpo, n.d.a), this creates difficulty in comparing passes due to the need to account for the time value of money. Employer passes are not typically paid a year in advance [18] (2007c).

5. Where an employee pass is paid by payroll deduction every two weeks for a total of 26 deductions per year, we calculated the total annual cost to the employee and divided the result by twelve. We then compared the resulting monthly cost with the cost of the comparable monthly adult pass offered by the transit operator.

6. We note that the city of Moncton offers its employees 20-ride passes at a 50% discount [30]. Because our aim is to gauge the effect on commuters, a city of Moncton employee would need to purchase two such discounted passes for a total of 40 rides per month to and from work (20 days of work with two rides per day) (Codiac Transit Commission, n.d.a) [33]. We compared the cost of two discounted 20 ride passes with the cost of an unlimited usage monthly pass (Codiac Transit Commission, n.d.b).

7. We ignore registration costs. We ignore restrictions on which categories of employees qualify for the program, for example, whether the program is available only to full-time employees or only to union employees.

Assignment of normalized scores

8. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$[\text{CMA}(i)/\text{MAX}] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

MAX = the maximum value among the 27 observed values.

9. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$[\text{CMA}(i)/\text{IDEAL}] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

IDEAL = the ideal level as described in the following paragraph

10. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the level of discount on a transit pass accorded employees of a CMA's namesake city when contemplating a 10 year timeframe.

Data verification

11. Because to verify the data in this case would mean effectively repeating our research by contacting all respondents a second time, data verification consisted instead of a review of the data entered to ensure its apparent accuracy and completeness as well as the accuracy and completeness of the citations created for each entry.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

BC Transit. (2007a). ProPass Program: Victoria Regional Transit. Retrieved September 11, 2007 from <http://www.bctransit.com/regions/vic/fares/propass.cfm>

BC Transit. (2007b). Fare payment. Retrieved September 11, 2007 from <http://www.bctransit.com/regions/kel/fares/>

Canadian Urban Transit Association. (2005, October 4). Tax Exemptions for Employer Provided Transit Benefits, 41. Retrieved September 11, 2007 from <http://www.cutaactu.ca/sites/cutaactu.ca/files/TEIIBI.pdf>

Codiac Transit Commission. (n.d.a) Punch Pass. Retrieved September 11, 2007 from <http://www.codiactransit-moncton.com/enstart.htm>

Codiac Transit Commission. (n.d.b) Monthly Pass. Retrieved September 11, 2007 from <http://www.codiactransit-moncton.com/enstart.htm>

City of Edmonton. (2007). Fares. Retrieved September 11, 2007 from http://www.edmonton.ca/portal/server.pt/gateway/PTARGS_0_0_280_218_0_43/http%3B/CMS/Server/COEWeb/getting+around/fares/

City of Hamilton. (2007). Fares and conditions. Retrieved September 11, 2007 from

<https://www.myhamilton.ca/myhamilton/CityandGovernment/CityServices/Transit/FaresandConditions.htm>

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from

http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

OC Transpo. (n.d.a). Fares. Retrieved September 11, 2007 from http://www.octranspo.com/fares_menuE.htm

OC Transpo. (n.d.b). ECOPASS: OC Transpo's Transit Pass Payroll Deduction Program. Retrieved September 11, 2007 from http://www.octranspo.com/fares_menuE.htm

Toronto Transit Commission. (2007a). TTC Fares. Retrieved September 11, 2007 from <http://www.toronto.ca/ttc/fares.htm#fares>

Toronto Transit Commission. (2007b). Volume Incentive Pass. Retrieved September 11, 2007 from <http://www.toronto.ca/ttc/vip.htm>

Toronto Transit Commission. (2007c). Participant Responsibility. Retrieved September 11, 2007 from <http://www.toronto.ca/ttc/vip.htm#participantresponsibility>

Toronto Transit Commission. (2006). Metropass Discount Plan. Retrieved September 11, 2007 from http://www.toronto.ca/ttc/pdf/mdp_brochure_october2006.pdf

Appendix H: Data methodology for the percentage of the cost difference between the 2007 Honda Civic gasoline and hybrid models covered by provincial tax incentives (2007).

Rationale

- Hybrid electric vehicles are among the cleanest vehicles on the road in terms of their greenhouse gas emissions (United States Environmental Protection Agency, n.d.). All other things being equal, sales tax credits encourage consumers to purchase hybrids. We therefore measure sales tax credits available to residents of a CMA when purchasing hybrids.
- We understand that it is the provincial and federal governments who have taxing authority on vehicle sales and therefore that only these levels of senior government can induce changes in car buyers' behavior. However, because these cars ultimately find a home within local communities and therefore impact their local environments, we believe that municipal governments have an imperative to bring political pressure to bear on senior levels of government.

Sources of data

- We determined which among the various vehicles available for sale in Canada in both gasoline and hybrid gasoline-electric versions was best-selling in its gasoline version (Bragman, 2007) (Canada NewsWire, 2007) (Reidl, 2007) (Transport Canada, 2007a).
- We obtained data on provincial sales tax or rebate initiatives available to purchasers of the 2007 Honda Civic gasoline-electric hybrid model; the gasoline version of the Honda Civic is the best-selling passenger car in Canada (Bragman, 2007) (Canada NewsWire, 2007).
- We compare the prices of the base model hybrid and gasoline versions of the 2007 Honda Civic. We understand that the base trim for the 2007 Honda Civic gasoline and gasoline-electric models may not be identical. We nonetheless use this figure because it is an approximation of the cost to the consumer to obtain a gasoline-electric hybrid model closest to the gasoline-only powered model.
- We calculated the value of the available rebates as a percentage of the difference in after-tax cost between the base trim and regular gasoline models of the 2007 Honda Civic, less the \$2,000 after-tax federal rebate applicable to the Honda Civic (Transport Canada, 2007b). The manufacturer's suggested retail prices in September, 2007 for the Honda Civic gasoline and gasoline-electric hybrid base models were \$16,980 and \$26,250 respectively (Honda Canada, 2007a; 2007b).
- Our formula is as follows: $[(\text{amount of provincial rebate})]/[(\text{MSRP after provincial and federal sales taxes of the 2007 base trim Honda Civic gasoline-electric hybrid model}) - (\text{MSRP after provincial and federal sales taxes of the 2007 base trim Honda Civic gasoline model}) - (\text{federal eco-credit of } \$1,500)]$ (British Columbia Ministry of Small Business and Revenue, 2007), (British Columbia Ministry of Finance), (De Lazzer, 2007), (Manitoba Finance, n.d.), (Province of Manitoba, 2007), (Ontario Ministry of Finance, 2007), (Ontario Ministry of Revenue, 2007), (Revenue Québec, n.d.a; n.d.b).
- In British Columbia, the purchase price of the vehicle is reduced by \$7,000 for the purposes of calculating the provincial sales tax. The purchaser receives a credit of up to \$2,000 on the resulting provincial sales tax. We modified the numerator in our formula for British Columbia accordingly (British Columbia Ministry of Small Business and Revenue, 2007), (British Columbia Ministry of Finance), (Environment Canada, 2007a).
- In Manitoba, the rebate is a fixed amount of \$2,000. We modified the numerator in our formula for Manitoba accordingly (Manitoba Finance, n.d.), (Province of Manitoba, 2007), (Environment Canada, 2007b).

10. In Ontario and Québec, the rebate is applied against the provincial taxes paid. In all cases the rebate is capped at a maximum of \$2,000. The rebate is processed after the tax on the full purchase price has been made. In Ontario, this means the full \$2,000 cap is reached; in Québec, the rebate is \$1968.75 (Ontario Ministry of Finance, 2007), (Ontario Ministry of Revenue, 2007), (Revenue Québec, n.d.a; n.d.b).

11. For the census metropolitan area of Ottawa-Gatineau, we population-weighted the prices based on the percentages of the population living in the Ontario and Québec portions of the CMA, respectively. We note that this affects the value of the credit within the CMA since the Ontario and Québec provincial sales tax rates differ (Statistics Canada, 2007a; 2007b).

12. We measure only provincial sales tax incentives and/or rebates designed to encourage the purchase of vehicles powered by alternative fuels and/or electricity and under which the 2007 Honda Civic hybrid model qualifies for the rebates. We do not include tax credits or other rebate programs for fuel efficiency in this calculation even if they apply to this vehicle nor do we attempt to measure income tax credits available to purchasers of hybrid vehicles.

Assignment of normalized scores

13. The sales tax values behave much like binary variables; that is, they do not vary much one from the other. We therefore use a binary value when counting the score toward the CMA's total score which determines its grade. Specifically, we assign to a CMA which exhibits any degree of tax incentives or rebates above zero a nominal score of 50; we combine this nominal score with a nominal score of 25 if the CMA in question also exhibits any degree of free transit in its downtown core (see Appendix L). We then divide the total by 75 (the maximum nominal score obtainable by any CMA); the CMA's nominal score out of 75 is then adjusted for the combined weightings of the sales tax and free transit in the core indicators.

14. Although these the sales tax values are treated as binary values, we nonetheless also calculate what is the CMA's score relative to the other CMAs and relative to the ideal sales tax credit level identified by the GreenApple expert panel. We calculate those values as described below.

15. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$[\text{CMA}(i)/\text{MAX}] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

MAX = the maximum value among the 27 observed values.

16. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$[\text{CMA}(i)/\text{IDEAL}] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

IDEAL = the ideal level as described in the following paragraph

17. The ideal level is set to 100%. The cost difference between the gasoline and gasoline-electric versions of the 2007 Civic are significant; however, we believe that once subjected to further political pressure from municipalities, senior levels of government will eliminate this difference through the use of rebates and tax incentives.

Data verification

18. To ensure accuracy, all data entered and all formulae were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and redisseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Bragman, Aaron. (2007, July 19). Honda to Increase North American Production. Global Insight Daily Analysis. Retrieved September 11, 2007 from Factiva Database.

British Columbia Ministry of Small Business and Revenue. (2007, June). What Visitors Should Know. Retrieved September 11, 2007 from <http://www.rev.gov.bc.ca/ctb/publications/brochures/bcsales.htm>

British Columbia Ministry of Finance. (2007, February 20). Part 2: Tax Measures. Retrieved September 11, 2007 from <http://www.bcbudget.gov.bc.ca/2007/bfp/default.aspx?hash=8>

Canada NewsWire. (2007, August 1). Honda Canada Reports July Sales. Canada NewsWire. Retrieved September 11, 2007 from Factiva Database.

De Lazzer, Rachel. (2007, March 20). Environment: Rebate seals the deal for some hybrid buyers. Globe and Mail. Retrieved September 11, 2007 from <http://www.theglobeandmail.com/servlet/story/RTGAM.20070320.wtorbudgetcars20/BNStory/budget2007/home>

Environment Canada. (2007a, July 20). Incentives and Rebates: Alternative Fuel Tax Concessions. Retrieved September 11, 2007 from http://www.ec.gc.ca/incitatifs-incentives/gc_fi_search_display.asp?id=34&jurisdiction=3&actionArea=8&keyword=

Environment Canada. (2007b, July 20). Incentives and Rebates: Manitoba Hybrid Electric Vehicle Rebate Program. Retrieved September 11, 2007 from http://www.ec.gc.ca/incitatifs-incentives/gc_fi_search_display.asp?id=271&jurisdiction=4&actionArea=8&keyword=

Honda Canada. (2007a). Build Your Honda Steps: Trim, Transmission, Colour. Retrieved September 11, 2007 from <http://www.honda.ca/HondaCA2006/BuildYourHonda/Step1?L=E&ModelName=CivicHybrid&yr=2007>

Honda Canada. (2007b). Build Your Honda Steps: Trim, Transmission, Colour. Retrieved September 11, 2007 from <http://www.honda.ca/HondaCA2006/BuildYourHonda/Step1?L=E&ModelName=CivicSedan&yr=2007>

Province of Manitoba. (2007). Eligible New Hybrid Electric Vehicles (as of May 2007). Retrieved September 11, 2007 from http://www.gov.mb.ca/est/pdfs/climate_change/eligible_hybrid_vehicles.pdf

Manitoba Finance. (n.d.) Retail sales tax. Retrieved September 11, 2007 from <http://www.gov.mb.ca/finance/taxation/taxes/retail.html>

Ontario Ministry of Finance. (2007, May 25). What You Should Know About Ontario's Taxes. Retrieved September 11, 2007 from <http://www.fin.gov.on.ca/english/resources/visitors.html>

Ontario Ministry of Revenue. (2007, July 23). What You Should Know About Ontario's Taxes. Retrieved September 11, 2007 from <http://www.fin.gov.on.ca/english/resources/visitors.html>

Reidl, Frank. (2007, July 18). [Hybrid_Vehicles for sale in Canada]. [Custom data file]. Toronto: Insurance Bureau of Canada.

Revenu Québec. (n.d.a). General information - GST and QST. Retrieved September 11, 2007 from <http://www.revenu.gouv.qc.ca/eng/particulier/taxes/consommateur/informations.asp>

Revenu Québec. (n.d.b). QST Rebate for Hybrid Vehicles. Retrieved September 11, 2007 from http://www.revenu.gouv.qc.ca/eng/particulier/taxes/remboursement/remb_part_tvq_vehicule_hybride.asp

Statistics Canada. (2007a, March 13). Ottawa - Gatineau (Ontario part), Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved September 11, 2007 from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007b, March 13). Ottawa - Gatineau (Quebec part), Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved September 11, 2007 from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Transport Canada. (2007a, July 17). [Hybrid_Vehicles for sale in Canada]. [Custom data file]. Ottawa: Minister of Transportation for Canada.

Transport Canada. (2007b, August 27). 2007 Model Year ecoAUTO Eligibility. Retrieved September 11, 2007 from <http://www.tc.gc.ca/programs/environment/ecotransport/ecoauto.htm#2007vehicleeligibility>

United States Environmental Protection Agency. (n.d.). Hybrid Cars. Retrieved September 11, 2007 from http://www.fueleconomy.gov/feg/hybrid_sbs_cars.shtml

Appendix I: Data methodology for the percentage of the CMA housing stock that is defined as either apartments or row units (2001).

Rationale

1. Single family homes cause automobile dependence and urban sprawl: the square feet of impervious surface attributable per household attributable to households housed in single family homes on any size lot is far greater than the comparable figure for row houses and apartments (Williams-Derry, 2007).

Sources of data

2. The data were obtained from Statistics Canada 2001 census data; the data are based on a 20% sample. We collected data on the percentage of dwellings within the CMA that were designated as being one of the following: row housing, apartment detached duplex, apartment building with fewer than five storeys and apartment building with five or more storeys (Statistics Canada 2007a; 2007b; 2007c; 2007d; 2007e; 2007f; 2007g; 2007h; 2007i; 2007j; 2007k; 2007l; 2007m; 2007n; 2007o; 2007p; 2007q; 2007r; 2007s; 2007t; 2007u; 2007v; 2007w; 2007x; 2007y; 2007z; 2007aa).

3. For the newly-created census metropolitan areas of Barrie, Kelowna and Moncton, we use Statistics Canada data for 2001 for the former census agglomerations of the same names.

4. We have verified that the use of data for the former census agglomerations is an acceptable measure for the newly created census metropolitan areas [1]. We compared the 2001 populations of the former census agglomerations as reported in the 2001 census with the 2001 populations of the newly created census metropolitan areas as reported in the 2006 census. In the cases of Barrie and Kelowna, the 2001 population counts were identical which suggests no boundary changes occurred. In the case of Moncton a non-material difference between the two counts exists [1] (Statistics Canada n.d.a; n.d.b; n.d.c; 2007ab; 2007ac, 2007ad).

5. We note that the census metropolitan areas of Ottawa-Gatineau and Saguenay experienced name changes as a result of municipal mergers that occurred following the 2001 census; these name changes have no material effect on the geographic boundaries of the census metropolitan areas. We verified that such is the case by comparing the 2001 populations for these census metropolitan areas using both the 2001 census geographic boundary definitions and the 2006 census geographic boundary definitions. In the case of Ottawa-Gatineau, the population counts differ by an amount that is not material; in the case of Saguenay, the population counts are identical [1] (Statistics Canada, n.d.d; n.d.e; 2007ae; 2007af),
Assignment of normalized scores

6. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

7. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i) / \text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

8. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the change in housing stock composition when contemplating a 10 year timeframe.

Data verification

9. To ensure accuracy, all data entered were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Statistics Canada. (2007a, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: St. John's. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431517>

Statistics Canada. (2007b, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Halifax. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431526>

Statistics Canada. (2007c, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Moncton. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431532>

Statistics Canada. (2007d, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Chicoutimi-Jonquière. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431545>

Statistics Canada. (2007w, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Calgary. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431637>

Statistics Canada. (2007x, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Kelowna. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431651>

Statistics Canada. (2007y, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Abbotsford. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431655>

Statistics Canada. (2007z, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Vancouver. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431656>

Statistics Canada. (2007aa, March 1). Structural Type of Dwelling (9) and Tenure (4) for Occupied Private Dwellings, for Canada, Provinces, Territories, Census Metropolitan Areas 1 and Census Agglomerations, 2001 Census - 20% Sample Data: Victoria. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=59162&APATH=3&METH=1&PTYPE=55430&THEME=40&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&L=0&RL=0&FREE=0&GID=431658>

Statistics Canada. (2007ab). 2006 community profiles: Barrie. Retrieved July 3, 2007, from http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=568__&Geo2=PR&Code2=35&Data=Count&SearchText=barrie&SearchType=Begins&SearchPR=01&B1=All&Custom=

Statistics Canada. (2007ac). 2006 community profiles: Kelowna. Retrieved July 3, 2007, from http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=915__&Geo2=PR&Code2=59&Data=Count&SearchText=kelowna&SearchType=Begins&SearchPR=01&B1=All&Custom=

Statistics Canada. (2007ad). 2006 community profiles: Moncton. Retrieved July 3, 2007, from http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=305__&Geo2=PR&Code2=13&Data=Count&SearchText=moncton&SearchType=Begins&SearchPR=01&B1=All&Custom=

Statistics Canada. (2007ae). 2006 community profiles: Ottawa. Retrieved July 3, 2007, from http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=505__&Geo2=PR&Code2=35&Data=Count&SearchText=ottawa&SearchType=Begins&SearchPR=01&B1=All&Custom=

Statistics Canada. (2007af). 2006 community profiles: Saguenay. Retrieved July 3, 2007, from http://www12.statcan.ca/english/census06/data/profiles/community/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=408__&Geo2=PR&Code2=24&Data=Count&SearchText=saguenay&SearchType=Begins&SearchPR=01&B1=All&Custom=

Statistics Canada. (n.d.a). Population and dwelling counts, for Canada, census metropolitan areas, census agglomerations and census subdivisions (municipalities), 2001 and 1996 censuses - 100% data: Barrie. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=568>

Statistics Canada. (n.d.b). Population and dwelling counts, for Canada, census metropolitan areas, census agglomerations and census subdivisions (municipalities), 2001 and 1996 censuses - 100% data: Kelowna. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=915>

Statistics Canada. (n.d.c). Population and dwelling counts, for Canada, census metropolitan areas, census agglomerations and census subdivisions (municipalities), 2001 and 1996 censuses - 100% data: Moncton. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=305>

Statistics Canada. (n.d.d). Population and dwelling counts, for Canada, census metropolitan areas, census agglomerations and census subdivisions (municipalities), 2001 and 1996 censuses - 100% data: Ottawa. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=505>

Statistics Canada. (n.d.e). Population and dwelling counts, for Canada, census metropolitan areas, census agglomerations and census subdivisions (municipalities), 2001 and 1996 censuses - 100% data: Chicoutimi - Jonquière. Retrieved July 3, 2007, from <http://www12.statcan.ca/english/census01/products/standard/popdwel/Table-CMA-C.cfm?T=1&SR=1&S=1&O=A&CMA=408>

Williams-Derry, Clark. (2007, September 6). Paving the Way. Message posted to Sightlines Institute Sprawl & Transportation - The Daily Score blog, archived at http://www.sightline.org/daily_score/sprawl.

Appendix J: Data methodology for the annual public transit regular revenue service kilometers traveled per capita, excluding heavy rail and commuter coach (2005).

Rationale

1. This metric provides an approximation of the level of transit service that was delivered within each CMA.
2. This metric is an imperfect measure. A more useful measure is seat-kilometers; data on that metric is not captured by CUTA (Canadian Urban Transit Association, 2005).

Caveats

3. Our use of revenue miles per capita is subject to a bias that favors smaller transit systems. Larger transit systems, while they may have the critical mass and density necessary to provide more service per capita, will tend to use larger buses. Our metric does not capture the size of the bus and accordingly will not accurately reflect the larger transit systems' service levels.
4. We chose not to measure data on ridership levels, that is, the number of passenger boardings. Such data are collected by way of surveys and are not independently observable. They are also subject to estimation methods that may be scientifically invalid or which are overly favorable to the transit operator in question. Furthermore, the transit systems included in our study use among them a variety of such methods, making comparisons between systems inappropriate [1].
5. We understand that by comparing systems with different levels of infrastructure and different modes of transportation that we are making comparisons between systems that are qualitatively distinct. We believe that the value of publicly displaying the data compensates for this flaw; moreover, we believe that showing these data is preferable to showing no data about transit systems.

Sources of data

6. We obtained data from the Canadian Urban Transit Association for the year 2005 [2]. Transit systems reported annual vehicle kilometers for regular revenue passenger service provided by all modes of transit. The figure we used is denoted as "Vs_r_avk" in the CUTA 2005 questionnaire database (Canadian Urban Transit Association, 2005, p.4).
7. Where data were not supplied to CUTA, or where the transit system was not a CUTA member, we obtained 2005 data directly from the transit system.
8. CUTA defines revenue vehicle kilometers as follows: "Annual vehicle revenue kilometres travelled by active revenue vehicles (buses, railcars, etc.) in regular passenger revenue service, including scheduled and non-scheduled service; does not include auxiliary passenger services (e.g. school contracts, charters, cross-boundary services to adjacent municipalities), deadheading, training, road tests, or maintenance" (Canadian Urban Transit Association, 2004, p.6).
9. Because we do not count revenue kilometers for special transit service including for those with a disability, we do not include revenue kilometers for any transit systems which provides only special services, even if these are provided on a regularly scheduled basis.
10. We excluded heavy rail service, for example, West Coast Express in Vancouver CMA and GO Transit in Hamilton, Toronto and Oshawa CMAs. We also exclude the commuter coach services operated by AMT in Montréal CMA and GO Transit in Toronto CMA.

11. We refer below to the complete names of the transit systems. However, the systems are identified within the CUTA spreadsheet using abbreviations of formal names [2]. We assume that the names identified within the CUTA spreadsheet would correspond to the proper names of the transit systems.

12. We determined the per capita figure by using population counts for the census metropolitan areas in question (Statistics Canada, 2007). These population counts are distinct from the service area population as defined by CUTA (Canadian Urban Transit Association, 2004, p.20). Our goal is to measure transit service within a CMA and therefore we include the census metropolitan area figure so as to reflect the extent of services within a CMA: the fact that a CMA may have boundaries that include semi-rural or suburban areas that are not well-served by transit is of interest to us.

Victoria CMA

13. For Victoria CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: BC Transit (Victoria) [2].

Vancouver CMA

14. For Vancouver CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Greater Vancouver Transit Authority [2] The Greater Vancouver Transit Authority is also known as Translink (Greater Vancouver Transportation Authority, n.d.).

15. We exclude data for the West Coast Express, which is a heavy rail commuter service [13].

Abbotsford CMA

16. For Abbotsford CMA, we included 2005 revenue vehicle kilometers as reported to us by BC Transit for the following transit systems: Central Fraser Valley [2] [6].

17. For this CMA's transit system, BC Transit does not use the same calculation as the one requested on the CUTA questionnaire; however, the data presented should be very close to data using the CUTA calculation [6].

Kelowna CMA

18. For Kelowna CMA, we included 2005 revenue vehicle kilometers as reported to us by BC Transit for the following transit systems: Kelowna [2] [6].

19. For this CMA's transit system, BC Transit does not use the same calculation as the one requested on the CUTA questionnaire; however, the data presented should be very close to data using the CUTA calculation [6].

Calgary CMA

20. For Calgary CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Airdrie and Calgary. These transit systems both provide service within the 2006 CMA geographical boundaries (Canadian Urban Transit Association, 2006, p.21) (Statistics Canada, 2007a). Airdrie does not maintain data on revenue kilometers; we requested the information of its transit services contractor [4]: the contractor did not supply the data in sufficient time for this first iteration of the index. We will make every effort to obtain the contractor's data in a later iteration of the index.

Edmonton CMA

21. For Edmonton CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Edmonton Transit System and St. Albert Transit. These transit systems all provide service within the 2006 CMA geographical boundaries [2] (Canadian Urban Transit Association, 2006, p.22) (Statistics Canada, 2007b).

22. Stathcona County Transit, which provides services within Edmonton CMA, did not report a figure to CUTA for 2005 [2] (Canadian Urban Transit Association, 2006, p.22). The manager of Strathcona transit informed us that this figure is not available [3].

Saskatoon

23. For Saskatoon CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Saskatoon Transit Services [2].

Regina

24. For Regina CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Regina Transit [2].

Winnipeg CMA

25. For Winnipeg CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Winnipeg Transit System [2].

Greater Sudbury

26. For Greater Sudbury CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Greater Sudbury Transit [2].

Windsor CMA

27. For Windsor CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Windsor Transit [2].

London CMA

28. For London CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: London Transit Commission [2].

Kitchener CMA

29. For Kitchener CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Grand River Transit [2]. We note that in the Canadian Urban Transit Association's database, Waterloo region refers to Grand River Transit (Canadian Urban Transit Association, 2006; 2004, p.119).

St. Catharines-Niagara CMA

30. For St. Catharines-Niagara CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Niagara Transit, St. Catharines Transit Commission and Welland Transit. These transit systems all provide service within the 2006 CMA geographical boundaries [2] (Canadian Urban Transit Association, 2006, p.32, 35, 36) (Statistics Canada, 2007c).

Hamilton CMA

31. For Hamilton CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Burlington Transit and Hamilton Street Railway Company. These transit systems all provide service within the 2006 CMA geographical boundaries [2] (Canadian Urban Transit Association, 2006) (Statistics Canada, 2007d).

32. We do not include revenue kilometers for GO Transit.

Barrie CMA

33. For Barrie CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Barrie Transit [2] [5].

34. We do not include revenue kilometers for GO Transit.

Toronto CMA

35. For Toronto CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Ajax-Pickering Transit Authority,

Brampton Transit, Town of Milton, Mississauga Transit, Oakville Transit, Toronto Transit Commission and York Region Transit. These transit systems all provide or provided service in 2005 within the 2006 CMA geographical boundaries [2] (Canadian Urban Transit Association, 2006, p.32) (Statistics Canada, 2007e).

36. We note that transit provided by the town of Halton Hills is for special services transit only (Canadian Urban Transit Association, 2006, p.31).

37. For the CMA of Toronto, the revenue kilometers for the former Ajax-Pickering Transit Authority are included. We note however that this system was absorbed by the newly created Durham Regional Transit on January 1, 2006 (City of Pickering, n.d.).

38. We note that the statistics for revenue kilometers for Milton Transit in 2005 is unaffected by the introduction in June 2007 of free transit on all routes during the hours 9am to 3pm (Town of Milton, n.d.).

39. We do not include revenue kilometers for GO Transit.

Oshawa CMA

40. For Oshawa CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: the former Oshawa Transit Commission and the former Whitby Transit. These transit systems both provided service in 2005 within the 2006 CMA geographical boundaries [2] (Statistics Canada, 2007f).

41. We furthermore included vehicle kilometers for Clarington Transit system as reported to us by Durham Regional Transit [10]. Clarington lies within Oshawa CMA and the former Clarington Transit provided services in the municipality of Clarington (Canadian Urban Transit Association, 2004, 72). The former Clarington Transit therefore provided services in 2005 within the 2006 CMA geographical boundaries (Statistics Canada, 2007f).

42. We note that transit services provided in 2005 by the former Ajax-Pickering Transit Authority fell primarily within the 2006 boundaries of Toronto CMA and accordingly we included its 2005 revenue kilometers with the figure for Toronto CMA. However, we note that effective January 1, 2006, the former Ajax-Pickering Transit Authority merged with the former Clarington Transit, the former Oshawa Transit Commission and the former Whitby Transit to form Durham Region Transit (City of Pickering, n.d.).

43. We do not include revenue kilometers for GO Transit.

Kingston CMA

44. For Kingston CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Kingston Transit [2].

Ottawa-Gatineau CMA

45. For Ottawa-Gatineau CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: OC Transpo and Société de Transport de l'Outaouais. These transit systems both provided service in 2005 within the 2006 CMA geographical boundaries [2] (Statistics Canada, 2007g).

Montréal CMA

46. For Montréal CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Société de Transport de Laval, Société de Transport de Montréal and Réseau de Transport de Longueuil. These transit systems all provide service within the 2006 CMA geographical boundaries [2] (Statistics Canada, 2007h).

47. For CIT Association, we used data provided to us by CIT Association for the following systems which provide services in part or in whole within the 2006 geographical boundaries of Montréal CMA: CIT Laurentides, CIT Chambly-Richelieu-Carignan, CRT Lanaudière, CIT Le Richelain, CIT Roussillon, CIT Sorel-Varennes, CIT Sud-Ouest, Vallée Richelieu, CIT La Presqu'Île [11].

48. Certain of the CIT Association member systems listed in the paragraph directly above provide services both within and without the 2006 geographic boundaries of the CMA. We cannot break out these figures and accordingly we include them all. The resulting figure is therefore not precisely accurate. We note that the revenue vehicle kilometers included for the CIT Association members represents less than 11% of total revenue vehicle kilometers for this CMA.

49. As a means of compensating for the inclusion of revenue kilometers gained outside the boundaries of the CMA, we exclude from our calculations data for MRC L'Assomption and MRC Les Moulins. Both these systems provide services within and without the 2006 geographic boundaries of the CMA (CRT Lanaudière, n.d.).

50. For OMIT Sainte-Julie, we include the information provided to us by Véolia Transportation, the contractor employed by the municipality of Sainte-Julie [8].

51. For Agence Métropolitaine de Transport, we do not include any data. This system only provides long-haul express commuter services by coach and by heavy rail [9].

Sherbrooke CMA

52. For Sherbrooke CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Société de Transport de Sherbrooke [2].

Québec CMA

53. For Québec CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Réseau de Transport de la Capitale [2].

54. We obtained and included 2005 data directly from Société de Transport de Lévis [12]. Société de Transport de Lévis provided services in 2005 within the 2005 geographical boundaries of the CMA (Société de Transport de Lévis, n.d.) (Statistics Canada, 2007i).

Saguenay CMA

55. For Saguenay CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Société de Transport de Saguenay [7].

Moncton

56. For Moncton CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Codiak Transit Commission. [2]

Halifax CMA

57. For Halifax CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: Halifax Regional Municipality Metro Transit. [2]

St. John's CMA

58. For St. John's CMA, we included 2005 revenue vehicle kilometers as reported to CUTA for the following transit systems: St. John's Transportation Commission. [2]

Assignment of normalized score

59. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

60. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$[\text{CMA}(i)/\text{IDEAL}] * 100 = \text{score for CMA } (i)$$

CMA(i) represents a given CMA included in our study

IDEAL = the ideal level as described in the following paragraph

61. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the revenue kilometres provided by local public transit authorities when contemplating a 10 year timeframe.

Data verification

62. To ensure accuracy, all data entered were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Canadian Urban Transit Association. (2006). CUTA Membership Directory 2006/2007. [Membership directory]. Toronto: Naylor Canada, Inc.

Canadian Urban Transit Association. (2005). Urban Transit Statistics – 2005. [Questionnaire]. Toronto: author unknown.

Canadian Urban Transit Association. (2004). CUTA Canadian Transit Fact Book (CUTA Report No. TS-04-5E/6F). Toronto: Tammy Siu and Philippe Bellon.

CRT Lanaudière. (n.d.). Municipalités Déservies. Retrieved August 23, 2007, from <http://www.crtl.amt.qc.ca/>

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007, from

http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007, from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Greater Vancouver Transportation Authority. (n.d.). Translink: The Greater Vancouver Transportation Authority. Vancouver. Retrieved August 23, 2007, from <http://www.translink.bc.ca/>

Town of Milton. (n.d.). New Milton Transit Developments. Retrieved August 17, 2007, from <http://www.milton.ca/Living-Getting+Around-71.htm>.

City of Pickering. (n.d.). Durham Region Transit launched January 1. Retrieved August, 2007, from <http://www.cityofpickering.com/standard/services/transit/main.html>.

Société de Transport de Lévis. (n.d.). Guides et Horaires Automne 2007. Retrieved August 23, 2007, from <http://www.stlevis.ca/>.

Statistics Canada. (2007, March 29). Table 3: Population of census metropolitan areas in 2006. Ottawa. Retrieved April 26, 2007, from <http://www12.statcan.ca/english/census06/analysis/popdwell/tables/table3.htm>

Statistics Canada. (2007a, March 13). Calgary, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007b, March 13). Edmonton, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007c, March 13). St. Catharines-Niagara, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007d, March 13). Hamilton, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007e, March 13). Toronto, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007f, March 13). Oshawa, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007g, March 13). Ottawa-Gatineau, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007h, March 13). Montréal, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007i, March 13). Québec, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Appendix K: Data methodology for the percentage of the CMA labour force bicycling, walking or taking public transit to work (2001).

Rationale

1. Bicycling, walking and public transit are all sustainable means of road transportation. Accordingly, we seek to measure the degree to which these methods are employed by a census metropolitan area's commuters.

Caveat

2. Census data is released only twice a decade. We have updated the figures using the methodology described below.

Sources of data

3. We obtained data from the 2001 census on the number of employed workers whose mode of transport to work was declared as bicycling, walking or public transit (Statistics Canada, 2007a; 2007b; 2007c; 2007d; 2007e; 2007f; 2007g; 2007h; 2007i; 2007j; 2007k; 2007l; 2007m; 2007n; 2007o; 2007p; 2007q; 2007r; 2007s; 2007t; 2007u; 2007v; 2007w; 2007x; 2007y; 2007z; 2007aa).

4. Using the number of workers as determined in the above paragraph, we determined the percentage of the labour force bicycling, walking and taking public transit to work using the following formula that takes into account each CMA's growth in its labour force between 2001 and 2006 as well as its total labour force at 2006

$$\% \text{ 2006 labour force bicycling, walking or taking public transit to work} = \frac{((\text{number of workers using these modes per 2001 census}) * (1 + (\text{average annual labour force growth rate 2001 to 2006} * 5))) / (\text{Total employed labour force, 2006})}{100}$$

5. We determined average labour force growth by comparing 2001 total employed labour force with 2006 total employed labour force (Statistics Canada, 2007ab; 2007ac; 2007ad; 2007ae; 2007af; 2007ag; 2007ah; 2007ai; 2007aj; 2007ak; 2007al; 2007am; 2007an; 2007ao; 2007ap; 2007aq; 2007ar; 2007as; 2007at; 2007au; 2007av; 2007aw; 2007ax; 2007ay; 2007az; 2007ba; 2007bb; 2007bc; 2007bd; 2007be; 2007bf).

6. The CMAs of Barrie, Kelowna and Moncton are new; 2006 labour market information was lacking for these CMAs and we used instead the relevant employment region as defined by Statistics Canada (Statistics Canada 2007ac; 2007ad; 2007ae); this is a close but imperfect match to the 2006 geographic boundaries of Moncton CMA.

Assignment of normalized scores

7. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i) / \text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

8. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i) / \text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

9. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO2) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO2) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the change in the percentage of the labour force bicycling, walking or taking public transit to work when contemplating a 10 year timeframe.

Data verification

10. To ensure accuracy, all data entered were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from

http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Statistics Canada. (2007a). 2001 community profiles: Community Highlights for Toronto. Retrieved July 25, 2007, from http://www12.statcan.ca/english/profil01/CP01/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=535__&Geo2=PR&Code2=59&Data=Count&SearchText=vancouver&SearchType=Begin s&SearchPR=01&B1=All

Statistics Canada. (2007b). 2001 community profiles: Community Highlights for Montréal. Retrieved July 25, 2007, from http://www12.statcan.ca/english/profil01/CP01/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=535__&Geo2=PR&Code2=59&Data=Count&SearchText=vancouver&SearchType=Begin s&SearchPR=01&B1=Work

Statistics Canada. (2007c). 2001 community profiles: Community Highlights for Vancouver. Retrieved July 25, 2007, from http://www12.statcan.ca/english/profil01/CP01/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=933__&Geo2=PR&Code2=59&Data=Count&SearchText=vancouver&SearchType=Begin s&SearchPR=01&B1=All&Custom=

Statistics Canada. (2007d). 2001 community profiles: Community Highlights for Ottawa - Hull. Retrieved July 25, 2007, from http://www12.statcan.ca/english/profil01/CP01/Details/Page.cfm?Lang=E&Geo1=CMA&Code1=505__&Geo2=PR&Code2=59&Data=Count&SearchText=vancouver&SearchType=Begin s&SearchPR=01&B1=All

Statistics Canada. (2007ba). Labour Force Activity (8), Age Groups (17B), Sex (3), Immigrant Status and Period of Immigration (10B) and Marital Status (7) for Population 15 Years and Over, for Canada, Provinces and Territories, 1981 to 2001 Censuses, and for Census Metropolitan Areas 1 and Census Agglomerations, 1991 to 2001 Censuses - 20% Sample Data. Statistics Canada Catalogue No. 97F0012XCB2001001. Ottawa. Retrieved July 25, 2007 from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=60337&APATH=3&METH=1&PTYPE=55440&THEME=46&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=99&GK=NA&VID=0&VNAMEE=&VNAMEF=&FL=0&RL=0&FREE=0&GID=431651>

Statistics Canada. (2007bb). Labour Force Activity (8), Age Groups (17B), Sex (3), Immigrant Status and Period of Immigration (10B) and Marital Status (7) for Population 15 Years and Over, for Canada, Provinces and Territories, 1981 to 2001 Censuses, and for Census Metropolitan Areas 1 and Census Agglomerations, 1991 to 2001 Censuses - 20% Sample Data. Statistics Canada Catalogue No. 97F0012XCB2001001. Ottawa. Retrieved July 25, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=60337&APATH=3&METH=1&PTYPE=55440&THEME=46&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=99&GK=NA&VID=0&VNAMEE=&VNAMEF=&FL=0&RL=0&FREE=0&GID=431655>

Statistics Canada. (2007bc). Labour Force Activity (8), Age Groups (17B), Sex (3), Immigrant Status and Period of Immigration (10B) and Marital Status (7) for Population 15 Years and Over, for Canada, Provinces and Territories, 1981 to 2001 Censuses, and for Census Metropolitan Areas 1 and Census Agglomerations, 1991 to 2001 Censuses - 20% Sample Data. Statistics Canada Catalogue No. 97F0012XCB2001001. Ottawa. Retrieved July 25, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=60337&APATH=3&METH=1&PTYPE=55440&THEME=46&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=99&GK=NA&VID=0&VNAMEE=&VNAMEF=&FL=0&RL=0&FREE=0&GID=431612>

Statistics Canada. (2007bd). Labour Force Activity (8), Age Groups (17B), Sex (3), Immigrant Status and Period of Immigration (10B) and Marital Status (7) for Population 15 Years and Over, for Canada, Provinces and Territories, 1981 to 2001 Censuses, and for Census Metropolitan Areas 1 and Census Agglomerations, 1991 to 2001 Censuses - 20% Sample Data. Statistics Canada Catalogue No. 97F0012XCB2001001. Ottawa. Retrieved July 25, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=60337&APATH=3&METH=1&PTYPE=55440&THEME=46&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=99&GK=NA&VID=0&VNAMEE=&VNAMEF=&FL=0&RL=0&FREE=0&GID=431584>

Statistics Canada. (2007be). Labour Force Activity (8), Age Groups (17B), Sex (3), Immigrant Status and Period of Immigration (10B) and Marital Status (7) for Population 15 Years and Over, for Canada, Provinces and Territories, 1981 to 2001 Censuses, and for Census Metropolitan Areas 1 and Census Agglomerations, 1991 to 2001 Censuses - 20% Sample Data. Statistics Canada Catalogue No. 97F0012XCB2001001. Ottawa. Retrieved July 25, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=60337&APATH=3&METH=1&PTYPE=55440&THEME=46&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=99&GK=NA&VID=0&VNAMEE=&VNAMEF=&FL=0&RL=0&FREE=0&GID=431545>

Statistics Canada. (2007bf). Labour Force Activity (8), Age Groups (17B), Sex (3), Immigrant Status and Period of Immigration (10B) and Marital Status (7) for Population 15 Years and Over, for Canada, Provinces and Territories, 1981 to 2001 Censuses, and for Census Metropolitan Areas 1 and Census Agglomerations, 1991 to 2001 Censuses - 20% Sample Data. Statistics Canada Catalogue No. 97F0012XCB2001001. Ottawa. Retrieved July 25, 2007 from

<http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=60337&APATH=3&METH=1&PTYPE=55440&THEME=46&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=99&GK=NA&VID=0&VNAMEE=&VNAMEF=&FL=0&RL=0&FREE=0&GID=431532>

Appendix L: Data methodology for percentage of total public transit kilometers that are free in the downtown core (2005).

Rationale

1. If CMAs are to reduce their residents' dependence upon automobiles, we believe that they must introduce more appealing reasons for the public to forego the use of automobiles. Free transit service in the downtown core provides members of the public with a novel and appealing reason to use transit.

Sources of data

2. We determined if there was free transit offered in the downtown core in a CMA's principal city by contacting the transit authorities in each CMA. We defined free transit as regularly scheduled regular service; we do not count special transit services operating for free. Some transit operators outside the downtown core provide free transit elsewhere in the CMA; however, we do not capture this metric as we are focused on the downtown urban core of the CMA around which the CMA's population is concentrated.

3. We obtained the total amount of kilometres of free transit service in the downtown core provided for the year 2005. We added this amount to the total amount of regular service revenue kilometres for the year 2005. We then determined the percentage of the total represented by kilometres of free transit service in the downtown core.

Notes concerning specific CMAs

4. Halifax CMA has free transit in its downtown core offered from July through October. We include the figures on the supposition that this service will be useful within the months it is offered.

5. Québec CMA has free transit available through a promotion offered to those whose place of employment is located along one of two bus routes which extend into suburban areas. The promotion is offered only in suburban areas served by the two bus routes. Registration is necessary and is available to those whose place of employment is situated along one of the two lines for which service is offered for free [14c] [14d]. We do not include such service as it is not serve the CMA's downtown core. Additionally in Québec CMA, a shuttle service in the downtown core was in a trial phase in 2005 and subsequently discontinued [14c].

6. Saskatoon CMA initiated its free service in July, 2005. The figure presented is for the months of July through December 2005, inclusive. Full year service commenced in 2006 and therefore the figure will be twice as high in 2006 [8].

Assignment of normalized scores

7. Values for the free transit in the downtown core values behave much like binary variables; that is, they do not vary much one from the other in absolute terms. We therefore use a binary value when counting the score toward the CMA's total score which determines its grade. Specifically, we assign to a CMA which exhibits any degree of free transit in the downtown core a nominal score of 25; we combine this nominal score with a nominal score of 50 if the CMA in question also exhibits any provincial sales tax credits toward the purchase of hybrid gasoline-electric vehicles (see Appendix H). We then divide the total by 75 (the maximum nominal score obtainable by any CMA); the CMA's nominal score out of 75 is then adjusted for the combined weightings of the sales tax and free transit in the core variables.

8. Although values for the free transit in the downtown core variable are treated as binary values in the calculation of a CMA's overall score, we nonetheless also calculate the CMA's score relative to the other CMAs and relative to the ideal sales tax credit level identified by the GreenApple expert panel. We calculate those values as described below.

9. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$[\text{CMA}(i)/\text{MAX}] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

MAX = the maximum value among the 27 observed values.

10. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$[\text{CMA}(i)/\text{IDEAL}] * 100 = \text{score for CMA}(i)$$

CMA(i) represents a given CMA included in our study

IDEAL = the ideal level as described in the following paragraph

11. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the change in the percentage of total regular service kilometres with in a CMA that are free provided without charge in the downtown core.

Works cited

Retrievable sources

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from

http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Appendix M: Data methodology for population-weighted annual adult transit pass cost (2007) adjusted by 2005 median household income.

Rationale

1. Demand for transit passes is not perfectly inelastic: all other things being equal, a cheaper pass price will result in more purchases of such passes. We believe that municipalities can influence demand for transit passes and hence transit usage by making transit passes as affordable as possible.

Caveat

2. We are not attempting to compare the consumer's absolute benefit per dollar spent on a transit pass: that is, we are not trying to measure and compare, in this measure of transit pass cost, what the various transit passes confer upon their holders. We understand that the latter comparison is ultimately fraught with difficulties. Instead, we simply are reporting the affordability relative to local incomes of the transit pass made available. Only a CMA that does well very well both in this measure of affordability and in the variables measuring transit service levels has no need to improve: a CMA that does not score well in affordability could, even with outstanding performance in regard to its transit service levels, improve upon the number of riders using its system, all other things being equal. Conversely, a CMA exhibiting very good affordability of its transit passes but poor service levels would score poorly overall in regard to transit.

Sources of data

3. This cost is used to gauge transit pass affordability as compared to median household income. We measure the cost of non-discounted adult transit passes providing local regular transit service within the CMA excluding commuter coach and heavy rail service. To measure affordability, we multiply monthly transit pass cost by twelve and divide by median household income; where an annual pass is less than 12 consecutive monthly passes (ignoring the time value of money), we use the cost of an annual pass.

4. We used 2005 median household income for all census metropolitan areas except Barrie, Kelowna and Moncton CMAs. The data were retrieved from Statistics Canada; 2005 was the most recent year for which these data were available (Statistics Canada, 2007a).

5. For Barrie, Moncton and Kelowna CMAs we use average household income because no median data were gathered by Statistics Canada for these CMAs prior to their formation as such 2006 (Statistics Canada, 2007ap). We use 2006 average household income using projects prepared by MapInfo Canada (Tetrad Computer Applications, 2007b); these estimates are based on 2001 census data and they use the CMA definition (Tetrad Computer Applications, 2007a).

6. We assume that household composition is not subject to a skewing effect due to certain CMAs having a larger percentage of single-person households. If such an effect does exist, we assume that Statistics Canada data corrects for this or that such correction is impossible to make.

Victoria CMA

7. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory (Canadian Urban Transit Association, p.p.23-26). We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA.

8. In Victoria CMA, transit services are provided by BC Transit – Victoria. We obtained information about transit pass costs from BC Transit (BC Transit, 2007a; 2007b).

Vancouver CMA

9. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory (Canadian Urban Transit Association, p.p.23-26). We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA.

10. In Vancouver CMA transit services are provided by Translink (Canadian Urban Transit Association, p.p.23-26).

11. To reflect the cost of local travel, we used the Translink one zone adult monthly regular pass which provides for travel within a limited number of communities. This allows us to better compare the cost of local service monthly adult transit passes in Vancouver CMA with those offered in other CMAs. We note that on weekends, holidays and on weekdays after 6:30p.m., these local passes are valid across all communities without a fare integration charge (Greater Vancouver Transportation Authority, n.d.a; n.d.b).

12. We note that that the Vancouver transit pass we use in our calculations is qualitatively difficult to compare with other passes because it includes light rail service (Greater Vancouver Transportation Authority, n.d.c).

Abbotsford CMA

13. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Abbotsford CMA transit services are provided by the BC Transit – Central Fraser Valley System (Canadian Urban Transit Association, p.p.23-26).

14. We used the cost of a monthly adult regular transit pass issued by BC Transit – Central Fraser Valley System (BC Transit, 2007c).

Kelowna CMA

15. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Kelowna CMA transit services are provided by the BC Transit – Kelowna Transit (Canadian Urban Transit Association, p.p.23-26).

16. We used the cost of a monthly adult regular transit pass issued BC Transit – Kelowna Transit (BC Transit, 2007d).

Calgary CMA

17. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Calgary CMA transit services are provided by Calgary Transit and the City of Airdrie (Canadian Urban Transit Association, p.p.21-23).

18. For Calgary CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators.

19. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

20. We note that that the Calgary transit pass we use in our calculations is qualitatively difficult to compare with other passes because it includes light rail service (Calgary Transit, n.d.a).

21. We make no attempt to include fare-integration charges in our calculation.

22. For the municipality of Calgary, which represented 91.6% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass [1] (Calgary Transit, n.d.b; n.d.c).

23. For the municipality of Airdrie, which represented 2.7% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass [2].

24. For the municipalities of Beiseker, Chestermere, Cochrane, Crossfield, Irricana, Rockyview No. 44 and Tsuu T'ina Nation 145, which together represented 5.8% of the 2006 CMA population, no local bus service appears to be available (Statistics Canada, 2007b). We grossed up the population-weighted average pass cost as if it were offered in these communities.

Edmonton CMA

25. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Edmonton CMA transit services are provided by Edmonton Transit, St. Albert Transit and Strathcona County Transit (Canadian Urban Transit Association, p.p.21-23).

26. For Edmonton CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators.

27. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

28. We note that that Edmonton Transit's pass is qualitatively difficult to compare with other passes because it includes light rail service. We nonetheless include it in our calculation (Edmonton Transit System, n.d.a).

29. We make no attempt to include fare-integration charges in our calculation

30. For the municipality of St. Albert, which represented 5.6% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass; this pass does not include shared service on other systems in the CMA (City of St. Albert, 2007) (Statistics Canada, 2007c).

31. For the municipality of Edmonton, which represented 70.6% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass (City of Edmonton, 2007) (Statistics Canada, 2007c).

32. For the municipality of Strathcona, which represented 8.0% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass (Statistics Canada, 2007c) (Strathcona County, 2007).

33. For the municipalities of Alexander 134, Beaumont, Betula Beach, Bon Accord, Bruderheim, Calmar, Devon, Fort Saskatchewan, Gibbons, Golden Days, Itaska Beach, Kapasiwin, Lakeview, Leduc, Leduc County, Legal, Morinville, New Sarepta, Parkland County, Point Alison, Redwater, Seba Beach, Spring Lake, Spruce Grove, Stony Plain, Stony Plain 135, Sturgeon County, Sundance Beach, Thorsby, Wabamun, Wabamun 133A, Wabamun 133B and Warburg, which together represented 15.9% of the 2006 CMA population, no local bus service appears to be available (Statistics Canada, 2007c). We grossed up the population-weighted average pass cost as if it were offered in these communities.

Regina CMA

34. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Regina CMA transit services are provided by Regina Transit (Canadian Urban Transit Association, p.p. 41-42).

35. We used the cost of a monthly adult regular transit pass issued by Regina Transit (Regina Transit, 2007).

Saskatoon CMA

36. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Saskatoon CMA transit services are provided by Saskatoon Transit Services (Canadian Urban Transit Association, p.p. 41-42).

37. We used the cost of a monthly adult regular transit pass issued by Saskatoon Transit Services [3] (City of Saskatoon, n.d.).

Winnipeg CMA

38. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Winnipeg CMA transit services are provided by the City of Winnipeg Transit System (Canadian Urban Transit Association, p. 26).

39. We used the cost of a monthly adult regular transit pass issued by City of Winnipeg Transit System (City of Winnipeg, 2004).

Greater Sudbury CMA

40. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Greater Sudbury CMA transit services are provided by Greater Sudbury Transit (Canadian Urban Transit Association, p.p. 28-37).

41. We used the cost of a monthly adult regular transit pass issued by Greater Sudbury Transit [4] (City of Greater Sudbury, 2007).

Windsor CMA

42. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Windsor CMA transit services are provided by Windsor Transit (Canadian Urban Transit Association, p.p. 28-37).

43. We used the cost of a monthly adult regular transit pass issued by Windsor Transit [5] (City of Windsor, n.d.).

London CMA

44. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In London CMA transit services are provided by London Transit (Canadian Urban Transit Association, p.p. 28-37).

45. We used the cost of a monthly adult regular transit pass issued by London Transit [6] (London Transit Commission, 2007).

Kitchener CMA

46. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Kitchener CMA transit services are provided by Grand River Transit (Canadian Urban Transit Association, p.p. 28-37).

47. We used the cost of a monthly adult regular transit pass issued by Grand River Transit (Grand River Transit, n.d.).

Barrie CMA

48. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Barrie CMA transit services are provided by Barrie Transit (Canadian Urban Transit Association, p.p. 28-37).

49. We used the cost of a monthly adult regular transit pass issued by Barrie Transit. [7] (Corporation of the City of Barrie, 2007).

St. Catharines-Niagara CMA

50. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In St. Catharines-Niagara CMA transit services are provided by Niagara Transit, St. Catharines Transit and Welland Transit (Canadian Urban Transit Association, p.p. 28-37).

51. For St. Catharines-Niagara CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators.

52. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

53. We make no attempt to include fare-integration charges in our calculation.

54. For the municipality of St. Catharines, which represented 33.8% of the 2006 CMA population, we used the cost of a monthly adult pass (St. Catharines Transit Commission, n.d.) (Statistics Canada, 2007d).

55. For the municipality of Niagara Falls, which represented 21.1% of the 2006 CMA population, we used the cost of a monthly adult pass (Corporation of the City of Niagara Falls, 2007) (Statistics Canada, 2007d).

56. For the municipality of Welland, which represented 12.9% of the 2006 CMA population, we used the cost of a monthly adult pass (Corporation of the City of Welland, 2007) (Statistics Canada, 2007d).

57. For the municipalities of Fort Erie, Lincoln, Niagara-on-the-Lake, Pelham, Port Colborne and Thorold, which together represented 32.2% of the 2006 CMA population, no local bus service appears to be available (Statistics Canada, 2007d). We grossed up the population-weighted average pass cost as if it were offered in these communities.

Hamilton CMA

58. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Hamilton CMA transit services are provided by Burlington Transit and Hamilton Street Railway Company (Canadian Urban Transit Association, p.p. 28-37).

59. For Hamilton CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators.

60. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

61. We make no attempt to include fare-integration charges in our calculation.

62. For the municipality of Hamilton, which represented 72.8% of the 2006 CMA population, we used the cost of a monthly adult pass (City of Hamilton, 2007) (Statistics Canada, 2007e).

63. For the municipality of Burlington, which represented 23.7% of the 2006 CMA population, we used the cost of a monthly adult pass (City of Burlington, 2007) (Statistics Canada, 2007e).

64. For the municipality of Grimsby, which represented 3.5% of the 2006 CMA population, no local bus service appears to be available (Statistics Canada, 2007e). We grossed up the population-weighted average pass cost as if it were offered in this community.

Toronto CMA

65. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Toronto CMA transit services are provided by the Brampton Transit, Durham Region Transit, Milton Transit, Mississauga Transit, Oakville Transit, Toronto Transit Commission and York Region Transit (Canadian Urban Transit Association, p.p. 28-37).

66. For Toronto CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators.

67. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

68. We note that that the Toronto Transit Commission's transit pass is qualitatively difficult to compare with other passes because it includes light rail service. We nonetheless include it in our calculation (Toronto Transit Commission, 2007).

69. We make no attempt to include fare-integration charges in our calculation.

70. For the municipality of Toronto, which represented 49.0% of the 2006 CMA population, we used the cost of an adult Metropass Discount Plan pass valid on Toronto Transit Commission routes (Toronto Transit Commission, n.d.a;)

71. For the municipalities of Vaughn, Markham, Richmond Hill, Newmarket, East Gwillumbury, Georgina and Aurora, which together represented 16.6% of the 2006 CMA population, we used the cost of a two-zone adult monthly pass issued by York Region Transit (Statistics Canada, 2007f) (York Region Transit, n.d.a) (York Region Transit, n.d.b).

72. For the municipality of Brampton, which represented 8.5% of the 2006 CMA population, we used the cost of a monthly adult pass issued by Brampton Transit. (Brampton, 2007a; 2007b) (Statistics Canada, 2007f).

73. For the municipality of Mississauga, which represented 13.1% of the 2006 CMA population, we used the cost of a monthly adult pass issued by Mississauga Transit (City of Mississauga, 2007) (Statistics Canada, 2007f).

74. For the municipality of Oakville, which represented 3.2% of the 2006 CMA population, we used the cost of a monthly adult pass issued by Oakville Transit (Town of Oakville, n.d.) (Statistics Canada, 2007f).

75. For the municipality of Milton, which represented 1.1% of the 2006 CMA population, we used the cost of a monthly adult pass issued by Milton Transit (Town of Milton, n.d.) (Statistics Canada, 2007f).

76. For the municipalities of Ajax and Pickering, which together represented 3.5% of the 2006 CMA population, we used the cost of a monthly adult pass issued by Durham Region Transit (Durham Region Transit, n.d.) (Statistics Canada, 2007f).

77. We did not include the town of Halton Hills's transit service because it offers only specialized services (Town of Halton Hills n.d.) (Statistics Canada, 2007f).

78. For the municipalities of Bradford West Gwillumbury, Caledon, Chippewas of Georgina Island First Nation, Halton Hills, King, Mono, New Tecumseth, Orangeville, Uxbridge and Whitchurch-Stouffville, which together represented 5.1% of the 2006 CMA population, no local bus service appears to be available. We grossed up the population-weighted average pass cost as if it were offered in these communities (Statistics Canada, 2007f).

Oshawa CMA

79. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Oshawa CMA transit services are provided by the Durham Region Transit (Canadian Urban Transit Association, p.p. 28-37).

80. We note that we are not including the population of the municipalities of Ajax and Pickering, both of which are served by Durham regional transit, since they lie within the 2006 geographical boundaries of Toronto CMA (Statistics Canada, 2007f). This does not affect our calculation as we are aware only of the single transit operator in Oshawa CMA [8].

81. We used the cost of a monthly adult regular transit pass issued by Durham Region Transit [8] (Durham Region Transit, n.d.).

Kingston CMA

82. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Kingston CMA transit services are provided by Kingston Transit (Canadian Urban Transit Association, p.p. 28-37).

83. We used the cost of a monthly adult regular transit pass issued by Kingston Transit (City of Kingston, n.d.).

Ottawa-Gatineau CMA

84. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Ottawa-Gatineau CMA transit services are provided by the OC Transpo and Société de Transport de l'Outaouais (Canadian Urban Transit Association, p.p. 28-41).

85. For Ottawa-Gatineau CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators.

86. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

87. We make no attempt to include fare-integration charges in our calculation.

88. For the municipality of Ottawa, which represented 71.8% of the 2006 CMA population, we used the discounted cost of a monthly adult regular transit pass purchased annually provided by OC Transpo [9] (OC Transpo, n.d.). We ignore the time value of money effects of pre-paying this pass at the beginning of each calendar year.

89. For the municipalities of Cantley, Chelsea and Gatineau, which together represented 22.7% of the 2006 CMA population, we used the discounted cost of a monthly adult transit pass purchased annually provided by Société de transport de l'Outaouais (Société de Transport de l'Outaouais, 2002a; 2002b; 2002c) (Statistics Canada, 2007g).

90. For the municipalities of Clarence-Rockland, Denholm, L'Ange-Gardien, La Pêche, Pontiac, Russell and Val-des-Monts, which together represented 6.8% of the 2006 CMA population, no local bus service appears to be available (Société de Transport de l'Outaouais, 2002a; 2002b; 2002c) (Statistics Canada, 2007g). We grossed up the population-weighted average pass cost in order to reflect the cost had it been offered in these communities.

Montréal CMA

91. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Montréal CMA local transit services are provided by CIT Chambly-Richelieu-Carignan, CIT La Presqu'île, CIT Laurentides, CIT Le Richelain, CIT Roussillon, CIT Sorel-Varennes, CIT Sud-Ouest, CIT Vallée du Richelieu, CRT Lanaudière, OMIT Sainte-Julie, RTC Longueuil, STL Laval and STM Montréal (Canadian Urban Transit Association, p.p.37-41). We exclude Agence Métropolitaine de Transport because it does not offer local services; it offers only commuter service by bus and heavy rail [10].

92. We further identified service providers for Montréal CMA using a list provided by the Société de Transport de Montréal and a map provided by the Agence Métropolitaine de Transport, both of which pertain to transit providers in the greater Montréal area (Agence Métropolitaine de Transport, 2006b) (Société de Transport de Montréal, n.d.a).

93. For Montréal CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators. We did not use the Zone 8 bus-subway-rail transit pass offered by AMT because this product has no equal in the other 26 CMAs; accordingly, its cost, which is higher, cannot be fairly compared with costs of the other passes.

94. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

95. We note that that the STM Montréal transit pass is qualitatively difficult to compare with other passes because it affords access to light rail service. We nonetheless include it in our calculation (Société de Transport de Montréal, n.d.b).

96. We make no attempt to include fare-integration charges in our calculation.

97. For the municipalities of Carignan, Chambly, Richelieu and Saint-Mathias-sur-Richelieu, which together represented 2.1% of the 2006 CMA population, we used the cost of a monthly adult local transit pass for 2007 from CIT Chambly (Agence Métropolitaine de Transport, 2006a; 2003c) (Statistics Canada, 2007h).

98. For the municipalities of Beloeil, McMasterville, Mont-Saint-Hilaire, Otterburn Park, Saint-Basile-le-Grand and Saint-Bruno-de-Montarville, which together represented 2.4% of the 2006 CMA population, we used the cost of a monthly adult "circuit 300" transit pass valid in the four relevant zones for 2007 from CIT de la Vallée du Richelieu the "circuit 300" pass offers commuter service to Montréal (Agence Métropolitaine de Transport, 2007f; 2006g; 2004; 2000a) (Statistics Canada, 2007h).

99. For the municipalities of Blainville, Bois-des-Filion, Boisbriand, Deux-Montagnes, Lorraine, Mirabel, Oka, Pointe-Calumet, Rosemère, Sainte-Anne-des-Plaines, Saint-Eustache, Sainte-Marthe-sur-le-Lac, Sainte-Thérèse, Saint-Jérôme and Saint-Joseph-du-Lac, which together represented 6.3% of the 2006 CMA population, we used the cost of a monthly adult "passe-partout +" transit pass for 2007 from CIT Laurentides; the "passé-partout +" pass offers service to Laval (Agence Métropolitaine de Transport, 2005a; 2005b; 2003d) (Statistics Canada, 2007h).

100. For the municipality of Lavaltrie, which represents 0.3% of the 2006 CMA population, we used the cost of a monthly Zone 5 adult local transit pass for 2007 from CRT Lanaudière for route 138; only the route 138 pass is applicable to Lavaltrie. The route 55 pass is not applicable to Lavaltrie (Agence Métropolitaine de Transport, 2007d; 2007e; 2003e) (Statistics Canada, 2007h).

101. For the municipalities of Mascouche and Terrebonne, which together represented 3.5% of the 2006 CMA population, we used the cost of a monthly adult local transit pass for 2007 from MRC Les Moulins (Agence Métropolitaine de Transport, 2006c; 2003a) (Statistics Canada, 2007h).

102. We note that the system CIT Deux Montagnes is no longer in existence; service for this area is not provided by CIT Laurentides (Deux-Montagnes MRC, n.d.) (Statistics Canada, 2007h).

103. For the municipality of Beauharnois, which represented 0.3% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from CIT du Sud-Ouest for this municipality (Agence Métropolitaine de Transport, 2007b; 2000c) (Statistics Canada, 2007h).

104. For the municipalities of Châteauguay and Kanawake, which together represented 1.2% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from CIT du Sud-Ouest for these municipalities (Agence Métropolitaine de Transport, 2007b; 2000c) (Statistics Canada, 2007h).

105. For the municipality of Léry, which represented 0.1% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from CIT du Sud-Ouest for this municipality (Agence Métropolitaine de Transport, 2007b; 2000c) (Statistics Canada, 2007h).

106. For the municipalities of l'Assomption, Charlemagne, Le Gardeur, L'Épiphanie (city), L'Épiphanie (parish) and Repentigny which together represented 2.9% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass for 2007 from MRC Assomption for these municipalities (Agence Métropolitaine de Transport, 2003b; 2006d) (Government of Québec, 2005a; 2005b) (Statistics Canada, 2007h).

107. For the municipalities of Candiac, La Prairie and Sainte-Philippe, which together represented 1.2% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass for 2007 from CIT Le Richelain for these municipalities (Agence Métropolitaine de Transport, 2006e; 2003f) (Statistics Canada, 2007h).

108. For the municipalities of Delson, Saint-Constant and Sainte-Catherine, which together represented 1.0% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass for 2007 from CIT Roussillon for these municipalities (Agence Métropolitaine de Transport, 2006e; 2001b) (Statistics Canada, 2007h).

109. For the municipality of Saint-Amable, which represented 0.2% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from CIT Sorel-Varennes. This pass provides service from Saint-Amable to Longueuil (Agence Métropolitaine de Transport, 2006f; 2000b) (Statistics Canada, 2007h).

110. For the municipality of Varennes, which represented 0.6% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from CIT Sorel-Varennes. This pass provides service from Varennes to Longueuil (Agence Métropolitaine de Transport, 2006f; 2000b) (Statistics Canada, 2007h).

111. For the municipality of Verchères, which represented 0.1% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from CIT Sorel-Varennes. This pass provides service from Verchères to Longueuil (Agence Métropolitaine de Transport, 2006f; 2000b) (Statistics Canada, 2007h).

112. The city of Repentigny appears no longer to offer its own transit service; the transit link on its web link links directly to MRC Assomption's transit service website (Réseau de transport collectif de la MRC de l'Assomption, n.d.) (Statistics Canada, 2007h) (Ville de Repentigny, n.d.).

113. The city of Saint-Eustache appears no longer to offer its own transit service; the transit link on its web offers a link to CIT Laurentides (Statistics Canada, 2007h) (Ville de Saint-Eustache, n.d.).

114. For the municipalities of Baie-D'Urfé, Beaconsfield, Côte-Saint-Luc, Dollard-des-Ormeaux, Dorval, Hampstead, Kirkland, L'Île-Dorval, Mont-Royal, Montréal, Montréal-Est, Montréal-Ouest, Pointe-Claire, Sainte-Anne-de-Bellevue, Senneville, Westmount, which together represented 50.5% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from STM. We identified the list of communities served by STM using its service map (Société de Transport de Montréal, n.d.c; n.d.d) (Statistics Canada, 2007h).

115. For the municipalities of Boucherville, Brossard, Longueuil and Saint-Lambert, which together represented 9.7% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from RTL Longueuil. [36] [37] We did not include the municipality of Saint-Bruno-de-Montarville with the municipalities served by RTL Longueuil because this municipality appears to be served equally by RTL Longueuil and CIT de la Vallée-du-Richelieu: the city's website makes no distinction between the two service providers (Ville de Saint-Bruno-de-Montarville, n.d.) (Statistics Canada, 2007h).

116. For the municipality of Laval, which represented 10.1% of the 2006 CMA population, we used the cost of the most expensive monthly adult local transit pass (that was not a regional pass offered through the Agence Métropolitaine de Transport) for 2007 from STL Laval (Société de Transport de la Ville de Laval, n.d.) (Statistics Canada, 2007h).

117. For the municipality of Sainte-Julie, which represented 0.05% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass (that was not a regional transit pass offered through Agence Métropolitaine de Transport) for 2007 from RTC Sainte-Julie. This pass includes service to Montréal (Ville de Sainte-Julie, 2005) (Statistics Canada, 2007h).

118. For the municipality of Mercier, which represented 0.3% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass (that was not a regional transit pass offered through Agence Métropolitaine de Transport) for 2007 from CIT Haut-St.-Laurent. This pass includes service to Montréal (Agence Métropolitaine de Transport, 2001a; n.d.) (Statistics Canada, 2007h).

119. For the municipality of Saint-Sulpice, which represented 0.5% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass (that was not a regional transit pass offered through Agence Métropolitaine de Transport) for 2007 from MRC L'Assomption. This pass includes service to Montréal (Agence Métropolitaine de Transport de Montréal, 2007c; 2006c) (Statistics Canada, 2007h).

120. For the municipality of Vaudreuil-Dorion, which represented 0.7% of the 2006 CMA population, we used the cost of the most expensive adult local transit pass (that was not a regional transit pass offered through Agence Métropolitaine de Transport) for 2007 from CIT Presqu'île (Agence Métropolitaine de Transport, 2007d; 2006h) (Statistics Canada, 2007h).

121. For the municipalities of Gore, Hudson, Kanesatake, L'Île-Cadieux, L'Île-Perrot, Les Coteaux, Les Cèdres, Notre-Dame-de-l'Île-Perrot, Pincourt, Pointe-des-Cascades, Saint-Colomban, Saint-Isidore, Saint-Lazare, Saint-Mathieu, Saint-Mathieu-de-Beloil, Saint-Placide, Saint-Zotique, Terrasse-Vaudreuil and Vaudreuil-sur-le-Lac, which together represented 5.5% of the 2006 CMA population, no local bus service appears to be available. We grossed up the population-weighted average pass cost as if it were offered in these communities (Agence Métropolitaine de Transport, 2006b) (Statistics Canada, 2007h).

Québec CMA

122. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are also aware of one transit operator providing services in this CMA that is not a member of CUTA. In Québec CMA transit services are provided by RTC Québec and STS Lévis (Canadian Urban Transit Association, p.p.37-41) (Société de Transport de Lévis, n.d.).

123. For Québec CMA we used a population-weighted pass cost to reflect the costs of monthly adult local transit passes sold by the various transit operators.

124. We multiplied the cost of each municipality's local transit pass by the percentage of the 2006 CMA population which resided in that municipality; we then summed these totals for the municipalities where local transit passes were available. In order to account for the percentage of the population where local transit passes are not available, we divided the total described in the last sentence by the percentage of the population within the CMA where local transit passes are available. We perform this grossing-up calculation because areas where local transit passes are not available would otherwise cause the CMA's figure to be artificially low, reflecting a lower cost when in fact service was simply not available in certain parts of the CMA.

125. We make no attempt to include fare-integration charges in our calculation.

126. For the municipalities of Québec, l'Ancienne-Lorette, Notre-Dame-des-Anges, Shannon, Boischatel, Saint-Augustin-des-Desmaures, which together represented 72.1% of the 2006 CMA population and all of which are served by the Réseau de Transport de la Capitale, we used the cost of a local service monthly adult pass from Réseau de Transport de la Capitale (Réseau de Transport de la Capitale, n.d.a; n.d.b) (Statistics Canada, 2007i).

127. For the municipality of Lévis, which represented 18.2% of the 2006 CMA population, we used the cost of a local service monthly adult pass (Société de Transport de Lévis, n.d.) (Statistics Canada, 2007i).

128. For the municipalities of Beaumont, Château-Richer, Fossambault-sur-le-Lac, l'Ange-Gardien, Lac-Beauport, Lac-Delage, Lac-Saint-Joseph, Saint-François-de-l'île-d'Orléans, Saint-Gabriel-de-Valcartier, Saint-Henri, Saint-Jean-de-l'île-d'Orléans, Saint-Lambert-de-Lauzon, Saint-Laurent-de-l'île-d'Orléans, Sainte-Brigitte-de-Laval, Sainte-Catherine-de-la-Jacques-Carter, Sainte-Famille, Sainte-Pétronille, Stoneham-et-Tewsbury and Wendake, which together represented 9.7% of the 2006 CMA population, no local bus service appears to be available. We grossed up the population-weighted average pass cost as if it were offered in these communities (Statistics Canada, 2007i).

Sherbrooke CMA

129. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Sherbrooke CMA transit services are provided by STS Sherbrooke (Canadian Urban Transit Association, p.p.37-41).

130. We used the cost of a monthly adult regular transit pass issued by STS Sherbrooke [11].

Saguenay CMA

131. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are aware of one operator within this CMA that is not a member of CUTA. In Saguenay, CMA transit services are provided by STS Saguenay (Canadian Urban Transit Association, p.p.37-41).

132. We used the cost of a monthly adult regular transit pass issued by STS Saguénay (Ville de Saguenay, 2007).

Moncton CMA

133. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Moncton CMA transit services are provided by Codiac Transit Commission (Canadian Urban Transit Association, p. 27).

134. We used the cost of a monthly adult regular transit pass issued by Codiac Transit Commission [12] (Codiac Transit Commission, 2007).

Halifax CMA

135. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Halifax CMA transit services are provided by Metro Transit (Canadian Urban Transit Association, p. 28).

136. We used the cost of a monthly adult regular transit pass issued by Metro Transit [13] (Halifax Regional Municipality, 2007).

St. John's CMA

137. To determine the existence of transit operators who provide regular service within this CMA, we consulted the 2006-2007 Canadian Urban Transit Association (CUTA) membership directory. We understand that some operators may choose not to join this association; we are not aware of any other operator within this CMA that is not a member of CUTA. In Halifax CMA transit services are provided by Metro Transit (Canadian Urban Transit Association, p.p.27-28).

138. We used the cost of a monthly adult regular transit pass issued by Metro Transit [14].

Assignment of normalized scores

139. For relative rankings, we assigned the CMA with the lowest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{MIN} / \text{observed}(i)] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MIN = the minimum value of the 27 observed values.

140. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{IDEAL} / \text{observed}(i)] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

141. The ideal level is set to 25.5% of the lowest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol. (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the cost of a local transit adult pass relative to median household incomes in the CMA.

Data verification

142. To ensure accuracy, all data entered and all formulae were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Agence métropolitaine de transport. (2007a). Tarifs. Retrieved July 3, 2007, from <http://www.amt.qc.ca/tc/tarifs/index.asp>

Agence métropolitaine de transport. (2007b). Tarifs. Retrieved July 3, 2007, from <http://www.citso.amt.qc.ca/tarifs/index.asp>

Agence métropolitaine de transport. (2007c). MRCLASSO: circuit # 15. Retrieved July 3, 2007, from http://www.tec.amt.qc.ca/itec/pa1/circuits/MRCLASSO_L15.htm

Agence métropolitaine de transport. (2007d). CRTL: circuit # 138. Retrieved July 3, 2007, from http://www.tec.amt.qc.ca/itec/pa1/circuits/CRTL_L138.htm

Agence métropolitaine de transport. (2007e). CRTL: circuit # 55. Retrieved July 3, 2007, from http://www.tec.amt.qc.ca/itec/pa1/circuits/CRTL_L55.htm

Agence métropolitaine de transport. (2007f). C.I.T. de la vallée du richelieu. Retrieved July 3, 2007, from <http://www.citvr.ca/citvr/>

Agence métropolitaine de transport. (2006a). Tarifs. Retrieved July 3, 2007, from <http://www.citrc.amt.qc.ca/tarifs/index.asp>

Agence Métropolitaine de Transport. (2006b, January). Autorités organisatrices de transport (AOT) dans la région Métropolitaine de Montréal. Retrieved July 3, 2007, from http://www.amt.qc.ca/tc/autobus/AOT_2006.gif

- Agence métropolitaine de transport. (2006c). Tarifs. Retrieved July 3, 2007, from <http://www.mrclm.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2006d). Tarifs. Retrieved July 3, 2007, from <http://www.mrclasso.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2006e). Tarifs. Retrieved July 3, 2007, from <http://www.citlr.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2006f). Tarifs. Retrieved July 3, 2007, from <http://www.citsv.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2006g). Tarifs. Retrieved July 3, 2007, from <http://www.citvr.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2006h). Tarifs. Retrieved July 3, 2007, from <http://www.citpi.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2005a). Tarifs. Retrieved July 3, 2007, from <http://www.citla.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2005b). Zones tarifaires. Retrieved July 3, 2007, from <http://www.citla.amt.qc.ca/tarifs/zones.asp>
- Agence métropolitaine de transport. (2004). Zones tarifaires. Retrieved July 3, 2007, from <http://www.citvr.amt.qc.ca/tarifs/zones.asp>
- Agence métropolitaine de transport. (2003a). MRC des moulins. Retrieved July 3, 2007, from <http://www.mrclm.amt.qc.ca/>
- Agence métropolitaine de transport. (2003b). OMIT de repentigny. Retrieved July 3, 2007, from <http://www.mrclasso.amt.qc.ca/>
- Agence métropolitaine de transport. (2003c). CIT Chambly-Richelieu-Carignan. Retrieved July 3, 2007, from <http://www.citrc.amt.qc.ca/>
- Agence métropolitaine de transport. (2003d). CIT Laurentides. Retrieved July 3, 2007, from <http://www.citla.amt.qc.ca/>
- Agence métropolitaine de transport. (2003e). Tarifs. Retrieved July 3, 2007, from <http://www.citdm.amt.qc.ca/tarifs/circuit138.asp>
- Agence métropolitaine de transport. (2003f). CIT le Richelain. Retrieved July 3, 2007, from <http://www.citlr.amt.qc.ca/>
- Agence métropolitaine de transport. (2001a). Tarifs. Retrieved July 3, 2007, from <http://www.cithsl.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2001b). Tarifs. Retrieved July 3, 2007, from <http://www.citrous.amt.qc.ca/tarifs/index.asp>
- Agence métropolitaine de transport. (2000a). CIT de la Vallée du Richelieu. Retrieved July 3, 2007, from <http://www.citvr.amt.qc.ca/>
- Agence métropolitaine de transport. (2000b). CIT de Sorel-Varennes. Retrieved July 3, 2007, from <http://www.citsv.amt.qc.ca/>
- Agence métropolitaine de transport. (2000c). CIT du Sud-Ouest. Retrieved July 3, 2007, from <http://www.citso.amt.qc.ca/>
- Agence métropolitaine de transport. (2000d). CIT la Presqu'île. Retrieved July 3, 2007, from <http://www.citpi.amt.qc.ca/>
- Agence métropolitaine de transport. (2000e). CIT Roussillon. Retrieved July 3, 2007, from <http://www.citrous.amt.qc.ca/>
- Agence métropolitaine de transport. (n.d.). Conseil inter-municipal de Transport du Haut-St.-Laurent. Retrieved July 3, 2007, from http://www.tec.amt.qc.ca/itec/Plans/CITHSL_reseau.jpg
- The Corporation of the City of Barrie. (2007). Fare structure. Retrieved July 3, 2007, from <http://www.city.barrie.on.ca/Content.cfm?C=529&SC=1&SCM=0&MI=454&L1M=4>
- BC Transit. (2007a). Victoria Regional Transit System: ProPass. Retrieved July 3, 2007, from <http://www.bctransit.com/regions/vic/fares/propass.cfm>
- BC Transit. (2007b). Victoria Regional Transit System: Fare Payment. Retrieved July 3, 2007, from <http://www.bctransit.com/regions/vic/fares/propass.cfm>
- BC Transit. (2007c). ValleyMax Transit system fares. Retrieved July 3, 2007, from <http://www.bctransit.com/regions/cfv/fares/>
- BC Transit. (2007d). Kelowna transit fares. Retrieved July 3, 2007, from <http://www.bctransit.com/regions/kel/fares/default.cfm>
- Brampton Transit. (2007a). Monday to Friday Service Map. Retrieved July 3, 2007, from http://www.brampton.ca/transit/maps/TransitMap_M-F.pdf
- Brampton Transit. (2007b). The official website of the city of Brampton, Ontario: Fares. Retrieved July 3, 2007, from <http://www.brampton.ca/transit/fares.taf>
- The City of Burlington. (2007). Fare information. Retrieved July 3, 2007, from <http://cms.burlington.ca/PageFactory.aspx?PageID=780>
- Calgary Transit. (n.d.a). Calgary's Light Rail Transit. Retrieved September 18, 2007 from http://www.calgarytransit.com/Routes/rt_stop.html
- City of Calgary. (n.d.b). Calgary transit - passes. Retrieved July 3, 2007, from <http://www.calgarytransit.com/html/Passes.html#adult>
- City of Calgary. (n.d.c). Calgary transit - fares. Retrieved July 3, 2007, from <http://www.calgarytransit.com/html/fares.html>
- Canadian Urban Transit Association. (2006). CUTA Membership Directory 2006/2007. [Membership directory]. Toronto: Naylor Canada, Inc.
- Codiac Transit. (2007). Codiac transit commission. Retrieved July 3, 2007, from <http://www.codiactransit-moncton.com/enstart.htm>
- Deux-Montagnes MRC. (n.d.). CLD deux-montagnes - MRC. Retrieved July 3, 2007, from <http://www.clddm.com/en/mrc.php>
- Durham Region Transit. (n.d.). Fares. Retrieved July 3, 2007, from http://www.durhamregiontransit.com/durham/index_e.aspx?ArticleID=80
- City of Edmonton. (2007). Edmonton Transit System: Fares. Retrieved July 3, 2007, from http://www.edmonton.ca/portal/server.pt/gateway/PTARGS_0_0_280_218_0_43/http://CMServer/COEWeb/getting+around/fares/

- Edmonton Transit System. (n.d.a). LRT in Edmonton . Retrieved September 18, 2007, from <http://www.edmontonstrl.com/>
- Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory
A Summary of Trends. Retrieved August 31, 2007 from
http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm
- Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm
- Grand River Transit. (n.d.). Fares in GRT. Retrieved July 3, 2007, from <http://www.grt.ca/web/transit.nsf/DocID/F0DD4196A9AC39D985256B210066A160?OpenDocument>
- City of Greater Sudbury. (2007). Transit (transportation services). Retrieved July 3, 2007, from http://www.city.greatersudbury.on.ca/cms/index.cfm?app=div_transit&lang=en&currID=3993&parID=0
- Greater Vancouver transportation authority. (n.d.a). Fare Pricing: Cash, FareSaver Tickets and Monthly FareCards. Retrieved July 3, 2007, from http://www.translink.bc.ca/Transportation_Services/Fares_Passes/fare_pricing.asp
- Greater Vancouver transportation authority. (n.d.b). Fare Zones: Bus, SkyTrain, and Seabus Fares. Retrieved July 3, 2007, from http://www.translink.bc.ca/Transportation_Services/Fares_Passes/integrated_fare_system.asp
- Greater Vancouver transportation authority. (n.d.c). Skytrain: Departing from 33 communities every 33 minutes. Retrieved September 18, 2007, from http://www.translink.bc.ca/Transportation_Services/SkyTrain/
- Halifax Regional Municipality. (2007). Tickets & passes - metro transit - halifax regional municipality. Retrieved July 3, 2007, from <http://www.halifax.ca/metrotransit/tickets.html>
- Town of Halton Hills. (n.d.). ActiVan transit - HaltonHills.ca. Retrieved July 3, 2007, from <http://www.town.halton-hills.on.ca/transit/index.php>
- City of Hamilton. (2007). Fares & Conditions. July 3, 2007, from <https://www.myhamilton.ca/myhamilton/CityandGovernment/CityServices/Transit/FaresandConditions.htm>
- City of Kingston. (n.d.). City of Kingston, Ontario, Canada - Kingston transit daytime (Monday-Saturday) schedules. Retrieved July 3, 2007, from <http://www.cityofkingston.ca/residents/transportation/transit/schedules/index.asp>
- London Transit Commission. (2005). London transit - fares. Retrieved July 3, 2007, from <http://www.londontransit.ca/Fares.htm#fourth-section>
- Town of Milton. (n.d.). Transit fares and ticket agents. Retrieved July 3, 2007, from <http://www.milton.ca/template.php?selectID=584&type=Living>
- City of Mississauga. (2007, February). Mississauga Transit: Fares effective February 26, 2007: Bus Fares. Retrieved July 3, 2007, from http://www.mississauga.ca/file/COM/BusFares_26Feb2007.pdf
- The Corporation of The City of Niagara Falls. (2007). City of Niagara falls Canada - fare structure. Retrieved July 3, 2007, from http://www.niagarafalls.ca/services/transit/fare_structure.asp
- Town of Oakville. (n.d.). Oakville transit: Fares + policies. Retrieved July 3, 2007, from <http://www.oakvilletransit.com/fares.htm>
- OC Transpo. (n.d.) Fares main menu E. Retrieved July 3, 2007, from http://www.octranspo.com/fares_menue.htm
- Gouvernement du Québec. (2005a). Municipalité : L'épiphanie – répertoire des municipalités du québec – MAMR. Retrieved July 3, 2007, from <http://www.mamr.gouv.qc.ca/cgi-bin/repert1.pl?region=&mrc=&geo=60035&muni>
- Gouvernement du Québec. (2005b). Municipalité : L'épiphanie – répertoire des municipalités du québec – MAMR. Retrieved July 3, 2007, from <http://www.mamr.gouv.qc.ca/cgi-bin/repert1.pl?region=&mrc=&geo=60040&muni>
- Regina Transit. (2007). Regina transit - fare structure. Retrieved July 3, 2007, from http://www.reginatransit.com/1_Rts_fare_structure.html#monthly_pass
- Réseau de transport collectif de la MRC de L'Assomption. (n.d.). Réseau de transport collectif de la MRC de L'assomption. Retrieved July 3, 2007, from <http://www.gortc.info/>
- Réseau de transport de la capitale. (n.d.a). Tarifs. Retrieved July 3, 2007, from <http://www.rtcquebec.ca/francais/tarifs/tarifs.html>
- Réseau de transport de la capitale. (n.d.b). Parcours par secteur. Retrieved July 3, 2007, from http://www.rtcquebec.ca/_cms/plugins/horaires/services_secteur.aspx
- Ville de Saguenay. (2007). Ville de Saguenay - tarifs. Retrieved July 3, 2007, from http://www.ville.saguenay.qc.ca/portail/wps/portal!/ut/p/.cmd/cs/.ce/7_0_A/.s/7_0_G9/_th/J_0_69/_mx.6_0_69/7_0_GP/_s.7_0_A/7_0_FT/_ps.7_0_GP/X/_s
- Ville de Saint-Bruno-de-Montardville. (n.d.) Transport en commun. Retrieved July 3, 2007 from http://www.ville.stbruno.qc.ca/asp/gabarits/Gabarit.asp?ID_MESSAGE=6185
- City of St. Albert. (2007). Fare Information. Retrieved July 3, 2007, from <http://www.stalbert.ca/admin/contentx/default.cfm?PageId=260&hdrmenu=1>
- St. Catharines Transit Commission. (n.d.). St. Catharines transit commission: Information & Fares. Retrieved July 3, 2007, from <http://www.yourbus.com/information.html>
- City of Saskatoon. (n.d.). City of Saskatoon • departments • utility services • transit services • fares & tickets. Retrieved July 3, 2007, from http://www.saskatoon.ca/org/transit/fares_tickets.asp
- Société de transport de la Ville de Laval. (n.d.). STL - tarification - tarification. Retrieved July 3, 2007, from <http://www.stl.laval.qc.ca/tarification/tarification-fr.shtm#renseignements>
- Société de transport de Lévis. (n.d.). Société de Transport de Lévis. Retrieved July 3, 2007, from <http://www.stlevis.ca/>

Société de transport de Montréal. (n.d.a). STM - liens vers d'autres sites. Retrieved July 3, 2007, from <http://www.stcm.qc.ca/info/f-sites.htm#tcm1>

Société de transport de Montréal. (n.d.b). STM – Métro. Retrieved July 3, 2007, from <http://www.stm.info/English/metro/a-mapmet.htm>

Société de transport de Montréal. (n.d.c). Touts Azimuts. Retrieved July 3, 2007, from http://www2.stm.info/azimuts/carte.wcs?lng=a&test_cookies=oui

Société de transport de Montréal. (n.d.d). STM - tarif. Retrieved July 3, 2007, from <http://www.stm.info/info/tarif.htm>

Société de transport de l'Outaouais. (2002a). STO - fares. Retrieved July 3, 2007, from http://www.sto.ca/tarification/tarifs_adultes_e.html

Société de transport de l'Outaouais. (2002b). STO - fares FIDÉLITÉ program. Retrieved July 3, 2007, from http://www.sto.ca/tarification/prelev_auto_conditions_e.html

Société de transport de l'Outaouais. (2002c). Welcome Aboard! Retrieved August 20, 2007, from http://www.sto.ca/index_e.asp

Statistics Canada. (2007a). Median total income, by family type, by census metropolitan area. Statistics Canada, CANSIM, table (for fee) 111-0009. Retrieved July 3, 2007, from <http://www40.statcan.ca/l01/cst01/famil107a.htm>

Statistics Canada. (2007b, March 13). Calgary, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007c, March 13). Edmonton, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2006d, January 22). St. Catharine-Niagara, Ont. (35), CMA/CA code 539, map 1 of 4 (map). Census Tract Reference Maps by Census Metropolitan Areas and Census Agglomerations. Statistics Canada Catalogue no. 92146UIB. Ottawa. Retrieved August 15, 2007, from http://geodepot.statcan.ca/Diss2006/Maps/Maps_Cartes/CMACACT/ON/CMAT539-B.pdf

Statistics Canada. (2007e, March 13). Hamilton, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007f, March 13). Toronto, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007g, March 13). Ottawa-Gatineau, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007h, March 13). Montréal, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007i, March 13). Québec, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Strathcona County. (2007). Strathcona County, Alberta, Canada: Ttransit fares for 2007. Retrieved July 3, 2007, from <http://www.strathcona.ab.ca/Strathcona/Departments/Transit/Transit+fares+for+2007.htm>

Tetrad Computer Applications. (2007a). 2007 Estimates; 2010, 2012 and 2017 Projections. Retrieved June, 2007, from

http://www.tetrad.com/demographics/canada/mapinfo_data/ep.html

Tetrad Computer Applications, Inc. (2007b). [Custom data file showing 2006 average household income by selected census metropolitan areas in Canada] [Data file]. Vancouver, BC: Tetrad Computer Applications, Inc. Retrieved July 23, 2007.

Toronto Transit Commission. (2007a). Subway schedules. Retrieved September 18, 2007, from <http://www.toronto.ca/ttc/schedules/subway/index.htm>

Toronto Transit Commission. (n.d.a) TTC fares. Retrieved July 3, 2007, from <http://www.toronto.ca/ttc/fares.htm#metropass>

Toronto Transit Commission. (n.d.b). Ride Guide. Retrieved July 3, 2007, from <http://www.toronto.ca/ttc/pdf/rideguide.pdf>

The Corporation of The City of Welland. (2006). Welland transit: Fares. Retrieved July 3, 2007, from <http://www.welland.ca/Transit/Fares.asp>

Ville de Repentigny. (n.d.). Site officiel de la ville de repentigny. Retrieved July 3, 2007, from <http://www.ville.repentigny.qc.ca/>

Ville Saint-Eustache. (2006). Répertoire des ressources: transport. Retrieved July 3, 2007, from http://ville.saint-eustache.qc.ca/fr/repertoire/repertoire_communautaire-liste.asp?ID=Transport

Ville de Sainte-Julie. (2005). Ville de Sainte-Julie: À votre service: transport en commun: grille tarifaire. Retrieved July 3, 2007, from http://www.ville.sainte-julie.qc.ca/cgi-bin/index.cgi?page=c4_10_3&langue=fra

The City of Windsor. (n.d.). Fare structure. Retrieved July 3, 2007, from <http://www.citywindsor.ca/001244.asp>

City of Winnipeg. (2004). City of Winnipeg: Departments: Winnipeg transit: Fares. Retrieved July 3, 2007, from <http://www.winnipegtransit.com/main/fares.jsp#passes>

York Region Transit. (n.d.a). Regional Maps. Retrieved July 3, 2007, from <http://www.yrt.ca/maps/index.asp>

York Region Transit. (n.d.b). Fares. Retrieved July 3, 2007, from <http://www.yrt.ca/fares/index.asp>

Appendix N: Data methodology for the percent of the CMA labour force holding employer issued transit passes (2006).

Rationale

1. Transit benefit programs increase ridership and offset the inherent inequality in many workplaces caused by free parking for commuters who use automobiles (Canadian Urban Transit Association, 2005) (Transport Canada, 2007). Commuters experience great convenience when they are able to buy transit passes at the workplace; paying by payroll deduction makes this process even easier for commuters. By establishing an employer pass program, transit systems can increase ridership.

Sources of data

2. We collected data from the transit operators providing regular, non-specialized service in the 27 census metropolitan areas. We inquired of each transit operator whether or not it had an employer pass program active as at December 2006; we have defined for the purpose of this research an employer pass program to mean a program that allows employees working for a participating employer other than the transit corporation or city hall to obtain a discounted monthly transit pass from or through the employer [1-44].

3. We included data for employer pass programs that distribute passes automatically as well as those which require the employee to obtain a new pass every month. We similarly included employer pass programs that collect payment through automatic payroll deduction as well as those which collect payment in the form of cash or cheque on a monthly basis. We included programs both in introductory and test phases as well as those which are well established. We excluded programs that were purposely restricted to a very small number of employers and which were no longer in a test phase.

4. We did not include information for any program that did not meet the criteria above. We did not include any program designed to provide passes to university or college students or to any group other than paid employees.

5. We captured only the existence of a program and the number of its enrollees. We did not capture the quantity of the discount afforded to those who enroll in the program as we presume that the magnitude of a discount will ultimately be reflected in the participation rate.

6. For systems with such programs, we obtained the number of passes issued for the month of December, 2006. Where the program allowed employees to opt out in a given month without financial penalty, we obtained the figure for November, 2006, in order to avoid a seasonal impact. Because most programs require enrolled employees to purchase passes even in months where holidays are present, and because we obtained data for the month of November in the cases where they did not, the results of our survey should not be influenced by the selection of December as the month examined [1] [9] [10] [11] [12] [17] [18] [19] [20] [24] [28] [30] [33] [37] [39] [40].

7. We divided the number of passes issued through employer pass programs for December 2006 in a CMA by the employed labour force in 2006 in the CMA as reported by Statistics Canada. The resulting figure reflects the percentage of the employed labour force which participates in a discounted employer pass program (Statistics Canada, 2007a).

8. The CMAs of Barrie, Kelowna and Moncton are new as of 2006; 2006 labour market information was lacking for these CMAs. For these CMAs, we determined the percentage of the relevant employment region's total population that was employed in 2006; we multiply this figure by 2006 population for these CMAs (Statistics Canada 2007b; 2007c; 2007d; 2007e).

Note about Vancouver CMA

9. The figure given to us was 14,000 riders. The figure is an approximation of what would have been the number of passes issued in December, 2006; the difficulty or impossibility of retrieving the number for December was cited as the reason for being unable to disclose an actual figure for December [10].

Note about Edmonton CMA

10. Edmonton's employer pass program commenced March, 2007; hence, no figures for this program are available for December, 2006 [14].

Note about Toronto CMA

11. York Region Transit's employer pass program was in a test phase and data were not provided to us [6].

Note about Québec CMA

12. Both of the transit operators included in our survey of Québec CMA offer employer pass programs. The employer pass program offered by Société de Transport de Lévis had five passes issued and outstanding at December, 2006. In addition, as at December, 2006, 283 passes had been issued by the Réseau de Transport de la Capitale (RTC) on behalf of Société de Transport de Lévis [18] [19]. Due to an oversight on our part discovered after press time, the values for Lévis were not included in the calculation of Québec CMA's score; had they been included, neither Québec CMA's total grade score nor its position among the 27 CMAs would have changed. We regret the error.

13. The RTC issued 3,290 passes to residents of the north shore of the St. Lawrence River who are employees of employers located on the north shore of the Saint Lawrence river [17] [19].

14. We do not include the passes issued to family members of primary pass holders under the Lévis and RTC employer pass programs as these are not necessarily issued to those who are part of the labour force.

Assignment of normalized scores

15. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

16. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i)/\text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

17. The ideal level is set to $[1/(1-0.25)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the change in the percentage of the labour force which holds employer-issued transit passes.

Data verification

18. To ensure accuracy, all data entered were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

BC Transit. (2007). Pro Pass Program. Retrieved May 1, 2007, from <http://www.bctransit.com/regions/kel/fares/propass.cfm>

Canadian Urban Transit Association. (2005, October 4). Tax Exemptions for Employer

Provided Transit Benefits, 41. Retrieved September 11, 2007 from <http://www.cutaactu.ca/sites/cutaactu.ca/files/TEIIBI.pdf>

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Grand River Transit. (n.d.). Fares: Corporate Pass. Retrieved May 2, 2007, from <http://www.grt.ca/web/transit.nsf/DocID/E677FB0EE9F4FB3085256B210066A16C?OpenDocument>

Greater Vancouver Transportation Authority. (n.d.). Employer Pass. Retrieved May 2,

2007, from

http://www.translink.bc.ca/Transportation_Services/Fares_Passes/employers_pass/default.asp

Regina Transit. (2007). Employer Pass. Retrieved May 2, 2007, from

http://www.reginatransit.com/1_Rts_fare_structure.html#employer_pass

Statistics Canada. (2007a). Labour force characteristics, population 15 years and older, by census metropolitan area. Statistics Canada catalogue no. 71-001-PIB. Ottawa. Retrieved May 4, 2007 from <http://www40.statcan.ca/l01/cst01/labor35.htm>.

Statistics Canada. (2007b, March 29). Table 3: Population of census metropolitan areas in

2006. Ottawa. Retrieved April 26, 2007, from

<http://www12.statcan.ca/english/census06/analysis/popdwell/tables/table3.htm>

Statistics Canada. (2007c). Labour force characteristics, population 15 years and older, by economic region, by province (Quebec, Ontario). Retrieved July 25, 2007, from <http://www40.statcan.ca/l01/cst01/labor36b.htm>

Statistics Canada. (2007d). Labour force characteristics, population 15 years and older, by economic region, by province (Manitoba, Saskatchewan, Alberta, British Columbia). Retrieved July 25, 2007, from

<http://www40.statcan.ca/l01/cst01/labor36c.htm>

Statistics Canada. (2007e). Labour force characteristics, population 15 years and older, by economic region, by province (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick). Retrieved July 25, 2007, from <http://www40.statcan.ca/l01/cst01/labor36a.htm>

Toronto Transit Commission. (2007). Volume Incentive Pass. Retrieved May 2, 2007, from <http://www.toronto.ca/ttc/fares.htm#vip>

Transport Canada. (2007, February 1). Eco-Pass: Employer-Sponsored Transit Passes. Retrieved May 2, 2007, from <http://www.tc.gc.ca/programs/Environment/UTSP/ecopass.htm>

Appendix O: Data methodology for the percentage of the CMA public transit bus fleet using alternative fuels, excluding commuter coach (March 2007).

Rationale

1. The use of alternative fuels can help to reduce greenhouse gas emissions and improve air quality. By measuring the degree to which a census metropolitan area's (CMA) transit fleet uses alternative fuel vehicles, we can gauge the degree to which it is helping to realize these important benefits.

Sources of data

2. We collected data from the transit operators providing regular, non-specialized service in the 27 CMAs. We obtained for each the total number of vehicles at March 2007 used to deliver revenue-generating regular transit services, excluding commuter coach; if figures for March 2007 were unavailable we used the most recent figures available [1-41]. We then asked the transit operator in question to identify for us the number of vehicles among the total identified which are fueled by alternative fuels as defined by Natural Resources Canada [1-41]. We report the percentage of the total fleet that uses alternative fuels.

3. Alternative fuels are defined in the Alternative Fuels Act (Alternative Fuels Act, S.C. 1995, c. 20, s.2). We obtained clarification from Natural Resources Canada's Fuels Policy and Programs section as to the interpretation of this definition [42]. Based on these sources, we defined for the purposes of this study alternative fuels to mean bio-diesel (or regular diesel mixed with any quantity of bio-diesel), electricity (or hybrid motors fueled in part by electricity), ethanol (or ethanol blended with gasoline where the concentration of ethanol is greater than 10%), natural gas and propane. All of these fuel sources are known to be environmentally beneficial to varying degrees; renewable fuels (those which are not carbon-based) are the subject of academic debate when accounting for the energy expended to produce them (Natural Resources Canada, 2005) (Lang, 2005).

4. Recognizing that carbon-based fuels like natural gas are non-renewable, despite having environmentally beneficial properties, we will likely exclude them in future versions of this index (Natural Resources Canada, 2005).

5. We excluded from the alternative fuel definition above any mixture of gasoline and ethanol whose ethanol content was 10% or less; given that the net environmental impact of ethanol is subject to academic debate, and given that blends with 10% or less ethanol are readily available at most major gasoline retailers and may be used without any modification to vehicle engines, blends at or below 10% essentially require no special effort on the part of the fleet operator and are the subject of uncertainty concerning their net environmental effects (Canadian Renewable Fuels Association, 2007) (Lang, 2005) (Natural Resources Canada, 2006). We accept any diesel mixture that is composed in part of biodiesel due to the fact that it is not yet widely available commercially and therefore it would not be possible to easily obtain such fuel no matter how desirable its use may be [42] (Natural Resources Canada, 2007).

Assignment of normalized scores

6. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

7. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i)/ \text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

8. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide (CO₂) emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide (CO₂) emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the change in the percentage of a CMA's transit fleet that is powered by alternative fuels.

Data verification

9. Because to verify the data in this case would mean effectively repeating our research by contacting all respondents a second time, data verification consisted instead of a review of the data entered to ensure its apparent accuracy and completeness as well as the accuracy and completeness of the citations created for each entry.

Works cited

Retrievable sources

Alternative Fuels Act, S.C. 1995, c. 20, s.2. Retrieved June 8, 2007 from <http://laws.justice.gc.ca/en/showdoc/cs/A-10.7///en?page=1>

Canadian Renewable Fuels Association. (2007). Fuel technology and terminology. Retrieved September 18, 2007 from <http://www.greenfuels.org/ethanol/terms.htm#a>

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory A Summary of Trends. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Lang, Susan. (2005, July 5). Cornell ecologist's study finds that producing ethanol and biodiesel from corn and other crops is not worth the energy. Chronicle Online. Retrieved August, 2007 from <http://www.news.cornell.edu/stories/July05/ethanol.toocostly.ssl.html>

Natural Resources Canada. (2007, April 16). Vehicle and Fuel Availability. Retrieved September 18, 2007 from <http://oee.nrcan.gc.ca/transportation/fuels/biodiesel/biodiesel-availability.cfm?attr=8>

Natural Resources Canada. (2006, November 11). Ethanol The [sic] Road to a Cleaner Future. Retrieved September 18, 2007 from http://oee.nrcan.gc.ca/publications/infosource/pub/vehiclefuels/ethanol/M92_257_2003.cfm

Natural Resources Canada. (2005, May 30). Aut\$mart Guide: Alternatives to Gasoline. Retrieved September 18, 2007 from http://oee.nrcan.gc.ca/publications/infosource/pub/transportation/new_autosmart_guide/section6.cfm

Appendix P: Data methodology for the percentage of the CMA taxi and limousine fleet that is powered by hybrid gasoline-electric means (2007).

Rationale

1. The use of hybrid gasoline-electric motors can reduce greenhouse gas emissions and improve air quality. By measuring the degree to which a census metropolitan area's (CMA) taxi and limousine fleet uses alternative fuel vehicles, we can gauge the degree to which it is helping to realize these important benefits.

Caveat

2. Where provincial motor vehicle registry data about taxi and limousine fleet fuel type composition were not available, we collected data manually by contacting individual taxi and limousine companies: because these companies have no impetus to cooperate with us, the technology adoption figures represented for such jurisdictions may be significantly lower than is actually the case. The most accurate estimate of the number of hybrid taxis and limousines within a CMA is one made using data collected by all municipalities within a CMA and/or by the provincial motor vehicle registry. Since many provinces with varying degrees of government intervention in the automobile insurance market maintain such data, we do not believe that its collection at the provincial level is onerous.

3. There exists the possibility that a hybrid gasoline-electric engine may be installed in a vehicle as an after-market modification [32]; such a vehicle would not be captured by our methodology. Nonetheless, we view such a possibility as remote given the nascent state of hybrid gasoline-electric technology and what must as a result be the corresponding paucity of after-market installations.

Sources of data

4. We collected data current at some point during 2007 about taxi and limousine registrations by year, make, model and municipality of registration from the provincial motor vehicle registries that maintain such data [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]. The provincial motor vehicle registries in Nova Scotia and Ontario do not maintain such data [11] [12].

5. We obtained data from the Insurance Bureau of Canada and Transport Canada which identify by make, model and year those vehicles powered by hybrid gasoline-electric motors which are qualified by Transport Canada for registration in Canada; this listing includes vehicles not marketed in Canada by their manufacturers but which may be registered here (for example, a U.S.-marketed vehicle that was imported into Canada after being purchased in the United States). We amalgamated these data into a single, comprehensive listing of such vehicles. Though neither the Insurance Bureau of Canada nor Transport Canada believes its data to be definitive and all-encompassing, we believe that the combined listing is as authoritative as possible [14] [16].

6. Using the listing of component municipalities for each CMA and the provincial motor vehicle registry data, we identified for each CMA the percentage of its taxi and limousine fleet which is comprised of vehicles powered by hybrid gasoline-electric means [13] [14] [15] [16] (Statistics Canada, 2007a; 2007b; 2007c; 2007d; 2007e; 2007f; 2007g; 2007h; 2007i; 2007j; 2007k; 2007l; 2007m; 2007n; 2007o; 2007p; 2007q; 2007r; 2007s; 2007t; 2007u; 2007v; 2007w; 2007x; 2007y; 2007z; 2007aa).

7. For the purposes of our research, the terms 'taxi' and 'limousine' are taken to mean chauffeur-driven light-duty passenger vehicles available for hire by periods of time measured in minutes and hours. We included limousines in the taxi fleet because in many cases these vehicles perform essentially the same duties as taxis (for example, airport limousines). Indeed, in Winnipeg CMA, we found many cases of vehicles registered as limousines whose makes and models do not suggest limousines: nearly half of all vehicles in Winnipeg CMA registered as limousines were Chevrolet or Pontiac minivans and all of them were at least three years old [7]. By including limousines and taxis together, we avoid a categorical sleight of hand that could result in skewed results.

8. When requesting information from provincial motor vehicle registries, we used the terms 'taxi' and 'limousine' and not the definition provided in the paragraph above. However, we did clarify with the provincial motor vehicle registries that limousines were included in the data together with taxis [2] [17] [18] [19] [20] [24]. We further clarified with all provincial motor vehicle registries that the definition of a limousine does not include, for the purposes of the data we received, funeral home limousines [2] [17] [18] [21] [22] [23].

9. Because some vehicles may have been registered as residing in a former municipality or a place name which does not appear on the Statistics Canada list of component municipalities for each CMA but which nonetheless lies within the 2006 geographic boundaries of the CMA, we queried the data using the place names identified by the methods described in Appendix D. Any such vehicles were added to the count for the relevant CMAs, except in St. John's CMA, as described in the following paragraph.

10. In the case of St. John's CMA, we supplied a list of component municipalities for the CMA to the provincial motor vehicle registry [25]; the provincial motor vehicle registry provided data to us only for those municipalities [10]. The Statistics Canada list of component municipalities for St. John's CMA did not include the following places which, using the methodology described in Appendix D, we determined were situated within the St. John's CMA's 2006 geographical boundaries and for which there were the following vehicle registrations for light duty vehicles under 4,500kg in the Statistics Canada 2005 vehicle registration database: Middle Cove (registrations: 177), Outer Cover (registrations: 368), Topsail (registrations: 225), Petty Harbour (registrations: 429), Goulds (registrations: 3,211), Upper Gullies (registrations: 4) and Seal Cove CB (registrations: 42) [26]. Taken together these 4,425 registrations represent less than 5% of the 93,709 total vehicle registrations within St. John's CMA [26]. Moreover, the bulk of taxi registrations within St. John's CMA are within the city of St. John's proper and it is therefore unlikely that many, if any, taxi or limousine registrations would be associated with these small towns [10]. Accordingly, we do not believe that any discrepancy that could result from the exclusion of these communities from our results would be significant.

11. For British Columbia data, we were supplied a list from the provincial motor vehicle registry identifying the communities which had hybrid taxi and limousine registrations [1] [2] [3]: we examined the list for registrations in places not listed on the Statistics Canada list of component municipalities for the relevant CMAs.

12. Where a vehicle model known to have been available for sale only with a hybrid engine (i.e. Toyota Prius, Honda Insight, Lexus RX400h, Lexus LS600h and Lexus GS450h for all model years these vehicles were produced) was registered as a taxi and/or limousine in a municipality situated within a CMA, we added that vehicle to the count of hybrids for that CMA.

Vehicle makes and models of ambiguous fuel type

13. Where a vehicle model known to have been available for sale with a regular gasoline or diesel engine as well as a hybrid engine was registered as a taxi and/or limousine in a municipality situated within the 2006 geographic boundaries of a CMA, we used the methodologies described in the following paragraphs.

14. In Newfoundland, we identified one 2003 Honda Civic whose fuel type we could not determine [10]. We noted that the vehicle model bore the suffix 'DX' [10]. We contacted Honda Canada's national customer service centre to determine if the 2003 'DX' was available with a hybrid engine; Honda Canada advised us that no 'DX' model sold in 2003 was equipped with a hybrid engine [27].

15. In New Brunswick, we note that no vehicles matched our queries [9].

16. In Québec, vehicles were classified according to fuel type. This allowed us to identify which were hybrid vehicles, the hybrid fuel type being denoted by the letter 'h' [8]. As a check that the letter 'h' was not assigned only to vehicles which had been offered for sale only with hybrid motors, we note that a number of Honda Civics, a model available for sale without hybrid engines, were registered as having fuel type 'h' though the bulk of Honda Civics were registered under another fuel type [8].

17. In Manitoba, there were no vehicles of ambiguous fuel type [7].

18. In Saskatchewan, a GMC Silverado of unknown fuel type was determined by Saskatchewan Government Insurance to be a gasoline or diesel model [27].

19. In Alberta, we obtained a listing by fuel type for the vehicles of ambiguous fuel type [4].

20. In British Columbia, the provincial motor vehicles registry identified the hybrid models for us [1] [2] [3].

CMAs in Nova Scotia and Ontario

21. For the 11 CMAs located in Ontario and the one CMA located in Nova Scotia, the relevant provincial motor vehicle registries do not collect data about whether or not a vehicle is used as a taxi or as a limousine [11] [12].

22. For these CMAs, we contacted each of a CMA's component First Nations and municipalities during the spring and summer of 2007. For each component First Nation or municipality we contacted an individual responsible for licensing to learn whether the government in question maintained data on the total number of registered taxis and limousines. These data were only collected and utilized for our study if maintained by the government in question or by an associated commission. Furthermore, when the government or associated commission did maintain taxi and limousine data, we inquired further as to whether the licensing body had additional data on the vehicle fuel type and/or knowledge of any vehicles powered by hybrid gasoline-electric means. These data were only collected and utilized when we first established that the data were reasonably accurate by ensuring that the government official had either referred to the relevant database or had first hand knowledge of the entire fleet.

Halifax CMA

23. For the Regional Municipality of Halifax, the Halifax Taxi Commission operating under the municipal government provided us with all of the necessary information for taxis and limousines licensed [106] [164].

24. There are no taxis or limousines registered in the other component municipalities within Halifax CMA [41] [42] [43] [44].

CMAs in Ontario

25. For CMAs within Ontario, we contacted each CMA's component First Nations and municipalities as listed by Statistics Canada. Where these governments maintained data on the total number of registered taxis and limousines, we used these data. Further, where the government in question maintained data on vehicle fuel type or was able to make a determination about the number of hybrid-powered vehicles among the licensed vehicles, we used these data.

26. Data about taxis and fleet composition were maintained by the following First Nations, municipalities and CMAs: Ajax [45], Aurora [46], Brampton [50], Caledon [51,b], Chippewas of Georgina Island First Nation [53], East Gwillimbury [54], Georgina [55], Halton Hills [56], King [57], Markham [58], Milton [59], Mississauga [60], Mono [61], New Tecumseth [62], Newmarket [63], Oakville [64], Pickering [68], Richmond Hill [69], Toronto [70] [71], Uxbridge [87], Vaughan [88], Whitchurch-Stouffville [89], Ottawa [91], Russell [92], Clarence-Rockland [90], Grimsby [94a,c] (Niagara Regional Police Service, 2003), Hamilton [95a] [95b], Adelaide Metacalfe [96], London [98], Middlesex Centre [99], Southwold [100], St. Thomas [111], Thames Centre [103], St-Catharines-Niagara CMA [105a] (Niagara Regional Police Service, 2003), Oshawa CMA [107-109], Windsor CMA [110-114b], Barrie CMA [115-117], Greater Sudbury CMA [118-121] and Kingston CMA [122] [123].

27. Data about limousines and fleet composition were maintained by the following municipalities and CMAs: Aurora [125], Brampton [127], Caledon [128], Chippewas of Georgina Island First Nation [129], Georgina [131], Halton Hills [132], King [133], Markham [134], Milton [135], Mississauga [136], Mono [137], New Tecumseth [138], Oakville [140], Orangeville [141], Richmond Hill [143], Toronto [144a, 144b], Uxbridge [145], Vaughan [146], Whitchurch-Stouffville [147], Ottawa [149a, 149b], Russell [150], Clarence-Rockland [148], Grimsby [152a, 152b], Hamilton [153], Adelaide Metacalfe [154], London [156], Middlesex Centre [157], Southwold [158], Thames Centre [161], Clarington [165], Whitby [167], Frontenac Islands [177], South Frontenac [179], Amherstburg [168], LaSalle [169], Lakeshore [170], Tecumseth [171], Innisfil [172], Springwater [173], St-Catharines-Niagara CMA [152a, 152b] and Greater Sudbury CMA [174-178].

28. For those First Nations and municipalities whose governments had no data available about the total number of taxis and/or limousines (nor, by consequence, about the number of these which were hybrid vehicles), we obtained from the First Nations and municipalities their lists of taxi and/or limousine license permit holders. We then contacted all licensees on the lists at least twice by telephone, leaving a voicemail message if there was no answer. Licensees who did not return our attempts at contact were deemed by default not to have any hybrid vehicles.

29. Data about taxi registrants (but not their fleet compositions) were maintained by the following municipalities and CMAs, whose data we used to contact taxi companies to learn about their fleets: Bradford West Gwillimbury [47-49], Orangeville [65-67], Burlington [93a-93c], Central Elgin [97a, 97b] and Kitchener CMA [104a-104g] (Regional Municipality of Waterloo, n.d.).

30. Data about limousine registrants were maintained by the following municipalities and CMAs, whose data we used to contact limousine companies to learn about their fleets: Burlington [151a-151e] and Kitchener CMA [162a-162q].

31. As our research indicates that very few limousines are powered by hybrid gasoline-electric motors, a lack of response by limousine companies whose data we needed to obtain has the effect of erroneously benefiting the score of the CMA in question. This beneficial contribution occurs because the denominator (i.e. the total number of taxis and limousines within the CMA) is as a result smaller than it otherwise would be and the numerator (i.e. the number of taxis and limousines which are powered by hybrid engines) is unchanged (since there would be little chance of the companies having hybrid limousines to report): where there is at least one alternative fuel vehicle, the percentage is higher than it otherwise would be. We do not correct for this effect.

32. Because larger taxi and limousine companies are more likely to have a manager or owner/operator who is more difficult to reach due to the presence of gate-keeping figure such as a secretary, the method of contacting licensees we have described is subject to a bias effect. Because taxi companies that are absolutely large enough to warrant the presence of a gate-keeping figure or figures are more likely to be situated in highly populated areas, this effect could be significant in the larger CMAs where municipal licensing data was not available.

33. We regret the inability to obtain data for such licensees. However, since information about the licensees' vehicle fleets is not subject to the relevant freedom of information legislation (Freedom of Information and Protection of Privacy Act, R.S.O. 1990, c. F-31, s. 2(1)), we could not compel its disclosure. The most accurate estimate of the number of hybrid taxis and limousines within a CMA is one made using data collected by all municipalities within a CMA.

34. We note that the municipality of Strathroy-Caradoc does not license taxis or maintain data about taxis operating within its jurisdiction [102a-102c] [103].

35. We note that the following municipalities and CMAs do not license limousines or maintain data about limousines operating within their jurisdictions: Ajax [124a-124e], Bradford West Gwillimbury [126], East Gwillimbury [130], Newmarket [139a-139c], Pickering [142a-142c], Central Elgin [155], St. Thomas [159a-159b], Oshawa [166a-166d], Kingston and Loyalist [179a-179d].

36. For those municipalities in which the municipal governments had no data available about the total number of taxis and/or limousines (nor, by consequence, about the number of these which were hybrid vehicles) and for those municipalities which do not license taxis and/or limousines, we searched the InfoCanada directory of business entities with Standard Industrial Classification codes 4119-03 (InfoCanada, 2007) for limousines and 4121-01 (InfoCanada, n.d.2) for taxis in each of the component municipalities listed by Statistics Canada for the 11 Ontario CMAs.

37. We elected to use the InfoCanada directory because it is a compendium of multiple telephone directories (InfoCanada, 2007). We chose not to use the Scott's directory of companies on the basis that it lacked as comprehensive a listing of taxi and limousine companies for the municipalities in question.

38. As a measure of how comprehensive the Scott's directory was, we performed a check that compared the limousine companies generated from the Scott's Directory against the municipal licensing authority lists provided by the municipalities of Toronto, Ottawa and the municipal licensing authority which serves the municipalities that comprise Kitchener CMA. For the municipality of Toronto, the municipal list identified 108 companies whereas the Scott's Directory identified only eight companies [144b] (Scott's Directories, 2006). Similar inconsistencies were found for the city of Ottawa and the Kitchener CMA: the comparison between the number of registrants on the municipal lists and the number of companies listed in the Scott's directory were 32 [149b] and 0 (Scott's Directories, 2006) and 23 [162a] and 3 (Scott's Directories, 2006), respectively. The discrepancy in results is due to the fact that company information collected by the Scott's Directory was the result of voluntary disclosure by the companies listed; moreover, the directory is not necessarily well-suited for services such as limousines and taxis [180].

39. We used instead the “Ontario Provinces Business Directory” 2007 Edition of InfoCanada; this provincial business directory is compiled primarily from telephone directories [180] (InfoCanada, 2007). In addition to telephone directories, InfoCanada also collects information from numerous annual reports, press releases, industry directories, periodicals and business listings (InfoCanada, n.d.1).

40. By using a compendium of telephone directories, we reduce to some extent the risk of a company escaping identification due to the company having elected not to advertise in any one directory. Additionally, we believe that the InfoCanada compendium directory is superior to any online directory since there are numerous such directories, thereby creating the possibility that no one among them is comprehensive of all taxi or limousine companies. Moreover, a taxi or limousine company which advertises online might elect to establish its own website in place of listing on any online directory.

41. We note that some taxi and limousine companies operate extra-legally by advertising their services in municipalities where they have no license to pick up fares and where a license is needed to pick up fares. These companies can sometimes be found to have established their head offices in neighboring municipalities which require no license for the operation of taxis or limousines [36]. We feel that the InfoCanada directory will correct for such discrepancies for the following two reasons: (i) the InfoCanada directory is a compendium of telephone directories and therefore will capture published telephone listings in all municipalities that belong to a CMA, including those where errant taxi or limousine licensees may be headquartered and (ii) our reconciliation of the InfoCanada directory’s listings for the cities of Ottawa and Toronto to those municipalities’ lists of licensed taxi and limousine operators, described in the next paragraph, shows relatively little discrepancy.

42. We tested the accuracy of the InfoCanada directory against the lists of registered limousine companies provided by the municipalities of Toronto and Ottawa. For the municipality of Toronto, the municipal listing identified 108 companies whereas the InfoCanada directory identified 50 companies [144a-144b] [38]. A plausible explanation for this discrepancy can be inferred through the geographical organization of the companies listed in the InfoCanada directory: in addition to the 50 limousine companies listed under Toronto there were also six companies listed under East York, three companies listed under York, 45 companies listed under North York, 23 companies listed under Scarborough and 51 companies listed under Etobicoke (InfoCanada, 2007). These five additional localities are of importance as they constitute former municipalities amalgamated in 1998 to form the new City of Toronto (City of Toronto, n.d.). Therefore, the InfoCanada listing for the municipality of Toronto actually exceeds the municipal listing of limousine licensees. For the city of Ottawa the figures from the municipal list and the directory results were 32 and 25 respectively [149b] [38].

43. In the case of the city of Barrie, the InfoCanada directory identified numerous companies operating extra-legally within the municipality [31a-31e] (InfoCanada, 2007). In this case we noted that these companies were operating extra-legally by advertising their services in municipalities where they have no license to pick up fares. Some limousine companies establish themselves as legal entities residing in neighboring municipalities which have more favorable limousine licensing regulations [31b]. To ensure that we properly captured these companies, we contacted all of the limousine companies listed by the InfoCanada directory as being within the city of Barrie. There were a total of 13 limousine vehicles reported to us by these companies versus the two the city of Barrie has licensed [31b-31e].

44. For all of the reasons cited above, we deem the InfoCanada directory a reliable source of information about the taxi and/or limousine companies operating within Ontario’s CMAs.

45. We do note a discrepancy in the InfoCanada data. Crown Limousines was listed by InfoCanada as being headquartered in Pickering, Ontario [38]. Pickering is located within the Toronto CMA (Statistics Canada, 2007k). However, upon speaking with the owner of this company, it became apparent that the company is based in Clarington [37]; Clarington is a component municipality for Oshawa CMA (Statistics Canada, 2007j). Furthermore, the company did not move recently nor has it ever been based in Pickering [37]. For this case, the data collected from Crown Limousine was omitted from the Pickering municipality; the data collected from the municipality of Clarington encompassed all licensed limousine companies for the Town of Clarington [37] [38] [165].

46. For all companies listed by InfoCanada as being situated within a First Nation or a municipality (or a former municipality or locality situated within the 2006 geographic borders of a CMA but not listed in the Statistics Canada list of component municipalities, as determined using the methodology described in Appendix D) that fell within a CMA, we contacted the company by telephone and requested to speak with its manager to obtain the total number of vehicles in its fleet and the number among these which were powered by hybrid gasoline-electric means.

47. Where we were not able to obtain the information during our first call, we called a second time. In each case, if there was no answer, we left a voicemail message where possible. We did not receive any call backs after the second message for at least one company in the following CMAs: Ajax [186a-c], Newmarket [187a-d], Pickering [188a-e], Burlington [189], Kitchener CMA [184a-g], Oshawa [190a-d] and Kingston [191].

48. Of the companies listed under Pickering [38], we omitted AAA Allied Limousine as data had already been collected from this company since it was also listed under Ajax [124c] (InfoCanada, 2007). As Pickering and Ajax are component municipalities of the Toronto CMA, the omission of AAA Allied Limousine from Pickering prevents the duplication and inflation of limousine counts for the Toronto CMA.

49. The following municipalities had companies that were either uncooperative or did not wish to participate: Newmarket [187c-d] and Pickering [189e].

50. The following municipalities had no companies listed in the InfoCanada directory; Bradford West Gwillimbury, East Gwillimbury and Loyalist (InfoCanada, 2007).

Note concerning Windsor CMA

51. Prior to its by-law enacted on July 16, 2007, the city of Windsor licensed four categories of livery vehicles excluding taxies [40]. These categories were identified as ‘limousines’, ‘vans’, ‘rickshaws’ and ‘specialty’ vehicles [39]. The data collected reveal the existence of 28 limousines, 26 vans, no rickshaws, and 6 specialty vehicles [39]. We included the 26 livery vans after confirming the fact that these vehicles are minivans (i.e. they share a body style used by taxis) and not shuttle-bus vans such as the Ford Econoline [40]. As concerns the six specialty vans, they appear to be medical vehicles licensed for hire and not taxis; we therefore exclude them from our dataset (City of Windsor, 2004).

Assignment of normalized scores

52. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

53. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i)/ \text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

54. The ideal level is set to 100%. Total lifetime carbon dioxide emissions from a hybrid car when taking into account manufacturing emissions are significantly lower than are emissions from a gasoline-powered car (Institute for Lifecycle Environmental Assessment, 2003); therefore, premature replacement of inefficient taxis is not necessarily harmful. We believe that this magnitude of change represents an appropriate and attainable goal within a 10-year timeframe for the change in the percentage of a CMA's taxi and limousine fleet that is powered by hybrid gasoline-electric means.

Data verification

55. For data from Nova Scotia and Ontario, data verification would mean effectively repeating our research by contacting all respondents a second time; instead, data verification consisted instead of a review of the data entered by a qualified individual to ensure its apparent accuracy and completeness as well as the apparent accuracy and completeness of the citations created for each entry.

56. For data from all other provinces, all data and formulae were checked manually by a qualified individual.

Works cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable sources

Freedom of Information and Protection of Privacy Act, R.S.O. 1990, c. F-31, s. 2(1). Retrieved July 30, 2007, from

http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90f31_e.htm#BK0

InfoCanada. (2007). Ontario Business Directory. (Vol. 3). Mississauga: InfoCanada.

InfoCanada. (n.d.1). How is our Business Database compiled? Retrieved July 6, 2007, from http://www.infocanada.ca/service/ca/bus_dbcomp.aspx

InfoCanada. (n.d.2). SIC Codes Sorted Alphabetically. Retrieved July 6, 2007, from <http://list.infocanada.com/CanSICalpha.htm>

Institute for Lifecycle Environmental Assessment. (2003, September 12). Automobiles: Electric vs. Gasoline. Retrieved September 19, 2007 from

<http://www.ilea.org/lcas/taharaetal2001.html>

Niagara Regional Police Service, Revised By-law No. 267, 2004, Licensing Bylaw. (August 23, 2003), s.2. Retrieved June 28, 2007, from <http://www.nrps.com/psb/bylaws/267-2004.pdf>

Scott's Directories. (2006). Summary Report Ontario All. CD-ROM. [CD-ROM]. Toronto: Scott's Directories.

Statistics Canada. (2007a, March 13). St. John's, Newfoundland and Labrador (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007b, March 13). Halifax, Nova Scotia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007c, March 13). Moncton, New Brunswick (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007d March 13). Saguenay, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007e March 13). Québec, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007f, March 13). Sherbrooke, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007g, March 13). Montréal, Quebec (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007h, March 13). Ottawa-Gatineau, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007i, March 13). Kingston, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007j, March 13). Oshawa, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007k, March 13). Toronto, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007l, March 13). Hamilton, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007m, March 13). St. Catharines-Niagara, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007n, March 13). London, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007o, March 13). Kitchener, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007p, March 13). Windsor, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007q, March 13). Barrie, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007r, March 13). Greater Sudbury, Ontario (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007s, March 13). Winnipeg, Manitoba (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007t, March 13). Regina, Saskatchewan (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007u, March 13). Saskatoon, Saskatchewan (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007v, March 13). Edmonton, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007w, March 13). Calgary, Alberta (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007x, March 13). Kelowna, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007y, March 13). Abbotsford, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007z, March 13). Vancouver, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Statistics Canada. (2007aa, March 13). Victoria, British Columbia (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from

<http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

City of Toronto. (n.d.). Building the New City of Toronto Status Report On Amalgamation (Executive Summary). 1998-1999. Retrieved July 23, 2007, from http://www.toronto.ca/toronto_history/amalgamation/amal_report1.htm

Regional Municipality of Waterloo. (n.d.). Doing business in the region of Waterloo Retrieved July 3, 2007, from

<http://www.region.waterloo.on.ca/web/region.nsf/0/195bac44cf78dc2285256bab0054aa97?OpenDocument>

City of Windsor. By-law No. 396-2004, A By-Law respecting the licensing and regulation of public vehicles, (December 13, 2004), s.L(5). Retrieved June 13, 2007, from <http://www.citywindsor.ca/documents/Licensing/LicensePdfFiles/By-law3962004.pdf>

Appendix Q: Data methodology for the percentage of the CMA municipal road fleet that is powered by alternative fuels (December 31, 2006).

Rationale

1. The use of alternative fuels can help to reduce greenhouse gas emissions and improve air quality. By measuring the degree to which a census metropolitan area's (CMA) municipal road vehicle fleet uses alternative fuel vehicles, we can gauge the degree to which it is helping to realize these important benefits.

Sources of data

2. We collected data on vehicle fleets from the 422 municipalities which comprise the 27 CMAs included in our study. We contacted the municipal fleet managers or equivalent. We obtained from each the total number of non-revenue-generating road transportation vehicles at December 31, 2006 excluding police and fire vehicles; if figures for December 31, 2006 were unavailable, we sought the most recent figures available [1-345]. We then asked the municipal fleet manager in question to identify for us the number of vehicles among the total identified which are fueled by alternative fuels as defined by Natural Resources Canada [1-345]. We report the percentage of the total fleet that uses alternative fuels.

3. Alternative fuels are defined in the Alternative Fuels Act (Alternative Fuels Act, S.C. 1995, c. 20, s.2). We obtained clarification from Natural Resources Canada's Fuels Policy and Programs section as to the interpretation of this definition [355]. Based on these sources, we defined for the purposes of this study alternative fuels to mean bio-diesel (or regular diesel mixed with any quantity of bio-diesel), electricity (or hybrid motors fueled in part by electricity), ethanol (or ethanol blended with gasoline where the concentration of ethanol is greater than 10%), natural gas and propane. All of these fuel sources are known to be environmentally beneficial to varying degrees; renewable fuels (those which are not carbon-based) are the subject of academic debate when accounting for the energy expended to produce them (Natural Resources Canada, 2005) (Lang, 2005).

4. Recognizing that carbon-based fuels like natural gas are non-renewable, despite having environmentally beneficial properties, we will likely exclude them in future versions of this index (Natural Resources Canada, 2005).

5. We excluded from the alternative fuel definition above any mixture of gasoline and ethanol whose ethanol content was 10% or less; given that the net environmental impact of ethanol is subject to academic debate, and given that blends with 10% or less ethanol are readily available at most major gasoline retailers and may be used without any modification to vehicle engines, blends at or below 10% essentially require no special effort on the part of the fleet operator and are the subject of uncertainty concerning their net environmental effects (Canadian Renewable Fuels Association, 2007) (Lang, 2005) (Natural Resources Canada, 2006). We accept any diesel mixture that is composed in part of biodiesel due to the fact that it is not yet widely available commercially and therefore it would not be possible to easily obtain such fuel no matter how desirable its use may be [355] (Natural Resources Canada, 2007).

Note concerning Moncton CMA

6. Moncton CMA consists of 14 component municipalities of which six are designated parishes (Statistics Canada, 2007). Parishes are organized as "local service districts" (LSDs) that depend on the provincial government to provide basic services [346]; the provincial government serves the vehicle needs of the local service districts by way of transportation districts [348]. These provincial transportation district boundaries do not coincide with local service district boundaries nor do they coincide with parish boundaries [347] [349]: accordingly, the fleets which serve the six parishes within Moncton CMA also serve, to some extent, communities lying outside the geographic boundaries of Moncton CMA. Although some vehicles, fire trucks in particular, may be allocated on the basis of local service districts, ultimately the majority of these vehicles are assigned by way of the transportation districts [348].

7. Deconstruction of the transportation district vehicle fleets to determine which vehicles were assigned to each of the six parishes in Moncton CMA was not possible [347] [348] [351]. We confirmed with Saint-Paul parish that parishes do not maintain vehicle fleet information using parish boundary definitions, apart from fire trucks [349] [350]. We confirmed with the provincial government that the district transportation office managing the relevant vehicle fleets would not maintain vehicle counts based on parish boundaries [351] [353] [354].

8. As a result of the impossibility of obtaining accurate vehicle counts for the six parishes located in Moncton CMA, we exclude these vehicle counts. For the eight municipalities and First Nations which maintain vehicle fleets within Moncton CMA and for which data about their vehicle fleets were readily available, we determined there to have been a total of 305 vehicles at December 31, 2006 among these communities' fleets. This figure for Moncton CMA is understated due to the lack of data about vehicle fleets in parishes. To estimate the degree of the understatement, we obtained the total number of road vehicles assigned to the District 3 transportation district, which overlaps parts of Moncton CMA; the District 3 operational area includes all of Albert County, Westmorland County, and Kent County, excluding all Cities, Towns, Villages, National Parks, First Nation reserves, and Rte 2 west of Moncton. The following vehicles are maintained by District 3:

- a. Service/Plow Trucks complete with salt/sand spreaders - 94
- b. Road Graders - 14
- c. Backhoes - 19
- d. Loaders - 4
- e. 1/2 ton trucks - 24
- f. Crew cab Trucks - 18
- g. Sign trucks complete with booms and augers - 2
- h. 1 ton bridge trucks - 5
- i. Booms trucks - 2

9. As Moncton CMA's vehicle fleet denominator is artificially low, its score on this variable would increase disproportionately if any alternative fuel vehicles were introduced among the eight fleets for which data are available; at December 31, 2006, no vehicles among the 305 within these fleets were alternative fuel vehicles. Conversely, we are not able to capture the existence of any alternative fuel vehicles in the relevant transportation district fleets.

Assignment of normalized scores

10. For relative rankings, we assigned the CMA with the highest observed value a normalized score of 100. Relative scores for all other CMAs are assigned on the basis of the following formula:

$$\text{Score}(i) = [\text{observed}(i)/\text{MAX}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

MAX = the maximum value of the 27 observed values.

11. For ideal rankings, we assigned values according to the following formula for all CMAs:

$$\text{Score}(i) = [\text{observed}(i)/\text{IDEAL}] * 100,$$

i represents the population rank of a given CMA relative to all 27 CMAs

IDEAL = the ideal level as described in the following paragraph

12. The ideal level is set to $[1/(1-0.255)]$ times the highest observed value. 25.5% represents the decrease needed from the level of 2005 national Canadian carbon dioxide emissions from road transportation to match the level of emissions that is 6% below that of the level of 1990 national Canadian carbon dioxide emissions from road transportation (Environment Canada, 2006a). A level 6% below 1990 emissions reflects Canada's announced intentions under the Kyoto protocol (Environment Canada, 2006b). We believe that this magnitude of change represents an appropriate and attainable goal for the change in the percentage of a municipal vehicle fleet that is powered by alternative fuels.

Data verification

13. Because to verify the data in this case would mean effectively repeating our research by contacting all respondents a second time, data verification consisted instead of a review by a qualified individual of the data entered to ensure its apparent accuracy and completeness as well as the accuracy and completeness of the citations created for each entry.

Works cited

Retrievable sources

Alternative Fuels Act, S.C. 1995, c. 20, s.2. Retrieved June 8, 2007 from <http://laws.justice.gc.ca/en/showdoc/cs/A-10.7///en?page=1>

Canadian Renewable Fuels Association. (2007). Fuel technology and terminology. Retrieved September 18, 2007 from <http://www.greenfuels.org/ethanol/terms.htm#a>

Environment Canada. (2006a, August 14). Canada's 2005 Greenhouse Gas Inventory

A Summary of Trends. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/inventory_report/2005/2005summary_e.cfm

Environment Canada. (2006b, June 21). About the Kyoto protocol. Retrieved August 31, 2007 from http://www.ec.gc.ca/pdb/ghg/about/kyoto_e.cfm

Lang, Susan. (2005, July 5). Cornell ecologist's study finds that producing ethanol and biodiesel from corn and other crops is not worth the energy. Chronicle Online. Retrieved August, 2007 from <http://www.news.cornell.edu/stories/July05/ethanol.toocostly.ssl.html>

Natural Resources Canada. (2007, April 16). Vehicle and Fuel Availability. Retrieved September 18, 2007 from

<http://oe.nrcan.gc.ca/transportation/fuels/biodiesel/biodiesel-availability.cfm?attr=8>

Natural Resources Canada. (2006, November 11). Ethanol The [sic] Road to a Cleaner Future. Retrieved September 18, 2007 from

http://oe.nrcan.gc.ca/publications/infosource/pub/vehiclefuels/ethanol/M92_257_2003.cfm

Natural Resources Canada. (2005, May 30). Aut\$mart Guide: Alternatives to Gasoline. Retrieved September 18, 2007 from

http://oe.nrcan.gc.ca/publications/infosource/pub/transportation/new_autosmart_guide/section6.cfm

Statistics Canada. (2007, March 13). Moncton, New Brunswick (table). 2006 Community Profiles. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Retrieved August 15, 2007, from <http://www12.statcan.ca/english/census06/data/profiles/community/Index.cfm?Lang=E>

Appendix R: National Air Pollution Surveillance Network station identification numbers

Note: The station identification numbers published below come from the 2004 listing of National Air Pollution Surveillance Network (NAPS) stations. We identified stations using the most current listing of National Air Pollution Surveillance Network (NAPS) stations.

Table 1:

NAPS stations whose annual median daily maximum one-hour average CO data for 2005 were used

CMASStation identification number	
St. John's	10401
Halifax	30118
Moncton	40302
Québec	50308
Saguenay (a)	-
Sherbrooke (a)	-
Montréal	50115
Ottawa-Gatineau	60104
Kingston (b)	65401
Oshawa (c)	61701
Toronto	60430
Barrie	65001
Hamilton	60512
St. Catharines-Niagara (d)	61302
Kitchener	61502
London	60903
Windsor	60204
Greater Sudbury	60607
Winnipeg	70119
Regina	80110
Saskatoon	80211
Edmonton	90122
Calgary	90218
Kelowna	100701
Abbotsford	101003
Vancouver	100111
Victoria	100307

Note. From Environment Canada, National Air Pollution Surveillance Network. (received 2007, September 12). [Listing of all stations in the National Air Pollution Surveillance Network as at 2004] [Data file]. Ottawa: Minister of the Environment for Canada. Adapted with permission.

(a) No station was available and we therefore assigned the minimum value observed among the remaining 24 stations.

(b) This is for data for the year 2004 for station 65401 which lies in Belleville, ON; no CO data were available for Kingston.

(c) Data reflects 1999 values, the most recent year for which data were available.

(d) Data reflects 2001 values, the most recent year for which data were available.

Table 2:

NAPS stations whose median annual maximum daily 8 hour average O3 data for the period May 1, 2005 to September 30, 2005 were used.

CMAStation identification number	
St. John's	10401
Halifax	30118
Moncton	40302
Québec (a)	N/A
Saguenay	50504
Sherbrooke	50404
Montréal	50129
Ottawa-Gatineau	50204
Kingston	60302
Oshawa (a)	N/A
Toronto	61603
Barrie	65001
Hamilton	60513
St. Catharines-Niagara	61302
Kitchener	61502
London	65301
Windsor	60211
Greater Sudbury	60609
Winnipeg	70118
Regina	80110
Saskatoon	80211
Edmonton	91301
Calgary	90222
Kelowna	100701
Abbotsford	101003
Vancouver	101301
Victoria	100307

Note. From Environment Canada, National, Air Pollution Surveillance Network. (received 2007, September 12). [Listing of all stations in the National Air Pollution Surveillance Network as at 2004] [Data file]. Ottawa: Minister of the Environment for Canada. Adapted with permission.

(a) Because the most current listing of NAPS stations was undergoing quality assurance by at the time of publication, we do not have permission to reproduce its contents (Peris, Melanie. Environment Canada. Email correspondence with Patrick Doré. September 11, 2007). The station identification numbers we reproduce here are for stations which appeared

Appendix S: Data methodology for census metropolitan area selection and population data

We present below details about the selection of the census metropolitan areas included in this study and the sources of their population figures.

Rationale

1. Using a population threshold of 150,000, we selected the 26 largest census metropolitan areas (CMAs) in Canada based on 2006 population data from Statistics Canada (Statistics Canada, 2007).
2. In addition to the 26 CMAs described in the paragraph above, we include the CMA of Moncton, the largest CMA in the province of New Brunswick (Statistics Canada, 2007). Had we not included Moncton CMA, no CMA from New Brunswick would have been represented. By including Moncton CMA, we have a sample of CMAs that is from a national perspective as broadly representative as possible.
3. We realize that in measuring CMAs we are effectively gauging the actions of many local government actors as if they were acting as one. We realize that inter-governmental plans are difficult to coordinate, especially so in those CMAs with many component municipalities. Our intent in publishing data aggregated at the CMA level is to motivate communities within a CMA to work together to harmonize their approach to creating sustainable road transportation: such cooperation will increase the overall improvement that will benefit the CMA's residents. Indeed, for many factors, no one municipality (with very few exceptions) can be immune from the effects of activities undertaken by its neighbors. Accordingly, we wish to capture the effects of the broader community.
4. The population figures presented in the report at Table 1 and at page 23 are from Statistics Canada (Statistics Canada, 2007).

Works Cited

Notice to the reader: Statistics Canada information is used with the permission of Statistics Canada. Users are forbidden to copy the data and disseminate them, in an original or modified form, for commercial purposes, without permission from Statistics Canada. Information on the availability of the wide range of data from Statistics Canada can be obtained from Statistics Canada's Regional Offices, its World Wide Web site at www.statcan.ca, and its toll-free access number 1-800-263-1136.

Retrievable Sources

Statistics Canada. (2007, March 29). Table 3: Population of census metropolitan areas in 2006. Ottawa. Retrieved April 26, 2007 from <http://www12.statcan.ca/english/census06/analysis/popdwell/tables/table3.htm>

Appendix T: Scoring mechanism methodology

We present below details about the design and application of the scoring mechanism that determines the ranked scores for the census metropolitan areas.

Rationale

1. A census metropolitan area's (CMA) score is based on its performance relative to the other CMAs on the 17 variables. We use the relative scores to determine letter grade because this is a transparent mechanism.

Scoring mechanism design

2. A panel of experts was convened to determine the appropriate weighting for each of 19 factors under consideration for inclusion in this index. The experts were instructed to assign exactly 100 points among the 19 factors. The experts were further advised that a score of zero should be assigned to a variable deemed by the expert to have nil value and that a score of 100 should be assigned to a single variable in the event that the 18 other variables have, in the expert's opinion, nil value.

3. Eight responses were received by the expert panel in regard to suggested weightings. An average weighting for each factor was determined and then examined for standard deviation. No concern with the use of weighted averages having been discovered, the variables were then ranked according to their average weightings.

4. Once ranked from highest to lowest, the average weightings were examined further. There were three groups of average weightings clearly visible. The individual panelists' responses were then scrutinized: there appeared to be significant disagreement among the panelists in a number of variables. Hence, we believe that there minimal likelihood of a bias common to all the experts.

5. The variables in the group whose average weightings were highest all were assigned weights of 3; the variables in the group whose average weightings were next highest were all were assigned weights of 2; the variables in the group whose average weightings were lowest were all assigned weights of 1.

6. Following the expert panelists' average weightings, two variables were excluded from the study. Among the remaining 17 variables, three variables had weightings of 3, six variables had weightings of 2 and eight variables had weightings of 1.

7. A CMA's relative scores for 15 of the 17 variables and binary scores for 2 of the 17 variables were calculated using the methodologies described in Appendices A.

8. through Q. A CMA's score on the 17 variables were aggregated into a single numerical score using the following formula:

$$\frac{\sum_{i=1}^{15} x_i * w_i + [(IF(\text{Free Transit Downtown} > 0, 25, 0)) + (IF(\text{Sales Tax Rebate } > 0, 50, 0)) * (100/75) * (2+1)]}{\sum_{i=1}^{17} w_i}$$

Where x_i is the CMA's relative numerical score on a given variable other than the variables for the sales tax credit rebate on a Honda Civic and for the presence of free transit in the downtown core,

And where w_i is the weighting accorded by the expert panel to variable i .

9. Letter grades were assigned to the cities based on the observed ranges of the numerical scores.