



The Alberta GPI Accounts: Transportation

Report # 7

by

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About this Report

This is one of 28 reports that provide the background for the Genuine Progress Indicators (GPI) System of Sustainable Well-being Accounts. It explains how we derived the index that was earlier published in "*Sustainability Trends 2000: The Genuine Progress Statement for Alberta, 1961 to 1999*." The research for this report was completed near the end of 2000. The appendices provide further background and explanation of our methodology; additional details can be obtained by contacting the authors. Appendix A includes a list of all GPI background reports.

In this report we explore the prevalence of various modes of transport in Alberta, including personal automobile, domestic freight and airline travel. The report answers the following questions:

1. How many personal vehicles are there in Alberta?
2. What is the direct expenditure associated with personal transport in Alberta?
3. How much domestic freight is Alberta responsible for?
4. How active are the airports in Alberta?

About the Authors

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The high quality of the data compiled by Statistics Canada and the opportunity to use this data enabled us to undertake a much more thorough analysis than would otherwise have been possible. We also thank Kim Sanderson for her editing assistance. Finally, the Pembina Institute appreciates the vision of Western Economic Diversification in supporting this project—the first of its kind for Alberta, if not internationally.

The contents of this report are the responsibility of the Pembina Institute and do not necessarily reflect the views and opinions of those who are acknowledged above or the opinions or positions of Western Economic Diversification who helped fund the research.

We have made every effort to ensure the accuracy of the information contained in this document at the time of writing. However, the authors advise that they cannot guarantee that the information provided is complete or accurate and that any person relying on this publication does so at their own risk. Given the broad scope of the project and time constraints, it has not been possible to submit the entire report for peer review. The material should thus be viewed as preliminary and we welcome suggestions for improvements that can be incorporated in any later edition of the work.

Contents

1.0 EXECUTIVE SUMMARY.....	1
2.0 PERSONAL TRANSPORT.....	4
2.1 Direct Expenditure on Driving in Alberta	6
3.0 FREIGHT	8
4.0 AIRLINE TRAVEL	9
5.0 BEYOND DIRECT EXPENDITURE: THE FULL COST OF DRIVING	10
6.0 CONCLUSION	11
APPENDIX A. LIST OF ALBERTA GPI BACKGROUND REPORTS	12
APPENDIX B. DATA DETAILS	14

Figures and Tables

Figure 1: Registered Personal Automobiles in Alberta, 1961 to 1999	4
Figure 2: Vehicle-Kilometres Traveled by Urban Transit, Select Provinces, 1975 to 1994	5
Figure 3: Percentage Change in Vehicle-Kilometres Traveled, Urban Transit, 1975 to 1994	5
Figure 4: Direct Personal Expenditure Associated with Automobile Use in Alberta.....	6
Figure 5: Personal Expenditure Related to Automobile Use in Alberta as an Index, 1961 to 19997	
Table 1: Export Trade Mode, Alberta	8

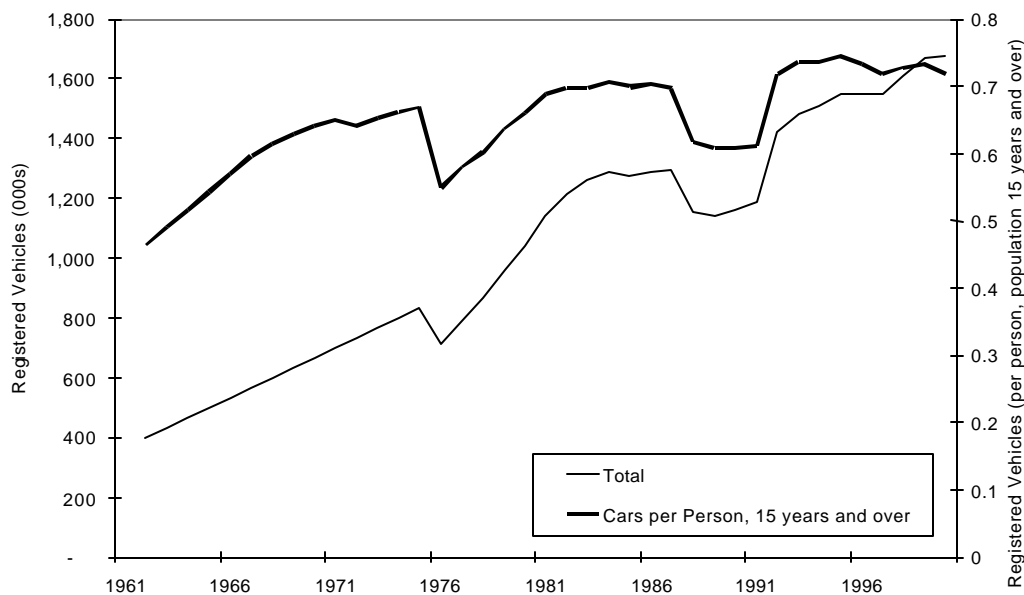
1.0 Executive Summary

More and more Albertans are using personal vehicles for transportation. In 1990, average kilometres traveled per car in the province amounted to 17,984 km. By 1995, that figure reached 19,168 km and in 1997 it was 19,765 km. Not only are automobiles traveling further than in the past, but there are more of them than ever before. The number of vehicles registered in Alberta increased substantially in the last several decades. The figure below shows that both total registered vehicles and registered vehicles per person (population 15 years and over) have increased since 1961. Total registered vehicles increased by 318 percent between 1961 and 1999, while cars per person increased by 55 percent. In 1961, there were 0.46 cars for every Alberta aged 15 years and over. In 1999, there were 0.72. Not only is vehicle travel on the rise, but travel by airplane is also a growing mode of transport. While 3,153,000 Canadians traveled from Canada to other parts of the world in 1990, 3,672,000 Canadians did so in 1996.

Noteworthy

- Total registered vehicles increased by 318% between 1961 and 1999.
- In 1961, there were 0.46 cars for every Albertan aged 15 years and over. In 1999, there were 0.72 cars.
- 3,153,000 Canadians traveled from Canada to other parts of the world in 1990, while 3,672,000 Canadians did so in 1996.
- Direct expenditure associated with personal automobile use in Alberta amounted to \$848.6 million (1998\$) in 1961.
- In 1999, direct expenditure associated with personal automobile use was \$7,337.6 million (1998\$).
- Direct expenditure associated with personal automobile use in Alberta increased by 765% from 1961 to 1999.
- The cost of transportation also includes substantial environmental and social costs (e.g., accidents).
- For every dollar spent on vehicle operating costs (the cost of fuel, etc.), approximately \$2.70 in environmental and social costs are imposed on society.

Registered Personal Automobiles in Alberta, 1961 to 1999

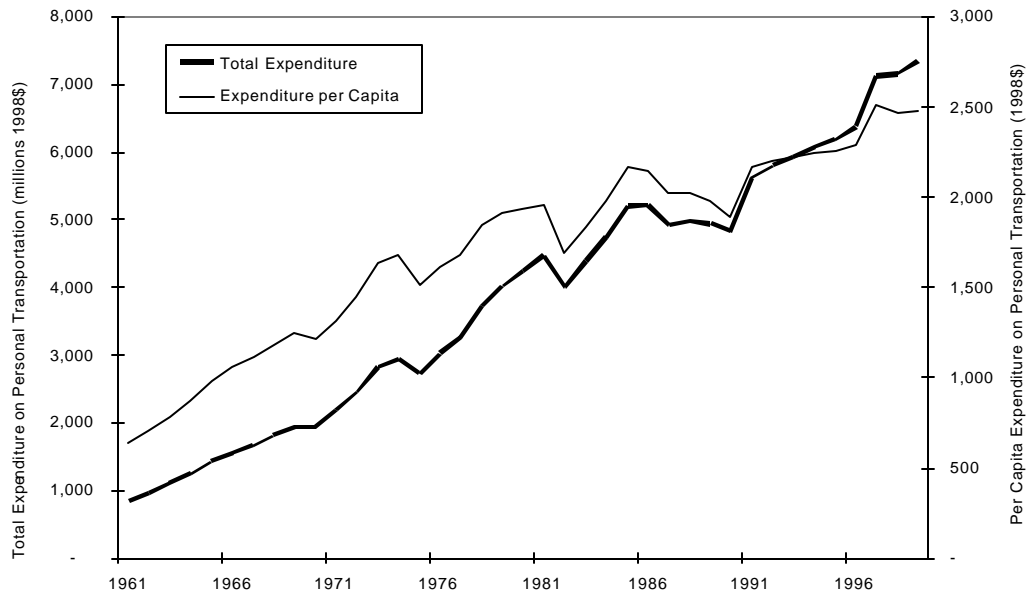


Source: Data from 1975 to 1998 from Statistics Canada CANSIM retrieval, other years derived through extrapolation.

So What?

The transportation sector in Alberta is substantial. The figure below shows the cost of personal automobile use in Alberta.

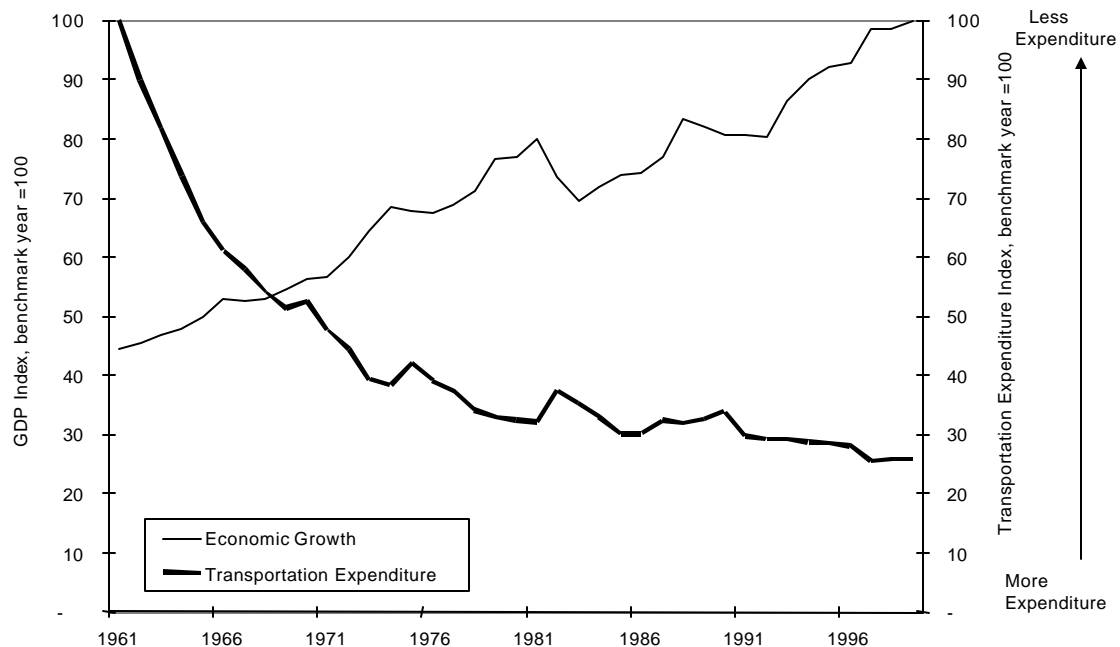
Personal Expenditure on Automobile Use in Alberta



Source: Statistics Canada, CANSIM retrieval

The following figure shows the same information as an index, comparing the trend in personal expenditure with that of provincial GDP.

Expenditure on Personal Automobile Use Index



The costs depicted in these figures are merely the financial costs associated with automobile use. The cost of transportation also includes significant environmental and social costs, such as costs due to collisions. Motor vehicles, for example, produce a host of air pollutants, including carbon monoxide, particulates, nitrogen oxides, volatile organic compounds, sulphur oxides, carbon dioxide, methane, road dust, and toxic gases such as benzene. These emissions can cause human illness and death, crop and material damage, global warming, ozone depletion, acid rain and reduced visibility.

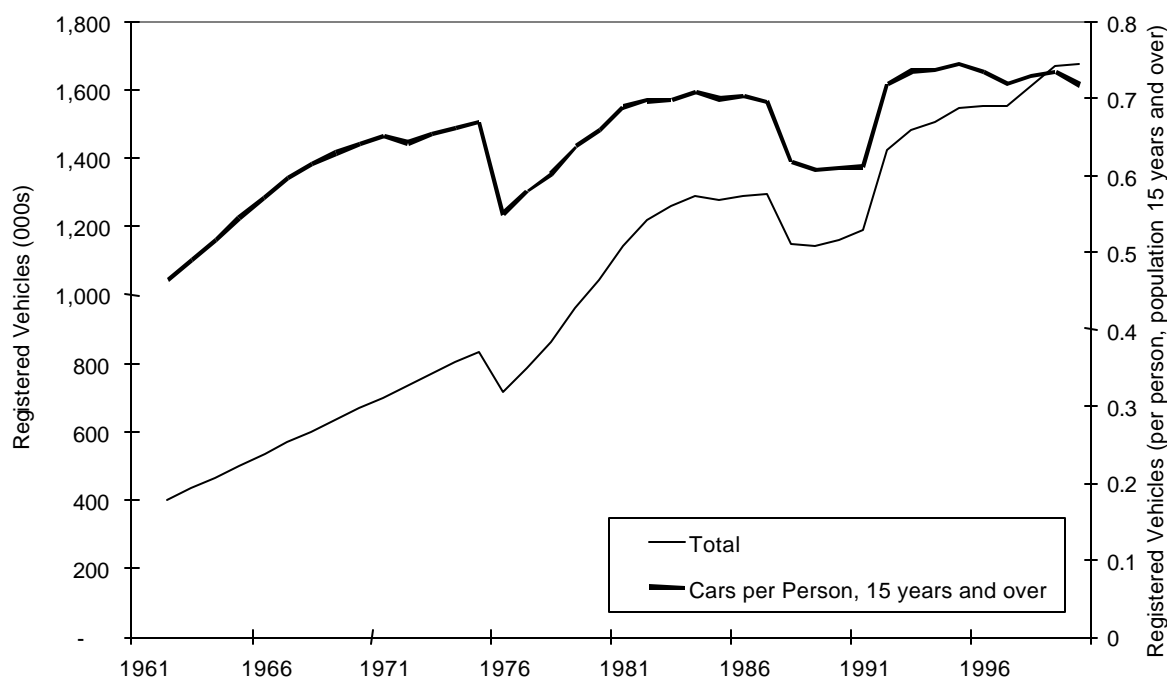
Indeed, the price that individuals pay—whether for personal transport, for goods that are shipped by freight, or for a plane ticket—is substantially less than the true (full) cost of travel when environmental and social impacts are taken into account. For example, research indicates that for every dollar spent on vehicle operating costs (the cost of fuel, etc.), costs of approximately \$2.70 are imposed on society. Thus a large portion of the true cost of driving is being subsidized by society at large in the form of reduced air quality and risk of injury or death. The same is true for both freight transport and airline travel.

Direct expenditure associated with personal automobile use in Alberta in 1999 was \$7.3-billion (1998\$). That is equal to 6.7 percent of 1999 GDP. As an index, direct expenditure associated with personal automobile use in Alberta in 1999 ranked 26 on a scale of 0 to 100, where 100 is the least amount of expenditure from 1961 to 1999.

2.0 Personal Transport

More and more Albertans are using personal vehicles to move around the province. In 1990, an average of 17,984 kilometres were traveled per car in Alberta. By 1995 that figure had increased to 19,168 km, and in 1997 it was 19,765 km.¹ Not only are automobiles traveling further than they did in the past, but there are more of them than ever before. The number of vehicles registered in the province rose substantially in the last several decades. Figure 1 shows registered vehicles in Alberta from 1961 to 1999.

Figure 1: Registered Personal Automobiles in Alberta, 1961 to 1999

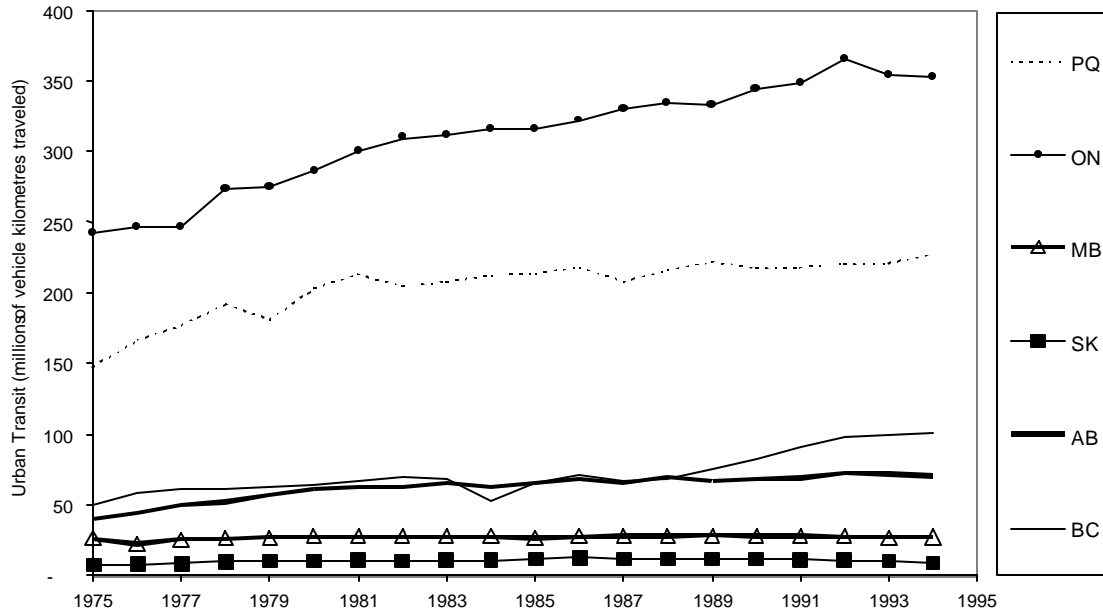


Source: Data from 1975 to 1998 from Statistics Canada CANSIM retrieval, other years derived through extrapolation.

Both the total number of registered vehicles and the number of registered vehicles per person 15 years and over have increased since 1961. Total registered vehicles increased by 318 percent between 1961 and 1999 while cars per person increased by 55 percent. In 1961, there were 0.46 cars for every Albertan aged 15 years and over. In 1999, that number had risen to 0.72. The increase in vehicles in Alberta has been accompanied by an increase in the kilometres of roads in the province—from 154,212 km to 159,607 km in the last decade,² which includes primary, secondary and local roads.

Canada and Alberta alike have also experienced an increase in vehicle-kilometres traveled by urban transit. Figure 2 shows vehicle-kilometres traveled (VKT) for select provinces in Canada from 1975 to 1994. VKT is highest in Ontario and Quebec, which is not surprising given the high populations of these provinces. VKT in Alberta and British Columbia were similar until the late 1980s when numbers in British Columbia increased while those for Alberta did not.

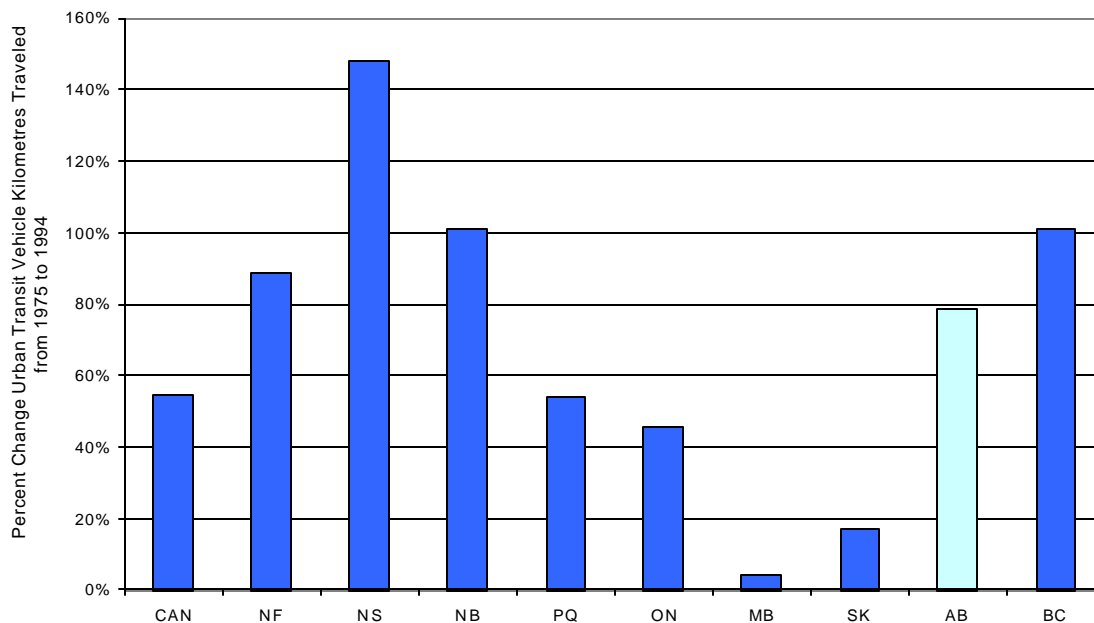
Figure 2: Vehicle-Kilometres Traveled by Urban Transit, Select Provinces, 1975 to 1994



Source: Statistics Canada Matrix 351

Figure 3 shows the percentage change in vehicle-kilometres traveled for urban transit vehicles in Canada, by province from 1975 to 1994. Nova Scotia, New Brunswick and British Columbia experienced the largest increases while Manitoba, Saskatchewan and Ontario experienced the least increase.

Figure 3: Percentage Change in Vehicle-Kilometres Traveled, Urban Transit, 1975 to 1994

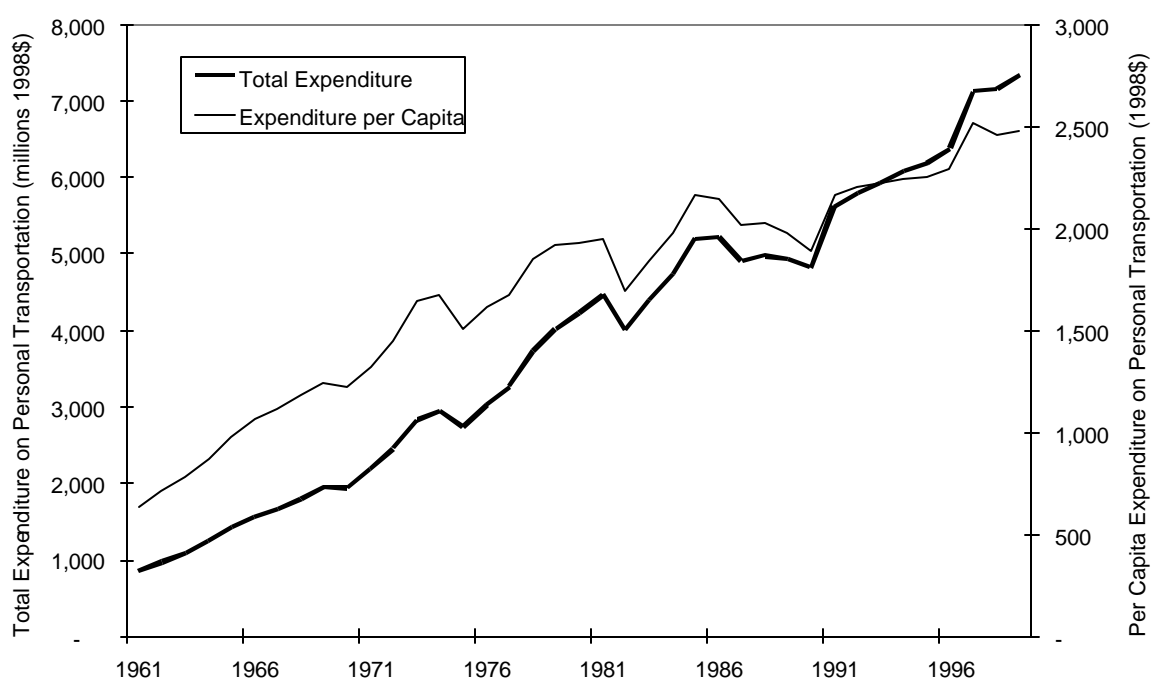


Source: Statistics Canada Matrix 351

2.1 Direct Expenditure on Driving in Alberta

The increase in the use of automobiles and urban transit in the province is costing Albertans money. To estimate the magnitude of direct personal expenditure on automobiles in Alberta from 1961 to 1999, we obtained values for Canada and prorated them to Alberta. Expenditure on personal automobile use includes expenditure on new and used vehicles, motor vehicle repairs and parts, motor fuels and lubricants, purchased transportation, and other automobile-related services. This expenditure amounted to \$7,337-million (1998\$) in 1999—a 765-percent increase from 1961 levels of \$848.6-million (1998\$). Figure 4 shows direct personal expenditure related to automobile transport in Alberta from 1961 to 1999. It is estimated that total transportation expenditures, commuting and otherwise, represent 15-20 percent of average household income and Gross Domestic Product.³

Figure 4: Direct Personal Expenditure Associated with Automobile Use in Alberta

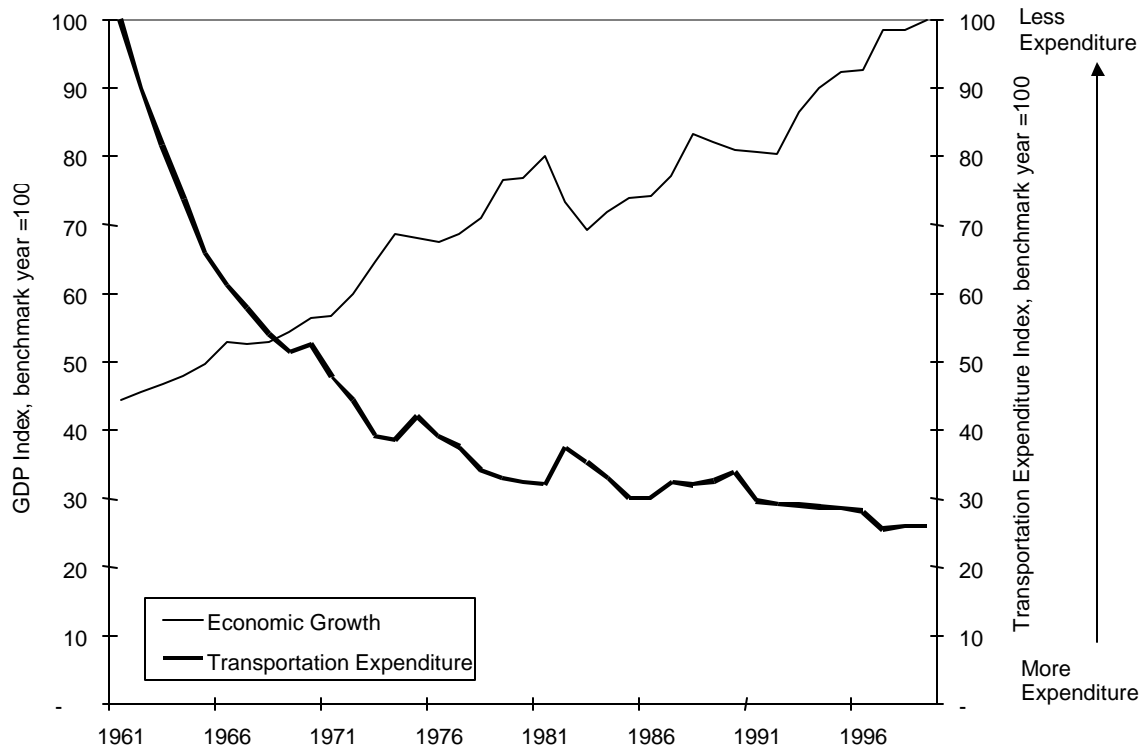


Source: Statistics Canada, CANSIM retrieval

Personal expenditure on fuels and lubricants comprised the single largest category of personal expenditure in 1961 (34 percent). By 1999, this category was replaced by expenditure on new and used vehicles, which accounted for 47 percent of the total; expenditure on fuels and lubricants fell to 25 percent. Expenditure on purchased transport (public transit and taxis) made up 26 percent of the total in 1961; by 1999, that figure had fallen to 17 percent. On a national level, the use of public transit services increased in both the 1970s and 1980s. Ridership in Canada peaked in 1990 when 1.53 billion passengers were using public transit; it declined between 1990 and 1996 and increased slightly in 1997 and 1998.⁴ So many factors affect use of public transit services including family size, cost, employment circumstances, fuel costs, parking rates, distance to work, convenience and community size that it is difficult to predict what Alberta's long-term ridership trend will be.⁵

Figure 5 shows personal expenditure on automobile use in Alberta as an index. For the index, we set 100 equal to the least amount of expenditure on personal automobile use over the study period. We call this year the benchmark year and measure change from that year as an index over time. The more expenditure deviates from the level of the benchmark year, the further the index value gets from 100 and the closer it gets to zero. As the figure indicates, while GDP continued to increase over the study period so too has expenditure on personal automobile use.

Figure 5: Personal Expenditure Related to Automobile Use in Alberta as an Index, 1961 to 1999



3.0 Freight

Along with personal automobiles, domestic freight makes up a large portion of transportation in Alberta. In 1996, Alberta shipped 3,048 thousands of tonnes of freight to British Columbia and 1,781 thousand tonnes of freight to Saskatchewan via road. Only Quebec shipped more freight by road than Alberta. In the same year, Alberta shipped 29,335 thousand tonnes of freight by rail to British Columbia, more than any other province in Canada.⁶ Table 1 shows the magnitude of exports shipped by various modes from Alberta.

Table 1: Export Trade Mode, Alberta

Export Trade: Mode	1996	1997	1998
Air Cargo (tonnes)	22,235	24,887	22,821
Rail (thousands of tonnes)	23,600	13,559	14,642
Pipeline: Oil (millions m ³)	73.7	75.6	77.7
Pipeline: Liquid Petroleum Gas (million m ³)	20.9	22.0	22.5
Pipeline: Natural Gas (billion m ³)	93.2	93.2	92.3
Truck (thousands of tonne)		6,296	8,567

Source: Statistics Canada Catalogue No. 52-216, 51-203, 55-201, 57-205, 53-222

Alberta's economic prosperity is highly dependent on trade—primarily the export of natural capital (oil, gas, coal, timber and agricultural products). The monetary value of exports to the Alberta economy represented 53.3 percent of Alberta's GDP by value in 1999. The environmental costs associated with freight are substantial, including costs associated with water pollution, air pollution, land degradation and noise pollution. Research on the cost of freight concludes that the true cost of freight (environmental and social costs included) is much higher than direct expenditure on freight. For example, a study by the Brotherhood of Maintenance of Way Employees (Ottawa) compared the direct expenditure on freight (internal costs) with external costs (environmental and social) associated with freight. They concluded that in the case of rail freight, 0.51 cents per tonne-kilometre traveled are external costs that are borne by society at large. In the case of semi trailer trucks, that figure is much higher at 2.10 cents per tonne-kilometre traveled.⁷ A second study concluded that the external costs associated with freight transport represent an additional cost of 7 to 20 percent over existing internal costs. This study also found that these costs tend to be higher for truck or barge than for rail.⁸

A third study on this subject estimated that in 1994, internal costs associated with truck freight were \$1.25 per vehicle-mile or 8.42 cents per ton-mile. The study concluded that that road user charges would need to be approximately triple these figures to internalize the external costs associated with truck freight. External costs include accidents, air pollution, greenhouse gases, noise pollution and roadway costs.⁹

In this analysis we do not attempt to quantify the environmental and social costs associated with moving freight from Alberta. Such a task would be complex to say the least. While we capture some of the environmental costs associated with trade in the "Ecological Footprint" report of the Alberta GPI Accounts (#28), we capture others in report #25, "Energy Use Intensity, Greenhouse Gas Emissions and Air Quality." We do not consider our analysis to be comprehensive but rather identify this issue as an important area for future research and analysis.

4.0 Airline Travel

Albertans are also traveling more by plane. In 1990, 3,153,000 Canadians traveled from Canada to other parts of the world; this number rose to 3,672,000 in 1996. The number of people visiting Canada from abroad increased from 3,185,000 in 1990 to 4,697,000 in 1996. This growth in airline travel has occurred despite a decline in the number of airports in Canada over the same time period. Canada had 1,200 airports in 1990, but by 1996 that figure had fallen to 1,141.

Calgary boasts the third largest Canadian airport, at 221,329 flight operations;^a only Vancouver and Toronto have more, at 329,960 and 372,308 flight operations respectively. The Edmonton International Airport and the Edmonton City Centre Airport are the 12th and 13th largest airports in Canada with 86,333 and 80,555 flight operations respectively.¹⁰

As Canadians increase their airline travel, their ecological footprint increases accordingly. Each additional travel mile increases our ecological and carbon footprint, moving us further from sustainability. Airline travel is associated with a host of environmental impacts including loss of wildlife habitat, impact on migration routes of birds, noise pollution and air pollution. Indeed, a transportation footprint of 0.39 hectares increases by over two-fold (to 0.89 hectares) when one trip from Vancouver to Montreal is taken via air travel.¹¹ In this analysis we do not attempt to quantify the environmental and social costs associated with airline travel. We recognize that they exist and that indeed, they are substantial and thus warrant further research in the future.

^a “Flight operations” includes flights as well as civilian operations like air carriers, air taxis and general aviations.

5.0 Beyond Direct Expenditure: The Full Cost of Driving

The transportation sector in Alberta is substantial and growing, as seen by the vast increase in the number of vehicles per person aged 15 years and over from 1961 to 1999. In 1961, there were just 0.46 vehicles per person aged 15 years and over in Alberta, increasing to 0.72 vehicles by 1999. The substantial increase in automobiles in Alberta, along with the increase in kilometres of roads in the province implies that Alberta is becoming a more automobile-dependent province. Alberta is not alone, as most North American communities depend heavily on their cars.¹² Automobile dependency in a region is associated with the fact that most households own automobiles and rely on them for most of their travel. As well, land use patterns are increasingly automobile-oriented, non-automobile travel options are often inferior to driving, and automobile use is the most viable option when choosing between mobility options. As automobile dependency increases, so too do the environmental and social impacts of that dependency.

We have only begun to explore the magnitude and impact of personal transport, domestic freight and airline travel in Alberta. The cost of transportation includes not only direct expenditure but substantial environmental and social costs as well. Motor vehicles, for example, produce a host of air pollutants, including carbon monoxide (CO), particulate matter (PM), nitrogen oxides (NO_x), volatile organic compounds, sulphur oxides (SO_x), carbon dioxide (CO₂), methane (CH₄), road dust, and toxic gases such as benzene. These emissions cause human illness and death, crop and material damage, global warming, ozone depletion, acid rain and reduced visibility.¹³

In addition to impacts associated with emissions from vehicle use, additional environmental and social costs include the cost of time spent traveling, vehicle accidents, the opportunity cost of land used by roads, cost of motor vehicle noise, water pollution and hydrological impacts of vehicle use and roads, and impacts from vehicle waste disposal among others. Indeed, the price that individuals pay, whether for personal transport, goods that are shipped by freight, or a plane ticket, is substantially less than the true cost of travel when environmental and social impacts are taken into account. For example, research indicates that for every dollar spent on vehicle operating costs (the cost of fuel, etc.), costs of approximately \$2.70 are imposed on society.¹⁴ Thus a large portion of the true cost of driving is being subsidized by society at large in the form of reduced air quality and risk of injury or death. The same is true for freight transport and airline travel.

In addition to the conventionally defined externalities described above, two other major problems are associated with automobile dependency. First, automobile dependency disproportionately affects those who cannot drive or who drive less. People who drive less or not at all bear more than their share of the external costs associated with automobile use. More often than not, those who drive less or not at all are low-income individuals and families, disabled people, children and seniors. Second, living in an automobile dependent region increases per-household consumer expenditure on transportation. A recent study found that per-household expenditures on transportation vary from one region to another, depending on the degree of automobile dependency of the particular region. Specifically, the study found that households spend up to 20 percent of their household budget on transportation in automobile-dependent regions, while those in communities with more diverse transportation systems spend less than 17 percent.¹⁵

Furthermore, while automobile use has been associated with benefits to the economy due to the importance of the automobile and petroleum industries, research now indicates that such economic returns are becoming relatively less important. Specifically, while vehicle and road production showed high returns on investment during the 1960s during a time of substantial

industrial growth, the returns are considerably less now that these industries are mature.¹⁶ A recent World Bank study supported this notion. The World Bank study found that beyond 7,500 kilometres of per capita annual automobile travel, increased driving, automobile-dependent transport systems and low density land use patterns impose economic costs that outweigh marginal economic benefits.¹⁷ Similarly, a Texas case study estimated the economic benefits of shifting one percent of regional travel (53 million vehicle-miles) from automobile to public transit. The investigation revealed that such a shift would result in a \$2.9-million increase in regional income and 226 additional regional jobs.¹⁸

In most cases, it is not the car itself that people ultimately desire, but rather mobility and access. Thus, it is necessary to consider increasing access not only via personal automobile but through alternative transportation options as well. Transportation Demand Management (TDM) focuses on transportation alternatives that result in more efficient use of existing transportation capacity rather than looking to increased capacity as a means of addressing mobility and access demands. TDM strategies use market principles to help solve transportation problems and meet growing access demands. They do this by a combination of removing distortions in markets, increasing consumer choice, and encouraging more efficient travel behaviour.¹⁹ Benefits from successful TDM policies include reduced traffic congestion, road and parking infrastructure savings, consumer savings and choice, equity, safety and environmental protection. Thus, successful TDM policies can yield significant savings to society in the form of reduced social and environmental costs and as a result of reduced infrastructure needs (roads and bridges).

6.0 Conclusion

In this paper we have examined trends in the transportation sector in Alberta over time. The results indicate that personal transportation is a growing industry with more cars, roads and air travel in the province. As well, we have considered the significance of freight in Alberta, which has proven to be very important, especially relative to other Canadian provinces. We have attempted to consider the substantial costs associated with transportation in Alberta however, we regard this analysis as preliminary. There is considerable scope for future research into the comprehensive impacts and full costs and benefits (including environmental and social) associated with transportation whether by automobile, aircraft or movement of freight in Alberta.

Appendix A. List of Alberta GPI Background Reports

A series of Alberta GPI background reports accompanies the *Alberta Sustainability Trends 2000* report and this report. These documents are being released in late 2001 and early 2002 and will be available on the Pembina Institute's website at www.pembina.org.

Alberta GPI Background Reports and Sustainability Indicators

GPI Background Reports	GPI Accounts Covered by Report
1. Economy, GDP, and Trade	<ul style="list-style-type: none">• Economic growth (GDP)• Economic diversity• Trade
2. Personal Consumption Expenditures, Disposable Income and Savings	<ul style="list-style-type: none">• Disposable income• Personal expenditures• Taxes• Savings rate
3. Money, Debt, Assets and Net Worth	<ul style="list-style-type: none">• Household debt
4. Income Inequality, Poverty and Living Wages	<ul style="list-style-type: none">• Income distribution• Poverty
5. Household and Public Infrastructure	<ul style="list-style-type: none">• Public infrastructure• Household infrastructure
6. Employment	<ul style="list-style-type: none">• Weekly wage rate• Unemployment• Underemployment
7. Transportation	<ul style="list-style-type: none">• Transportation expenditures
8. Time Use	<ul style="list-style-type: none">• Paid work time• Household work• Parenting and eldercare• Free time• Volunteerism• Commuting time
9. Human Health and Wellness	<ul style="list-style-type: none">• Life expectancy• Premature mortality• Infant mortality• Obesity
10. Suicide	<ul style="list-style-type: none">• Suicide
11. Substance Abuse; Alcohol, Drugs and Tobacco	<ul style="list-style-type: none">• Drug use (youth)
12. Auto Crashes and Injuries	<ul style="list-style-type: none">• Auto crashes
13. Family Breakdown	<ul style="list-style-type: none">• Divorce
14. Crime	<ul style="list-style-type: none">• Crime
15. Gambling	<ul style="list-style-type: none">• Problem gambling
16. Democracy	<ul style="list-style-type: none">• Voter participation
17. Intellectual Capital and Educational Attainment	<ul style="list-style-type: none">• Educational attainment
18. Energy (Oil, Gas, Coal and Renewable)	<ul style="list-style-type: none">• Oil and gas reserve life• Oilsands reserve life
19. Agriculture	<ul style="list-style-type: none">• Agricultural sustainability
20. Forests	<ul style="list-style-type: none">• Timber sustainability• Forest fragmentation

GPI Background Reports	GPI Accounts Covered by Report
21. Parks and Wilderness	<ul style="list-style-type: none">• Parks and wilderness
22. Fish and Wildlife	<ul style="list-style-type: none">• Fish and wildlife
23. Wetlands and Peatlands	<ul style="list-style-type: none">• Wetlands• Peatlands
24. Water Resource and Quality	<ul style="list-style-type: none">• Water quality
25. Energy Use Intensity, Greenhouse Gas Emissions and Air Quality	<ul style="list-style-type: none">• Energy use intensity• Air quality-related emissions• Greenhouse gas emissions
26. Carbon Budget	<ul style="list-style-type: none">• Carbon budget deficit
27. Municipal and Hazardous Waste	<ul style="list-style-type: none">• Hazardous waste• Landfill waste
28. Ecological Footprint	<ul style="list-style-type: none">• Ecological footprint

Appendix B. Data Details

Stock of Vehicles, Vehicles per Person (population 15 years and over), Total Direct Expenditure on Personal Transportation per Capita and Direct Expenditure Index, where benchmark year =100

Year	Stock of Vehicles (thousands)	Vehicles per Person (population 15 years and over)	Total Expenditure on Personal Transport per Capita (1998\$ millions)	Direct Expenditure Index
1961	400	0.46	636	100
1962	434	0.49	707	90
1963	467	0.52	782	81
1964	501	0.54	872	73
1965	534	0.57	979	65
1966	568	0.60	1,061	60
1967	601	0.62	1,109	57
1968	635	0.63	1,183	54
1969	668	0.64	1,246	51
1970	702	0.65	1,218	52
1971	735	0.64	1,316	48
1972	769	0.65	1,449	44
1973	802	0.66	1,639	39
1974	836	0.67	1,675	38
1975	716	0.55	1,510	42
1976	789	0.58	1,618	39
1977	864	0.60	1,675	38
1978	960	0.64	1,847	34
1979	1040	0.66	1,917	33
1980	1142	0.69	1,934	33
1981	1216	0.70	1,951	33
1982	1260	0.70	1,693	38
1983	1290	0.71	1,837	35
1984	1274	0.70	1,983	32
1985	1289	0.70	2,165	29
1986	1296	0.70	2,147	30
1987	1151	0.62	2,018	32
1988	1142	0.61	2,028	31
1989	1163	0.61	1,977	32
1990	1188	0.61	1,893	34
1991	1424	0.72	2,166	29
1992	1482	0.74	2,201	29
1993	1507	0.74	2,217	29
1994	1546	0.74	2,246	28
1995	1549	0.73	2,255	28
1996	1551	0.72	2,294	28
1997	1609	0.73	2,511	25
1998	1670	0.73	2,462	26
1999	1674	0.72	2,475	26

Source: Statistics Canada, CANSIM matrices D16179, D16180, D16181, D16182, D161823 and 356

Endnotes

- ¹ Natural Resources Canada. *Canada's Emissions Outlook: An Update*.
- ² Data from Alberta Infrastructure.
- ³ Litman, Todd. *Transportation Cost: Analysis: Techniques, Estimates and Implications*. Victoria Transport Policy Institute, Victoria, British Columbia.
- ⁴ Kohn, Harold. *Factors Affecting Urban Transit Ridership*. Statistics Canada Catalogue No. 53F0003-XIE.
- ⁵ Kohn, Harold. *Factors Affecting Urban Transit Ridership*. Statistics Canada Catalogue No. 53F0003-XIE.
- ⁶ U.S. Department of Transportation et al. *North American Transportation in Figures* BTS00-05 Washington DC. Call 1-800-700-1033 to obtain copies of this report.
- ⁷ Brotherhood of Maintenance of Way Employees (Ottawa). 1994. *External Costs of Truck and Train*.
- ⁸ Committee for Study of Public Policy for Surface Freight Transport. 1996. *Paying Our Way: Estimating Marginal Social Costs of Freight Transport*. Washington DC: www.nas.edu/trb
- ⁹ Forkenbrock, David. 1999. "External Costs of Intercity Truck Freight Transportation," *Transportation Research A*, Vol. 33, No. 7/8.
- ¹⁰ Bureau of Transportation Statistics et. al. 2000. *North American Transportation in Figures*. U.S. Census Bureau, Washington, DC. www.census.gov/econ/www/natf/natf.html
- ¹¹ See www.mec.ca for details on calculating your ecological footprint.
- ¹² Litman, Todd. December, 1999. *The Cost of Automobile Dependency and the Benefits of Balanced Transportation*. Victoria Transport Institute, Victoria, British Columbia.
- ¹³ Litman, Todd. *Transportation Cost: Analysis: Techniques, Estimates and Implications*. Victoria Transport Policy Institute, Victoria, British Columbia.
- ¹⁴ Litman, Todd. *Transportation Cost: Analysis: Techniques, Estimates and Implications*. Victoria Transport Policy Institute, Victoria, British Columbia.
- ¹⁵ McCann, Barbara. 2000. *Driven to Spend; the Impact of Sprawl on Household Transportation Expenses*. STPP (www.transact.org).
- ¹⁶ Boarnet, Marlon. May 1997. "New Highways and Economic Productivity: Interpreting Recent Evidence," *Journal of Planning Literature*, Vol. 11, No. 4, p. 476.
- ¹⁷ Kenworth, Jeff, et al. February 1997. *Indicators of Transport Efficiency in 37 Global Cities*, Sustainable Transport Research Group, Murdoch University (Perth), for the World Bank, Washington DC.
- ¹⁸ Miller, Jon, Henry Robinson and Michael Lahr. 1999. *Estimating Important Transportation-Related Regional Economic Relationships in Bexar County, Texas*. VIA Metropolitan Transit, San Antonio.
- ¹⁹ Litman, Todd. *TDM Encyclopedia, TDM and Economic Development. Impacts on Productivity, Employment, Business Activity and Investment*. Victoria Transport Policy Institute, Victoria, British Columbia.