

The Alberta GPI Accounts: Auto Crashes and Injuries

Report # 12

by

Mark Anielski

December 2001

About the Pembina Institute

The Pembina Institute is an independent, citizen-based organization involved in environmental education, research, public policy development and corporate environmental management services. Its mandate is to research, develop, and promote policies and programs that lead to environmental protection, resource conservation, and environmentally sound and sustainable resource management. Incorporated in 1985, the Institute's main office is in Drayton Valley, Alberta with additional offices in Calgary and Ottawa, and research associates in Edmonton, Toronto, Saskatoon, Vancouver and other locations across Canada. The Institute's mission is to implement holistic and practical solutions for a sustainable world.

The Green Economics Program is dedicated to designing and implementing practical, street-smart economic tools that would reorient society back to the original meaning of the word "economy"—the care and management of the wealth of the household. By developing new tools for measuring the true wealth or well-being of nations, we can help guide Canadians and Albertans to a sustainable future.

For more information on the Pembina Institute's work, please visit our website at www.pembina.org, or contact:

The Pembina Institute
Box 7558
Drayton Valley, AB T7A 1S7
tel: 780-542-6272 fax: 780-542-6464
e-mail: info@pembina.org

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.

This report examines the trends in deaths and injuries due to auto crashes in Alberta from 1961 to 1999. It also estimates the full direct and indirect costs of auto crashes during this time period. In the GPI accounting system, auto crashes are considered a regrettable cost to human health and social well-being. Current national income accounting treats private and public expenditures related to auto crashes as positive contributions to economic growth rather than regrettable depreciation of quality of life and human capital. This report and the GPI accounting system attempt to measure these impacts in a more holistic accounting of genuine well-being that is otherwise lacking in GDP accounting. The incidence of auto crashes is among a series of social and human health indicators in the 51-indicator GPI accounts for Alberta. This report is a first step towards a more complete and holistic full impact analysis of auto crashes in Alberta and serves as a benchmark study for other Canadian provinces. We welcome more research and input to our initial steps.

About the Author

Mark Anielski is Director of the Green Economics team, and has considerable experience in public policy analysis including natural resource, energy, royalty and fiscal policy issues in both the public (Alberta Government) and private (GPC – Government Policy Consultants) sector. He also serves as Senior Fellow to the U.S. economic policy think-tank Redefining Progress in Oakland, California and authored the 1999 U.S. GPI report with journalist Jonathan Rowe. He currently advises the National Round Table on Economy and the Environment’s Sustainable Development Indicator Steering Committee on the development of indicators for measuring sustainability in Canada. Mark teaches business and the environment in the University of Alberta’s School of Business. His expertise is varied and broad including accounting for sustainable development, natural resource accounting, public policy analysis, business planning and performance measurement. Mark pioneered the development of natural capital accounts for Alberta’s timber, oil, gas, coal and other natural capital as well as having experience in the development of performance measurement systems, land use planning and non-market resource valuation, royalty policy analysis (forestry, oil and gas), and analysis of subsidies for both government and private forestry, energy and financial service industries. He holds a Masters degree in forest economics, plus bachelor degrees in economics and forestry.

Acknowledgements and Disclaimer

We acknowledge the valuable contribution to the Alberta GPI report on auto crashes and injuries from Don Szarko of the Alberta Motor Association, Liz Owens of Alberta Infrastructure, and Nancy Stanilan of the Calgary Health Authority. Their input and review of draft reports and of our interpretation of the data and trends was most valuable. We attempted to provide a balanced perspective on the subject, acknowledging there will be differing opinions in interpretation of data and trends and how to derive the true full cost of auto crashes. We believe this first set of GPI accounts for Alberta provides a good starting point for future research and development by others more skilled and knowledgeable on the subject.

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. EXECUTIVE SUMMARY.....	1
2. INJURIES AND AUTO CRASHES	3
3. TRENDS IN AUTO CRASHES VERSUS ECONOMIC GROWTH.....	4
4. TRENDS IN AUTOMOBILE CRASHES	5
5. SETTING A TARGET FOR AUTO CRASHES	7
6. AUTO CRASHES AS AN INDEX	8
7. THE COSTS OF AUTOMOBILE CRASHES	9
8. SO WHAT? POLICY RECOMMENDATIONS	12
REFERENCES	13
APPENDIX A. LIST OF ALBERTA GPI BACKGROUND REPORTS	14
APPENDIX B. AUTO CRASH DATA, INDEX AND COST OF AUTO CRASHES	16
APPENDIX C. U.S. GPI METHODOLOGY FOR THE COST OF AUTOMOBILE ACCIDENTS	17
APPENDIX D. AUSTRALIAN GPI METHODOLOGY FOR COST OF TRANSPORT ACCIDENTS AND INDUSTRIAL ACCIDENTS	19

Figures

Figure 1: Alberta GPI Auto Crash Index versus Economic Growth, 1961 to 1999	4
Figure 2: Auto Crashes per 10,000 Registered Vehicles, 1961 to 1999	6
Figure 3: Auto Crash Fatalities and Injuries, Alberta, 1961 to 1999	6
Figure 4: Auto Crashes in Alberta as an Index, 1961 to 1999.....	8
Figure 5: The Direct and Indirect Costs of Auto Crashes in Alberta, 1961 to 1999	11

1. Executive Summary

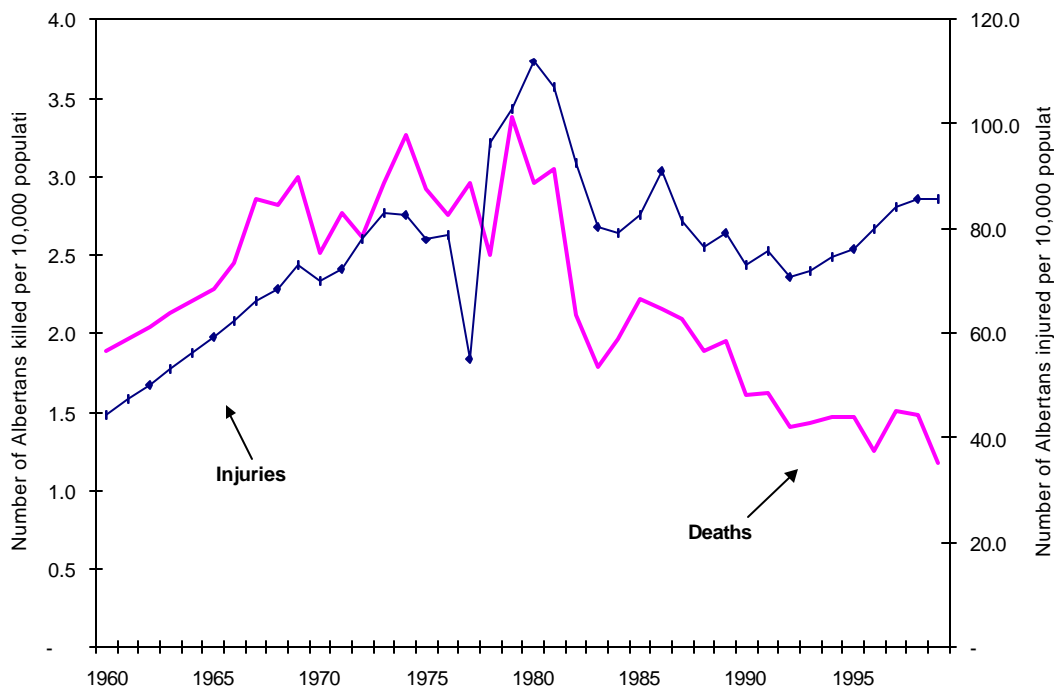
Auto accidents exact a large toll in terms of fatalities, injuries and economic costs. Expenditures related to auto accidents are significant and these regrettable expenditures actually contribute to Alberta's GDP and economic growth. According to the Alberta Motor Association, Alberta has the highest per capita rate of auto crashes and fatalities in the country. Albertans have one of the poorest records of seatbelt use in Canada as well as other poor driving habits. Despite the importance of auto accidents and their significant economic cost, the issue tends to be avoided by political leaders.

The figure below shows the trends in the rate of automobile accidents, mortality and injuries (per 10,000 people) since 1960. The figure shows a decrease in fatalities but an increase in injuries. This would indicate that while there are more accidents than before, fewer accidents are resulting in death.

Noteworthy

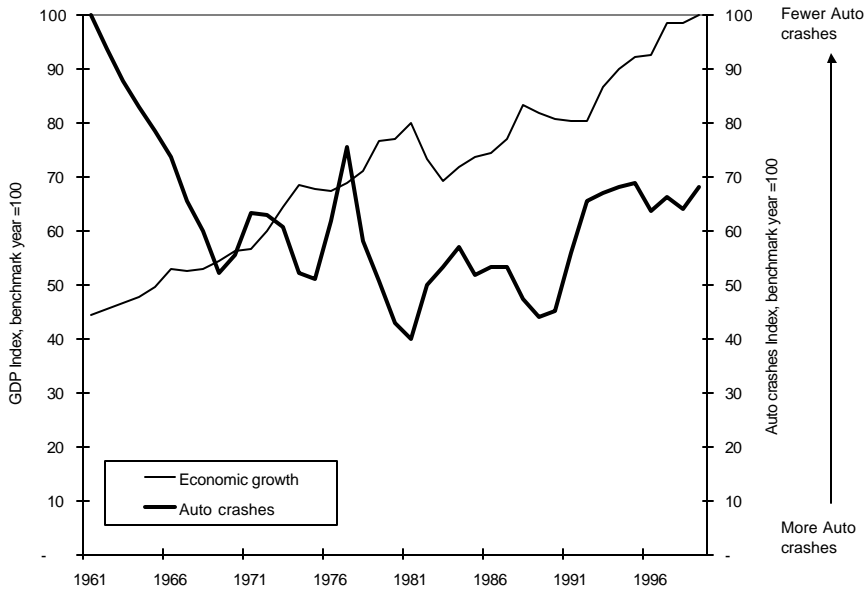
- Expenditures related to auto accidents are significant, and these regrettable expenditures actually contribute to Alberta's GDP and economic growth.
- Albertans have one of the poorest records of seatbelt use in Canada, as well as other poor driving habits.
- Since 1961, there has been a decrease in auto fatalities but an increase in injuries in Alberta.
- Adding up the full costs of fatalities, injuries and property damage yields a range of costs from a low of \$2,679-million in 1992 to a high of \$7,121-million in 1969, all in 1998 dollars.
- In 1969, the total direct costs associated with auto crashes would have represented 22.6% of Alberta's GDP.
- The total direct costs associated with auto crashes declined significantly to 2.8% of GDP in 1999.

Auto Crash Fatalities and Injuries, Alberta 1961 to 1999



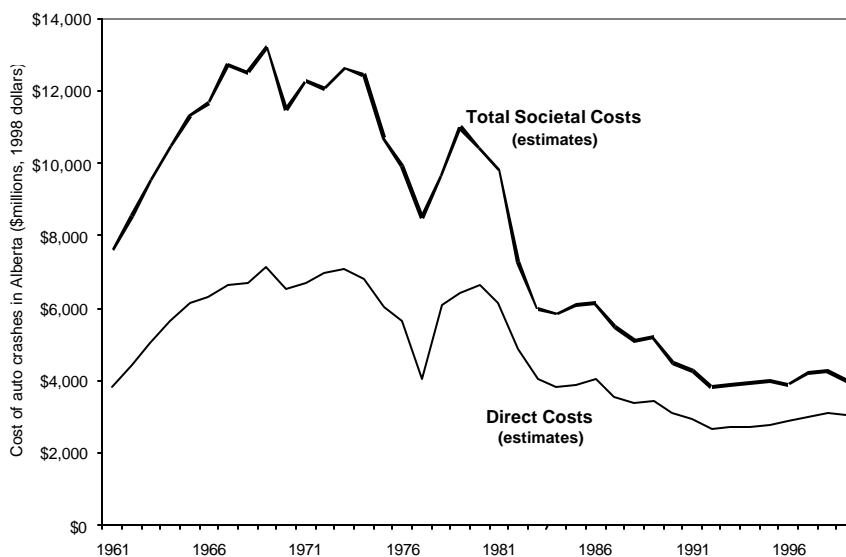
As an index, automobile crashes in Alberta in 1999 ranked 68.05 on a scale of 0 to 100, where 100 is the least number of accidents from 1961 to 1999 (see figure below).

Auto Crash Index: Where are we today?



Auto crashes, like other injuries, impose a substantial cost to society; these include loss of life as well as direct and indirect costs of injuries and property damage. Expenditures on cleaning up the damage due to automobile accidents are counted as a positive addition to Alberta’s GDP accounts. The GPI identifies such expenditures as “regrettable.” The figure below shows the direct and indirect costs of automobile crashes in Alberta from 1961 to 1999. Direct expenditures include the cost of automobile repairs and insurance premiums while indirect costs include lost work and income due to injury or death.

The Direct and Societal Costs of Auto Crashes in Alberta 1961 to 1999



Source: Estimated by the authors based on previous cost of auto crash studies by the Urban Institute on behalf of the BC Ministry of Transportation and Highways.

We estimate that the total societal costs (direct and indirect) of fatalities from automobile accidents range from \$951-million in 1999 to a high of \$6,101-million in 1967; the direct costs (including hospital costs, property damage and forgone income taxes) of fatalities range from \$53-million in 1999 to \$339-million in 1967. The total societal costs of injuries due to auto crashes range from \$2,096-million in 1992 to \$5,563-million in 1973. The total cost of property damage ranges from \$452-million in 1995 to \$1,333-million in 1969. Adding up the full costs of fatalities, injuries and property damage yields a range of costs from \$2,679-million in 1992 to a high of \$7,121-million in 1969, all in 1998 dollars. These are significant amounts in relation to Alberta's GDP. For example, the estimated direct costs associated with auto crashes were as high as 23.0 percent of Alberta's GDP in 1965, declining to a low of 2.8 percent of GDP in 1999 (\$3,026-million, 1998\$). If we were to add the estimated value of the loss of life (productivity losses) the total societal costs of auto crashes would amount to an estimated 3.6 percent of GDP in 1999.

2. Injuries and Auto Crashes

Injuries due to auto crashes, industrial accidents, falls, poisoning, and other unintentional causes in Alberta have been described by Alberta Health and Wellness as an "epidemic."¹ According to their 1997 statistics, 1,342 people lost their lives prematurely because of injuries—nearly four people every day. Of this total, 429 people died in auto crashes in 1997. Injuries are the fifth leading cause of death in Alberta and the leading cause of death for people aged 1 to 44 years. Injuries rank second after cancer as the leading cause of premature mortality, accounting for 26,851 hospitalizations. Falls were the most common cause of injury, most of which involved older people. According to provincial government statistics, the hospitalization rate for falls by seniors in Alberta between 1983 and 1992 was the highest of all provinces.

The costs of injuries are significant. On a national basis the estimated cost of falls, auto crashes, and poisoning made up nearly 65 percent of the \$8.7-billion estimated cost of unintentional injuries in 1995/96.² Unfortunately more recent estimates or estimates specific to Alberta were not available but require more research. If prorated based on population (Alberta's population in 1995/96 was 9.3 percent of Canada's total population), Alberta's share of this cost would be roughly \$809-million.

Every day someone dies and 68 people are injured as a result of auto crashes in Alberta.³ Alberta ranks fourth in Canada when the death rate from auto crashes is calculated in terms of registered vehicles, with "fatality rates per 10,000 population outpacing every other province except Prince Edward Island."⁴ According to Alberta Health and Wellness statistics, in 1998 there were 98,601 collisions reported, 429 traffic fatalities, and nearly 25,000 people injured. In 1999, traffic fatalities dropped to 347, the lowest number since 1965; total casualties (fatalities plus injuries) increased to 1.7 percent over 1998 to 25,798⁵ even though reported total crashes decreased 3.4 percent to 95,246.

According to conventional economic accounting, the cost of each injury related to auto crashes, falls, industrial accidents or poisoning adds to the GDP of Alberta and Canada. Common sense would suggest that these are regrettable, or defensive, costs and that accidents imply a nation or province that is worse off instead of better off—contrary to what a rising GDP implies; thus these costs should be deducted from GDP. Society incurs a loss of well-being with these regrettable costs. Yet the economic and financial consequences of auto crashes and transportation accidents are recorded as additions to GDP. The classic case of a transportation accident contributing to

GDP was the Exxon Valdez oil tanker disaster and spill into Prince William Sound; the spill and the costs of cleaning up the mess (as well as millions in legal costs) added more to Alaska and U.S. GDP than had the tanker successfully docked its oil cargo in a Seattle wharf.

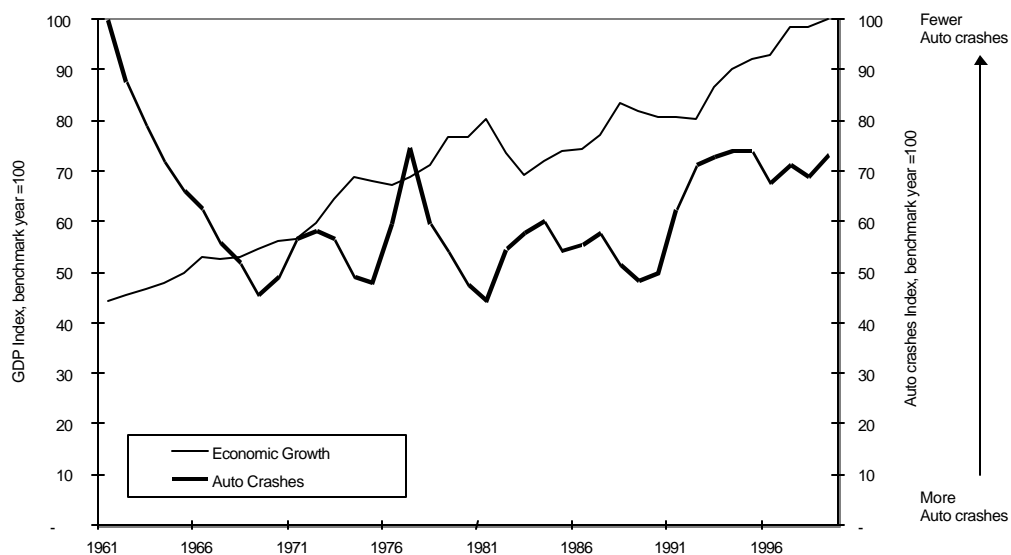
This area of the Alberta GPI accounts focuses only on the trends in auto crashes although, ideally, we should account for all accidents, including industrial accidents. Future research is required to account for the full costs of all accidents to the well-being of Alberta and the real impact on the economy.

The direct costs of auto crashes are accounted for, including the costs of cleaning up after the crashes, auto and property damage repair, insurance payouts, policing costs, and medical and hospitalization costs. In addition, non-market or indirect costs to victims, families, workplaces, and communities—such as the economic value of lost productivity and earnings resulting from the impact of death and injuries—are also accounted for and should, in principle, be accounted for in a full cost-benefit GPI income statement. These indirect, non-market costs should also be deducted against economic income (GDP) since they represent a decline in well-being of the province and nation. In essence, these lost earnings and medical costs are already included in the provincial/national accounts and GDP. Efforts must be made to avoid double counting of health costs accounted for elsewhere in the GPI accounts as defensive costs.

3. Trends in Auto Crashes versus Economic Growth

The Alberta GPI auto crash index shows the trend over time in auto crashes and is plotted against economic growth (GDP) in Figure 1. Using raw data of auto crashes per 10,000 registered vehicles, we chose the lowest rate of auto crashes as the benchmark against which annual rates can be compared. In this case, 1961 saw the lowest rate of auto crashes at 318 per 10,000 registered vehicles. This benchmark rate is set to 100 basis points and every other year of data is then compared to the benchmark year to show trends over time. Figure 1 shows that the rate of auto crashes is declining (improving) in the 1990s but is still worse than the early 1960s. It also shows that auto crashes were the lowest in the 1960s at the same time as economic growth or prosperity was also lowest.

Figure 1: Alberta GPI Auto Crash Index versus Economic Growth, 1961 to 1999



4. Trends in Automobile Crashes

Auto accidents exact a large toll on Albertans and non-Albertans^a in terms of fatalities, injuries and economic costs. Some suggest using caution with auto crash reported data.^b According to Don Szarko⁶ of the Alberta Motor Association, Alberta has one of the highest per capita rates of auto crashes and fatalities in the country. Despite the importance of auto accidents and their significant economic cost, the issue tends to be avoided by political leaders.

In 1999, there were 25,451 injuries for a total of 25,798 total casualties; this year also saw 347 fatalities or 1.6 per 10,000 registered vehicles. Not since the first record in 1965 (with 331 fatalities),^c were so few fatalities recorded. The highest number of fatalities was in the year 1979 when 708 deaths were recorded (the highest rate was 1969 with 5.8 fatalities per 10,000 registered vehicles). Mortality due to auto crashes ranks second only to suicides as the leading cause of death of young people aged 30 years or less. Figures 2 and 3 below illustrate the trends in the rate of automobile accidents, mortality and injuries since 1961.

^a Alberta Infrastructure statistics include fatalities for both Albertans and non-Albertans and do not distinguish between the two.

^b Don Schopfloch of Alberta Health (personal communication, September 12, 2000) cautioned that data on auto crashes and injuries reported by Alberta Infrastructure may be incomparable with data recorded by Alberta Health related to fatalities and injuries. Alberta Infrastructure counts fatalities that involve both Albertans and non-Albertans with typically 40-50 fatalities per year being non-Albertans. Alberta Health only records Alberta resident fatalities. The highest rates of accidents are on the Trans-Canada #1 highway east of Calgary, due to high commuting volumes in and from Calgary. Don suggested that the ultimate measure of traffic safety is a “travel standardized rate” that adjusts for road conditions (type of road traveled) and other variables that impact accidents. Don noted that injury accident data from Alberta Infrastructure are highly unreliable because the data come from RCMP/police reports, which may not record injuries at the time of accident and which may later be reported by patients to their physicians in future diagnosis. Ultimately data should be cross-checked between injury reports with hospitalization statistics and physician visit information, which has not been done.

^c We did estimate auto crash rates from 1961-1964, extrapolating raw data available from 1965 to 1999, which suggest that auto crashes were the lowest in Alberta history in this period. However, in the absence of concrete figures, we cannot place much confidence in these extrapolated estimates.

Figure 2: Auto Crashes per 10,000 Registered Vehicles, 1961 to 1999

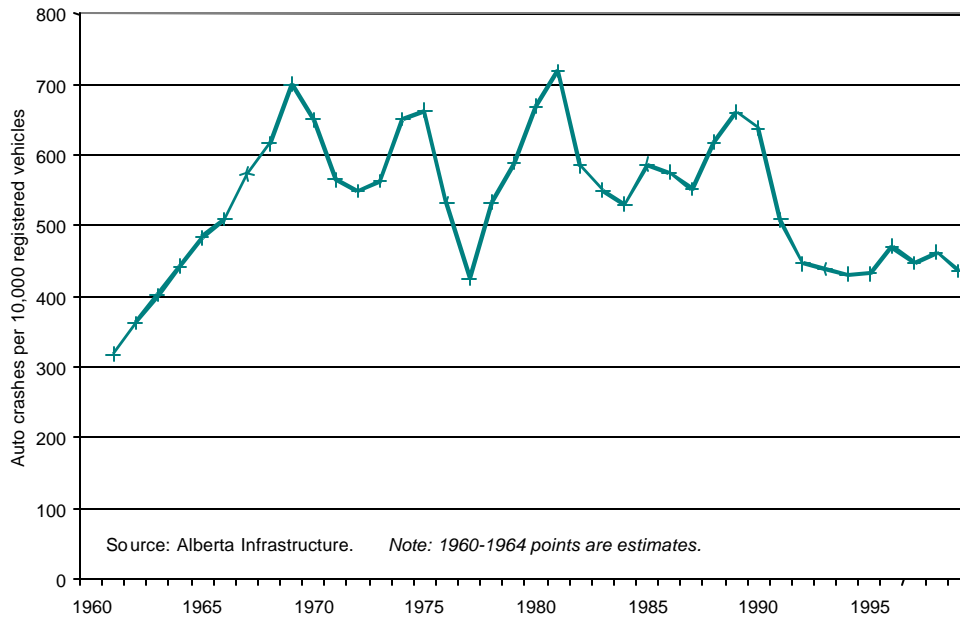
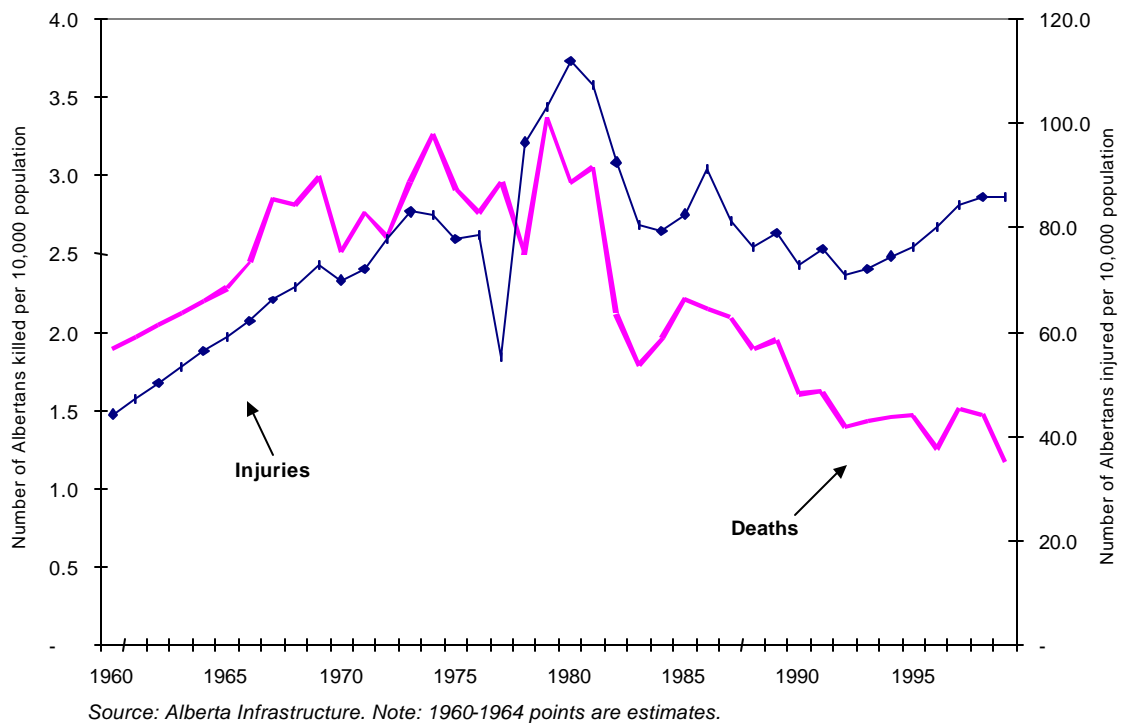


Figure 3: Auto Crash Fatalities and Injuries, Alberta, 1961 to 1999



Although fatalities are down, the number of injuries due to auto accidents increased in the 1990s. An upward trend, which began in 1993, resulted in 25,798 reported injuries or a rate of 85.8 per 10,000 population in 1999. Injury rates are higher than they were in the 1960s but lower compared to the 1970s and 1980s.

Overall, the number of automobile collisions per 10,000 population has remained relatively stable through the 1990s. In 1999 there were 95,246 reported collisions (321 per 10,000 population). The year 1981 had the highest number of collisions at 121,330 (529 per 10,000 population). The 1960s had the lowest level of collisions with an average (estimated) of 233 collisions per 10,000 people compared to 435 per 10,000 population in the 1980s, the decade with the highest rate.

Government officials at Alberta Infrastructure and the Alberta Motor Association attribute the reduced fatality rates to recent road safety campaigns and programs, use of seatbelts, airbags and improved automobile design, which they hope will continue the downward trend in fatalities. Overall the trends appear to be positive in the case of deaths but rising injuries are a concern.

The causes of automobile accidents are not well understood. Certainly the increased pace of life and distractions, including increased use of cell phones, may lead to less attentive driving habits and thus more accidents and injuries. According to the AMA's Don Szarko, Albertans have one of the poorest safety records and lowest rates of seat belt use in Canada.⁷

5. Setting a Target for Auto Crashes

Establishing a target for acceptable rates of auto crashes and injuries is challenging. We have chosen for simplicity's sake to adopt a lowest-rate-is-best approach to benchmarking performance over time, with 1961 recording the lowest collision rate in the past 40 years. According to the AMA's Don Szarko, the Association has begun to examine the need to set auto crash reduction targets for their Mission Possible campaign against which progress can be measured. They are now in the process of examining the success of their campaign, comparing the initial objectives with other successful initiatives around the world, such as the Swedish program, which has adopted "Zero-Vision" for traffic injuries and collisions (Johansson, Lie and Tingvall 1998).

The AMA exercise involves developing proper traffic safety indicators and measures. These will be forthcoming in a provincial trends study now being carried out by the Traffic Injury Research Foundation. An Alberta research advisory group is steering this research, and includes the AMA, Alberta Coalition of Auto Insurers, Alberta Center for Injury Control, provincial health, infrastructure, justice departments, using police, and regional health authorities in a consultative capacity. The research is being funded by the Coalition of Auto Insurers under the Mission Possible Traffic Safety Partnership Initiative.

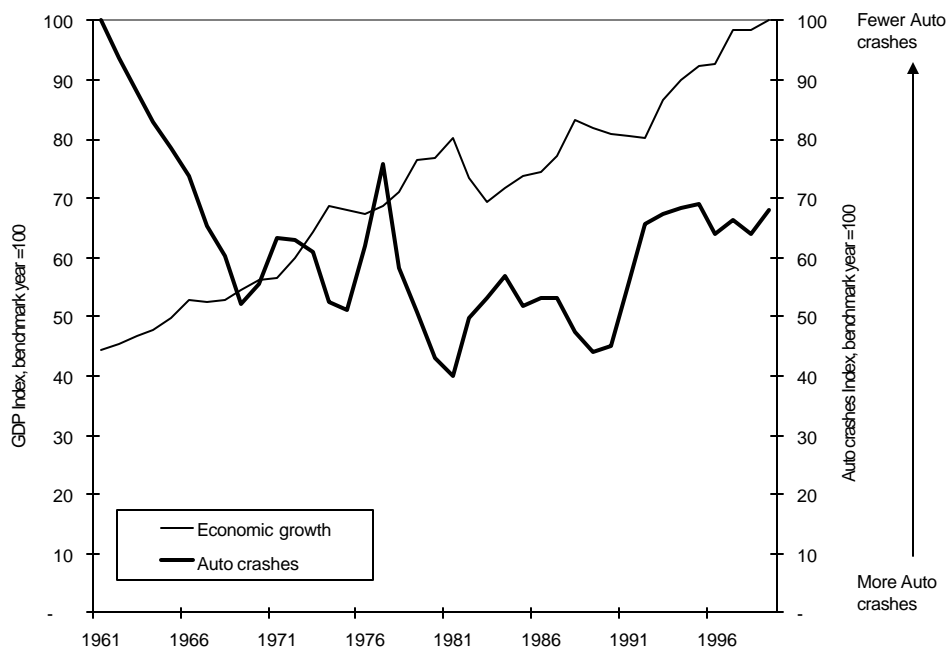
6. Auto Crashes as an Index

The GPI accounting system takes raw data and converts it to an index for comparison with other indicators and for aggregation with other indicators to create composite indices such as the Societal GPI Index (containing 22 social and human health indicators) and the aggregate GPI (containing all 51 indicators in the GPI accounts).

The auto crashes index comprises raw data on the incidence of auto crashes per adult Albertan (see Appendix B). The auto crash index is derived by first selecting a benchmark year, which in this case is the lowest auto crash rate over the 40-year study period: 1961. This figure for the lowest rate of auto crashes is set to 100 basis points then the entire raw data time series from 1961 to 1999 is divided through by the 1961 figure. In the absence of data from 1961 to 1964, these figures were estimated by extrapolating other historical time series data back to 1961. This indexing system thus assumes that fewer auto crashes are more desirable than more auto crashes.

Indexing is useful for comparing social indicator trends with, for example, Genuine Progress Indicators or composites of indices that would otherwise not be comparable. Figure 4 compares the auto crash index trend with the economic growth index over 40 years.

Figure 4: Auto Crashes in Alberta as an Index, 1961 to 1999



7. The Costs of Automobile Crashes

Auto crashes (like other injuries) impose a significant cost to society in terms of loss of life and in terms of the direct and indirect costs of injuries and property damage. Expenditures on cleaning up the damage due to automobile accidents are counted as a positive addition to Alberta's GDP accounts. We believe that such expenditures should be identified as "regrettable" in the province's income statement, and argue that the direct and indirect costs of automobile accidents be subtracted from Alberta's GDP (gross income or gross expenditure) line.

Accurate estimates of the full costs (direct and indirect) of auto accidents to households, businesses and government are not collected. The Alberta Motor Association, one of the most progressive motor associations in the country, provides very rough estimates of the full economic costs of automobile accidents for Alberta. These are based on the full costs of auto crashes estimated originally by the Urban Institute and Ted Miller (Bein, Miller and Waters 1994) for British Columbia. Miller has conducted and participated in numerous studies of crash costs and injury (Miller 1993; Miller, Pindus, and Douglas 1993; Miller and Guria 1991; Miller, Luchter and Brinkman 1989). The Urban Institute,^d on behalf of the British Columbia Ministry of Transportation and Highways calibrated a U.S. crash-cost model (based on Miller's U.S. work) using B.C. data; they estimated the cost of a fatal crash at \$2,900,000 (\$2,800,000 per statistical life, \$156,000 in direct costs and \$73,000 in forgone income taxes), the cost of an injury at \$100,000 and the cost of property damage only at \$6,000.

Alberta Transportation and Utilities (1995) also examined the total societal cost (direct and indirect) of collisions for Alberta considering the work of the Urban Institute, Miller's U.S. estimates, and the B.C. Ministry of Transportation and Highways' work, as well as recommendations provided by KPMG Consultants.^e At that time (1995), Alberta's societal cost estimates were based on a 1983 paper entitled *Societal Costs of Traffic Crashes in Alberta: Methodology and Estimates for 1982*.^f Development of a "made in Alberta" societal cost measure was recommended in the discussion paper. However, Alberta Infrastructure has not issued an official Alberta societal cost estimate to date.^g The most recent effort to estimate the true cost of auto crashes in Alberta is being conducted by the Calgary Health Authority, which is examining the hospital and medical costs to the regional health care system associated with auto crashes. Once completed, these estimates should provide more concrete cost figures of at least the direct costs of auto crashes on the health care system. Their methodological approach could then be applied across all of Alberta's Regional Health Authorities.

The AMA has estimated the full costs of auto crashes, based on the B.C. and Miller estimates. Using these cost estimates and auto crash statistics they estimate that in 1998 the total cost of automobile accidents in Alberta amounted to \$3,800-million.^g This is based on crash cost

^d The Urban Institute, based in Washington, D.C., is a major authority in statistical analysis of costs of highway crashes.

^e KPMG Consultants were commissioned in 1994 by Alberta Transportation and Utilities to examine a suitable approach to estimated societal costs of collisions in Alberta. They examined three cost options and proposed figures of \$3.8-million per fatality, \$100,000 per injury and \$12,000 per property damage only, higher than those used by the B.C. Ministry.

^f This paper was referenced in the Alberta Transportation and Utilities discussion paper *Societal Costs of Collisions in Alberta: A Discussion Paper*, but we could not ourselves source this document.

^g The cost of automobile accidents is based on estimates by economist Ted Miller (British Columbia) who has developed a full costing model that includes estimates of the cost of lost labour productivity due to

estimates of \$2.9-million per single fatality (the value of a statistical life), \$100,000 per injury, and \$7,000-\$8,000 per property damage incident due to a collision. These estimates are based on 1998 auto crash statistics of Alberta Infrastructure of 429 deaths and 24,935 injuries due to automobile accidents. The \$3,800-million figure includes direct costs (insurance payouts, hospitalization) of roughly \$900-million and indirect costs (including loss of labour productivity due to fatalities) of \$2,900-million.

The \$2.9-million fatality estimate is based on the willingness-to-pay or comprehensive concept where total societal costs include the value of the individual's life, and the cost saved by the rest of society in preventing an injury.^h The willingness-to-pay method attempts to put a dollar value on pain and suffering. In the cost of a fatal collision estimated by Miller and the Urban Institute for B.C. at \$2.9-million per fatality, 35 percent consists of direct or hard costs related to medical care, property damage, and lost production and 65 percent is the cost associated with pain, suffering and the value of a statistical life. According to the Alberta Workers Compensation Board, loss of labour productivity due to auto accidents is significant, accounting for about 30 percent of total down time for injured workers.

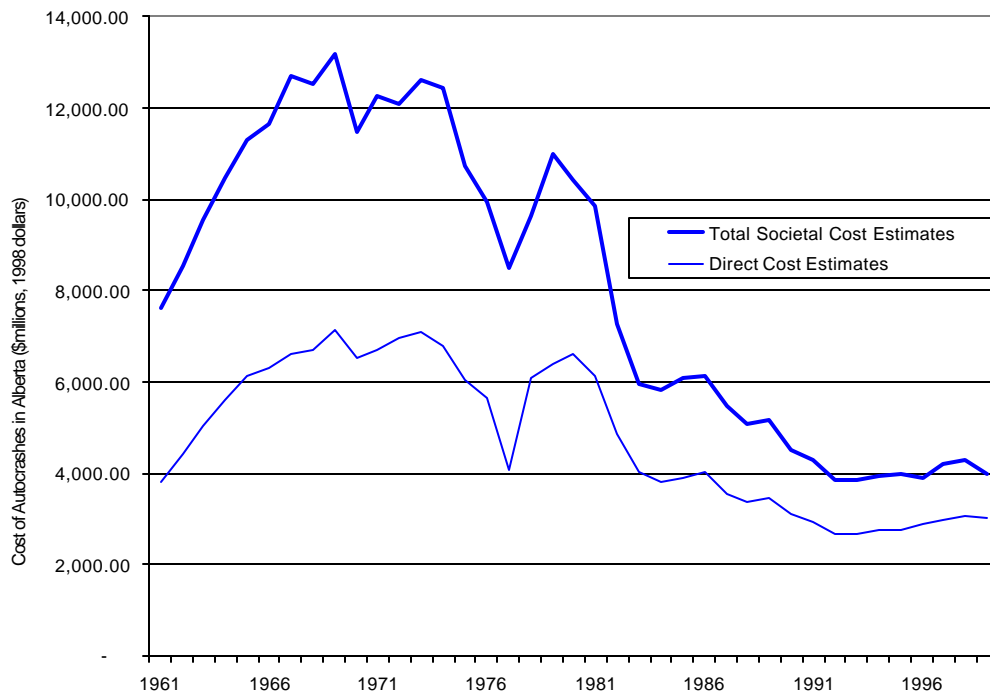
We took the 1998 direct cost estimates provided by the AMA and assumed a real constant cost of the GPI accounting period 1961 to 1999 applied to the auto crash fatality, injury and property damage data time series provided by Alberta Infrastructure. Our cost estimates thus include only direct costs and forgone income taxes resulting from fatalities plus the direct costs of injuries and property damage. We excluded the estimated cost of a lost statistical life, in terms of discounted value of labour productivity losses. This provides a longitudinal, real cost estimate of the costs of auto crash fatalities, injuries and property values lost. All costs are expressed in 1998 constant dollars. Ideally we would want annual, actual direct cost figures, which may eventually become available through the efforts of the Calgary Health Authority.

Applying these cost estimates to the actual number of fatalities, injuries and crashes, we then estimated the total number of auto crashes, fatalities and injuries. The direct costs of auto crashes range from a low of \$2,678-million (1998\$) in 1992 to a high of \$7,121-million (1998\$) in 1969. This total figure can be broken down even further. The total societal costs (indirect and direct costs) of fatalities range from \$951-million in 1999 to a high of \$6,101-million in 1967; the direct costs (including hospital costs, property damage and forgone income taxes) of fatalities range from \$53-million in 1999 to \$339-million in 1967. The total societal costs of injuries due to auto crashes range from \$2,096-million in 1992 to \$5,563-million in 1973. The total costs of property damage range from \$452-million in 1995 to \$1,333-million in 1969. The trends in the costs of auto crashes is shown in Figure 5 (see also Appendix B for data), with a steady decline in costs since the peak in the late 1960s.

fatalities and other direct costs. According to Don Szarko, Miller's estimates are conservative, particularly the estimates of direct costs, including health care expenditures, policy costs, property damage and other costs. However, according to Alberta Infrastructure's Liz Owen there is less confidence in Miller's B.C. estimates of direct and indirect costs when applied to Alberta. We were directed to the Canadian Council on Motor Transport for more current figures; however, after requesting cost data from CCMT, they informed us that cost data were not available. Thus, we opted to use the Miller estimates in the absence of more reliable data from provincial or federal government sources.

^h According to Alberta Transportation and Utilities' 1995 discussion paper, *Societal Costs of Collisions in Alberta*, virtually every U.S. federal government agency uses the willingness-to-pay concept and values for monetizing the benefits of saving lives.

Figure 5: The Direct and Indirect Costs of Auto Crashes in Alberta, 1961 to 1999



These are significant values in relationship to Alberta's GDP. For example in 1969 the total direct costs associated with auto crashes would have represented 22.6 percent of Alberta's GDP. This declined significantly to 2.8 percent of GDP in 1999. If we were to add the value of the loss of lives the figures would be even more dramatic from a high of 43.9 percent of GDP in 1967 to a more modest 3.6 percent of GDP in 1999.

The cost of auto crashes is then used in the GPI net sustainable income statement as a deduction of social costs against GDP (personal consumption expenditures) to yield a more accurate estimate of the net economic welfare of Alberta. While the economic cost estimates may seem high, we believe them to be conservative. Don Szarko of the AMA believes that the full direct costs of automobile accidents are in fact underestimated. For example, the current estimates exclude the costs of police and fire services dedicated to automobile accidents.

As noted, the Calgary Health Authority has initiated an accounting exercise to identify their total health care costs directly attributable to automobile accidents. Calgary is concerned that these accidents are a major public health issue and their impact on the regional health care system must be understood and accounted for. They are estimating the insurance claim and injury costs (including emergency, and hospitalization costs). Preliminary estimates, based on actual patient treatment and admissions due to automobile accidents, show \$6,800 for each emergency treatment (when treated and released the same day) and \$10,800 for each in-patient treatment (treated and overnight stay). They have also estimated property damage per collision at \$2,900 and the average bodily injury (legal) claim per injury at \$30,000 per claim. This only includes injuries reported to police. The minimum cost of a collision is estimated at \$2,800 per collision.

In addition, the Toronto-based Traffic Research Injury Foundation has begun a study to derive a suitable set of indicators for automobile accidents. The insurance industry itself recognizes the importance of these costs to its own viability, though figures from the industry are not readily available.

All of society bears the economic costs of auto accidents, such as costs of increased health insurance premiums. This results in a decrease in the welfare of the nation and its households. Costs also show up in increased public expenditures such as policing and transportation, and as infrastructure costs that are borne by all taxpayers. When you add the cost of loss of life and reduced productivity due to injury, the real costs are significant enough to warrant closer attention and management to mitigate the negative impacts on the well-being of society.

8. So What? Policy Recommendations

The true costs of injuries and auto crashes impose a significant regrettable economic burden on the economy and society. Paradoxically as injuries increase so does the economic barometer, the GDP. Alternatively, GPI accounting recognizes injuries and auto crashes as regrettable detractions from the well-being of households and society and thus as real costs that should be deducted from aggregate income and the GDP. Appreciating the significance of these costs on all households, government can better manage public policy and investments in mitigation of injuries and auto crashes. At the very least, GPI full cost-benefit accounts would alert governments to the rising (or decreasing) costs to the economy and lead to more prudent public policy and fiscal management, leading in turn to improved well-being. Fundamentally, injuries and auto crashes are a public health issue and should be managed as one no less important than suicide and disease, particularly if injuries are considered an epidemic by government itself. The Calgary Health Authority, for example, considers auto accidents as its number one issue. Working with organizations such as these, government can assist in educating and encouraging drivers to exercise more care, attentiveness, and defensive driving methods to reduce the incidence and economic cost of auto accidents.

References

- Alberta Health and Wellness. 1999. *The Report on the Health of Albertans – Looking through a wider lens*. November 1999. Edmonton, Alberta.
- Alberta Infrastructure. 2000. Alberta Collision Summary, 1965-1999. Alberta Infrastructure, Driver Safety Research, July 13, 2000.
- Alberta Transportation and Utilities. 1995. *Societal Costs of Collisions in Alberta: A Discussion Paper*. Alberta Transportation and Utilities, Motor Transport Services, Transportation Safety Branch. August 30, 1995
- Anielski, Mark and Jonathan Rowe. 1999. The Genuine Progress Indicator – 1998 Update. Redefining Progress, San Francisco. March 1999.
http://www.rprogress.org/pubs/pdf/gpi1998_data.pdf
- Edmonton Journal*, August 23, 2000. “Alta. Traffic deaths at 34-year low,” p. A1
- Hamilton, Clive and Denniss, Richard. 2000. *Tracking Well-being in Australia The Genuine Progress Indicator 2000*. The Australia Institute.
- Johansson, Roger, Anders Lie, and Claes Tingvall. 1998. “The Zero Vision: What it is and what it has done in Sweden.” Presentation at the 1998 Traffic Safety Summit, Kananaskis, Canada.
- The Newsletter of the International Center for Studies and Research in Biomedicine*. 1998. “Eradication of Road Death and Serious Injury, a Perspective from Environmental Epidemiology.” January 1998.
- Miller, Ted. 1994. “British Columbia Road User Unit Costs” from Peter Bein, Ted Miller and William Waters in *Proceedings, Canadian Transportation Research Forum Annual Conference*, 1994.
- Miller, T., 1993. “Costs and Functional Consequences of U.S. Roadway Crashes,” *Accident Analysis and Prevention*, 25(5):593-608.
- Miller, T., M. Pindus, and J. Douglass. 1993. “Motor Vehicle Injury Costs by Body Region and Severity,” *Journal of Trauma*, 34(2):270-275.
- Miller, T., and J. Guria. 1991. *The Value of Statistical Life in New Zealand: Market Research on Road Safety*.
- Miller, Ted R., Stephen Luchter and C. Philip Brinkman. 1989. “Crash Costs and Safety Investment.” *Accident Analysis and Prevention*. 21(4):303-315.
- Owen, Liz, Alberta Infrastructure. Personal communication. January 23, 2001.
- Schopfloch, Don, Alberta Health. Personal communication. September 12, 2000
- Statistics Canada. 2000. *Energy Resources Handbook*, July 2000
- Szarko, Don, Alberta Motor Association. Personal communication. August 30, 2000
- Tingvall, Claes. “The Zero Vision.” GLA Traffic Safety Programs, pp. 17-19.
- U.S. Department of Transportation. 1993. *Saving Lives and Dollars: Highway Safety Contribution to Health Care Reform and Deficit Reduction*. Office of Plans and Policy, National Highway Safety Administration. September 1993.

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

GPI Background Reports	GPI Accounts Covered by Report
	<ul style="list-style-type: none">• Forest fragmentation
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. Auto Crash Data, Index and Cost of Auto Crashes

Auto crash data, index, and cost of auto crashes

Year	Total auto crashes per Alberta adult (15+ years)	Auto crashes index benchmark where lowest (277.9 crashes per adult in 1961)= best (100 points)	Cost of auto crashes (\$ millions, 1998\$)
1961	277.9	100.00	3,809.46
1962	297.0	93.57	4,409.32
1963	316.1	87.92	5,021.69
1964	335.2	82.91	5,614.06
1965	354.3	78.44	6,136.90
1966	376.3	73.84	6,284.07
1967	424.6	65.45	6,623.17
1968	461.6	60.21	6,691.32
1969	531.9	52.25	7,121.41
1970	500.8	55.49	6,539.16
1971	439.2	63.27	6,708.82
1972	441.7	62.92	6,954.08
1973	456.3	60.90	7,078.62
1974	531.1	52.32	6,781.80
1975	545.3	50.96	6,021.98
1976	448.2	62.00	5,627.87
1977	367.5	75.61	4,050.23
1978	478.0	58.13	6,091.89
1979	546.7	50.84	6,394.78
1980	645.0	43.09	6,615.57
1981	695.2	39.98	6,132.71
1982	557.5	49.85	4,861.32
1983	522.3	53.21	4,045.22
1984	488.4	56.90	3,805.09
1985	536.3	51.82	3,881.65
1986	522.3	53.21	4,032.93
1987	523.0	53.14	3,542.43
1988	586.9	47.35	3,384.20
1989	630.9	44.05	3,449.68
1990	616.0	45.11	3,118.02
1991	497.3	55.88	2,934.33
1992	424.0	65.54	2,678.60
1993	413.5	67.21	2,688.90
1994	407.2	68.25	2,738.39
1995	403.2	68.92	2,769.89
1996	435.5	63.81	2,886.02
1997	418.2	66.46	2,984.40
1998	433.4	64.12	3,079.28
1999	408.4	68.05	3,026.43

Appendix C. U.S. GPI Methodology for the Cost of Automobile Accidents

The U.S. GPI estimates include an estimate of the cost of automobile accidents as a regrettable cost to be deducted from the GDP in calculating a net sustainable economic welfare figure that better reflects the associated depreciation of human, social and produced capital resulting from automobile accidents. These and other detailed GPI methodological descriptions for the U.S. GPI analysis can be found in Anielski and Rowe (1999).⁹ The following provides a description of the U.S. GPI methodology taken Anielski and Rowe methodology report *The Genuine Progress Indicator – 1998 Update*.

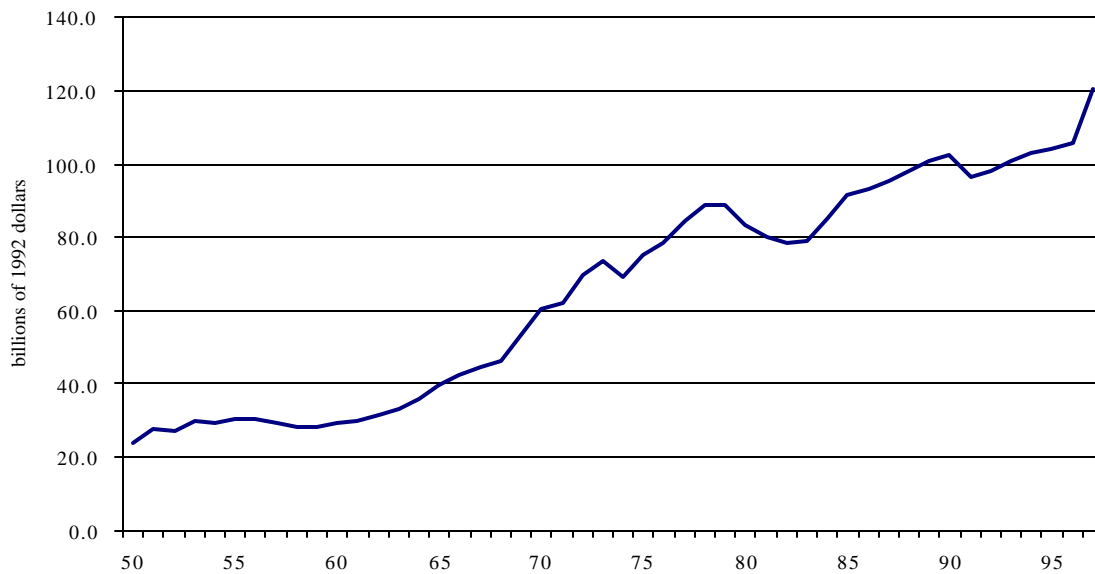
The Cost of Automobile Accidents in the U.S. GPI

The damage due and economic loss due to automobile accidents represents a real cost of industrialization and increasing traffic densities. Economic loss estimates are derived from *Statistical Abstract* and *Accident Facts* (National Safety Council, 1998), and are derived from *Insurance Facts* published by Insurance Information Institute, New York, N.Y. Economic loss figures cover only motor vehicle accidents on and off the road and all injuries regardless of length of disability. Economic loss includes wage loss; legal, medical, hospital, and funeral expenses; insurance administration costs; and property damage.

According to the Insurance Information Institute motor vehicle accidents have increased from 24.9 million accidents in 1972 to 34.5 million in 1995, while motor vehicle accident-related injuries have increased from 5.19 million to 6.02 million over the same period.

An interesting aside is the impact of all forms of accidents – traffic, work, home and public. The National Safety Council (*Accident Facts*) provides estimates of these four classes of accidents. The year 1997 recorded the second lowest unintentional-injury deaths per 100,000 at 35.0 compared to the lowest rate of 34.0 in 1992. Actual unintentional-injury deaths were estimated at 93,800 in 1997, the fifth leading cause of death exceed only by heart disease, cancer, stroke, and chronic pulmonary diseases. According to the National Safety Council, in 1995 roughly 60.5 million Americans sought medical attention or suffer at least one day of activity restriction from an injury. Each year about 2.6 million people are hospitalized due to unintentional injuries from motor vehicle-related accidents that in 1995 resulted in an estimated 2.5 million years of potential life lost before age 75.

Figure 12 **ECONOMIC COST OF AUTOMOBILE ACCIDENTS**



In terms of the economic loss due to motor vehicle accidents, 1997 recorded a significant increase of 13.7 percent over 1996 rising from \$119.3 billion in 1996 to \$135.7 billion in 1997, in current dollars. The GPI estimates for cost of automobile accidents shows a steady increase) in the economic loss (in constant 1992 dollars) from \$23.7 billion in 1950, \$29.5 billion in 1960, \$60.3 billion in 1970, \$83.7 billion in 1980, \$102.2 billion in 1990, and \$120.5 billion in 1997.

Appendix D. Australian GPI Methodology for Cost of Transport Accidents and Industrial Accidents

This appendix outlines the Australia GPI methods for estimating the cost of transport accidents and industrial accidents described in *Tracking Well-being in Australia The Genuine Progress Indicator 2000*. Appendix A of that report contains a complete set of Australia GPI data organized into a series of columns. Thus, references to “columns” in the description below relate to the columns as presented in the above-mentioned publication. For complete details see *Tracking Well-being in Australia The Genuine Progress Indicator 2000* prepared by Clive Hamilton and Richard Denniss, Australia Institute, 2000.¹⁰ The following outlines their methodological approach to costing auto crashes or transport accidents, which is instructive for future GPI accounting in Canada.

The costs of transport accidents in the Australian GPI

A nation that has more accidents is worse off; yet additional economic activity generated by accidents is recorded as an addition to GDP. The classic case is the damage caused by the Exxon Valdez oil spill disaster. In this section we account for the costs of transport accidents. In principle we should account for all accidents but, with the notable exception of industrial accidents evaluated in the next section, data limitations prevent this.

The monetary costs associated with transport accidents are defensive as they involve repairing damage to both property and humans. These costs, which are added to national income, should be deducted. Non-market costs include losses to victims and their families from pain and suffering. To the extent that monetary values can be assigned to these, they too are deducted from the GPI because they represent a decline in welfare. However, not all costs of accidents should be deducted, as that would involve double counting. Thus lost earnings and medical expenses are already reflected in the national accounts and, in the case of health costs, have been dealt with elsewhere in the GPI.

A number of studies of the costs of transport accidents have been conducted by the BTCE and the results are summarised in ABS (1997: 109-110). For 1993, the cost of road, air, rail and sea accidents in Australia amounted to \$6.597 billion, of which \$6.136 billion was due to road accidents. Excluding the costs of lost earnings and hospital, medical and rehabilitation costs,ⁱ the cost of accidents in 1993 was \$4.858 billion.^j Deflating by the price index for private final consumption, this is \$4.428 in 1989-90 prices. To form a time series, we assume that the real cost per accident has varied with changes in real GDP (ABS 5216.0). A consistent series on the number of accidents is not available as the definition changed in 1980, so we employ number of deaths as a proxy (Australian Transport Safety Bureau 2000). This may be preferable because a large part of the costs of accidents are due to deaths and because the relationship between number of accidents and number of deaths has diverged in the early 1980s (Vamplew 1987: 174; ABS 1997: 106).

ⁱ The data also exclude costs associated with search and rescue, accident investigation and losses to non-victims.

^j Made up of family and community losses (\$0.629 billion), pain and suffering (\$1.531 billion), vehicle damage (\$2.064 billion) and insurance administration (\$0.635 billion).

The costs of industrial accidents in the Australian GPI

In Australia, up to 2700 people are killed each year through workplace accidents – more fatalities than on the roads. In addition, around 650 000 workers each year suffer a work-related injury (Industry Commission 1995: 9-10). The costs of these deaths and injuries are enormous. Excluding pain and suffering, work-related accidents are estimated to cost between \$20 billion and \$37 billion each year.^k

Some of these costs are reflected in the national accounts. The Industry Commission (1995: 18-19) divides the costs into three groups.

Costs borne by employers. These include workers' compensation, loss of productivity and additional overtime, damage to equipment and legal penalties. They amount to around 40 percent of total costs but are best regarded as 'intermediate inputs' that are reflected in prices paid by consumers and are thus already included in the GPI.

Costs borne by the community. These include social welfare payments, medical and health costs and loss of human capital and are estimated to account for 30 percent of the total. They are for the most part dealt with elsewhere in the GPI, in the treatment of public health spending and social security.

Costs borne by injured workers. These include loss of income, pain and suffering, loss of future earnings, medical costs, losses of leisure, self-esteem and social status, and costs imposed on family members. They are estimated to amount to about 30 percent of the total. While medical costs and loss of income are reflected elsewhere in the GPI, the other costs are not measured in the Industry Commission's estimate of \$20 billion per annum. In the case of road accidents, these costs, along with family and community losses, amount to a third of the total.^l

We therefore estimate that the costs of work-related injuries in 1992-93 was 30 percent of \$20 billion, or \$6 billion (\$6.384 in 1989-90 prices). In the absence of historical data, this figure is indexed by the size of the labour force. It is also indexed by real GDP to reflect changes in the real cost of an accident.

^k The first figure is from the Industry Commission (1995: 17), the second from WorkSafe Australia (1994).

^l Only a small proportion of work-related accidents are road accidents (Industry Commission 1994: J2), so double counting with the costs of transport accidents is minimal.

Endnotes

¹ Alberta Health and Wellness. 1999. *The Report on the Health of Albertans – Looking through a wider lens*. November 1999. Edmonton, Alberta; p. 25.

² Alberta Health and Wellness. 1999. *The Report on the Health of Albertans – Looking through a wider lens*. November 1999. Edmonton, Alberta; p. 25

³ Alberta Health and Wellness. 1999. *The Report on the Health of Albertans – Looking through a wider lens*. November 1999. Edmonton, Alberta; p. 25

⁴ Alberta Health and Wellness. 1999. *The Report on the Health of Albertans – Looking through a wider lens*. November 1999. Edmonton, Alberta; p. 25

⁵ Alberta Infrastructure statistics.

⁶ Personal conversation August 30, 2000.

⁷ Personal communication with Don Szarko August 30, 2000.

⁸ Based on personal communication with Liz Owen of Alberta Infrastructure January 23, 2001 While we were advised to consult the Canadian Council on Motor Transport for most current and acceptable crash cost estimates for Canada and/or provinces, they informed us that figures were not available.

⁹ Anielski, Mark and Jonathan Rowe. 1999. *The Genuine Progress Indicator – 1998 Update*. Redefining Progress, San Francisco. March 1999. http://www.rprogress.org/pubs/pdf/gpi1998_data.pdf

¹⁰ Hamilton, Clive and Denniss, Richard. 2000. *Tracking Well-being in Australia The Genuine Progress Indicator 2000*. The Australia Institute.