



# BENEFITS OF REDUCING THE AGE OF AUSTRALIA'S LIGHT VEHICLE FLEET

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**ECONOMIC  
CONNECTIONS**

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Australian  
Automobile  
Association

Summary report - December 2017





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## Foreword

The age of the Australian car fleet has remained consistently high compared to other developed nations, raising serious concerns over safety and vehicle emissions. Despite the nation's economic status as a relatively wealthy country, Australians own passenger vehicles that are on average 9.8 years old and light commercial vehicles that are on average 10.4 years old. The legacy of Australia's outdated car fleet is one of substandard safety features that fail to prevent road deaths. This is coupled with the added detriment of greater-than-necessary vehicle emissions.

The Australian Automobile Association (AAA) has commissioned Economic Connections (ECON), with Pekol Traffic and Transport and Monash University Accident Research Centre to analyse the benefits of a one-year reduction in the average age of Australia's light vehicle fleet.

This report has modelled the outcome based on two separate scenarios for the benefit of comparison and charted the benefits over a period of 20 years. The first scenario deals with the lowering of the age of the fleet by one year in a short take up period – of four years. The second scenario deals with lowering the fleet age by one year in a longer take up period – of eight years.

The results have shown the short take up period (four years) would yield a benefit of 1,377 lives saved. The economic results of this reduced road trauma coupled with the emission reduction benefits over the 20 years would total \$19.7 billion.

The second scenario with a longer take up period (eight years) would save 1,206 lives. The road trauma and emission reduction benefits over the 20 years would total \$16.8 billion.

The cost of new cars is a significant deterrent for consumers, however the Government could lower the price of new vehicles by abolishing tariffs (especially given the end of the Australian car manufacturing industry) and the luxury car tax (LCT) – which would save consumers about \$4.7 billion over the forward estimates. The Government could also ensure the broader Australian tax regime encouraged the purchase of safer vehicles.

The AAA urges the Australian Government to use these levers to reduce the vehicle fleet age given the significant productivity, environmental and safety benefits.



**Michael Bradley**

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Chief Executive  
Australian Automobile Association

## Foreword

Economic Connections Pty Ltd is pleased to have undertaken this analysis of the road safety and emissions-related benefits of reducing the average age of Australia's light vehicle fleet, in partnership with Peko Traffic and Transport and the Monash University Accident Research Centre.

The report shows the significant gains to be made over a 20 year period in reduced road trauma from a younger vehicle fleet, given 'step change' improvements in vehicle safety in recent year vehicle models.

Through the AAA, we trust that this research assists in contributing to debate on national policy strategies to improve road safety and to alleviate the health and climate change impacts of road transport.



**Phil Potterton**  
**Anthony Ockwell (Dr)**

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Directors  
Economic Connections Pty Ltd

## Section One

# Introduction

The Australian Automobile Association commissioned Economic Connections (ECON), with Peko Traffic and Transport and Monash University Accident Research Centre, to analyse the road safety and environmental benefits of a one-year reduction in the average age of Australia's light vehicle fleet.

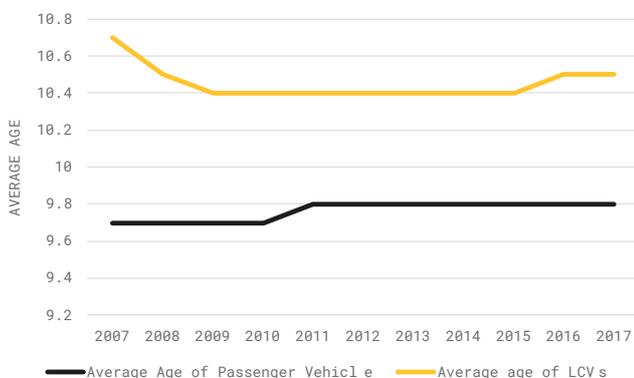
The AAA summary report provides an overview of the *Benefits of reducing the age of Australia's light vehicle fleet* report (the ECON report).

Two alternative scenarios have been modelled as part of the analysis; a short phase-in period and a long phase-in period to better inform policy makers. The short phase-in period supports significant policy intervention which would reduce the age of the vehicle fleet by one year over a period of four years. The long phase-in scenario models a policy intervention that can be implemented over a period of eight years.

The ECON 2017 report has considered both passenger cars and light commercial vehicles (LCVs) in its analysis.<sup>1</sup> LCVs have been included in recognition of the fact that they are an increasingly popular vehicle choice in Australia and have less stringent safety and environmental standards than passenger vehicles. These combined factors mean that Australians are at an increased risk on our roads.

The average age of the Australian light vehicle fleet has remained static over the past 10 years. It is around 9.8 years for passenger cars and around 10.5 years for LCVs (Figure 1).

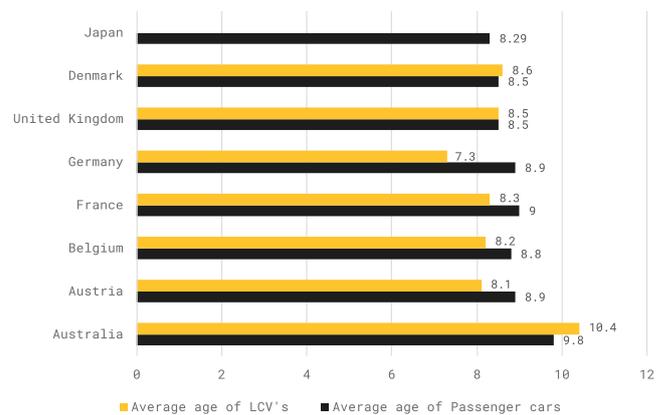
**Figure 1:** Average age of motor vehicles in Australia, over 10 years.



Source: Australian Bureau of Statistics (ABS) Motor Vehicle Census

The average age of Australia's light vehicle fleet also remains relatively high when compared to some international jurisdictions (Figure 2).

**Figure 2:** Comparison of the average age of motor vehicles, by country, 2015<sup>2</sup>



Reducing the age of the vehicle fleet is a high-level direction outlined in the National Road Safety Strategy (NRSS), however the most recent NRSS progress report noted that the national average fleet age for 2015 was slightly greater than the average in the baseline period. Further, the progress report noted that 'no specific action has been undertaken aimed at reducing fleet age, beyond the promotion of safer vehicles'. Consequently, the AAA urges the Australian Government to prioritise actions that seek to reduce the vehicle fleet age given the significant productivity, environmental and safety benefits.

The report is divided into the following high-level sections:

1. A future light vehicle fleet is estimated under a 'business as usual' case and under two scenarios: a 'short take up' (four-year phase-in) and a 'long take up' (eight-year phase in), with the reduced average age retained for the remainder of a 20-year analysis period.
2. Road safety impacts and vehicle emissions impacts are quantified for the business as usual case for each scenario.
3. A benefit analysis is conducted, providing an economic valuation of: the reduction in fatalities, disabilities and other costs (road trauma); avoided mortality and morbidity (pollutant emissions); and avoided climate damage (greenhouse gas emissions).
4. Financial savings to government resulting from benefits are estimated.

# BENEFITS OF A YOUNGER FLEET

If the average age of the Australian light vehicle fleet was reduced by one year over a period of four years, there would be significant safety, economic and environmental benefits over the 20 year analysis period.

## NEWER CARS ARE SAFER



**5.4%** REDUCTION  
IN CRASHES



**1,377**  
fewer fatalities



**44,467**  
fewer hospitalised  
injuries



**262,995**  
fewer non-hospitalised  
injuries

## SAVINGS FROM SAFETY AND EMISSIONS IMPROVEMENTS



**\$19.0B**  
in road trauma  
benefits



**SAVINGS**  
across areas such as  
income support and legal



**\$747M**  
in emissions reduction  
benefits

**\$3.3B** DIRECT SAVINGS  
TO GOVERNMENT

**\$19.7B** TOTAL BENEFITS

## ENVIRONMENTAL AND HEALTH BENEFITS



**POLLUTANTS TO FALL  
WITHIN A RANGE OF  
0.7% TO 11.6%**



**NET REDUCTION OF 0.1%  
IN CO2 EXPECTED**

## Section Two

# Road trauma trends

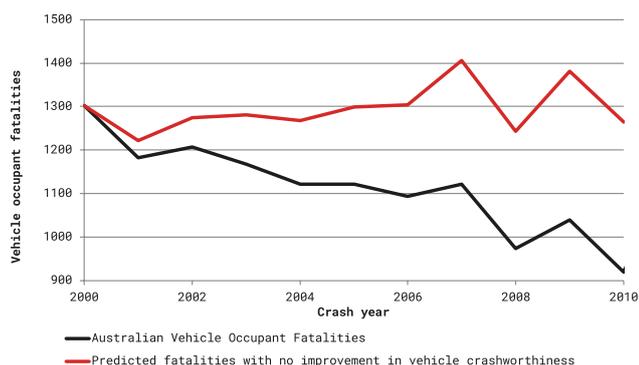
### Reducing the risk

Over a 50-year period of new vehicle design improvement, the risk of death or serious injury in a crash has fallen by nearly 75 per cent from around 8 per cent in the 1960s to around 2 per cent in 2015. A large part of this improvement has been driven by the introduction of Australian Design Rules (ADRs) for vehicles mandating the inclusion of safety features or safety performance requirements. In more recent times, improvements have also been driven by consumer information programs such as the Australasian New Car Assessment program (ANCAP) and the Used Car Safety Ratings (UCSR) program.

According to the ECON 2017 report, safe vehicles are a key pillar of the 'Safe System'. The Safe System has been designed to both assist crash avoidance in the event of human error, as well as manage transfers of energy during a crash to mitigate injury. Analysis of Australian crash data demonstrates that a light vehicle is involved in at least 90 per cent of all crashes reported to the police. Safety of the light vehicle fleet is therefore crucial, especially given that it has some role in determining injury outcomes. In the ECON 2017 report, safety of the light vehicle fleet is considered a dominant driver of overall vehicle safety in the Safe System.

Improvements in vehicle safety are also imperative to meeting future goals of the National Road Safety Strategy (NRSS). Newer vehicles tend to have improved occupant protection. Therefore, bringing newer, safer vehicles into the fleet, and replacing older, less safe vehicles improves the average safety of the fleet. Figure 3 shows total annual actual fatalities among light vehicle occupants involved in crashes over the years 2000 to 2010 against the expected number of fatalities had the fleet not regenerated.<sup>3</sup> The analysis shows the benefits of fleet regeneration on fatalities through the introduction of newer, safer vehicles into the fleet and the removal of older less safe vehicles. It indicates an annual saving of around 350 fatalities after 10 years.

**Figure 3:** Impact of improvement in crashworthiness on road fatalities



### The Business as Usual (BAU) Scenario

The ECON 2017 report considered a Business as Usual (BAU) scenario for comparative purposes. The BAU assessed some of the benefits of a younger vehicle fleet based on the current trajectory for improvements in the vehicle fleet. The BAU also provided a method for comparison for the two aforementioned scenarios.

Based on vehicle-related and socio-economic data, the future light vehicle stock is estimated to increase, in the BAU case, from 16.5 million in 2014, to 25.2 million in 2034. The vehicle fleet is projected to grow at an average annual rate of 2.1 per cent. Total vehicle kilometres travelled (VKT) are estimated to increase by 1.6 per cent a year for passenger vehicles.

In the BAU case, the total number of crashes is held constant, but with their severity reducing.

In summary, over the 20-year period from 2014 to 2034 the BAU case assumes:

#### ROAD SAFETY BENEFITS

- Fatal and injury crashes decline by 36 per cent
- Non hospitalised crashes fall from 27.9 per cent to 22.8 per cent
- Property damage crashes increase from 67.3 per cent to 74 per cent.

#### ENVIRONMENTAL BENEFITS

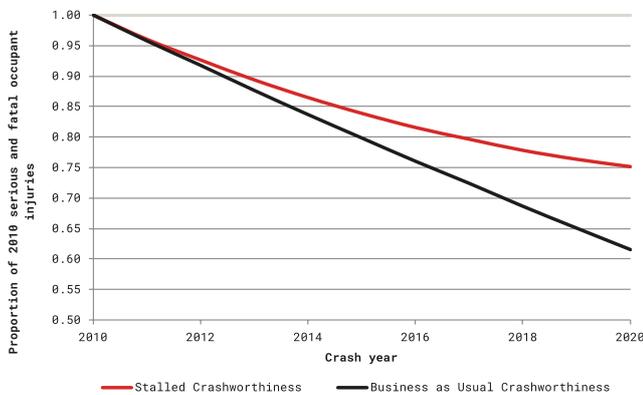
- Greenhouse gas emissions increase by 1.4 per cent per year for passenger vehicles and by 2.3 per cent per year for LCVs
- Methane (CH<sub>4</sub>) emitted by the passenger vehicle fleet, and nitrous oxide (N<sub>2</sub>O) emitted by passenger cars continue to decline
- Pollutants are projected to fall over the 20 year period, however at a diminishing rate.

## Projected changes in safety under BAU

The ECON 2017 report has selected a 20-year trajectory, from 2014 to 2034.

Figure 4 shows the estimated reduction in expected fatalities due to fleet regeneration under BAU and a “worst case” scenario, over a period of 10 years. BAU is based on the trend of improving crashworthiness of new vehicles continuing at the same rate as observed over the period from 1960s to 2015. Alternatively, the worst case scenario follows the assumption that there is no further improvement in the crashworthiness of new vehicles in future years. The worst case scenario still shows significant benefits from removing older vehicles from the fleet, however these improvements are expected to slow over time. As seen in the graph below, the estimated future fatality reductions vary across the two scenarios, from 25 per cent under the worst case scenario to 38 per cent under BAU, over a period of 10 years.

**Figure 4:** Projected impact of continued improvement in new vehicle crashworthiness



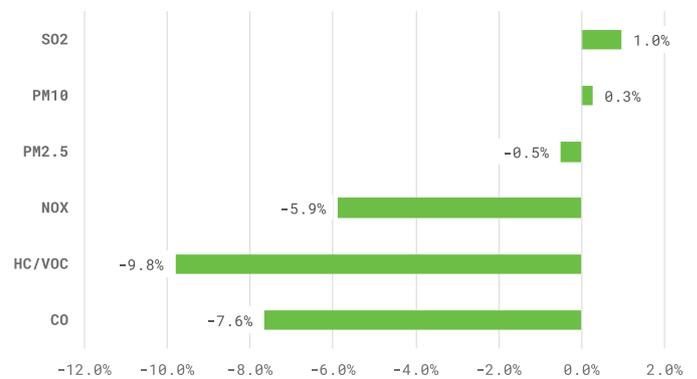
The ECON 2017 report considers the impact of two primary safety technologies, Autonomous Emergency Braking (AEB) and Electronic Stability Control (ESC). ESC has been mandated in new Australian passenger cars from 2012, while the fitment rate for LCVs is expected to reach 100 per cent by 2020. The AEB fitment rate is projected to follow the trajectory of ESC take up, approaching 90 per cent in the early 2020s, with LCVs reaching this level in the later 2020s.

The report assumes that the risk of crash involvement will fall by 9.8 per cent as a result of ESC, and by 12 per cent with the introduction of AEB.

## Projected changes in emissions under BAU

Under BAU, significant further reductions are expected in carbon monoxide (CO), hydrocarbons/volatile organic compounds (HC/VOC) and oxides of nitrogen (NOx) (Figure 5).

**Figure 5:** Pollutants, BAU, annual per cent change, 2014 - 2034



According to the ECON 2017 report, reduction rates for noxious emissions are projected to diminish by the mid 2020s, with very low levels having been achieved by that time as a result of the continuing impact of Euro 5 noxious emissions standards.<sup>4</sup> In contrast, ECON 2017 found that there is minimal progress in the reduction of particulate matter (PM) - the most harmful pollutant.

While the AAA acknowledges these assumptions, AAA-commissioned research<sup>5</sup> found that noxious emissions in the real world could be much higher than those reported in a laboratory. Further emissions reductions could be achieved by requiring real-world testing. This would suggest that emissions reductions from new vehicles may be able to provide a greater economic benefit than forecast by ECON 2017.

The ECON 2017 report notes that if tighter regulations were introduced the future emission trajectory would be lowered.

Under BAU conditions, greenhouse gas emissions are expected to increase by 1.4 per cent per year for passenger vehicles over the 20-year period from 2014 to 2034.<sup>6</sup>

The ECON report estimates that greenhouse gas emissions will increase by 2.3 per cent per year for LCVs. Conversely, methane (CH4) emitted by the passenger vehicle fleet, and nitrous oxide (N2O) emitted by passenger cars are expected to continue to decline.

# Detailed analysis

## Overview

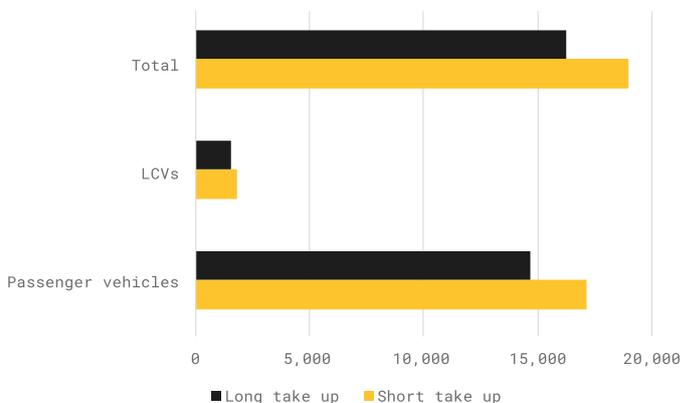
An economic valuation was conducted to measure the benefits of a younger fleet. The valuation was based on estimates of: reduced road trauma from improved vehicle safety, avoided health costs from lower vehicle pollutant emissions, and avoided global climate damage from reduced greenhouse gas emissions.<sup>7</sup>

The present value of total benefits is estimated at \$19.7 billion in the short take up and \$16.8 billion in the long take up scenario.

## Road safety benefits

The ECON 2017 report has estimated that the monetary value of road trauma benefits over the 20-year period would be \$19.0 billion in the short take up, and \$16.3 billion in the long take up. Passenger vehicles account for 92 per cent of benefits in short take up and 90 per cent in long take up.

**Figure 7: Road trauma reduction benefits \$billion**



Under the short take up period of four years, total fatal crashes would fall by 1,263 and hospitalised injury crashes would decline by 36,298. Total crashes (all types) would fall by 5.4 per cent. In the long take up scenario of eight years, all crashes would reduce by 4.8 per cent.

Fatal and hospitalised crashes<sup>8</sup> reduce in the short take up by 7.5 per cent for passenger vehicles, and in the long take up by 6.5 per cent. LCV fatal and hospitalised crash numbers would fall by 5.2 per cent under the short take up, and 4.6 per cent under the long take up period.

Under the short take up period, fatalities<sup>9</sup> are estimated to fall by 1,377, with 44,467 fewer hospitalised injuries (total 20-year injury reduction) and 262,995 fewer non-hospitalised injuries. Injury reduction outcomes for the short up take scenario are 12 per cent higher than the long take up scenario.

In terms of annual impacts, estimated crash savings peak at the point where the full maximum age reduction is delivered (after 4 years and 8 years respectively) and diminish slightly thereafter. Over 20 years, total crashes are 5 per cent lower than BAU.

## Emission reduction benefits

Transport emissions are detrimental to human health, both in the short term and the long term. This is because transport emissions deteriorate air quality, which subsequently increases the risk of death, hospitalisation and asthma attacks.

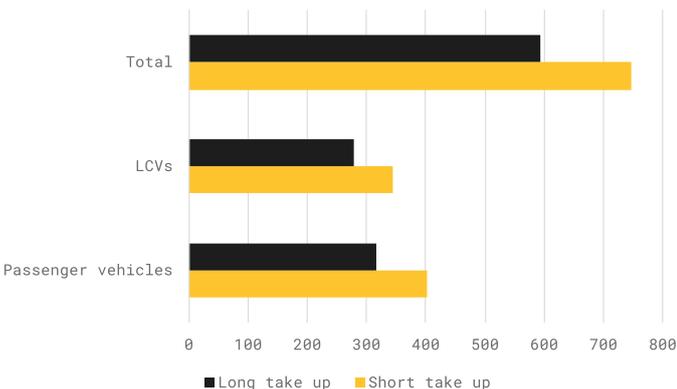
Light petrol vehicles are the main transport contributors to carbon dioxide emissions, while diesel vehicles tend to produce nitrogen oxide at a higher rate per vehicle relative to petrol vehicles. Vehicle exhausts are a source of particle emissions, which are damaging to human health, as they often contain metals and sulfates. In addition, greenhouse gas emissions from the burning of fossil fuels also have a detrimental impact on the environment.

The BAU scenario estimates that carbon dioxide (CO<sub>2</sub>) emitted by total road transport will continue to increase at around two thirds of the rate of increase in total distance travelled. CO<sub>2</sub> emissions from road transport are projected to grow around 1 per cent per year between 2015 and 2030.

Notwithstanding this situation, new vehicles are mostly more fuel efficient than their older counterparts and the long-term trend improvement rate for new light vehicles has been estimated at slightly greater than one per cent per year. This trend improvement creates a limited opportunity to lower greenhouse gas emissions and assist the effort to mitigate climate change, through introduction of a younger vehicle fleet.

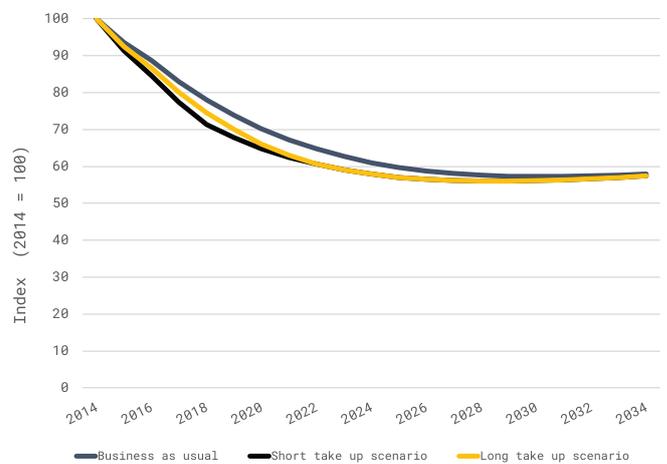
The ECON 2017 report finds that the present value of emission reduction benefits over the 20-year period is estimated at \$746.9 million in the short take up, and \$593.9 million in long take up scenario. Passenger vehicles account for 78 per cent of benefits in the short take up; 77 per cent of benefits under the long take up.

**Figure 8: Emission reduction benefits, present value, 2015, \$m**



Under the short take up period, pollutants are projected to fall within a range of 0.7 per cent to 11.6 per cent.<sup>10</sup> Under the long take up the corresponding range is from 0.6 per cent to 8.6 per cent.<sup>11</sup>

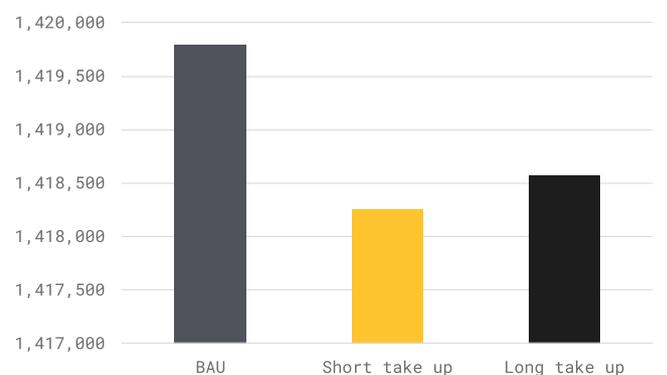
**Figure 9: Pollutant emissions, business as usual and scenarios**



A small net reduction of 0.1 per cent in CO<sub>2</sub> emissions is expected under the short and long take up scenarios over the 20-year period (Figure 12). This includes a partially offset increase in LCV emissions.

While the fuel consumption rate for new petrol LCVs is expected to continue to decline, the fuel consumption rate for the growing share of new diesel LCVs is expected to remain fairly static and scenario reductions are almost too small to discern.

**Figure 10: CO<sub>2</sub> Emissions, in tonnes, over a period of 20 years**





## Financial savings to government

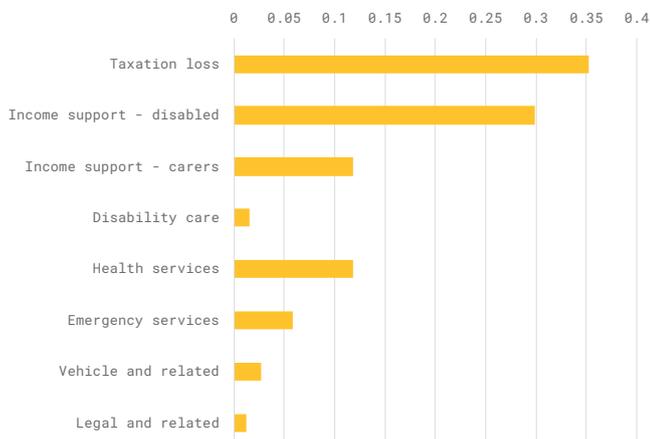
Government finances are impacted by road trauma and pollution-induced mortality and morbidity particularly through, the affects they have on workforce participation and earnings. This has implications for government taxation revenues and income support expenditure outlays. In addition, there are increased costs to government such as emergency service costs, and health and disability care costs not covered by private insurance arrangements.

In a separate report Economic Cost of Road Trauma 2015, also commissioned by the AAA, the cost to government of 2015 road trauma was estimated at \$3.7 billion.<sup>12</sup> More than three quarters of this cost comprised the present value of many future years of forgone taxation revenue and additional income support payments, arising directly from road crash fatalities and disabilities and the cost of disability carer income support.

About one third of the cost to government from 2015 road trauma was estimated to accrue immediately, i.e. within twelve months of the crash, whereas forgone taxation and additional income support and disability care costs, accrue over a period of more than 90 years.<sup>13</sup>

The ECON 2017 report also calculated financial savings to government, this time for a one-year reduction in the vehicle fleet age. Savings to government across taxation, income support, health services, emergency services, legal and other areas of government are estimated at \$3.3 billion (short take up) and \$2.8 billion (long take up), both in 2015 prices. Percentage distribution across cost categories are given in Figure 11.

**Figure 11:** Savings to government from reduced road trauma, by cost category, per cent



## Section Four

# Methodology

### Overview

A future light vehicle fleet is estimated under BAU case and under the two alternative long and short term scenarios, with the reduced average age retained for the remainder of a 20 year analysis period. The report assumes a base year of 2014.

### Benefits analysis

The ECON 2017 report included an economic valuation of future benefits. The report adopts a discount rate of three per cent (real), consistent with ECON 2017 and BITRE 2009.

The report also includes sensitivity tests, to quantify the net present value of benefits in short and long take ups under BITRE's human capital valuation approach and the BITRE 2009 willingness to pay (WTP) for road safety approach.

Under the human capital valuation approach, the net present value of benefits is \$17.5 billion and \$15.0 billion for the short and long take ups respectively. Under the WTP for road safety approach, corresponding benefits are \$26.6 billion and \$22.7 billion for the short and long take up scenarios. (Table 1)

**Table 1: Sensitivity tests, alternative parameter valuations, 2015 \$m**

Scenario	SENSITIVITY 1 <sup>(1)</sup>			STUDY ESTIMATES			SENSITIVITY 2 <sup>(2)</sup>		
	Passenger vehicle	LCV	Total	Passenger vehicle	LCV	Total	Passenger vehicle	LCV	Total
<b>Short take up</b>	<b>15,734.9</b>	<b>1,808.0</b>	<b>17,542.9</b>	<b>17,544.0</b>	<b>2,160.7</b>	<b>19,704.7</b>	<b>23,606.6</b>	<b>2,991.6</b>	<b>26,598.2</b>
Safety	15,533.4	1,636.0	17,169.5	17,141.0	1,816.7	18,957.8	23,002.2	2,475.6	25,477.8
Emissions	201.5	172.0	373.5	402.9	344.0	746.9	604.4	516.0	1,120.4
<b>Long take up</b>	<b>13,465.1</b>	<b>1,561.6</b>	<b>15,026.7</b>	<b>14,988.8</b>	<b>1,857.0</b>	<b>16,825.8</b>	<b>20,127.4</b>	<b>2,565.5</b>	<b>22,692.9</b>
Safety	13,307.4	1,422.4	14,729.7	14,673.4	1,578.5	16,251.9	19,654.1	2,147.8	21,801.9
Emissions	157.8	139.2	297.0	315.4	278.5	593.9	473.3	417.7	891.0

(1) This involves, for road safety, an ECON proxy of the BITRE hybrid human capital approach and, for emissions, a 50 per cent reduction of all study values.

(2) This involves use of the BITRE 2009 willingness to pay for road safety sensitivity approach and, for emissions, an increase in study values of 50 per cent.

Sensitivity tests also considered an alternative discount rate of seven per cent. Under the human capital valuation approach, total benefits are approximately \$12.8 billion and \$10.5 billion for the short and long take up scenarios. Under WTP for road safety method, total benefits are estimated at \$19.4 billion and \$15.9 billion for short and long take up periods. (Table 2)

**Table 2: Sensitivity tests, 7 per cent discount rate, 2015 \$m**

Scenario	SENSITIVITY 1 <sup>(1)</sup>	STUDY ESTIMATES	SENSITIVITY 2 <sup>(2)</sup>
<b>Short take up</b>	<b>12,763.8</b>	<b>14,364.0</b>	<b>19,429.3</b>
Safety	12,473.2	13,782.7	18,557.4
Emissions	290.6	581.3	871.9
<b>Long take up</b>	<b>10,504.4</b>	<b>11,796.5</b>	<b>15,921.2</b>
Safety	10,282.8	11,353.3	15,256.3
Emissions	221.6	443.3	664.9

The economic valuation of road trauma has been based on the ECON update, using 2015 data, of estimates by BITRE of the cost of road trauma in 2006. The WTP approach has been recommended by the Office of Best Practice Regulation (OBPR).

The valuation of pollutant emissions was based on Australian Government's draft regulation impact statement on introduction of Euro 6 light vehicle emission standards.



# Endnotes

- 1 Light commercial vehicles are motor vehicles constructed for the carriage of goods or specialised equipment which are less than or equal to 3.5 tonnes gross vehicle mass (GVM). These include utility vehicles, panel vans, cab chassis, and goods carrying vans with a GVM of less than 3.5 tonnes (for example, the Toyota Hilux or Ford Ranger).  
  
Light passenger vehicles are motor vehicles constructed for the carriage of persons and contain less than 10 seats, excluding motorcycles (two and three wheeled vehicles) and buses (10 or more seats).
- 2 Data on the average age of light commercial vehicles (LCVs) in Japan was unavailable.
- 3 i.e. had the mix of vehicles in the fleet by year of manufacture stayed the same as in 2000.
- 4 through ADR 79/04 – Emission Control for Light Vehicles) for newly approved models first manufactured from November 2013 and for all light vehicles manufactured from November 2016 (DIRD 2016c, p. 12).
- 5 ABMARC, The Real World Driving Emissions Test – 2017 Fuel economy and emissions report (2017) accessed at: <http://aaa.asn.au/storage/real-world-driving-emissions-test-summary-report.pdf>
- 6 In carbon dioxide equivalent (CO<sub>2</sub>-e) terms.
- 7 A discount rate of 3 per cent was applied in the analysis.
- 8 Fatal crashes refer to crashes for which there is at least one death. A single fatal crash may result in a number of fatalities.
- 9 Fatalities, in this context refers to the number of people killed in a crash
- 10 Under the short take up scenario, pollutants range from 0.7 per cent (SO<sub>2</sub>) to 11.6 per cent (HC/VOC)
- 11 Under the long take up scenario, pollutants range from 0.6 per cent (SO<sub>2</sub>) to 8.6 per cent (HC/VOC).
- 12 In present value terms, discounted at three per cent real.
- 13 By which time the youngest person killed or disabled in a road crash within the 20 year analysis period would otherwise, on actuarial assumptions and absent the road crash, have ceased either paid work or reliance on disability-related income support.

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