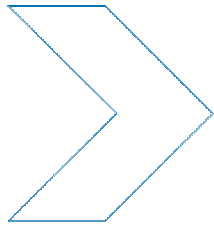


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The economic cost and impact of the road toll on South Australia

MRJ Baldock, AJ McLean

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The economic cost and impact of the road toll on South Australia

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ABSTRACT

The Bureau of Transport Economics (BTE) released a report in 2000 that documented the economic costs of road crashes across Australia in 1996. The present report used the BTE analyses and crash data from 2002 to estimate the annual economic costs of road crashes in South Australia, stating all figures in Australian dollars. It was found that the annual cost to the state is approximately 1.18 billion dollars. The savings to the South Australian economy associated with a relatively modest reduction in road crash injuries (10 fatalities, 100 serious injuries, 1,000 minor injuries) were calculated to be in excess of 60 million dollars.

KEYWORDS

Accident costs, Economic analysis

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Summary

A recent report by the Bureau of Transport Economics (BTE) (now the Bureau of Transport and Regional Economics) provided an analysis of the costs of road crashes in Australia using crash data from 1996 (Bureau of Transport Economics, 2000). This report concluded that road crashes in 1996 cost the Australian economy nearly 15 billion dollars.

By adjusting the costs presented in the BTE report according to inflation since 1996 and applying these costs to the number of crashes occurring in South Australia, it was possible to estimate the economic cost of road crashes in South Australia. This was done using 2004 prices from the March quarter and the most recently available complete set of South Australian crash figures (2002). The resulting estimate of the annual cost of road crashes in South Australia was nearly 1.18 billion dollars. The full details of these costs are provided in Table 1.

Table 1
Costs associated with road crashes in South Australia each year

Cost type	Cost per year in South Australia (\$)	Percent
Human costs		
Lost labour in the workplace	150,422,908	12.8
Lost labour in the household and community	138,414,413	11.8
Quality of life	167,608,441	14.3
Ambulance	3,090,022	0.3
Hospital in-patient	10,698,792	0.9
Other medical	15,847,103	1.3
Long term care	167,377,428	14.2
Coroner	103,362	0.0
Premature funeral	314,903	0.0
Legal	55,772,270	4.7
Correctional services	1,576,553	0.1
Workplace disruption and staff replacement	22,282,760	1.9
Vehicle costs		
Vehicle repair	271,914,655	23.1
Towing	3,339,721	0.3
Time lost due to vehicle unavailability	14,201,617	1.2
General costs		
Non-vehicle property damage	2,340,926	0.2
Police	5,368,755	0.5
Fire and emergency services	764,702	0.1
Insurance administration	72,256,579	6.1
Travel delays	72,228,543	6.1
Total	1,175,924,453	100.0

Given that road crashes in South Australia result in these great costs to the community and economy, considerable savings to the state could be made in the event of reductions in crash numbers. Following the calculation of crash costs in South Australia, the savings that would occur in the event of crash reductions were estimated, using reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries as a basis for the calculations. The estimate for these savings was

\$63,793,751, of which 80% were in human costs, 9% in vehicle costs, and 10% in general costs. These savings, broken down into the separate savings associated with fatalities, serious injuries, and minor injuries, are shown in Table 2. It can be seen in Table 2 that the greatest savings associated with the specified set of crash reductions would come from the reductions in serious injuries.

The various savings components presented in Table 2 can also be described in terms of specific benefits to the state. Some of these *annual* benefits are:

- a lifetime's labour for ten people (in the workplace, household and community);
- at least an additional 2,500 days of labour (in the workplace, household and community);
- a saving equivalent to over 850 typical ambulance call-outs;
- the availability of nearly 900 extra hospital bed days;
- approximately 4,400 fewer of each of the following: instances of use of hospital out-patient or emergency care, visits to a general practitioner, consultations with a specialist, use of prescription pharmaceutical products, and sessions of treatment by allied health services;
- no more need for the long term care of 18 people, five of whom would be severely and permanently disabled, thus lessening the need for the provision and co-ordination of carers, which, in turn, would also ease the burden on rehabilitation centres;
- a saving of approximately \$5.7 million in insurance costs (legal costs plus administration), which could result in lower insurance premiums;
- a saving of the cost of 535 days of prison time for one person;
- reduced workplace disruption and staff replacement, saving business in the state \$1.7 million;
- a saving of over 7,000 hours of police time;
- and reduced travel delays, saving business in the state \$4.7 million.

Table 2
Savings in road crash costs in South Australia associated with reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries, separately for each crash injury level

Cost type	Savings per year in South Australia					
	Fatal		Serious Injury		Minor Injury	
	\$	%	\$	%	\$	%
Human costs						
Lost labour in the workplace	6,495,326	66.5	3,276,651	33.5	0	0.0
Lost labour in the household and community	6,014,190	66.9	2,977,626	33.1	0	0.0
Quality of life	3,837,414	28.8	4,117,074	30.9	5,385,730	40.4
Ambulance	4,160	1.4	36,054	12.4	250,305	86.2
Hospital in-patient	16,515	2.3	660,719	92.9	33,679	4.7
Other medical	12,245	1.2	991,860	94.3	48,114	4.6
Long term care	0	0.0	10,882,798	100.0	0	0.0
Coroner	6,712	100.0	0	0.0	0	0.0
Premature funeral	20,448	0.0	0	0.0	0	0.0
Legal	162,961	3.7	2,597,529	59.8	1,586,543	36.5
Correctional services	102,374	100.0	0	0.0	0	0.0
Workplace disruption and staff replacement	97,153	5.6	998,476	57.3	647,127	37.1
Vehicle costs						
Vehicle repair	59,943	1.1	519,504	9.4	4,961,931	89.5
Towing	749	1.1	6,491	9.4	62,001	89.5
Time lost due to vehicle unavailability	3,185	1.1	27,603	9.4	263,648	89.5
General costs						
Non-vehicle property damage	525	1.1	4,550	9.4	43,458	89.5
Police	73,938	20.2	254,039	69.3	38,491	10.5
Fire and emergency services	172	1.1	1,486	9.4	14,196	89.5
Insurance administration	16,205	1.1	140,444	9.4	1,341,419	89.5
Travel delays	486,206	10.3	4,213,782	89.7	0	0.0
Total	17,410,421	27.3	31,706,686	49.7	14,676,642	23.0

The savings in Table 2 can also be expressed in terms of the savings per fatality, per serious injury and per minor injury (refer to Table 3). For some cost categories, the savings had to be calculated on a per crash basis and there was no available information to determine the relative cost ratios between crashes of different levels of injury severity. For these cost categories, fatal, serious injury, and minor injury crashes were assumed to cost the same amount. It is likely that the more severe crashes are actually more expensive for these cost categories, and so the savings shown in Table 3 are likely to underestimate the savings from reductions in fatalities and serious injuries, and overestimate the savings from reductions in minor injuries. Table 3 shows that fatalities are the most expensive for the majority of cost categories but that reductions in serious injuries are associated with the greatest savings for various medical services, legal services, and the costs of workplace disruption and staff replacement.

Table 3
Savings in road crash costs in South Australia associated with reductions of a single fatality, a single serious injury and a single minor injury, separately for each crash injury level

Cost type	Fatality	Serious injury	Minor injury
Human costs			
Lost labour in the workplace	649,533	32,767	0
Lost labour in the household and community	601,419	29,776	0
Quality of life	383,741	41,171	5,386
Ambulance	416	361	250
Hospital in-patient	1,652	6,607	34
Other medical	1,225	9,919	48
Long term care	0	108,828	0
Coroner	671	0	0
Premature funeral	2,045	0	0
Legal	16,296	25,975	1,587
Correctional services	10,237	0	0
Workplace disruption and staff replacement	9,715	9,985	647
Vehicle costs			
Vehicle repair	6,660	6,660	6,660
Towing	83	83	83
Time lost due to vehicle unavailability	354	354	354
General costs			
Non-vehicle property damage	58	58	58
Police	7,394	2,540	38
Fire and emergency services	19	19	19
Insurance administration	1,801	1,801	1,801
Travel delays	54,203	54,203	0
Total	1,747,522	331,107	16,965

In summary, road crashes in South Australia cost the state approximately \$1.18 billion in a year. Even a relatively small reduction in crash numbers would result in considerable savings to the economy. These savings would enable increased productivity for business in the state and would also reduce the need for government spending on the provision of services.

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1 Introduction

A recent report by the Bureau of Transport Economics (BTE) (now the Bureau of Transport and Regional Economics) provided an analysis of the costs of road crashes in Australia using crash data from 1996 (Bureau of Transport Economics, 2000). This report concluded that road crashes in 1996 cost the Australian economy nearly 15 billion dollars.

The aims of the present report are twofold. The first is to use the costs provided in the BTE report to estimate the current costs of road crashes in South Australia. This involves adjusting the costs in the BTE according to the number of crashes occurring in South Australia and according to the changes in dollar values since the writing of the BTE report. The previous analysis of road crash costs in South Australia was conducted in the early 1980s (Somerville & McLean, 1981). The second aim of the present report is to calculate the savings to South Australia resulting from reductions in the number of crashes occurring on the State's roads, and to translate these potential monetary savings into specific benefits to the State (e.g. more hospital beds, greater availability of police resources for other activities).

2 Method of calculating costs of road crashes in South Australia

The BTE report provides details of the components of crash costs associated with varying degrees of crash or injury severity. Where appropriate (e.g. hospital in-patient costs), different costs are estimated per crash participant for different levels of injury severity (fatal, serious, minor), whereas other crash cost variables (e.g. ambulance attendance costs) are estimated per crash for different levels of overall crash injury severity (resulting in fatal injury, resulting in serious injury, resulting in minor injury, property damage only). Fatal injuries are defined as those that result in the death of a crash participant within 30 days of the crash. Serious injuries are those that require admission to hospital for treatment but which do not result in a fatality, whereas minor injuries are those that require treatment at a hospital or by a doctor but which cannot be classified as serious or fatal. The BTE report used fatal and serious injury crash data from the Australian Transport Safety Bureau but used ratios between minor and serious injuries taken from hospital data to estimate minor injury crash numbers, and used insurance data to calculate the likely number of crashes only causing property damage.

The estimated crash costs are not presented separately for different states of Australia but are aggregated into national averages. It was assumed for the purposes of the present report, with a small number of exceptions, that South Australian costs per crash and per injury were comparable with those presented in the BTE report for Australia as a whole.

Crash costs in the BTE report were calculated using the human capital, rather than willingness to pay, approach. These two methods of calculating costs differ with respect to the monetary value attributed to human life. According to the human capital approach, people are treated as a labour source for production, and the value of a life is the discounted present value of a person's future earnings. The willingness to pay approach estimates the value of life in terms of how much people are prepared to pay to reduce risk, and produces values that reflect quality of life and the joy of living. As the willingness to pay approach includes elements that are not used in human capital calculations, it produces higher cost estimates. According to the BTE report, if the willingness to pay approach had been used, the total road crash costs for Australia would have been calculated to be either \$19 billion or \$24 billion, depending on whether potential earnings losses were still included or not. The human capital approach, as previously noted, produced a total cost estimate of \$15 billion (Bureau of Transport Economics, 2000). The authors of the BTE report chose to use the human capital approach because it provides a "reliable lower bound estimate of the social cost of crashes" (Bureau of Transport Economics, 2000, p21). It must be noted that the willingness to pay approach has been adopted for cost-benefit analyses of road safety

programs in the UK, US, New Zealand, and in some European countries (Bureau of Transport Economics, 2000).

To determine the total crash costs for South Australia, it was necessary to have accurate information regarding the number of crashes of different levels of severity occurring within a year. The most recent official publication of this type (Transport SA, 2003) provides the crash numbers for the calendar year 2002. As the BTE report estimated crash costs on the basis of one year of crash data, crash costs in the present report were based on the 2002 crash figures. The number of crashes and injuries of different levels of severity in 2002, with 1996 figures provided for comparison, are shown in Table 2.1. All figures are taken from the report by Transport SA (2003). It must be noted that these data represent *police-reported* crash numbers. Police-reported crash numbers are likely to be affected by under-reporting of property damage only crashes (Bureau of Transport Economics, 2000) and may also differ from other potential data sources (e.g. hospital data) in terms of numbers of injury crashes. However, the data used by the BTE report for serious injury and fatal crashes were police-reported data, and such data are conventionally used when determining official crash numbers in Australian jurisdictions.

Table 2.1
Road crashes and injuries in 1996 and 2002 (data taken from Transport SA(2003))

Crash or injury severity	1996	2002
Injury severity		
Fatality	181 ^a	154
Serious injury	1,720	1,538
Other injury	6,775	8,391
Total injury	8,676	10,083
Crash severity		
Fatal crash	162 ^b	138
Serious injury crash	- ^c	1,199
Other injury crash	-	6,254
Property damage only	32,590	32,539
Total crashes	38,939	40,130

Note: Numbers of serious injury crashes and other injury crashes for 1996 were not provided by Transport SA (2003).

^a Given in BTE (2000) as 182.

^b Given in BTE (2000) as 163

^c Given in BTE (2000) as 1,323

All costs in the BTE report are in 1996 Australian dollars. In order to update the costs to present day values, the costs per crash presented in the BTE report were adjusted using Consumer Price Index (CPI) increases between 1996 and 2004. Although the crash figures used to calculate South Australian crash costs in this report were taken from 2002 (due to the lack of more recent data), the dollar values were based on those of the present day (2004). The 1996 crash cost figures were assumed to represent dollar values from the midpoint of 1996 (i.e. the June quarter). The most recently published CPI figures at the time of writing were for the March quarter, 2004 (Australian Bureau of Statistics, 2004). As the crash costs in the BTE report are for Australia as a whole, CPI increases for Australia as a whole (i.e. eight cities combined) were used to update the crash costs presented in the BTE report. The ABS reports that the CPI for June 1996 relative to 1989-1990 was 119.8, while that for March 2004 relative to 1989-1990 was 144.1 (Australian Bureau of Statistics, 2004). Therefore, to adjust 1996 costs to reflect 2004 dollar values, 1996 costs were multiplied by the ratio between these two indices (i.e. 144.1 divided by 119.8, which equals approximately 1.203). This was done uniformly for all types of cost and thus any differences across costed items in terms of CPI increases or 'real' cost increases (or decreases) were not taken into account. Therefore, some costs in the present report may be marginally under- or over-estimated, according to the relative changes in those cost types compared to overall CPI increases between 1996 and 2004.

3 Costs of road crashes in South Australia

Crash costs for South Australia are presented in this section using the same sub-sections presented in the BTE report. The summary of crash costs begins with what the BTE report called “human costs” (lost labour in the workplace, lost labour in the household and community, quality of life, ambulance, hospital in-patient, other medical, long term care, coroner, premature funeral, legal, correctional services, workplace disruption and staff replacement), followed by “vehicle costs” (repairs, towing, unavailability of vehicles), followed by “general costs” (non-vehicle property damage, police, fire and emergency services, insurance administration, travel delays), and finishes with overall costs (the sum of the all the human, vehicle and general costs). Within each of these sections, estimated costs are presented in the same order as they are in the BTE report.

3.1 Human costs

3.1.1 Lost labour in the workplace costs

These are costs associated with loss of labour resulting from fatal injuries or injuries preventing immediate return to work. A fatality or permanent injury preventing the injured party from ever returning to work were both estimated by the BTE to cost \$540,000 in 1996 dollars. For serious injuries (requiring hospital admission), the BTE estimated the time absent from work to be the average length of stay in hospital plus two days recuperation for each day of hospitalisation. As the average stay in hospital for seriously injured crash participants was 8.3 days, the estimated average time absent from work was 25 days. Combined with the costs of permanent injuries, this gave an estimated cost per serious injury for absence from work of \$27,241 in 1996 dollars. Loss of labour from minor injuries was estimated to be small enough that it could be excluded from the calculations.

The conversion of the BTE report costs to estimated costs for South Australia, using 2002 crash data and CPI increases between 1996 and 2004, is shown in Table 3.1. The second column shows the BTE report cost estimates per injured person, the third shows these costs adjusted to present day prices using CPI increases since 1996 (i.e. the costs in the second column multiplied by approximately 1.203), and the final column shows the total costs in South Australia for these injury types using 2002 crash data (i.e. the costs in the third column multiplied by 154 for fatalities and 1,538 for serious injuries). Table 3.1 shows that the total lost labour cost to South Australia for fatalities, using 2002 crash statistics and 2004 prices, was \$100,028,013 and for serious injuries was \$50,394,895. Summing these figures, the total cost of lost workplace labour per year in South Australia attributable to road crashes is estimated to be \$150,422,908.

Table 3.1
Lost labour in the workplace costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	540,000	649,533	100,028,013
Serious injury ¹	27,241	32,767	50,394,895
Total			150,422,908

¹ ‘Serious injury’ denotes a seriously injured person

3.1.2 Lost labour in the household and community costs

In addition to losses of labour in the workplace, road crashes result in losses of labour in the household and in the community. Calculations for these losses resemble those for labour losses in the workplace. The BTE assigned costs in 1996 dollars of \$500,000 per fatality and \$24,755 per serious injury (including permanent injuries). As with lost labour in the workplace, minor injuries were excluded from the calculations.

Table 3.2 shows the calculations for costs associated with lost labour in the household and community. Again, the second column shows the costs in the BTE report, the third shows these costs in 2004 prices, and the fourth column shows the costs for South Australia on the basis of crash statistics from 2002. The annual total cost to South Australia for lost labour in the household and community resulting from road crashes is approximately 138 million dollars.

Table 3.2
Lost labour in the household and community costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	500,000	601,419	92,618,531
Serious injury	24,755	29,776	45,795,882
Total			138,414,413

3.1.3 Quality of life costs

The effects of injuries on quality of life were estimated in the BTE report using compensation payouts as a proxy measure, with fatalities regarded as maximum incapacity and costed according to the maximum compensation value. Lost quality of life of family and friends was not included in the costs. It was estimated that the quality of life cost per fatality was \$319,030, and that the cost per serious injury was \$34,228. The cost per minor injury was not stated but the total quality of life cost for minor injuries was estimated as \$388,000,000 for Australia in 1996 (it was \$628,000,000 for fatalities and \$753,000,000 for serious injuries).

Adjusting these figures for 2004 dollar values gives a cost per fatality of \$383,741 and a cost per serious injury of \$41,171. Applying these costs to the number of fatalities and serious injuries per year in South Australia, using 2002 figures, gives a total quality of life cost for fatalities of \$59,096,180 and for serious injuries of \$63,320,600.

To calculate the cost for minor injuries, it was assumed that the ratio between costs per minor injury and costs per serious injury in 2002 was the same as for 1996. It was also necessary to take into account the change between 1996 and 2002 in the ratio between the number of minor injuries and the number of serious injuries. In South Australia in 1996, for every serious injury, there were approximately 3.94 minor injuries (6,775 minor injuries divided by 1,720 serious injuries) (Transport SA, 2003). It is assumed for this analysis that this ratio for South Australia was representative of that for all of Australia. In 2002 in South Australia, for every serious injury, there were 5.46 minor injuries (8,391 minor injuries divided by 1,538 serious injuries). The total cost for Australia for minor injuries in 1996 was \$388,000,000, compared to \$753,000,000 for serious injuries, giving a ratio of approximately 0.515. This needs to be adjusted for the increase in the ratio of minor injuries to serious injuries from 3.94 to 5.46, giving an estimated ratio of total minor injury costs to total serious injury costs of approximately 0.714 (0.515 multiplied by 5.46 divided by 3.94). When this ratio of 0.714 is applied to the total serious injury costs of \$63,320,600 for South Australia in 2002, it gives a total minor injury cost of \$45,191,661.

Summing the figures for quality of life costs for fatalities, serious injuries and minor injuries, the total quality of life costs of road crashes each year in South Australia, using 2002 crash data and 2004 prices, is approximately \$168 million. These results are summarised in Table 3.3.

Table 3.3
Quality of life costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	319,030	383,741	59,096,180
Serious injury	34,228	41,171	63,320,600
Minor Injury			45,191,661
Total			167,608,441

3.1.4 Ambulance costs

Ambulance costs for road crashes include attendance at the scene, treating injured parties at the scene, and transport of injured persons to and between hospitals. It was estimated in the BTE report that the cost of ambulance services for all of Australia in 1996 was \$39.6 million. To determine the cost of ambulance services in South Australia, the cost of \$39.6 million needs to be adjusted according to the relative crash numbers in South Australia in 2002 (40,130) compared to all of Australia in 1996 (618,600). When adjusted in this way (multiplied by 0.0649), the cost becomes \$2,568,943.

This cost also needs to be adjusted according to CPI increases since 1996. This produces a total cost to South Australia per year, at 2004 prices, of \$3,090,022. The BTE report estimated that 20 percent of ambulance services are for fatal and serious injury crashes, 68 percent are for minor injury crashes, and 12 percent for property damage only crashes (for which ambulances are often called before it is determined that no-one is injured). This gives costs for fatal and serious crashes in South Australia of \$618,004 (\$462 each), costs for minor injury crashes of \$2,101,215 (\$336 each), and costs for property damage only crashes of \$370,803 (\$11 each).

3.1.5 Hospital in-patient costs

Hospital in-patient costs refer to the costs of keeping a patient in hospital and providing them with treatment for their injuries. In the BTE report, these costs were assumed to be directly proportional to the length of time in hospital. Approximately a third of fatally injured crash participants (681 out of 1,970) died after admission to hospital. These fatally injured crash participants were estimated to have been in hospital for six days. The average stay in hospital for patients with serious injuries was 8.3 days. A small proportion of crash participants with minor injuries was treated at hospital and their stay in hospital was estimated as one day. The estimated costs per crash participant given in the BTE report were \$1,373 for a fatality, \$5,493 for a serious injury, and \$28 for a minor injury.

The calculations of annual hospital in-patient costs for injured crash participants in South Australia are shown in Table 3.4. It can be seen that the total cost is over ten million dollars.

Table 3.4
Hospital in-patient costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	1,373	1,651	254,330
Serious injury	5,493	6,607	10,161,857
Minor Injury	28	34	282,604
Total			10,698,792

3.1.6 Other medical costs

Medical costs, other than ambulance and in-patient costs, include costs associated with hospital accident and emergency departments, outpatient clinics, general practitioners, specialists and allied health services (e.g. occupational therapy, physiotherapy), and pharmaceutical products. In the BTE report, costs per usage of each of these services were used to estimate total “other medical” costs for each level of injury severity. The average fatality cost \$1,018, the average serious injury cost \$8,246 and the average minor injury cost \$40.

The calculations for converting these 1996 costs into estimated current costs for South Australia are provided in Table 3.5. It can be seen that the total of other medical costs resulting from road crashes in South Australia per year is nearly 16 million dollars.

Table 3.5
Other medical costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	1,018	1,224	188,571
Serious injury	8,246	9,919	15,254,811
Minor Injury	40	48	403,721
Total			15,847,103

3.1.7 Long term care costs

Long term care is required for those with permanent injuries and may be provided in nursing homes or private homes. The BTE report estimated that 18% of those seriously injured in road crashes in 1996 were disabled as a result of their injuries. Furthermore, nearly 5% of seriously injured crash participants were estimated to have suffered a “permanent and severe disability affecting their core communication, mobility and self-care abilities” (Bureau of Transport Economics, 2000, p48). In South Australia, in-patient rehabilitation services are available to seriously injured persons discharged from hospital so that they may relearn abilities lost through severe injury. Many people require on-going care at home after exiting the rehabilitation centre, and, when a personal friend or relation is not available to provide such care, considerable expense must be directed into co-ordination and provision of carers. A carer can be required to provide up to a maximum of 50 hours of care per week for one client. When there is a carer shortage, clients may have to remain for longer periods as in-patients at a rehabilitation centre (Dr R. Marshall, personal communication, 22/12/2004).

The cost per year for long term care of disabled crash participants was estimated by the BTE report to be an average of \$90,476 per serious injury. Adjusted for CPI increases since 1996, this cost in 2004 dollar values was \$108,828 per serious injury. Therefore, long term care in South Australia for injured crash participants, using 2002 crash statistics, is \$167,377,428 per year.

3.1.8 Coronial costs

Road crashes frequently require a coroner’s report and the cost for this per fatality, estimated by the BTE using 1996 data, was \$558. Adjusted for CPI increases since 1996, this cost would now be \$671. The total cost for South Australia per year for Coroner’s reports, using the 154 fatalities in 2002 as the basis for the cost estimate, would be \$103,362.

3.1.9 Premature funeral costs

The cost of a funeral for a person fatally injured in a road crash would otherwise have accrued interest until the expected end of that person's lifetime. This loss of money that otherwise could have accrued interest was calculated by the BTE to be \$1,700 per fatality in 1996. In 2004 dollar values, this cost per fatality is approximately \$2,045. Using 2002 crash statistics, the premature funeral costs resulting from road crashes in South Australia each year are \$314,903.

3.1.10 Legal costs

Legal costs associated with road crashes can result from insurance claims or criminal proceedings. The most expensive of these is associated with insurance claims, which amounted to a cost of \$788,000,000 in Australia in 1996. Per fatality, the insurance claims legal cost was \$12,000. Per serious injury, it was \$21,147 and per minor injury, it was \$1,264. The total cost in Australia in 1996 for property damage only crashes was \$29,961.

These insurance claims legal costs are converted to yearly costs for South Australia in Table 3.6, with the relatively small costs associated with crashes causing only property damage excluded. The total insurance claim legal costs per year are over 54 million dollars.

Table 3.6
Insurance claims legal costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	12,000	14,434	2,222,845
Serious injury	21,147	25,436	39,121,209
Minor Injury	1,264	1,520	12,757,570
Total			54,101,623

Legal costs associated with road crash-related criminal proceedings in Australia in 1996 were \$1,548 per fatality, \$448 per serious injury and \$55 per minor injury. Table 3.7 shows the conversion of these costs into costs per year in South Australia. The total legal costs for criminal proceedings associated with road crashes each year are approximately 1.7 million dollars.

Table 3.7
Criminal proceedings legal costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	1,548	1,862	286,747
Serious injury	448	539	828,784
Minor Injury	55	66	555,116
Total			1,670,647

3.1.11 Correctional services costs

These costs apply to the cost of providing correctional services (imprisonment, periodic detention, community service orders) to those who committed a criminal offence related to a road crash. Only prison-related costs were used in the BTE report (costs of lost productivity of prison inmates were not included). The total costs for Australia in 1996 were calculated to be \$16.8 million. This was converted to a cost per fatality of \$8,511.

Adjusting this cost for CPI increases since 1996 produces a cost per fatality at 2004 prices of \$10,237. This produces a total cost for correctional services related to road crashes in South Australia of \$1,576,553 per year.

3.1.12 Workplace disruption and staff replacement costs

Injuries sustained by workers in road crashes can result in productivity declines, other staff having to work overtime, and the need for temporary staff. In the case of fatalities or serious injuries, organisations must bear the costs of the recruitment and training of replacement workers. These costs were estimated by the BTE as \$8,077 for fatalities, \$8,301 for serious injuries, and \$538 for minor injuries.

Table 3.8 shows the use of the BTE figures to determine annual road crash-related costs in South Australia for workplace disruption and staff replacement. The total of these costs to businesses are estimated to be over 22 million dollars.

Table 3.8
Workplace disruption and staff replacement costs associated with road crashes in South Australia

Crash injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	8,077	9,715	1,496,160
Serious injury	8,301	9,985	15,356,559
Minor Injury	538	647	5,430,042
Total			22,282,760

3.1.13 Total human costs

On the basis of the calculations in this section, the total human costs for South Australia per year that result from road crashes is estimated to be over 733 million dollars. The components of this cost are shown in Table 3.9.

Table 3.9
Human costs associated with road crashes in South Australia

Human cost type	Cost per year in South Australia (\$)	Percent
Lost labour in the workplace	150,422,908	20.5
Lost labour in the household and community	138,414,413	18.9
Quality of life	167,608,441	22.9
Ambulance	3,090,022	0.4
Hospital in-patient	10,698,792	1.5
Other medical	15,847,103	2.2
Long term care	167,377,428	22.8
Coroner	103,362	0.0
Premature funeral	314,903	0.0
Legal	55,772,270	7.6
Correctional services	1,576,553	0.2
Workplace disruption and staff replacement	22,282,760	3.0
Total	733,508,955	100.0

3.2 Vehicle costs

3.2.1 Vehicle repair costs

The costs for repairs to crash-involved vehicles in Australia in 1996 totalled nearly \$3.9 billion. The BTE report estimated the cost per vehicle type, with estimates of \$3,100 per car, \$4,400 per motorcycle, \$5,500 per rigid truck, \$11,900 per articulated truck and \$2,000 per bus. To determine the vehicle repair costs for South Australia per year, the repair costs per vehicle presented in the BTE report were adjusted according to CPI increases since 1996 and then multiplied by the number of vehicles of each type involved in crashes, as reported in Transport SA (2003). These calculations are shown in Table 3.10, where it can be seen that total vehicle repair costs per year in South Australia are over \$270 million.

Table 3.10
Vehicle repair costs associated with road crashes in South Australia

Type of vehicle	BTE (2000) repair cost per vehicle (\$)	CPI adjustment (\$)	Number of crash-involved vehicles (Transport SA, 2003)	Cost for SA crashes (\$)
Cars	3,100	3,729	66,299	247,215,578
Motorcycles	4,400	5,292	833	4,408,642
Rigid trucks	5,500	6,616	1,499	9,916,798
Articulated trucks	11,900	14,314	657	9,404,149
Buses	2,000	2,406	403	969,487
Total				271,914,655

3.2.2 Towing costs

The total cost of towing vehicles damaged in road crashes in Australia in 1996, according to the BTE (2000), was \$42.8 million. This cost, at 2004 prices, is approximately \$51.5 million. Assuming that the number of crash-involved vehicles per crash in South Australia is the same as was the case for all of Australia in 1996, and also assuming that the proportion of vehicles towed from the scene of South Australian crashes is the same as the proportion towed from the scene Australia-wide in 1996, the total cost of towing for South Australian crashes can be calculated by adjusting the cost of \$51.5 million according to the relative crash numbers in South Australia. As stated in Section 3.1.4., in Australia in 1996, there were 618,600 crashes, whereas in South Australia in 2002 there were 40,130 (i.e. 6.49% of the number of crashes used as the basis for the BTE report). Adjusting the cost of \$51.5 million according to this difference in crash numbers gives a total towing cost for South Australian road crashes per year of \$3,339,721.

3.2.3 Time lost costs due to vehicle unavailability

There are costs associated with the unavailability of vehicles damaged in road crashes. For commercial owners, these costs include lost business, employee time wasted, or work delayed or cancelled. For private owners, there is the cost of a rental vehicle, or the inconvenience of public transport, lost leisure time and some trips not being taken. These costs were estimated by the BTE to be \$182 million in 1996. At 2004 prices, this cost is approximately \$219 million. Adjusting this cost according to the relative number of crashes in South Australia in 2002 (i.e. calculating 6.49%) gives an estimate of total costs associated with lost time due to vehicle unavailability in South Australia each year of \$14,201,617.

3.2.4 Total vehicle costs

The various vehicle costs associated with road crashes in South Australia per year are shown in Table 3.11. It can be seen that the total of these costs is over \$289 million.

Table 3.11
Vehicle costs associated with road crashes in South Australia

Vehicle cost type	Cost per year in South Australia (\$)	Percent
Vehicle repair	271,914,655	93.9
Towing	3,339,721	1.2
Time lost due to vehicle unavailability	14,201,617	4.9
Total	289,455,993	100.0

3.3 General costs

3.3.1 Non-vehicle property damage costs

These costs apply to street furniture (e.g. signs, poles), fences and housing damaged as a result of being struck by vehicles in road crashes. The BTE report estimated the cost of non-vehicle property damage for Australia in 1996 to have been \$30 million. The total number of crashes in Australia in 1996 was estimated by BTE to be 618,600, meaning that the non-vehicle property damage costs per crash was approximately \$48.

Adjusting this cost to reflect 2004 prices gives a cost per crash of \$58. If this cost is applied to the total number of crashes in South Australia in 2002 (40,130), it gives a total cost for non-vehicle property damage of \$2,340,926.

3.3.2 Police costs

The costs of police response to road crashes encompass costs associated with attendance at the scene of crashes, administration of crash reports, notification of next of kin in the case of fatal crashes, assisting coronial attendance and investigation, crash investigation that may lead to criminal prosecution, administration of fines, and road audits for serious crashes. The estimated costs provided in the BTE report were \$6,147 per fatality, \$2,112 per serious injury and \$32 per minor injury.

Calculations to determine crash costs in South Australia each year associated with police response to crashes are shown in Table 3.12, using only injury data. As this excludes property damage only crashes, the resulting total cost would under-estimate the true cost of police response to road crashes. This estimate of police costs attributed to road crashes each year in South Australia is over five million dollars.

Table 3.12
Police costs associated with road crashes in South Australia

Injury level	BTE (2000) costs per injury (\$)	CPI adjustment (\$)	Costs for SA crashes (\$)
Fatal	6,147	7,394	1,138,652
Serious injury	2,112	2,540	3,907,126
Minor injury	32	38	322,976
Total			5,368,755

3.3.3 Fire and emergency services costs

These services must attend road crashes when there is a need for fire control, hazard management or rescue assistance. The estimated cost provided in the BTE report for the utilisation of these services across all of Australia in 1996 was \$9.8 million. These costs were for a total number of crashes in 1996 of 618,600. As noted earlier, the total number of crashes in South Australia in 2002 was 40,130 (6.49% of the total for Australia in 1996) and, therefore, the total cost in 1996 dollars for South Australian crashes would be \$635,748 (6.49% of 9.8 million). This cost, using 2004 dollar values, would be \$764,702.

3.3.4 Insurance administration costs

These are the costs associated with underwriting insurance claims, both for vehicle damage and injuries (Compulsory Third Party insurance in South Australia). The costs for insurance administration in 1996 for all of Australia, according to the BTE report, were \$926 million (\$683 million for vehicle damage and \$243 million for injuries). As noted previously, these costs were for a total number of crashes in 1996 of 618,600, while the total number in South Australia in 2002 was 40,130 (6.49% of the 1996 Australian total). Therefore, the insurance administration costs for South Australia, using 1996 dollar values, would be \$60,071,743 (6.49% of 926 million). Adjusting this cost for CPI increases since 1996 produces an insurance administration cost for South Australia per year of \$72,256,579.

3.3.5 Travel delay costs

Road crashes often cause delays for other traffic because of blockage of the road and restriction of traffic flow to allow follow-up crash investigation. The costs for all of Australia in 1996 resulting from these travel delays were estimated in the BTE report to be \$1.45 billion. In order to calculate an estimate of South Australian costs, this total was adjusted down according to comparative crash numbers. As the BTE report assumed that significant travel delays were only caused by serious injury or fatal crashes, only these crashes were used to adjust the estimated travel delays cost. In Australia in 1996, there were 19,280 serious or fatal crashes, compared to 1,337 in South Australia in 2002. To adjust the cost appropriately, it is therefore necessary to multiply 1.45 billion by 1,337 and divide by 19,280. This produces a travel delay cost in South Australia, at 1996 prices and using 2002 crash data, of \$100,552,386.

However, it was claimed in the BTE report that traffic flows in Sydney and Melbourne were higher than those in other capital cities (1,137 versus 679 vehicles per hour), and so travel delay costs per crash would be *lower* for Adelaide crashes than for those in Sydney and Melbourne. For this reason, the initial calculated cost of \$100,552,386 for South Australian travel delays in the present report needs to be revised down. As the differences in traffic flow were assumed in the BTE report to only apply to the cities and not to the rural areas of the different states, all rural crashes in South Australia were estimated by the BTE to produce the same travel delays as those in rural Victoria and New South Wales. However, in order to produce a *conservative* estimate of South Australian travel delay costs in the present report, it was decided to adjust the cost down using the ratio of traffic flows in Adelaide to those of Sydney and Melbourne (a ratio of 679:1,137). When the estimated cost for South Australia was adjusted according to this ratio (i.e. multiplied by 679 and divided by 1,137), the new cost was \$60,048,434.

Finally, this cost needs to be adjusted according to CPI increases since 1996. This final adjustment results in estimated travel delay costs attributable to road crashes in South Australia each year of \$72,228,543.

3.3.6 Total general costs

On the basis of the calculations in this section, the total general costs for South Australia per year that result from road crashes is estimated to be nearly 153 million dollars. The components of this cost are shown in Table 3.13.

Table 3.13
General costs associated with road crashes in South Australia

General cost type	Cost per year in South Australia (\$)	Percent
Non-vehicle property damage	2,340,926	1.5
Police	5,368,755	3.5
Fire and emergency services	764,702	0.5
Insurance administration	72,256,579	47.2
Travel delays	72,228,543	47.2
Total	152,959,505	100.0

3.4 Total costs

The total sum of road crashes in Australia in 1996, according to the BTE report, was approximately \$14.98 billion. The total costs estimated in the present report for road crashes in South Australia per year, using the BTE costs adjusted for CPI increases since 1996, and applied to crash data from 2002, were \$1,175,924,453. This total cost consisted of \$733,508,955 for human costs (62%), \$289,455,993 for vehicle costs (25%), and \$152,959,505 for general costs (13%).

It needs to be pointed out that these would represent *conservative* estimates of the costs of road crashes in South Australia. In addition to the use of a human capital, rather than willingness to pay, approach, which results in considerably lower cost estimates, the BTE report used a number of assumptions that would have lowered the estimated costs of road crashes. For example, the cost of lost labour associated with minor injuries was assumed in the BTE report to be negligible. Data for compensation paid out by the Motor Accident Commission in South Australia suggest that minor injuries may be more costly than estimated by the BTE, with 38% of claims and 28% of costs associated with neck or non-demonstrable injuries (e.g. whiplash) (R. McColl, private communication, 19/10/2004). A second example is the estimation of travel delay costs. By excluding crashes only resulting in minor injuries or property damage and all crashes occurring on 60 km/h roads, a substantial proportion of travel delays would not be counted in the BTE report.

However, the conservative nature of the cost estimates calculated by the BTE, as noted in Section 2 of this report with regard to the choice of the human capital approach, allows for a reliable *lower bound* estimate of the cost of road crashes. Moreover, by uniformly adopting the method of cost calculation used by the BTE, a consistent approach to estimating road crash costs in South Australia can be maintained throughout the present report.

4 Benefits to South Australia of reduced crash numbers

Given the costs associated with road crashes in South Australia each year, considerable savings to the state's economy could be expected in the event of reductions in crash numbers. These savings can be converted to direct tangible benefits to the state in terms of specific resources and services. To illustrate this, the following section provides details of the benefits to the state that would result from reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries. These reductions, relative to 2002 figures, equate to 6.5% of fatalities, 6.5% of serious injuries, and 11.9% of minor injuries. All estimates in this section are based on information provided in BTE (2000) and the costs to South Australia

calculated in Section 3 of this report. Therefore, the estimated reductions are based on estimated *average* costs (sum of all the production costs divided by the number of units produced - e.g. the cost of treating all patients divided by the number of patients) rather than estimated *marginal* costs (the additional cost of producing one extra unit of output - e.g. treating one extra patient). It could be argued that marginal costs are more appropriate for calculations of benefits of crash reductions but, given the difficulty of calculating marginal costs, and also that some average and marginal costs would be identical, average costs were used for the present report.

4.1 Savings in human costs

4.1.1 Lost labour in the workplace

South Australian costs for lost labour in the workplace per fatality were calculated to be approximately \$649,553 and the average cost per serious injury was approximately \$32,767 (refer to Section 3.1.1.). This average cost for serious injuries includes a proportion of serious injuries that result in permanent disability and prevent the injured party from ever returning to work. Each permanent injury of this sort causes the same lost labour cost as a fatality. The remaining serious injuries were calculated to result in an average of 25 days of lost labour. No costs were calculated for minor injuries.

This means that an estimate of labour cost savings for South Australia for reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries in a year would provide benefits to the state's economy of ten times \$649,553, plus 100 times \$32,767. These labour savings amount to a total of \$9,771,977. These savings represent a lifetime's labour of at least ten people (it would be more if any of the seriously injured would have never returned to work) and at least another 2,500 days of labour resulting from serious injuries (again, it would be more if some of these people would have been permanently disabled).

4.1.2 Lost labour in the household or community

South Australian costs for lost labour in the household or community per fatality were found to be approximately \$601,419 and the average cost per serious injury was approximately \$29,776 (refer to Section 3.1.2.), using similar methods of calculation to those used for lost labour costs for the workplace. Again, no costs were determined for minor injuries.

Applying these estimated costs to reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries, the estimated saving for South Australia resulting from these reductions would be ten times \$601,419, plus 100 times \$29,776. These savings amount to \$8,991,816. Again, these savings represent a lifetime's labour of at least ten people and at least 2,500 days of labour associated with serious injuries.

4.1.3 Quality of life

Quality of life costs associated with road crashes in South Australia were estimated to be approximately \$383,741 per fatality and \$41,171 per serious injury. Costs for minor injuries were estimated to total \$45,191,661. Dividing this total by the number of minor injuries in South Australia in 2002 (8,391) gives a cost per minor injury of approximately \$5,386 (refer to Section 3.1.3.). These quality of life costs were based on typical compensation payouts, rather than a willingness to pay measure, and so are conservative cost estimates.

If there were reductions in South Australia of 10 fatalities, 100 serious injuries and 1,000 minor injuries, then the quality of life savings would be ten times \$383,741, plus 100 times \$41,171, plus 1,000 times \$5,386. These savings amount to \$13,340,218. It is difficult to express these savings in terms of benefits to the state because quality of life costs are "non-economic losses" (Bureau of Transport Economics, 2000, p32). The savings

calculated here merely represent a conservative dollar value placed on the pain and suffering that would be avoided through the specified road crash reductions.

4.1.4 Ambulance

Costs to South Australia for ambulance attendance at road crashes were estimated to be \$462 per fatal or serious injury crash, \$336 per minor injury crash, and \$11 per property damage only crash (see Section 3.1.4). The cost for property damage only crashes is low because many such crashes are not attended by an ambulance.

As these costs were calculated on a per crash basis rather than per injured person, the injury reductions for which savings are being calculated in this section (10 fatalities, 100 serious injuries, 1,000 minor injuries) need to be converted to crash reductions in order to determine ambulance cost savings. For the purposes of these calculations, the crash numbers to be used were based on the ratios, for each injury level, between the number of crashes and the number of injured persons for 2002 data in Transport SA (2003). As costs for ambulance services were aggregated for fatal and serious crashes, the 10 fatalities and 100 serious injuries will be combined here. For fatalities and serious injuries combined, in 2002 in South Australia, there were 1,337 fatal or serious injury crashes and 1,692 fatalities or serious injuries, giving a ratio of crashes to injuries of approximately 0.79. Therefore, the number of crashes used in the savings calculations to represent 10 fatalities and 100 serious injuries will be 0.79 times 110, which equals approximately 87 (86.9 rounded up). For minor injuries, it was assumed for this analysis that they were confined to minor injury crashes (that is, that none of the fatal or serious injury crashes also produced minor injuries). In 2002 in South Australia, there were 6,254 minor injury crashes resulting in 8,391 minor injuries, giving a crash to injury ratio of 0.745. Therefore, the reduction of 1,000 minor injuries was assumed to be associated with a reduction of 745 minor injury crashes.

Reductions in 10 fatalities, 100 serious injuries and 1,000 minor injuries were thus estimated to require reductions of 87 serious (fatal or serious injury) crashes and 745 minor injury crashes. Due to the likelihood that some of the minor injuries would result from serious crashes, these crash numbers would slightly over-estimate the crash numbers expected to produce the specified number of injuries. The savings in ambulance costs resulting from these crash reductions would be 87 times \$462, plus 745 times \$336. These savings amount to \$290,519. The benefits to the state can be calculated by converting this total cost saving to the number of typical ambulance call-outs that it equates to. The BTE report states that, at 1996 prices, the typical ambulance call-out costs \$282. Adjusting this for CPI increases since 1996, the cost per call-out, at 2004 prices, is \$339. Therefore, the cost savings to the State of \$290,519 would equate to approximately 856 typical ambulance call-outs per year.

4.1.5 Hospital in-patient

Costs for hospital in-patient treatment in South Australia (see Section 3.1.5.) were estimated to be \$1,651 per fatality (approximately a third of fatally injured crash participants die after a period of hospital in-patient care), \$6,607 per serious injury, and \$34 per minor injury (a small proportion of those with minor injuries are treated at hospital).

Applying these costs to determine the savings to the state of reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries produces savings of 10 times \$1,651 for fatalities, 100 times \$6,607 for serious injuries, and 1,000 times \$34 for minor injuries. The total of these hospital in-patient savings is \$710,913.

The hospital in-patient costs per serious injury in the BTE report were calculated on the basis of the typical seriously injured crash participant spending 8.3 days in hospital. Therefore, a day of in-patient hospital care costs \$6,607 divided by 8.3, which equals \$796. This cost per day can be used to determine the number of hospital beds that would be made available for other patients in the event of reductions in the specified number of

injuries. This is calculated by dividing the total cost (\$710,913) by the cost per day of \$796. This equals approximately 893, indicating that a reduction of 10 fatalities, 100 serious injuries and 1,000 minor injuries would result in nearly 900 extra hospital bed days being available in South Australia over the course of a year.

4.1.6 Other medical

Other medical costs were defined in the BTE report as those associated with hospital accident and emergency departments, outpatient clinics, general practitioners, specialists and allied health services (e.g. occupational therapy, physiotherapy), and pharmaceutical products. These costs were estimated to be \$1,224 per fatality, \$9,918 per serious injury, and \$48 per minor injury (see Section 3.1.6.).

If there were reductions in South Australia of 10 fatalities, 100 serious injuries and 1,000 minor injuries, the savings to the state would be 10 times \$1,224, plus 100 times \$9,918, plus 1,000 times \$48. This gives a total saving of \$1,052,219. Costs, in 1996 prices, for different medical services *per instance of use* were estimated in the BTE report. Following adjustment for CPI increases since 1996, these costs were as follows (with the 1996 cost in brackets): \$83 (\$69) for hospital non in-patient care, \$32 (\$27) for general practitioners, \$79 (\$66) for specialists, \$20 (\$17) for prescriptions, and \$21 (\$18) for allied health services. The total cost of a single instance of use of each of these services is \$237, and dividing the estimated saving of \$1,052,219 by this cost gives a total of 4,441 instances of use. Therefore, reductions of the specified number of road crash-related injuries would save the community nearly four and a half thousand instances of use of hospital non in-patient care, visits to the general practitioner, consultations with a specialist, use of prescriptions, and sessions of treatment by allied health services.

4.1.7 Long term care

The cost for long term care of disabled crash participants was estimated to be \$108,828 per serious injury (see Section 3.1.7.). This estimate was based on 18% of those seriously injured in road crashes being disabled as a result of their injuries, and nearly 5% suffering a permanent and severe disability.

If there were 100 less serious injuries in South Australia resulting from road crashes, then the saving to the state would be \$10,882,798. This amount represents money saved as a result of there being no need to pay for the long term care of 18 seriously injured crash participants, five of whom would have been permanently and severely disabled. Specifically, there would be no more need to co-ordinate and provide carers for 18 people. In addition to directly reduced care costs, this reduction in serious injuries would lessen the likelihood of carer shortages, and would therefore also lessen the likelihood of patients being subjected to longer stays in a rehabilitation centre.

4.1.8 Coronial

The cost per road fatality for Coroner's reports was estimated to be approximately \$671 (see Section 3.1.8.). The reduction of 10 fatalities in South Australia in a year would be expected to save the state \$6,712 in coronial costs.

4.1.9 Premature funeral

The cost to the economy attributed to premature funerals of crash participants was estimated to be approximately \$2,045 per fatally injured person (see Section 3.1.9.). If there were 10 less fatalities in a year resulting from road crashes, then the saving to the state's economy would be \$20,448.

4.1.10 Legal

Legal costs associated with road crashes can result from insurance claims or criminal proceedings. The crash-related insurance claims legal costs in South Australia were calculated to be \$14,434 per fatality, \$25,436 per serious injury, and \$1,520 per minor injury (see Section 3.1.10). The costs for property damage only crashes were minimal.

If there was a reduction in South Australia of 10 fatalities, 100 serious injuries and 1,000 minor injuries, the savings in insurance claims legal costs would be 10 times \$14,434, plus 100 times \$25,436, plus 1,000 times \$1,520. This equates to savings of \$4,208,370. These savings could result in cheaper compulsory third party insurance premiums.

Criminal proceedings were estimated to cost \$1,862 per fatality, \$539 per serious injury, and \$66 per minor injury (see Section 3.1.10.). Reductions in South Australia of 10 fatalities, 100 serious injuries and 1,000 minor injuries would thus result in savings of 10 times \$1,862, plus 100 times \$539, plus 1,000 times \$66. The sum of these savings is \$138,663.

The total legal cost savings associated with the specified reductions in injuries would be the sum of the savings related to insurance claims and criminal proceedings. This total is \$4,347,033.

4.1.11 Correctional services

The BTE report used only prison costs to determine the costs of correctional services (thus excluding the costs of periodic detention and community service orders). These costs were assumed by the BTE to apply only to fatal crashes and were estimated to be approximately \$10,237 per fatality (see Section 3.1.11.). Savings in correctional services for the reduction of 10 fatalities would be \$102,374.

The average daily cost of maintaining a prisoner, according to the BTE report, was \$159. Adjusting this cost for CPI increases since 1996, the daily cost per prisoner would now be \$191. Therefore, the correctional services savings associated with a reduction of ten fatalities equates to not having to pay for one prisoner for 535 days (102,374 divided by 191).

4.1.12 Workplace disruption and staff replacement

The costs to organisations of recruiting and training employees to replace injured or fatally injured workers were estimated to be \$9,715 per fatality, \$9,985 per serious injury, and \$647 per minor injury (refer to Section 3.1.12.). If in South Australia there were reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries, the savings to business in the state would be 10 times \$9,715, plus 100 times \$9,985, plus 1,000 times \$647. These savings amount to \$1,742,756.

4.1.13 Total savings in human costs

The total savings in human costs associated with a reduction of 10 fatalities, 100 serious injuries, and 1,000 minor injuries in South Australia are shown in Table 4.1. The total annual savings for the state would be over \$51 million.

Table 4.1
Annual savings in human costs associated with a reduction of 10 fatalities, 100 serious injuries and 1,000 minor injuries in South Australia (2004 dollars)

Human cost type	Savings in South Australia (\$)
Lost labour in the workplace	9,771,977
Lost labour in the household and community	8,991,816
Quality of life	13,340,218
Ambulance	290,519
Hospital in-patient	710,913
Other medical	1,052,219
Long term care	10,882,798
Coroner	6,712
Premature funeral	20,448
Legal	4,347,033
Correctional services	102,374
Workplace disruption and staff replacement	1,742,756
Total	51,259,783

4.2 Savings in vehicle costs

4.2.1 Vehicle repairs

The costs of vehicle repairs were estimated to be \$3,729 per car, \$5,292 per motorcycle, \$6,616 per rigid truck, \$14,314 per articulated truck, and \$2,406 per bus (see Section 3.2.1.). In order to calculate the likely savings to South Australia resulting from reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries, it is necessary to calculate the number of crashes likely to cause this number of injuries, and then to calculate the number of each type of vehicle likely to be involved in that number of crashes.

The reductions in crashes required for the specified reductions in injuries were calculated in Section 4.1.4. to be 87 fatal or serious injury crashes and 745 minor injury crashes (a total of 832 crashes). Table 4.2 shows the number and percentage of vehicles of each type involved in casualty (all injury) crashes in South Australia in 2002 (Transport SA, 2003). It can be seen that there were 12,744 vehicles involved in the 7,591 casualty crashes that occurred in South Australia in 2002. Therefore, 832 casualty crashes would be likely to involve 1,397 vehicles (12,744 divided by 7,591 to give the number of vehicles per crash, multiplied by 832). Using the percentages in the third column of Table 4.2, the numbers of vehicles of each type likely to be involved in the 832 crashes are: 1,288 cars (92.2% of 1,397), 57 motorcycles (4.1% of 1,397), 27 rigid trucks (1.9% of 1,397), 17 articulated trucks (1.2% of 1,397) and 9 buses (0.6% of 1,397).

Table 4.2
Type of vehicle involved in casualty crashes in South Australia, 2002

Vehicle type	Involved in casualty crashes (number)	Percentage
Cars	11,750	92.2
Motorcycles	520	4.1
Rigid trucks	242	1.9
Articulated trucks	154	1.2
Buses	78	0.6
Total	12,744	100.0

Source: Transport SA (2003)

The savings in vehicle repairs associated with crash reductions likely to result in 10 fewer fatalities, 100 fewer serious injuries and 1,000 fewer minor injuries can be calculated by

multiplying the number of vehicles of each type likely to be involved in 832 casualty crashes by the average cost of repairs for each vehicle type. A summary of the calculations and costs are provided in Table 4.3. The savings in vehicle repairs associated with the specified number of injuries would be approximately 5.5 million dollars.

Table 4.3
Savings in vehicle repair costs associated with a reduction of 10 fatalities, 100 serious injuries and 1,000 minor injuries in South Australia

Type of Vehicle	Number of vehicles	Repair cost per vehicle	Total repair cost
Cars	1,288	3,729	4,802,098
Motorcycles	57	5,292	301,639
Rigid trucks	27	6,616	175,472
Articulated trucks	17	14,314	241,601
Buses	9	2,406	20,566
Total	1,397		5,541,378

4.2.2 Towing

The total cost of towing in South Australia in a year was calculated to be \$3,339,721 (see Section 3.2.2.). This was based on 40,130 crashes occurring in South Australia in 2002. In order to calculate the savings in towing costs associated with 10 fatalities, 100 serious injuries and 1,000 minor injuries, the towing cost per crash (\$3,339,721 divided by 40,130) needs to be multiplied by the estimated number of crashes required to cause this number of injuries (832). The savings in towing costs, according to this method of calculation, are \$69,241.

4.2.3 Time lost due to vehicle unavailability

The costs associated with the unavailability of vehicles damaged in road crashes per year in South Australia were estimated to be \$14,201,617 (see Section 3.2.3.). The savings in these costs resulting from reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries can be calculated in a similar manner to the savings in towing costs. That is, the total estimated cost of vehicle unavailability is divided by 40,130 and multiplied by 832. This gives an estimated saving of \$294,437.

4.2.4 Total savings in vehicle costs

The total savings in vehicle-related costs resulting from reductions in 10 fatalities, 100 serious injuries, and 1,000 minor injuries are shown in Table 4.4. It can be seen that the savings in vehicle costs would be nearly \$6 million.

Table 4.4
Vehicle cost savings associated with a reduction of 10 fatalities, 100 serious injuries and 1,000 minor injuries in South Australia

Vehicle cost type	Savings in South Australia (\$)
Vehicle repair	5,541,378
Towing	69,241
Time lost due to vehicle unavailability	294,437
Total	5,905,056

4.3 Savings in general costs

4.3.1 Non-vehicle property damage

Non-vehicle property damage was estimated to cost approximately \$58 per crash (see Section 3.3.1.). To determine the savings in non-vehicle property damage that would come with a reduction in South Australia of 10 fatalities, 100 serious injuries and 1,000 minor injuries, this cost per crash needs to be multiplied by the number of crashes that would be likely to cause this number of injuries (832). This gives a saving of \$48,534 in a year.

4.3.2 Police

The costs of police response to road crashes were estimated to be approximately \$7,394 per fatality, \$2,540 per serious injury, and \$38 per minor injury (see Section 3.3.2.). The savings in police costs resulting from reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries would be 10 times \$7,394, plus 100 times \$2,540, plus 1,000 times 38. These savings total \$366,469.

The BTE report documents the time taken by police for all of the different tasks associated with crashes (attending the crash scene, administration of crash reports, notification of next of kin, assisting coronial investigations, crash investigation that may lead to criminal prosecution, administration of fines, and road audits). Therefore, in addition to the savings in police costs, it is possible to determine the savings in police time resulting from the specified crash reductions. For these calculations, again the estimates of 87 serious and 745 minor crashes were used. As there are additional police costs for fatal crashes that do not apply to non-fatal serious crashes, an estimate is needed of how many of the 87 serious crashes would result in at least one fatality. In 2002, the 154 fatalities in South Australia resulted from 138 fatal crashes (a ratio of crashes to fatalities of 0.90). On this basis, it was assumed for this analysis that the 10 fatalities would have occurred in nine crashes. This leaves 78 serious injury crashes remaining.

According to the BTE report, fatal crashes require an average of 4.25 hours of at-scene attendance by four officers, giving a total of 17 police hours for this task. In addition to crash scene attendance, fatal crashes require an average of 20 minutes for administration of the crash report, four hours for notifying the next of kin, 80 hours investigating the crash to determine if criminal prosecution is necessary, and one hour to conduct a road audit. In some cases, a coronial hearing is required, for which police typically spend 30 hours preparing information. For the purpose of a savings estimate, and to ensure that estimate is conservative, the costs for coronial hearings will be excluded. The total estimated time for each fatal crash is, therefore, 102 hours and 20 minutes, and the total for nine fatal crashes is 921 hours.

For serious injury crashes, it was estimated in the BTE report that four police were required to spend 1.5 hours each at the scene, giving a total of six police hours for crash scene attendance. In addition, serious injury crashes require an average of 20 minutes for administration of the crash report, 1.5 hours to notify the next of kin, 50 hours investigating the crash to determine if criminal prosecution is necessary, and one hour to conduct a road audit. Therefore, the total police time required for each serious injury crash is 58 hours and 50 minutes, and the total for 78 crashes is 4,589 hours.

For minor injury crashes, the only costs were those associated with one hour each of at-scene attendance for two officers, plus the 20 minutes for administration of the crash report, giving a cost per minor injury crash of two hours and 20 minutes. The total police time required for 745 minor crashes is, therefore, 1,738 hours and twenty minutes.

Summing the hours of police work for each of the levels of crash severity, the total police time saved in the event of reductions of the specified number of crashes is 7,248 hours and 20 minutes.

4.3.3 Fire and emergency services

The cost of providing fire and emergency services for road crashes in South Australia was estimated to be \$764,702 (see Section 3.3.3.). This was the cost for 40,130 crashes. The savings for a reduction in the 832 crashes necessary to cause 10 fatalities, 100 serious injuries, and 1,000 minor injuries would be \$764,702 divided by 40,130 and multiplied by 832. These savings amount to approximately \$15,854.

4.3.4 Insurance administration

The cost of crash-related insurance administration in South Australia per year was estimated to be \$72,256,579 (see Section 3.3.4.). This cost applied to 40,130 crashes, so the savings likely with a reduction in 832 crashes would be \$72,256,579 divided by 40,130 and multiplied by 832. These savings are approximately \$1,498,068. These savings in underwriting costs for insurers could result in lower insurance premiums.

4.3.5 Travel delays

The cost of travel delays resulting from road crashes in South Australia each year was estimated to be \$72,228,543 (see Section 3.3.5.). This was the cost associated with 1,337 serious injury or fatal crashes. The savings resulting from a reduction of 87 crashes (the number of serious crashes necessary to cause 10 fatalities and 100 serious injuries) would be \$4,699,987. This saving of \$4.7 million would equate to increases in business productivity.

The BTE report notes that many transport analysts argue that the value that can be placed on time saved is less than the value that can be placed on time lost. That is, the monetary costs associated with time lost are greater than the monetary savings associated with the same amount of time saved. This is because delays “are unexpected and travellers are generally prepared to pay a premium” to avoid them (Bureau of Transport Economics, 2000, p74). This does not affect the values of the savings presented in this section, however. This section is providing a value not for time saved but for time that, because of fewer crashes, would no longer be lost. It is valuing the time for which travellers, according to the BTE, are “prepared to pay a premium”.

4.3.6 Total savings in general costs

The total savings to South Australia in general costs that could be expected with road crash-related reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries are over \$6.6 million. The components of these savings are shown in Table 4.5.

Table 4.5
Savings in general costs associated with a reduction of 10 fatalities, 100 serious injuries and 1,000 minor injuries in South Australia

General cost type	Savings in South Australia (\$)
Non-vehicle property damage	48,534
Police	366,469
Fire and emergency services	15,854
Insurance administration	1,498,068
Travel delays	4,699,987
Total	6,628,912

4.4 Total savings

The total savings that would be expected in South Australia in the event of road crash-related reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries are estimated to be approximately \$63,793,751. These savings would consist of savings in human costs of \$51,259,783 (80%), savings in vehicle costs of \$5,905,056 (9%), and savings in general costs of \$6,628,912 (10%).

5 Summary and conclusions

Using a report by the Bureau of Transport Economics (2000) that calculated the costs of road crashes in Australia in 1996, and data for road crashes in South Australia in 2002 (Transport SA, 2003), it was possible to estimate the annual costs associated with road crashes in South Australia. These costs have been estimated to be approximately \$1.18 billion, 62% of which are due to human costs, 25% to vehicle costs, and 13% to general costs. A complete breakdown of these costs is provided in Table 5.1.

Table 5.1
Costs associated with road crashes in South Australia each year

Cost type	Cost per year in South Australia (\$)	Percent
Human costs		
Lost labour in the workplace	150,422,908	12.8
Lost labour in the household and community	138,414,413	11.8
Quality of life	167,608,441	14.3
Ambulance	3,090,022	0.3
Hospital in-patient	10,698,792	0.9
Other medical	15,847,103	1.3
Long term care	167,377,428	14.2
Coroner	103,362	0.0
Premature funeral	314,903	0.0
Legal	55,772,270	4.7
Correctional services	1,576,553	0.1
Workplace disruption and staff replacement	22,282,760	1.9
Vehicle costs		
Vehicle repair	271,914,655	23.1
Towing	3,339,721	0.3
Time lost due to vehicle unavailability	14,201,617	1.2
General costs		
Non-vehicle property damage	2,340,926	0.2
Police	5,368,755	0.5
Fire and emergency services	764,702	0.1
Insurance administration	72,256,579	6.1
Travel delays	72,228,543	6.1
Total	1,175,924,453	100.0

Given that road crashes in South Australia result in these great costs to the community and economy, considerable savings to the state could be made in the event of reductions in crash numbers. Following the calculation of crash costs in South Australia, the savings that would occur in the event of crash reductions were estimated, using reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries as a basis for the calculations. The estimate for these savings was \$63,793,751, of which 80% were in human costs, 9% in vehicle costs, and 10% in general costs (refer to Table 5.2).

The various savings components presented in Table 5.2 can also be described in terms of specific benefits to the state. Some of these *annual* benefits are:

- a lifetime's labour for ten people (in the workplace, household and community);
- at least an additional 2,500 days of labour (in the workplace, household and community);
- a saving equivalent to over 850 typical ambulance call-outs;
- the availability of nearly 900 extra hospital bed days;
- approximately 4,400 fewer of each of the following: instances of use of hospital out-patient or emergency care, visits to a general practitioner, consultations with a specialist, use of prescription pharmaceutical products, and sessions of treatment by allied health services;
- no more need for the long term care of 18 people, five of whom would be severely and permanently disabled, thus lessening the need for the provision and co-ordination of carers which, in turn, would also ease the burden on rehabilitation centres;
- a saving of approximately \$5.7 million in insurance costs (legal costs plus administration), which could result in lower insurance premiums;
- a saving of the cost of 535 days of prison time for one person;
- reduced workplace disruption and staff replacement, saving business in the state \$1.7 million;
- a saving of over 7,000 hours of police time;
- and reduced travel delays, saving business in the state \$4.7 million.

Table 5.2
Savings in road crash costs in South Australia associated with reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries

Cost type	Savings per year in South Australia (\$)	Percent
Human costs		
Lost labour in the workplace	9,771,977	15.3
Lost labour in the household and community	8,991,816	14.1
Quality of life	13,340,218	20.9
Ambulance	290,519	0.5
Hospital in-patient	710,913	1.1
Other medical	1,052,219	1.6
Long term care	10,882,798	17.1
Coroner	6,712	0.0
Premature funeral	20,448	0.0
Legal	4,347,033	6.8
Correctional services	102,374	0.2
Workplace disruption and staff replacement	1,742,756	2.7
Vehicle costs		
Vehicle repair	5,541,378	8.7
Towing	69,241	0.1
Time lost due to vehicle unavailability	294,437	0.5
General costs		
Non-vehicle property damage	48,534	0.1
Police	366,469	0.6
Fire and emergency services	15,854	0.0
Insurance administration	1,498,068	2.3
Travel delays	4,699,987	7.4
Total	63,793,751	100.0

The savings summarised in Table 5.2 can also be separated into the component savings associated with reductions in fatalities, reductions in serious injuries and reductions in minor injuries. These figures are provided in Table 5.3. Note that for some cost types (vehicle repair, towing, time lost due to vehicle unavailability, non-vehicle property damage, fire and emergency services, insurance administration), costs were calculated on a per crash, rather than per injury, basis. It is possible that more severe crashes, in terms of injury level, would be associated with higher costs per crash for these cost categories but no information was available in the BTE report to determine the appropriate ratios for these costs. For this reason, costs for individual crashes across the three injury levels were assumed to be the same for these cost categories. It is likely, therefore, that savings associated with fatal and serious injuries in Table 5.3 are underestimated and those for minor injuries are overestimated. Despite this, Table 5.3 clearly shows that the greatest savings in costs associated with the specified set of injury reductions would result from the reduction in serious injuries. Elimination of 100 serious injuries would particularly save the community in terms of costs associated with hospital care, other medical care, long-term care, legal work, workplace disruption, police work, and travel delays.

Table 5.3
Savings in road crash costs in South Australia associated with reductions of 10 fatalities, 100 serious injuries and 1,000 minor injuries, separately for each crash injury level

Cost type	Savings per year in South Australia					
	Fatal		Serious Injury		Minor Injury	
	\$	%	\$	%	\$	%
Human costs						
Lost labour in the workplace	6,495,326	66.5	3,276,651	33.5	0	0.0
Lost labour in the household and community	6,014,190	66.9	2,977,626	33.1	0	0.0
Quality of life	3,837,414	28.8	4,117,074	30.9	5,385,730	40.4
Ambulance	4,160	1.4	36,054	12.4	250,305	86.2
Hospital in-patient	16,515	2.3	660,719	92.9	33,679	4.7
Other medical	12,245	1.2	991,860	94.3	48,114	4.6
Long term care	0	0.0	10,882,798	100.0	0	0.0
Coroner	6,712	100.0	0	0.0	0	0.0
Premature funeral	20,448	0.0	0	0.0	0	0.0
Legal	162,961	3.7	2,597,529	59.8	1,586,543	36.5
Correctional services	102,374	100.0	0	0.0	0	0.0
Workplace disruption and staff replacement	97,153	5.6	998,476	57.3	647,127	37.1
Vehicle costs						
Vehicle repair	59,943	1.1	519,504	9.4	4,961,931	89.5
Towing	749	1.1	6,491	9.4	62,001	89.5
Time lost due to vehicle unavailability	3,185	1.1	27,603	9.4	263,648	89.5
General costs						
Non-vehicle property damage	525	1.1	4,550	9.4	43,458	89.5
Police	73,938	20.2	254,039	69.3	38,491	10.5
Fire and emergency services	172	1.1	1,486	9.4	14,196	89.5
Insurance administration	16,205	1.1	140,444	9.4	1,341,419	89.5
Travel delays	486,206	10.3	4,213,782	89.7	0	0.0
Total	17,410,421	27.3	31,706,686	49.7	14,676,642	23.0

The figures in Table 5.3 can also be expressed in terms of savings likely from each individual fatality, serious injury and minor injury that no longer occurs. These savings per injury type are shown in Table 5.4. As noted for Table 5.3, some types of savings are calculated per crash rather than per injury and were assumed to be the same for each type of crash (crashes causing fatal injury, serious injury, minor injury). Given that the costs would be likely to be greater for crashes causing more severe injuries, it is likely that savings per minor injury (\$16,965) are over-estimated, while savings per fatal (\$1,747,522) and serious injury (\$331,107) are under-estimated.

Table 5.4
Savings in road crash costs in South Australia associated with reductions of a single fatality, a single serious injury and a single minor injury, separately for each crash injury level

Cost type	Fatality	Serious injury	Minor injury
Human costs			
Lost labour in the workplace	649,533	32,767	0
Lost labour in the household and community	601,419	29,776	0
Quality of life	383,741	41,171	5,386
Ambulance	416	361	250
Hospital in-patient	1,652	6,607	34
Other medical	1,225	9,919	48
Long term care	0	108,828	0
Coroner	671	0	0
Premature funeral	2,045	0	0
Legal	16,296	25,975	1,587
Correctional services	10,237	0	0
Workplace disruption and staff replacement	9,715	9,985	647
Vehicle costs			
Vehicle repair	6,660	6,660	6,660
Towing	83	83	83
Time lost due to vehicle unavailability	354	354	354
General costs			
Non-vehicle property damage	58	58	58
Police	7,394	2,540	38
Fire and emergency services	19	19	19
Insurance administration	1,801	1,801	1,801
Travel delays	54,203	54,203	0
Total	1,747,522	331,107	16,965

In summary, road crashes in South Australia cost the state approximately \$1.18 billion in a year. Even a relatively small reduction in crash numbers would result in considerable savings to the economy. These savings would enable increased productivity for business in the state and would also reduce the need for government spending on the provision of services.

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