COST OF ROAD TRAUMA IN AUSTRALIA

ECONOMIC CONNECTIONS

Australian Automobile Association

Summary report - September 2017

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Table of contents

Foreword		4
Section One	**Introduction**	**8**
	Summary of findings	8
Section Two	**Cost of road trauma**	**9**
	Cost to the economy	9
	Cost to Governments	10
Section Three	**Detailed analysis**	**11**
	Overview	11
	Road fatalities	12
	Hospitalised injuries	12
	Non-hospitalised injuries	13
Section Four	**Methodologies used for calculating the cost of road trauma**	**14**
Section Five	**Future directions**	**15**
Appendix		**16**
Glossary		**17**
Endnotes		19

Foreword

At a time when new vehicles and roads have never been safer, we need to understand not only why 40 years of road safety improvement is being reversed, but also the true cost to our community of road death and trauma.

This is the best way to ensure that we can develop effective road safety policies for the future, and to give these policies priority in line with the devastating human and economic cost of road trauma.

The Australian Government's forthcoming review of the National Road Safety Strategy (NRSS) will help to shed light on why it has failed to meet its goals of reducing road deaths and trauma by at least 30 per cent by 2020.

To help ensure everyone involved in road safety is better able to give this area of policy the priority it requires, and to make informed investment decisions, the Australian Automobile Association (AAA) commissioned Economic Connections Pty Ltd to undertake an economic analysis of the cost of road crashes based on the most recent full year's data (2015).

The analysis summarised in this document estimates the annual economic cost of road trauma in Australia is almost $30 billion (using 2015 as the reference year) and the direct cost of just one year's trauma to government budgets is more than $3.7 billion. The report shows that although fatalities have fallen, injuries requiring hospitalisation continue to increase, contributing to the significant costs to the economy and the Australian community.

The AAA is pleased to make this analysis available as an important tool which governments and stakeholders at all levels can use to inform their policy and investment decisions.

Michael Bradley

Chief Executive
Australian Automobile Association

Foreword

Economic Connections Pty Ltd has much experience in modelling the national economic benefits of infrastructure projects and policies on behalf of governments and government agencies.

Economic Connections is proud to have conducted this work which attempts to quantify one aspect of road safety – the economic cost of road death and trauma in Australia. Of course, the human cost remains unmeasurable.

The economic cost Australia bears each year as a result of road trauma is enormous. It encompasses productive lives cut short or severely diminished, as well as direct costs to the community in terms of extra health and emergency services expenditure.

Through the AAA, we trust that this research assists in contributing to debate on road safety policy and future investment decisions.

Phil Potterton
Anthony Ockwell (Dr)

Directors
Economic Connections Pty Ltd

Introduction

After decades of decline the number of road deaths recorded in Australia has begun to climb again. Aside from the obvious and very personal impact of road trauma, there is an economic cost which has not been quantified in recent years.

The AAA commissioned Economic Connections Pty Ltd (ECON) to quantify the cost that the Australian community incurs each year as a result of road crashes, using data from the 2015 calendar year. The report Cost of Road Trauma 2015, AUTHORED BY PHIL POTTERTON, ANTHONY OCKWELL AND JAMIE CROSS, is referred to as the ECON report in this summary report.

Prior to this research, the most recent analysis available was the *Cost of road crashes in Australia 2006* (BITRE 2009) report published by the Bureau of Infrastructure, Transport and Regional Economics (BITRE).

Importantly, the ECON report shows that despite a 25 per cent reduction in fatalities between 2006 and 2015, the cost of road trauma in 2015 was only 6.8 per cent lower than the cost in 2006 when expressed in 2015 prices. The report also shows that although fatalities have fallen, injuries requiring hospitalisation continue to increase, contributing to the significant costs to the economy and the Australian community.

Summary of findings

Over recent years, including at the time of the BITRE 2009 report, different methods of evaluation have been utilised in the absence of a nationally agreed methodology for valuing road trauma. ECON finds that for the 2015 calendar year the total cost of road trauma was $29.7 billion (using the "willingness to pay for road safety" methodology included in the BITRE 2009 report). This is an increase (in nominal terms) from the $27 billion per annum derived in 2006 prices.

The Australian Government Office of Best Practice Regulation (OBPR) has published its own methodology and ECON utilises this method to derive the base case estimates for the report. Based on the OBPR methodology, ECON finds that for the 2015 calendar year:

- the total cost of road trauma is estimated at $22.2 billion
- the economic cost of each road fatality was $4.34 million
- the cost per hospitalisation caused by road injury was $239,000

The ECON report also estimates that the direct cost to government for only one year's worth of trauma – as distinct from the total economic cost – was more than $3.7 billion.

Of the $3.17 billion cost to government of:

- Immediate responses to road trauma in health, emergency services and other areas incur $945 million of this cost in the first year after a crash.
- More than three quarters of this cost comprises the present value of future years of forgone taxation revenue and additional income support payments arising directly from road crash deaths and disabilities.
- The need to provide additional health services represents 11.8 per cent of this cost.

The ECON report suggests that there were several factors that contributed to the change in the cost of road trauma from 2006 to 2015. The change in total cost can largely be explained by a decrease in fatalities and disabled persons as well as casualty aging which all put downward pressure on total costs. Factors that contributed to an increase included an increase in hospitalised and non-hospitalised injuries as well as total road crashes and increases in health costs.

Cost of road trauma

Cost to the economy

Road trauma cost the Australian economy an estimated $22.2 billion in 2015, equivalent to 1.3 per cent of gross domestic product.[1] When using the same methodology used in the BITRE 2009 report, the cost estimate of road trauma comes to $29.7 billion in 2015, compared with $27 billion in 2006 (in nominal terms).[2]

Using the ECON methodology, the cost per fatality was estimated at $4.34 million and cost per hospitalised injury, including disabled persons is $239,000 for the reference year 2015 only (Table 1).[3]

Table 1: *Cost of road trauma 2015 per casualty, $ million*

Casualty type	Number	Total cost $m	Cost per person
Fatalities	1,205	5,228.9	4.339
Hospitalised injuries	37,964	9,072.5	0.239
Disabled persons*	4,436	3,078.9	0.694
Non-hospitalised injuries	227,572	2,830.6	0.012
TOTAL	266,741	17,132.0	

**Disabled persons are included in the hospitalised injuries total.*
Source: ECON analysis

Despite a 25 per cent reduction in fatalities since 2006, the cost of road trauma in 2015 was only 6.8 per cent or $1.6 billion lower than the cost in 2006 when expressed in 2015 prices.[4]

Loss of life, health and wellbeing represents the largest cost item to total economic costs of road trauma in 2015 (Figure 1). This cost item accounts for approximately 41.7 per cent of total economic costs of road trauma. Fatalities totalled 47,692 life years. Using $4.1 million as the statistical value of life, fatalities cost $4.9 billion for 2015.

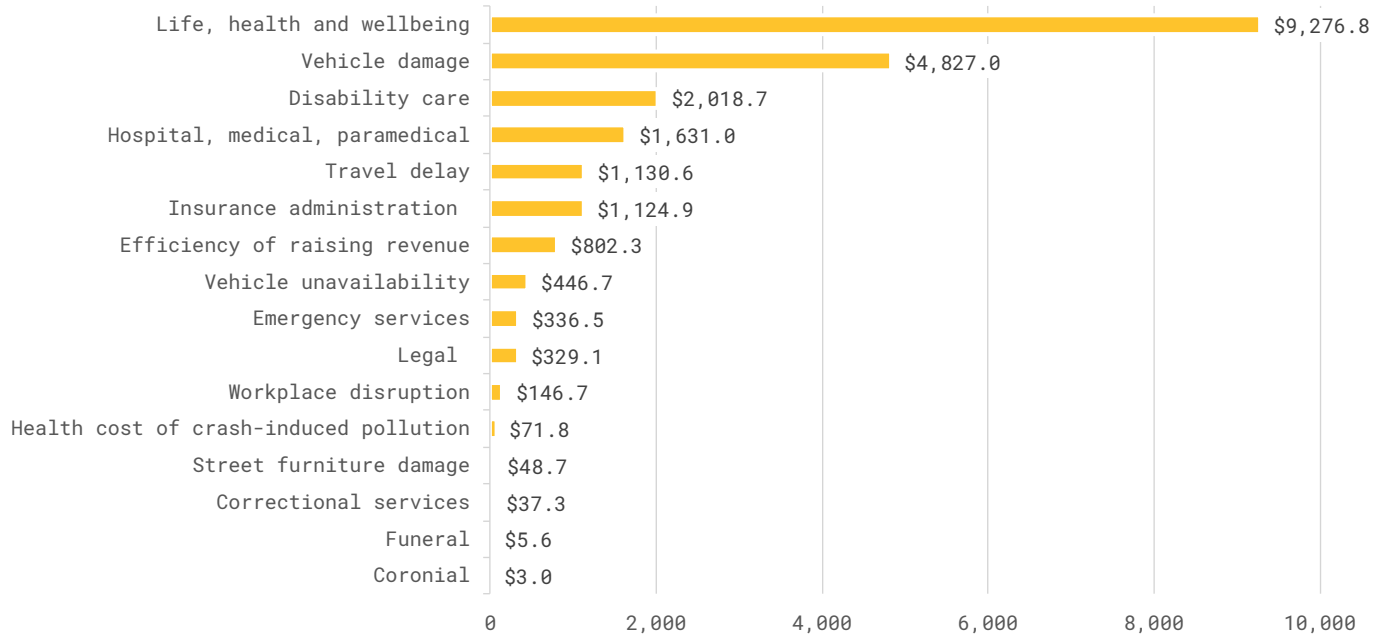
Vehicle damage is the second largest cost item, valued at $4.3 billion. This is equivalent to 21.7 per cent of total economic costs of road trauma in 2015. The average damage cost per passenger vehicle was estimated at $3,001.[5]

Costs associated with disability care is the third largest cost item. Carer costs were approximately $1.7 billion, while the total cost of aid, appliance and equipment were $334.4 million.

Other key features of the data are the costs associated with travel delay and workplace disruption costs. The estimated total cost of travel delay in 2015, as a result of additional vehicle costs and time spent queuing was $1.1 billion. The adverse health impact of crash-related urban pollutant emissions was estimated at $71.8 million.

Total workplace disruption costs were estimated at $146.7 million. Estimates were based on cost of lost output, temporary or permanent replacement of employee, costs pending employees return to work following injury or work-preventing disability as well as recruitment and retraining costs.

Figure 1: *Cost to economy for 2015 road trauma, $ million*



Source: ECON analysis

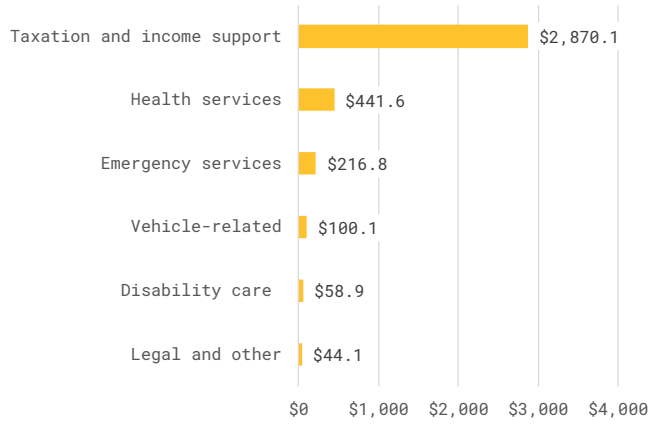
Cost to Governments

Road trauma has long-term implications on government budgets. This is because road trauma impacts workforce participation and earnings, which subsequently affects taxation revenue and income support expenditure outlays. Other areas of government activity are affected as well.

The report calculates costs to government as the net sum of all financial flows (i.e. the negative flows less any positive flows or savings known to affect government budgets) as a result of road trauma in 2015.

According to the ECON report, the direct cost of road trauma to government was valued at more than $3.7 billion (in 2015 dollars). More than three quarters of this cost comprises the present value of many future years of forgone taxation revenue and additional income support payments arising directly from road crash fatalities and disabilities. The health services area is also a significant contributor at 11.8 per cent, representing a cost of $441.6 million to all government budgets in 2015 (Figure 2).

Figure 2: *Cost to Government for 2015 road trauma, $ million*



Source: ECON analysis

A breakdown of the government funding share for each of the cost categories is given in the appendix.

The report presents two generic budget periods to estimate the annual cost to government budgets. The 'first year' cost allows for a period of up to 12 months following all road crashes that occurred during the 2015 calendar year.

The 'subsequent year' cost captures the lasting impact of road crash fatalities and injuries as they affect government budgets: forgone taxation, due to partial or complete loss of earnings; additional income support payments, and long term disability care and support costs.[6]

The ECON report estimates that the annual cost to government budgets in the first year (2015) is $943.8 million, equivalent to 25.3 per cent of the government's total cost of $3.7 billion.

Total foregone taxation revenue, and additional income support payments including payments to carers, comprise 98.3 per cent of the subsequent year average cost, with disability care costs making up the balance. This cost averages $141.2 million per year, higher in the early years and lower later. This is consistent with the age profile of road fatalities and injured persons, where those aged between 40 and 64 (with, absent road trauma, high levels of labour force involvement) comprise the largest group.

Results from the ECON report suggest that the absence of road trauma in 2015 would reduce government budget funding costs by $3.7 billion in present value terms. The improvement in the government fiscal balance could allow either a reduction in taxation, or in government borrowing, that would reduce longer term tax liabilities. Alternatively, expenditure proposals that currently cannot be pursued due to government budget constraints might be implemented.

Detailed analysis

Overview

Over the last decade, Australia has been grappling with the increasing challenge of how to reduce road trauma, especially given the growth in population and the increase in total number of vehicle kilometres travelled on Australian roads.

The cost of road trauma has also been subject to change over the ten year period from 2006.

The ECON report suggests that there were several factors that contributed to the change in the cost of road trauma from 2006 to 2015. These factors are summarised in the table below but can be largely explained by a decrease in fatalities and a decrease in disabled persons (estimated), as well as casualty aging, which all put downward pressure on total costs. While factors that contributed to an increase included an increase in hospitalised and non-hospitalised injuries as well as total road crashes and increases in health costs.

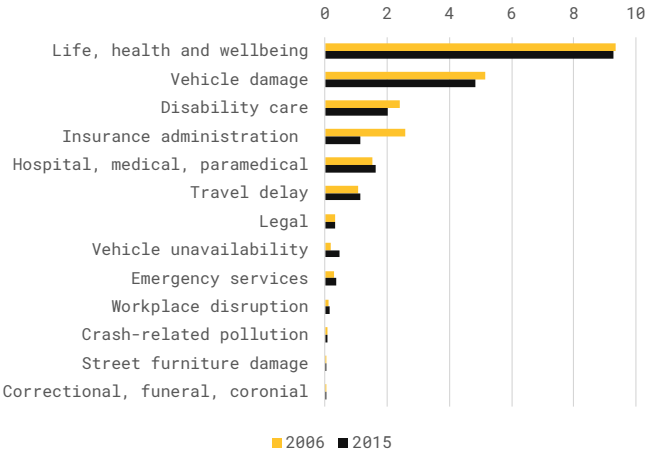
Table 2: *Factors contributing to the change in cost of road trauma from 2006 to 2015.*

Cost driver type	Reducing total cost compared with 2006	Increasing total cost compared with 2006
Population numbers, charactaristics	Fatalaties	Hospitalised injuries
	Persons disabled	Non-hospitalised injuries
	Casualty ageing	Road crashes
Unit costs	Vehicle cost growth below CPI	Health (hospital and medical) cost growth above CPI
Cost categories		New cost category - Efficiency cost of government revenue-raising
Valuation methodology	Disability care - carers	
	Insurance administration	Life, health and wellbeing - Disability-adjusted life year and willingness to pay approaches

Source: ECON analysis

A comparison of cost categories between 2006 and 2015 is also given below:

Figure 3: *Cost category comparison 2006 and 2015, 2015 $ billion*



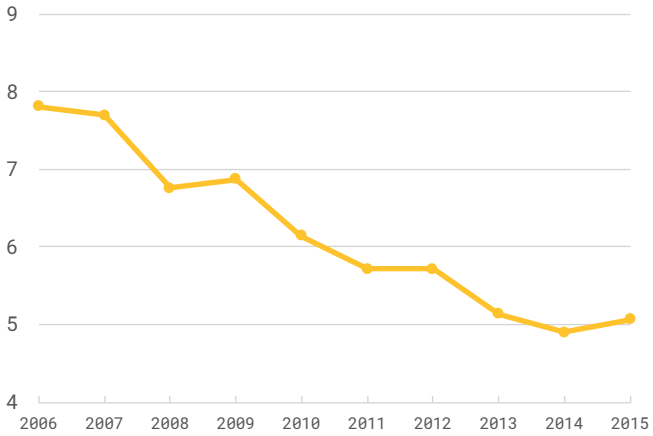
Source: ECON analysis

Road fatalities

Road fatalities have fallen by 25 per cent, from 1,598 in 2006 to 1,205 fatalities in the 2015 reference year. Improvements in infrastructure and passenger vehicle standards are cited as reasons for the reduction in fatalities over this ten year period.

Despite these improvements, recent data indicates that the last two calendar years have been characterised by a sharp increase in road fatalities. Fatalities have increased from a rate of 4.9 per 100,000 population in 2014 to 5.1 in 2015 and increasing further in 2016, as shown in figure 3 below:

Figure 4: *Fatalities per 100,000 population*



Source: BITRE 2016 Road trauma Australia 2015 statistical summary *and ECON analysis*

The ECON report also found that consistent with the broader ageing of the Australian population, the average age of the fatality cohort increased from 38.6 years in 2006 to 45.6 years in 2015. Gender distribution remained unchanged over the decade, with males continuing to account for 72 per cent of road crash fatalities.

Unprotected road users (i.e. motorcyclists, cyclists and pedestrians) comprised 36 per cent of fatalities in 2013, compared with 31 per cent five years earlier. Unprotected road users account for half of the fatality increase over the past two years and also make up 50 per cent of the growing number of hospitalised injuries.

Hospitalised injuries

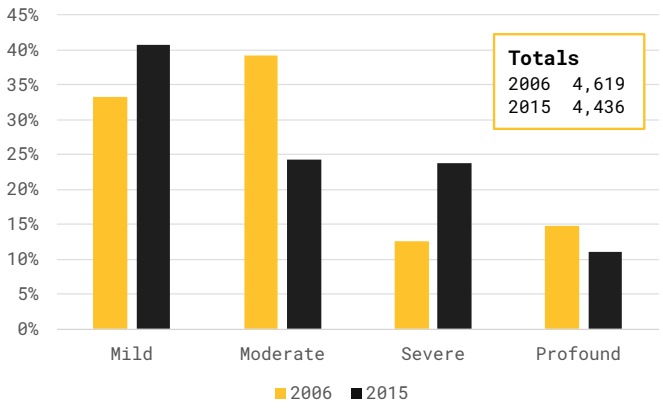
There were an estimated 679,359 road crashes in 2015, four per cent more than in 2006. Fatal crashes, i.e. involving one or more fatalities, were 24.3 per cent below the 2006 level, while hospitalised injury crashes were 24.1 per cent higher.

Hospitalised injuries have increased by 22 per cent over the ten years to 2015 from 31,204 to 37,964. The average age of those hospitalised increased from 36.6 years to 40.0 years between 2008 and 2013. This trend is comparable to the average age of fatality cohort, and reflects ageing of the Australian population. Males accounted for around two thirds of hospitalised injuries in 2015.

Of 37,964 people hospitalised as a result of a road crash in 2015, an estimated 4,436 will have become lastingly disabled, in the sense of facing a limitation in undertaking the core activities of communication, mobility and/or self-care.

The total of 4,436 persons disabled compares with an estimate of 4,619 in BITRE 2009, a reduction of four per cent (Figure 4).

Figure 5: *Profile of people disabled from road crash injury, 2006 and 2015.*



Source: Australian Bureau of Statistics Survey of Disability, Ageing and Carers 2015 *and ECON analysis*

Total post-crash health services costs are estimated at $1.6 billion, an increase of 88.7 per cent on 2006 costs. A fall in the number of fatalities is offset by an increase in the number of injured, both hospitalised and non-hospitalised. However, the main factor in the cost increase is the estimated cost increase for hospital and medical services of 75 per cent over the nine years.

Non-hospitalised injuries

There were an estimated 227,572 non-hospitalised injuries resulting from road crashes in 2015. This compares to 216,500 non-hospitalised injuries in 2006. Non-hospitalised injuries accounted for $2.8 billion of total economic costs of road trauma in 2015, or an average cost of $12,000 per person.

Section Four

Methodologies used for calculating the cost of road trauma

Investment decisions are informed by the estimated value of expected safety benefits. However, such estimates are influenced by the particular methods used to place an economic value on human life. Best practice in this area favours the use of a valuation method known as the willingness-to pay (WTP) approach, which tends to produce higher estimates than other, more traditional, methods. So, in summary, human capital and WTP methodologies are simply ways of valuing life for economic purposes.

The willingness to pay methodology is supported by the AAA and member clubs, as when it comes to making investment decisions, particularly on road infrastructure projects, a WTP approach would be expected to increase the economic justification for projects with a substantial safety component. The willingness-to-pay approach is also widely used among OECD countries as the preferred approach to valuation and there is a growing acceptance that this practice should be adopted more widely and more consistently in Australia. However, the techniques for determining willingness-to-pay values vary and are quite complex.

- Human Capital approach: This technique treats an individual as a productive entity. Its application to transport safety involves estimating the victim's earning stream from the time of their premature death to the end of their actuarially expected lifetime. Australian approaches to estimating the economic benefits of safety measures have conventionally been based on the human capital method of valuing human life.

- Willingness-to-pay approach: Is an alternative method that relies on individual preferences for reducing risk to life. Estimates are based on the amounts that individuals are prepared to pay for reduced risk (or to accept in compensation for bearing risk). For a particular type of risk, a value for society is generally calculated by aggregating and averaging values obtained from a representative sample of individuals.

The NRSS noted that there is a need for Australia to develop and adopt suitable willingness-to-pay estimates at a national level, which was then included in the NRSS action plan. The work supporting this action is underway. As such a nationally agreed valuation method still hasn't been resolved, and so a number of values have been calculated by Economic Connections.

Using the willingness to pay approach used in BITRE 2009, the 2015 cost of road trauma is estimated at $29.7 billion. However, Economic Connections adopts the 'willingness to pay' based valuation of statistical life recommended by the Australian Government Office of Best Practice Regulation, in preference to the BITRE 2009 'hybrid human capital' valuation and the BITRE 2009 'willingness to pay' valuation. Comparison of estimates are included in the table below.

Table 3: *Economic cost of road trauma 2015 (and 2006) sensitivity tests*

Measure	BITRE 2009 Hybrid human capital approach (ECON proxy estimate)	ECON Willingness to pay approach (OBPR)	BITRE 2009 Willingness to pay for road safety in Australia sensitivity test
Value of statistical life 2015 (VSL, 40 years), 2015 $m	3.44	4.41	7.04
Value of statistical life year (VSLY), 2015 $m	144,370	185,073	333,473
Economic cost of road trauma 2015, $m	20,196.6	22,236.9	29,675.6
Economic cost of road trauma 2006 (BITRE 2009) estimates for reference			
Value of statistical life 2006 (40 years), 2006 $m	2.41		6.34*
Value of statistical life year 2006 $m	101,050		266,350
Economic cost of road trauma 2006, (2006 $m) 2015 $m	(17,849.3) 23,809.4		(27,120.0) 36,962.0

**ECON estimates based on BITRE 2009 and Hensher, D, Rose, J, de Dios Ortuzar, J and Rizzi, L 2009,* Estimating the willingness-to-pay and value of risk reduction for car occupants in the road environment

Source: BITRE 2009, Hensher et all 2009 and ECON analysis

Future directions

Future studies of the economic and financial costs of road trauma would benefit from:

- authoritative, research-backed guidance on the use of willingness to pay-based valuations of statistical life and statistical life year in Australian road safety project and policy analysis;
- improved data on non-hospitalised injuries, complementing a current National Road Safety Strategy initiative to link police-reported crash data and hospital admissions data on a nationally consistent basis;
- research into the longer term outcomes and costs for the full spectrum of persons disabled following road crash injury; and
- improved understanding of the opportunity costs for carers, in areas including work, study and recreation; and
- research into the impact of road crashes on road network congestion and efficiency.

Appendix

Government and non-government funding shares

Cost category	Government				Non-government
	Commonwealth	State & territory	Local	Total	
Taxation and income support (fatalities and injuries)					
Taxation loss	80.0%	16.5%	3.5%	100.0%	0.0%
Income support net increase	100.0%			100.0%	0.0%
Disability care					
Carers	20.7%			20.7%	79.3%
Aids, appliances and equipment	17.6%			17.6%	82.4%
Health services					
Paramedical	4.1%	0.9%		5.0%	95.0%
Medical - hospitalised	4.1%	0.9%		5.0%	95.0%
Medical - non-hospitalised	50.0%	11.1%		61.1%	38.9%
Hospital stay	4.1%	0.9%		5.0%	95.0%
Emergency services					
Ambulance		68.1%		68.1%	31.9%
Fire		32.5%		32.5%	67.5%
Police		100.0%		100.0%	0.0%
Vehicle-related					
Vehicle damage	0.1%	0.6%	0.1%	0.8%	99.2%
Vehicle unavailability	0.1%	0.6%	0.1%	0.8%	99.2%
Travel delays including additional pollution	0.1%	0.6%	0.1%	0.8%	99.2%
Street furniture damage		66.4%	33.6%	100.0%	0.0%
Legal and other					
Criminal legal		100.0%		100.0%	0.0%
Correctional services		100.0%		100.0%	0.0%
Coronial		100.0%		100.0%	0.0%

Source: ECON analysis

Glossary

Cost to government: The ECON report makes a distinction between financial costs to Government and costs to the economy more generally. Financial costs to government includes loss of taxation revenue and increased income support payments. In addition, 'financial costs to Government' includes costs associated with disability care, health services, emergency services, legal services and other costs related to vehicles such as infrastructure damage. Excluded from the analysis are costs associated with loss of life, health and wellbeing; insurance administration and funeral costs; and efficiency costs of additional government revenue-raising.

Disability Adjusted Life Year (DALY): A quantification of statistical life and disability following injury. The metric considers both loss of life and loss of functional wellbeing, and involves the use of weightings where a DALY of zero represents a year of perfect health and a DALY of one represents death.

Human Capital approach: This technique treats an individual as a productive entity. Its application to transport safety involves estimating the individual's earning stream from the time of their premature death to the end of their actuarially expected lifetime. Australian approaches to estimating the economic benefits of safety measures have conventionally been based on the human capital method of valuing human life

Value of statistical life (VSL): A measure of willingness to pay to avoid risk of losing a life with 40 years of life expectancy.

Value of statistical life year (VSLY): A measure of society's willingness to pay to avoid the risk of premature death, expressed in terms of saving a statistical life year.

Willingness to Pay (WTP) approach: This alternative to the Human Capital approach relies on individual preferences for reducing risk to life. Estimates are based on the amounts that individuals are prepared to pay for reduced risk (or to accept in compensation for bearing risk). For a particular type of risk, a value for society is generally calculated by aggregating and averaging values obtained from a representative sample of individuals.

Willingness to Pay (WTP) for Road Safety in Australia approach: The approach is based on individual preferences for reducing risk to life while travelling in a motor vehicle. Estimates are based on the value individuals would place on road safety in terms of avoiding a fatality.

Endnotes

[1] Based on ECON willingness to pay approach (OBPR).

[2] Willingness to pay for road safety in Australia approach was included as a sensitivity test in BITRE 2009.

[3] Cost per fatality has increased by 33 per cent since 2006, however this is attributed to change in valuation approach from human capital to willingness to pay (WTP). The change in valuation approach to disability carer labour also reduces hospitalised injury cost per person, as does increasing average age, with regard to both fatalities and hospitalised injuries. See Economic Connections Cost of Road Trauma 2015 for a detailed account of the change in valuation approach.

[4] When looking at base cases $22.2 billion (ECON 2017) versus $23.9 billion (BITRE 2009).

[5] This value was within one per cent of the nominal (actual) average repair cost in 2006.

[6] The report assumes that the time duration of forgone taxation and income support payments extends until member of the youngest age group will have reached the age of retirement from the workforce (i.e. age 70 from the mid 2030s onwards, under existing government policy). Government funded support services for disabled persons is expected to continue for the remainder of the disabled person's life.

Mailing Address:
GPO Box 1555
Canberra ACT 2601

P 02 6247 7311
T @aaacomms
W www.aaa.asn.au

Address:
103 Northbourne Ave
Canberra ACT 2601

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AUSTRALIAN AUTOMOBILE ASSOCIATION, 103 NORTHBOURNE AVE CANBERRA ACT 2601.