The Business Case for Active Transportation

The Economic Benefits of Walking and Cycling

Go for Green
The Active Living & Environment Program

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BEST
BETTER ENVIRONMENTALLY SOUND TRANSPORTATION

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Active Transportation provides many societal and personal benefits. Most of these benefits also have a positive economic impact. Active transportation consists of human-powered forms of travel such as walking, cycling, using a wheel chair, in-line skating, skate boarding, cross-country skiing, canoeing and kayaking. The most popular forms are walking and cycling and will be the forms examined here.

Currently 6.6% of Canadians walk to work while 1.2% bicycle. Victoria, B.C. has the highest levels of active transportation use in Canada with walking accounting for 10.4% of trips and cycling accounting for 4.8% of trips. Many countries around the world have significantly higher levels of active transportation use. In the Netherlands, walking accounts of 19% of trips while cycling accounts for 27% and in Sweden, walking accounts for 39% of trips while cycling accounts for 10%. Clearly there is room for growth, especially in cycling trips.

A significant percentage of motor vehicle trips are of a distance that is easy to cycle or walk. There is a very high degree of willingness among Canadians to walk or ride a bike instead of driving, with 82% willing to walk more and 66% willing to cycle more given appropriate facilities.

Safety concerns are one of the main reasons Canadians do not cycle more. While actual safety and perception of safety may differ, there is a severe lack of safe active transportation infrastructure in Canada. Improving facilities for cycling and walking is most likely the best way of increasing the numbers of people using these forms of transportation. Such expenditures should prove to be very popular. A large majority of Canadians (82%) supports government spending to create dedicated bicycle lanes and paths. In addition, legislation and more education programs to support active transportation are critical.

The economic benefits of active transportation include:

- Reduction in road construction, repair and maintenance costs
- Reduction in costs due to greenhouse gas emissions
- Reduction in health care costs due to increased physical activity and reduced respiratory and cardiac disease
- Reduction in fuel, repair and maintenance cost to user
- Reduction of costs due to increased road safety
- Reduction in external costs due to traffic congestion
- Reduction in parking subsidies
- Reduction of costs due to air pollution
- Reduction of costs due to water pollution
- The positive economic impact of bicycle tourism
- The positive economic impact of bicycle sales and manufacturing
- Increased property values along greenways and trails
- Increased productivity and a reduction of sick days and injuries at the workplace
- Increased retail sales in pedestrian friendly areas

Even at today's low levels of daily use, the benefits of active transportation are significant. The current total of these economic benefits amounts to $3.6 billion dollars per year in Canada. If the mode share of active transportation increases to 15.2% (that of Victoria), the benefits would increase to $7.0 billion a year.

The current economic benefits justify increased government expenditures on active transportation in Canada. The projected benefits of doubling the mode share of active transportation make the case even more compelling.

1. INTRODUCTION

Active transportation consists of human-powered forms of travel such as walking, cycling, using a wheel chair, in-line skating, skate boarding, cross-country skiing, canoeing and kayaking. This report focuses exclusively on walking and cycling, thus other forms of active transportation are not examined, yet may offer additional benefits. Active Transportation provides many societal and personal benefits. Most of these benefits also have a positive economic impact. This report outlines several such economic benefits and estimates their monetary value both at the current level of active transportation use and a realistic target level. The target level chosen is 15.2%, which is the current level in Victoria B.C, the leader in Canada.

Although there is some acknowledgement of active transportation in government policies and plans, a much stronger commitment is needed at all levels of government to realize the potential benefits of active transportation.

This report compiles existing research on the economic benefits of active transportation. Much of this report is built upon the work contained in *Quantifying the Benefits of Non-Motorized Travel for Achieving TDM Objectives* by Todd Litman of the Victoria Transport Policy Institute.[1]

In order to make the case that there is potential for increased use of active transportation, the current state of active transportation in Canada and other countries is examined.

Canadian sources are used whenever available. All monetary values are in 2004 Canadian dollars unless otherwise noted. All quantified economic benefits have been converted as needed.[2] There are gaps in available research. These gaps are identified in section *5, Significant Gaps in Research*.

[1] T. Litman, *Quantifying the Benefits of Non-Motorized Travel for Achieving TDM Objectives*, (http://www.vtpi.org/nmt-tdm.pdf), Victoria Transport Policy Institute, 1999.

[2] An exchange rate of 1.30 is used when converting American to Canadian. The Consumer Price Index (CPI) was used to convert to 2004 dollars. Many of the values were in 1996 dollars. The CPI values were taken from January 1996 and December 2003 resulting in a conversation rate of 1.17. Bank of Canada *Consumer Price Index, 1995 – present*, (http://www.bankofcanada.ca/en/cpi.htm), 2003.

2. CURRENT STATE

While a relatively low percentage of Canadians use active transportation daily, the majority of Canadians occasionally walk or cycle for recreational purposes.

2.1. WALKING

Statistics Canada reports in the 2001 census that, 6.6% or 881,085 Canadians walked to work.[3] Almost six in ten Canadians (58%) report walking as a mode of transportation "at least sometimes".[4] The average walking trip is one kilometre.[5]

2.2. CYCLING

Statistics Canada reports in the 2001 census that, 1.2% or 162,910 Canadians cycle to work up from 1.1% or 137,440 in 1996.[6]

While over half of Canadian adults own a bike (57%), only one in four ever cycle as a mode of transportation. However, one in two Canadians cycle for leisure or recreational purposes[7]. Bicycle ownership is highest in Manitoba, Alberta and Quebec. Men, affluent and university-educated Canadians are most likely to own bicycles.

The average bicycle trip is approximately 3.2 kilometres.[8]

Table 1: Distances Cycled One Way as a Percentage of Total Trips in Vancouver[9]

Distance	Percentage
< 2 km:	12%
2-5 km:	23%
5-10 km:	27%
10-30 km:	28%
> 30 km:	9%
Total	100%

2.3. TRIP DISTANCE AND TIME

The average distance of commuting trips tends to be longer than the average distance of all trips. The table below details the average active transportation commutes including the percentage of employees that walk or bicycle commute at least one day, the number of days a year that they walk or bicycle commute and the distance they commute. Note that the numbers are per day so they include both the trips to and from work.

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[3] Statistics Canada, *2001 Census: analysis series - Where Canadians work and how they get there*, http://www12.statcan.ca/english/census01/products/analytic/companion/pow/pdf/96F0030XIE2001010.pdf, 2003.
[4] Environics, *National Survey on Active Transportation*, Go for Green, (http://www.goforgreen.ca/active_transportation/pdf/AT Survey.pdf), 1998.
[5] No Canadian estimates of average distance could be found so the US average of 1 km is used. 1 km is most likely conservative and is shorter than the average walk commute trip. U.S Department of Transportation, *Bicycling and Walking in the United States Today*, (http://safety.fhwa.dot.gov/pedbike/univcourse/swless02.htm), 1995.
[6] Statistics Canada, *2001 Census: analysis series - Where Canadians work and how they get there*.
[7] Environics, *National Survey on Active Transportation*.
[8] No Canadian estimates of average distance could be found so the US average of 3.2km is used. 3.2km is most likely conservative and is shorter than the average bicycle commute trip. U.S Department of Transportation, *Bicycling and Walking in the United States Today*.
[9] City of Vancouver Engineering Services, *Bicycle Plan 1999: Reviewing the Past, Planning the Future* (http://www.city.vancouver.bc.ca/engsvcs/transport/cycling/pdf/1999bikeplan.pdf), 1999, p 103.

Table 2: Active Commuting Time and Distance[10]

	Employees who Walked to Commute				Employees who Bicycled to Commute			
	In past year	Days per year	Minutes per day	Distance per day	In past year	Days per year	Minutes per day	Distance per day
Sector								
Private Business	34%	155	36	3.0km	14%	53	33	11.0km
Government or Public Organization	40%	146	38	3.2km	16%	66	43	14.3km

In downtown areas, cycling can be the fastest mode of door-to-door travel for trips of up to 10 km.[11]

Table 3: Active Transportation Average Speed[12]

Mode	Minutes Per kilometre	Speed (km/hour)
Bicycle	3	20
Walk	12	5

Distance or the time required to cover the distance, does not seem to be the main barrier for active transportation. Given the speeds in the table above, the distance of the average cycling or walking trip is significantly less than the distance that could be cycled or walked in the time required by the average trip time for all modes. The table below details the average time people spend travelling by all modes for a given purpose and shows the distance that they could walk or cycle in that period of time.

Table 4: Average Time Spent Travelling [13]

Reason for travel	Participants (% of population)	Average time spent travelling (all modes) (Minutes)	Distance Walkable (km)	Distance Cycleable (km)
Commuting	47	62	5.2	20.7
Shopping	34	39	3.3	13.0
Entertainment or socializing	23	44	3.7	14.7
Personal care or meals	13	25	2.1	8.3
Providing care	10	47	3.9	15.7
Participation in hobbies and sports	9	57	4.8	19.0
Education	8	53	4.4	17.7
Volunteer or religious activities	6	42	3.5	14.0

[10] C. Cameron, C. Craig, T. Stephens and T. A. Ready, *Increasing Physical Activity-Supporting an Active Workforce*, Canadian Fitness and Lifestyle Research Institute, 2001, page 80.
[11] US Department of Transportation, *The National Bicycle and Walking Study, Final Report*, 1994.
[12] Converted to kilometers and rounded. NationalHighway Institute, *Estimating the Impacts of Urban Transportation Alternatives, Participant's Notebook*, National Highway Institute, Federal Highway Admin. (Washington DC), Course #15257, Dec. 1995, p VI-16.
[13] W. Clark, *Traffic report: Weekday commuting patterns, Canadian Social Trends*, (http://www.statcan.ca/english/kits/pdf/social/traff2.pdf), Statistics Canada, Spring 2000.

3. POTENTIAL

There is much evidence to suggest that the mode share for active transportation could be much higher than current levels. The facilities for active transportation in most Canadian communities are poor or non-existent. In general, facilities in Canada are not built to the high standards seen in other countries where the mode share for active transportation is high. Furthermore, a significant percentage of motor vehicle trips are of a distance that is easy to cycle or walk.

Surveys show a considerable desire by Canadians to use active transportation given safe facilities, with 82% willing to walk more and 66% willing to cycle more.[14] In addition, more supportive legislation could play a significant role in increasing the level of active transportation in Canada.

Looking at the mode share for active transportation in cities in Canada and around the world will give an idea of the potential for active transportation in Canada. When improvements have been made to facilities in Canada and around the world, the number of people using active transportation has increased as detailed in section *3.3.3*.

3.1. CLIMATE

Some might suspect that the weather in Canada, especially the extreme cold, snow and ice in the winter, would limit the potential of active transportation in many parts of Canada. This, however does not appear to be the case as other countries around the world with similar climates such as Denmark and Sweden have very high levels of active transportation use. In Canada, the Yukon is tied with British Columbia for the highest percentage of commuter cyclists. It is reasonable to expect that the use of active transportation, especially cycling, will be higher in the summer.

3.2. ACTIVE TRANSPORTATION USE IN VARIOUS CITIES

Victoria leads the major metropolitan areas in the country in the levels of both cycling and walking commuting. In 2001, 10.4% of residents walked and 4.8% cycled to work for a total of 15.2% using active transportation. This is almost twice the national average of 7.9%.

Even Victoria is significantly behind many cities world-wide. In Amsterdam, 47% of trips are made using active transportation – three times that of Victoria and almost six times the national average. For cycling, the mode share in Amsterdam is a staggering 14 times that of the average of Canadian cities and over four times that of Victoria. [15]

Table 5: Commuting Mode Shares in Canadian Census Metropolitan Areas[16]

	Walk (%)	Bicycle (%)	Car (%)	Transit (%)	Total Active Commuting (%)
Calgary	5.9	1.5	78.6	13.2	7.4
Edmonton	4.7	1.2	84.3	8.6	5.9
Halifax	10.3	0.9	77.7	9.9	11.2
Hamilton	5.1	0.9	85.3	8	6
Kingston	10.4	2.2	82.4	3.5	12.6
Kitchener	4.9	1.1	89.4	3.9	6
London	5.9	1.5	85.7	6	7.4
Montréal	5.9	1.3	70.4	21.7	7.2

[14] Environics, *National Survey on Active Transportation*, Go for Green, (http://www.goforgreen.ca/active_transportation/pdf/AT Survey.pdf), 1998.
[15] The mode share for Amsterdam is for all types of trips while the Canadian mode shares are for commuting trips. While the Canadian mode shares for all types of trips are likely somewhat higher, the main point that Amsterdam has a much greater percentage of people using active transportation still holds.
[16] Statistics Canada, *2001 Census: analysis series - Where Canadians work and how they get there*, http://www12.statcan.ca/english/census01/products/analytic/companion/pow/pdf/96F0030XIE2001010.pdf, 2003.

Oshawa	3.6	0.5	87.9	7.1	4.1
Ottawa-Hull	6.8	1.9	72	18.5	8.7
Quebec	7	1.3	81.2	9.8	8.3
Regina	5.2	1.4	88.2	4.4	6.6
Saskatoon	5.8	2.5	86.3	4.1	8.3
St. John's	5.9	0.1	89.6	2.8	6
Toronto	4.6	0.8	71.5	22.4	5.4
Vancouver	6.5	1.9	79.2	11.5	8.4
Victoria	10.4	4.8	73.5	9.7	15.2
Minimum	3.6	0.1	70.4	2.8	4.1
Maximum	10.4	4.8	89.6	22.4	15.2
Average	6.4	1.5	81.4	9.7	7.9

Table 6: Mode Share in Selected Cities World Wide[17]

	Walk	Bicycle	Car	Transit	**Active Total**
Amsterdam	26	21	38	15	**47**
Basel	28	21	23	27	**49**
Bristol	26	2	65	7	**28**
Gothenburg	23	4	44	29	**27**
Munich	23	13	39	24	**36**
Paris	23	1	57	18	**24**
Perth	15	3	76	6	**18**
Portland	10	1	83	5	**11**
Santa Cruz[18]	10	6	75	9	**16**
Vienna	27	3	35	34	**30**

3.3. ACTIVE TRANSPORTATION USE BY COUNTRY

From the table below, it is apparent that Canada lags behind many countries in the use of active transportation. Bicycle useage in these countries is ten times that of Canada. It is also important to note that every country that has a low level of car use has a high level of active transportation use. Canada is 38 percentage points behind the maximum and 22 percentage points behind the average.

Table 7: Mode Share in Selected Countries[19]

	Walk (%)	Bicycle (%)	Transit (%)	Car (%)	**Total Active (%)**
Austria	31	9	13	39	40
Canada	**10**	**1**	**14**	**74**	**11**
Denmark	21	20	14	42	41
France	30	4	12	54	34
Germany	27	10	11	52	37
Netherlands	19	27	8	44	46
Sweden	39	10	11	36	49
Switzerland	29	10	20	38	39
United Kingdom	12	8	14	62	20
United States	9	1	3	84	10

[17] W. Brog and N. Mense, *Eight cities walking: comparative data on walking as a transport mode from cities in Europe, Australia and the US, Portland*, (http://www.americawalks.org/PDF_PAPE/Brog.pdf), Socialdata GmbH, p 5.
[18] U. S. Census Bureau, *United States Census 2000*.
[19] J.Pucher and C. Lefèvre, *The Urban Transport Crisis*, MacMillan (London), 1996, pp 16-17.

Average	**23**	**10**	**12**	**53**	**33**
Minimum	9	1	3	36	10
Maximum	39	27	20	84	49
Range	30	26	17	48	39
Canada Minus Maximum	-29	-26	-6	-10	-38
Canada Minus Average	-13	-9	2	21	-22

3.3.1. Barriers

Perceived safety

The perception that cycling is not safe is one of the main obstacles that discourages more people from cycling. Survey results indicate that 53% of Canadians believed that cycling is unsafe due to motor vehicle traffic.[20]

Lack of Facilities

The relatively low number of people that cycle and walk is not surprising considering the lack of facilities in many municipalities.

Bike Lanes

Most municipalities have little or no infrastructure supporting cyclists. Just over one-third report having on-street bike lanes. Only 11% have more than 20 kilometres of bike lanes. Only approximately one-quarter of these municipalities with bike lanes report maintaining them in the winter.[21]

Off-road paths and trails

Just over one quarter of adults report that there are many multi-purpose trails that can be used for physical activity in their community.[22] While many municipalities report having some trails, few have networks of trails that permit travelling from one point to another exclusively on off-road trails. [23] More than two in five adults strongly agree that a well-linked network of trails would help them become more physically active.

Sidewalks

Only one third of municipalities report having sidewalks on both sides of at least some major arterials. Around one in five report having arterials with shoulders or sidewalks for pedestrians. [24]

3.3.2. Demand

The 1998 Go for Green National Survey on Active Transportation, conducted by Environics International, indicates a strong desire by people to use active transportation.[25]

Cycling

A strong current desire to cycle exists among Canadians: two in three (66%) would like to bike more often. This is most strongly expressed by Canadians living in medium sized cities (100K to 1M), and those up to the age of 55, three in four of whom would like to cycle more often.

A large majority of Canadians (82%) supports government spending to create dedicated bicycle lanes and paths.

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[20] Environics, *National Survey on Active Transportation*, Go for Green, (http://www.goforgreen.ca/active_transportation/pdf/AT Survey.pdf), 1998.
[21] S. Cragg, C. L. Craig and S. J. Russell, *Increasing Physical Activity – Enhancing Municipal Opportunities,* (http://www.cflri.ca/pdf/e/2000capacity.pdf), Canadian Fitness and Lifestyle Research Institute (Ottawa, ON), 2000, p 22.
[22] Ibid., p23
[23] Ibid.
[24] Ibid., p 24.
[25] Environics, *National Survey on Active Transportation*, Go for Green.

Despite reporting that "convenience" and "laziness" are barriers to cycling, seven in ten (70%) Canadians say they would cycle to work if there "were a dedicated bike lane which would take me to my workplace in less than 30 minutes at a comfortable pace."

Not only do two in three (66%) Canadians say they would like to cycle more often, but clearly, an overwhelming majority could cycle to routine destinations within 30 minutes or eight kilometres of home. Over eight (84%) in ten Canadians live within a 30-minute cycle of a routine destination, including:

- shopping/errands (68%)
- leisure/recreation (57%)
- friends/family (47%)
- school (48%)
- work (33%)

As well, 54% of the total population of working Canadians could cycle to work but do not, 36 percent of all Canadians, could, but do not, cycle to visit friends and family, 41% of students could cycle to school, but do not.

Walking

Canadians are motivated to walk more as a mode of transportation. Eight in ten (82%) agree that they would ideally like to walk more often than they do. In fact, fewer than two in ten (16%) are not willing to walk more often.

When asked, only a minority of Canadians say they do not have time to walk. Only one in three (31%) agree with the statement "I never have time to walk as a mode of transportation."

Given the distances involved, 21% of Canadians could walk for shopping/errands but do not, while seven percent could walk to work, but do not.

3.3.3. Increases Following Infrastructure Improvements

Several cities have seen significant growth in the amount of people cycling after major investments in bicycle infrastructure. For example, the level of cycling increased in Toronto by 270%, the level in Copenhagen increased by 50% and the level in Eugene, Oregon increased by 75%.[26] In 1995, daily bicycle use in New York City had increased 124% over 1980 levels. [27]

From 1990 to 1999, almost $6 million were spent on the bicycle network in Vancouver which increased the total length of bicycle routes from 8.8 km to 133 km.[28]From 1991 to 1998, the number of cyclists entering the downtown core in a three-hour period almost doubled from approximately 1,200 to 2,000 cyclists.[29] The Adanac Bikeway in Vancouver was completed in 1993. Bicycle volumes increase 225% during the period from 1992 to 1996.[30]

[26] New York City, New York City Bicycle Master Plan, (http://www.ci.nyc.ny.us/html/dcp/pdf/bike/cyclnyc.pdf), 1997, p 6.
[27] Ibid., p 5.
[28] City of Vancouver Engineering Services, *Bicycle Plan 1999: Reviewing the Past, Planning the Future* (http://www.city.vancouver.bc.ca/engsvcs/transport/cycling/pdf/1999bikeplan.pdf), 1999, p 20.
[29] Ibid., p 47.
[30] Ibid., p 58.

4. ECONOMIC BENEFITS

The economic benefits of active transportation are detailed in the following sections. Where the benefits are quantifiable, monetary amounts are calculated for the current mode shares in Canada. Reasonable target mode shares for Canada would be 4.8% for cycling and 10.4% walking for a combined total of 15.2%. These mode shares correspond to the current mode shares for Victoria. The benefits of active transportation increase dramatically for this target level. Estimates of the benefits at the target levels have been provided for comparison. Note that the combined target share of 15.2% is in line with the U.S. nation goal of 15.8% of trips by active transportation.[31] It is less than one-third the current active transportation mode share of 46% in the Netherlands.

It is expected that walking and cycling trips to routine destinations are more direct than driving a car, and will likely replace longer automobile trips. Users of active transportation do not have to drive around looking for parking or drive extra distance to find it. Often there are shortcuts available to cyclists and pedestrians. In addition, cyclists and pedestrians are more likely to pick a closer destination if comparable options exist. For example, when people are walking or cycling, they are likely to shop at a store that is close to where they live rather than driving across town. There is a lack of research on how much longer if any, the replaced trips are.

For the purposes of estimating the benefits, it will be assumed that a walking trip replaces a driving trip of 1 km and a cycling trip replaces an automobile trip of 3.2 km.[32] These distances do not assume that the active transportation trips are replacing longer motor vehicle trips, thus the estimates of the benefits are likely conservative.

For many of the categories, the benefits differ for peak-urban, non-peak urban or rural trips. The weighted average was calculated on the assumption that 60% of trips are urban with 33% of those occurring during peak hours.[33]

Most of the benefits are based on active transportation trips replacing driving trips. Thus, for the purposes of calculating the benefits per year in Canada, only trips made by people of driving age (16 years old) will be considered. Approximately 24 million Canadians are of driving age.[34] They make approximately three trips per day.[35] Thus, around 26 billion passenger trips are made per year in Canada. The calculations of benefits are based on the 26 billion total trips and the mode shares for cycling and walking from the 2001 Census.

4.1. TRANSPORTATION BENEFITS

Reduction of congestion, decreased road maintenance costs, less costly infrastructure, increased road safety and decreased user costs are the main transportation- related economic benefits of increased use of active transportation.

4.1.1. Congestion Reduction

On congested urban roads, each additional motor vehicle trip increases the delay experienced by other vehicles on the road. There is a significant economic cost when people and goods are delayed in traffic. Traffic congestion increases travel time, vehicle-operating costs, stress and air pollution.[36]

Congestion costs in Ontario were estimated to be $6.4 billion annually in 2001.[37] Without increased investment in alternatives, the time that is required for an average commute in the Greater Toronto Area could grow 50 percent by

[31] U.S. Department of Transportation, *Bicycling and Walking Can Be Feasible Transportation Choices:Making More Modes*, (http://www.tfhrc.gov/pubrds/fall94/p94au28.htm), 1994.
[32] U.S. Department of Transportation, *Bicycling and Walking in the United States Today*, (http://safety.fhwa.dot.gov/pedbike/univcourse/swless02.htm), 1995.
[33] T. Litman, *Transportation Cost and Benefit Analysis – Congestion Cost,* (http://www.vtpi.org/tca/tca0505.pdf), 2003, p 5.5-13.
[34] Statistics Canada, *Population by sex and age group*, (http://www.statcan.ca/english/Pgdb/demo10a.htm), 2003.
[35] NFO Cfgroup Inc., *Regional Travel Survey, July 2000*, (http://www.translink.bc.ca/files/polls_surveys/regtravel.pdf), TransLink, 2003, p 23.
[36] D. Schrank and T. Lomax, Mobility Study-1982 to 1996, (http://mobility.tamu.edu/ums/), Texas Transportation Institute, 1998.
[37] Go for Green, *Active Transportation Community Solutions for Climate Change, Health And Transportation*, (http://www.goforgreen.ca/active_transportation/pdf/Finance%20Brief%20-%20Final.pdf), 2002, p 12.

2021, adding an additional $7 billion per year to congestion costs.[38] Roadway congestion in Greater Montreal was found to cost users more than $500 million annually", according to KPMG Consulting LP.[39] The total congestion costs borne by the goods movement industries in Toronto, Montreal, Ottawa and Greater Vancouver is estimated to be in excess of $3 billion per year.[40]

Walking causes little or no congestion. Cycling only causes significant congestion on higher speed roads with narrow lanes that do not allow motor traffic to easily pass the cyclist. Since such roads do not provide a safe or pleasant cycling experience cyclists tend to avoid such roads. In general, cycling causes little congestion, thus it can be assumed that switching a trip from motor vehicle to bicycle will significantly reduce congestion. No congestion is assumed in rural areas. [41]

Only the external costs of congestion are included in this section. Congestion costs borne by the individual are counted under travel time and vehicle operating costs.

Table 8: Benefits of Congestion Reduction

	Urban Peak	Urban Non-Peak	Rural	**Weighted Average[42]**
Per km[43]	$0.152	$0.015	0	**$0.036**
Walking Trip (1 km)	$0.152	$0.015	0	**$0.036**
Cycling Trip (3.2 km)	$0.487	$0.048	0	**$0.115**

Table 9: Benefits of Congestion Reduction per Year

	Mode Share	**Trips**	**Total Distance**	**Benefit[44]**
Current				
Walk	6.6%	1,716,000,000	1,716,000,000 km	**$61,776,000**
Bike	1.2%	312,000,000	998,400,000 km	**$35,880,000**
Total	7.8%	2,028,000,000	2,714,400,000 km	**$97,656,000**
Canada Same as Victoria[45]				
Walk	10.4%	2,704,000,000	2,704,000,000 km	**$97,344,000**
Bike	4.8%	1,248,000,000	3,993,600,000 km	**$143,520,000**
Total	15.2%	3,952,000,000	6,697,600,000 km	**$240,864,000**

4.1.2. Roadway Cost Savings

Roadway costs include the public expenditures of adding new road capacity, maintaining roads and safety enhancements to roads. This does not include costs that are paid for by road users through tolls or gas taxes. Most local roads are paid for through property taxes and development charges and are not paid for directly by the users of

[38] McCormick Rankin Corporation with Metropolitan Knowledge International for the Ontario Ministry of Transportation, *Central Ontario Highway Transportation Perspective*, 2002.
[39] KPMG Consulting LP, *Comparative Study of Socio-Economic Factors Related to Concrete and Asphalt Highway Surfaces*, Cement Association of Canada, 2000.
[40] Canadian Urban Transit Association, *Transit Means Business:The Economic Case for Public Transit in Canada*, (http://www.cutaactu.ca/pdf/issue5.pdf), 2003.
[41] T. Litman, *Quantifying the Benefits of Non-Motorized Travel for Achieving TDM Objectives*, (http://www.vtpi.org/nmt-tdm.pdf), Victoria Transport Policy Institute, 1999, p 2.
[42] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)
[43] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 2.
[44] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[45] The benefits if all of Canada had the same mode share as Victoria

the road. Maintenance costs vary with the size, weight and the speed of vehicle. Studded tires also increase maintenance costs.

A shift to active transportation will lead to lower roadway costs. Bicycles are very light vehicles that take up little space thus their roadway costs are negligible. Sidewalks used by pedestrians are needed for basic mobility. Sidewalks are used by everyone including drivers when they access their vehicles so including the cost of the sidewalk as a cost of walking is not appropriate.[46]

A roadway can carry 7 to 12 times as many people per metre of lane per hour by bicycle compared to by automobile at similar speeds in urban areas. Even when compared to higher-speed motorways, bicycles are twice as efficient as cars, based on the number of commuters that can be accommodated per hour for each metre width of roadway. Paths for pedestrians are even more efficient, handling 20 times the volume per hour than roads for cars in mixed traffic.[47]

Active transportation improves the efficiency of the transportation system. Congestion can be reduced by providing paved shoulders for cyclists at a cost of $50,000 to $100,000 per kilometre or paved pathways at a cost of $250,000 per kilometre[48] rather than by widening a two lane urban arterial road to four car lanes which costs approximately $1.3 million per kilometre.[49]

A relatively small portion of the transportation budget can facilitate high levels of bicycle use. In the Netherlands, only 6% of the money spent on road infrastructure is spent on bicycle facilities, yet the bicycle has a 27% share of all journeys and a 9% share of all kilometres travelled.[50] In Freiburg, Germany, just 1% of the transportation budget is devoted to cycling yet the mode share for cycling is 19%.[51]

Table 10: Benefits of Roadway Cost Savings

	Urban Peak	Urban Non-Peak	Rural	**Weighted Average[52]**
Per km[53]	$0.038	$0.019	$0.019	$0.023
Walk Trip (1km)	$0.038	$0.019	$0.019	$0.023
Bicycle Trip (3.2km)	$0.122	$0.061	$0.061	$0.073

[46] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 2.
[47] Go for Green, *Active Transportation Community Solutions for Climate Change*, p 12.
[48] Ministry of Transportation Ontario, 1992.
[49] T. Litman, *Public Transit Benefits in the Victoria Region*, BC Transit, 1996.
[50] Min. Verkeer en Waterstaat, Den Haag, *Feiten over het fietsen in Nederland (Facts about cycling in the Netherlands)*, 1993.
[51] T. Bracher, IVU Berlijn, *A least cost approach to transportation planning*, paper for World Conference on Transport Research WCTRs, Antwerp, 1998
[52] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)
[53] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 3.

Table 11: Benefits of Roadway Cost Savings per Year

	Mode Share	Trips	Total Distance	Benefit[54]
Current				
Walk	6.6%	1,716,000,000	1,716,000,000 km	**$39,468,000**
Bike	1.2%	312,000,000	998,400,000 km	**$22,776,000**
Total	7.8%	2,028,000,000	2,714,400,000 km	**$62,244,000**
Canada Same as Victoria[55]				
Walk	10.4%	2,704,000,000	2,704,000,000 km	**$62,192,000**
Bike	4.8%	1,248,000,000	3,993,600,000 km	**$91,104,000**
Total	15.2%	3,952,000,000	6,697,600,000 km	**$153,296,000**

4.1.3. Road Safety Savings

The economic costs of collisions include medical expenses, lost productivity, vehicle and property damage, pain and suffering, and loss of life.[56] In Canada, these costs were estimated to be $10.5 billion in 1998.[57]
A significant portion of these costs are not accounted for in the user cost of driving and will be accounted for here regardless of whether they are borne by those responsible for the collision, other road users or society at large.

Cyclists and pedestrians are far less likely to injure other road users in collisions. Thus a shift to active transportation will reduce the costs associated with collisions. While the risk to individuals switching to active transportation likely will increase somewhat, this risk can be decreased through education and the construction of safer facilities. As well, there is strong evidence to suggest that an increase in the number of cyclists on a road decreases the risk of cycling. If the number of cyclists doubles, the number of fatalities only increases by 25% thus reducing the risk of cycling by 37%.[58] It is likely that this is due to the increased expectation of drivers that there will be cyclists around, thus increasing the likelihood that they will drive in a manner that is less likely to injure cyclists. Put another way, while a switch to cycling may increase the risk to the individual, it will decrease the risk to all other cyclists and road users.

Table 12: Benefits of Road Safety Savings

	Urban Peak	Urban Non-Peak	Rural	Weighted Average[59]
Per km[60]	$0.057	$0.046	$0.038	**$0.045**
Walk Trip (1 km)	$0.057	$0.046	$0.038	**$0.045**
Bicycle Trip (3.2 km)	$0.183	$0.146	$0.122	**$0.144**

[54] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[55] The benefits if all of Canada had the same mode share as Victoria
[56] Transport Canada, *The State of Road Safety in Canada in 1998*, (http://www.ccmta.ca/english/pdf/roadsafety.pdf), 2000.
[57] Ibid. p 4.
[58] L. Leden, P. Gårder, U. Pulkkinen, "An expert judgement model applied to estimating the safety effect of a bicycle facility". *Accident Analysis and Prevention,* 2000, 32:589-99.
[59] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)
[60] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 5.

Table 13: Benefits of Road Safety Savings per Year

	Mode Share	Trips	Total Distance	Benefit[61]
Current				
Walk	6.6%	1,716,000,000	1,716,000,000 km	**$77,220,000**
Bike	1.2%	312,000,000	998,400,000 km	**$44,928,000**
Total	7.8%	2,028,000,000	2,714,400,000 km	**$122,148,000**
Canada Same as Victoria[62]				
Walk	10.4%	2,704,000,000	2,704,000,000 km	**$121,680,000**
Bike	4.8%	1,248,000,000	3,993,600,000 km	**$179,712,000**
Total	15.2%	3,952,000,000	6,697,600,000 km	**$301,392,000**

4.1.4. User Savings

Active transportation is very inexpensive for the user. The cost of walking is minimal. Bicycles are inexpensive to own and operate. People who own a bicycle and an automobile will save a significant amount in operating costs when they use the bicycle instead of the automobile. When increased use of active transportation enables a household to own fewer automobiles, the savings are even more substantial.

For some trips, the travel time is less with a bicycle than an automobile. For many trips however, walking and bicycling are slower. Since many people enjoy walking and cycling and the physical activity involved, the additional travel time should not be considered a cost as long as it is a voluntary choice. [63] Many people also choose to structure their lives so that they live within a short cycling or walking distance of work and shopping, thus eliminating the need for long automobile trips.

Automobiles are very expensive to operate. Direct user costs include depreciation, interest charges, insurance, repairs, fuel, pay parking and routine maintenance. The Canadian Automobile Association estimates the cost of owning and operating a car at $9,525 a year.[64]

Estimated Benefits of User Savings

It costs an average of $0.14 per kilometre to operate an automobile.[65] Stop-and-go driving during urban peak periods can increase the cost by 50%. The short trips replaced by active transportation are twice the cost due to the greater maintenance and fuel costs of cold starts. The cost of active transportation is estimated to be $0.01 per kilometre. [66]

Table 14: User Savings

	Urban Peak[67]	Urban Non-Peak[68]	Rural[69]	**Weighted Average[70]**
Per km	$0.410	$0.270	$0.270	$0.298
Walk Trip (1km)	$0.410	$0.270	$0.270	$0.298
Bicycle Trip (3.2km)	$1.312	$0.864	$0.864	$0.953

[61] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[62] The benefits if all of Canada had the same mode share as Victoria
[63] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 3.
[64] Based based on the Cavalier Z24 driven 18,000 km per year. Canadian Automobile Association (CAA), *Driving Costs – 2003 Edition*, (http://www.caa.ca/e/automotive/pdf/driving-costs-03.pdf), 2003.
[65] A Cavalier Z24 costs $0.1375 per km and Caravan SE costs $0.01525 per km., CAA, *Driving Costs – 2003 Edition*.
[66] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 4.
[67] $0.14 per km, 50% more for stop and go, double for cold start, minus $0.01 per km cost of active transportation.
[68] $0.14 per km, double for cold start, minus $0.01 per km cost of active transportation.
[69] $0.14 per km, double for cold start, minus $0.01 per km cost of active transportation..
[70] Assuming 60% of trips are urban with 33% of those occurring during peak hours.

Table 15: User Savings per Year in Canada

	Mode Share	Trips	Total Distance	Benefit[71]
Current				
Walk	6.6%	1,716,000,000	1,716,000,000 km	**$511,368,000**
Bike	1.2%	312,000,000	998,400,000 km	**$297,336,000**
Total	7.8%	2,028,000,000	2,714,400,000 km	**$808,704,000**
Canada Same as Victoria[72]				
Walk	10.4%	2,704,000,000	2,704,000,000 km	**$805,792,000**
Bike	4.8%	1,248,000,000	3,993,600,000 km	**$1,189,344,000**
Total	15.2%	3,952,000,000	6,697,600,000 km	**$1,995,136,000**

4.1.5. Parking Cost Reduction

When car use is reduced, fewer parking spaces are needed. Bicycle parking facilities reduce the chance of theft and vandalism and thus serve to stimulate bicycle use. Indoor secure bicycle parking in workplaces will provide additional security and is a good way of encouraging employees to bicycle to work. The cost of constructing a parking space for a bicycle is approximately 5% of the cost of a parking space for an automobile. This applies both when a parking bay on a street is compared to a space in an outdoor bicycle and when a space in an indoor bicycle storage area is compared to a stall in an underground parking or a parkade.[73] The cost of building parking underground or in a parkade is between $16,000 and $20,000 per stall. The cost of surface parking lots is around $3,000 per stall.[74]

Parking is a significant cost of automobile use. This cost includes land, construction and operating costs of parking facilities. Free parking is provided to an estimated 80% of commuters and an even larger portion of shoppers.[75] This represents a major subsidy of driving that results in higher taxes and retail prices and lower wages and benefits.[76] The cost of parking in an urban facility ranges from $60 to $200 per month, or about $3.00 to $10.00 per day in Vancouver.[77] In Toronto, parking averages $200 per month or $10 per day.[78] Bicycle parking costs much less as up to 20 bicycles can be stored in the space required for one automobile. No parking is required for pedestrians.

Table 16: Benefits of Reduction of Parking Costs

	Urban Peak	Urban Non-Peak	Rural	Weighted Average[79]
Walking Trip[80]	$2.285	$0.381	$0.076	**$0.636**
Cycling Trip[81]	$2.171	$0.362	$0.072	**$0.604**

[71] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[72] The benefits if all of Canada had the same mode share as Victoria
[73] Parkeercatalogus Amsterdam (Parking catalogue Amsterdam), *Een leidraad over gebouwde parkeervoorzieningen in de vooroorlogse stadswijken*, gem. Amsterdam 1998.
[74] The City of Regina, *The Future of Housing in Regina – Laying the Groundwork*, (http://www.cityregina.com/pdfs/housing_report/downtown_housing.pdf), 2000, p 84.
[75] Donald Shoup, "Cashing Out Free Parking," *Journal of American Planning Association*, June 1994.
[76] T. Litman, *Transportation Cost and Benefit Analysis – Parking*, (http://www.vtpi.org/tca/tca0504.pdf), 2003.
[77] Better Environmentally Sound Transportation , *Parking Management:Making Your Trip Reduction Program More Effective,* (http://www.carpool.ca/pdf/Parking_Management.pdf), 2002, p3.
[78] Toronto Transit Commission, *Save $3,900 a year by taking the TTC instead of your car!*, (http://www.toronto.ca/ttc/ttc_vs_car/ttc_vs_car.htm), 2004.
[79] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)
[80] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 3.
[81] Bicycle parking requires 1/20 of the parking space of an automobile so assume the cost is 1/20 of that of an automobile thus subtract 1/20 from the per trip benefit.

Table 17: Benefits of Reduction of Parking Costs per Year

	Mode Share	Trips	Benefit[82]
Current			
Walk	6.6%	1,716,000,000	**$1,091,376,000**
Bike	1.2%	312,000,000	**$188,448,000**
Total	7.8%	2,028,000,000	**$1,279,824,000**
Canada Same as Victoria[83]			
Walk	10.4%	2,704,000,000	**$1,719,744,000**
Bike	4.8%	1,248,000,000	**$753,792,000**
Total	15.2%	3,952,000,000	**$2,473,536,000**

4.2. ENVIRONMENTAL BENEFITS

In Canada, the environmental cost of motor vehicle use is estimated at $14-36 billion per year.[84] These costs include the damage to the environment and to people's health caused by air pollution, greenhouse gas emissions and noise.

4.2.1. Greenhouse Gas Emissions Reductions

Road transport accounts for roughly 70% of transportation greenhouse gas (GHG) emissions, with 45% from cars and light-duty trucks. On-road, vehicular use of gasoline, the largest source of transportation emissions, is expected to increase by 44% between 1990 and 2020.[85] Urban car/light truck travel accounted for 47,882 megatonnes of GHG emissions, 58% of the passenger transport emissions[86] in 1997. These urban car/light truck CO_2 emissions average 215 grams per passenger kilometre[87].

Nitrous oxide (N_20) is a potent greenhouse gas with 310 times more global warming potential than carbon dioxide.[88] Nitrous oxide emissions are approximately 36 mg per vehicle mile[89]. This converts to a carbon dioxide equivalent of 4 grams per passenger kilometre. Thus the total CO_2 equivalent emissions per passenger kilometre are 219 grams.

The use of active transportation causes no significant net GHG emissions. Switching to active transportation from motorized vehicles will reduce GHG emissions.

At an active transportation mode share of 15.2%, an equivalent of 3.3 million tonnes of CO_2 are not emitted into the atmosphere. If these figures are applied to current commuters, it means that for each commuter who switches from personal automobile travel to active modes of transportation, a reduction of 0.64 tonnes per active commuter is achieved annually, - the equivalent of nearly two-thirds of the goal set under the 'One tonne challenge'.

[82] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[83] The benefits if all of Canada had the same mode share as Victoria
[84] Transport Canada, *1997 Sustainable Development Strategy*, (http://www.tc.gc.ca/programs/Environment/SD/strategy97/challenges7.htm), 1997.
[85] *Ibid.*
[86] Adapted by Transport Canada. Natural Resources Canada, *Economic Analysis Directorate from unpublished update of Canada's Energy Outlook: 1996 – 2020*, July 1999.
[87] Ibid.
[88] Environment Canada, *Curbing the Effect of Waste on Climate*, (http://www.ec.gc.ca/science/sandenov02/article1_e.html), 2002.
[89] Eduardo Behrentz, *Measurements Of Nitrous Oxide Emissions from Light-Duty Motor Vehicles: Analysis of Important Variables and Implications for California's Greenhouse Gas Emission Inventory*, (http://www.bol.ucla.edu/~ebehrent/N2O.pdf), University of California, May 2003, p 2.

Table 18: Expected Benefits of GHG Reductions

Estimates on the cost of CO_2 emissions reductions range from $10 to $50 per tonne. The majority of experts predict a price close to $10.[90]

Table 18: Benefit of GHG Reductions at $10 per Tonne	Urban Peak	Urban Non-Peak	Rural	**Weighted Average[91]**
Per km	$0.007	$0.004	$0.004	$0.005
Walk Trip (1km)	$0.007	$0.004	$0.004	$0.005
Bicycle Trip (3.2km)	$0.021	$0.014	$0.014	$0.015

Table 19: Benefit of GHG Reductions at $50 per Tonne

	Urban Peak	Urban Non-Peak	Rural	**Weighted Average[92]**
Per km	$0.035	$0.020	$0.020	$0.025
Walk Trip (1km)	$0.035	$0.020	$0.020	$0.025
Bicycle Trip (3.2km)	$0.105	$0.070	$0.070	$0.075

Table 20: Benefit of GHG Reductions Per Year in Canada

	Mode Share	**Tonnes of CO_2**	**Benefit at $10/tonne**	**Benefit at $50/tonne**
Current				
Walk	6.6%	858,000	**$8,580,000**	**$42,900,000**
Bike	1.2%	468,000	**$4,680,000**	**$23,400,000**
Total	7.8%	1,326,000	**$13,260,000**	**$66,300,000**
Canada Same as Victoria[93]				
Walk	10.4%	1,352,000	**$13,520,000**	**$67,600,000**
Bike	4.8%	1,872,000	**$18,720,000**	**$93,600,000**
Total	15.2%	3,224,000	**$32,240,000**	**$161,200,000**

4.2.2. Air Pollution Reduction

Motor vehicles produce an array of pollutants that have a serious impact on human health and the environment. These include:[94]

Nitrogen oxides (NO_x). Motor vehicles are the major source of this group of toxic gases, which can destroy lung tissue, leading to emphysema, and increase susceptibility to other respiratory disease. As well as being greenhouse gases, nitrogen oxides are a precursor of ground level ozone, the major component of smog. In addition to impairing human health, ground-level ozone can damage crops and forests and can be transported hundreds of kilometres by wind currents. Nitrogen oxides are also a major contributor to acid rain, which acidifies soils and inland water and damages entire ecosystems.

[90] Government of Canada, *Climate Change Plan for Canada* , (http://www.climatechange.gc.ca/plan_for_canada/plan/pdf/full_version.pdf), 2002, p 58.
[91] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)
[92] Ibid.
[93] The benefits if all of Canada had the same mode share as Victoria
[94] G. Simmons, *Canadian regulation of air pollution from motor vehicles*, (http://www.sierralegal.org/reports/air_report.pdf), Greenpeace and the Sierra Legal Defence Fund, January 2002, p 9.

Carbon monoxide (CO) inhibits the blood's ability to carry oxygen to the organs. In urban areas, the contribution of motor vehicles to CO levels may exceed 90%.

Sulphur dioxide (SO_2). The presence of sulphur in diesel and gasoline results in the formation of SO_2 upon combustion, exposure to which can cause respiratory problems. As with NO_x and ozone, effects are most severely felt by those with pre-existing respiratory problems such as asthma. SO_2 emissions also produce acid rain.

Particulate matter (PM). There is mounting evidence of the serious health impacts of unburned carbon particles emitted from tailpipes as a result of incomplete combustion. Fine particles, known as PM2.5, are inhaled deep into the lungs and up to half of the particles breathed into the lungs are not breathed out again. The result can be degenerative lung disease, asthma, pneumonia, weakening of the immune system or premature mortality. As is often the case with air pollution, those most affected are children, the elderly and people already suffering from lung and heart conditions.

Other Air Pollutants

Other hazardous air pollutants include a range of pollutants, many of which originate from motor vehicles. These include polycyclic aromatic hydrocarbons, linked to cancer, growth retardation, and skin and eye disorders, and benzene, a known carcinogen.

A study exploring geographic differences in medical care use and air pollution using millions of Medicare records from 183 metropolitan areas in the U.S. showed that air pollution significantly increases the use of medical care among older adults - even after controlling for other demographic and geographic factors including income, cigarette consumption, and obesity.[95] The study found that, on average, hospital admissions for respiratory problems were 19% higher, outpatient care was 18% higher, and total hospital admissions were 10% higher for elderly people in the 37 areas with the highest pollution compared with the 37 areas with the least pollution. They found that this pollution leads to significantly higher health care costs.

While the exact causes are subject to further study, there is strong evidence that air pollution exacerbates heart disease.[96]

Estimated Benefits of Reducing Air Pollution

Walking and bicycling produces virtually no air pollution. Per kilometre air pollution reductions are large because bicycling usually replaces short, cold start trips for which internal combustion engines have high emission rates, so each 1% of automobile travel replaced by active transportation decreases motor vehicle air pollution emissions by 2% to 4%.[97]

Table 21: Benefits of Reduction in Air Pollution

	Urban Peak	Urban Non-Peak	Rural	**Weighted Average[98]**
Per km[99]	$0.090	$0.070	$0.010	$0.052
Walk Trip (1km)	$0.090	$0.076	$0.010	$0.052
Bicycle Trip (3.2km)	$0.284	$0.230	$0.047	$0.167

[95] V. R. Fuchs and S. R. Frank, "Air Pollution and Medical Care Use by Older Americans: A Cross Area Analysis," *Health Affairs*, Vol. 21, No. 6 (www.healthaffairs.org), November/December, 2002, pp. 207-214.

[96] Health Canada, *Health and Air Quality – Heart and Lung Diseases*, (http://www.hc-sc.gc.ca/hecs-sesc/air_quality/heart_lung.htm), 2001.

[97] Charles Komanoff and Cora Roelofs, *The Environmental Benefits of Bicycling and Walking, National Bicycling and Walking Study Case Study No. 15*, U.S. Department of Transportation, January 1993, FHWA-PD-93-015.

[98] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)

[99] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 4.

Table 22: Benefits of Reduction in Air Pollution per Year in Canada

	Mode Share	Trips	Total Distance	Benefit[100]
Current				
Walk	6.6%	1,716,000,000	1,716,000,000 km	**$89,232,000**
Bike	1.2%	312,000,000	998,400,000 km	**$52,104,000**
Total	7.8%	2,028,000,000	2,714,400,000 km	**$141,336,000**
Canada Same as Victoria[101]				
Walk	10.4%	2,704,000,000	2,704,000,000 km	**$140,608,000**
Bike	4.8%	1,248,000,000	3,993,600,000 km	**$208,416,000**
Total	15.2%	3,952,000,000	6,697,600,000 km	**$349,024,000**

4.2.3. Noise Reduction

Noise refers to unwanted sounds and vibrations. Motor vehicles cause various types of noise, including engine acceleration, tire/road contact, braking, horns and vehicle theft alarms.[102] Vehicle noise imposes disturbance and discomfort. Noise costs vary depending on location and type of vehicle[103] and are greatest on residential streets, where a change in traffic volumes of just a few hundred vehicles per day can significantly affect property values.[104] Non-motorized travel tends to replace driving on such noise-sensitive, residential streets, and peak-period trips occur during early morning when noise sensitivity is high.

Table 23: Benefits of Reduction in Noise

	Urban Peak	Urban Non-Peak	Rural	Weighted Average[105]
Per km[106]	$0.038	$0.019	$0.008	$0.018
Walk Trip (1km)	$0.038	$0.019	$0.008	$0.018
Bicycle Trip (3.2km)	$0.122	$0.061	$0.024	$0.058

Table 24: Benefits of Reduction in Noise per Year in Canada

	Mode Share	Trips	Total Distance(km)	Benefit[107]
Current				
Walk	6.6%	1,716,000,000	1,716,000,000	**$30,888,000**
Bike	1.2%	312,000,000	998,400,000	**$18,096,000**
Total	7.8%	2,028,000,000	2,714,400,000	**$48,984,000**
Canada Same as Victoria[108]				
Walk	10.4%	2,704,000,000	2,704,000,000 km	**$48,672,000**
Bike	4.8%	1,248,000,000	3,993,600,000 km	**$72,384,000**
Total	15.2%	3,952,000,000	6,697,600,000 km	**$121,056,000**

[100] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[101] The benefits if all of Canada had the same mode share as Victoria
[102] Office of Policy and Planning, *Indicators of the Environmental Impacts of Transportation*, US Environmental Protection Agency, Washington DC, (www.itre.ncsu.edu/cte), 1999.
[103] K. Sæ lensminde, *Environmental Costs Caused by Road Traffic in Urban Areas, Institute for Transport Economics*, Oslo, 1992; P. Bein, *Monetization of Environmental Impacts of Roads*, B.C. Ministry of Transportation and Highways, (http://www.geocities.com/davefergus/Transportation/0ExecutiveSummary.htm), Victoria BC, 1997.
[104] Gordon Bagby, "The Effects of Traffic Flow on Residential Property Values," *Journal of the American Planning Association*, January 1980, pp. 88-94.
[105] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)
[106] T. Litman, *Quantifying the Benefits of Non-Motorized Travel*, p 4.
[107] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[108] The benefits if all of Canada had the same mode share as Victoria

4.2.4. Water Quality

Motor vehicles, roads and parking facilities are a major source of water pollution and hydrologic disruptions.[109]

Water pollution sources include:

- Crankcase oil drips and disposal.
- Road de-icing (salt) damage.
- Roadside herbicides used to clear vegetation.
- Leaking underground fuel storage tanks.
- Air pollution settlement.

Hydrologic impacts include:

- Increased impervious surfaces due to paving of roads and parking lots.
- Concentrated runoff, increased flooding due to impervious surfaces.
- Loss of wetlands due to road and parking lot expansion.
- Shoreline modifications.
- Road construction activities along shorelines.

Table 25: Benefits of Reduction in Water Pollution

	Urban Peak	Urban Non-Peak	Rural	**Weighted Average[110]**
Per km[111]	$0.02	$0.02	$0.02	$0.02
Walk Trip (1km)	$0.02	$0.02	$0.02	$0.02
Bicycle Trip (3.2km)	$0.064	$0.064	$0.064	$0.064

Table 26: Benefits of Reduction in Water Pollution per Year

	Mode Share	**Trips**	**Total Distance**	**Benefit[112]**
Current				
Walk	6.6%	1,716,000,000	1,716,000,000 km	**$34,320,000**
Bike	1.2%	312,000,000	998,400,000 km	**$19,968,000**
Total	7.8%	2,028,000,000	2,714,400,000 km	**$54,288,000**
Canada Same as Victoria[113]				
Walk	10.4%	2,704,000,000	2,704,000,000 km	**$54,080,000**
Bike	4.8%	1,248,000,000	3,993,600,000 km	**$79,872,000**
Total	15.2%	3,952,000,000	6,697,600,000 km	**$133,952,000**

4.2.5. Land Use

Automobile dependant communities require more land for roads and parking than communities that are not as reliant on the automobile. Increased use of active transportation can reduce the use of the automobile, freeing land for other uses or preventing increased amounts of land from being dedicated for roads and parking.

Benefits include:

- More greenspace and parks
- More wildlife habitat
- Less fragmentation of habitat

[109] T. Litman, *Transportation Cost and Benefit Analysis – Water Pollution*, (http://www.vtpi.org/tca/tca0515.pdf), 1996, p 5.15-1.

[110] Assuming 60% of trips are urban with 33% of those occurring during peak hours. (T. Litman 1999)
[111] T. Litman, *Transportation Cost and Benefit Analysis – Water Pollution*, p 5.15-7.
[112] The benefits are calculated using the weighted average of the benefits per trip. The weighted average has been rounded to three significant digits. The yearly benefit below has been calculated using the non-rounded average.
[113] The benefits if all of Canada had the same mode share as Victoria

- More wetlands
- More land available for residential and commercial development

4.3. SOCIAL BENEFITS

Current available analysis of social benefits intertwines transportation mode choice with land use and development patterns. Certainly increases in cycling and walking due to improvements to active transportation facilities will have an impact but in addition, major redevelopment of these communities to make them more compact and walking-friendly is required. Thus no attempt will be made to quantify the social benefits of active transportation.

4.3.1. Increased Mobility

Not all members of society have full-time access to a motor vehicle. In communities where there is poor accommodation of other forms of transportation, these people will likely have reduced access to employment, social opportunities, shopping and other services.[114] Especially in areas with limited transit service, active transportation can provide such people with increased mobility and thus an improved quality of life.

4.3.2. Increased Sense of Community

Walking and cycling allow much more personal interaction between people than driving. People who are walking and cycling are more likely to meet and converse with each other. This interaction can lead to a stronger sense of community.[115]

4.3.3. Barrier Effect Reduction

The barrier effect or severance refers to delays and discomfort that vehicle traffic imposes on pedestrians and cyclists. Severance typically focuses on the impacts of new or wider highways, while the barrier effect takes into account the impacts of vehicle traffic. Discomforts include air pollution, noise and risk of collision. The barrier effect reduces the convenience and viability of active transportation.[116]

A person switching from driving to active transportation will reduce traffic and thus reduce the impact of the barrier effect on other people using active transportation.

4.3.4. Improved Liveability

Often people value living in or visiting a community where the use of active transportation is safe, pleasant and common. People also like living away from the noise and pollution of motorized traffic. As a result, improving active transportation facilities and reducing motorized traffic can help communities become more "liveable," thus increasing property values and retail activity.[117]

4.4. REGIONAL ECONOMIC IMPACTS

Local business activity and employment can be reduced by automobile use since vehicles, parts and fuel are often imported from outside the region. In regions where the automotive or petroleum industries have a significant presence, this reduction will be less to the extent that locally produced goods are consumed locally. The table below shows the regional income and jobs created by automotive and non-automotive consumer expenditures. Automobile expenditures generate far less regional income than general consumer expenditures. This indicates that money saved

[114] T. Litman, *Transportation Cost and Benefit Analysis – Transportation Diversity*, (http://www.vtpi.org/tca/tca0509.pdf), 2003, p 5.9-8.
[115] T. Litman, *Transportation Cost and Benefit Analysis – Land Use Impacts*, (http://www.vtpi.org/tca/tca0514.pdf), 2003, p 5.14-9.
[116] T. Litman, *Transportation Cost and Benefit Analysis – Barrier Effect*, (http://www.vtpi.org/tca/tca0513.pdf), 1996.
[117] T. Litman, Transportation Cost and Benefit Analysis – Transportation Diversity, (http://www.vtpi.org/tca/tca0509.pdf), 2003, p 5.9-1

by replacing motor vehicle trips with active transportation and thus spent on other consumer items, tends to provide net regional economic development benefits including increased local business activity and employment.

Estimated Regional Economic Benefits
The table below shows that non-automotive expenditures have a regional economic impact that is $219,000 per million dollars or $0.219 per dollar greater than automobile expenditures. In 1999, transportation accounted for 13% of household spending amounting to $6,880 per year.[118]

Table 27: Regional Economic Impacts of $1 Million Expenditure[119]

Expenditure Category	Regional Income	Regional Jobs
Automobile Expenditures	$307,000	8.4
Non-automotive Consumer Expenditures	$526,000	17
Benefit of Active Transportation	**$219,000**	**8.6**

Since Canada has significant automotive and petroleum industries and due to the regional nature of this benefit, it likely would not be valid to calculate a Canada-wide benefit from this regional benefit. For emphasis, the benefits for a region of 100,000 households with total transportation expenditures of $688 million are shown in the table below. It is assumed that impacts for a region in Canada are similar to the county in Texas that was the subject of the research.

Table 28: Increased Regional Economic Impacts a Year per 100,000 households

	Mode Share	Benefit	Jobs
Current			
Walk	6.6%	$9,944,352	391
Bike	1.2%	$1,808,064	71
Total	**7.8%**	**$11,752,416**	**462**
Target[120]			
Walk	10.4%	$15,669,888	615
Bike	4.8%	$7,232,256	284
Total	**15.2%**	**$22,902,144**	**899**

4.5. INDUSTRY

4.5.1. Bicycle Sales

In 2002 Canadian households spent an average of $42 on bicycles, parts and accessories for a total of $495,600,000[121].

In 2000, the Québec cycling industry had sales totalling over $181 million and sustained over 2,800 jobs (person years), generating revenues of $17.2 million for the Government of Québec and $13.6 million for the Government of Canada.[122]

[118] Statistics Canada, *The Daily*. (http://www.statcan.ca/Daily/English/001212/d001212a.htm), December 12, 2000.
[119] J. Miller, H. Robison and M. Lahr, *Estimating Important Transportation-Related Regional Economic Relationships in Bexar County, Texas*, (http://www.vtpi.org/modeshft.pdf), VIA Metropolitan Transit (San Antonio), 1999.
[120] The benefits if all of Canada had the same mode share as Victoria
[121] Statistics Canada, *Table 203-0010 - Household spending on recreation, by province and territory, annual*, (http://cansim2.statcan.ca/cgiwin/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII___&Array_Pick=1&ArrayId=2030010), 2003.
[122] Vélo Québec, *Cyclists spend over $95 million CAD ($64.6 million USD) annually along the Route verte*, (http://www.velo.qc.ca/english/pressroom2.lasso?id=20030508171603), March 31, 2003.

Bicycle Manufacturing

Québec produces 86% of the bicycles made in Canada: of the 960,000 bicycles manufactured, 825,000 are made in Québec.[123]

4.6. WORKPLACE BENEFITS

Studies have shown that there are significant benefits to employers of having staff that are physically active. Employees who participate in physical activities report fewer days off due to illness (by 6-32%), lower turnover rates , lower healthcare costs (by 20-55%) and increased productivity (by 2-52%) than non-physically active employees[124].

There is an opportunity cost to participants of organized physical activity programs at work such as exercise classes. Such activities involve either the employer allowing the employee to take time off or the employee engaging in these activities during work breaks. Commuting by active transportation allows the employee to build physical activity into their daily routine. With people's many responsibilities and daily time commitments, using active transportation may indeed be the only way they can get the daily physical activity they require. Commuting by active transportation may prove to be more acceptable and more cost-efficient than programmes that focus on activities at the work site during the day.[125]

The majority of organizations that have tracked the results of physical activity programs or initiatives report that participating employees are pleased with the results. [126]

Employees report that physical activity improves:

- Personal productivity;
- Relaxation;
- Self-confidence;
- Job satisfaction;
- Morale;
- Stamina;
- Sleep;
- Enjoyment of work
- Reaction time;
- Mental alertness;
- Memory; and
- Mental concentration

The ability of a physically active executive group to make complex decisions increases dramatically compared to non-exercisers. Studies suggest that those who exercise work at full efficiency all day, amounting to a 12.5% increase in productivity over those who do not exercise.

Estimating the Workplace Benefits of Increased Physical Activity

In companies with employee physical activity initiatives, the improvements in productivity and reductions in absenteeism, turnover and injury can result in a benefit of $513 per worker per year.[127]

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[123] Ibid.
[124] World Health Organization, *Economic Benefits of Physical Activity*, (http://www.who.int/hpr/physactiv/economic.benefits.shtml), 2003.
[125] Shephard, "A critical analysis of work-site fitness programmes and their postulated economic benefits", *Medicine and Science in Sports and Exercise*, 24(3) , 1992.
[126] Health Canada, *The Business Case for Active Living*, (http://www.hc-sc.gc.ca/hppb/fitness/work/impact_e.html), 2004.
[127] World Health Organization, *Economic Benefits of Physical Activity*, 2003.

The total benefit per year possible if all 12.2 million[128] Canadian workers who commute were physically active is $6,258,600,000.[129] Each 1% increase in physical activity results in a benefit of $62,586,000.

People who use active transportation are also likely engage in other forms of physical activity.
It is estimated that an average of 41% of an individual's physical activity can be attributed to walking if they walk for transportation purposes. The estimate for cycling is 34%.[130]

Table 29: Workplace Benefits of Increased Physical Activity per 1% Mode Share

	Physical activity attributed to mode	Savings per 1%[131] mode share
Walk	41%	$26,286,120
Bicycle	34%	$21,279,240

Table 30: Workplace Benefits of Increased Physical Activity per Year in Canada

	Mode Share	Benefit
Current		
Walk	6.6%	$173,488,392
Bike	1.2%	$25,535,088
Total	**7.8%**	$199,023,480
Canada Same as Victoria[132]		
Walk	10.4%	$273,375,648
Bike	4.8%	$102,140,352
Total	**15.2%**	**$375,516,000**

4.7. HEALTH BENEFITS

Switching to active transportation from motorized transportation results in increased physical activity, reduced air pollution and increased road safety. Both the increase in physical activity and the reduction in air pollution will result in improved health for Canadians and thus reduce health care costs.

4.7.1. Air Quality

Air pollution can cause or exacerbate a variety of health problems including asthma, heart disease, emphysema, pneumonia and cancer. Switching from driving to active transportation reduces air pollution and its harmful effects.

The health benefits of reduced air pollution are detailed and quantified in the environmental benefits section *4.2.2*.

4.7.2. Physical Activity

Physical inactivity has been shown to contribute to a variety of serious health problems including heart disease, colon cancer and type 2 diabetes. Research has determined the maximum proportion of disease that can be attributed to physical inactivity and thus the proportion of the costs that could be assigned. These proportions are as follows:

- 35% for heart disease

[128] Statistics Canada, *2001 Census: analysis series - Where Canadians work and how they get there*, http://www12.statcan.ca/english/census01/products/analytic/companion/pow/pdf/96F0030XIE2001010.pdf, 2003.
[129] $513 per worker multiplied by 12.2 million workers.
[130] By dividing 100 by the total percentage of people engaged in the nineteen most popular forms of physical activity excluding the one we are trying to find, we can obtain an estimate of the amount of physical activity that can be attributed to a particular form of physical activity. This estimate assumes equal benefits for all forms of physical activity. These percentages are taken from the *National Population Health Survey*, Statistics Canada, 1998/1999.
[131] 41% percent of $40,527,000 for walking, 34% percent of $40,527,000 for cycling
[132] The benefits if all of Canada had the same mode share as Victoria

- 32% for colon cancer
- 35% for type 2 diabetes[133,134]

There is widespread acknowledgement in the health, environmental and transportation fields that focusing on active transportation has great potential to improve health and thus reduce direct and indirect health care costs.[135] Research is focusing on ways to enable people to incorporate physical activity into their lifestyles[136],[137]. The 1999 WHO Charter on Transport, Environment and Health emphasized the critical role of active transportation in improving health.[138]

Canadian research indicates that 2.5% of health care costs are attributable to physical inactivity.[139] In 2002, Canadians spent a total of about $112 billion or $3,572 per capita on health care.[140] Thus, in 2001 approximately $2.8 billion was spent on direct health care costs attributable to physical inactivity. A 10% increase in physical inactivity rates in Canadians could result in $280 billion dollar reduction in direct healthcare costs.

Walking is the most popular form of physical activity with 69% of Canadians reporting that they walk for exercise. Bicycling is the fifth most popular with 24% of Canadians reporting that they cycle.[141]

Canada's Physical Activity Guide recommends an accumulation of 60 minutes of physical activity each day, easily attainable through use of Active Transportation to routine destinations such as work, school, community meeting places and shopping.

Estimating the Health Benefits of Increased Physical Activity

People who use active transportation are also likely engage in other forms of physical activity, thus not all of the benefits of physical activity can be attributed to active transportation. It is estimated that an average of 41% of an individual's physical activity can be attributed to walking if they walk for transportation purposes. The estimate for cycling is 34%.[142] Each 1% increase in physical activity results in a savings of $28 million in direct health care costs.[143]

The health care savings benefit for each 1% of the population using active transportation is detailed in the following table.

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[133] Powell and Blair, "The public health burdens of sedentary living habits: theoretical but realistic estimates", *Medicine and Science in Sports and Exercise*, 1993, p 26

[134] Ruwaard and Kramers (eds), *Volksgezandheid Toekomst Verkenning,* 1993.

[135] British Medical Association, *Road transport and health* 1997.

[136] Oja, Vuori and Paronen, "Daily walking and cycling to work: their utility as health-enhancing physical activity", *Patient Education and Counselling*, 1998, p 33.

[137] Owen et al, "Environmental determinants of physical activity and sedentary behaviour", *Exercise and Sports Science Reviews*, 28(4), 2000.

[138] World Health Organization (WHO), *Charter on transport, environment and health,* (http://www.who.dk/document/peh-ehp/charter_transporte.pdf), 1999.

[139] Katzmarzyk, Gledhill and Shephard , "The economic burden of physical inactivity in Canada", *Canadian Medical Association Journal*, 2000, 163(11).

[140] Canadian Institute for Health Information (CIHI), *Health Care in Canada 2003*, (http://secure.cihi.ca/healthreport/AR43_2003highlight_e.html), 2003.

[141] Statistics Canada, *National Population Health Survey*, 1998/1999.

[142] By dividing 100 by the total the percentages of people engaged in the nineteen most popular forms of physical activity excluding the one we are trying to find, we can obtain an estimate of the amount of physical activity that can be attributed to a particular form of physical activity. This estimate assumes equal benefits for all forms of physical activity. These percentages are found in: *National Population Health Survey*, Statistics Canada, 1998/1999.

[143] The $2.8 billion in direct heath care costs divided by 100.

Table 31: Health Benefits of Increased Physical Activity

	Physical activity attributed to mode	Savings per 1%[144] mode share
Walk	41%	$11,760,000
Bicycle	34%	$9,520,000

Table 32: Health Benefits of Increased Physical Activity per Year in Canada

	Mode Share	Benefit
Current		
Walk	6.6%	**$67,032,000**
Bike	1.2%	**$14,112,000**
Total	7.8%	**$81,144,000**
Canada Same as Victoria[145]		
Walk	10.4%	**$122,304,000**
Bike	4.8%	**$56,448,000**
Total	15.2%	**$178,752,000**

4.8. TOURISM

Active transportation infrastructure, such as long-distance hiking and walking trails and bike lanes or paths in both urban and rural settings can act as tourist attractions and boost the local economy. Often such infrastructure can be used for both recreational and transportational purposes. Economic activity associated with tourism includes transportation, lodging, eating, retail and service businesses, which in turn lead to jobs, personal income and government tax revenues. [146] A variety of types of trails- urban trails, heritage trails, nature trails, and educational trails have proven to serve as tourist draws. [147] Several trends in the travel and tourism industry suggest that the economic benefits of tourism associated with active transportation infrastructure will continue to grow. In a tourism survey, 76.7% of respondents indicated use of walking trails.[148]

- There is a trend towards more pleasure-travel. By 1988, 75% of all travel was for pleasure.[149]
- Ecotourism or sustainable tourism continues to gain in popularity. This ecologically responsible form of tourism allows visitors to experience the natural environment and culture of an area while supporting the local economy and conservation efforts. According to the Travel Industry World Yearbook, ecotourism comprised 10-20% of all travel in 1992.[150]
- In recent years, more frequent, shorter weekend tourist trips have grown in popularity while extended two weeks vacations are becoming less common. As a result, features that increase the attractiveness of a community as a weekend tourist destination have a powerful potential to influence the local economy.[151]

[144] 41% of $28 million for walking, 34% of $28 million for cycling
[145] The benefits if all of Canada had the same mode share as Victoria
[146] National Park Service, *Economic Impacts of Protecting Rivers, Trails and Greenway Corridors,* (http://www.nps.gov/pwro/rtca/econ_index.htm), US National Park Service Rivers, Trails and Conservation Assistance, 1995.
[147] B. Lane, *Trails and Tourism: The Missing Link-Issues in Partnering with the Tourism Industry: A European Perspective*, (http://www.americantrails.org/resources/economics/TourismUKecon.html), Rural Tourism Unit, University of Bristol, UK and Journal of Sustainable Tourism, 1999.
[148] R. Dodds, *Urban Green Tourism - Ecotourism In The City: A Case Study of Toronto, Canada*, (http://www.world-tourism.org/sustainable/IYE/Regional_Activites/Brazil/cases/Dodds.htm), Green Tourism Association, August 2001.
[149] National Park Service, *Economic Impacts of Protecting Rivers, Trails and Greenway Corridors.*
[150] Ibid.
[151] Ibid.

4.8.1. Walking and Hiking Tourism

There are ample examples illustrating how tourist activity spurred by trails and greenways can be powerful contributors to the local economy. The biggest beneficiaries are eating and drinking establishments, retail and lodging[152]. Following is a list of some North American cases:

- In British Columbia, 12% of non-resident tourists and 9% of BC residents hiked or backpacked during their trip. [153]
- In 1994, visitors to the Overmountain Victory National Historic Trail in the eastern U.S., spent an average $49.05 US a day over 1.14 million visits. Average expenditures were as follows: Restaurants- $11.29 US, Food and Beverages- $2.69 US, Lodging $12.29 US, Retail Purchases- $7.35 US, All other purchases- $8.49 US[154],[155].
- The Bruce Trail in Ontario had an estimated 410,000 visitors in 1994, 70% of whom stated that the trail was their primary reason for being in the area. The average number of nights in the area was 3.8. There were about 417,000 nights spent in accommodation by trail-users. Seventy percent of users spent money on non-durable goods, mainly within 10 km of the trail resulting in a high local economic impact. Average expenditure per group was $60.99.[156]
- A study of nine Nova Scotian trails revealed that average spending per party per trip for non-Nova Scotians was $1,210, $1,120 of which was spent more than 30 minutes from the trail and $90 of which was spent within 30 minutes of the trail. Nova Scotian tourists spent $210 per party of which $80 was spent within 30 minutes of the trail.[157]
- The Riverwalk in San Antonio, Texas contributes $1.5 billion to the local economy and is considered the anchor of the tourism industry.[158]

4.8.2. Cycle tourism

Cycle tourism has proven to lead to significant economic activity as shown in the following cases:

- 30% of Ontario tourists cycled at least once on their trip. Touring cyclists spent at least $150 a day. Bicycle retail and tourism in Ontario are worth at least $150 million a year.[159]
- The annual expenditures specifically linked to La Route Verte rose to $95.4 million in 2000, representing 2,000 jobs and $15.1 million and $11.9 million for the governments of Quebec and Canada respectively. Most of the users of La Route Verte are sport cycle tourists (that is, tourists for whom cycling is the primary reason for being on La Route Verte, rather than some other tourist activity) who account for 57% of the expenditures.[160]
- In 2002, Québec hosted 190,000 bicycle tourists. They spent an average of $112 per day as opposed to other tourists who spend $52 per day. They stayed an average of 6.5 nights as opposed to other tourists who stayed 3.1 nights. [161]
- In British Columbia, 12% of non-residents tourists and 9% of BC residents cycled at least once during their trip. [162]
- In 1994, bicycle tour companies in Canada counted 28,000 cyclist trip days with an average expenditure of $116 per day per cyclist. The average trip lasted 5.6 days.

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[152] R. L Moore and K. Barthlow, *The economic impacts and uses of long distance trails: A case study of the Overmountain Victory National Historic Trail*, (http://ntl.bts.gov/lib/12000/12200/12275/12275.pdf), US Department of the Interior National Park Service, 1998.
[153] Tourism British Columbia, *B.C. Visitor Study*, (http://www.tourism.bc.ca/PDF/BC%20Visitor%20Study%20-%20Provincial%20Overview.pdf), 1998.
[154] Go for Green, *The Economic Benefits of Trails*, (http://www.trailpaq.com/documents/ACF415.pdf),
[155] R.L Moore and K. Barthlow, *The economic impacts and uses of long distance trails*.
[156] Go for Green, *The Economic Benefits of Trails*.
[157] Ibid.
[158] Regional Niagara, *Bikeway Master Plan Study*, (http://www.transportationiagara.com/bikestudy.html), 2003.
[159] Regional Niagara, *Bikeway Master Plan Study*.
[160] M. G. Archambault and P. Joly, *Les Retombées Économiques de la Route Verte*.
[161] Vélo Québec, *La Route Verte Special Issue*, September 2002.
[162] Tourism British Columbia, *B.C. Visitor Study*.

- A study of cycle tourism in Maine revealed that many cyclists will travel further distances to take advantage of shared paths. Research in this state has pointed to the importance of effective marketing, infrastructure investments and supportive services for a successful cycle tourism industry.[163]

In order to maximize the economic opportunity of cycle tourism and trail use, there is a need for cooperation between the public and private sectors on product development, to ensure that services such as bike rentals, accommodation and transportation are adequately available.[164] It is clear that the level of expenditure for each user tends to vary dramatically according to how long they travelled to get to the trail, how long they stay and the type of accommodation used while there. Studies have shown that visitors who have travelled further tend to spend more than locals do.[165] This is supported by findings of studies of day-trippers on Quebec's cycle route *La Route Verte* where in 1996, local users spent on average of $7-8 per trip while non-locals spent $22-25 per trip.[166] The exact economic impact of trails and cycle tourism will depend greatly on the characteristics of the trail or route, the local economy and the users.

Estimating Economic Benefits of Tourism

Trails used for cycling and walking are a great investment. As shown in the table below, the return on investment in the construction of the trails ranges from 104% to 2657% per year.

Table 33: Yearly Return on Investment of Selected Trails

Trail	Construction Cost	User Spending per Year	Yearly Return on Investment	Users per Year	Jobs
Welland Canals Trails[167] Ontario	$2,500,000	$12,000,000	480%	150,000	NA
La Route Verte[168] Quebec	$88,000,000	$95,400,000	108%	NA	2000
Trans Canada Trail - Alberta[169]	$6,500,000	$6,785,000	104%	37,000	160
Celtic Trail[170] U.K.	$27,280,000	$35,960,000	132%	200,000	1000
Tarka Project[171] U.K.	$1,736,000	$46,128,000	2657%	483,000	481

Unfortunately, no Canada-wide data could be found on the total economic benefits of cycling tourism. Besides Québec, the only data that could be found were for cycling tour companies which would not include the significant number of cyclists who arrange their own trips. One could guess the Canada-wide levels of cycling tourism would be two to three times that of Québec and thus would be around $300 million.

Table 34: Bicycle Tourism Benefits

	Number of Cyclists	Spending per Day	Days	**Benefit**
Bicycle Tour Companies	5000	$116	5.6	$3,248,000
Québec [172]	190,000	$112	6.5	$138,320,000
Total				**$141,568,000**

[163] Maine Department of Transportation, *Bicycle Tourism in Maine, Economic Impacts and Marketing Recommendations*, (http://www.maine.gov/mdot/opt/pdf/biketourismexecsumm.pdf), 2001.
[164] National Park Service, *Economic Impacts of Protecting Rivers, Trails and Greenway Corridors.*
[165] Moore, R.L., & Barthlow, K., *The economic impacts and uses of long distance trails.*
[166] Go for Green, *The Economic Benefits of Trails*.
[167] The Regional Municipality of Niagara, Welland Canals Parkway Trails - The Greater Niagara Circle Route, (http://www.computan.com/canal/), 1997.
[168] Vélo Québec, *La Route Verte Special Issue*, September 2002.
[169] Price Waterhouse Coopers, *An Economic Impact Analysis of the Proposed Alignment of the Trans Canada Trail in East-Central Alberta*, (http://www.cd.gov.ab.ca/building_communities/sport_recreation/resources_links/trails_economic_impact_analysis/)
[170] Sustrans, *Cycle Tourism,* (http://www.sustrans.co.uk/downloads/989A87_ff28.pdf), August 1999.
[171] Tarka County, *Tarka Project*, (http://www.tarka-country.co.uk/tarkaproject).
[172] Vélo Québec, *La Route Verte Special Issue*, September 2002.

4.9. RETAIL SALES IMPROVEMENTS

Pedestrian improvements can greatly improve retail sales and generate increased sales and property tax revenues.

A survey of cities around the world, concerning their pedestrianisation schemes, revealed environmental improvement closely related to the removal of traffic. The survey also showed that 49% of all the pedestrian areas developed experienced an upward trend in retail turnover, while only 2% experienced a decrease[173].

Table 35: Effects on Trade of 18 Pedestrianisation Schemes

Atchison, Kansas	18% increase
Cologne, Germany	25-35% increase
Copenhagen, Denmark	25-40% increase
Durham, North Carolina	20% reduction - retailers asked for buses to be reintroduced into the city centre
Dusseldorf, Germany	36-40% increase
Essen, Germany	25-35% increase after initial decline
Gothenburg, Sweden	A range from 20% reduction to 10% increase
Hamburg, Germany	70% of shopkeepers noted an increase in sales
Hereford, UK	10-15% increase, one case where increase was 25-50%
Kalamazoo, Michigan	15% increase
Carnaby Street, London, UK	81% of shopkeepers agreed that pedestrianisation had been a good idea
Minneapolis, Minnesota	14% increase
Munich, Germany	Approximately 40% increase
Norwich, UK	Of 32 shops in London Street, 28 increased their trade
Ponoma, California	16% increase
Rouen, France	10-15% increase
Vienna, Austria	20% increases noted by 60% of merchants
Watford, UK	72% of retailers said pedestrianisation had expanded trade

Pedestrian Retrofit for Downtown Lodi

In downtown Lodi, California, $4.5 million US was spent on a pedestrian-oriented project that included a retrofit of five main street blocks. The improvements included: widened sidewalks, curb bulges, colored paving stones, the installation of a striking gateway, street trees, lighting, benches, and other streetscape amenities. The pedestrian improvements and economic development incentives are credited with the establishment of 60 new businesses, a drop in the vacancy rate from 18% to 6%, and a 30% increase in sales tax revenues since work was completed in 1997.[174]

Castro Street – The Heart of Mountain View

Downtown Mountain View, California was suffering due to new automobile-oriented retail development in the suburbs. In the late 1980s, the city turned Castro Street into the heart of the city by redesigning it to include a flexible area where sidewalk café tables replaced parked cars in the summer. A pedestrian-oriented civic jewel was located on Castro Street – the new city hall and performing arts centre complex with an outdoor plaza. This, in turn, spurred a $150 million US in private investment including an office-over-retail development surrounded by hundreds of homes, and pedestrian passages that connect Castro Street to a city park. Downtown Mountain View is now a regional draw, complete with bookstores, brew pubs, restaurants and most importantly, pedestrians. [175]

[173] City of Toronto, *Economic Benefits of Pedestrianisation for Toronto*, (http://www.city.toronto.on.ca/legdocs/1999/agendas/council/cc/cc990413/ed6rpt/cl001.htm)) 1999.
[174] Local Government Commission Center for Livable Communities (LGC), *The Economic Benefits of Walkable Communities* , (http://www.lgc.org/freepub/PDF/Land_Use/focus/walk_to_money.pdf).
[175] Ibid.

Old Pasadena

In Old Pasadena, the creation of a pedestrian-only commercial street proved to be financially rewarding. The city invested $25 million US in sidewalk and street improvements when the district opened in 1983 and since then, sales revenue for businesses in the district have grown from $10 million US a year to $165 million US last year. [176]

4.10. PROPERTY VALUES

Accommodating active transportation has been shown to increase property values. Properties near trails and neighbourhoods with pedestrian friendly features such as narrow streets, sidewalks, curb bulges and traffic circles are proving to be popular with buyers and will command higher prices.

- Real estate values over the next 25 years are predicted to rise fastest in pedestrian friendly communities that incorporate traditional characteristics of successful cities including a mix of residential and commercial districts.[177] A study by the Urban Land Institute found that people would pay $26,000 US extra for homes in pedestrian-friendly communities. [178]
- In Surrey B.C., single family property values that bordered a greenway or a trail proved to be 1% to 20% greater than those that did not.[179]
- According to 1998 study, lots adjacent to the Mountain Bay Trail in Brown County, Wisconsin sold faster and for an average of 9% more than comparable property not located next to the trail.[180]
- Realizing the selling power of greenways, the developers of the Shepherd's Vineyard housing development in Apex, North Carolina, increased the prices of the 40 homes adjacent to the regional greenway by $5,000 US. Those homes were still the first to sell.[181]

[176] Ibid.
[177] ERE Yarmouth and Real Estate Research Corporation, *Defining New Limits: Emerging Trends in Real Estate*, , 1998.
[178] LGC, *The Economic Benefits of Walkable Communities.*
[179]RealBASE Consulting Inc., *Greenway Proximity Study, 1980-1991*, (https://www.landcor.com/newsletters%5Cgreenwayproximitystudy Surrey.pdf), City of Surrey.
[180] Brown County Planning Commission, *Recreation trails, Crime, and Property Values: Brown County's Mountain-Bay Trail and the Proposed Fox River Trail*, Green Bay, July 6, 1998.
[181] Don Hopey, "Prime Loction on the Trail," *Rails-to-Trails*, Fall/Winter 1999, p 18.

5. SIGNIFICANT GAPS IN RESEARCH

5.1. CANADA-SPECIFIC DATA

Transportation data for Canada appears to be a lot less comprehensive than for the United States. For instance no data on average trip length or mode share for non-commute trips could be found for cycling or walking.

5.2. TRACKING OF NON-COMMUTING TRIPS

Active transportation in general accounts for a larger percentage of non-commuting trips (shopping, social, recreational, etc.) than commuting trips. Thus using the census commute mode share numbers likely understates the true levels of use of active transportation. Some regions do track all trip types but no mode shares could be found for Canada as a whole.

5.3. LEVEL OF RESOURCES NEEDED TO ATTRACT A CERTAIN LEVEL OF ACTIVE TRANSPORTATION USAGE

While the return on investment both in number of users and regional economic benefits has often been tracked for trails used by tourists, little such tracking has been done for facilities that have been built for commuters. Thus it is difficult to determine what level of expenditure will be required to attract a particular level of active transportation use.

5.4. TOURISM IN CANADA

No Canada-wide data could be found on cycling or walking tourism.

5.5. URBAN TOURISM

Surprisingly enough, no research could be found on the impact of paths in urban areas such as Vancouver's Seawall. Such paths are extremely popular with residents and tourists alike. It is suspected that there is much agreement that the benefits of such paths outweigh the costs, thus there has been little need for studies to justify their construction. Still, many such paths are constructed in sections as nearby development occurs. The developer is often required to cover the cost of the construction and contribute the right-of-way. While such an approach is cost effective for municipalities, it may take many years for a path to be completed and for the full benefits to be realized. It is suspected that the benefits of such paths are great enough to justify their completion sooner rather than later. More research into the benefits of such paths is required to confirm this.

5.6. RENTALS

The rental of bicycles and in-line skates is very popular among visitors to cities such as Vancouver. No information could be found as to the value of such rentals.

5.7. SALES WALKING GEAR

It is suspected that walking spurs sales of items such as shoes, backpacks, packs, in-soles. No research could be found that details this.

5.8. OTHER FORMS OF ACTIVE TRANSPORTATION

It could be assumed that other forms of active transportation have similar benefits to that of cycling and walking. More research is needed to confirm this. Many measures that need to be taken to encourage cycling and walking would also benefit other forms of active transportation such as in-line skating and skateboarding. Unfortunately no data were found on the mode share of other forms of active transportation. It would be useful to track the levels of use of all forms of active transportation. Perhaps this could be included in the next census. Although the mode shares of the other forms of active transportation are small, even a mode share of .1% would amount to 26 million trips per year.

5.9. QUANTIFICATION OF SOCIAL BENEFITS

Existing work has quantified the social costs of automobile dependency. Some portion of the costs is due to the form of development and not the form of transportation used. The portion due to transportation has not been determined, thus the benefit of switching to active transportation cannot be quantified without further work.

5.10. PEDESTRIAN IMPROVEMENTS IN CANADA

Analysis of the benefits of pedestrian improvements and pedestrianization schemes in Canada could not be found. While it is expected that the benefits would be similar to those in the United States, it would be useful to confirm this.

6. BENEFITS OF FEDERAL INVESTMENT IN ACTIVE TRANSPORTATION

Given the enormous economic benefits of active transportation, the Canadian federal government needs to adopt stronger policies and programmes and increase investment in active transportation infrastructure. This section highlights how the mandates of key federal departments relate to active transportation and summarizes the benefits of greater active transportation support.

6.1. TRANSPORT CANADA

As required of federal departments, Transport Canada, has prepared a sustainable development strategy. The *Sustainable Development Strategy 2004-2006* defines challenges and specific commitments for the next three years. In this strategy, Transport Canada commits to promoting active transportation as part of its challenge to encourage Canadians to make more sustainable transportation choices.[182] Also, more fundamentally, Transport Canada is responsible for facilitating the movement of people and goods, and as an effective strategy of moving people, the facilitation of active transportation needs be considered part of Transport Canada's mandate.

This promotion of active transportation is consistent with the sustainable development principles as stated in *Straight Ahead - A Vision for Transportation in Canada* and the *Sustainable Development Strategy 2004-2006*.[183]

These principles include:

- Economic — efficiency, cost internalization, affordability.
- Social — safety, security and health, access and choice, quality of life.
- Environmental — pollution prevention, protection and conservation, environmental stewardship.

The key benefits of active transportation as related to these principles are outlined below. The great value of these benefits warrants much greater support of active transportation by Transport Canada.

6.1.1. Economic

Active transportation is very efficient and affordable. Switching trips to active transportation from driving results in significant savings to the user and to society at large.

User Savings

Direct costs of passenger motor vehicle include fuel, repair, maintenance and parking. Switching to active transportation saves users a significant amount of money. Refer to section *4.1.4 User Savings* for more details. The following table details the user savings both at the current level and the target level of active transportation use.

Table 36: User Savings per Year

	Current level of 7.8%	Target level 15.2%
User savings	$808,704,000	$1,995,136,000

External Savings

There are many external costs of automobile use that result in the subsidization of driving. These costs include road costs (road construction, maintenance and repair), congestion and parking. Refer to section *4.1*

[182] Transport Canada, *Sustainable Development Strategy 2004-2006,* (http://www.tc.gc.ca/programs/environment/sd/sds0406/docs/TC%20SDS_E3.pdf) 2004, p 19.
[183] Ibid. pp 67-68.

Transportation Benefits for more details. Switching to active transportation reduces these costs and results in significant savings to society at large. The following table details these external savings at both the current level and the target level of active transportation use.

Table 37: External Transportation Savings per Year in Canada

	Current level of 7.8%	Target level of 15.2%
Road construction, maintenance and repair	$97,656,000	$240,864,000
Congestion	$199,023,480	$375,516,000
Parking	**$296,679,480**	**$616,380,000**

6.1.2. Social

The use of active transportation improves people's health through physical activity. Refer to section *4.7 Health Benefits* for more details. Transport Canada's vision as stated in the *Strategic Plan for Transportation Safety and Security* is for Canada to have "the safest transportation system in the world".[184] By reducing the number of vehicles on the road, the use of active transportation can help make this vision a reality. Refer to section *4.1.3 Road Safety* for more details. In addition, the improvement of active transportation facilities will increase the safety of cyclists and pedestrians.

Air pollution can cause or exacerbate a variety of health problems including asthma, heart disease, emphysema, pneumonia and cancer. Switching from driving to activate transportation reduces air pollution and its harmful effects. The health benefits of reduced air pollution are detailed and quantified in the environmental benefits in section *4.2.2*.

The following table details the social benefits at both the current level and the target level of active transportation use. Note that the use of active transportation instead of motor vehicles also improves people's health by reducing harmful air pollution. This benefit has been included in the environmental benefits of reduced air pollution quantified below in section *6.1.3*.

Table 38: Social Benefits per Year in Canada

	Current level of 7.8%	Target level of 15.2%
Health due to increased physical activity	$91,728,000	$178,752,000
Road Safety	$122,148,000	$301,392,000
Total	**$213,876,000**	**$480,144,000**

6.1.3. Environmental

The environmental benefits of using active transportation include reductions in greenhouse gas emissions (GHG), air pollution, water pollution and noise. Note that the GHG benefits are calculated using a very conservative emissions credit value of $10 dollars a tonne. If emissions credits were valued at $50 a tonne, the benefits would be five times greater. Refer to section *4.2 Environmental Benefits* for more details. The following table details these benefits at both the current and target levels of active transportation use.

Table 39: Environmental Benefits per Year in Canada

	Current level of 7.8%	Target level of 15.2%
GHG Emissions Reduction	$13,260,000	$32,240,000
Air Pollution Reduction	$52,104,000	$349,024,000
Water Pollution Reduction		$133,952,000
Noise Reduction	$48,984,000	$121,056,000
Totals	**$266,448,000**	**$636,272,000**

[184] Transport Canada, *Strategic Plan for Transportation Safety and Security*, (http://www.tc.gc.ca/tcss/safety_e.htm), 2001.

6.2. ENVIRONMENT CANADA

Environment Canada's mandate includes the preservation and enhancement of the natural environment including air, water and soil and the conservation of Canada's renewable resources including migratory birds and other non-domestic flora and fauna.[185]

In Canada, the environmental cost of motor vehicle use is estimated at $14-36 billion per year.[186] These costs include the damage to the environment caused by air pollution, greenhouse gas (GHG) emissions and noise. The environmental benefits of using active transportation instead of motor vehicles include reductions in greenhouse gas emissions, air pollution, water pollution and noise. Refer to section *4.2 Environmental Benefits* for more details.

Given the great value of the benefits outlined below, greater investment in the promotion and facilitation of active transportation will enable the Government Canada to meet its commitments to improve the natural environment.

6.2.1. GHG Emissions Reduction Benefits

Investing in active transportation is a cost-effective way for Canada to meet its commitments under the Kyoto Protocol. Switching to active transportation will help individual Canadians achieve the personal reduction in GHG emissions put forth in the One Tonne Challenge. More details on the greenhouse gas emissions reduction benefits can be found in the section *4.2.1 Greenhouse Gas Emissions Reductions*.

Estimates on the cost of CO_2 emissions reductions range from $10 to $50 per tonne. The majority of experts predict a price close to $10.[187] The following table details the GHG emissions reduction benefits at both the current and target levels of active transportation use.

Table 40: GHG Emissions Reduction Benefits per Year in Canada

	Current level of 7.8%	Target level of 15.2%
$10 per tonne	$13,260,000	$32,240,000
$50 per tonne	$66,300,000	$161,200,000

6.2.2. Air Pollution Reduction Benefits

Active transportation can play an important role in meeting the commitments to improve air quality as detailed in the Government of Canada's *10-year Action Plan on Clean Air* and *the Canadian Environmental Protection Act (CEPA) 1999*. More details on the air pollution reduction benefits can be found in section *4.2.2 Air Pollution Reduction*.

The following table details the air pollution reduction benefits at both the current and target levels of active transportation use.

Table 41: Air Pollution Reduction Benefits per Year in Canada

	Current level of 7.8%	Target level of 15.2%
Air Pollution Reduction	$52,104,000	$349,024,000

[185] Environment Canada*, Mission, Mandate and Vision*, (http://www.ec.gc.ca/introec/mandate.htm), 2002.
[186] Transport Canada, *1997 Sustainable Development Strategy*, (http://www.tc.gc.ca/programs/Environment/SD/strategy97/challenges7.htm), 1997.
[187] Government of Canada, *Climate Change Plan for Canada*, (http://www.climatechange.gc.ca/plan_for_canada/plan/pdf/full_version.pdf), 2002, p 58.

6.2.3. Water Pollution Reduction Benefits

Active transportation can play an important role on meeting the commitment "To protect and enhance the quality of the water resource" as detailed in the *Federal Water Policy*. [188] More details on the water pollution reduction benefits can be found in section *4.2.4 Improved Water Quality*.

The following table details the water pollution reduction benefit at both the current and target levels of active transportation use.

Table 42: Water Pollution Reduction Benefits per Year in Canada

	Current level of 7.8%	Target level of 15.2%
Water Pollution Reduction	$54,288,000	$133,952,000

6.2.4. Other Environmental Benefits

Automobile dependant communities require more land for roads and parking than communities that are not as reliant on the automobile. Increased use of active transportation can reduce the use of the automobile, freeing land for other uses or preventing increased amounts of land from being dedicated to roads and parking.

Benefits include:

- More greenspace and parks
- More wildlife habitat
- Less fragmentation of habitat
- More wetlands
- More land available for residential and commercial development

6.3. INFRASTRUCTURE CANADA

As stated in *An Introduction to Infrastructure Canada* [189], "a modern national infrastructure is the key to:

- the prosperity of our cities;
- the health of our communities;
- the well-being of our citizens; and
- the competitiveness of our economy"

Including active transportation facilities in infrastructure projects will help achieve these goals in a cost-effective manner. Infrastructure Canada states in the *Report on Plans and Priorities (RPP): 2003-2004 Estimates*, "It must ensure that infrastructure spending is part of a long-term strategy to help build a modern Canada, and that projects across the country are complementary and contribute to multiple benefits for Canadians."[190]

The *Report on Plans and Priorities* states that Infrastructure Canada was established to strengthen public infrastructure including local transportation, highway and rail projects.[191] In addition to supporting stand-alone active transportation facilities, Infrastructure Canada can require and help fund the inclusion of active transportation facilities in infrastructure projects. This should prove to be a cost-effective strategy of maximizing the economic, health and environmental benefits of infrastructure projects to Canadians.

[188] Environment Canada, *Federal Water Policy*, (http://www.ec.gc.ca/water/en/info/pubs/fedpol/e_fedpol.pdf), 1987, p 3.
[189] Infrastructure Canada, *An Introduction to Infrastructure Canada*, (http://www.infrastructure.gc.ca/info/index_e.shtml?menuE), 2003.
[190] Infrastructure Canada, *Report on Plans and Priorities (RPP): 2003-2004 Estimates,* (http://www.infrastructure.gc.ca/publications/cp/rpp/2003/20030327rpp_e.pdf), p 12.
[191] Ibid., p 5.

Opportunities for the inclusion of active transportation include:

- greenways along water or sewer pipeline right-of-ways;
- paths for cyclists and pedestrians on highway, railway or transit bridges
- shared use paths along highway, rail or rapid transit right-of-ways;
- sidewalks along roads and highways;
- bike lanes on roads and highways;
- pedestrian and cyclists overpasses over roads and tracks;
- bicycles on transit; and
- good cyclist and pedestrian access to transit and rail stations

As detailed below, the large value of the benefits of active transportation to Canadians justifies much greater investment in active transportation facilities.

6.3.1. Prosperity of Our Cities

Tourism

The *Report on Plans and Priorities* states that Infrastructure Canada supports tourism and recreational facilities[192]. Trails and greenways used for cycling and walking are a great investment. Trail users spend a significant amount of money on food, lodging and transportation in communities near such trails. As shown in the table below, the return on investment ranges from 104% to 480% per year.

Table 43: Yearly Return on Investment of Selected Trails in Canada

	Cost	User Spending per Year	Yearly Return on Investment per year	Users per Year	Jobs
Welland Canals Trails Ontario[193]	$2,500,000	$12,000,000	**480%**	150,000	NA
La Route Verte Quebec[194]	$88,000,000	$95,400,000	**108%**	NA	2000
Trans Canada Trail – Alberta[195]	$6,500,000	$6,785,000	**104%**	37,000	160

Regional Economic Impacts

The *Report on Plans and Priorities* states that Infrastructure Canada will benefit Canadians by supporting economic development and job creation.[196] Local business activity and employment can be reduced by automobile use since vehicles, parts and fuel are often imported from outside the region. Thus, the use of active transportation instead of motor vehicles can increase local business activity and jobs. Refer to section *4.4 Regional Economic Impacts* for more details. The table below shows the estimated benefits for a community of 100,000 households.

[192] Ibid.
[193] The Regional Municipality of Niagara, Welland Canals Parkway Trails - The Greater Niagara Circle Route, (http://www.computan.com/canal/), 1997.
[194] Vélo Québec, *La Route Verte Special Issue*, September 2002.
[195] Price Waterhouse Coopers, *An Economic Impact Analysis of the Proposed Alignment of the Trans Canada Trail in East-Central Alberta*, (http://www.cd.gov.ab.ca/building_communities/sport_recreation/resources_links/trails_economic_impact_analysis/)
[196] Infrastructure Canada, *Report on Plans and Priorities,* p 5.

Table 44: Increased Regional Economic Impacts a Year per 100,000 households

	Mode Share	Benefit	Jobs
Current	7.8%	$11,752,416	462
Target[197]	15.2%	$22,902,144	899

6.3.2. Competitiveness of Our Economy

One of the goals of both the Canada Strategic Infrastructure Fund (CSIF) and the Border Infrastructure Fund (BIF) is the reduction of congestion.[198] Congestion costs the Canadian economy billions of dollars per year. Traffic congestion increases travel time, vehicle-operating costs, stress and air pollution.[199] Refer to section *4.1.1 Congestion Reduction* for more details.

Increased use of active transportation instead of motorized transportation will improve the competitiveness of our economy. Employees who participate in physical activities report fewer days off due to illness, lower turnover rates, lower healthcare costs and increased productivity than non-physical active employees.[200] The benefit to employers can amount to $513 per worker per year.[201] For more information, refer to section *4.6 Workplace Benefits*.

The following table details the benefits of reduced congestion and the workplace benefits of increased physical activity both at the current level and the target level of active transportation use.

Table 45: Economic Competitiveness Benefits

	Current level of 7.8%	Target level of 15.2%
Congestion Reduction	$97,656,000	$240,864,000
Workplace Benefits of Increased Physical Activity	$199,023,480	$375,516,000
Total	**$296,679,480**	**$616,380,000**

6.3.3. The Well-being of Our Citizens

The use of active transportation improves people's health through physical activity. Refer to section *4.7 Health Benefits* for more details. By reducing the number of motor vehicles on the road, the use of active transportation helps reduce collisions and associated costs of bodily injury and property damage. Refer to section *4.1.3 Road Safety* for more details. Note that the use of active transportation instead of motor vehicles also improves people's health by reducing harmful air pollution. This benefit has been included in the environmental benefits of reduced air pollution quantified above in section *6.1.3*.

The following table details the health benefits at both the current level and the target level of active transportation use.

Table 46: Well-being Benefits per Year

	Current level of 7.8%	Target level of 15.2%
Health due to increased physical activity	$91,728,000	$178,752,000
Road Safety Savings	$62,244,000	$301,392,000
Total	**$153,972,000**	**$480,144,000**

[197] The benefits if all of Canada had the same mode share as Victoria
[198] Infrastructure Canada, *Report on Plans and Priorities,* p 19.
[199] D. Schrank and T. Lomax, Mobility Study-1982 to 1996, (http://mobility.tamu.edu/ums/), Texas Transportation Institute, 1998.
[200] World Health Organization, *Economic Benefits of Physical Activity*, (http://www.who.int/hpr/physactiv/economic.benefits.shtml), 2003.
[201] Ibid.

6.3.4. Environmental

The *Report on Plans and Priorities* states that Infrastructure Canada will benefit Canadians by "enhancing the quality of Canada's environment". In *Taking action on climate change,* Infrastructure Canada pledges to support the commitment the Government of Canada made to reduce greenhouse gas emissions through the Kyoto Protocol.

The environmental benefits of using active transportation include reductions in greenhouse gas emissions (GHG), air pollution, water pollution and noise. Note that the GHG benefits are calculated using a very conservative emissions credit value of $10 dollars a tonne. If emissions credits were valued at $50 a tonne, the benefits would be five times greater. Refer to section *4.2 Environmental Benefits* for more details. The following table details these benefits at both the current and target levels of active transportation use.

Table 47: Environmental Benefits per Year

	Current level of 7.8%	Target level of 15.2%
GHG Emissions Reduction	$13,260,000	$32,240,000
Air Pollution Reduction	$52,104,000	$349,024,000
Noise Reduction	$48,984,000	$121,056,000
Water Pollution	$54,288,000	$133,952,000
Total	**$266,448,000**	**$636,272,000**

6.4. HEALTH CANADA

Health Canada's mission is "to help the people of Canada maintain and improve their health".[202] Health Canada's objectives include "preventing and reducing risks to individual health and the overall environment" and "promoting healthier lifestyles".[203] In addition, the Government of Canada has made a commitment to encourage healthy living and physical activity, as well as action to address illness prevention, as major themes for the Department.[204]

Active transportation can be instrumental in reaching these objectives in a cost-effective manor. Switching to active transportation from motorized transportation results in increased physical activity, reduced air pollution and increased road safety. Both the increase in physical activity, the reduction in air pollution and the increase in road safety will result in improved health for Canadians and thus reduce health care costs.

6.4.1. Improved Air Quality

According to the *Health and Air Quality Bulletin - Air Pollution and Active Transportation*, air pollution can:[205]

- Irritate the respiratory system, causing inflammation of the lungs;
- Reduce lung function, making it harder to breathe;
- Aggravate asthma and Chronic Obstructive Pulmonary Disease (COPD);
- Result in hospital admission, increased medication use, or, in especially sensitive people, even death

Switching from driving to active transportation reduces air pollution and its harmful effects.[206]

The health benefits of reduced air pollution are detailed and quantified in the environmental benefits section *4.2.2 Air Pollution Reduction*.

[202] Health Canada, *2004-2004 Estimates: Part III – Report on Plans and Priorities*, (http://www.tbs-sct.gc.ca/est-pre/20032004/pdf/health-e.pdf), 2003, p 7.
[203] Ibid. p 8.
[204] Ibid. p 13.
[205] Health Canada, *Health and Air Quality Bulletin - Air Pollution and Active Transportation*, (http://www.hc-sc.gc.ca/hecs-sesc/air_quality/factsheet/transport.htm), 2002.
[206] Ibid.

The following table details the benefits of the reduction of air pollution at both the current level and the target level of active transportation use. Note that in addition to the health benefits, the values in the table also include other environmental benefits of a reduction in air pollution.

Table 48: Air Pollution Reduction Benefits per Year

	Current level of 7.8%	Target level of 15.2%
Air Pollution Reduction	$52,104,000	$349,024,000

6.4.2. Increased Physical Activity

According to the *Health and Air Quality Bulletin - Air Pollution and Active Transportation*, "Regular physical activity reduces the risk of premature death, heart disease, obesity, high blood pressure, adult-onset diabetes, osteoporosis, stroke, depression and colon cancer." [207] Furthermore the *Bulletin* states that, "Canadians say that lack of time is the greatest personal barrier to being physically active. Active transportation helps break down this barrier by building physical activity into daily commuting habits and errands." [208] Refer to section *4.7.2 Increased Physical Activity* for more details.

The following table details the health benefits of increased physical activity at both the current level and the target level of active transportation use.

Table 49: Health Benefits of Physical Activity pre Year

	Current level of 7.8%	Target level of 15.2%
Health due to increased physical activity	$91,728,000	$178,752,000

6.4.3. Road Safety Benefits

One of the strategic outcomes stated in Health Canada's *Report on Plans and Priorities* is a "a healthier population by promoting health and preventing illness". The stated objective is to "promote health and prevent and control injury and disease."[209] The total costs of injuries due to motor vehicles in Canada amount to $1.7 billion a year. The direct health care costs of motor vehicle-caused injuries are $375 million per year.[210] By reducing the number of motor vehicles on the road, the use of active transportation helps reduce collisions and associated costs of bodily injury. In addition, the improvement of active transportation facilities will reduce active transportation injuries. Refer to section *4.1.3 Road Safety* for more details.

The following table details the benefits at both the current level and the target level of active transportation use. Note that the values below include other benefits including decreased property damage in addition to the health care savings.

Table 50: Road Safety Benefits per Year

	Current level of 7.8%	Target level of 15.2%
Road Safety Benefits	$122,148,000	$301,392,000

[207] Ibid.
[208] Ibid.
[209] Health Canada, *2004-2004 Estimates: Part III – Report on Plans and Priorities*, p 27.
[210] Health Canada, *The Economic Burden of Unintentional Injury in Canada*, (http://www.hc-sc.gc.ca/pphb-dgspsp/injury-bles/ebuic-febnc/index.html), 1998.

7. SUMMARY OF ECONOMIC BENEFITS

The following tables summarize and total the quantifiable benefits of active transportation per year in Canada for both the current mode share and the target mode share. The calculations of benefits are based on total passenger trips for all modes of 26 billion[211] per year.

7.1. SUMMARY OF BENEFITS AT CURRENT MODE SHARES

Table 51: Economic Benefits of Active Transportation at 2001 Mode Shares

	Walk	Bike	**Total**
Mode Share	6.6%	1.2%	**7.8%**
Average Trip Length (km)	1	3.2	
Trips	1,716,000,000	312,000,000	**2,028,000,000**
Total Distance (km)	1,716,000,000	998,400,000	**2,714,400,000**
Benefit			
Congestion Reduction	61,776,000	35,880,000	**97,656,000**
Roadway Savings	39,468,000	22,776,000	**62,244,000**
External Parking Savings	1,091,376,000	188,448,000	**1,279,824,000**
User Savings	511,368,000	297,336,000	**808,704,000**
Road Safety Savings	77,220,000	44,928,000	**122,148,000**
GHG Emissions Reductions	8,580,000	4,680,000	**13,260,000**
Air Pollution Reduction	89,232,000	52,104,000	**141,336,000**
Water Pollution Reduction	34,320,000	19,968,000	**54,288,000**
Noise Reduction	30,888,000	18,096,000	**48,984,000**
Workplace	173,488,392	25,535,088	**199,023,480**
Health Care Savings	77,616,000	14,112,000	**91,728,000**
Tourism Revenue	NA	141,568,000	**141,568,000**
Bicycle Industry Revenue	NA	495,600,000	**495,600,000**
Total	**$2,195,332,392**	**$1,361,031,088**	**$3,556,363,480**

[211] Based on an average of 3 trips per person per day. NFO Cfgroup Inc., *Regional Travel Survey, July 2000*, (http://www.translink.bc.ca/files/polls_surveys/regtravel.pdf), TransLink, 2003, p 23.

7.2. SUMMARY OF BENEFITS AT TARGET MODE SHARE

Victoria has the highest levels of active transportation use in the country according to the 2001 Census. If the rest of the country increased its mode shares to those in Victoria, the benefits would be as follows:

Table 52: Economic Benefits of Active Transportation at Victoria's Mode Share

	Walk	Bike	**Total**
Mode Share	10.4%	4.8%	**15.2%**
Average Trip Length (km)	1	3.2	
Trips	2,704,000,000	1,248,000,000	**3,952,000,000**
Total Distance (km)	2,704,000,000	3,993,600,000	**6,697,600,000**
Benefit			
Congestion Reduction	97,344,000	143,520,000	**240,864,000**
Roadway Savings	62,192,000	91,104,000	**153,296,000**
External Parking Savings	1,719,744,000	753,792,000	**2,473,536,000**
User Savings	805,792,000	1,189,344,000	**1,995,136,000**
Road Safety Savings	121,680,000	179,712,000	**301,392,000**
GHG Emissions Reduction	13,520,000	18,720,000	**32,240,000**
Air Pollution Reduction	140,608,000	208,416,000	**349,024,000**
Water Pollution Reduction	54,080,000	79,872,000	**133,952,000**
Noise Reduction	48,672,000	72,384,000	**121,056,000**
Workplace	273,375,648	102,140,352	**375,516,000**
Health Care Savings	122,304,000	56,448,000	**178,752,000**
Tourism Revenue	NA	141,568,000	**141,568,000**
Bicycle Industry Revenue	NA	495,600,000	**495,600,000**
Total	**$3,459,311,648**	**$3,532,620,352**	**$6,991,932,000**

8. CONCLUSION

Currently 6.6% of Canadians walk to work while 1.2% bicycle. Victoria has the highest levels of active transportation use in Canada with walking accounting for 10.4% of trips and cycling accounting for 4.8% of trips, for a total mode share of 15.2%. Many countries around the world have significantly higher levels of active transportation use. In the Netherlands, walking accounts of 19% of trips while cycling accounts for 27% and in Sweden, walking accounts for 39% of trips while cycling accounts for 10%. Clearly there is room for much growth, especially in cycling trips.

There is a very high degree of willingness among Canadians to walk or ride a bike instead of driving, with 82% willing to walk more and 66% willing to cycle more given safe and convenient facilities. The high levels of active transportation use in Sweden indicate that Canadian weather is not a barrier to achieving high levels of active transportation use.

A major barrier to more people using active transportation is the lack of safe, convenient facilities. Expenditures to remove this barrier should prove to be very popular. A large majority of Canadians (82%) supports government spending to create dedicated bicycle lanes and paths. When improvements have been made to cycling infrastructure, the number of people cycling has often risen dramatically. In addition, legislation to promote and support active transportation is critical.

The quantified economic benefits of active transportation include:

- Reduction in road construction, repair and maintenance costs
- Reduction in costs due to greenhouse gas emissions
- Reduction in health care costs due to increased physical activity and reduced respiratory and cardiac disease
- Reduction in fuel, repair and maintenance costs to users
- Reduction of costs due to increased road safety
- Reduction in external costs due to traffic congestion
- Reduction in parking subsidies
- Reduction of costs due to air pollution
- Reduction of costs due to water pollution
- The positive economic impact of bicycle tourism
- The positive economic impact of bicycle sales and manufacturing
- Increased property values along greenways and trails
- Increased productivity and a reduction of sick days and injuries at the workplace

In this report, the total quantifiable economic benefits of active transportation per year at the current levels are estimated at $3.5 billion dollars a year. If the active transportation mode share for all of Canada increases to 15.2% (that of Victoria), the benefits would increase to 7.0 billion dollars a year.

It is suspected that one of the largest economic benefits of active transportation is related to tourism. Unfortunately, only data could be found for cycling in Québec. However, in Québec alone, the benefits of bicycle tourism amounts to $131 million per year.

The current economic benefits are enough to justify increased government expenditures on active transportation in Canada. The projected benefits of doubling the mode share of active transportation make the case even more compelling.