The Centre for
Sustainable Transportation

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In this issue:

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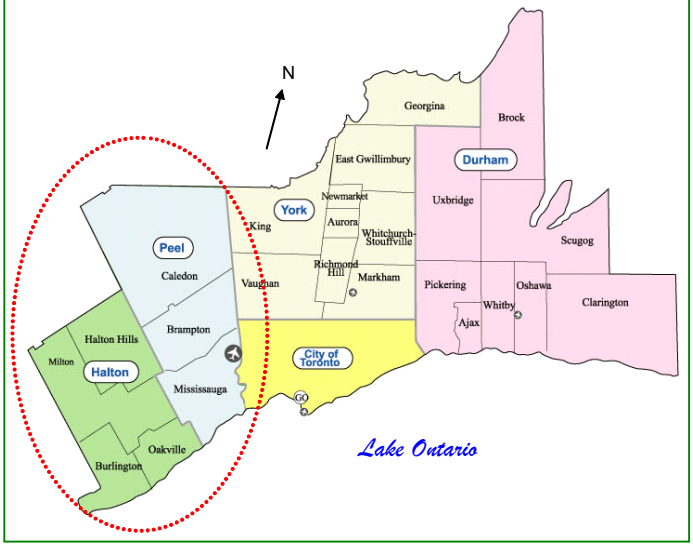
CHILDREN AND TRANSPORTATION

Work on children's transportation is important for the attainment of sustainable transportation for several reasons.[1†] Child-friendly transportation is usually more sustainable than other transportation. Children who travel sustainably may be more likely to do so when they are adults. Children are transport's 'canaries'. They are more vulnerable to adverse impacts, e.g., air pollution, and thus provide warnings of heightened unsustainability. Last but not least, sustainability is about intergenerational equity, which implies equal consideration for all generations, those living now and those to come.

This issue of the *Sustainable Transportation Monitor* provides key findings from a project on children and transportation in the regions of Halton and Peel (see Box 1) recently completed by the Centre.[2] A subsequent section sets out available data on children's travel in Halton and Peel. These data may also be relevant to children's travel in the suburbs of other large urban regions across Canada. The final section begins a discussion of the possible contribution of transport practices to the growing incidence of obesity in Canada, particularly in children.

Box 1. Halton and Peel regions showing their constituent municipalities and their relationship to the rest of the Greater Toronto Area



KIDS ON THE MOVE IN HALTON AND PEEL

The Centre's project Kids on the Move in Halton and Peel took its name from a remarkable European Union publication, *Kids on the Move*.[3] This is a superbly executed manual for European local government officials, teachers, and others who

 † The superscript numbers in the text refer to 46 reference notes on Pages 9-11.

want to create better ways of making children's mobility more environmentally sound, safer, healthier, and more enriching.

One goal of the Centre's project was to determine whether the *Kids on the Move* manual should be adapted for use in North America, and, if so, to figure out how to go about adapting it. Our conclusion is that it should not be adapted as such, but that several much shorter booklets on children and transportation should be produced, targeting specific audiences.

The second and more important goal of our project was to use the consultations about the *Kids on the Move* manual to identify actions that could be undertaken in Halton-Peel and elsewhere to improve children's mobility options. To this end we consulted with almost 300 individuals, mostly in Halton and Peel, and encountered many indications as to challenges with respect to children and transportation, barriers to improvement, and ways of overcoming the barriers. Our respondents identified three basic challenges:

- Increase children's active transportation (walking, bicycling, etc.) for the trip to school.
- Increase children's active transportation for non-school trips.
- Reduce adult automobile use (and thus children's exposure to pollution inside and outside vehicles and to traffic).

Numerous barriers to addressing each challenge were noted, together with suggestions for addressing the barriers. Prominent among the barriers are lack of appropriate infrastructure especially sidewalks, safety and security fears, and lack of parental awareness of the short- and long-term health impacts of moving their children by automobile rather than allowing them to travel from place to place by foot, bicycle or transit.
Specific recommendations were made with respect to formal education and

Box 2. Summary of several health impacts of transport on children

- Traffic fatalities are the leading cause of death from injury in Canada for children over the age of one year.[4]
- Less than half of Canadian children walk to school. (Most children who live within three kilometres of school do walk, but a sufficient number live farther from school to bring the average who walk down to less than half of all children.)[5]
- Two out of three Canadian children do not meet average physical activity guidelines to achieve optimum growth and development.[6]
- More than a quarter of Canadian children and youth are overweight.[7]
- Children who live near high-traffic areas (20,000 cars passing per day) may be six times more likely to develop childhood leukemia and other cancers.[8]
- Smog has been linked to asthma as both a trigger and possible cause.[9]
- Children are more vulnerable to airborne pollution "because of their high inhalation rates relative to body mass, high activity concentrations, greater time spent outdoors, narrower lung airways, immature immune systems, and rapid growth".[10]
- Children living in areas with poor air quality have been found to have reduced lung function growth that places them at risk for future respiratory illness.[11]
- Heavy traffic reduces the independent mobility of children and youth.[12]
- Opportunities and locations for spontaneous, non-structured play are severely restricted by traffic.[13]
- A study of children's exposure to diesel exhaust on school buses in the United States indicated that concentrations of $PM_{2.5}$ were often 5-10 times higher than average levels measured at fixed-site monitoring stations.[14]
- Low-level but chronic noise of moderate traffic can stress children and raise their blood pressure, heart rates and levels of stress hormones.[15]
- 25-30% of children who survive traffic accidents may suffer from post-traumatic stress disorder, unless treated. This may include depression, recurring nightmares, difficulty attending to school work, fear of cars.[16]
- "In-car benzene concentrations sometimes exceed concentrations in the roadside air by up to four fold. Carbon monoxide concentrations may be more than 10 times higher inside cars than at the side of the road. Elevated in-car pollution concentrations particularly endanger children, the elderly, and people with asthma and other respiratory conditions. They receive little attention. Nevertheless, in-car air pollution may pose one of the greatest modern threats to human health."[17]
- In Canada, approximately 30% of greenhouse gas emissions result from transportation. These emissions are contributing to global warming which will have long term impacts on children.[18]

public awareness regarding children and transportation, and with respect to land-use planning and transportation planning to promote active transportation and reduce auto-dependency.

The report on the Kids on the Move in Halton and Peel project identifies several matters that deserve further work. They include among others development of the booklets noted above and efforts to increase consideration of children's needs in land-use and transportation planning. The report includes an overview of recent work on the health impacts of transportation on children. A brief indication of these impacts appears in Box 2, which is taken from the report.

TRAVEL BY CHILDREN AND YOUNG PEOPLE IN HALTON AND PEEL[19]

Travel patterns of Halton and Peel residents are surveyed every five years by means of the Transportation Tomorrow Survey (TTS),[20] which covers most of south-central Ontario. There is essentially no other source of reliable information as to how people move around in this area.

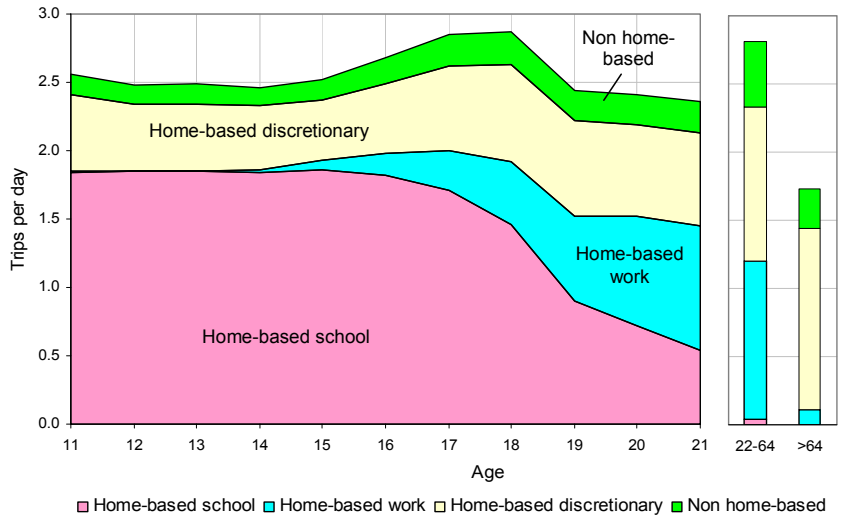
TTS concerns weekday travel behaviour of persons aged 11 years and over during the school year. The first of the four surveys, conducted in 1986, provided some data on 6- to 10-year-olds. TTS data are gathered by telephone interviews, usually with a single household member about each trip made by each household member on the previous day. TTS attempts to capture all motorized and bicycle trips made during the 24 hours. Walking to and from work or school is also counted when the entire trip is by this mode. Other walking trips are not formally counted. Nor is the walking component of transit trips.

For collecting data about young people's travel, this process is limited in that adults were more likely to be interviewed.[21] They may have had less than complete knowledge about the travel behaviour of younger members of the household, especially secretive teenagers.

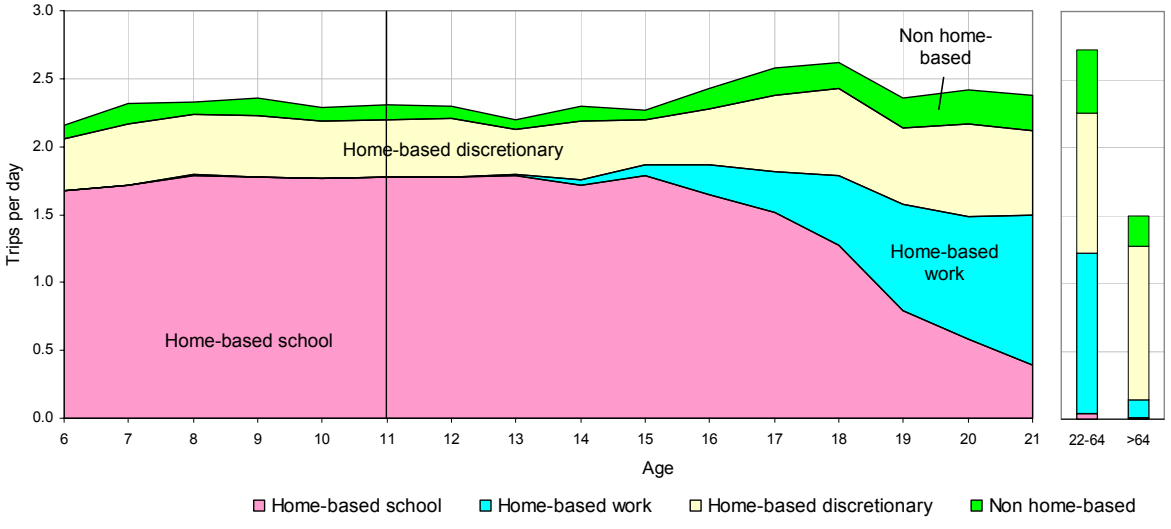
Notwithstanding its limitations—including the major limitation that no information is collected about weekend travel—TTS is a well-administered survey whose results have considerable credibility. They form the basis for just about all planning for the movement of people in south-central Ontario.

Box 3 presents data from the 2001

Box 3. Weekday travel by purpose and age in Halton and Peel, 2001



Box 4. Weekday travel by purpose and age in Halton and Peel, 1986



survey on the *purposes* of travel by persons resident in Halton and Peel, organized by age. School trips predominate until age 18, comprising well over half of the surveyed trips (i.e., trips on a schoolday).[22]

Box 4 shows the same data for 1986. There are few differences between the two data sets, even though they were collected 15 years apart.

Data were collected for children aged 6-10 in the 1986 survey. Box 4 shows that in terms of trip purpose the trip pattern of 7- to 10-year-olds was similar to that of 11- to 13-year-olds.

Overall, more trips per person were made in 2001, at all ages , e.g., 12-year-olds made 2.30 trips per day in 1986, but 2.48 trips per day in 2001. There were more of every type of trip in 2001, including school trips, which suggests that the increase may be an artefact of the survey method. However, there were disproportionately larger increases for 'home-based discretionary' trips (e.g., social visits and shopping), and for 'non-home-based trips' (e.g., going from school to a soccer game).

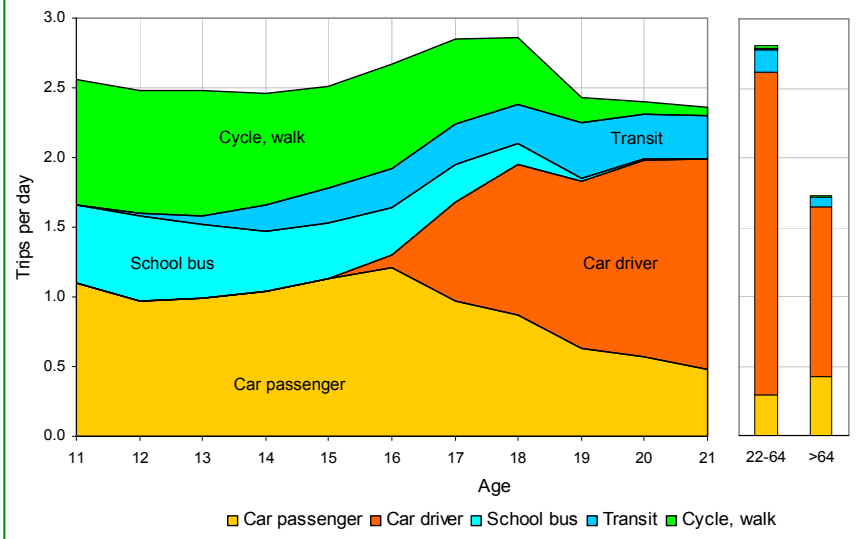
Box 5 and Box 6 present trip data for 2001 and 1986, but arranged by mode of transport rather than by purpose of trip. In 1986, children under 11 travelled more by car than 11- to 13-year-olds, with the latter group doing relatively more walking and bicycling.

An evident difference between the two sets of survey results is that in 2001 young people of all assessed ages travelled by car. This was as a passenger until and including age 15, and then as a passenger or driver. For example, in 1986, 27 per cent of trips by 11- to 15-year-olds were by car; in 2001, 42 per cent of such trips were by car. There were correspondingly fewer walking and bicycling trips in 2001, and trips by transit or school bus. In 1986, 6- to 10-year-olds travelled more by car than 11- to 13-year-olds (see Box 6), suggesting that in 2001 car travel by children of this age comprised even more than 42 per cent of all journeys.

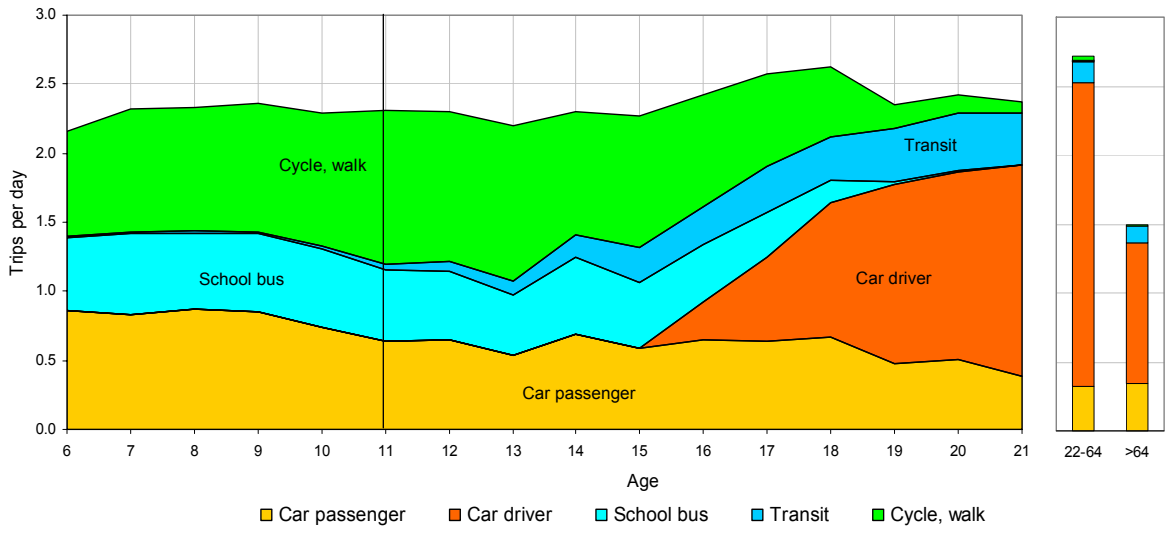
Another result is the suggestion that children were starting to use transit later, roughly from age 10 in 1986 and from age 12 in 2001 (compare Box 5 and Box 6).

TTS data allow comparisons with other parts of the Greater Toronto Area (GTA). Box 7 concerns trip purpose and corresponds to Box 3, differing in that the data in Box 7 are from the part of the surveyed area

Box 5. Weekday travel by mode and age in Halton and Peel, 2001



Box 6. Weekday travel by mode and age in Halton and Peel, 1986



that is the most different from Halton and Peel in terms of travel patterns. It is the inner part of the present City of Toronto, corresponding very roughly to the old City of Toronto, the former City of York, and the former Borough of East York (total population, 1.04 million, residential density 7,800 persons per square kilometre).[23] Fewer journeys were reported per resident each day in this area than in Halton and Peel (population 1.36 million, residential density 2,000 persons per urbanized square kilometre),[24] mostly because fewer discretionary and non-home-based trips were reported. (Some trips to inner-city corner stores in Toronto, for example, may not have been reported because they were so short or brief; whereas a comparable journey in Halton and Peel may have required a car ride.)

Another evident difference concerns 16- to 21-year-olds. In Halton and Peel they made relatively more trips to work and fewer trips to school than their inner-city counterparts.

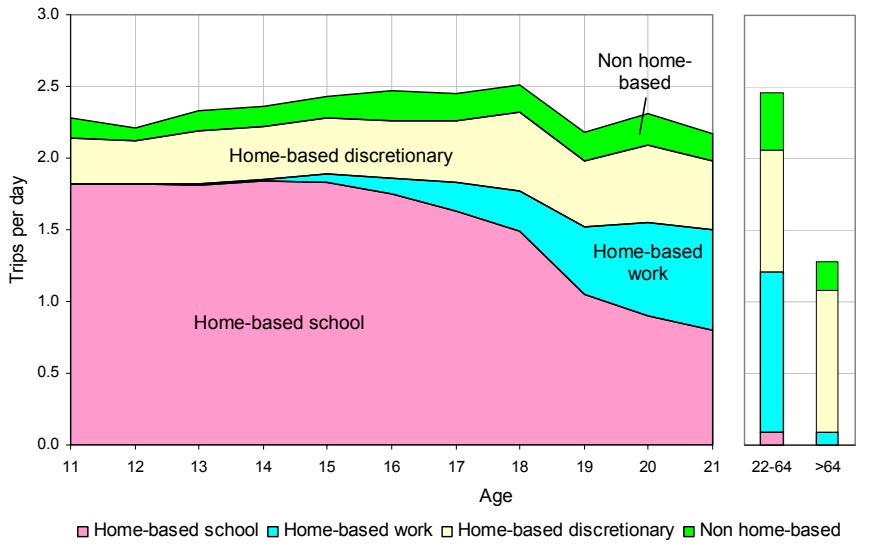
Notwithstanding these differences, the *similarities* between Box 3 and Box 7 are more striking.

Box 8 concerns trip mode and corresponds to Box 5. Comparison of Box 8 and Box 5 shows there are more evident differences between Halton and Peel (shown in Box 5), and the inner part of the City of Toronto (shown in Box 8). In the latter area, at all ages, there was much less use of cars and school buses, and much more use of transit. For example, at age 13 in 2001, the share of school-day journeys by children living in the inner part of the City of Toronto made by car, school bus, and transit was 30, 5, and 23 per cent, respectively, whereas in Halton and Peel the equivalent shares were 40, 21, and 3 per cent. Moreover, in the inner city transit use appears to start at an earlier age. At age 11 in 2001, 10 per cent of journeys were made by transit, whereas at this age in Halton and Peel essentially none of 11-year-old children had used transit.

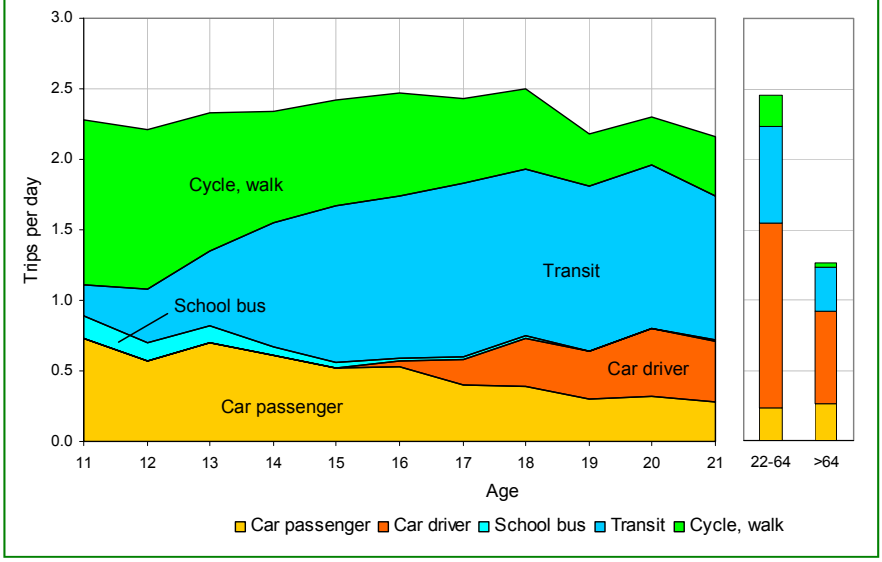
Regarding walking and cycling, comparison of data from Halton and Peel and from inner Toronto shows that 11- 13-year-olds in the latter area are much more likely to make trips in this way, but there are no differences between the two areas in this respect for older young people.

The relative contributions of potential factors to these transport differences between Halton and Peel and the inner city are not known and deserve investigation. Such factors could include urban form, transit availability, income, and cultural factors (e.g., less discomfort in encountering strangers,

Box 7. Weekday travel by purpose and age in the inner part of the City of Toronto, 2001



Box 8. Weekday travel by mode and age in the inner part of the City of Toronto, 2001



greater familiarity with diverse social norms, and adherence to a conserving way of living).

In summary, the following can be said from available data about the travel of children and youth in Halton and Peel:

- Until about age 18, travel on schooldays is dominated by the journey to and from school. Among 11- to 14-year-olds, just over half of these trips are made by school bus (28 per cent of the total) or by car (23 per cent of the total). The share of journeys by car is larger for older young people, and also likely larger among 6- to 10-year-olds.
- The share of journeys by car increased steeply between 1986 and 2001, for all purposes.
- The age at which children begin to use transit in Halton and Peel increased between 1986 (about 10 years) and 2001 (about 12 years).
- Compared with their counterparts in the inner part of the present City of Toronto, children and youth in Halton and Peel make more trips overall, many more trips by car and school bus, many fewer trips by transit, and, at least up to age 13, fewer trips cycling or walking.

Overall, the limited available data provide substance to what appear to be general impressions about travel by children and youth in Halton and Peel. The paucity of data about this significant feature of young people's lives is striking. A strong case could be made that there would be value in securing data on travel by 6- to 10-year-olds during the 2006 TTS survey, and this will be proposed to the survey managers. Ideally, data on non-schoolday trips would also be gathered.

TRANSPORT'S CONTRIBUTION TO THE CHILDHOOD OBESITY EPIDEMIC

Obesity may be edging ahead of smoking as a major public health concern, at least in the United States. This was the finding of a national survey of 1,002 U.S. residents conducted by the Harvard School of Public Health earlier this year: 79 per cent said adult obesity is a major health problem, compared with 76 per cent who so identified smoking and 76 per cent who so identified childhood obesity.[25] Respondents strongly supported several measures to fight childhood obesity by promoting more exercise and better eating. They were not given a chance to comment on the potential importance of children's transportation in children's obesity, a matter discussed below.

The survey respondents' assessment of the importance of obesity is in accord with the concern about it among public health practitioners in several countries. For example, one practitioner in the UK concluded recently that "obesity is associated with similar risk of mortality, and loss of life expectancy, as smoking in normal weight individuals".[26] He noted that the prevalence of obesity in the UK is approaching that of smoking.

In the U.S., the prevalence of obesity may now exceed that of smoking.[27] In Canada, there may still be more smokers than obese people but, as in the UK and many other countries,[28] the prevalence of obesity is rising and that of smoking is falling.[29] The prevalence of obesity in Canadian children appears to have increased at a similar or even higher rate than in adults.[30]

Increased food consumption—or increased consumption of fat in food—is often thought to be the main cause of increases in the prevalence of obesity.[31] This view is not supported by available evidence. Studies conducted in several countries suggest that annual per-capita energy intake from food and drink has declined and energy intake from fat in food and drink has declined more.[32] These declines have occurred while body weights have been increasing The only other potential contributor to weight gain is a decline in energy expenditure, i.e., physical activity. (Metabolic and other genetic factors play a role in individual weight difference, but are unlike to contribute to a change in prevalence of obesity in a population across a few decades.)

Physical inactivity has been highlighted as a contributing factor to excess body weight and obesity in several studies.[33] Remedial actions have focused on organized activity such as physical education in schools.[34] However, in adults at least, the rate of such organized or deliberate physical activity appears to have remained unchanged or even increased,[35] and yet body weights continue to rise.

Box 9 provides another indication of the lack of association between body weight and formal physical activity.[36] People in Halton and Peel regions appear to engage in more leisure-time physical activity than people in To-

Box 9. Leisure-time physical activity and body weight in Halton-Peel and Toronto

	Physical activity	
	Active	Inactive
Halton-Peel	43.2%	56.8%
Toronto	37.1%	62.9%

	Body weight	
	Not excess	Excess
Halton-Peel	52.5%	47.5%
Toronto	60.5%	39.5%

ronto, but they also seem to have a greater prevalence of excess body weight. Some other factor contributes to the lower body weight in Toronto than leisure-time physical activity. The higher weights in the suburban regions are consistent with a recently reported U.S. study, which found that at the extreme—Geauga County in the Cleveland, Ohio, metropolitan area vs. the four inner boroughs of New York City—residents of a sprawling area weighed on average 2.9 kilograms more than residents of a compact area.[37]

This other factor could be the amount of incidental activity that people engage in. Lawns are mowed with a powered mower rather than a hand mower. Television channels are changed remotely rather than at the set.[38] Of special significance may be transportation practices, which now involve much less physical activity on account of the with the growth in automobile use,. The lower rates of car ownership and use in Toronto, compared with Halton and Peel, could be a factor in the lower body weights shown in Box 9.[39] People in Toronto walk and cycle more, not so much as a leisure-time activity but as part of their everyday lives. However, the role of transportation is often ignored in discussions of the factors contributing to excess body weight and obesity.[40]

Transportation—and the associated matter of urban form—has been emphasized in several places. An influential World Health Organization report on obesity included an appeal to fashion transportation systems and urban form so they would not be "obesity promoting agents".[41] An editorial in the *Mayo Clinic Proceedings* highlighted how everyday activities, including using transit (which usually involves much more walking than car use), can protect against weight gain.[42] A French and Irish study examined the role of walking or bicycling to work in protecting against weight gain in middle-aged men.[43] Its results suggested that the positive effect of these activities may be comparable to that of engaging in regular high-intensity, leisure-time physical activity, and considerably more than that of regular moderate-intensity, leisure-time physical activity.

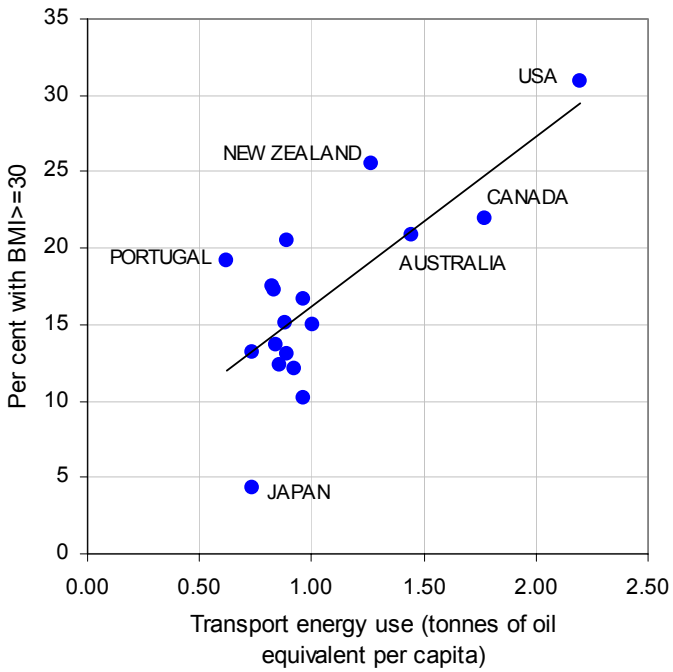
A substantial contribution to the literature on transportation and public health is a review prepared in 2000 for the U.S. Centers for Disease Control.[44] It concluded, "On balance, the literature supports the hypothesis that urban form variables influence levels of walking and bicycling. Higher densities, a greater mixture of land uses, a balance between housing and jobs, pedestrian- and bicycle-friendly site and street designs, grid street networks, and the presence of separate facilities for bicycles and pedestrians have all been shown to increase walking and bicycling."

Further support for a link between transportation and body weight is provided in Box 10, which shows the prevalence of obesity and transport energy use (a surrogate for motorized transport activity) in 18 affluent countries.[45] There is a strong positive correlation between the two variables, suggesting that a high level of use of motorized transport contributes to inactivity and body weight gain.

More work needs to be done to establish the nature of the potential links between obesity and transport activity, particularly in children. Obesity in children is of special importance because overweight children tend to have more behavioural and medical problems, and because they tend to remain overweight as adults and to continue to have problems.[46]

Over the next year, the Centre intends to begin work on how, if at all, current transport practices contribute to excess body weight and obesity in childhood, noting especially the differences that may exist in this respect between urban and suburban circumstances. Some of the potential implications of such work for progress towards sustainable transportation are set out in the opening paragraph of this issue of the *Monitor*.

Box 10. Obesity and energy use for transport in 18 OECD countries



THE CENTRE FOR SUSTAINABLE TRANSPORTATION

The Centre is a federally chartered, non-profit organization.

The mission of The Centre for Sustainable Transportation is to work proactively in achieving the sustainable transportation of persons and goods in Canada through co-operative partnerships, relevant and timely research; projects; the communication and dissemination of balanced information; and the monitoring and supporting of sustainable transportation activities.

To achieve its mission the Centre provides reliable information, fills knowledge gaps through research, educates stakeholders and raises awareness among them, and offers strategic policy advice in selected areas.

The Centre's first publication was its Definition and Vision of Sustainable Transportation, published in mid 1997. You are reading the ninth issue of the Sustainable Transportation Monitor, published annually from 1998 to 2000 and now twice a year. All issues of the Monitor are available at the Centre's Web site, as are the Centre's other publications (visit www.cstctd.org). The Monitor provides evaluation of progress towards or away from sustainable transportation and discussion of related matters.

This issue has been written by Richard Gilbert, the Centre's research director. The content has been endorsed by the Board of Directors acting as individuals rather than as representatives of the organizations with which they are affiliated.

Comments on this issue of the Monitor and proposals as to what should be covered in coming issues are much appreciated. E-mail is the preferred mode of communication but feedback by any mode is welcome. Please see Page 1 for our e-mail address, fax and phone number, and mailing address. Contact the Centre to become a corporate or individual member of the Centre.

REFERENCE NOTES

1. What the Centre means by sustainable transportation is captured in the following definition:
   A sustainable transportation system is one that:
   - Allows the basic access needs of individuals to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
   - Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
   - Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable re sources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.

   A slightly modified version of the Centre's definition has been adopted by the transport ministers of all 15 countries of the European Union (see the minutes of the 2340th meeting of the European Council at the first URL below). The Centre's definition was also used in *Canada's Urban Strategy: A Blueprint for Action*, report of the Prime Minister's Caucus Task Force on Urban Issues, November 2002 (see Page 15 of that document), available at the second URL below. Further uses have been by Transport Canada (see the material at the third URL below) and by the Union internationale des transport publics (see the document at the fourth URL below). A further indication of the extent of use of the Centre's definition is in the following: "Discussions with leading transportation research institutions have highlighted a growing international acceptance of the definition of sustainable transportation developed by the Canadian Centre for Sustainable Transportation" (from Page 29 of Hall RP, *Introducing the Concept of Sustainable Transportation to the U.S. DOT through the Reauthorization of TEA-21*. MS thesis, Faculty of Engineering, Massachusetts Institute of Technology, 2003).
   1. http://corporate.skynet.be/sustainablefreight/trans-counci-conclusion-05-04-01.htm. Accessed December 16, 2003.
   2. http://www.liberal.parl.gc.ca/urb/BluePrint_English.pdf. Accessed December 16, 2003.
   3. http://www.tc.gc.ca/programs/environment/sd/discussion00/sustainabletransport.htm. Accessed December 16, 2003.
   4. http://www.uitp.com/Project/pics/susdev/Leaflet-UK.pdf. Accessed December 16, 2003.

2. The map of the Greater Toronto Area in Box 1 was adapted from a map at the Web site of the Greater Toronto Marketing Alliance (see the first URL below). The Kids on the Move in Halton and Peel project was led by Dr. Catherine O'Brien, research associate of the Centre, and supported by The Ontario Trillium Foundation, an agency of the Ontario Ministry of Culture. It was conducted during the period March-September, 2003. The full report on the project is available at the second URL below.
   1. http://www.greater.toronto.on.ca/gta/gta_glance/gta_map.html. Accessed December 16, 2003.
   2. http://www.cstctd.org/CSTadobefiles/Kids on the Move.pdf. Accessed December 16, 2003.

3. The full designation of this document is European Commission, Directorate-General for the Environment *Kids on the Move*, Office for Official Publications of the European Communities, Luxembourg (2002). The document is available as a printed manual and also at the URL below.
   1. http://europa.eu.int/comm/environment/youth/air/kids_on_the_move_en.pdf. Accessed December 16, 2003.

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5. Go for Green (1998) *Nation Survey on Active Transportation: Summary Report*. Go for Green and Environics International, Ottawa. Available at the URL below:
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6. Vail, S. (2001) *The Physical Inactivity Epidemic: The Preventative Role of Active School Communities*. Discussion Paper Prepared for Delegates of the National Roundtable on Active School Communities, October 18-20. Available at the URL below.
   1. http://www.yorku.ca/suevail/asc/ASCdiscusspap.doc. Accessed December 16, 2003.

7. See the sources detailed in Notes 6, 28, 29, and 30.

8. Pearson, R., Wachtel, H., Ebi, K. (2000) Distance-weighted traffic density in proximity to a home is a risk factor for leukemia and other childhood cancers, *Journal of the Air & Waste Management Association*, 50, pp. 175-180.

9. California Air Resources Board (2002) *The Children's Health Study*, Fact Sheet, available at the URL below:
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15. Evans, G., Lercher, P., Meis, M., et al (2001) Community noise exposure and stress in children, *Journal of the Acoustical Society of America*, 109 (3), pp. 1023-1027.

16. Stallard, P., Velleman, R., Baldwin, S. (1998) Prospective study of post-traumatic stress disorder in children involved in road traffic accidents *British Medical Journal,* 317, pp.1619-1623.

17. This quotation is from International Centre for Technology Assessment (2000). *In-Car Air Pollution: The Hidden Threat to Automobile Drivers*. International Centre for Technology Assessment, Washington DC. Available at the URL below.
1. http://www.icta.org/projects/trans/incar.pdf. Accessed December 16, 2003.

18. Canadian Institute of Child Health, *Climate Change and Your Child's Health*, Information Package, Available at the URL below:
1. http://www.cich.ca./Publications.html. Accessed September 7, 2003.

19. This section comprises most of the section with the same title in the report of the project Kids on the Move in Halton and Peel (see Note 2).

20. Information about the Transportation Tomorrow Survey is available at the URL below. Each TTS survey involves a sample selected to be representative of each of the included municipalities.
1. http://www.jpint.utoronto.ca/index.html. Accessed December 16, 2003.

21. In the 2001 survey, 11- to 15-year olds comprised 8.8% of the sample, but were the household respondents in only 0.6% of cases. 16- to 20-year-olds comprised 7.8% of the sample, but were household respondents in only 2.6% of cases. In the 1986 survey, the respective proportions of children and youth aged 6-10, 11- 15, and 16-20 years were 7.6%, 7.8%, and 7.8%.

22. In Box 3, Box 4, and Box 7, 'home-based school' and 'home-based work' mean trips between home and school or work; 'home-based discretionary' means trips between home and other destinations; 'non-home-based' means trips that do not have home as an origin or a destination.

23. The inner part of the present City of Toronto comprises what are known in the TTS protocol as Planning Districts 1-4 and 6, i.e., Planning District 1, which embraces the downtown area, and the four contiguous planning districts. Its land area of about 133 square kilometres is assumed to be entirely urbanized.

24. This density estimate is based on the author's estimate that close to 680 square kilometres of Halton and Peel were urbanized in 2001 (i.e., developed for roads, buildings, parking lots, neighbourhood parks, etc.). This corresponds to approximately 25% of Halton Region's total land area of 959 square kilometres and 35% of Peel Region's 1,225 square kilometres.

25. For the Harvard School of Public Health questionnaire and poll results, see the URL below.
1. http://www.phsi.harvard.edu/health_reform/questionnaire.pdf. Accessed December 16, 2003.

26. The quote is from a presentation by Nigel Unwin of the University of Newcastle's Departments of Diabetes and Epidemiology and Public Health to a seminar at the Freeman Hospital, Newcastle, UK, on February 20, 2003. His slides are at the URL below. At a recent meeting of the Canadian Cardiovascular Society, David L. Katz of Yale University School of Medicine is reported to have said that obesity has become a crisis of historic proportions and that it is only a matter of time before it overtakes tobacco as the leading cause of premature and preventable death (Friscolanti M, Teen heart disease coming: expert. *National Post*, October 27, 2003). 'Obesity' here refers to a Body-Mass Index (BMI, weight in kilograms divided by the square of the height in metres) of more than 30. 'Overweight' here refers to a BMI of more than 25, up to and including 30.
1. http://www.campus.ncl.ac.uk/pimd/SPECS/endocrin/obesity.ppt. Accessed December 16, 2003.

27. One authoritative source of information gives the prevalence of adult obesity (>14 years) in the U.S. in 2000 as 30.9% (i.e., 30.9% of all adults were obese, as assessed in health examinations), and the prevalence of self-reported daily smoking as 19.0% (also >14 years, but for 1999). The source is *Health at a Glance; OECD Indicators 2003*, Organization for Economic Cooperation and Development, Paris, France, 2003. Another authoritative source—the Atlanta-based Centers for Disease Control (CDC)—gives the self-reported prevalences in the U.S. as 20.9% (obesity) and 17.8% (daily smoking; note when 'some day' smokers are included the prevalence was 23.4%), both for persons >17 years in 2001 (see the first and second URLs below). Note that the obesity data in the OECD compendium are based on health examinations and those provided by CDC are based on self-reports, suggesting that about a third of obese people in the U.S. under-report their weight.
1. http://www.cdc.gov/nccdphp/dnpa/obesity/trend/prev_char.htm. Accessed December 16, 2003.
2. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5214a2.htm. Accessed December 16, 2003.

28. For a brief overview of obesity increases in several countries, see Tremblay MS, Katzmarzyk PT, Willms JD, Temporal trends in overweight and obesity in Canada, 1981-1996. *International Journal of Obesity*, 26, 538-543, 2002.

29. According to the OECD source detailed in Note 27, the prevalences in Canada of self-reported obesity in 2001 and daily smoking in 2000 were 14.9% and 20% (both for persons aged >14 years). The paper by Tremblay et al. detailed in Note 28 indicates that the prevalence of self-reported obesity among Canadians aged 20-64 years increased from 8% to 13% between 1981 and 1996. According to Health Canada, the prevalence of smoking among persons aged >14 years declined from 30% to 25% between 1990 and 1999 (see the URL below).
1. http://www.hc-sc.gc.ca/hecs-sesc/tobacco/prof/cessation_program/improving_trends.html. Accessed December 16, 2003.

30. See Tremblay MS, Willms JD, Is the Canadian childhood obesity epidemic related to physical inactivity? *International Journal of Obesity*, 27, 100-1105, 2003. These authors note that the prevalence of obesity among children aged 7-13 years increased from 5% to 15% between 1981 and 1986. The source detailed in Note 13 noted an increase in adult obesity in Canada from 5.6% to 12.7% between 1985 and 1996. Obesity may be less prevalent among Canadian youth aged 12-19 than among children and adults; see Carrière G, *Parent and child factors associated with youth obesity*. Statistics Canada, Ottawa. Supplement to *Health Reports*, vol. 14, 2003 (Cat. 82-003), available at the URL below.
1. http://www.statcan.ca/english/freepub/82-003-SIE/free.htm. Accessed December 16, 2003.

31. For example, a recent newspaper article included the following: "Food manufacturers may face more regulation in the future as

consumers demand change from an industry that is increasingly being blamed for an epidemic of obesity." (Palmer K, Food fight: Schools battle obesity. *Toronto Star*, August 3, 2003). The new government of the Province of Ontario has vowed to ban the sale of 'junk food' in schools.

32. For a brief review of evidence on food intake in relation to obesity, see Weinsier RL and four others, The etiology of obesity: relative contribution of metabolic factors, diet, and physical activity. *American Journal of Medicine*, 105, 145-150, 1998. See also, Blair SN, Nichaman MZ, The public health problem of increasing prevalence rates of obesity and what should be done about it. *Mayo Clinic Proceedings*, 77(2), 109-113, 2002.

33. See, for example, the paper by Tremblay and Willms cited in Note 30 (for children), and the paper by Weinsier et al. cited in Note 32 (for all ages).

34. See, for example, Anderson R, The spread of the childhood obesity epidemic. *Canadian Medical Association Journal*, 163(11), 1461-1462, 2000.

35. Statistics Canada reported that the rate of adult engagement in "active and moderate physical activity" increased between 1994-5 and 2000-01 (Canadian Community Health Survey: A first look. *The Daily*, May 8, 2002, available at the URL below). Blair and Nichaman (see Note 32) noted that in the U.S. there was no decline in reported physical activity between 1975 and 2000.
1. http://www.statcan.ca/Daily?English/020508/d020508a.htm. Accessed December 16, 2003.

36. The body weight data in Box 9 are from Statistics Canada, *Health Indicators*, Cat. No. 82-221-X1E, May 2002, available at the first URL below. They are for residents aged >19 years. 'Excess weight' means BMI>25 (see Note 26). The activity data are from the same source, with the data available at the second URL below. They are for residents aged >11 years. 'Active' includes 'physically active' and 'moderately active'.
1. http://www.statcan.ca/english/freepub/82-221-XIE/01002/tables/pdf/1216.pdf. Accessed December 16, 2003.
2. http://www.statcan.ca/english/freepub/82-221-XIE/01002/tables/pdf/2166.pdf. Accessed December 16, 2003.

37. Ewing R and four others, Relationship between urban sprawl and physical activity, obesity, and morbidity. *Journal of Public Health Promotion*, 18(1), 47-57, 2003, available at the URL below.
1. http://www.smartgrowthamerica.org/report/JournalArticle.pdf. Accessed December 16, 2003.

38. A list of such comparisons, and the respective energy expenditures, appears in the paper by Blair and Nichaman detailed in Note 32.

39. TTS data (see Note 20 suggest that in 2001 the car ownership rate in Halton and Peel regions was 75 per 100 residents aged >15 years; in Toronto the corresponding rate was 53 per 100 residents. In Halton and Peel regions, 6% of households did not have an automobile; in Toronto, 25% of households did not.

40. For example, the paper by Tremblay and Willms (see Note 30), which focused on the contribution of physical inactivity to childhood obesity but does not mention transportation. A recent report by Toronto's Medical Officer of Health discusses lack of transportation as a potential barrier to engaging in physical activity, but does not mention the inactivity associated with widespread automobile use (Basrur S, *Physical Activity and Public Health*, Report to Toronto's Board of Health, June 2003, available at the URL below).
1. http://www.city.toronto.on.ca/health/pa_calltoaction_report_boh.htm. Accessed December 16, 2003.

41. World Health Organization, *Obesity: Preventing and Managing the Global Epidemic*. WHO Technical Report No. 894, WHO, Geneva, Switzerland, 2000.

42. See the paper by Blair and Nichaman cited in Note 17.

43. See Wagner A and 11 other authors, Leisure-time physical activity and regular walking or cycling to work associated with adiposity and 5y weight gain in middle-aged men: the PRIME study. *International Journal of Obesity*, 25, 940-948, 2001.

44. Frank LD, Engelke P, *How Land Use and Transportation Systems Impact Public Health: A Literature Review of the Relationship Between Physical Activity and Built Form.* Centers for Disease Control, Active Community Environments Initiative, Working Paper No. 1, 2000. Available at the URL below.
1. http://www.cdc.gov/nccdphp/dnpa/pdf/aces-workingpaper1.pdf. Accessed December 16, 2003.

45. The body weight data in Box 10 are from the first source detailed in Note 27. The energy use data are from *Energy Balances of OECD Countries,* International Energy Agency, Paris, 2002. The OECD countries represented are those with data for 1999 for both variables: Australia, Austria, Belgium, Canada, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. For Box 10, the obesity prevalences for all countries except Australia, United Kingdom, and United States have been increased by 50% to compensate for potential under-reporting of body weights. For the three indicated countries, body weight data were gained during health examinations, rather than from self-reports. The Pearson correlation coefficient of the two variables is +0.73, which is significant at better than the 1% level.

46. For behavioural problems, see Lumeng JC and four others, Association between clinically meaningful behaviour problems and overweight in children. *Pediatrics*, 112(5), 1138-1145, 2003. For medical problems, see Must A, Strauss RS, Risks and consequences of childhood and adolescent obesity. *International Journal of Obesity*, 23(Supplement 2), S2-S11, 1999. For continuation of obesity into adulthood, see Shengxu L and six others, Childhood cardiovascular risk factors and carotid vascular changes in adulthood: the Bogalusa heart study. *Journal of the American Medical Association*, 290(17), 2271-2276, 2003. (For the last matter, also see Raitakari OT and 11 others, Cardiovascular risk factors in childhood and carotid artery intima-media thickness in adulthood: the Cardiovascular Risk in Young Finns study. *Journal of the American Medical Association*, 290(17), 2277-2283, 2003, which demonstrated a clear link for overweight adolescents only, not for overweight younger children.)