

The Links between Public Health and Sustainable and Active Transportation

Overview

Sustainable and active transportation has a key role to play in improving the health of Canadians.

This issue paper summarizes the most relevant research on the links between Canadians' health and their access to and use of sustainable and active transportation infrastructure.

It reviews the major health risks associated with physical inactivity and exposure to air pollutants from motorized transportation vehicles, as well as the many benefits that can be derived when people choose to use active and sustainable transportation.

Selected Resources

1. Health Canada, [Health Effects of Air Pollution](#) and [Road Traffic and Air Pollution](#)
2. Ontario Medical Association, [The Illness Costs of Air Pollution](#)
3. Lawrence Frank, et al, [Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars](#)
4. Victoria Transport Policy Institute, [Quantifying the Benefits of Nonmotorized Transportation for Achieving Mobility Management Objectives](#)

References are found at the end of this issue paper.

Context

Access to sustainable and active transportation infrastructure and supporting policies and programs influences how Canadians travel to their daily destinations. In turn, Canadians who choose to use active and sustainable transportation modes can also improve their overall health and reduce the risk of certain diseases.

According to Statistics Canada, more than 80% of Canadians live in urban centres. Research shows that urban living can be good for your health because people who live in compact, well-designed urban areas tend to walk, cycle and take public transit more, and drive less.

However, Statistics Canada also reports that, in 2005, approximately 86% of Canadians traveled to work by car as drivers or passengers. Of those, 57% of residents lived less than a five-kilometre drive from work. This is particularly true in suburban and rural areas where communities are designed for car travel. As a result, people are more likely to drive to their everyday destinations—work, school, shops, recreational opportunities, etc.—a situation that can have a detrimental impact on their health.

Health & Safety Issues

After decades of research, the evidence is clear that even modest increases in physical fitness can reap enormous health benefits.

To experience health benefits, the Public Health Agency of Canada (PHAC) recommends that adults exercise a minimum of 30 minutes each day. However, 63% of Canadians are still not active enough to achieve the health benefits they need from physical activity. Using active and sustainable modes of transportation to and from daily destinations can help meet that daily requirement.

Risk factors of physical inactivity

The 2004 Canadian Community Health Survey determined that almost half of all Canadian adults are overweight and, of those, 23% are obese. In the case of children, the Heart and Stroke Foundation's *2005 Report Card on Canadians' Health* reported that the number of obese children has tripled over the past 20 years, with 37% of children either overweight or obese.

The number of deaths in Canada related to obesity has almost doubled in the past 15 years, from 2,514 in 1985 to 4,321 in 2000 (Heart and Stroke Foundation, 2004) and the Canadian Institute of Health Research reported that 9% of all deaths in Canada among adults aged 20 to 64 could be attributed to being overweight or obese.

The increase in obesity, and also the prevalence of other risk factors such as high blood pressure, tobacco use and a sedentary lifestyle, is increasing the incidence of both heart disease and stroke. As many as 50,000 Canadians suffer a

stroke every year, while cardiovascular disease claims the lives of 79,500 (Heart and Stroke Foundation, 2006).

The rate of type 2 diabetes is also rising. Unlike type 1 diabetes, type 2 can be delayed or prevented entirely with a healthy diet, increased physical activity, weight loss, not smoking and stress reduction. Five thousand people died from the disease in 1999 and the mortality rate has been rising since 1986.

As obesity rates increase and Canada's population ages, Health Canada predicts that as many as four million Canadians will be affected by type 2 diabetes, causing a dramatic increase in the mortality rate by the year 2010.

In a study conducted by the Canadian Diabetes Association, people at risk of developing type 2 diabetes were able to cut their risk 58% by exercising moderately for 30 minutes a day and by losing 5-7% of their body weight. In people aged 60 and over, the risk was cut by almost 71%.

Exposure to air pollution

Passenger road transportation is responsible for half of Canadians' personal greenhouse gas emissions (Transport Canada). Driving less, and cycling, walking or taking public transit more, has an immediate and positive impact on the air we breathe.

Certain health conditions can be delayed or avoided by daily exercise and other healthy lifestyle choices. In addition, these choices can lower the risk of exposure from vehicle emissions.

Most Canadians are now familiar with smog alerts and, particularly in eastern parts of Canada, smog days have become more common in recent years. But what exactly is smog?

Smog is composed of particulate matter (PM) and ground-level ozone.

Particulate matter is comprised of dust and smoke from vehicles, smokestacks, etc. and can adversely affect human health all year round.

Ground-level ozone is formed when two pollutants—volatile organic compounds or hydrocarbons and nitrogen oxides—react with each other. Ground-level ozone requires heat to form, so smog days usually occur during the warmer parts of the year. Winter smog can occur, however, when stagnant air causes a build-up in pollutants.

Several studies, including those by the U.S. Environmental Protection Agency and the Centre for Disease Control, have concluded that, even at low levels, there is no safe level for smog.

Each year, the effects of smog cause an estimated 16,000 premature deaths (Climate Change Connection Manitoba).

In addition, the Ontario Medical Association estimated that, in 2005, approximately 17,000 Ontarians were admitted to hospitals with health problems related to air pollution exposure—a number that is expected to rise to 24,000 in twenty years.

The number of smog alerts and smog days in Ontario has increased in the last decade, with 2005 being a particularly bad smog year. Fifteen smog advisories were issued that covered a total of 53 days, one of which was during the first week of February—the first winter smog advisory ever recorded in Canada.

Smog advisories issued for Ontario by the Ministry of Environment since 1995		
Year	Number of Advisories	Total Number of Days
1995	6	14
1996	3	5
1997	3	6
1998	3	8
1999	5	9
2000	3	4
2001	7	23
2002	10	27
2003	7	19
2004	8	20
2005	15	53
2006*	6	17
*As of October 18, 2006.		
Source: Ontario Ministry of Environment, Air Quality Ontario.		

Health effects start to occur at very low levels of both PM and ground-level ozone and increase steadily as concentrations increase. The elderly, small children and people with respiratory or cardiovascular disease are most at risk, but even healthy adults who are very physically active or work outdoors can be susceptible (Environment Canada).

Children, for example, need more oxygen for their body weight than adults and breathe at a faster rate, taking in, proportionately, more air pollutants (Canadian Institute of Child Health, 2005). Transport Canada's Urban Transportation Showcase Program's issue paper No. 40, *Transportation for Young People*, provides an overview of the health issues affecting children.

The good news is that people who use active and sustainable modes of transportation are at a lower risk of exposure to air pollution. In fact, drivers and car passengers are exposed to up to 10 times more pollution than pedestrians, cyclists or transit users (Climate Change Connection Manitoba).

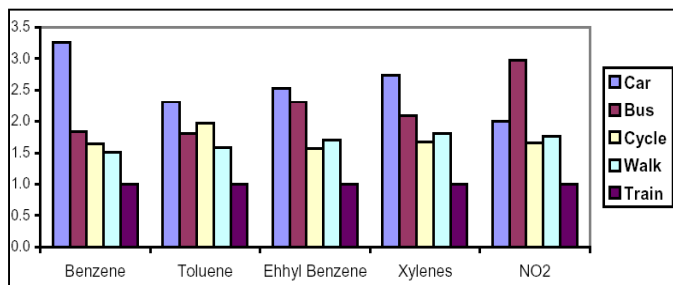
This has been proven in several studies, including one published in the Health Promotion Journal of Australia. That study found that the relative air pollution exposure by mode was as follows:

The study authors concluded that people traveling to work in peak-hour periods should use alternatives to cars to reduce their exposure to air pollutants, and also to reduce the exposure of other commuters by reducing their contribution to greenhouse gas emissions.

As stated above, ground-level ozone requires heat to form, so the highest levels are typically experienced in the afternoons on warm days. To minimize exposure to smog, many health professionals advocate that people do not exercise outdoors during these periods, that they replace vigorous activities such as jogging, with exercises such as walking, or change their exercise times to early mornings and evenings.

Toronto Public Health, for example, determined pollutant levels depending on the time of day, as shown in the table below.

Pollutant	Time of Day Pollutant Level less than Daily Average
Sulphur Dioxide	Before 7 a.m. and after 6 p.m.
Ozone	Before 10 a.m. and after 8 p.m.
Nitrogen dioxide	Before 6 a.m. and between 10 a.m. and 7 p.m.
Carbon dioxide	Before 6 a.m. and after 5 p.m.
Particulate Matter (≤ 2.5 micrometers)	Before 7 a.m. and after 7 p.m.



Comparison of Air Pollution Exposure for Five Commuting Modes in Sydney—Car, Train, Bus, Bicycle and Walking, Health Promotion Journal of Australia, Vol. 15, No. 1.

Because many of the most common pollutant levels are at lower levels during peak rush hours, using active and sustainable modes of transportation for commuting (and particularly on smog days) can lower a person's risk of exposure to air pollution.

Traffic safety

Using public transit, cycling and walking tends to be safer overall. Figures from Transport Canada showed that, in 1995, motor vehicle crashes killed 3,347 Canadians and injured 241,800. By contrast, between all of 1986 and 1995, 5,179 pedestrians were killed by motor vehicles and 157,703 injured.

According to the Victoria Transport Policy Institute (VTPI), shifting from driving to non-motorized transportation modes reduces the total per capita crash risk. The VTPI reported that collisions between pedestrians or cyclists and motor vehicles decline in areas that have higher rates of non-motorized travel, suggesting that drivers become more cautious when they see more walkers and cyclists.

Similarly, the *Cascadia Scorecard 2006* found that traffic on narrow streets of cities and denser suburbs tends to move more slowly than on wide suburban arterials, lessening the severity of collisions. A walker struck by a motor vehicle traveling at 64 kilometres per hour (kph) survives only 15% of the time. At 48 kph, the odds of survival rise to 45%.

In addition, the American Public Transportation Association claims that riding public transit can be as much as 79 times safer than car travel.

A strategic consideration: Canada's aging population

Statistics Canada reports that by 2031, the number of people over the age of 65 will account for almost one-quarter of Canada's population (Statistics Canada, December 15, 2005). This will not only have an impact on the health care system, but also on public transit.

The elderly use transit more than any other age group and public transit use as a percentage share of total trips also increases dramatically with age. For example, in Montreal 66% of off-peak transit trips are taken by persons 65 to 74, while in Ottawa, 73% of off-peak transit trips are taken by persons 65 to 74 (Transport Canada, 1997).

The Canadian Urban Transit Association (CUTA) believes that, since the rising proportion of those aged 65 and over is expected to increase off-peak ridership, demand for "community bus" type services, connecting residential areas to shopping, health care facilities, and community centres will increase in future.

Urban Form

Several recent studies have found that the type of community Canadians live in can make a difference to their health.

Urban Sprawl

The term "urban sprawl" has been used for many years to describe communities built on the edges of cities or towns, but what exactly does the term mean?

One study on the relationship between where people live and obesity levels defined urban sprawl as:

1. A population widely dispersed in low-density residential development.
2. Rigid separation of homes, shops, and workplaces.

3. Lack of distinct, thriving activity centres, such as strong downtowns or suburban town centres.
4. A network of roads marked by large block size and poor access from one place to another (Ewing, et al., 2003).

One of the leading studies on the relationship between urban form and health is *Obesity Relationships with Community Design*, published in the August 2004 issue of the American Journal of Preventive Medicine (Frank et al, 2004). The study authors followed 11,000 individuals and discovered links between suburban living and obesity levels.

Controlling for age, income, and education, the odds of being obese decreased with communities that had a greater mix of uses. In other words, when people were able to walk or cycle to shops, work, school and other daily destinations, they were less likely to be overweight or obese.

For residents in the most walkable communities, more than one-third of the residents met the 30-minute daily requirement of exercise (about 2 kilometres) and for every additional kilometre walked per day, the likelihood of being obese decreased a further 5%. Those who spent at least 30 minutes each day driving, however, were 3% more likely to be obese.

The authors concluded that:

Increasing walking can be achieved through a variety of policy options that include shorter-term incentives for walking for both utilitarian and recreational purposes, and longer-term changes in the built environment, such as increased mixed use, density, and street connectivity that make walking an attractive and viable option.

The results of the Frank study have been confirmed by other North American studies. In its 2005 *Report Card*, for example, the Heart and Stroke Foundation found that people living in suburbia and small towns rely more on cars to travel and therefore get less physical activity. They also found that individuals living in moderate-to-high density neighbourhoods with community and commercial services within walking or cycling distance of where they live are 2.4 times more likely to meet the 30-minute daily requirement for exercise.

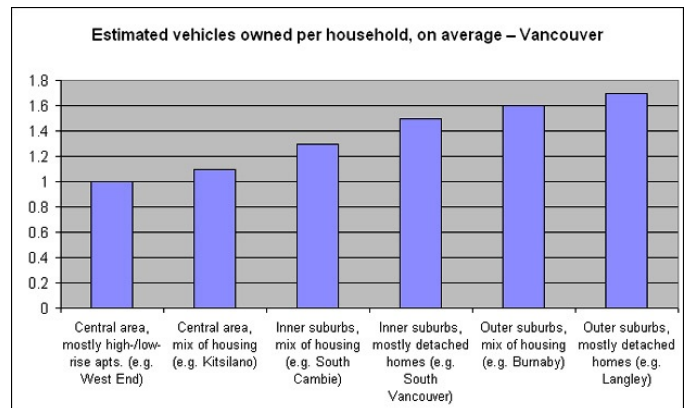
Designing communities for better health

Clearly, the way communities are designed can influence how Canadians exercise. Many suburban neighbourhoods, for example, are characterized by looping streets, with few or no sidewalks, bicycle paths or pedestrian crossings. This can make walking and cycling a less safe and less attractive option.

On the other hand, Canada Mortgage and Housing Corporation (CMHC) offers a glimpse of how compact

community design can have a positive impact on air quality.

CMHC found that in the Toronto area, greenhouse gases from weekday passenger travel generated by people living in mixed-use, pedestrian and transit-friendly neighbourhoods were one-third the level generated by people living in dispersed neighbourhoods on the urban fringe (CMHC, *Your Next Move*).



Canada Mortgage and Housing Corporation (CMHC). Estimated by CMHC's Greenhouse gas emissions from urban travel: tool for evaluating neighbourhood sustainability. 2000. Based on an average household size of 2.6 people. All rights reserved. All other uses and reproductions of this material are expressly prohibited.

In addition, CMHC studied five of Canada's largest cities (Vancouver, Calgary, Toronto, Ottawa and Montreal) to see how many vehicles were owned per household. Each city was divided into five areas (e.g., central area to outer suburbs).

As depicted in the graph for Vancouver above, those living in the suburbs owned twice as many cars as those living in more central areas, where public transit and active transportation infrastructure is more prevalent. Similar results were found in each of the five cities studied.

Costs & Benefits

The effects of physical inactivity, air pollution, and a lack of transportation options have real dollar costs and benefits attached to them.

Health care

The Canadian Medical Association Journal has estimated that the annual economic burden of physical inactivity is \$5.3 billion (\$1.6 billion in direct costs and \$3.7 billion in indirect costs). As one example, Environment Canada estimated the average medical costs associated with a hospital admission for respiratory illness at \$3,000, with an additional \$1,000 in lost wages and worker production.

Ontario, which has the largest population, incurs the brunt of the health care costs. The Ontario Chief Medical Officer of Health's 2004 report found that obesity costs the provincial health care system about \$4.3 billion annually—\$1.6 billion in hospital care costs, drugs and doctors, and \$2.7 billion in indirect costs such as lost earnings due to illness or premature death.

That being said, the risks factors for a host of diseases—type 2 diabetes, heart disease, stroke, arthritis, obesity, cancer, osteoporosis, etc.—all decrease when Canadians increase their level of physical fitness. For example, cardiovascular disease, which costs the health care system over \$7.3 billion in direct costs annually, could be cut by 50% if Canadians exercised regularly (PHAC).

Environment

Transport Canada's 1997 Sustainable Development Strategy reported that the environmental costs of transportation were between \$14 billion and \$36 billion each year.

Furthermore, a study produced for the Ontario government reported that smog costs about \$9.6 billion each year in health care and environmental damage (Ontario Ministry of Energy).

Replacing driving with active or sustainable transportation modes, therefore, has an immediate and positive effect on local air quality, helping to reduce harmful smog and particulate matter.

Go for Green estimated that if the entire Canadian population increased its current average of 8% walking or cycling to and from work to 10%, the total number of vehicle trips in Canada would drop by about 100 million annually. Each trip that is switched to cycling or walking avoids releasing 26 grams of hydrocarbon, 20 grams of carbon dioxide and 1.6 grams of nitrogen oxides per passenger mile.

Infrastructure

Providing active and sustainable transportation infrastructure is much less expensive than building new roads. The Ontario Ministry of Transportation estimated that providing paved shoulders for cyclists costs between \$50,000 and \$100,000 per kilometre and \$250,000 per kilometre for paved pathways. The cost to widen an urban arterial road to four lanes, on the other hand, costs roughly \$1.3 million per kilometre.

Additional Benefits

The VTPI determined that the average saving per 16,093 kilometres (10,000 miles) of shifting from motorized transportation to non-motorized transportation is approximately \$16,700 (\$14,300 US) as shown in the table below.

Benefits	Per 1,609 km	Total
Congestion reduction	\$0.02	\$200
Roadway cost savings	\$0.05	\$500
Vehicle cost savings	\$0.28	\$2,800
Parking costs (assuming a one-mile average trip length)	\$1.14	\$11,400
Air pollution reduction	\$0.05	\$500
Noise pollution reduction	\$0.03	\$300
Energy conservation	\$0.05	\$500
Traffic safety benefits	\$0.05	\$500
Total	\$1.67	\$16,700
Source: Adapted from VTPI. <i>Quantifying the Benefits of Nonmotorized Transportation for Achieving Mobility management Objectives</i> . November 30, 2004.		

For employers, encouraging employees to use active and sustainable modes of transportation can increase productivity and reduce the costs associated with stress or sick leave. Municipal employees in Toronto, for example, missed 3.35 fewer days in the first six months of their 'Metro Fit' fitness programs than employees not enrolled in the program (Canadian Council for Health and Active Living at Work).

Social benefits can be difficult to quantify, but evidence suggests that active and sustainable transportation promotes social cohesion and better community life. Research also suggests that, for the elderly, physical activity—like that from using active or sustainable transportation—can help them continue to live independently (PHAC).

Conclusion

Encouraging active and sustainable transportation can take many forms and programs or policies can come from many different sources—governments, employers, health professionals, schools, etc.

There are a host of mobility management programs that can be implemented. The Urban Transportation Showcase Program case studies provide in-depth information about many of these and, for ease of reference, the list below shows the wide range of possible strategies:

- Improvements to transit, walking and cycling infrastructure
- Providing bicycle parking facilities and integrating bicycles with public transit
- Congestion pricing and distance based fees (e.g., toll roads)
- Employee transportation benefits (e.g., discounted transit passes)
- Increasing parking prices or fuel taxes
- Location-efficient and transit-oriented development (smart growth communities, compact urban form)

- Traffic calming
- Car-free planning assistance
- Public education to encourage the use of non-motorized transportation

The issues discussed in this paper cover a wide territory and cannot be viewed merely through a transportation lens. Encouraging better health and reducing motorized transportation involves recognizing and addressing the barriers that exist, and creating the necessary incentives to encourage people to change their travel behaviour.

Social marketing campaigns have proven to be an effective tool at shifting people's behaviours from vehicle use to active and sustainable modes of transportation.

Finally, it is important to note that those involved in these issues must seek allies in several disciplines, including public health. Not only is this necessary for programs and policies to succeed, it is an opportunity to bring additional benefits to the population. Partnering with a variety of organizations can bring more resources to a project, such as financing or expertise, and increase credibility of the issues with the general public.

References and Resources

American Journal of Public Health. *Promoting safe walking and cycling to improve public health: lessons from the Netherlands and Germany*. September 2003, vol. 93, no. 9.

American Public Transportation Association. <http://www.publictransportation.org>.

Canada Mortgage and Housing Corporation. *Comparing Neighbourhoods for Sustainable Features*. http://www.cmhc-schl.gc.ca/en/co/buho/sune/sune_007.cfm#CP_JUMP_98625.

Canadian Council for Health and Active Living at Work. *Frequently Asked Questions About Physical Activity in the Workplace*. <http://www.cchalw-ccsvat.ca/english/faq.aro>.

Canadian Diabetes Association. *The Prevalence and Cost of Diabetes*. http://www.diabetes.ca/Section_About/prevalence.asp.

Canadian Fitness and Lifestyle Research Institute. *A municipal perspective on opportunities for physical activity: Trends from 2000 to 2004*. <http://www.cflri.ca/eng/statistics/surveys/documents/2004capacity.pdf>.

City of Toronto. *A report on cycling fatalities in Toronto 1986-1998: recommendations*. http://www.toronto.ca/cycling/coroner_recomend.htm.

Environment Canada. *Environmental Indicators: Smog*. http://www.ecoinfo.org/env_ind/region/smog/smog_e.cfm.

Ewing, Reid, et al. *Relationship between Urban Sprawl and Physical Activity, Obesity, and Morbidity*. Science of Health Promotion. September/October 2003, Vol. 18, No. 1.

Frank, Lawrence, et al. *Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars*. American Journal of Preventive Medicine, 2004;27(2). <http://www.ajpm-online.net/article/PIIS074937970400087X/fulltext>.

Go for Green. *Making the Case for Active Transportation*. Fact Sheet #1. http://www.goforgreen.ca/active_transportation/pdf/fact%20sheet%20-%20English.pdf.

Health Canada. *Health Effects of Air Pollution*. http://www.hc-sc.gc.ca/ewh-semt/air/out-ext/effe/health_effects-effets_sante_e.html; *It's Your Health: Type 2 Diabetes*. http://www.hc-sc.gc.ca/iyh-vsv/diseases-maladies/diabete_e.html; *Road Traffic and Air Pollution*. http://www.hc-sc.gc.ca/iyh-vsv/envIRON/traf_e.html.

Heart and Stroke Foundation of Canada. *2005 Report Card on Canadians' Health—Has the Suburban Dream Gone Sour?* February 2005. <http://ww2.heartandstroke.ca/Page.asp?PageID=33&ArticleID=3832&Src=news&From=SubCategory>; *Heart and Stroke Foundation Warns Fat is the New Tobacco*. February 10, 2005. <http://ww2.heartandstroke.ca/Page.asp?PageID=1613&ContentID=15421&ContentTypeID=1>.

Katzmarzyk, Peter T., et al. *The economic burden of physical inactivity in Canada*. Canadian Medical Association Journal. November 28, 2000. 163(11).

Moving on Sustainable Transportation. *Social Marketing of the "Transportation Cocktail" concept to young adults*. <http://www.tc.gc.ca/programs/environment/most/transportationcocktail.htm>.

Ontario College of Family Physicians. *The Health Impacts of Urban Sprawl: Obesity and Report on Public Health and Urban Sprawl in Ontario*. <http://www.ocfp.on.ca>.

Ontario Medical Association, *The Illness Costs of Air Pollution*, <http://www.oma.org/Health/smog/icap.asp#intro>.

Ontario Ministry of Energy. *Our Energy, Our Future*. <http://www.energy.gov.on.ca/index.cfm?fuseaction=english.energyfuture2>.

Ontario Ministry of Environment. *Smog Watches in Ontario*. <http://www.ene.gov.on.ca/envision/news/2005/020301fs.pdf>.

Ontario Ministry of Health and Long-Term Care. *2004 Chief Medical Officer of Health Report: Healthy Weights, Healthy Lives*. http://www.health.gov.on.ca/english/public/pub/ministry_reports/cmoh04_report/healthy_weights_112404.pdf.

Public Health Agency of Canada, <http://www.phac-aspc.gc.ca/pau-uap/paguide/start.html>.

Sightline Institute, *Cascadia Scorecard 2006*, <http://www.sightline.org/publications/books/CS2006/CS06>.

Statistics Canada, Summary Tables, *Population urban and rural*. <http://www40.statcan.ca/l01/cst01/demo62a.htm>; 2001 Census Technical Report, *Journey to Work*, Section 3.3.4, Table 11,

http://www12.statcan.ca/english/census01/Products/Reference/tech_rep/journey/index.cfm; *The Daily*, July 6, 2005 and August 22, 2006 issues; *The Daily: Population Projections*, December 15, 2005.
<http://www.statcan.ca/Daily/English/051215/d051215b.htm>.

Toronto Public Health. *Air Pollution and Physical Activity: Examination of Toronto Air Data to Guide Public Advice on Smog and Exercise*. June 2003.

Transport Canada. *1997 Sustainable Development Strategy*.
<http://www.tc.gc.ca/programs/environment/sd/strategy97/menu.htm>.

Victoria Transport Policy Institute, *Quantifying the Benefits of Nonmotorized Transportation*. <http://www.vtpi.org/nmt-tdm.pdf>.