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Department of Infrastructure, Transport, Regional Development and Communications

Final Regulation Impact Statement

Reducing Trauma from Light Vehicles: Autonomous Emergency Braking

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Reducing Trauma from Light Vehicles: Autonomous Emergency Braking Final Regulation Impact Statement

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Contents

Executive Summary

Road Crash Trauma Involving Light Vehicles

The impact of road trauma is significant, costing the Australian economy over $29 billion per annum. Light vehicle crashes constitute almost $13 billion of this, including around $1.9 billion from crashes involving a light vehicle striking a pedestrian or the rear of another vehicle. These types of casualty crashes are concentrated in urban areas where increasing population and traffic density raises crash frequency. Whilst they may not be as destructive as other crash types (such as heavy vehicle crashes), the vulnerability of pedestrians and high rear-end crash frequencies amount to significant trauma and associated costs. This is the specific road safety problem that has been considered in this Final Regulation Impact Statement (RIS).

Most rear-end crashes take place in urban traffic, at intersections and in tunnels due to a combination of driver distraction and the relative cognitive complexity of these traffic conditions. Rear-end crashes also have an increasingly apparent correlation between the types of locations noted above and periods of high traffic density e.g. peak hour traffic. For these reasons, rear-end crashes occur on urban roads at a rate around 20 per cent higher than on rural roads.

Pedestrians comprise 13 per cent of all road fatalities in Australia. Risk of a pedestrian being struck by a vehicle increases in urban areas where high pedestrian activity and traffic densities converge. Unlike vehicle-to-vehicle collisions where occupants can be substantially protected by vehicle safety systems, pedestrians are unprotected and trauma can be severe. Children and the elderly are particularly vulnerable to fatality and severe or permanent injury when struck.

The top five pre-crash risks in fatal road crashes in Australia (often referred to as “Fatal Five” behaviours) are speeding, intoxication, fatigue, distraction and unrestrained occupants. The majority of these behaviours result in slower driver reaction in emergency situations. Post-crash statistics published by jurisdictions show that these behaviours result in trauma crashes most commonly occurring in complex or dense driving situations including at intersections, multi-lane merges and pedestrian crossings. Though campaigns targeting driver behaviour can help reduce rates of driver error, Advanced Driver Assist Systems (ADAS) such as Autonomous Emergency Braking (AEB) can directly mitigate collisions where driver reaction is insufficient.

Autonomous Emergency Braking (AEB)

AEB is designed to reduce the likelihood of a crash by warning the driver and then automatically braking to reduce impact speed when a collision is imminent. Whilst AEB has been available for some time, such as Volvo’s low cost standard fit City Safety low-speed AEB system (NHTSA, 2013) introduced in 2008, its performance varies across the Australian fleet, particularly with regard to protecting pedestrians and infrastructure. Consequently, early analyses may have overstated the effectiveness of AEB systems or may have anticipated particularly sophisticated future systems.

Under the National Road Safety Strategy 2011-2020, the Department of Infrastructure, Transport, Regional Development and Communications (the department) works to increase the uptake of effective safety technologies through the development of national vehicle standards known as the

Australian Design Rules (ADRs). The Department is active in the development of internationally agreed standards for new vehicle technologies, commonly known as United Nations (UN) regulations, that form the basis of the ADRs. Harmonising ADRs with these UN regulations provides Australian consumers with access to vehicles meeting the latest global levels of safety and innovation at the lowest possible cost.

No country has yet implemented a standard for AEB for light vehicles, the European Union (EU) is mandating AEB for light vehicles from July 2022. The Department played a leading role in the rapid international development of a new standard for AEB for light vehicles through the UN World Forum for the Harmonization of Vehicle Regulations (known as WP.29), including shaping the international standard to suit Australian road safety. The standard was endorsed by WP.29 in early 2020 and has been available for adoption by contracting parties from late 2020 as a UN regulation.

In preliminary evaluations, the department found that mandating AEB prior to AEB technology maturity (particularly with respect to pedestrian detection) and the availability of an effective standard would not have been cost-effective in Australia. Moreover, if adopted as an ADR prior to the availability of an internationally agreed standard, the benefits of harmonisation could not be obtained, creating additional costs and regulatory barriers for manufacturers.

With the development of a new UN regulation for AEB for light vehicles underway, the department commissioned research into its impact on Australian road safety. This research found that AEB has the potential to positively impact the outcome in up to 64 per cent of light vehicle crashes occurring in low (up to 60 km/h) speed zones. The research further highlighted that injury risk reductions associated with AEB were greater for serious and fatal injuries than for minor injuries. The research also found that AEB reduced injury risk in crashes involving pedestrians, having greatest influence in alleviating minor pedestrian injuries and mitigating elderly pedestrian fatalities.

Prior to the availability of an international standard, non-regulatory programs such as the Australasian New Car Assessment Program (ANCAP) are fundamental in increasing the uptake of promising technologies such as AEB. The Commonwealth provides substantial funding to the ANCAP for this purpose. The ANCAP’s latest market analysis based on sales of Australian new light vehicles shows the standard fitment of AEB has increased rapidly – rising from 18 per cent in June 2017 to 71 per cent in September 2020 of all new light passenger, SUV and light commercial vehicles sold. However, AEB is now not available for 12 per cent of vehicles sold, which is a reduction of 1 per cent from approximately one year ago.

Though some AEB systems available in Australia may not yet meet all requirements of the new UN regulation for light vehicle AEB, these uptake figures and independent testing by the ANCAP demonstrate that manufacturers are capable of achieving high deployment rates and meeting or exceeding minimum performance requirements.

Harmonising AEB requirements also enables consistency in driver expectations of system capability (including day/night and inclement weather performance) and usage (including by standardising activation requirements and the provision of driver warnings/feedback). As with other technologies covered by UN regulations, harmonised minimum requirements will enhance the usability and effectiveness of AEB independent of manufacturer or a driver’s brand familiarity.

This Final RIS considers six base options to increase the fitment of AEB systems to reduce rear-end and pedestrian fatalities in the Australian light vehicle fleet: Option 1: no intervention (business as usual); Option 2: user information campaigns; Option 3: fleet purchasing policies; Option 4: codes of practice; Option 5: mandatory standards under the *Competition and Consumer Act 2010* (C'th) (CCA); Option 6: mandatory standards under the *Road Vehicle Standards Act 2018* (C'th)[1] (RVSA).

Option 2 was separated into two sub-options: 2a (targeted awareness) and 2b (advertising). Of the base options, Option 1, 2a, 2b, and 6 were considered viable and were examined in detail. The results of the benefit-cost analysis over a 35 year period for each of these options (assuming an intervention policy period of 15 years) are summarised in Table 1 to

Table 3.

Table 1: Summary of gross and net benefits for each option

	Gross benefits ($m)	Net benefits ($m)	
		Best case	Likely case
Option 1: no intervention	-	-	-
Option 2a: targeted awareness	334	92	28
Option 2b: advertising	554	40	-65
Option 6: regulation	2,681	1,477	1,089

Table 2: Summary of costs and benefit-cost ratios for each option

	Costs ($m)	Benefit-cost ratios	
		Best case	Likely case
Option 1: no intervention	-	-	-
Option 2a: targeted awareness	306	1.4	1.1
Option 2b: advertising	619	1.1	0.9
Option 6: regulation	1,592	2.1	1.7

[1] Set to replace the *Motor Vehicle Standards Act 1989.*

Table 3: Summary of number of lives saved and serious injuries (hospital admissions) avoided

	Lives saved	Serious injuries avoided	Minor injuries avoided
Option 1: no intervention	-	-	
Option 2a: targeted awareness	37	1,294	4,644
Option 2b: advertising	86	3,009	10,802
Option 6: regulation	582	20,524	73,868

Option 6 which enables regulation through the adoption of the new UN regulation for light vehicle AEB generated the highest number of lives saved (582) and serious (20,524) and minor (73,868) injuries avoided to yield the highest savings ($2,681 million) and highest benefit-cost ratio range of 1.7 (likely) to 2.1 (best).

Public Comment

A consultation version of this RIS was circulated for an eight week public comment period, which closed on 11 December 2020. A summary of the feedback and department responses is included at Appendix 8.

The implementation timeframe proposed for consultative purposes was 1 July 2022 for new vehicle models and 1 July 2024 for all new vehicles (for both Car-2-Car and Car-2-Pedestrian detection, C2C and C2P respectively).

During the consultation period, feedback was received from members of the public, state government agencies, industry, and road user organisations. A majority of the feedback strongly supported the implementation of Option 6.

Most passenger and light commercial vehicle manufacturers, importers and their representative organisation (the Federal Chamber of Automotive Industries, FCAI) supported Option 1 - No intervention. In their submissions they argued that there was no need for intervention by the Government as they were voluntarily fitting AEB systems or that it is an option on most of their models and for some manufacturers at least standard for their premium models. The FCAI and a majority of its members that made individual submissions indicated more implementation time is needed, especially for AEB systems capable of detecting collisions with pedestrians and suggested longer implementation time is required if Option 6 - Regulation is the most strongly supported option. If Option 6 is the preferred option they proposed an implementation schedule that would allow suppliers appropriate and sufficient lead times. Their proposals highlighted that it is essential for uninterrupted supply of vehicles to Australia that introduction is not in advance of schedules adopted in major international markets.Their recommendation for implementation timing was to align with the introduction of the regulation in other major markets, especially the EU. It was highlighted in their submissions to further stage the introduction of the requirements in the standard so that C2P detection is delayed by two years after C2C detection is implemented.

During the development of the Consultation RIS, the original version of the UN regulation for light vehicle AEB (version release date 4 February 2020) had combined requirements for C2C and C2P detection in the context of gaining a Type Approval from the UN. Under this arrangement, the benefits and costs identified in the Consultation RIS took into account C2P detection benefits from July 2022. However, in November 2020 during the public consultation period for the Consultation RIS, the first supplement to the original version of the UN regulation was released splitting the requirements for gaining a Type Approval for C2C and C2P. Seperating C2C and C2P requirements with regard to gaining a Type Approval in the UN context aligns with industry's submissions on the Consultation RIS to stage the requirements for C2C and C2P detection.

The effect of extending the implementation schedule was examined in a sensitivity analysis; this involved considering the extension to mandating AEB systems capable of detecting pedestrians to July 2024. Therefore the revised implementation timing proposed would be as follows:

For AEB systems capable of detecting collisions with other vehicles (00 series of UN Regulation No. 152)

- July 2022 for new model vehicles
- July 2024 for all new vehicles.

For AEB systems capable of detecting collisions with pedestrians (00 series of UN Regulation No. 152)

- July 2024 for new model vehicles
- July 2026 for all new vehicles

The effect of this suggested timing by industry on benefits, costs and lives saved was examined in a post consultation analysis, which also showed substantial positive benefits in comparison with the Consultation RIS released in October 2020. Gross benefits identified increased to $2,681 million (from $ 2,645 million) and total costs reduced to $1,592 million (from $ 1,685 million). Average additional fitment costs for AEB systems were reduced by 30 per cent for the first two years in the benefit-cost analyses to accommodate AEB systems without pedestrian detection. There was a reduction in the trauma savings (4 less lives saved, 75 less major injuries prevented and 70 less minor injuries prevented) and a reduction in the required annual offset of $11 million (from $183 million to $172 million). The new timing provides for continuity of supply to the Australian market and certainty for business.

Five jurisdictions and one road safety agency made submissions strongly supporting the recommended Option 6 - Regulation, including in many cases maintaining the implementation timing recommended in the Consultation RIS to ensure the broadest benefit of the technology. One road safety agency supported the implementation of Option 3 - Government fleet purchasing policies until the implementation of Option 6 - Regulation is finalised. All jurisdictions that made submissions identified the voluntary fitment of AEB systems by manufacturers however highlighted that the feature is often not available as an option on lower cost variants within a model range. Their submissions noted these variants of a model are often those selected by people who are more vulnerable and/or have the potential to be involved in more road incidents such as young people and senior citizens. The ACT government submission further recognised the significant increase in safety for VRU (pedestrians) who are not participants in the consumer choice of vehicle owners but are potentially affected by the outcomes of those choices. All submissions identified variabilities in crash detection performance and operating interfaces would exist without a national standard and therefore would result in different outcomes to consumers, operators and ultimately road users in the context of a crash and its level of severity.

Submissions from Australasia's leading independent vehicle safety authority (Australasian New Car Assessment Program, ANCAP) and the peak organisation for Australia's motoring clubs (Australian Automobile Association, AAA) supported the recommended Option 6 - Regulation maintaining the implementation timing recommended in the Consultation RIS. ANCAP and AAA submissions also noted that the European Union plans to expand the AEB regulatory requirement for enhanced capability of detecting pedestrians and cyclists. Both submissions encouraged the Australian Government to participate in updating UN R152 to cater for additional AEB test scenarios, and subsequent adoption of an updated UN R152. ANCAP highlighted that despite its best efforts, there is not universal fitting of AEB across all new light vehicles and to reach 100 per cent fitting rate across the market, an ADR is required.

Recommended Option

In accordance with the Australian Government Guide to Regulation (2014) ten principles for Australian Government policy makers, the policy option offering the greatest net benefit is the recommended option. Option 6: regulation offers the greatest net benefit. Under this option, the UN regulation for light vehicle AEB (UN Regulation No. 152) would be mandated for new light passenger and commercial vehicles up to 3.5 tonnes Gross Vehicle Mass (GVM). These vehicles include ADR categories passenger vehicles MA, MB, MC and light goods vehicles NA1 and NA2. The relevant ADR categories are summarised in Appendix 1 - Vehicle Categories. The final implementation dates will be determined as part of the ADR by the Government.

The RIS Process

This Final RIS has been written in accordance with Australian Government RIS requirements. In the subsequent eight chapters, the seven assessment questions set out in the Australian Government Guide to Regulation (2014) have been addressed. In addition, measurement of regulatory burden and cost offsets are considered. The seven base assessment questions addressed are:

1. What is the problem you are trying to solve?
2. Why is government action needed?
3. What policy options are you considering?
4. What is the likely net benefit of each option?
5. Who will you consult about these options and how will you consult them?
6. What is the best option from those you have considered?
7. How will you implement and evaluate your chosen option?

In line with the principles for Australian Government policy makers, the regulatory costs imposed on business, the community and individuals associated with each viable option were quantified and measures that offset these costs have been identified. It is anticipated that regulatory savings from further alignment of the ADRs with international standards will offset the additional costs of implementing the recommended option.

Chapter 1: What is the Problem?

Overview

Trauma caused by light vehicles occurs more frequently than trauma associated with other vehicle types such as heavy vehicles and motorcycles. Light vehicle trauma crashes concentrate in urban areas where larger population, traffic complexity and density raises crash frequencies. Despite significant government efforts to reduce them, rear-end and pedestrian crashes remain the most prevalent trauma crash types in urban areas.

Experts agree that technologies such as autonomous emergency braking (AEB) can mitigate the high prevalence of rear-end and pedestrian trauma crashes and associated costs. Although voluntary fitment rates of AEB are increasing through manufacturer initiatives and informed consumer choices, there has been a recent increase in the number of light vehicle models in the market which cannot be purchased fitted with AEB. In addition, until recently, the lack of a standard for light vehicle AEB has meant that AEB capability, usage and performance varies substantially in the Australian light vehicle fleet. In particular, some current AEB systems cannot detect pedestrians.

1.1 The Cost of Road Trauma in Australia

Individuals and families affected by road crashes must deal with pain and suffering, medical costs, lost income, higher insurance premium rates and crash repair costs. There is also a personal cost that is not possible to measure. For society as a whole, road crashes also result in substantial costs in terms of lost productivity, property repair and healthcare expenses. The cost to the Australian economy is broadly borne by the general public, businesses and government and has been estimated to be over $29 billion per annum (ECON, 2017). This translates to an average cost of $1,170 per annum levied upon every person in Australia.

1.2 Light Vehicle Trauma Rates

Light vehicles represent over 74 per cent of the 19.5 million registered motor vehicles in the national fleet with an annual a growth rate of 1.2 per cent (1.6 per cent including light commercial vehicles) (ABS, 2019a). In Australia, light vehicles also account for more road kilometres travelled than any other vehicle type. In the 12 months ending June 2018, passenger vehicles travelled 179,761 million kilometres, accounting for 70.5 per cent of annual kilometres travelled on road, the greatest exposure of any vehicle type. Each light vehicle travels an average 12.6 thousand kilometres per year (ABS, 2019b).

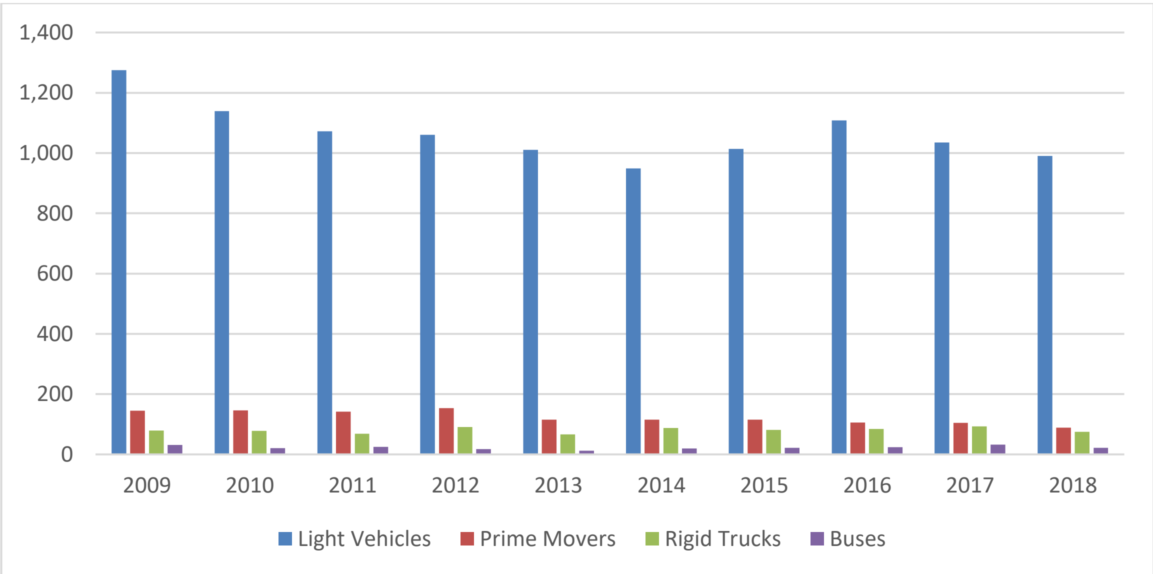
Whilst heavy and commercial vehicles are predominantly operated by professionals subject to government and industry oversight (for instance, in compliance with health and safety guidance), light vehicles are mostly driven for personal use (54 per cent) followed by travel to and from work (25 per cent), with fewer kilometres travelled for business purposes (21 per cent). In line with light vehicle registrations and the proportion of kilometres they travel, 71 per cent of crashes causing road trauma involve light vehicles (BITRE, 2019a). Recent research commissioned for this study indicate these crashes cost the Australian economy almost $13 billion each year.

1.2.1 Fatal Crashes

The Australian Road Deaths Database, maintained by the Bureau of Infrastructure, Transport and Regional Economics (BITRE), provides Australian road crash fatality data as reported by police. The majority of road fatalities are occupants of light vehicles, constituting approximately 75 per cent of all single vehicle crash fatalities and 68 per cent of all multiple vehicle crash fatalities (BITRE, 2019a).

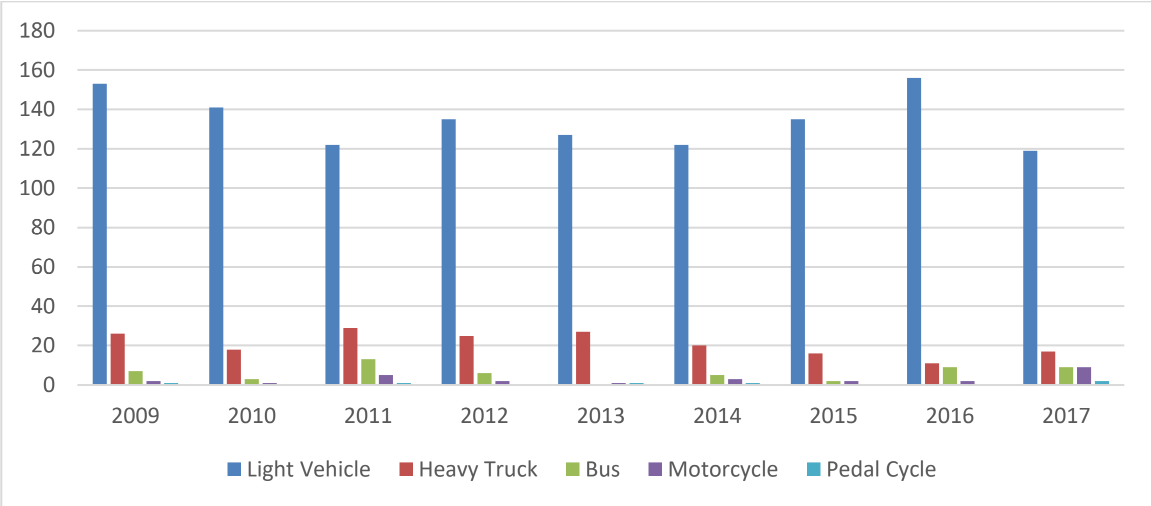
Light vehicle occupant fatalities historically outnumber combined fatalities from all other vehicle types. Figure 1 shows the annual number of deaths in crashes involving light vehicles in Australia compared to other vehicle types over the period 2009 to 2018. Fatalities in crashes involving light vehicles decreased by nearly 25 per cent between 2009 and 2014 but has since increased by 13 percent in 2016.

Figure 1: Yearly fatalities in crashes by vehicle type (BITRE, 2019a)



Light vehicle crashes causing pedestrian fatalities substantially outnumber combined pedestrian fatalities from all other vehicle types, and account for approximately 76 per cent of all fatal pedestrian accidents (BITRE, 2015). During the period 2017-2019, an average of 175 pedestrians fatalities were recorded each year (BITRE, 2019b). Figure 2 compares pedestrian fatalities in light vehicle crashes to pedestrian fatalities from other vehicle types. While crash outcomes for vehicle occupants have improved over the ten years to 2018, similar improvements have not occurred for pedestrians and other vulnerable road users including motorcyclists and pedal cyclists.

Figure 2: Pedestrian deaths – vehicle type involved (BITRE, 2019a)

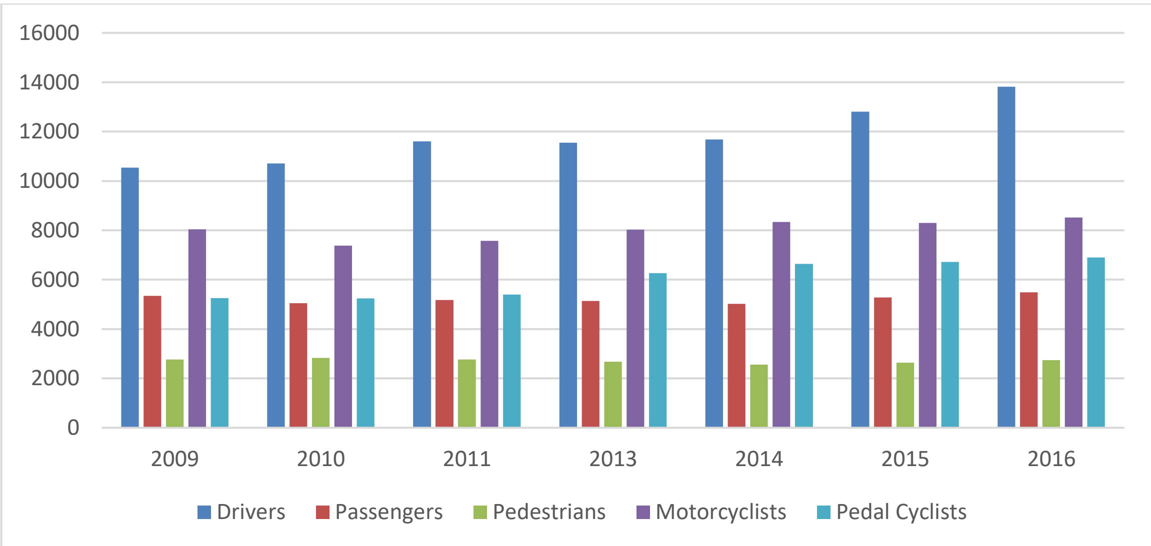


1.2.2 Serious and Minor Injury Crashes

The National Injury Surveillance Unit at Flinders University, using the Australian Institute of Health and Welfare National Hospital Morbidity Database, provides data on hospitalisations due to land transport incidents. Patients hospitalised following a road crash were most likely to have been injured because they were an occupant of a light vehicle, with annual rates of 71 and 74 hospitalisations per 100,000 population for males and females respectively (AIHW, 2018). Hospitalisation of pedestrians accounted for 12 cases per 100,000 population (AIHW, 2018).

Figure 3 shows that from 2009 to 2016, the trends for pedestrians and vehicle passengers hospitalised with injuries did not decline and that driver hospitalisations increased.

Figure 3: Hospitalised injuries – by road user (BITRE, 2019a)



1.3 Characteristics of Light Vehicle Crashes

Up to 90 per cent of road crashes in Australia result from human error (NTC, 2017). Numerous factors have been identified as increasing the risk of a driver being involved in a car accident. The top five pre-crash risk factors in fatal light vehicle crashes in Australia (often referred to as the "Fatal Five") are speeding, intoxication, fatigue, distraction and unrestrained occupants (ATSB, 2004).

In addition to identified pre-crash risk factors, Australian state and territory governments examine crash data reported by police so that common crash types can be identified and addressed, for instance through driver education campaigns targetting driver behaviour or encouraging the uptake of effective vehicle technology. Such information (Figure 4 to Figure 10) shows that complex and dense traffic situations (e.g., intersections, multi-lane merges, crossings and urban environments) are common factors in trauma crashes, with rear-end and pedestrian collisions the most frequent crash types reported in these situations.

This information has been used to shape driver education campaigns that encourage a change in driver behaviours and the uptake of effective technologies that can reduce rear-end and pedestrian crash risks. For example, in areas where rear-end and pedestrian trauma risk occurs, campaigns across a number of jurisdictions have targeted:

- driver attention
- safer speeds and reduced urban speed zoning near pedestrian areas and schools
- the benefits of drivers choosing newer vehicles fitted with technologies capable of mitigating driver error.

Figure 4: Crashes by type in ACT (ACT, 2017)

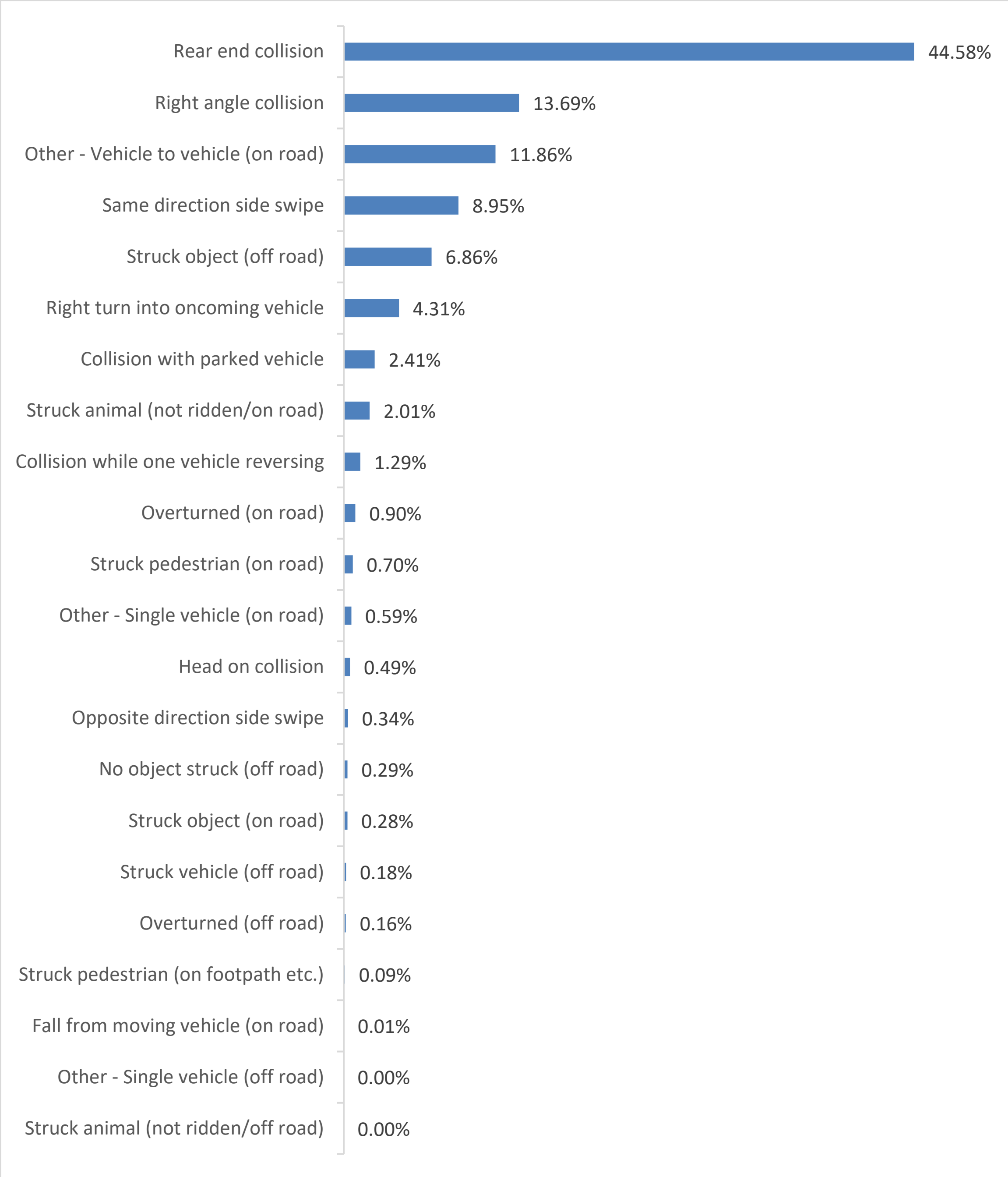


Figure 5: Crashes by type in NSW 2013 - 2017 (TfNSW, 2018)

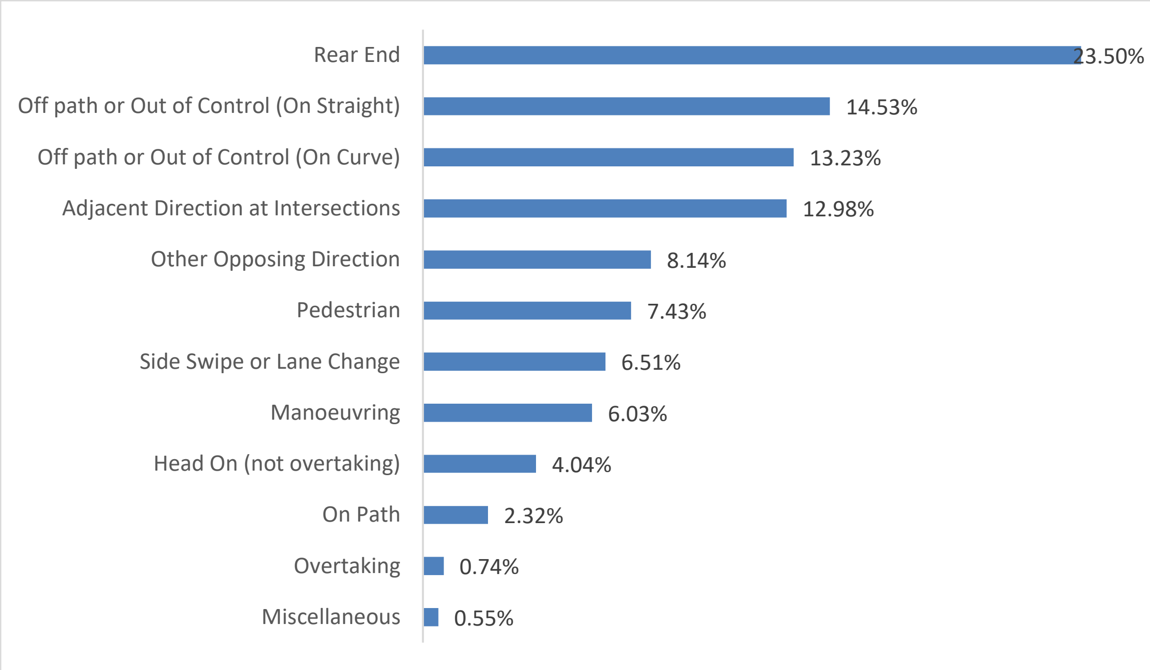


Figure 6: Crashes by type in QLD (QLD, 2019b)

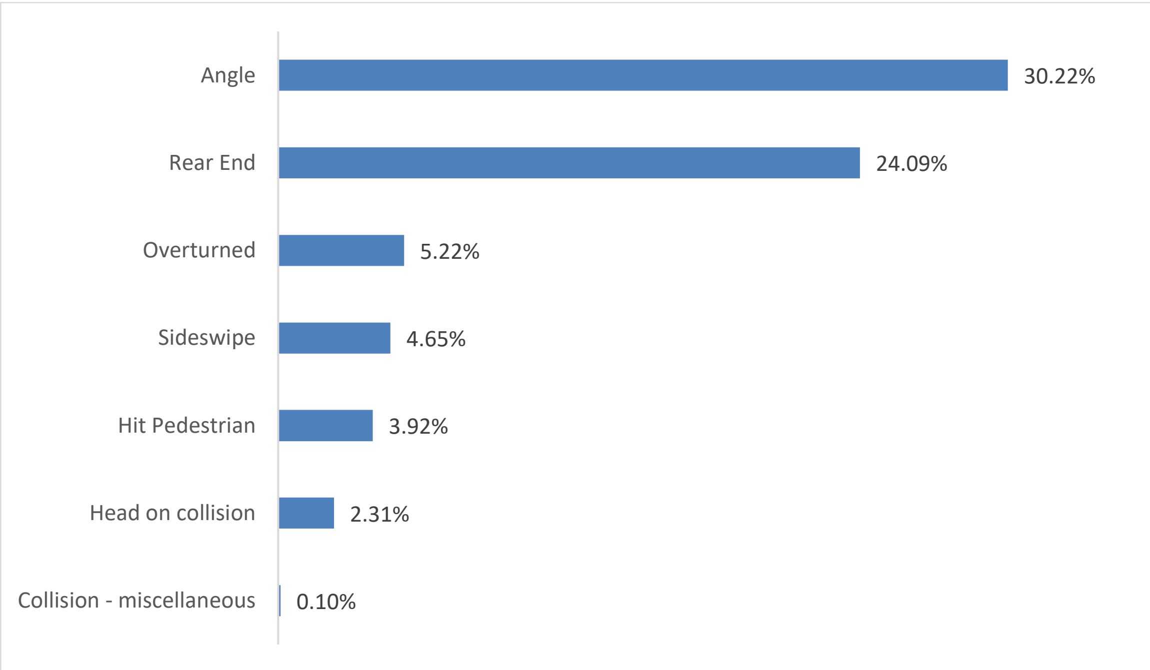


Figure 7: Crashes by type in SA (SA, 2018)

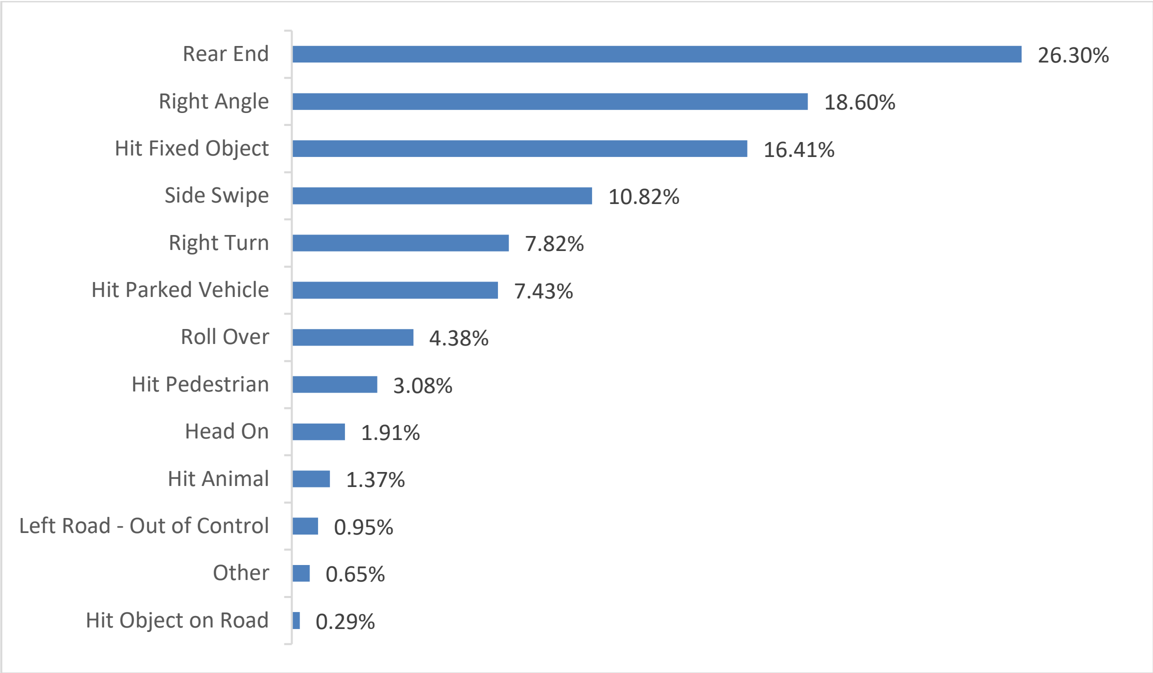


Figure 8: Crashes by type in Tasmania (AAMI, 2018)

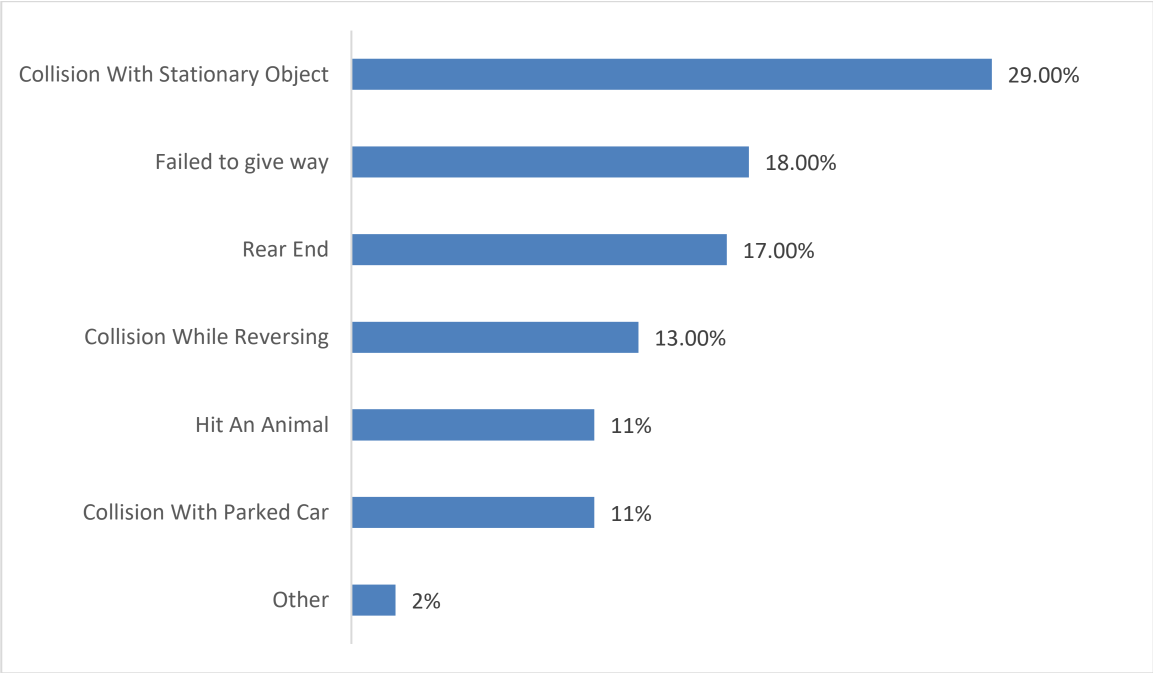


Figure 9: Crashes by type in Victoria 2013-2019 (VIC, 2019)

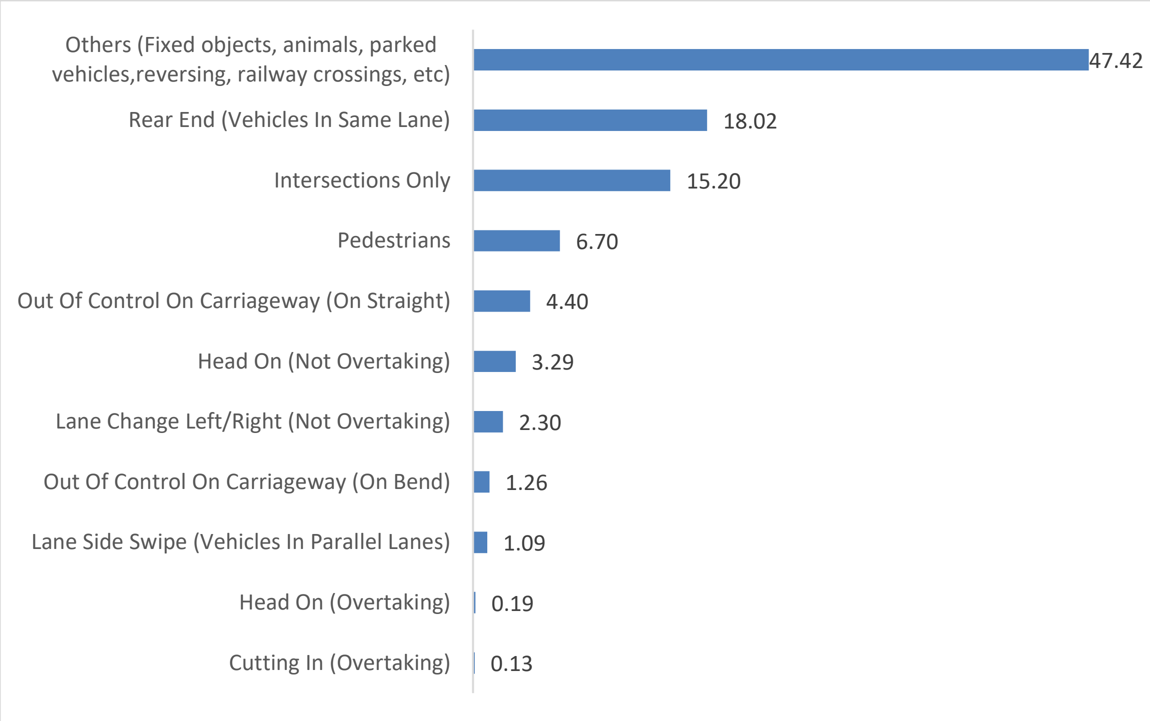
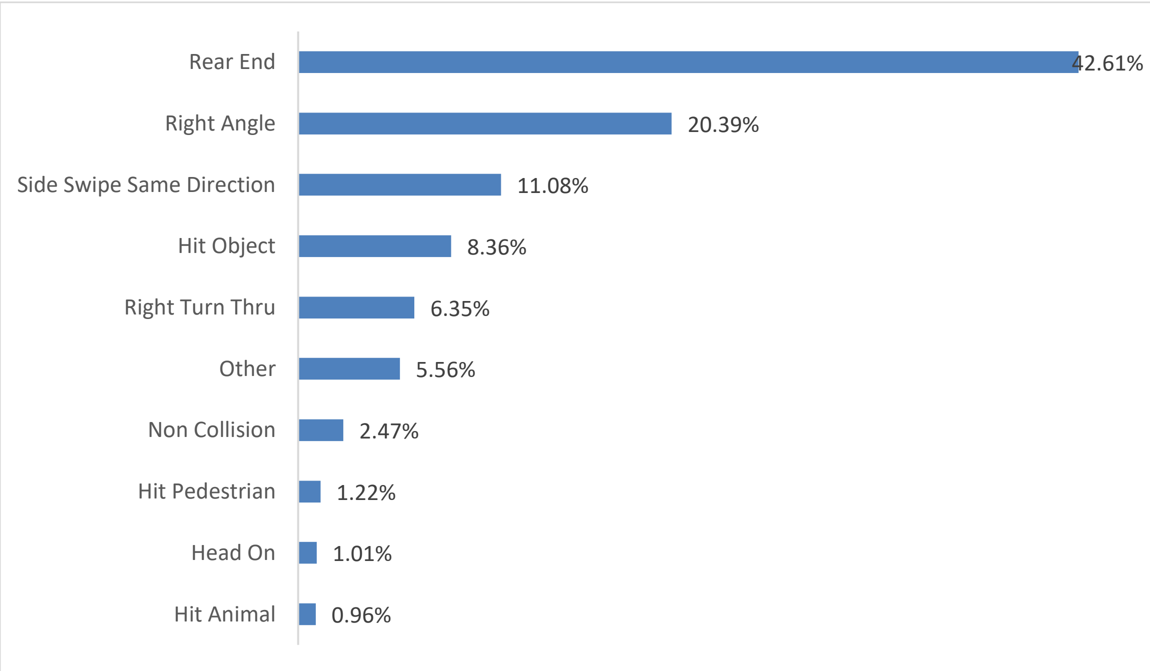


Figure 10: Crashes by type in WA 2014-2018 (MRWA, 2019)



1.3.1 Rear-end Crashes

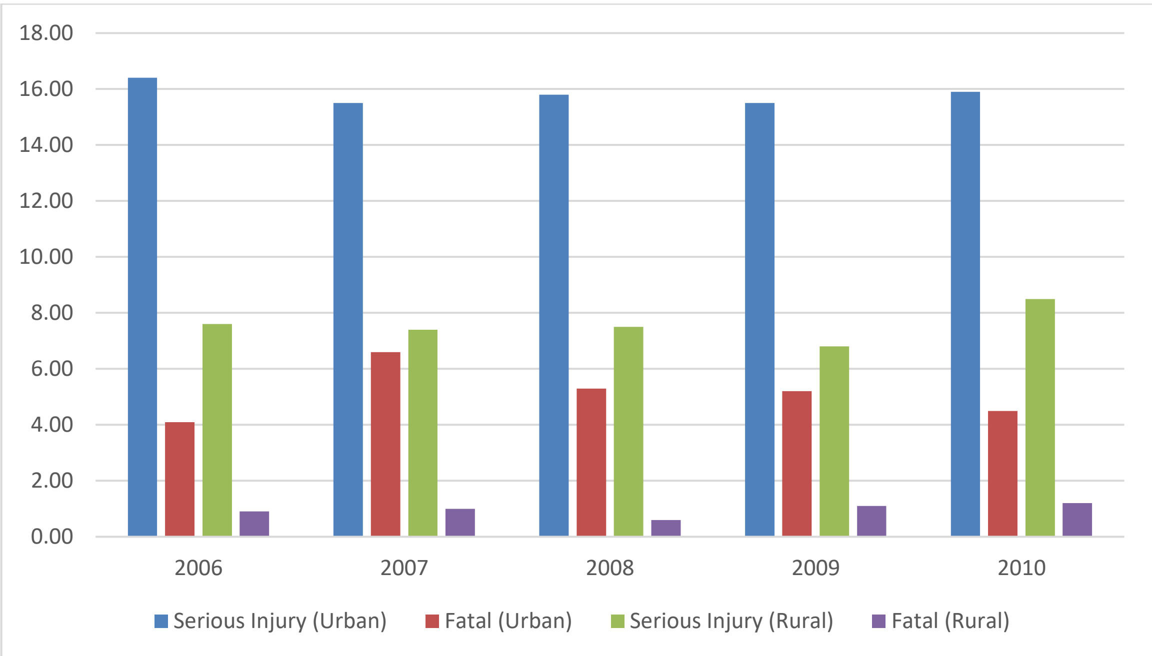
Collisions involving a light vehicle impacting the rear of another vehicle account for almost 15 per cent of all Australian light vehicle trauma (MUARC, 2020). About one quarter of rear-end crashes result in fatal or serious injuries (Austroads, 2015).

Distraction and cognitive complexity involved in some driving tasks are common factors in rear-end crashes. As a result, they most commonly occur when changing lanes, at pedestrian crossings (Antonucci et al., 2004), in tunnels (Austroads, 2018 and Cornelia, 2007) and at intersections. Indeed, the most common type of two-vehicle crash at intersections is rear-end collisions (Austroads, 2015). Further, from a sample of 13 tunnels in Australia and New Zealand where crash data was available, 62 per cent of crashes were identified as rear-end type with light vehicles involved in 78 per cent of all crashes in tunnels (Austroads, 2018).

In urban areas, rear-end crash frequencies are exacerbated by traffic density. As well as increasing cognitive load on drivers, behaviours (including queue jumping and tailgating) are more common during peak hour traffic and lead to a higher incidence of rear-end crashes (Rakotonirainy et al, 2017). In line with exposure to peak traffic times, the occurrence of rear-end crashes during the day is 50 per cent higher than at night (Yan et al., 2005).

Figure 11 highlights that rear-end trauma is most common in an urban environment. At higher vehicle speeds common in rural and highway environments, reduced driver reaction times and extended or high speed emergency braking application increases rear-end crash severity. However, rear-end crash risk is comparatively lower in highway environments due to increased traffic flow consistency and decreased environmental complexity (Austroads, 2015), (Yan et al. 2005).

Figure 11: Proportions of rural and urban rear-end fatal and serious injury crashes by year (Austroads, 2015).



1.3.2 Pedestrian Crashes

Most Australians regularly walk on or near roads and related infrastructure. Pedestrians (along with motorcyclists and pedal cyclists) are considered particularly vulnerable because they have little or no protection if struck by a road vehicle.

Pedestrians travel low kilometres relative to other road user groups yet comprise 13 per cent of all road fatalities in Australia (BITRE, 2015). Whilst vehicle occupant fatalities declined in the ten years to 2018, fatalities of pedestrians and vulnerable road users have not (BITRE, 2019a). The majority of pedestrian fatalities (75.8 per cent) involve a light vehicle striking the pedestrian (BITRE, 2015).

Pedestrians face increased trauma risk in higher speed zone collisions due to reduced driver reaction times and because collisions become more destructive at higher speeds. Where a pedestrian is struck by a car, the risk of death has been estimated at 5 per cent at an impact speed of 30 km/h, 10 per cent at 37 km/h, 50 per cent at 59 km/h, 75 per cent at 69 km/h and 90 per cent at 80 km/h (Hussain et al. 2019).

1.4 Government Actions to Address Light Vehicle Trauma

Government actions to address trauma in crashes involving light vehicles include initiatives at the state and federal government levels. They include both regulatory and non-regulatory means such as the use of market forces, manufacturer commitments, codes of practice, public education campaigns and fleet purchasing policies. Despite the programs outlined below, significant levels of urban light vehicle rear-end and pedestrian trauma remains.

1.4.1 National Funding for Road Safety Initiatives

The Australian Government allocates dedicated funding for a number of road safety programs. For example, The Road Safety Awareness and Enablers Fund provides $4 million over four years from 2019–20 for grants to fund road safety awareness, education and collaboration initiatives such as to the Australasian College of Road Safety, the Australian Road Safety Foundation, Driver Reviver Australia, the Campervan and Motorhome Club of Australia, the Traffic Management Association of Australia and Safer Australian Roads and Highways (SARAH) Group and Fatality Free Friday (ORS, 2019).

1.4.2 Infrastructure Upgrades

The Australian Government's infrastructure investment agenda focusses on funding land transport infrastructure that delivers safer and efficient connections for all road users. This involves investing $100 billion over 10 years from 2019-20 through its rolling infrastructure plan to help manage Australia’s growing population, meet the national freight challenge and get Australians home sooner and safer. It includes an additional $23 billion of new funding in the 2019–20 Budget for new projects and initiatives across every state and territory.

Whilst safe vehicle design is predominantly an offshore business activity, road planning, design operation and improvements are generally managed by Australian government agencies. Despite this separation, there are opportunities to ensure that infrastructure and vehicle designs are complementary. For example, use of road furniture and intersection geometries that maximise vehicle occupant outcomes in crashes. Funding is allocated to national infrastructure upgrades and projects that improve productivity and road safety outcomes.

A large component of the ongoing work to implement and further develop elements of the National Road Safety Strategy and Action Plan related to road infrastructure is being carried out through the Austroads Road Safety Program. Austroads is the peak organisation of Australasian road transport and traffic agencies. Austroads members are collectively responsible for the management of a majority of Australian roads.

Key nationally focused infrastructure research and development projects being undertaken by Austroads and other partners include (DITC&RD, 2020):

- Australian National Risk Assessment Model (ANRAM) provides a system to implement a nationally-consistent risk-based road assessment program, to identify road sections with the highest risk of severe crashes.
- Austroads project 'Safe System Infrastructure on Mixed Use Arterials', will investigate how the Safe System approach can be applied to urban arterials.
- Austroads project 'Understanding and Improving Safe System Intersection Performance', will provide guidance to road agencies on options for design and retrofit of intersections so they better align with Safe System principles.
- Austroads project 'Translating Safe System Infrastructure Research and Knowledge into Practice' (SS2016), will produce a guidance document and a series of workshops for road practitioners outlining knowledge and research about designing, managing and operating roads and roadsides within a Safe System environment.
- The Australian Road Assessment Program (AusRAP) is an analysis of the major highways and motorways in Australia, as defined in the National Land Transport Network Determination 2014. AusRAP is a program run by the Australian Automobile Association (AAA) and the state and territory motoring clubs.

1.4.3 State and Territory Government Action

State and territory governments undertake activities that improve identified light vehicle safety concerns such as pedestrian and rear-end trauma crashes. These actions include investment in research projects, education campaigns, and strategic partnerships. They also include increased stringency in safety requirements and commercial arrangements, particularly for access to government contracts. For instance, all vehicle fleet purchasing policies across the jurisdictions state that the vehicle must have a five star ANCAP rating.

Through their road safety strategies most jurisdictions have committed to 'Towards Zero' which has as its guiding vision that no person should be killed or seriously injured on Australia's roads. This vision aims to improve road safety through four cornerstones: safe road use; safe roads and road sides; safe speeds and safe vehicles. Recognising that road safety is a complex issue, the strategies cover a range of actions, including campaigns that target:

- Driver distraction awareness
- Safe driving
- School and community road safety education
- Drivers to consider new and proven vehicle technology when purchasing a new vehicle

1.4.4 The National Road Safety Strategy 2011-2020 (NRSS)

The Australian Government also works closely with state and territory governments to implement commitments under the NRSS. The NRSS for 2011-2020 was endorsed by Transport Ministers in May 2011. The NRSS set an ambitious target to reduce the number of deaths and serious injuries on the nation's roads by 30 per cent by 2020 (relative to the baseline period 2008-2010 levels). Though the full target has not been achieved at this time, from the baseline of over 1,400 deaths per year, fatalities on Australian roads reduced to 1,105 for the 12 months to 30 June 2020 (Transport and Infrastructure Council, 2011).

The National Road Safety Action Plan 2018–2020 (NRSAP) is intended to support implementation of the NRSS. It details national priorities to be undertaken by governments over the final three years of the NRSS from 2018 to 2020. The NRSAP contains nine Priority Actions that all jurisdictions have agreed to complete in order to meet the targets for road trauma reduction contained in the NRSS. The NRSAP also includes a list of Other Critical Actions – these represent either extensions of existing national efforts or supporting actions that are important to continue in addition to the key national priority list. The choice of Priority Actions and Other Critical Actions has been informed by available data and evidence regarding effective approaches to reduce road trauma.

Activities prioritised in the NRSAP 2018-2020 under the NRSS that target light vehicle road trauma include:

- Priority Action 3 to reduce trauma from crashes at urban intersections.
- Priority Action 4 to examine mandating international standards for AEB for light vehicles in the Australian new vehicle fleet.
- Priority Action 9 to increase the market uptake of safer new and used vehicles and emerging vehicle technologies with high safety benefits. This Priority Action required the Commonwealth and state and territory Governments to update their fleet policies to require ANCAP 5-star rated light passenger and light commercial vehicles, as well as driver assistance technologies.
- Other Critical Action C to better protect light vehicle occupants by updating to the latest available international crash standards.
- Other Critical Action E targets reduced road trauma associated with driver distraction.

Many of the actions undertaken under the NRSS and NRSAP involve initial research and investigation work that is needed to underpin effective road safety interventions. A large component of this work is progressed through the Austroads Safety Program. Research and development work linked to the implementation of the Strategy is also undertaken by a number of other bodies, including the National Transport Commission (NTC), the former National Road Safety Council, the Department of Infrastructure, Transport, Regional Development and Communications and the state and territory road authorities.

1.4.5 National Vehicle Standards

The Australian Government administers the *Motor Vehicle Standards Act 1989*, set to be replaced by the *Road Vehicle Standards Act 2018* (C'th) (RVSA), which requires that all new road vehicles, whether they are manufactured in Australia or are imported, comply with national vehicle standards known as the Australian Design Rules (ADRs), before they can be offered to the market for use in transport in Australia. The ADRs are generally performance based and cover vehicle safety, anti-theft and environmental impacts.

ADRs covering vehicle structures and restraint systems have improved crash performance significantly. Passive safety features such as airbags, seat belts, collapsible steering columns, head restraints and padded surfaces help prevent or manage the forces of impact in crashes. More recently, ADRs covering technologies that assist in mitigating crashes, such as Anti-lock Braking Systems (ABS) and Electronic Stability Control (ESC), offer further reductions in road trauma.

1.4.6 Australasian New Car Assessment Program (ANCAP)

ANCAP is an independent vehicle safety authority that publishes consumer education information covering a range of new passenger, sports utility and light commercial vehicles entering the Australian and New Zealand markets, using a rating system of 0 to 5 stars. These ratings are continually reviewed and are displayed with a date stamp in order to keep pace with technology developments and to ensure that star ratings reward the most effective technologies. Some vehicles with an older date stamped rating will not have been tested to the latest, most stringent, standards. ANCAP works in partnership with 23 member organisations including the Australian Commonwealth, State and Territory governments.

Where international standards are yet to be developed, or there is not a strong case for implementation in Australia, non-regulatory programs such as ANCAP can be an effective alternative to improve safety. The Government provides substantial funding to ANCAP for this purpose. Government support for ANCAP has been a long standing element in the Future Steps of the Safe Vehicles pillar of the NRSS 2011-2020 and ensures ANCAP continues to encourage the latest vehicle safety innovations.

As set out above, there is a strong commitment by federal, state, territory and local governments to improve road safety in Australia. Nevertheless, the number of deaths and serious injuries on Australian roads remains unacceptably high, despite government goodwill and action.

Chapter 2: Why Is Government Action Needed?

Overview

Though Australian businesses and governments work towards reducing light vehicle trauma, the cost of urban rear end and pedestrian trauma remains significant. AEB can help to mitigate such trauma. The technology is now at a more mature stage, partly through the work of ANCAP to increase its uptake by better informing consumers about the safety benefits. However, while AEB fitment remains unregulated, design, performance capability and usability of AEB systems varies across vehicle models in the Australian fleet (ANCAP, 2020). Where voluntarily fitted systems lack standard capability (such as pedestrian performance) and gaps remain in the opportunity for AEB to reduce light vehicle trauma, regulation is necessary to standardise minimum AEB performance requirements and driver interfaces. Furthermore, by setting a standard minimum performance level, regulation can provide cost-effective and maximised fitment in the new Australian light vehicle fleet.

2.1 The Need for Government Action

Government action may be needed where the market fails to provide the most efficient and effective solution to a problem. Light vehicle rear impact and pedestrian crashes cost the Australian community around $1.9 billion every year. Given the availability and promising effectiveness of modern AEB systems, there remains substantial potential to reduce these costs.

Over recent years, market research has shown a marked increase in the performance, fitment rates, and consumer uptake of collision avoidance technologies such as AEB. However, to derive the highest benefits in the reduction of road trauma and associated costs, it is important to maximise fitment and standardise minimum performance requirements.

Examples of government action in implementing effective vehicle standards include:

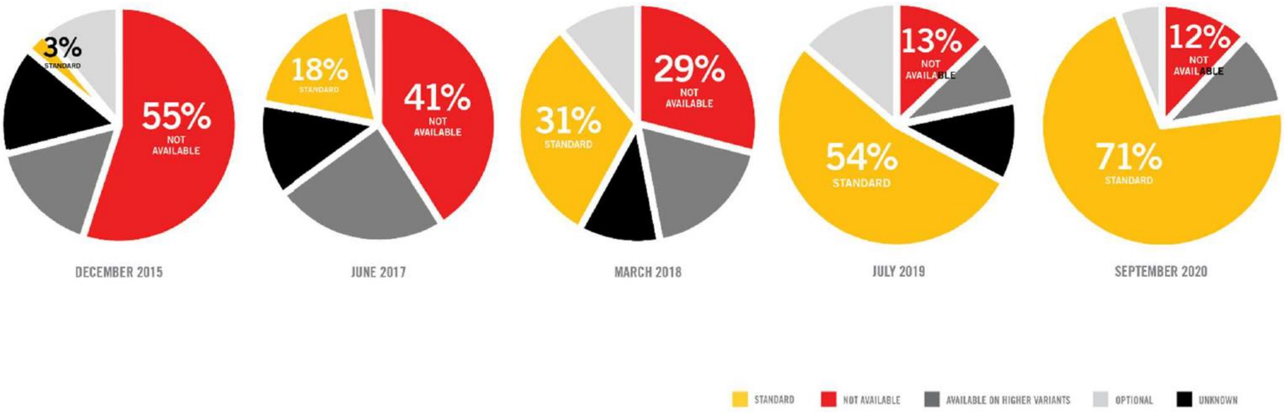
- Pole side impact measures for cars and light commercial vehicles (ADR 85, 2017) adopting the requirements of UN Regulation No. 135. It is estimated that this measure will save 128 lives over 15 years, while providing net benefits to the community of $417 million.
- Anti-lock braking systems for motorcycles (ADR 33, 2019) adopting requirements of UN Regulation No. 78. It is estimated that this measure will save 587 lives over 15 years, while providing net benefits to the community of $1.6 billion.
- Electronic stability control for heavy vehicles and trailers (ADR 38 and 35, from 2019). It is estimated that these measures will save 126 lives over 15 years, while providing net benefits to the community of $216 million.

2.2 Availability and Uptake of AEB

In November 2020, ANCAP released new figures on the market availability and consumer uptake of AEB, reporting that the standard fitment of AEB has risen from 18 per cent in June 2017 to 71 per cent in September 2020 of all new light passenger, SUV and light commercial vehicles sold.

However, ANCAP's analysis also shows that AEB is now not available for 12 per cent of vehicles sold, which is a reduction of 1 per cent from approximately one year ago. The results from over the period December 2015 to September 2020 are included in Figure 12.

Figure 12: AEB Availability - 2015 to 2020 (ANCAP, 2020)



Though ANCAP reports AEB fitment is increasing in the Australian fleet the performance capability is variable (ANCAP, 2020). The results obtained through a top ten model comparison showed a broad difference in effectiveness of AEB systems across models. In addition, many consumers are choosing to purchase vehicles not fitted with AEB.

The adoption of international regulations as a basis for national or regional standards results in the highest safety levels at the lowest possible cost. Harmonising Australian requirements with those in other major markets would minimise costs associated with AEB system development and provides manufacturers the flexibility to incorporate or adapt systems that have already been developed, manufactured and tested in (or for) markets with equivalent AEB performance requirements. It would also enable leveraging of testing and certification frameworks already conducted in those markets where the vehicles are manufactured.

Harmonising AEB requirements also enables consistency in driver expectations of system capability (including day/night and inclement weather performance) and usage (including by standardising activation requirements and the provision of driver warnings/feedback). As with other technologies covered by internationally agreed regulations, harmonised minimum requirements will enhance the usability and effectiveness of AEB independent of manufacturer or a driver's brand familiarity.

Common test and rating protocols were adopted by ANCAP and Euro NCAP in 2018 and the protocols are being updated again for 2020. These will most likely result in an even sharper focus on safety from manufacturers. Some of these changes include:

- the number of physical crash tests increasing from five to eight (of which two are far-side impact tests)
- the speed of the frontal offset test has dropped from 64 kph to 50 kph. The severity of the crash will increase with the introduction of a dynamic deformable barrier instead of a static barrier

- the speed of side impact test will increase from 50 kph to 60 kph with trolley mass increased to 1400 kg from 1300 kg.
- further AEB testing incorporating scenarios with pedestrians during reversing and other car to car scenarios at intersections
- protocols relating to post-crash response to help first responders

ANCAP conducts a range of AEB tests and assessments with vehicles required to meet minimum score thresholds for each star rating level. The data gathered from the tests are assessed, along with an inspection of the vehicle, test dummies, on-board hazards and performance of in-built systems, and scores determined for each respective test. ANCAP's recently published test results show AEB systems evaluated have been variable in performance across manufacturers and models (ANCAP, 2020).

2.3 Vehicle Technology Interventions

Though campaigns targeting the Fatal Five and driver behaviour can help reduce rates of driver error, vehicle technology can directly mitigate collisions where driver reaction is insufficient.

The last two decades have seen the advent of various intelligent driver aids that are commonly referred to as Advanced Driver Assistance Systems (ADAS). Some examples of ADAS are Lane Departure Warning (LDW), Adaptive Cruise Control (ACC) and AEB.

In the development of the NRSS, experts agreed the most promising vehicle technology towards reducing light vehicle trauma is AEB (Kuehn et al, 2009). This view is supported internationally in the UN prioritisation of the development of a UN Regulation for light vehicle AEB, and in domestic research (MUARC 2019). AEB technology is also considered an important technology in supporting NRSS and NRSAP targets, as well as road safety concerns identified by states and territories.

2.4 AEB Systems

AEB is designed to reduce the likelihood of a crash by warning the driver and then automatically braking the vehicle to reduce impact speed if a collision is imminent. While AEB has been available for some time, capability across vehicles in the Australian fleet has been variable (ANCAP, 2020) and sometimes misunderstood, particularly around pedestrian and infrastructure performance. Early analyses may have overstated the effectiveness of AEB systems or anticipated particularly sophisticated systems would become common (see section 2.4.1). Nevertheless, AEB has the potential to mitigate both rear-end and pedestrian crashes, which constitute a significant proportion of crashes reducing trauma risks and has proven to be particularly effective in urban environments and at intersections (Austroads, 2015).

Like other ADAS, an AEB system reads inputs from a variety of devices to monitor the environment. In the event that a collision with a vehicle or pedestrian is predicted, the driver is warned via optical, haptic and acoustic alarms. If the driver does not respond, a warning brake phase may be initiated. If the driver still does not react to the event, the system will prime the brakes and soon after execute an emergency braking phase in order to mitigate the collision. The

AEB system is typically linked with and complements ABS in most light vehicles, ensuring that an automatically generated emergency stop intervention does not lead to, for example, directional instability and wheel lock when over-braked (Bosch, 2007). The purpose of ABS is to help maintain directional stability and control during braking, and possibly reduce stopping distances on some road surfaces, especially on wet roads.

The timing of the emergency braking phase may be delayed until the last opportunity for the driver to steer to avoid the accident. While not substantially reducing the potential to mitigate an impending collision, the system may use this delay to eliminate false target detections. It also gives the driver the ability to deliberately steer close to an object without triggering unnecessary emergency braking warning signals or activation.

An AEB system may also be capable of providing a “brake assist” function. This can occur when a driver does not apply sufficient brake pedal force to avoid a collision. In this instance, the AEB system calculates the velocity and displacement of the vehicle from the target and applies additional braking force to mitigate the collision.

AEB systems use a variety of sensors to monitor their environment. Complex algorithms bring together vehicle motion and relative position data with data from environment scanning sensors, such as radar, LiDAR (light detecting and ranging) and cameras, to identify potential collisions with cars or pedestrians or both. When a critical situation is identified and the driver fails to react sufficiently, the AEB system automatically applies the brakes to avoid or mitigate the impact.

Since AEB systems are designed to intervene at the last possible moment prior to a collision, the deceleration brought about by an AEB intervention is rapid and so uncomfortable for the driver. This serves the purpose of preventing the behaviour known as driver adaptation (Xiong & Boyle, 2012). An AEB system is not designed to replace the driver’s responsibility to remain in control at all times. It exists to support the driver in the event of a collision otherwise occurring.

Conventional AEB systems estimate the collision risk using risk metrics such as time-to-collision (TTC) and usually apply a maximum brake pressure to prevent the collision when TTC is lower than a threshold (Kusano et al, 2012). Nevertheless, these types of AEB systems incorporate algorithms that are so conservative that they disregard the human factors, which would arouse driver distrust and discomfort and even limits the actual effectiveness (Angela et al, 2014 and Fildes et al, 2015). Current research and development efforts of AEB systems to detect other members of the VRU group have focussed on adapting AEB systems to human drivers, which requires thorough investigation into driver behaviour in vehicle to bicycle conflicts. Rating of AEB systems for the protection of bicyclists was included in ANCAP’s testing protocols from January 2018 with varying results across vehicle models and manufacturers (ANCAP, 2020). With further development of the technology, it is anticipated that the UN regulation for light vehicle AEB will incorporate requirements for the protection of pedal cyclists.

2.4.1 Claimed Benefits of AEB

Table 4 lists the findings of previous research studies investigating the benefits of AEB systems at the time the technology was in its early development phases. While the majority of these evaluations claim substantial benefits with regard to crash avoidance or injury mitigation, most are supported by desk-top evaluations and simulation of expected crash and injury outcomes. This was primarily due to low initial AEB fitment rates, limited available crash data and low crash rates amongst the newer safer vehicles optionally fitted with the technology. Therefore, at the time of publication, limited evidence and/or confounding factors may have challenged the establishment of the real-world effectiveness of AEB systems in reducing crashes and injuries.

It should be noted that previous studies often examined vehicles co-fitted with a range of different ADAS functionalities, that assessment methods varied substantially, and that the designed capability of each AEB system studied varied substantially. Design variability exists in the sensors utilised and intended capability of the system to react to stationary vehicles, pedestrians, and target objects of different sizes. For instance, in a recent study the US Insurance Institute for Highway Safety (IIHS) rated the pedestrian crash prevention systems of 16 midsize cars (IIHS, 2019). The ratings demonstrated that the performance of AEB systems varied substantially among manufacturers and vehicle models with vehicle to pedestrian scenarios. The tests also showed that the AEB systems achieved inconsistent speed reductions in vehicle to pedestrian scenarios. In November 2020, ANCAP published the results of its first side-by-side comparison of AEB systems across Australia's top 10 selling vehicle models (ANCAP, 2020). The results obtained through the top ten comparison showed the effectiveness of AEB systems across models varied significantly.

Table 4: Published studies of benefits of AEB technology (Fildes et al, 2015)

Study	AEB Type	Assessment Method	Crash Reduction %	Injury Reductions %			
				Fatalities	Serious	Slight	Injuries
Sugimoto & Sauer (2005)	CMBS	Simulation rear-end crashes	38	44			
Page et al (2005)	EBA	Case analysis Forward crashes		7.5			11
Najm et al (2006)	ACAS	FOT responses	6-15				
Breuer et al (2007)	BAS+	Simulation ped/rear crashes	44				
Kuehn et al (2009)	CMBS	Case analysis front/rear crash	40.8				
GDV (2011)	EBA2	Case analysis rear-end crashes	13.9	2.2	9.4	35.7	
Grover et al (2008)	AEB	Case analysis sensitive crashes	30				
Kusano & Gabler (2012)	AEB	Case analysis rear-end crashes	7.7	50			
HLDI (2011)	AEB	Insurance claims	22-27				51
Doecke et al (2013)	AEB	Case analysis rear-end crash	25-28				
Chauvel et al (2013)	AEB	Case analysis pedestrians	4.3	15	37		

2.4.2 Challenges to AEB

The design capability and mode of operation of light vehicle AEB systems varies across vehicles fitted with the technology, resulting in consumer confusion and substantial variability in the ability of available AEB systems to mitigate trauma crashes of different types.

As with any ADAS, technical challenges also exist, for instance in reliably identifying AEB collision threats and avoiding false alarms in complex environments. Where ADAS systems generate false or unnecessary alerts or reactions, user trust is compromised. This often results in drivers deactivating such systems.

Such challenges may be alleviated through the development and adoption of an internationally agreed performance standard for AEB. This would not only provide additional certainty on minimum performance capability (for instance, certainty around pedestrian performance and false alarm rates) for consumers purchasing vehicles fitted with AEB, but it would also remove inconsistencies in a driver’s ability to utilise the technology interfaces across different vehicle manufacturers.

In initial evaluations, the department found that an AEB mandate implemented prior to AEB technology maturity and availability of an effective standard (including pedestrian capability) would not have been cost-effective in Australia. As the technology has matured and an agreed international performance standard which includes pedestrian performance has been developed, the benefits of AEB against trauma can be maximised.

2.5 AEB Standards Development

Australia participates in the peak United Nations (UN) forum that sets both the framework and technical requirements for international vehicle standards, known as WP.29. The Australian Government has been involved for over thirty years and is a signatory to the two major treaties for the development and administration of UN Regulations (the 1958 Agreement) and Global Technical Regulations (GTRs) (the 1998 Agreement).

No country has implemented a mandatory standard for AEB for light vehicles. However, Australia has played a leading role in the rapid international development of a new UN regulation for AEB (UN Regulation No. 152) for light vehicles, including shaping requirements for the technology to suit Australian road safety. The European Parliament has voted to mandate AEB for light vehicles from mid-2022; i.e. a gradual introduction of various levels of AEB technology, where the first phase only detects vehicles, the next phase will detect pedestrians and a third phase will detect cyclists.However the proposed European requirements will need to be updated further to force compliance with the requirements of the UN regulation. In the US, a voluntary agreement to fit AEB was sought, although this is no longer being actively pursued. A previous media report about Korea mandating AEB was incorrect (Korea mandated AEB for heavy passenger vehicles i.e. buses, not light vehicles, as well as heavy commercial vehicles – both based on heavy vehicle AEB UN Regulation No. 131).

Though some AEB implementations available in Australia may not yet meet all requirements of the new UN regulation being developed for light vehicle AEB, uptake figures and independent testing by the ANCAP demonstrate that manufacturers are capable of achieving high deployment rates and meeting or exceeding minimum performance requirements.

In initial evaluations, the department found that an AEB mandate implemented prior to AEB technology maturity and availability of an effective standard would not have been cost-effective in Australia, largely due to the absence of pedestrian performance. Furthermore, if adopted as an ADR prior to the availability of an internationally agreed standard, the benefits of harmonisation could not be obtained, creating additional costs and potential regulatory barriers for manufacturers.

With the availability of an internationally agreed regulation for light vehicle AEB that includes pedestrian and urban performance requirements, its adoption in Australia is expected to effectively mitigate light vehicle urban trauma crashes and associated costs.

2.6 Summary of UN Regulation No. 152

2.6.1 Scope

UN Regulation No. 152 covers AEB systems fitted to UN vehicle categories M1 and N1, corresponding to ADR subcategories MA, MB, MC, NA1 and NA2. These systems automatically detect a potential forward collision, provide the driver with an appropriate warning and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating the severity of a collision with a car or pedestrian or both.

2.6.2 System Requirements

As a minimum, the AEB system must provide an acoustic or haptic warning, which may also be a sharp deceleration, so that an unaware driver is alerted to a critical situation. The timing of the warning signals must be such that they provide the possibility for the driver to react to the risk of collision and take control of the situation. Following the warning phase, in the event of an imminent collision with a target vehicle or pedestrian in front of the vehicle, the system must achieve the specified requirements of the braking phase. For passenger vehicles, the AEB system must be active within the vehicle speed range of 10 to 60 kph for vehicle to vehicle scenarios and 20 to 60 kph for vehicle to pedestrian scenarios.

During any phase of action taken by the AEB system (the warning or emergency braking phases), the driver can, at any time through a conscious action such as a steering action, an accelerator kickdown or operating the direction indicator control, take control and override the system, indicating that the driver is aware of the emergency situation.

Since approval authorities cannot test all traffic conditions and infrastructure features in the type-approval process, false warnings or false braking must be limited so that they do not encourage the driver to switch the system off (if the vehicle is equipped with a means to manually deactivate the AEB system). The UN regulation also recognises that the technical performances required cannot be achieved in all conditions (vehicle condition, road adhesion, weather conditions, deteriorated road infrastructure and traffic scenarios may affect system performance). In addition, the AEB system may deactivate due to adverse weather conditions, when in a carwash, or in case of misalignment of sensors. In these instances, the driver is provided with an optical warning to indicate system status.

In the case of a failure in the AEB system, it is a requirement that the safe operation of the vehicle must not be endangered.

2.6.3 Test Conditions

The application for approval of a vehicle fitted with compliant AEB requires testing the vehicle to warning, activation and speed reduction requirements. The applicability of a vehicle type to the requirements in these tests is dependent upon the Gross Vehicle Mass (GVM) of the vehicle. The AEB performance requirements for passenger vehicles (ADR subcategories MA, MB and MC) are more stringent than those applicable to goods vehicles (ADR subcategories NA1 and NA2) due to loading configuration challenges goods vehicles experience. Appendix 4 - UN Regulation No. 152 Performance RequirementsProvides more detail on the performance requirements in the regulation.

The vehicle is tested under two load conditions:

- Mass in running order - means the mass of an unladen vehicle with bodywork, including coolant, oils, at least 90 per cent of fuel, 100 per cent of other liquids and driver (75 kg) but excludes water, tools, and any spare wheel.
- Maximum mass - means the maximum operating vehicle mass permitted by the vehicle manufacturer.

2.6.4 Test Target Types

A target is an object detected by the AEB system so that a collision may be mitigated. Certification tests of light vehicles fitted with AEB systems conforming to the UN regulation utilise two target types:

Vehicle Target

The target used for vehicle detection tests utilise the high volume series production passenger car of UN category M1 AA ‘saloon body shape’ (equivalent to a passenger car of ADR sub-category MA), comprising not more than 9 seats including that of the driver’s seat. A ‘soft target’ representative of such a vehicle may be used that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a testing collision.

Pedestrian Target

The target used for pedestrian detection tests utilise an ‘articulated soft target’ that is representative of a child.

2.7 Objective of Government Action

Australia has a strong history of government actions aimed at increasing the availability and uptake of safer vehicles and Australians have come to expect high levels of safety. The general objective of the Australian Government is to ensure that the most appropriate measures for delivering safer vehicles to the Australian community are in place. The most appropriate measures will be those which provide the greatest net benefit to society and are in accordance with Australia's international obligations.

Where intervention involves the use of regulation, the Agreement on Technical Barriers to Trade requires Australia to adopt international standards where they are available or imminent. Where the decision maker is the Australian Government's Cabinet, the Prime Minister, minister, statutory authority, board or other regulator, Australian Government RIS requirements apply. This is the case for this Final RIS. The requirements are set out in the Australian Government Guide to Regulation (Australian Government, 2014).

The objective of this Final RIS is to examine the case for government intervention to reduce light vehicle urban rear-end and pedestrian crashes. Specifically, it is to improve the in-lane crash avoidance capability (including pedestrian crashes) of the new light vehicle fleet in Australia by increasing the fitment rate of effective AEB systems. This action will substantially reduce the cost to society of road trauma associated with these crash types.

Chapter 3: What Policy Options Are Being Considered?

Overview

A range of options in line with the requirements set out in the Australian Government Guide to Regulation were considered to increase the fitment of AEB systems to new light vehicles supplied to the Australian market. These included both non-regulatory and/or regulatory means such as the use of market forces, education campaigns, codes of practice, fleet purchasing policies, as well as regulation through the ADRs under the RVSA.

3.1 Summary of Options

3.1.1 Non-Regulatory Options

3.1.1.1 Option 1: No Intervention

Allow market forces to provide a solution to the problem (no intervention).

3.1.1.2 Option 2: User Information Campaigns

Information campaigns (suasion) to inform consumers about the benefits of AEB systems using:

- Option 2a: targeted awareness; or
- Option 2b: advertising.

3.1.1.3 Option 3: Fleet Purchasing Policies

Permit only light vehicles fitted with AEB systems access to government fleet purchases (economic approach).

3.1.2 Regulatory Options

3.1.2.1 Option 4: Codes of Practice

Allow light vehicle supplier associations, with government assistance, to initiate and monitor a voluntary code of practice for the fitment of AEB systems to all new light vehicles (regulatory - voluntary). Alternatively, mandate a code of practice (regulatory - mandatory).

3.1.2.2 Option 5: Mandatory Standards under the Competition and Consumer Act (CCA) 2010.

Mandate standards for the fitment of AEB systems to new light vehicles under the *Competition and Consumer Act 2010* (CCA) (regulatory - mandatory).

3.1.2.3 Option 6: Mandatory Standards under the RVSA (Regulation)

Mandate standards requiring the fitment of AEB systems to all new light vehicles under the RVSA based on UN Regulation No. 152 (regulatory - mandatory).

3.2 Discussion of Options

3.2.1 Option 1: No Intervention (Business as Usual)

The business as usual (BAU) case relies on the market fixing the problem, the community accepting the problem, or some combination of the two.

The BAU case includes the effect of information campaigns and ANCAP consumer education activity which encourages manufacturers to fit AEB to new vehicles as well as informing consumers of the benefits of purchasing vehicles fitted with AEB. It also includes the effect of current business and government fleet purchasing policies as well as state and territory actions to promote road safety. As a consequence of these existing activities current voluntary fitment of AEB systems to light vehicles, based on ANCAP's latest analysis, is around 71 per cent. However, ANCAP's analysis shows that AEB is now not available for 12 per cent of vehicles sold, which is a reduction of 1 per cent from approximately one year ago.

ANCAP is supported by all Australian and New Zealand motoring clubs, the Australian Government, the New Zealand Government, Australian state and territory governments, the Victorian Transport Accident Commission, NRMA Insurance and the FIA Foundation.

3.2.2 Option 2: User Information Campaigns

User information campaigns can be effective in promoting the benefits of a new technology to increase demand for it. Campaigns may be carried out by the private sector and/or the public sector. They work best when the information being provided is simple to understand and unambiguous. They can be targeted towards the single consumer or to those who make significant purchase decisions, such as private or government fleet owners. Campaigns around vehicle safety technologies do not need to consider manufacturer system development costs, because consumers are educated to choose from existing (developed) models that already include the technology.

Appendix 2 - Awareness Campaigns (2a) details two real examples of awareness campaigns; a broad high cost approach and a targeted low-cost approach. The broad high cost approach cost $6 million and provided a benefit-cost ratio of 5. The targeted low-cost approach cost $1 million and generated an awareness of 77 per cent. The targeted low-cost approach was run over a period of four months, with an effectiveness of 77 per cent. It is likely that a campaign would have to be run on a regular basis to maintain effectiveness. The low-cost targeted approach is preferred and has been adopted for analysis of Option 2a.

Appendix 3 - Information Campaigns (2b) details three notable automotive sector advertising campaigns for Hyundai, Mitsubishi and Volkswagen. The costs of such campaigns are not made public. However, a typical cost would be $5 million for television, newspaper and magazine advertisements for a three-month campaign. Research has shown that for general goods, advertising campaigns can lead to an around 8 per cent increase in sales (Radio Ad Lab, 2005). This increase is similar to the result achieved by the Mitsubishi campaign promoting the benefits of its ESC. While some costs were available, the effectiveness of the campaigns was not able to be determined. It is likely that a campaign would have to be run on a regular basis to maintain effectiveness. Advertising Campaigns were analysed under Option 2b.

Table 5: Estimation of campaign costs and effectiveness

Campaigns	Estimated Cost ($m)	Expected Effectiveness	BCA
Awareness - broad	6	$5 benefit/$1 spent	5
Awareness – targeted (2a)*	1 (1 per four month campaign, or 3 per year)	Total of 77 per cent awareness and no sales (but no greater than existing sales if already more than 77 per cent)	
Advertising (2b)*	1.5 per month campaign, or 18 per year	8 per cent increase in existing sales	-

*used in benefit-cost analysis (Chapter 4:)

Targeted awareness campaigns (Option 2a) could include the promotion of AEB for light vehicles as well as market incentives, including at point of sale. Such campaigns can be tailored to a specific user group. With the increasing BAU fitment rates expected for AEB for light vehicles, it was determined that targeted awareness campaigns would continue to have an impact for up to 10 years of policy intervention. After this period, BAU rates would approximate the campaign-influenced rate. This factor was included in benefit-cost modelling.

Advertising campaigns (Option 2b) typically capitalise on media and event promotion of a technology, and may be less specific in effect in comparison to targeted awareness campaigns. They usually have a minor to moderate effect on technology uptake in comparison to targeted awareness campaigns, and may be more costly.

Taking into consideration the existing BAU fitment rates for AEB systems, it is forecast that targeted awareness campaigns would have the strongest effect over the later years of a policy lifespan for light vehicles.

Both Options 2a and 2b were considered viable and analysed further to determine expected benefits.

3.2.3 Option 3: Fleet Purchasing Policies

The Australian Government could intervene by permitting only light vehicles fitted with AEB systems to be purchased for its fleet. This would create an incentive for manufacturers to fit these systems to models that are otherwise compatible with government requirements.

The Australian Government Fleet Team within the Department of Finance administers the arrangement for motor vehicle fleet management and leasing services to Commonwealth government entities. The current AGF Vehicle Selection Policy requires that agencies must ensure vehicles have a five star ANCAP safety rating (this includes AEB). This means that there is no remaining opportunity to increase AEB fitment through varying AGF purchasing policies.

The number of new vehicles purchased by agencies and authorities at all levels of government in Australia varies with renewal cycles but has historically reached around 50,000 vehicles. Of the approximately one million new vehicle sales reported by FCAI each year, government purchases could represent up to 5 per cent of new vehicle sales.

In comparison to other intervention options, the low percentages of new vehicle sales represented by government fleet purchases and the lack of scope to increase AEB fitment in those government fleets through varying existing purchasing policies means that Option 3 is not viable in increasing AEB fitment in the broader Australian fleet. The option was not considered in further detail.

3.2.4 Option 4: Codes of Practice

A code of practice can be either voluntary or mandatory. If mandatory, there can be remedies for those who suffer loss or damage due to a supplier contravening the code, including injunctions, damages, orders for corrective advertising and refusing enforcement of contractual terms.

3.2.4.1 Voluntary Code of Practice

Compared with legislated requirements, voluntary codes of practice usually involve a high degree of industry participation, as well as a greater responsiveness to change when needed. For them to succeed, the relationship between business, government and consumer representatives should be collaborative so that all parties have ownership of, and commitment to, the arrangements (Commonwealth Interdepartmental Committee on Quasi Regulation, 1997).

A voluntary code of practice could be an agreement by industry to fit AEB systems to light vehicles at nominated fitment rates. Based on real world tests conducted under controlled conditions, the environmental capability and the performance characteristics of existing AEB systems is known to vary substantially across manufacturers. Applying this to real world scenarios in uncontrolled conditions is likely to reveal further variance in performance across manufacturers. In terms of alleviating trauma, AEB performance across the fleet, particularly in common crash scenarios, can be as critical as fitment rates.

Voluntary codes are unlikely to cover all light vehicle manufacturers and as consequence any breaches of the code would be difficult for the various industry bodies and/or the Australian Government to monitor and control. Further, given the sophistication of AEB systems for light vehicles, detecting a breach would be particularly difficult in the case of a crash resulting from reduced performance. Such breaches would usually only be revealed through continual failures in the field or by expert third party reporting. Any reduction in implementation costs relative to other options would need to be balanced against the consequences of such failures. In the case of AEB systems for light vehicles, taking into account the severity of typical crashes, a breach could have serious consequences, including increased road trauma.

A compromised ability to guarantee a minimum performance of safety critical system such as AEB for light vehicles carries high risk of residual trauma costs and/or a high cost in terms of both monitoring/detecting breaches and the opportunity to take action in the event of breaches. For these reasons, Option 4 was not considered in further detail.

3.2.4.2 Mandatory Code of Practice - Regulation

Mandatory codes of practice can be an effective means of regulation in areas where government agencies do not have the expertise or resources to monitor compliance. However, in considering the options for regulating the performance of light vehicles, the responsible government agency (Department of Infrastructure, Transport, Regional Development and Communications) has existing legislation, expertise, resources and well-established systems to administer a compliance regime that would be more effective than a mandatory code of practice. For this reason this option was not considered in further detail.

3.2.5 Option 5: Mandatory Standards under the CCA - Regulation

As with codes of practice, standards can be either voluntary or mandatory as provided for under the CCA. However, in the same way as a mandatory code of practice was considered in the more general case of regulating the performance of light vehicles, the responsible government agency (Department of Infrastructure, Transport, Regional Development and Communications) has existing legislation, expertise and resources to administer a compliance regime that would be more effective than a mandatory standard administered through the CCA. For this reason, this option was not considered in further detail.

3.2.6 Option 6: Mandatory Standards under the RVSA - Regulation

Under Option 6, the Australian Government would mandate the fitment of AEB systems to new light vehicles supplied to the market via a new national standard (ADR) under the RVSA. This new ADR would adopt the technical requirements of UN Regulation No. 152 and set the requirement that AEB must be fitted to vehicles of the applicable categories. As ADRs apply to new vehicles, implementation of this option would not affect vehicles already in service.

Current AEB systems from various manufacturers can react differently in potential crash situations and operating interfaces vary (ANCAP, 2020). An agreed regulation would standardise and simplify system interface design and set minimum performance requirements. As this option is considered viable, the introduction of a mandatory standard was analysed further in terms of expected benefits to the community.

It is noted that ANCAP has reported that AEB is now not available for 12 per cent of vehicles sold, which is a reduction of 1 per cent from approximately one year ago. Despite ANCAP's best efforts, there is not universal fitting of AEB across all new light vehicles. To reach 100 per cent fitting rate across the market, a mandatory standard is required.

3.2.6.1 Background

Australia currently mandates approximately sixty active ADRs under the MVSA (soon to be RVSA). Vehicles are approved on a model (or vehicle type) basis known as type approval, whereby the Australian Government approves a vehicle type based on test and other information supplied by the manufacturer. Compliance of vehicles built under that approval is ensured by the regular audit of the manufacturer’s production, design and test facilities. This includes audit of the manufacturers’ quality systems and processes.

The ADRs apply equally to new imported vehicles and new vehicles manufactured in Australia. No distinction is made on the basis of country of origin/manufacture and this has been the case since the introduction of the MVSA and will be the case with the replacement of MVSA with the RVSA.

A program of harmonising the ADRs with international standards, as developed through the UN, began in the mid-1980s and has recently been accelerated. Harmonising with UN requirements provides consumers with access to vehicles meeting the latest levels of safety and innovation, at the lowest possible cost.

Harmonised Australian requirements would minimise costs associated with AEB system development, provides manufacturers the flexibility to incorporate or adapt systems that have already been developed and tested for markets with the same requirements. It would also enable leveraging of testing and certification frameworks already conducted in other markets.

The Australian Government has the capability and experience to adopt, whether by acceptance as alternative standards or by mandating, both UN GTRs and UN regulations into the ADRs. As discussed earlier, consideration of the case for mandating AEB systems for light vehicles contributes to several priority actions in the NRSS and NRSAP and advances the government’s regulatory program. As covered in Chapter 1:, these include NRSAP Priority Actions 3, 4 and 9 as well as Other Critical Actions C and E, and NRSS Future Steps.

3.2.6.2 Scope / Applicability

The internationally agreed standard for light vehicle AEB systems is the United Nations (UN) Regulation No. 152. This regulation sets requirements for detecting vehicles and pedestrians in the forwards impact zone, making it particularly effective in light vehicle rear-end and pedestrian collisions. All light passenger vehicles and light goods vehicles covered under UN vehicle categories M1 and N1, corresponding to ADR subcategories MA, MB, MC, NA1 and NA2 (see Appendix 1 - Vehicle Categories) would be in scope.

The adoption of international regulations results in the highest safety levels at the lowest possible cost. Harmonised Australian requirements would minimise costs associated with AEB system development, and provides manufacturers the flexibility to incorporate or adapt systems that have already been developed and tested for other markets.

3.2.6.3 Implementation Timing

The ADRs only apply to new vehicles and typically use a phase-in period to give models that are already established in the market, time to change their design. The implementation lead time of an

ADR is generally no less than 18 months for models that are new to the market (new model vehicles) and 24 months for models that are already established in the market (all new vehicles), but this varies depending on the complexity of the change and the requirements of the ADR.

The proposed applicability dates under this option are:

For AEB systems capable of detecting collisions with other vehicles (00 series of UN Regulation No. 152)

- July 2022 for new model vehicles
- July 2024 for all new vehicles.

For AEB systems capable of detecting collisions with pedestrians (00 series of UN Regulation No. 152)

- July 2024 for new model vehicles
- July 2026 for all new vehicles

Final implementation dates will be determined by the Government as part of the relevant ADR, following consultation by the Department with industry on implementation dates.

Chapter 4: What Are the Likely Net Benefits of Each Option?

4.1 Benefit-Cost Analysis

The methodology used in this benefit-cost analysis is a Net Present Value (NPV) model. Using this model, the flow of benefits and costs are reduced to one specific moment in time. The time period for which benefits are assumed to be generated is over the life of the vehicle(s). Net benefits indicate whether the returns (benefits) on a project outweigh the resources outlaid (costs) and indicate what, if any, this difference is. Benefit-cost ratios (BCRs) are a measure of efficiency of the project. For net benefits to be positive, this ratio must be greater than one. A higher BCR in turn means that for a given cost, the benefits are paid back many times over (the cost is multiplied by the BCR). For example, if a project costs $1 million but results in benefits of $3 million, the net benefit would be 3-1 = $2 million while the BCR would be 3/1 = 3.

In the case of adding specific safety features to vehicles, there will be an upfront cost (by the vehicle manufacturers) at the start, followed by a series of benefits spread throughout the life of the vehicles. This is then repeated in subsequent years as additional new vehicles are registered. There may also be other ongoing business and government costs through the years, depending on the option being considered.

Four of the policy options outlined in 3.2 of this Final RIS (Options 1, 2a, 2b and 6), were considered viable to analyse further. The results of each option were compared with what would happen if there was no government intervention, that is, Option 1: no intervention (BAU).

The period of analysis covers the expected life of the policy option (up to 15 years of intervention) plus the time it takes for benefits to work their way through the fleet (around 35 years, the approximate maximum lifespan of a light vehicle).

Given that the function of UN Regulation No. 152 is broadly to enhance light vehicle and pedestrian safety, included benefits focus on the safety benefit from expected reductions in trauma. Furthermore, with full fleet fitment, it is not unreasonable to note that AEB could be an effective vehicle technology for reducing the impact speed of light vehicles in a range of other crash types. It should be noted, however, that other benefits (for example, alleviation of property damage) would also occur but have not been included in this Final RIS. The net benefit and the benefit-cost ratio for each option are therefore likely to be conservative estimates.

4.1.1 Benefits

For Option 1, there are no intervention benefits (or costs) as this is the BAU case.

For Options 2 and 6 the benefits were established based on the difference between the expected BAU level of fitment of AEB to new light vehicles and the level of fitment expected under the implementation of each proposed option. Benefits are derived from the fitment effect from each intervention option (which varies across options) and the overall impact of the technology when fitted, which is the product of sensitivity (the proportion of light vehicle and pedestrian crashes whose severity could be reduced by AEB - common to all options) and the effectiveness of the technology in mitigating trauma when fitted.

4.1.1.1 Fitment Effect of Each Option

Figure 13 to 15 show the forecast percentages of fleet fitment under each analysed intervention option in comparison to BAU (Option 1). Current and projected fitment rates up to 2024 were sourced from FCAI and ANCAP. Under BAU, non-regulatory technology interventions generally exhibit an uptake limit below 100 per cent fitment. Without regulation, manufacturers may not be expected to fit AEB as a standard feature on all future models they produce. Similarly, when purchasing vehicles, some consumers may for instance choose to purchase vehicles based on purchase price rather than safety benefits. For this reason, BAU fitment is modelled to initially climb rapidly but ultimately sustain fitment rates in a range steadily increasing from 75 to up to 85 percent of new vehicles sold.

It is also noted that once a policy intervention has expired, fitment levels fall over time to BAU levels. The decline is more profound following the end of short-term non-regulatory interventions than for long-term regulatory interventions. Though it is expected that a regulatory intervention would sustain high fitment rates well into the future, it is not guaranteed. For instance, through disruptive change or substantial transitional shift in the direction of the vehicle industry, AEB may be of no safety benefit to vehicles manufactured several decades into the future.

Importantly, it is noted that though the benefit-cost analysis includes accumulative run-out trauma saving effects from vehicles fitted with AEB during the 15-year intervention period for a further 35 years, AEB fitment costs and trauma savings associated with vehicles fitted with AEB after the 15-year policy intervention period are not considered in the benefit-cost analysis. The fitment rate reduction depicted following the 15-year regulatory intervention period has no effect on the analysis.

Accordingly, for Options 2a and 2b, the effect of intervention is illustrated to reduce to the BAU fitment rate after the policy lifespan (15 years). For Option 6, though fitment rates are known to remain close to 100 per cent after a technology is mandated, a reduction in the fitment rate back to BAU rates after a 15-year policy lifespan is illustrated.

Figure 13: Fitment via Option 2a in comparison with BAU

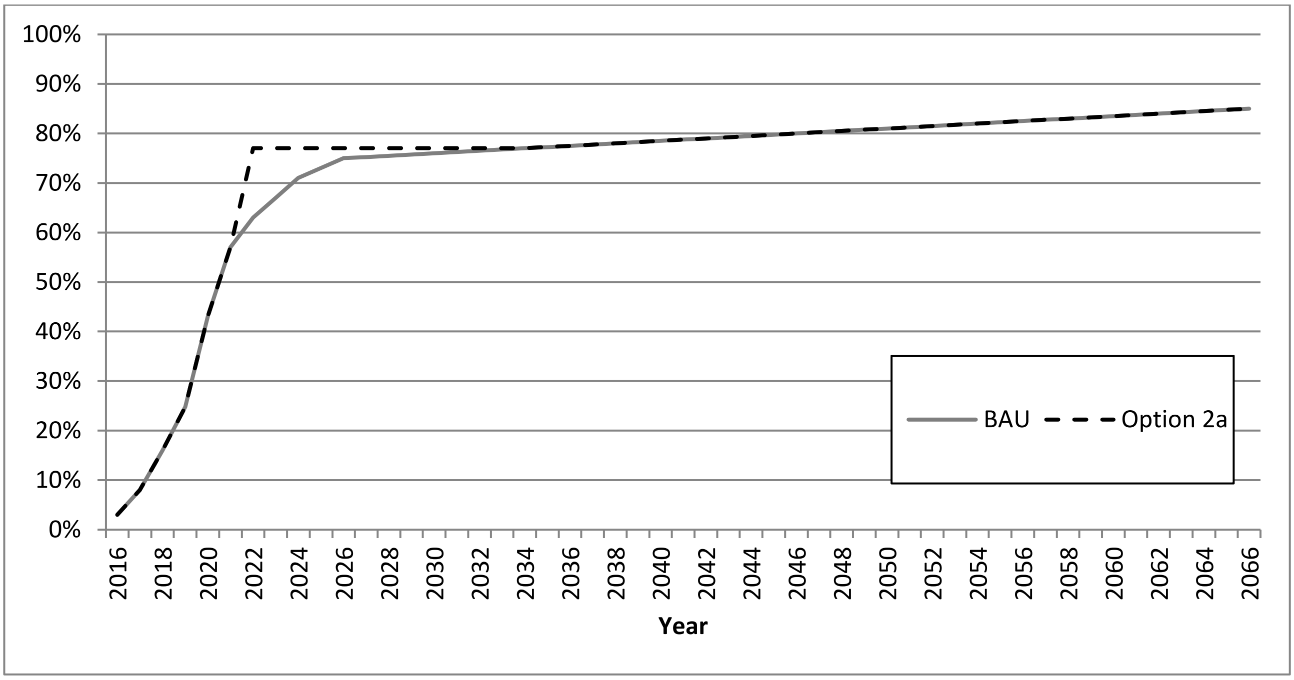


Figure 14: Fitment via Option 2b in comparison with BAU

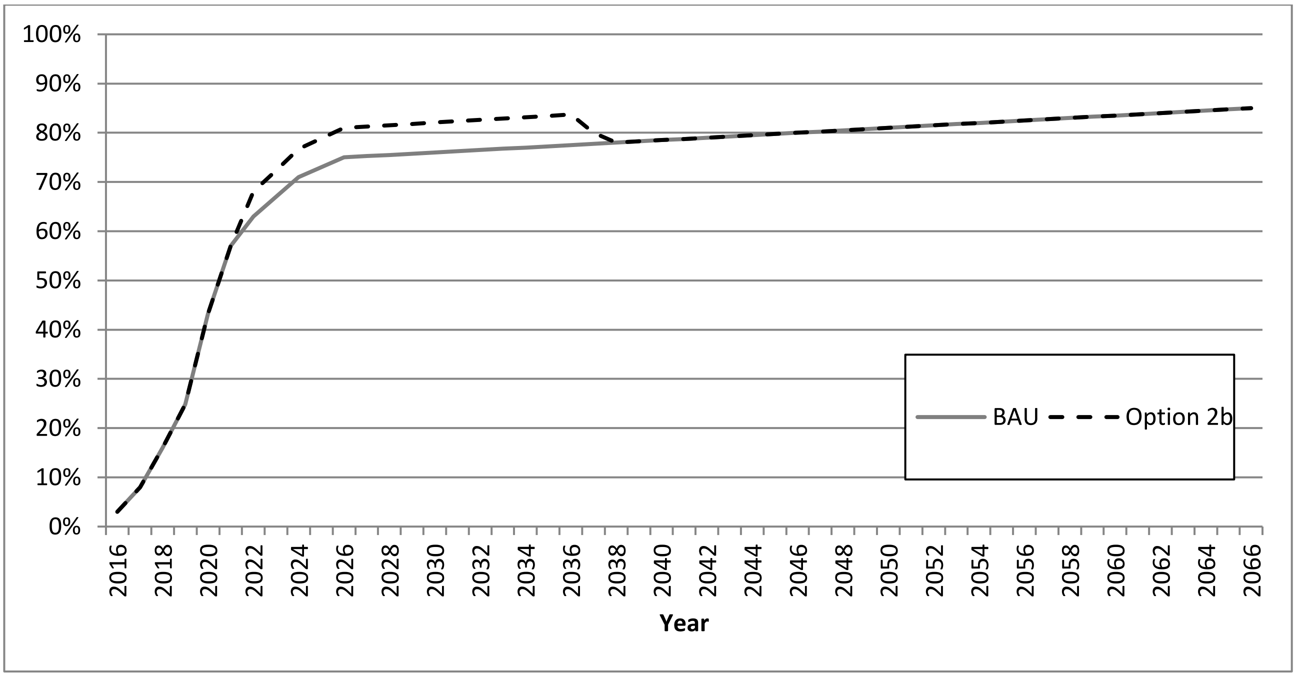
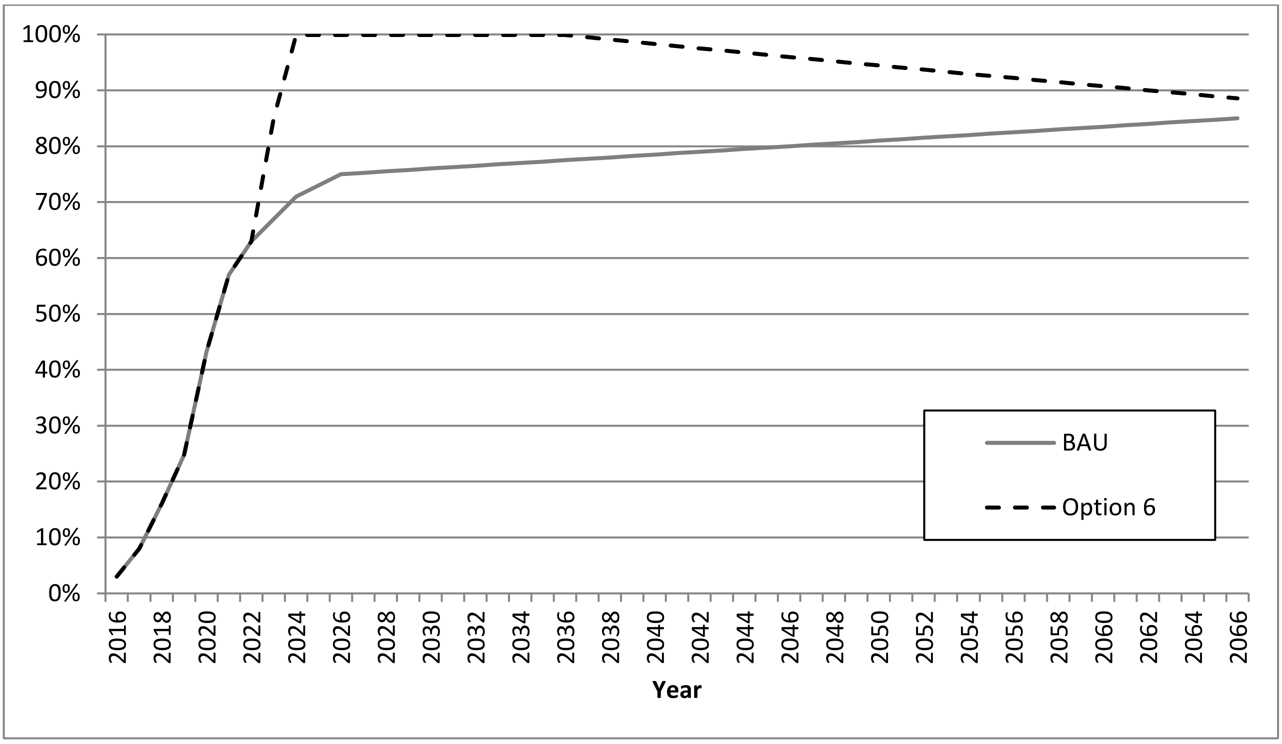


Figure 15: Fitment via Option 6 in comparison with BAU



4.1.1.2 Impact Of AEB When Fitted To Light Vehicles

Sensitivity

Monash University Accident Research Centre (MUARC) reported on the impact of AEB for light vehicles in Australia. Crash and crash injury benefits were modelled on police reported crash data occurring in Australia between 2013-2016 inclusive. Classification of sensitive crashes included those where trauma could potentially be mitigated by AEB. The analysis includes crashes involving pedestrians, but not cyclists. This is in line with the requirements of UN Regulation No. 152. Though inclusion of cyclists would increase the percentage of sensitive crashes substantially and some AEB systems are capable of reacting to cyclists, cyclist trauma was not included as a benefit.

Crashes occurring at speeds above 60kph were not included because this is beyond the scope of UN Regulation No. 152. However, most AEB systems are able to operate at speeds slightly or even substantially above this range. Because only crashes occurring below 60kph were included in the analysis, the benefits are conservative.

MUARC also found that 2.8 per cent of all Australian light vehicle trauma crashes are sensitive to AEB. While this may appear a low sensitivity to pedestrian trauma in an Australia-wide context, a majority of exposure occurs in urban environments where pedestrians are over-represented in trauma crashes.

MUARC found that while over 9 car occupant fatalities per year are narrowly sensitive to AEB, 78 pedestrian fatalities were narrowly sensitive to AEB. This represents a significant potential for pedestrian trauma savings through effective AEB fitment increases. Similarly, a higher proportion of serious pedestrian injury per crash is sensitive to AEB than for vehicle occupants. Minor injury sensitivity, however, was found to be far higher for vehicle occupants than pedestrians. This is due to the statistical rarity of minor pedestrian injury (pedestrians tend to suffer more serious trauma when struck by a vehicle).

In total around 28 per cent (27.8) of all light vehicle crashes were classified as sensitive to avoidance or mitigation with AEB. This figure incorporates narrowly sensitive light vehicle crashes only, i.e., those crashes exhibiting a high degree of confidence that AEB would alleviate or mitigate the crash (including with pedestrians) and not those crashes where there was only some or minor evidence.

MUARC found that, on average, for every sensitive fatal crash, 35 serious and 149 minor injury sensitive crashes also occurred.

Effectiveness

Table 4 lists research, analysis, testing and simulation studies investigating the benefits of AEB systems at the time the technology was in its early development phases. These publications claimed the technology would provide substantial benefits with regard to crash avoidance or injury mitigation. While the majority of these evaluations claim substantial benefits, most are supported by desk-top evaluations of expected crash and injury outcomes. This is a result of the slow fitment rates of new technologies, limited crash data and lower crash rates by owners of new safer vehicles. Therefore, limited evidence exists of real world effectiveness of AEB systems in reducing crashes and injuries. New systems are also commonly available on only a few car models and in some cases optional which increases the time needed to assess their real-world effectiveness. It should be noted that many of these studies used a range of different technology functionalities and assessment methods and the AEB system in each study varied in performance.

Regarding existing research, the Bureau of Infrastructure, Transport and Regional Economics found in 2014 that AEB could deliver promising safety benefits. However, this finding was based upon preliminary analyses that evaluated AEB as an emerging technology. Unfortunately, some promoters of AEB have continued to portray the BITRE report as a definitive analysis of technology available in the market, which should be immediately acted upon with regulation. Similarly, a more recent analysis from the Australian National University relied upon the same preliminary analyses.

The most accurate published research was carried out in 2013-14, when the Department (and ANCAP) provided funding to an Euro NCAP led real-world study of the effectiveness of low-speed AEB systems for light vehicles. This study showed a 38 per cent reduction in rear-end crashes (at the same time recognising that rear-end crashes between light vehicles largely result in property damage and minor injuries rather than fatalities/serious injuries). However, AEB systems are continuing to be improved and so future research is expected to show increased trauma reductions, as AEB systems become more sophisticated.

MUARC determined the effectiveness of AEB for light vehicles from Australian light vehicle crash data. Crash reductions in sensitive crashes associated with light vehicle AEB fitment was determined to be 22 per cent effectiveness against all sensitive trauma and 26 per cent against serious and fatal trauma. MUARC found that the effect of AEB is most significant against pedestrian fatalities and minor injuries to vehicle occupants (this is where significant crash volume exists).

MUARC found that the reduction of crash trauma from AEB for vehicle occupants was 28 per cent, whilst for AEB effectiveness against pedestrian trauma was 18 per cent. While around 9 AEB-sensitive vehicle occupant fatalities occur each year, around 78 AEB-sensitive pedestrian fatalities occur each year, meaning potential pedestrian lives saved by AEB outnumber those of vehicle occupants. The greatest potential trauma alleviations in serious and minor injury crash numbers occur for vehicle occupants.

Like other vehicle safety technologies, AEB effectiveness is higher for fatal and serious injuries than for minor injuries. This is due in part to the effect of downgrading of trauma severity at higher trauma levels (to serious, minor or completely mitigated from fatal) whereas for minor severity traumas, complete mitigation is the only improved outcome. This effect is modelled as an approximate 10 per cent increment in effectiveness for mitigation of fatal and serious injury crash outcomes over that of minor injury crashes, which has been observed in light vehicle crash data.

Overall Impact on Australian Light Vehicle Trauma

The overall impact of AEB when fitted against all light vehicle road trauma is the product of sensitivity and effectiveness. The result is 6.1 per cent effectiveness against all light vehicle trauma crashes, and 7.2 per cent against all light vehicle fatal and serious trauma crashes.

4.1.1.3 Crash Savings

The economic benefits of increased fitment of AEB to new Australian light vehicles would flow from trauma reductions. In addition, there would be benefits to families, businesses and the broader community in ways it is not possible to measure.

Campaigns promoting light vehicle AEB fitment were projected to have a modest positive effect on trauma alleviation over the modelled period. Option 2a is expected to save 37 lives, 1,294 serious injuries and 4,644 minor injuries amounting to trauma alleviation savings of approximately $334 million. Option 2b is expected to save 86 lives, 3,009 serious injuries and 10,802 minor injuries, amounting to trauma alleviation savings of approximately $553 million.

Regulation of AEB for light vehicles was projected to have a substantially greater effect. Option 6 yielded the greatest trauma reductions with 582 lives saved, 20,524 serious injuries and 73,868 minor injuries alleviated, amounting to $2,681 million in trauma savings.

Table 6 summarises the trauma reductions associated with each intervention option. These savings do not incorporate other benefits from crash alleviation expenses such as property and infrastructure damage, road closures, police investigations, etc.

Table 6: Summary of trauma reductions with each intervention option

	Lives Saved	Serious Injuries Avoided	Minor Injuries Avoided
Option 1: No Intervention	-	-	-
Option 2a: Targeted Awareness	37	1,294	4,644
Option 2b: Advertising	86	3,009	10,802
Option 6: Regulation	582	20,524	73,868

4.1.2 Costs

4.1.2.1 System Development Costs

No additional system development cost was added for options 2a and 2b, as it was assumed that the light vehicle owners/operators persuaded by information campaigns to purchase light vehicles equipped with AEB would simply choose from existing models available with these systems.

A development cost of $50,000 to $100,000 was added for each additional vehicle model for which AEB would be developed due to government intervention under Option 6. Preliminary industry consultation indicated that the incremental AEB development cost is reduced substantially due to prior fitment of ABS and/or ESC, a typical sub-component of AEB which is required to be fitted by separate legislation. The estimated development cost included design, logistics, production line floor area allocation, and other overheads, for those models where AEB is not an existing optional fitment. An additional $10,000 per model was added to cover validation and testing, as well as a further $10,000 per model for certification and regulatory expenses as an extension of a manufacturer's regulatory and certification administration process.

4.1.2.2 System Fitment Cost

A likely wholesale AEB system fitment cost range from $500 (low/best case) to $800 (high/worst case) was adopted. This range represents the average incremental cost of fitting an AEB system relative to existing systems otherwise required to be fitted, such as ABS. The estimate includes only the costs of a system able to meet the requirements of UN Regulation No. 152, and not the more advanced systems that may be able to detect stationary objects, infrastructure, cyclists and flora or fauna. The fitment cost adopted was a conservative average of wholesale cost estimations obtained from a survey of light vehicle manufacturers. The adopted fitment cost is conservative in comparison to other estimates including $300 to $400 (MUARC, 2014) and USD $115 retail (NHTSA, 2012).

4.1.2.3 Government Costs

It was assumed that a targeted awareness campaign under Option 2a would cost the government a total of $3 million per annum, comprising of three 4-month campaigns at a cost of $1 million each. A cost of $18 million per year was assumed for the Australian Government to create and run an advertising campaign under Option 2b.

It was assumed there would be an estimated annual cost of $50,000 for the Department to create, implement and maintain a regulation under Option 6. This includes the initial development cost, as well as ongoing maintenance and interpretation advice. The value of this cost was based on Department experience.

4.1.2.4 Summary of Costs

Table 7 provides a summary of the various costs associated with the implementation of Options 2a, 2b and 6.

Table 7: Summary of costs associated with the implementation of each option

Cost related to:	Cost relative to BAU			Option(s)	Applicability	Impact
	Best Case	Likely Case	Worst Case			
Development of systems	50,000	-	100,000	6	Per model	Business
Fitment of systems	500	-	800	2a, 2b, 6	Per vehicle	Business
Testing of systems		10,000		6	Per model	Business
Certification of system		10,000		6	Per model	Business
Implement and maintain policy		3,000,000		2a	Per year	Government
Implement and maintain policy		18,000,000		2b	Per year	Government
Implement and maintain regulation		50,000		6	Per year	Government

4.1.3 Benefit-Cost Analysis Results

Appendix 5 - Benefit Cost Analysis details the calculations for the benefit-cost analysis. A summary of the results is provided below in Table 8. A 7 per cent discount rate was used for summarised options.

Table 8: Summary of benefits, costs, lives saved and serious injuries avoided under each option

Case	Gross Benefits ($)	Net Benefits ($m)	Cost To Business ($m)	Cost To Government ($)	BCR	Number Of Lives Saved	Serious Injuries Avoided	Minor Injuries Avoided
Option 1								
Best	-	-	-	-	-	-	-	-
Likely	-	-	-	-	-	-	-	-
Option 2a								
Best	334	92	215	27	1.4	-	-	-
Likely		28	278	27	1.1	37	1,294	4,644
Option 2b								
Best	554	40	350	164	1.1	-	-	-
Likely		-65	455	164	0.9	86	3,009	10,802
Option 6								
Best	2,681	1,477	1,296	0.5	2.1	-	-	-
Likely		1,089	1,592	0.5	1.7	582	20,524	73,868

4.1.4 Sensitivity Analysis

A sensitivity analysis was carried out to determine the effect of varying the critical parameters on the outcome of the benefit-cost analysis.

Firstly, while a 7 per cent (per annum) real discount rate was used for all options, the benefit cost analysis for Option 6 was also tested with a rate of 3 per cent and 10 per cent. Table 9: Impact on BCR of changes to the real discount rate (Option 6) shows that the BCR remained positive under all three discount rates.

Table 9: Impact on BCR of changes to the real discount rate (Option 6)

	BCR	Net Benefit ($m)
Low discount rate (3%)	2.7	3,530
Base case discount rate (7%)	1.7	1,089
High discount rate (10%)	1.3	358

Next, the effectiveness of light vehicle AEB systems was varied to establish its effect on the analysis, using both high (increment 5 per cent) and low (decrement 5 per cent) effectiveness scenario. As shown in Table 10, despite analysing an unrealistically low effectiveness (equivalent to the lowest rate reported by MUARC for the worst performing systems in the fleet), the BCR remained positive. It was noted that varying the effectiveness was less significant than varying the discount rate.

Table 10: Impact on BCR of changes to effectiveness of AEB for light vehicles (Option 6)

	BCR	Net Benefit ($m)
Low effectiveness (-5%)	1.2	359
Base case effectiveness	1.6	960
High effectiveness (+5%)	1.9	1,561

The BAU fitment rate was also subjected to a sensitivity analysis, including both a high and a low fitment rate scenario (BAU fitment curves adjusted +/- 10 per cent), to account for variations in the market uptake of light vehicle AEB systems. As shown in Table 11, the net benefits and BCR remained positive in both the high and the low BAU fitment rate scenarios.

Table 11: Impact of fitment rates on net benefits and BCR

	BCR	Net Benefit ($m)
Low BAU fitment (-10%)	1.5	1,292
Base case fitment	1.6	960
High BAU fitment (+10%)	1.6	633

Finally, the fitment cost range was varied, incrementing the fitment cost range upwards by 50 per cent. The BCRs in the likely to best case ranges remained positive. However, further cost increases would mean the BCRs would not remain positive for the entire increased range.

4.2 Economic Aspects - Impact Analysis

Impact analysis considers the magnitude and distribution of the benefits and costs among the affected parties.

4.2.1 Identification of Affected Parties

In the case of AEB systems for light vehicles, the parties affected by the options are:

Business

- vehicle manufacturers or importers;
- component suppliers;
- vehicle owners.

The affected businesses and consumer parties are represented by a number of peak bodies and interest groups, including:

- Federal Chamber of Automotive Industries (FCAI) which represents the automotive sector and includes vehicle manufacturers, vehicle importers and component manufacturers/importers;
- Federation of Automotive Products Manufacturers (FAPM) which represents the automotive component manufacturers/importers; and
- The Australian Automobile Association (AAA) which represents vehicle owners and operators (passenger cars and derivatives) through the various automobile clubs around Australia (RAC, RACV, NRMA etc.).

Government

- Australian/state and territory governments and their represented communities.

4.2.2 Impact of Viable Options

There were four options that were considered viable for further examination: Option 1: no intervention; Option 2a: user information campaigns – targeted awareness, Option 2b: user information campaigns - advertising; and Option 6: regulation. This section looks at the impact of these options in terms of quantifying expected benefits and costs, and identifies how these would be distributed among affected parties. These were summarised in Table 8 previously and are discussed in more detail below.

4.2.2.1 Option 1: No Intervention

Under this option, the government would not intervene, with market forces instead providing a solution to the problem. As this option is the BAU case, there are no new benefits or costs allocated. Any remaining option(s) are calculated relative to this BAU option, so that what would have happened anyway in the marketplace is not attributed to any proposed intervention.

4.2.2.2 Options 2a and 2b: User Information Campaigns

Under these options, light vehicle owners and operators would be informed of the benefits of AEB for light vehicles through information campaigns. As this option involves intervention only to influence demand for the systems in the market place, the benefits and costs are those that are expected to occur on a voluntary basis, over and above those in the BAU case. The fitment of AEB would remain a commercial decision within this changed environment.

<u>Benefits</u>

Owners:

There would be a direct benefit through a reduction in road crashes (over and above that of Option 1) for the light vehicle owners who are persuaded by information campaigns to purchase light vehicles equipped with AEB. This would save an estimated 37 lives and 1,294 serious and 4,644 minor injuries under Option 2a, and 86 lives and 3,009 serious and 10,802 minor injuries under Option 2b (over and above Option 1). There would also be direct benefits to owners (and/or insurance companies) through reductions in compensation, legal costs, vehicle repair and replacement costs, loss or damage of other property, and in some cases fines.

Pedestrians:

A significant proportion of alleviated trauma would include pedestrians. AEB would reduce injury risk in crashes involving pedestrians, having the greatest influence in alleviating minor pedestrian injuries and mitigating elderly pedestrian fatalities.

Business/manufacturers:

There would be no direct benefit to light vehicle manufacturers. Light vehicle owners persuaded by the campaign would simply choose from existing light vehicle models already equipped with AEB. This could lead to some shift in market share between the respective light vehicle brands (depending on the availability/cost of the technology by manufacturer), but would be unlikely to have much effect on the overall number of new light vehicles sold. Component suppliers (predominantly international) may benefit directly in terms of increased income/revenue from supplying additional equipment to light vehicle manufacturers.

Governments/community:

There would be an indirect benefit to governments (over and above that of Option 1) from the reduction in road crashes that would follow the increase in the uptake of new light vehicles equipped with AEB, achieved as a result of the information campaigns. This would have benefits of $334 million under Option 2a and $554 million under Option 2b over and above Option 1. These benefits would be shared by the community and as cost savings to governments.

<u>Costs</u>

Owners:

There would be a direct cost of between $500 and $800 (over and above that of Option 1) to the light vehicle owners who are persuaded by information campaigns to purchase and/or operate light vehicles equipped with AEB. This is due to the additional cost of purchasing a vehicle equipped with this technology. This is a likely cost for Option 2a and Option 2b (over and above Option 1). The light vehicle owners would be likely to absorb most of this cost (but, as noted above, would also receive a proportion of the benefits).

Business/manufacturers:

The approximate cost to business is between $500 and $800 per vehicle which is expected to be passed onto consumers. There may be further development costs, however, most brands have developed or are developing AEB systems meeting the requirements of the UN Regulation.

Governments:

There would be a cost to governments for funding and/or running user information campaigns to inform light vehicle owners and operators of the benefits of AEB. This is likely to be estimated at $27 million for Option 2a and $164 million for Option 2b.

4.2.2.3 Option 6: Regulation

As Option 6 involves direct intervention to compel a change in the safety performance of light vehicles supplied to the marketplace, the benefits and costs are those that would occur over and above those of Option 1. The fitment of AEB would no longer be a commercial decision within this changed environment.

Benefits

Owners:

There would be a direct benefit through a reduction in road crashes (over and above that of Option 1) for light vehicle owners who purchase and/or operate new light vehicles equipped with AEB due to a mandated standard. These would be particularly substantial in higher-risk urban traffic areas. Regulation would save an estimated 582 lives and 20,524 serious and 73,868 minor injuries under Option 6 (over and above Option 1). There would also be direct benefits to owners (and/or insurance companies) through reductions in compensation, legal costs, vehicle repair and replacement costs, loss or damage of property, and in some cases fines.

Pedestrians:

A significant proportion of alleviated trauma would include pedestrians. AEB would reduce injury risk in crashes involving pedestrians, having the greatest influence in alleviating minor pedestrian injuries and mitigating elderly pedestrian fatalities.

Business/manufacturers:

There would be no direct benefit to light vehicle manufacturers (over and above that of Option 1). Component suppliers (mostly international) benefit directly in terms of increased income/revenue from supplying additional equipment to light vehicle manufacturers.

Governments/community:

There would be an indirect benefit to governments (over and above that of Option 1) from the reduction in road crashes that would follow the increase in the number and percentage of new light vehicles equipped with AEB systems due to a mandated standard. This would have benefits of

$2,681 million under Option 6 (over and above Option 1). These benefits would be shared among the community and as cost savings to governments.

<u>Costs</u>

Business:

There would be a direct cost to light vehicle manufacturers (over and above that of Option 1) as a result of design/development, fitment and testing costs for the additional light vehicles sold fitted with AEB due to a mandated standard. This would likely cost $1,592 million under Option 6 (over and above Option 1). It is likely that manufacturers would pass this increase in costs on at the point of sale to light vehicle owners who would then absorb most of it (but, as noted above, would also receive a portion of the benefits).

Governments:

There would be a cost to governments for developing, implementing and administering regulations (standards) that mandate the fitment of AEB. This is estimated to be $0.5 million.

Chapter 5: Regulatory Burden and Cost Offsets

The Australian Government Guide to Regulation (2014) requires that all new regulatory options are costed using the Regulatory Burden Measurement (RBM) Framework. Under the RBM Framework, the regulatory burden is the cost of a proposal to business and the community (not including the cost to government). It is calculated in a prescribed manner that usually results in it being different to the overall costs of a proposal in the benefit-cost analysis. In line with the RBM Framework, the average annual regulatory costs were calculated for this proposal by totaling the undiscounted (nominal) cost (including development and fitment cost) for each option over the 10 year period 2021-2030 inclusive. This total was then divided by 10.

The average annual regulatory costs under the RBM Framework for the four viable options (Options 1, 2a, 2b and 6) are set out in Table 12 to Table 15. There are no costs associated with Option 1 as it is the BAU case. The average annual regulatory costs associated with Options 2a, 2b and 6 are estimated to be $33.4 million, $48.4 million and $172.6 million respectively.

The Australian Government Guide to Regulation sets out ten principles for Australian Government policy makers. One of these principles is that all new regulations (or changes to regulations) are required to be quantified under the RBM Framework and where possible offset by the relevant portfolio.

It is anticipated that regulatory savings from further alignment of the ADRs with international standards will offset the additional RBM costs of this measure.

Table 12: Regulatory burden and cost estimate - Option 1

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	Business	Community organisations	Individuals	Total change in costs
Total by sector	-	-	-	-

Table 13: Regulatory burden and cost estimate - Option 2a

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	Business	Community organisations	Individuals	Total change in costs
Total by sector	$33.4m	-	-	$33.4m

Table 14: Regulatory burden and cost estimate - Option 2b

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	Business	Community organisations	Individuals	Total change in costs
Total by sector	$48.4m	-	-	$48.4m

Table 15: Regulatory burden and cost estimate - Option 6

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	Business	Community organisations	Individuals	Total change in costs
Total by sector	$172.6m	-	-	$172.6m

Post-Consultation Analysis

As noted in the Executive Summary, the FCAI and most of their members that made submissions all indicated more implementation time is needed and suggested alternative dates. The most extended of these was delaying the mandate for C2P AEB systems until July 2024 while maintaining the mandate for C2C AEB systems from July 2022. Post consultation analysis shows that this timetable would reduce the average annual regulatory costs associated with the recommended option to $172.6 million. This is a reduction from the Consultation RIS analysis which identified average annual regulatory costs of $183.6 million. To model this shift in timing additional fitment costs were reduced for the years 2022 until 2024 to accommodate the variance in AEB system type fitted to vehicles during this phase in period. These values are updated in Table 15 above.

Final implementation dates (and therefore final annual regulatory costs) will be determined by the Government as part of an ADR, following further consultation by the Department with industry on alternative implementation dates.

Chapter 6: What is the Best Option?

The impacts of the following viable options to reduce light vehicle urban and pedestrian trauma crashes through the increased fitment of AEB have been examined:

- Option 1: no intervention;
- Option 2a: user information campaigns – targeted awareness;
- Option 2b: user information campaigns – advertising; and,
- Option 6: mandatory standards under the MVSA/RVSA (regulation).

According to the Australian Government Guide to Regulation (Australian Government, 2014a) ten principles for Australian Government policy makers, the policy option offering the greatest net benefit should be the recommended option.

6.1 Net Benefits

Net benefit (total benefits minus total costs in present value terms) provides the best measure of the economic effectiveness of the options. Accordingly, the Australian Government Guide to Regulation (2014) states that the policy option offering the greatest net benefit should always be the recommended option.

Option 6: regulation provides the highest likely net benefit of the options examined at $1,089 million and a BCR range of 1.7 (likely) to 2.1 (best). The benefit would be spread over a 15 year period of regulation followed by a period of around 35 years over which the overall percentage of light vehicles fitted with AEB in the fleet continues to rise as older vehicles without AEB are deregistered at the end of their service life.

6.2 Casualty Reductions

Of the regulatory options, Option 6 provides the greatest reduction in road crash casualties, including 582 lives saved and 20,524 serious and 73,868 minor injuries avoided.

This is a minor decrease in the casualty reductions identified in the Consultation RIS (4 less lives saved, 75 less major injuries prevented and 70 less minor injuries prevented).

The road casualty reductions for user information campaigns are substantially lower than regulation, with only 37 lives saved and 1,294 serious and 4,644 minor injuries avoided under option 2a.

6.3 Recommendation

This Final RIS identified the road safety problem in Australia of crashes involving light vehicles impacting rear-end collisions and pedestrians that can be substantially alleviated via fitment of AEB. Although market uptake is increasing, the current standard fitment of AEB is moderate at 71 per cent of all new light passenger, SUV and light commercial vehicles sold. The potential for fitment rate improvements, standardisation of AEB system use and performance, and the number and severity of crash rear-end and pedestrian crashes in urban areas indicates a need for intervention.

There is a strong case for government intervention to increase the fitment of AEB to light vehicles via regulation. Analysis shows that such an intervention will provide significant reductions in road trauma while achieving the maximum net benefit for the community. Most benefit derives from the effectiveness of AEB against pedestrian trauma, and the high volume of alleviated minor injury to vehicle occupants. It is noted that ANCAP has reported that AEB is now not available for 12 per cent of vehicles sold, which is a reduction of 1 per cent from approximately one year ago. Despite ANCAP's best efforts, there is not universal fitting of AEB across all new light vehicles. To reach 100 per cent fitting rate across the market, a mandatory standard is required to close the gap.

Option 6 (regulation) provides the greatest reduction in road crash casualties, including 582 lives saved and 20,524 serious and 73,868 minor injuries avoided. It would adopt the requirements of UN Regulation No. 152, harmonising Australian requirements with internationally agreed standards. Harmonisation minimises costs associated with AEB system development, provides manufacturers the flexibility to incorporate or adapt systems that have already been developed and tested in the regions that the vehicle was originally designed. This should enable some leveraging of testing and certification frameworks already conducted in other markets.

Manufacturers and operators are likely to be impacted via additional AEB fitment costs for new light vehicles. However, such businesses also receive substantial benefits. The occurrence of light vehicle crashes is high and therefore relatively expensive on aggregate. The number of vulnerable road users accessing roads is constantly increasing. Crash alleviation will play an important role in contributing to Australia's productivity and the success of the light vehicle industry.

Option 6 offers the important advantage of being able to guarantee 100 per cent fitment of AEB to all light vehicles. There would be no guarantee that non regulatory options, such as Option 2, would deliver the targeted result, or that the predicted uptake of AEB would be reached and then maintained. Other options may also not fully address the variability in existing AEB system performance and usage between vehicle models (ANCAP, 2020), particularly around pedestrian performance. Furthermore, sections of the market may continue to offer AEB as an option only, often as part of a more expensive upgrade package.

The policy option offering the greatest net benefit should be the recommended option. Option 6 (regulation) is therefore the recommended option. It represents an effective option to influence the new light vehicle fleet in Australia that would guarantee on-going provision of improved reduction in rear end and pedestrian crashes, particularly in higher-risk urban areas.

6.4 Impacts of Recommended Option

Under Option 6, the fitment of AEB would no longer be a commercial decision within this changed environment. This intervention would mean businesses and the government are impacted by both benefits and costs.

6.4.1 Benefits

6.4.1.1 Business/Users

There would be a direct benefit through a reduction in road crashes for the light vehicle owners/operators who purchase and/or operate new light vehicles equipped with AEB due to a mandated standard. Option 6 would save an estimated 582 lives saved and 20,524 serious and 73,868 minor injuries. A significant proportion of these would be occupants of light vehicles and pedestrians through reductions in road trauma and other road crash related costs. There would also be direct benefits to business (including owners/operators and/or insurance companies) through reductions in compensation, legal costs, driver hiring and training, vehicle repair and replacement costs, loss of goods, and in some cases, fines relating to spills that lead to environmental contamination.

6.4.1.2 Governments/community

There would be a benefit to governments and the community from the reduction in road crashes and pedestrian impacts improving safety outcomes in higher-risk pedestrian and school areas that would follow the increase in the number and percentage of new light vehicles equipped with AEB due to a mandated standard. This would have benefits of $2,681 million under Option 6. The benefits would be shared among the community and as cost savings to governments.

6.4.2 Costs

6.4.2.1 Business

There would be a direct cost to light vehicle manufacturers as a result of design/development, fitment and testing costs for the additional light vehicles sold fitted with AEB due to a mandated standard. This would most likely cost $1,592 million under Option 6. It is likely that manufacturers would pass this increase in costs on at the point of sale to light vehicle owners/operators who would then absorb most of it (but, as noted above, would also receive a portion of the benefits).

6.4.2.2 Governments

There would be a cost to governments for developing, implementing and administering regulations (standards) that mandate the fitment of AEB. This is estimated to be $0.5 million. The Australian Government maintains and operates a vehicle certification system, which is used to ensure that vehicles first supplied to the market comply with the ADRs. A cost recovery model is used and so ultimately, the cost of the certification system as a whole is recovered from business.

6.5 Scope of the Recommended Option

The international standard for AEB systems on light vehicles is the UN Regulation No. 152. The vehicle categories to which this regulation applies are the UN vehicle categories M1 and N1, corresponding to ADR subcategories MA, MB, MC, NA1 and NA2.

6.6 Timing of the Recommended Option

The proposed light vehicle AEB implementation timeframe for consultative purposes in the Consultation RIS was:

- 1 July 2022 for applicable new model vehicles
- 1 July 2024 for all applicable new vehicles.

The implementation lead-time for an ADR change that results in an increase in stringency is generally no less than 18 months for new models and 24 months for all other models. The proposed timetable would meet these typical minimum lead-times.

The revised implementation timing proposed in this Final RIS would be as follows:

For AEB systems capable of detecting collisions with other vehicles (00 series of UN Regulation No. 152)

- July 2022 for new model vehicles
- July 2024 for all new vehicles.

For AEB systems capable of detecting collisions with pedestrians (00 series of UN Regulation No. 152)

- July 2024 for new model vehicles
- July 2026 for all new vehicles

Final implementation dates will be determined by the Government as part of the relevant ADR, following consultation by the Department with industry on implementation dates.

Chapter 7: Consultation

The Department of Infrastructure, Transport, Regional Development and Communications undertakes public consultation on significant proposals. Development of safety-related ADRs under the RVSA is the responsibility of the Vehicle Safety Policy and Partnerships Branch and the Vehicle Safety Operations Branch of the Department. It is carried out in consultation with representatives of the Australian Government, state and territory governments, manufacturing and operating industries, road user groups and experts in the field of road safety.

7.1 Consultative Committees

Depending on the nature of the proposed changes, consultation may involve community and industry stakeholders as well as established government committees such as the Technical Liaison Group (TLG), Strategic Vehicle Safety and Environment Group (SVSEG), Infrastructure and Transport Senior Officials' Committee (ITSOC) and the Infrastructure and Transport Ministers' Meeting (ITMM).

- TLG consists of technical representatives of government (Australian and state/territory), the manufacturing and operational arms of the industry (including organisations such as the Federal Chamber of Automotive Industries and the Australian Trucking Association) and of representative organisations of consumers and road users (particularly through the Australian Automobile Association).
- SVSEG consists of senior representatives of government (Australian and state/territory), the manufacturing and operational arms of the industry and of representative organisations of consumers and road users (at a higher level within each organisation as represented in TLG).
- ITSOC consists of state and territory transport and/or infrastructure Chief Executive Officers (CEOs) (or equivalents), the CEO of the National Transport Commission, New Zealand and the Australian Local Government Association.
- ITMM consists of the Australian, state/territory and New Zealand Ministers with responsibility for transport and infrastructure issues.

While the TLG sits under the higher level SVSEG forum, it is the principal consultative forum for advising on the more detailed aspects of ADR proposals.

7.2 Public Comment

The publication of a Consultation RIS of the proposal for public comment is an integral part of the consultation process. This provides an opportunity for businesses and road user groups, as well as all other interested parties, to respond to the proposal by writing or otherwise submitting their comments to the Department. Analysing proposals through the RIS process assists in identifying the likely impacts of the proposals and enables informed debate on any issues.

During the consultation period, feedback was received from members of the public, state government agencies, industry, and road user organisations. A majority of the feedback strongly supported the implementation of Option 6.

Most passenger and light commercial vehicle manufacturers, importers and their representative organisation (the Federal Chamber of Automotive Industries, FCAI) supported Option 1 - No intervention. In their submissions they argued that there was no need for intervention by the Government as they were voluntarily fitting AEB systems or that it is an option on most of their models and for some manufacturers at least standard for their premium models. The FCAI and a majority of its members that made individual submissions indicated more implementation time is needed and suggested longer implementation time is required if Option 6 - Regulation is the most strongly supported option. Their recommendation for implementation timing was to align with the introduction of the regulation in other major markets, especially the EU. It was highlighted in their submissions to further stage the introduction of the requirements in the standard so that C2P detection is delayed by two years after C2C detection is implemented.

The effect of extending the implementation schedule was examined in a sensitivity analysis; this involved considering the extension to mandating AEB systems capable of detecting pedestrians to July 2024. The effect of this suggested timing by industry on benefits, costs and lives saved was examined in a post consultation analysis, which also showed substantial positive benefits. There was a minor reduction in the trauma savings (4 less lives saved, 75 less major injuries prevented and 70 less minor injuries prevented) and a reduction in the required annual offset of $11 million (from $183 million to $172 million).

Five jurisdictions and one road safety agency made submissions strongly supporting the recommended Option 6 - Regulation, including in many cases maintaining the implementation timing recommended in the Consultation RIS to ensure the broadest benefit of the technology. One road safety agency supported the implementation of Option 3 - Government fleet purchasing policies until the implementation of Option 6 - Regulation is finalised. All jurisdictions that made submissions identified the voluntary fitment of AEB systems by manufacturers however highlighted that the feature is often not available as an option on lower cost variants within a model range. Their submissions noted these variants of a model are often those selected by people who are more vulnerable and/or have the potential to be involved in more road incidents such as young people and senior citizens. The ACT government submission further recognised the significant increase in safety for VRU (pedestrians) who are not participants in the consumer choice of vehicle owners but are potentially affected by the outcomes of those choices. All submissions identified variabilities in crash detection performance and operating interfaces would exist without a national standard and therefore would result in different outcomes to consumers, operators and ultimately road users in the context of a crash and its level of severity.

Submissions from Australasia’s leading independent vehicle safety authority (Australasian New Car Assessment Program, ANCAP) and the peak organisation for Australia’s motoring clubs (Australian Automobile Association, AAA) supported the recommended Option 6 - Regulation maintaining the implementation timing recommended in the Consultation RIS. ANCAP and AAA submissions also noted that the European Union plans to expand the AEB regulatory requirement for enhanced capability of detecting pedestrians and cyclists. Both submissions encouraged the Australian Government to participate in updating UN R152 to cater for additional AEB test scenarios, and subsequent adoption of an updated UN R152. ANCAP highlighted that despite its best efforts, there is not universal fitting of AEB across all new light vehicles and to reach 100 per cent fitting rate across the market, an ADR is required.

In line with the Australian Government Guide to Regulation (2014), the Consultation RIS was circulated for eight weeks' public comment which closed on 2 November 2020. A summary of public comment input and Departmental responses are included in this Final RIS (see Appendix 8) that is used for decision making by the responsible minister. This Final RIS has been published on the Department's website and has been distributed to the consultative committees outlined above.

As Australia is a party to the World Trade Organisation (WTO) Agreement, and harmonisation of requirements with international regulations is a means of compliance with its obligations, a notification will be lodged with the WTO for the required period, to allow for comment by other WTO members. Formal submissions to the Consultation RIS were received from the following state and territory governments, organisations and industry

State and territory governments

ACT Government – Transport Canberra and City Services

NSW Government - Transport for NSW

Government of South Australia - Department for Infrastructure and Transport

Road Safety Commission, Main Roads WA and the Department of Transport, WA

Department of Transport and Main Roads (TMR) QLD

Confidential submission made by one road safety agency

Consumer / Road Safety Organisations

Australasian New Car Assessment Program (ANCAP)

Australian Automobile Association (AAA)

Industry

Federal Chamber of Automotive Industries (FCAI)

Caravan Industry Association of Australia Ltd

BMW Group Australia

Volvo Car Australia Pty Ltd

Audi Australia Pty Ltd

Volkswagen Group Australia

Toyota Australia

Mitsubishi Motors Australia Limited

Isuzu Ute Australia Pty Ltd

Lotus Cars Ltd

Honda Australia

Chapter 8: Implementation

New ADRs and amendments to ADRs are determined by the responsible minister under section 7 of the MVSA and section 12 of the RVSA.

As Australian Government regulations, ADRs are subject to review every ten years as resources permit. This ensures that they remain relevant, cost effective and do not become a barrier to the importation of safer vehicles and vehicle components. A new ADR for light vehicle AEB would be scheduled for a full review on an ongoing basis and in line with this practice.

The Bureau of Infrastructure, Transport and Regional Economics (BITRE) regularly publishes road crash statistics for Australia, including quarterly and annual summaries of trauma from road crashes in which one or more light vehicles were involved. Each state and territory also publishes police reported road crash data, including for crashes involving light vehicles. The Department expects these data sources will be used to collectively inform and support future evaluation(s) of the implementation of the recommended option.

In August 2019, the then Transport and Infrastructure Council (Council) strongly committed to developing the next National Road Safety Strategy (NRSS) based on a target of zero fatalities and made Road Safety a standing item on its agenda. Further, Council agreed the Commonwealth will streamline the process for legislative and regulatory changes to vehicle safety standards to improve the uptake of new safety technology in the Australian new vehicle fleet, and will endeavor to align Australian regulations with the [then] proposed European regulatory package to commence within a similar timeframe.

As Option 6 was the most supported option the Government will aim to harmonise national vehicle safety standards with leading international markets.

Importantly, as the Government has chosen to mandate UN Regulation No. 152 in Australia through the ADRs, the introduction schedule will endeavor to allow vehicle manufacturers appropriate and sufficient lead times and ensure introduction is not in advance of schedules adopted in Europe.

While most manufacturers did not support mandating AEB for light vehicles they noted that if a regulatory option were to be preferred then Australia should follow the implementation steps and timing of the EU; i.e. a gradual introduction of various levels of AEB technology, where the first phase only detects vehicles (C2C), the next phase will detect pedestrians (C2P) and a third phase will detect cyclists (C2B).

The Consultation RIS examined the first two phases, i.e. AEB technology detecting vehicles and pedestrians. In reviewing the ADR in line with Australian Government requirements and revisions to the UN regulation, the Department will examine the case for expanding the scope of the technology to specifically detect other VRUs; such as pedal cyclists and motorcyclists as such technology and regulation become available.

Chapter 9: Conclusion and Recommended Option

9.1 Conclusion

Light vehicle rear-impact crashes and collisions with pedestrians in higher-risk pedestrian and school areas are the specific road safety problem that has been considered in this Final RIS. These crashes cost the community $1.9 billion annually. Light vehicle AEB systems capable of mitigating rear impact and pedestrian crashes are a mature technology for which an international standard is now developed (UN Regulation No. 152).

Research commissioned by the Department shows that AEB has the potential to impact the outcome in up to 64 per cent of light vehicle crashes occurring in low (up to 60 kph) speed zones. The research highlighted that injury risk reductions associated with AEB were greater for serious and fatal injuries than for minor injuries. The research also found that AEB reduced injury risk in crashes involving pedestrians, having greatest influence in alleviating minor pedestrian injuries and mitigating elderly pedestrian fatalities.

In Australia, 71 per cent of new light vehicles are fitted with AEB systems as standard. However, ANCAP has reported that AEB is now not available for 12 per cent of vehicles sold, which is a reduction of 1 per cent from approximately one year ago. Despite ANCAP's best efforts, there is not universal fitting of AEB across all new light vehicles. To reach 100 per cent fitting rate across the market, a mandatory standard is required to close the gap.

Though some AEB implementations available in Australia may not yet meet all requirements of the new UN regulation being developed for light vehicle AEB, these uptake figures and independent testing by the ANCAP demonstrate that manufacturers are capable of achieving high deployment rates and meeting or exceeding minimum performance requirements. No country has implemented a standard for AEB for light vehicles. However, the department played a leading role in the rapid international development of a new standard for AEB for light vehicles through WP 29, including shaping the international standard to suit Australian road safety. The standard was endorsed by WP 29 in January 2020 and available for enforcement as a UN regulation from late 2020.

This Final RIS examined the case for government intervention to increase fitment rates of AEB for new light vehicles. Four intervention options were considered, in addition to the BAU case to increase fitment of AEB to the light vehicle fleet. It was found that the most significant net benefits are to be gained by mandating AEB fitment for new light vehicles.

Option 6, mandatory broad scope regulation adopting the internationally-agreed requirements of UN Regulation No.152, is expected to yield benefits of $2,681 million over the BAU case, with a likely case benefit-cost ratio of 1.7 (best case up to 2.1). Option 6 would save 582 lives and mitigate 20,524 serious and 73,868 minor injuries. Furthermore, Option 6 has the potential to contribute considerably to the NRSS 2011-2020 target of reducing Australian road trauma by at least 30 per cent.

According to the Australian Government Guide to Regulation (2014) ten principles for Australian Government policy makers, the policy option offering the greatest net benefit should always be the recommended option. Therefore, Option 6: regulation (broad scope) is the recommended option. Under this option, fitment of AEB would be mandated for all new light vehicles covered by UN

Regulation No. 152. This constitutes all light passenger vehicles and light goods vehicles covered under UN vehicle categories M1 and N1 corresponding to ADR subcategories MA, MB, MC, NA1 and NA2.

A Consultation RIS was released for an eight week public comment period, which closed 11 December 2020. The majority of feedback received during this period strongly supported the implementation of Option 6. The proposed implementation timing for consultative purposes was:

- 1 July 2022 for new model vehicles
- 1 July 2024 for all new vehicles.

Feedback received during the public consultation process from vehicle manufacturers proposed an implementation schedule that would allow suppliers appropriate and sufficient lead times, if Option 6 is the preferred option. Their proposal highlighted that it is essential for uninterrupted supply of vehicles to Australia that introduction is not in advance of schedules adopted in major international markets.

In the case of mandating AEB for light vehicles (Option 6), the Australian Government will endeavor to align with the timelines proposed in the EU GSR for light vehicle AEB. Therefore the revised implementation timing proposed would be as follows:

For AEB systems capable of detecting collisions with other vehicles (00 series of UN Regulation No. 152)

- July 2022 for new model vehicles
- July 2024 for all new vehicles.

For AEB systems capable of detecting collisions with pedestrians (00 series of UN Regulation No. 152)

- July 2024 for new model vehicles
- July 2026 for all new vehicles.

The effect of extending the implementation schedule was examined in a sensitivity analysis; this involved considering the extension to mandating AEB systems capable of detecting pedestrians (C2P) to July 2024. The effect of this suggested timing by industry on benefits, costs and lives saved was examined in a post consultation analysis, which also showed substantial positive benefits in comparison with the Consultation RIS released in October 2020. Gross benefits identified increased to $2,681 million (from $ 2,645 million) and total costs reduced to $1,592 million (from $ 1,685 million). Average additional fitment costs for AEB systems were reduced by 30 per cent for the first two years in the benefit-cost analyses to accommodate AEB systems without pedestrian detection. There was a reduction in the trauma savings (4 less lives saved, 75 less major injuries prevented and 70 less minor injuries prevented) and a reduction in the required annual offset of $11 million (from $183 million to $172 million). The new timing provides for continuity of supply to the Australian market and certainty for business.

In terms of the impact of the recommended option, the costs to business for the necessary changes to vehicles would normally be passed on to consumers, while the benefits would flow to the community and the consumers or their families that are directly involved in crashes.

Final implementation dates will be determined by the Government as part of the relevant ADR, following consultation by the Department with industry on implementation dates.

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Appendix 1 - Vehicle Categories

A two-character vehicle category code is shown for each vehicle category. This code is used to designate the relevant vehicles in the national standards, as represented by the ADRs, and in related documentation.

Passenger Vehicles (Other Than Omnibuses) (M)

Passenger Car (MA)

A passenger vehicle, not being an off-road passenger vehicle or a forward-control passenger vehicle, having up to 9 seating positions, including that of the driver.

Forward-Control Passenger Vehicle (MB)

A passenger vehicle, not being an off-road passenger vehicle, having up to 9 seating positions, including that of the driver, and in which the centre of the steering wheel is in the forward quarter of the vehicle's '*Total Length*.'

- MB1 up to 2.7 tonnes 'GVM'
- MB2 over 2.7 tonnes 'GVM'

Off-road Passenger Vehicle (MC)

A passenger vehicle having up to 9 seating positions, including that of the driver and being designed with special features for off-road operation.

- MC1 up to 2.7 tonnes 'GVM'
- MC2 over 2.7 tonnes 'GVM'

Goods Vehicle (N)

A motor vehicle constructed primarily for the carriage of goods and having at least 4 wheels; or 3 wheels and a 'Gross Vehicle Mass' exceeding 1.0 tonne.

Light Goods Vehicle (NA)

A goods vehicle with a 'Gross Vehicle Mass' not exceeding 3.5 tonnes.

The categories listed below are those relevant to vehicles greater than 4.5 tonnes Gross Vehicle Mass and trailers greater than 4.5 tonnes Gross Trailer Mass (Light Vehicles).

- NA1 up to 2.7 tonnes 'GVM'
- NA2 over 2.7 tonnes 'GVM'

Appendix 2 - Awareness Campaigns

There are numerous examples of awareness advertising campaigns that have been successful. One particularly successful campaign was the Grim Reaper advertisements of 1987. In an attempt to educate the public about risk factors for HIV Aids; television and newspaper advertisements were run showing the Grim Reaper playing ten pin bowling with human pins. This campaign led to significant increases in HIV testing requests meaning that the campaign effectively reached the target market. Other awareness campaigns can be as successful if well designed, planned and positioned. Two examples are the more recent Skin Cancer Awareness Campaign and the Liquids, Aerosols and Gels Awareness Campaign.

Providing accurate costings is a difficult task. Each public awareness campaign will consist of different target markets, different objectives and different reaches to name a few common differences. In providing a minimum and maximum response two cases have been used; the maximum cost is developed from the Department of Health & Ageing’s Skin Cancer Awareness Campaign. The minimum cost is developed from the Office of Transport Security’s Liquids, Aerosols and Gels (LAGs) Awareness Campaign.

Broad High Cost Campaign

The “Protect yourself from skin cancer in five ways” campaign was developed in an effort to raise awareness of skin cancer amongst young people who often underestimate the dangers of skin cancer.

Research prior to the campaign found that young people were the most desirable target market as they had the highest incidence of burning and had an orientation toward tanning. This group is also highly influential in setting societal norms for outdoor behaviour. A mass marketed approach was deemed appropriate.

The Cancer Council support investment in raising awareness of skin cancer prevention as research shows that government investment in skin cancer prevention leads to a $5 benefit for every $1 spent.

Whilst it is not a direct measure of effectiveness, the National Sun Protection Survey would provide an indication as to the changed behaviours that may have arisen as a result of the advertising campaign. The research showed that there had been a 31 per cent fall in the number of adults reporting that they were sunburnt since the previous survey in 2004 suggesting that the campaign was to some extent effective. The actual effectiveness of the campaign was not publicly released.

The costs of this campaign were from three sources:

Creative Advertising Services (e.g. advertisement development)	$378,671
Media Buy (e.g. placement of advertisements)	$5,508,437
Evaluation Research (measuring the effectiveness of the campaign)	$211,424
Total	**$6,098,532**

Applicability to AEB Systems for Light Vehicles

Using a mass marketing approach can be regarded as an effective approach because it has the ability to reach a large number of people. However, this may not be the most efficient approach as most people exposed to such advertisements would not be members of the target market. Further, political sensitivities can arise from large scale marketing campaigns and that there would likely be a thorough analysis of any such spending. As a result, it would be essential to demonstrate that such a campaign is likely to be effective prior to launch.

The scale of the above example would be too large for a campaign targeting an Australian light vehicle fleet. Unlike the examples given in Appendix 3, light vehicles are traditionally not advertised as commodities through television media, as the target market is too small proportion of the public. In lieu of advertising the equipment through manufacturers' commercials, a safety advertisement would instead reach a larger proportion of the public that have the means to act on the campaign. Comparing to reported expenditure of government agencies for 2015-2016 (Department of Finance, 2016), the estimate of $1.5 million per month, or $18 million per year to run a mass market approach was comparable.

Targeted Low-cost Campaign

In August 2006, United Kingdom security services interrupted a terrorist operation that involved a plan to take concealed matter on board an international flight to subsequently build an explosive device. The operation led to the identification of a vulnerability with respect to the detection of liquid explosives.

As a result, the International Civil Aviation Organisation released security guidelines for screening Liquids, Aerosols & Gels (LAGS). As a result new measures were launched in Australia. To raise awareness of the changes, the following awareness campaign was run over a period of four months:

- 14 million brochures were published in English, Japanese, Chinese, Korean & Malay and were distributed to airports, airlines, duty free outlets and travel agents
- 1200 Posters, 1700 counter top signs, 57000 pocket cards, 36 banners and 5000 information kits were prepared.
- Radio and television Interviews
- Items in news bulletins
- Advertising in major metropolitan and regional newspapers
- A website, hotline number and email address were established to provide travellers with a ready source of information.
- 5 million resealable plastic bags were distributed to international airports
- Training for 1900 airport security screeners and customer service staff was funded and facilitated by the department.

The campaign won the Public Relations Institute of Australia (ACT) 2007 Award for Excellence for a Government Sponsored Campaign having demonstrated a rapid rise in awareness. 77 per cent of travellers surveyed said they had heard of the new measures in general terms and 74 per cent of respondents claimed to be aware of the measures when prompted.

The costs of this campaign were from three sources:

Developmental Research (e.g. Understanding Public Awareness prior to the campaign)	$50,000
Media Buy (e.g. Placement of advertisements)	$1,002,619
Evaluation Research (Measuring the effectiveness of the campaign)	$40,000
Total	**$1,092,619**

Applicability to AEB Systems for Light Vehicles

This campaign had a very narrow target market; international travellers. As a result, the placement of the message for the most part was able to be specifically targeted to that market with minimum wastage through targeting airports and travel agents.

Should a light vehicle campaign be run, there would be a similar narrow target market; new light vehicle buyers. As a result, placement of similar marketing tools could be positioned in places where these buyers search for information. Particular focus may be on light vehicle sales locations and in print media (e.g. magazines) specifically covering light vehicles.

The scale of the above example would be too large for a campaign targeting an Australian light vehicle campaign. Targeting specific media publications, both online and print media, would provide the best outcomes. Using reported expenditure of government agencies for 2015-2016 (Department of Finance, 2016), an estimate of $200,000 for a three month period was used. The cost modelling of this option started with a two year campaign followed by campaigns every second year (to prevent advertising fatigue) while the BAU fitment rate remained under 70 per cent.

Appendix 3 - Information Campaigns

The following are real-world advertising campaigns that featured automotive technologies as a selling point, with a measured outcome:

A Mitsubishi Outlander advertising campaign was launched in February 2008. It focused solely on the fact that the car had “Active Stability Control as standard”. Changes in sales were attributable directly to the campaign. There was an immediate effect with sales of the Mitsubishi Outlander increasing by 9.1 per cent for the month of February alone.

A Hyundai advertising campaign was launched in April 2008, offering free ESC on the Elantra 2.0 SX until the end of June. This was supplemented by television commercials launched in early May. The impact of this campaign was significant, with a 52.8 per cent increase in sales for this model over the period.

A 2008 Volkswagen Golf advertising campaign aimed to inform the market that the Golf had “extra features at no extra cost”. The result was a 69.1 per cent increase in sales for those models over the April – June period.

Appendix 4 - UN Regulation No. 152 Performance Requirements

Warning and Activation Test

UN Regulation No. 152 covers AEB systems fitted to UN vehicle categories M1 and N1, corresponding to ADR subcategories MA, MB, MC, NA1 and NA2. The AEB system automatically detects a potential forward collision, provide the driver with an appropriate warning and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating the severity of a collision with a car or pedestrian or both.

- Vehicle Target - Tests conducted to detect another vehicle (or equivalent) as the target are required to be carried out under two scenarios (moving and stationary target vehicle).
- Pedestrian Target - Tests conducted to detect a pedestrian (or equivalent) target are conducted with the pedestrian travelling in a straight line perpendicular to the subject vehicle direction of travel at a constant speed of 5 km/h.

Failure Detection Test – AEB system failure

This test requires simulating an electrical failure in the AEB system either through the disconnection of power supply to or communication between AEB components. The failure warning signal activated during this test shall remain activated for as long as the simulated failure exists and even after subsequent ignition “off” ignition “on” cycles. During this simulated system failure, there should be no interruption to:

- the driver warnings on the AEB system
- the control of the manual AEB deactivation switch (if fitted to the vehicle)

Deactivation Test – Automatic AEB Reactivation

For vehicles equipped with means to deactivate the AEB system, this test requires verifying:

- the AEB system warns the driver when the system is deactivated via a warning signal
- the AEB system reactivates once the ignition (start) is switched to the “off” position and back to the “on” position

the previously activated AEB system warning signal remains deactivated once the AEB is reactivated.

False Reaction Senarios

Since the AEB system in not only required to achieve high performance, but also to avoid false activations, the system needs to carefully evaluate whether to activate or not based on what the sensors detect. Classification of an object (target) can be crucial when assessing whether to start an intervention (warning or brake activation) or not. Therefore the characteristics of an object plays a big part in AEB system performance.

The system shall be designed to minimise the generation of collision warning signals and to avoid autonomous braking in situations where the driver would not recognise an impending collision.

Demonstration of meeting the requirements to minimise these false positives are carried out under two scenarios:

- Vehicle Target
  Two stationary vehicles of MA category shall be positioned facing the same direction of travel as the subject vehicle with a distance of 4.5m between them. The rear of both stationary vehicles shall be aligned with each other. The subject vehicle shall travel in a straight line for at least 60m at a constant speed and pass centrally between the two stationary vehicles. The AEB system shall not provide a collision warning and shall not initiate the emergency braking phase.
- Pedestrian Target
  The stationary pedestrian target is to face in the same direction of travel as the subject vehicle. The pedestrian target is to keep a distance of 1m from the subject vehicle side closes to the target toward the side in the direction of traffic. The subject vehicle shall travel in a straight line for at least 60m at a constant speed and pass the stationary pedestrian target. The AEB system shall not provide a collision warning and shall not initiate the emergency braking phase.

"Mass of a vehicle in running order" means the mass of an unladen vehicle with bodywork, including coolant, oils, at least 90 per cent of fuel, 100 per cent of other liquids, driver (75 kg) except used waters, tools, spare wheel.

"Maximum mass" means the maximum mass stated by the vehicle manufacturer.

"Subject Vehicle" means the vehicle being tested.

"Vehicle Target" means a target that represents a vehicle.

"Time To Collision" (TTC) means the value of time obtained by dividing the longitudinal distance (in the direction of travel of the subject vehicle) between the subject vehicle and the target by the longitudinal relative speed of the subject vehicle and the target, at any instance in time.

Subject Vehicle

UN Category	ADR Subcategory	Test Mass Conditions	
M1	MA, MB, MC	Vehicle mass in running order + 125 kg	Vehicle at maximum mass
N1	NA1, NA2		

Target Vehicle

UN Category	ADR Subcategory	Equivalent ISO Vehicle Target Requirements
M1 AA Saloon	MA sedan	"Soft target" representative of a test device for target vehicles according to ISO 19206-1:2018

Target Pedestrian

Equivalent ISO Pedestrian Target Requirements
"Soft target" representative of a test device for human targets according to ISO 19206-2:2018

Test Site Conditions

Surface Profile		Flat (consistent slope between level and 1 per cent)
Surface Moisture		Dry
Surface Material		Concrete or Asphalt
Peak Braking Coefficient (PBC)		0.9
Ambient temperature		0℃ - 45℃
Horizontal Visibility		Car or pedestrian target to be visible throughout the test
Natural Ambient Illumination **(lux - luminous flux per unit area)**	**Car to car**	Must be homogenous in the test area and greater than 1000 lux
	Car to pedestrian	Must be homogenous in the test area and greater than 2000 lux
Wind Conditions		No wind liable to affect results
*No tests to be performed whilst driving towards, or away from the sun at low angles		

Warning and Activation Test - Stationary Vehicle Target

ADR Subcategory (Subject Vehicle)	Test Speed (km/h) Subject vehicle is travelling at a constant speed with a TTC of atleast 4 s (Stationary vehicle target is placed facing in the same direction)	Collision Warning Phase Atleast 0.8 s before emergency braking phase if collision is anticipated (or before emergency braking phase if collision cannot be anticipated in time to meet 0.8 s requirement above)	Emergency Braking Phase
MA, MB, MC, NA1, NA2	20 , 42 and 60	Collision warning provided by atleast 2 modes: Haptic or Acoustic or Optical	Provide braking demand of at least 5 m/s^2

Warning and Activation Test - Moving Vehicle Target

ADR Subcategory (Subject Vehicle)	Test Speed (km/h) Subject vehicle is travelling at a constant speed with a TTC of atleast 4 s (Moving vehicle target speed of 20 km/h in the same direction)	Collision Warning Phase Atleast 0.8 s before emergency braking phase if collision is anticipated (or before emergency braking phase if collision cannot be anticipated in time to meet 0.8 s requirement above)	Emergency Braking Phase
MA, MB, MC, NA1, NA2	30 and 60	Collision warning provided by atleast 2 modes: Haptic or Acoustic or Optical	Provide braking demand of at least 5 m/s^2

Warning and Activation Test - Moving Pedestrian Target

ADR Subcategory (Subject Vehicle)	Test Speed (km/h)	Collision Warning Phase	Emergency Braking Phase
	Subject vehicle is travelling at a constant speed with a TTC of atleast 4 s (Pedestrian target travelling in a straight line at 5 km/h perpendicular to subject vehicle's direction)	No later than the start of the emergency braking phase	
MA, MB, MC, NA1, NA2	20, 30 and 60	Collision warning provided by atleast 2 modes: Haptic or Acoustic or Optical	Provide braking demand of at least 5 m/s^2

AEB System Failure Detection Test

ADR Subcategory (Subject Vehicle)	Failure Simulated	System Requirements	Warning Requirements
	Electrical failure (for instance a disconnected power source or AEB component)	Driver AEB warning signal should not be compromised Optional manual AEB deactivation switch function should not be compromised	Driver AEB warning should activate and remain activated no later than 10 s after the subject vehicle is driven at a speed greater than 10 km/h This warning should reactivate immediately after an ignition "off" igniting "on" cycle as long as the simulated failure exists
MA, MB, MC, NA1, NA2	Constant yellow optical warning signal		

False Reaction Test - Between Stationary Vehicles

ADR Subcategory (Subject Vehicle)	**Test Speed (km/h)** Subject vehicle should travel in a straight line for a distance of atleast 60m at a constant speed	**Collision Warning Phase** No collision warning signal should be provided	**Emergency Braking Phase** No emergency braking should occur
MA, MB, MC	10, 15, 20, 25, 30, 35, 40, 42, 45, 50, 55, 60	Haptic or Acoustic or Optical	Provide a braking demand of at least 5 m/s^2
NA1, NA2	10, 15, 20, 25, 30, 32, 35, 38, 40, 42, 45, 50, 55, 60	Haptic or Acoustic or Optical	Provide a braking demand of at least 5 m/s^2

False Reaction Test - Passing Stationary Pedestrian

ADR Subcategory (Subject Vehicle)	**Test Speed (km/h)** Subject vehicle should travel in a straight line for a distance of atleast 60m at a constant speed 1m distance from subject vehicle side closest to the pedestrian	**Collision Warning Phase** No collision warning signal should be provided	**Emergency Braking Phase** No emergency braking should occur
MA, MB, MC	20, 25, 30, 35, 40, 45, 50, 55, 60	Haptic or Acoustic or Optical	Provide a braking demand of at least 5 m/s^2
NA1, NA2	20, 25, 30, 35, 40, 45, 50, 55, 60	Haptic or Acoustic or Optical	Provide a braking demand of at least 5 m/s^2

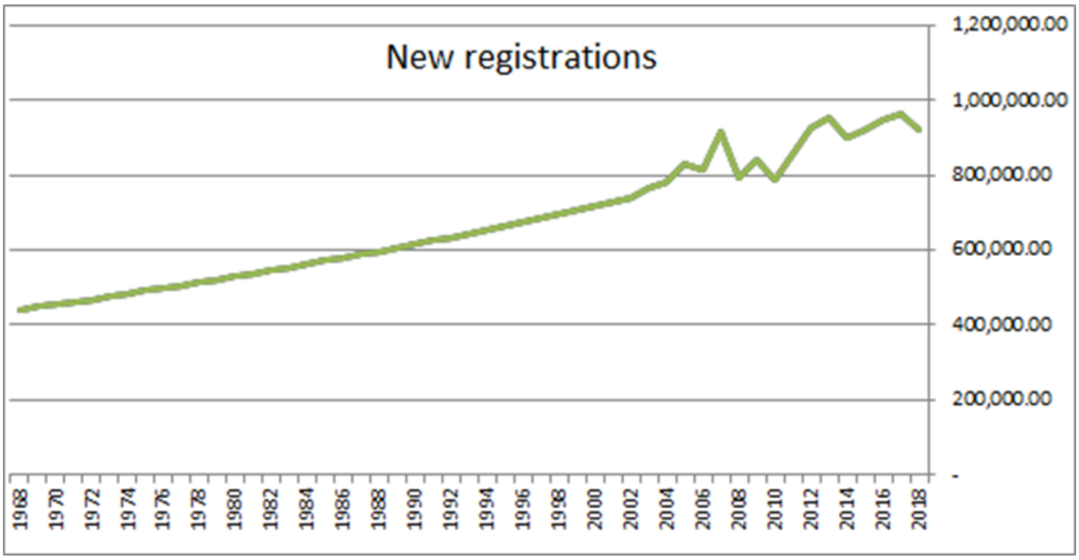
Appendix 5 - Benefit Cost Analysis

The model used in this analysis was the Net Present Value (NPV) model. The costs and expected benefits associated with a number of options for government intervention were summed over time. The further the cost or benefit occurred from the nominal starting date, the more they were discounted. This allowed all costs and benefits to be compared equally among the options, no matter when they occurred. The table at the end of this appendix summarises the figures from this analysis.

The analysis was broken up into the steps outlined below.

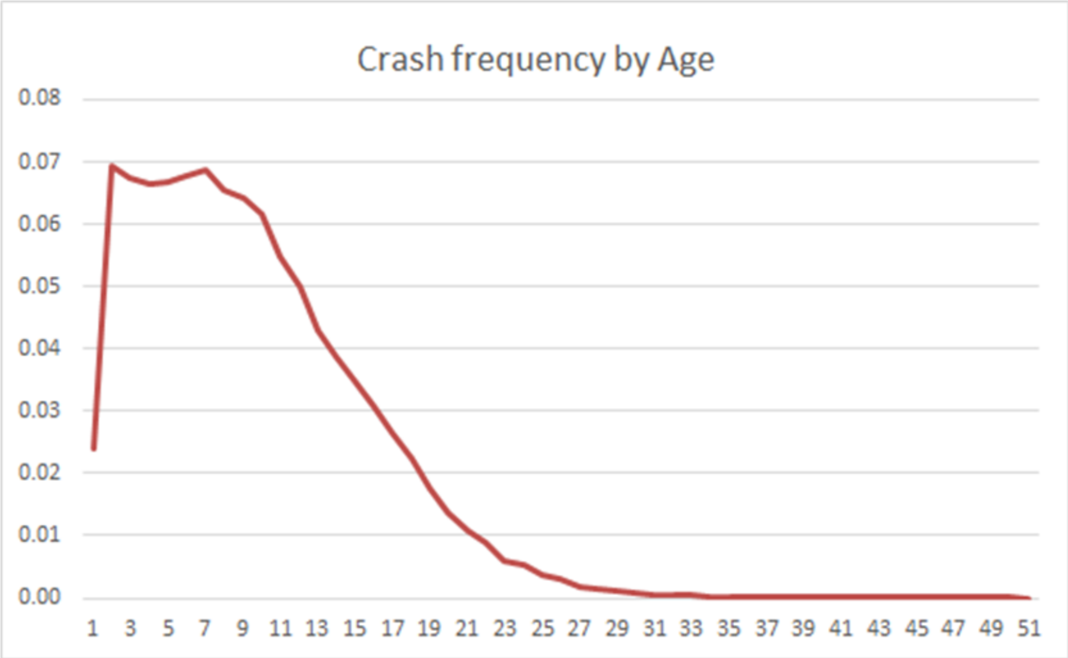
1. The number of new registered vehicles in ADR categories covered by UN Regulation No. 152 were established for each year between 1968 and 2019 inclusive, utilising available Australian Bureau of Statistics Motor Vehicle Census (report series 9309.0) data (Australian Bureau of Statistics, 2019a), and registrations per capita for years prior to availability of census data (Figure 16):

Figure 16: New vehicle registrations



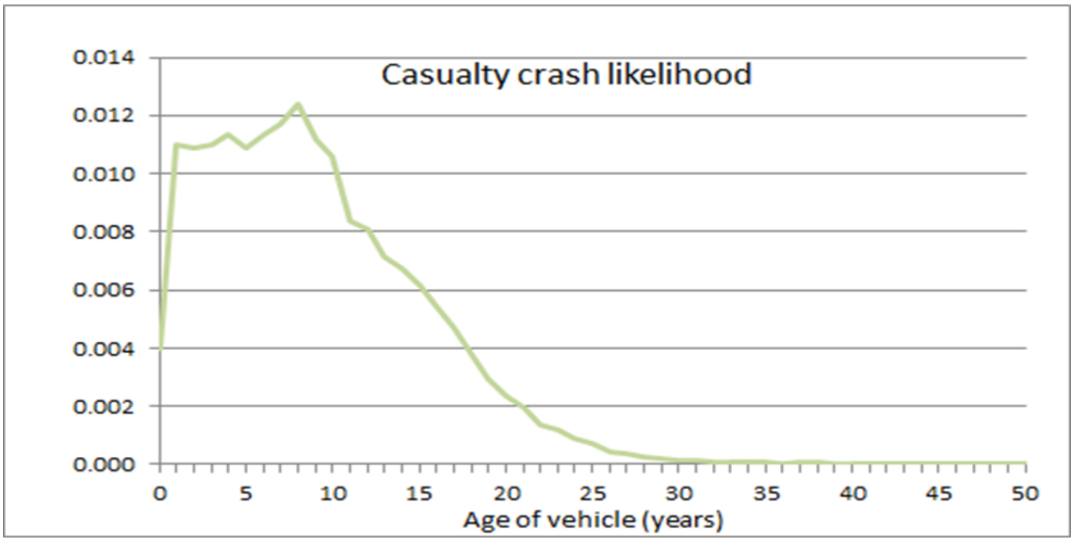
2. Data from MUARC 2020 was used to determine the typical crash frequency by age for vehicle categories covered by UN Regulation No. 152 (Figure 17):

Figure 17: Typical crash frequency by age



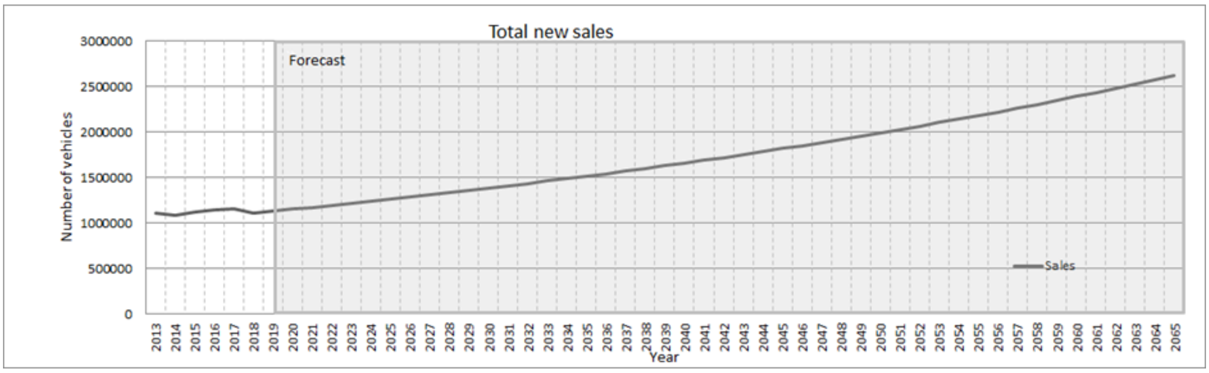
3. The data from steps 1 and 2 were used to determine the likelihood of a vehicle of a given age being involved in a casualty crash over course of 1 year as a function of number of registered vehicles of a given age (Figure 18):

Figure 18: Casualty crash likelihood with vehicle age



4. Recent new vehicle combined sales data for the relevant vehicle categories was established (Figure 19):

Figure 19: New vehicle combined sales data



Short to medium term forecast sales were derived from industry data of past sales (VFACTS) and growth factors approximated using data from the Australian Bureau of Statistics.

5. The projected increased fitment rates at sale was established for each intervention option (Figure 20 to 22):

Figure 20: Projected fitment rates option 2a

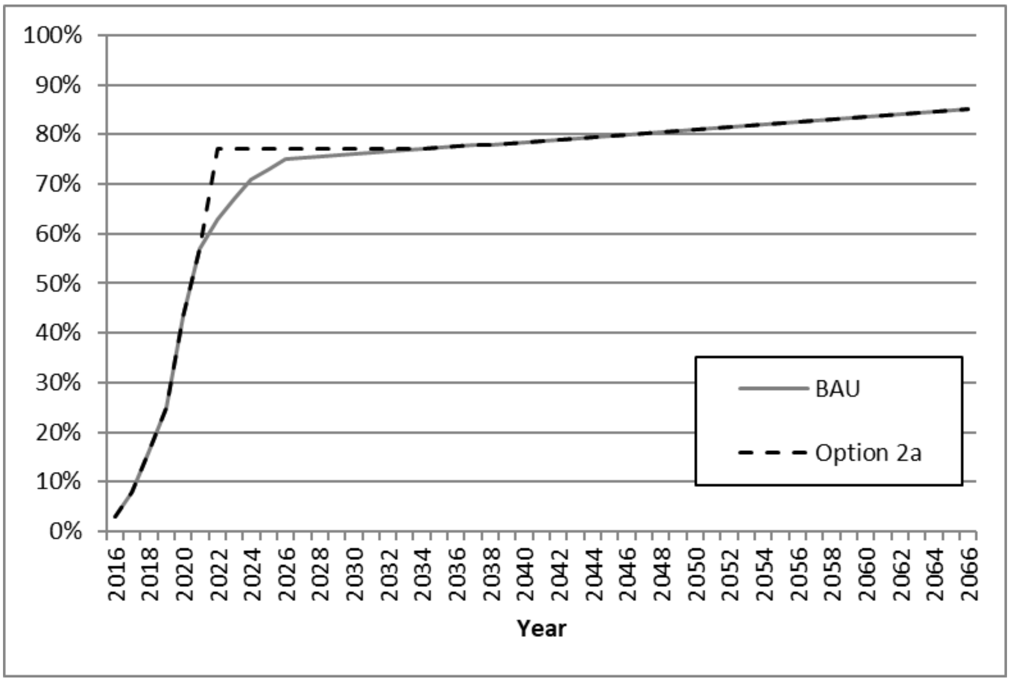


Figure 21: Projected fitment rate option 2b

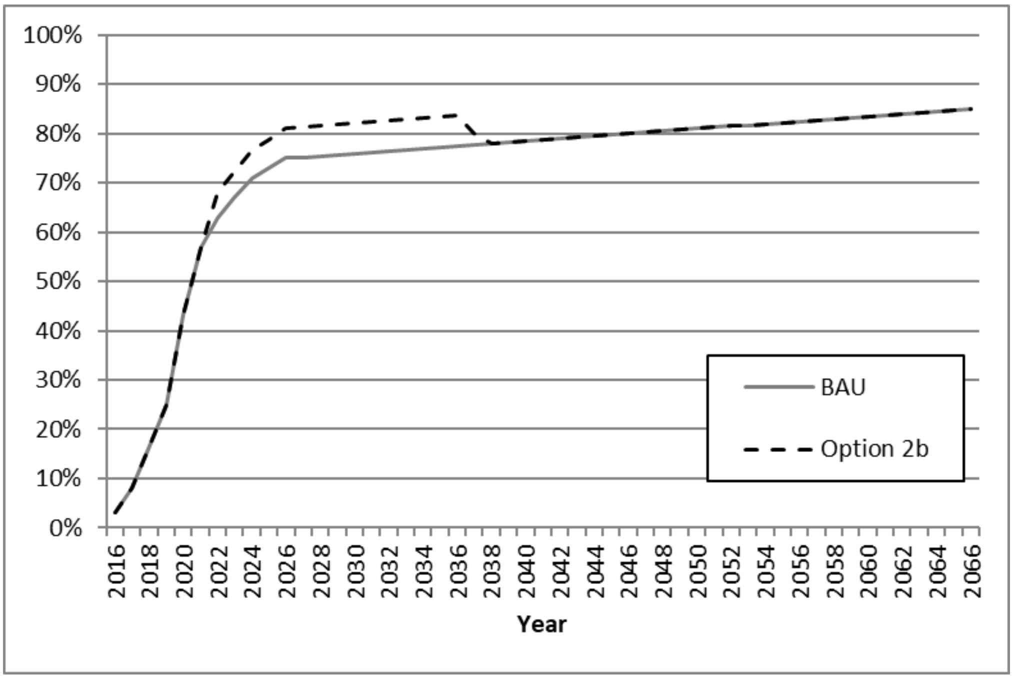
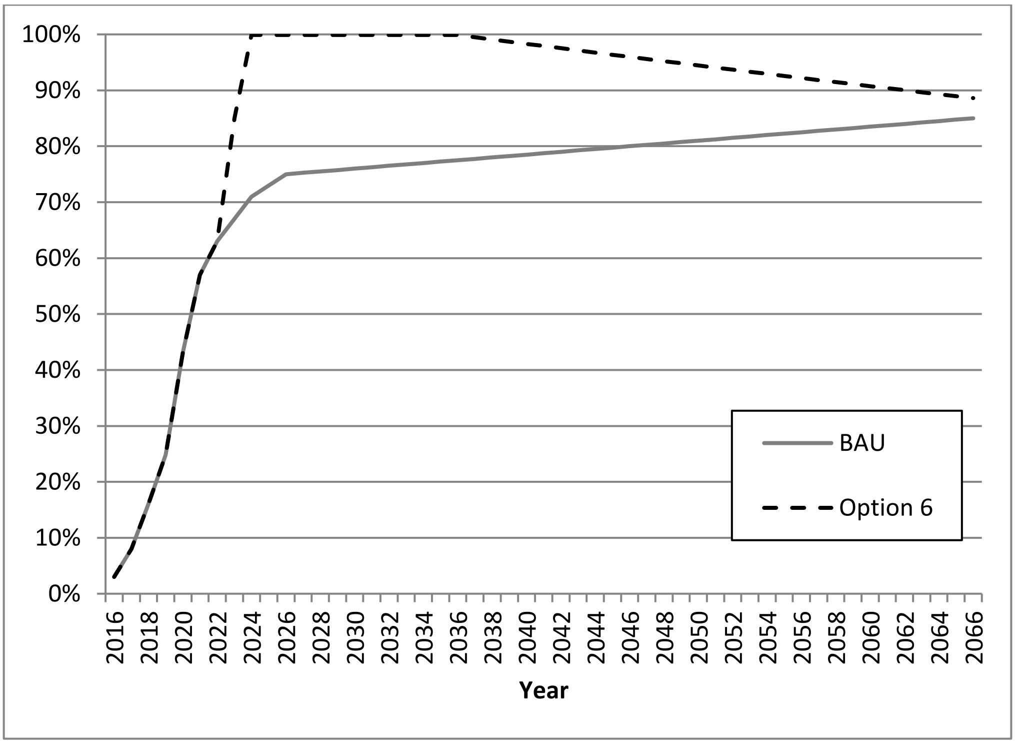


Figure 22: Projected fitment rate option 6



6. From sales data (step 4) and fitment data (step 5), determine the fitment increase by year due to each option (Table 16):

Table 16: Fitment increase via options 2a, 2b and 6

	Fitment Increase at Sale		
Year	**Option 2a**	**Option 2b**	**Option 6**
2022	119,548	64,078	215,188
2023	73,049	69,153	351,853
2024	49,595	72,409	333,529
2025	25,254	75,762	314,412
2026	22,504	77,413	316,983
2027	19,644	79,100	319,541
2028	16,761	80,822	322,087
2029	13,582	82,850	324,617
2030	10,374	84,377	327,132
2031	7,043	86,211	329,630
2032	3,586	88,084	332,109
2033	-	89,997	334,567
2034	744	91,951	337,003
2035	-	93,945	339,416
2036			335,637
2037			331,629
2038			327,386
2039			322,900
2040			318,164
2041			313,171
2042			307,914
2043			302,385
2044			296,575
2045			290,478
2046			284,085
2047			277,386
2048			270,375
2049			263,041
2050			255,376
2051			247,371
2052			239,016
2053			230,301
2054			221,216
2055			211,752
2056			201,897
2057			191,641
2058			180,973
2059			169,883
2060			158,357
2061			146,386
2062			133,956
2063			121,055
2064			107,672
2065			93,792

7. Table 17 shows for each year and each option, the fitment increase at sale due to intervention were used to calculate the additional fitment costs over the intervention policy period (15 years):

Table 17: Additional fitment costs for options 2a, 2b and 6

Year	Additional Fitment Costs ($)		
	Option 2a	Option 2b	Option 6
2022	77,706,703	41,650,793	139,872,066
2023	47,481,904	44,949,536	228,704,504
2024	32,237,047	47,066,089	216,794,143
2025	16,415,104	49,245,313	204,368,051
2026	14,627,500	50,318,599	206,038,780
2027	12,768,553	51,414,708	207,701,802
2028	10,836,246	52,534,119	209,356,266
2029	8,828,506	53,677,317	211,001,294
2030	6,743,213	54,844,798	212,635,981
2031	4,578,192	56,037,070	214,259,387
2032	2,331,215	57,254,650	215,870,544
2033	-	58,498,064	217,468,452
2034	483,559	59,767,852	219,052,078
2035	-	61,064,563	220,620,356

8. From year 1 of intervention (2022), the number of crashes affected by the increased fitment was determined for each year over a 37 year period (2 year implementation plus 35 year analysis), for each viable intervention option (Option 2a, 2b and 6 respectively) as shown in Tables 18 to 21. The crashes affected each year are the product of the likelihood of crash at the vehicles age (from step 3) with the increased fitment at sale (from step 5), summed as they infiltrate the fleet over time.

Year	Vehicle Age																																	Total vehicles
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	..	..	36	37	
1	656																													..	..			656
2	1803	477																												..	..			2280
3	1784	1311	292																											..	..			3387
4	1812	1298	801	198																										..	..			4109
5	1866	1318	793	544	101																									..	..			4622
6	1784	1358	805	538	277	90																								..	..			4852
7	1867	1298	830	547	274	247	78																							..	..			5141
8	1923	1358	793	563	278	244	215	67																						..	..			5442
9	2041	1399	830	539	287	248	213	183	54																					..	..			5794
10	1839	1485	855	564	274	256	217	181	149	41																				..	..			5860
11	1743	1338	907	580	287	244	223	184	147	114	28																			..	..			5796
12	1375	1268	818	616	295	256	213	189	150	113	77	14																		..	..			5384
13	1330	1000	775	555	314	263	223	181	154	114	76	39	0																	..	..			5026
14	1174	968	611	526	283	280	230	189	147	118	78	39	0	3																..	..			4645
15	1109	854	591	415	268	252	244	195	154	113	80	40	0	8	0															..	..			4323
16	1014	807	522	401	211	239	220	207	159	118	76	41	0	8	0	0														..	..			4023
17	900	737	493	354	204	188	208	187	169	121	80	39	0	8	0	0	0													..	..			3689
18	769	655	451	335	180	182	164	177	152	129	82	41	0	8	0	0	0	0												..	..			3325
19	619	559	400	306	170	161	159	139	144	116	87	42	0	8	0	0	0	0	0											..	..			2911
20	484	450	342	272	156	152	140	135	114	110	79	45	0	8	0	0	0	0	0	0										..	..			2485
21	391	352	275	232	138	139	133	119	110	87	75	40	0	9	0	0	0	0	0	0	0									..	..			2099
22	321	284	215	187	118	123	121	113	97	84	59	38	0	9	0	0	0	0	0	0	0	0								..	..			1769
23	228	233	174	146	95	105	108	103	92	74	57	30	0	8	0	0	0	0	0	0	0	0	0							..	..			1453
24	199	166	143	118	74	85	92	91	84	70	50	29	0	8	0	0	0	0	0	0	0	0	0	0						..	..			1209
25	145	145	101	97	60	66	74	78	74	64	48	26	0	6	0	0	0	0	0	0	0	0	0	0	0					..	..			985
26	116	106	89	69	49	54	58	63	64	57	43	24	0	6	0	0	0	0	0	0	0	0	0	0	0	0				..	..			796
27	67	84	65	60	35	44	47	49	51	49	39	22	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0			..	..			617
28	57	49	51	44	31	31	38	40	40	39	33	20	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0		..	..			478
28	46	41	30	35	22	27	27	33	32	31	27	17	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			373
30	36	34	25	20	18	20	24	23	27	25	21	13	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			289
31	21	26	21	17	10	16	17	20	19	20	17	11	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			219
32	0	15	16	14	9	9	14	15	16	14	14	9	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			148
33	0	0	9	11	7	8	8	12	12	13	10	7	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			99
34	0	0	0	6	6	6	7	7	10	9	9	5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			66
35	0	0	0	0	3	5	6	6	6	7	6	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			44
36	0	0	0	0	0	3	4	5	5	4	5	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..	0		30
37	0	0	0	0	0	0	3	4	4	4	3	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..	0	0	20

Year														Vehicle Age																			Total vehicles
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	..	..	36	37	
1	236																													..	..			236
2	649	256																												..	..			905
3	642	703	276																											..	..			1621
4	652	695	759	289																										..	..			2395
5	672	706	751	794	302																									..	..			3226
6	642	728	762	786	831	309																								..	..			4058
7	672	696	785	798	822	849	316																							..	..			4939
8	692	728	751	822	835	840	868	323																						..	..			5859
9	735	750	786	786	860	853	859	887	330																					..	..			6845
10	662	796	809	823	823	879	872	877	906	337																				..	..			7783
11	627	717	859	847	861	841	898	891	896	926	344																			..	..			8707
12	495	679	774	899	886	880	859	918	910	916	946	352																		..	..			9514
13	479	536	733	810	941	906	899	878	938	930	936	966	359																	..	..			10311
14	422	519	579	768	848	962	925	918	897	958	950	956	987	367																..	..			11056
15	399	458	560	606	803	866	983	945	938	916	979	971	977	1009	375															..	..			11785
16	365	433	494	586	634	821	885	1004	966	959	936	1000	992	998	1031	139														..	..			12242
17	324	395	467	517	613	648	839	905	1026	987	980	956	1022	1014	1020	381	0													..	..			12092
18	277	351	427	489	541	627	662	857	924	1048	1009	1001	977	1044	1036	377	0	3												..	..			11648
19	223	300	379	447	511	553	640	676	876	944	1071	1030	1023	998	1067	383	0	9	0											..	..			11129
20	174	241	323	397	467	523	565	654	691	895	965	1094	1053	1045	1020	394	0	9	0	0										..	..			10509
21	141	189	260	339	415	477	534	577	668	706	914	986	1118	1076	1068	377	0	9	0	0	0									..	..			9853
22	115	152	204	273	354	424	488	546	590	683	721	934	1007	1142	1099	395	0	9	0	0	0	0								..	..			9136
23	82	125	164	213	285	362	433	498	557	603	698	737	954	1029	1167	406	0	9	0	0	0	0	0							..	..			8324
24	72	89	135	172	223	291	370	443	509	570	616	713	753	975	1051	431	0	9	0	0	0	0	0	0						..	..			7422
25	52	78	96	141	180	228	298	378	452	520	582	629	728	769	996	389	0	9	0	0	0	0	0	0	0					..	..			6527
26	42	57	84	101	148	184	233	304	386	462	532	595	643	744	786	368	0	10	0	0	0	0	0	0	0	0				..	..			5677
27	24	45	61	88	105	151	188	238	311	395	472	543	607	657	760	290	0	9	0	0	0	0	0	0	0	0	0			..	..			4946
28	20	26	49	64	92	108	154	192	243	318	403	482	555	621	671	281	0	8	0	0	0	0	0	0	0	0	0	0		..	..			4288
28	17	22	28	51	67	94	110	158	196	248	324	412	493	567	634	248	0	7	0	0	0	0	0	0	0	0	0	0	0	..	..			3677
30	13	18	24	30	53	69	96	112	161	201	254	332	421	504	579	234	0	6	0	0	0	0	0	0	0	0	0	0	0	..	..			3106
31	8	14	19	25	31	55	70	98	115	165	205	259	339	430	514	214	0	6	0	0	0	0	0	0	0	0	0	0	0	..	..			2567
32	0	8	15	20	26	32	56	72	100	117	168	210	265	346	439	190	0	5	0	0	0	0	0	0	0	0	0	0	0	..	..			2070
33	0	0	9	16	21	27	32	57	73	102	120	172	214	271	354	162	0	5	0	0	0	0	0	0	0	0	0	0	0	..	..			1635
34	0	0	0	9	17	22	27	33	58	75	105	122	176	219	276	131	0	4	0	0	0	0	0	0	0	0	0	0	0	..	..			1274
35	0	0	0	0	10	17	22	28	34	59	76	107	125	179	223	102	0	4	0	0	0	0	0	0	0	0	0	0	0	..	..			987
36	0	0	0	0	0	10	17	23	28	35	61	78	109	128	183	83	0	3	0	0	0	0	0	0	0	0	0	0	0	..	..	0		758
37	0	0	0	0	0	0	10	18	23	29	35	62	80	112	130	68	0	2	0	0	0	0	0	0	0	0	0	0	0	..	..	0	0	570

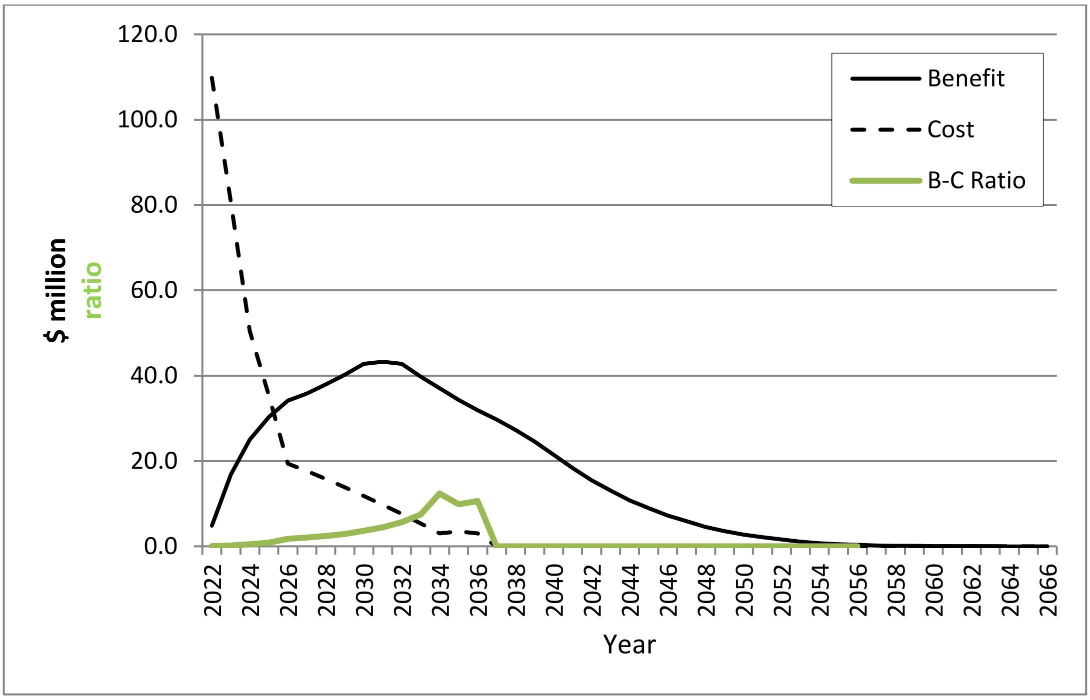
Year	Vehicle Age																																	Total vehicles
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	..	..	36	37	
1	0																													..	..			0
2	0	859																												..	..			859
3	0	2361	1405																											..	..			3765
4	0	2336	3860	1331																										..	..			7527
5	0	2372	3819	3659	1255																									..	..			11105
6	0	2444	3879	3620	3449	1265																								..	..			14657
7	0	2337	3995	3677	3413	3477	1276																							..	..			18174
8	0	2445	3820	3787	3466	3440	3505	1286																						..	..			21750
9	0	2517	3998	3622	3570	3494	3468	3533	1296																					..	..			25499
10	0	2673	4116	3790	3414	3599	3523	3496	3561	1306																				..	..			29478
11	0	2408	4371	3902	3573	3442	3629	3551	3523	3588	1316																			..	..			33302
12	0	2282	3938	4143	3678	3602	3470	3657	3579	3551	3616	1326																		..	..			36840
13	0	1800	3731	3733	3906	3708	3631	3497	3686	3606	3578	3643	1336																	..	..			39855
14	0	1742	2944	3536	3519	3937	3738	3660	3525	3715	3634	3605	3670	1345																..	..			42570
15	0	1537	2848	2790	3334	3548	3969	3768	3689	3552	3743	3661	3631	3697	1355															..	..			45122
16	0	1452	2513	2700	2631	3361	3576	4001	3798	3717	3579	3771	3688	3658	3723	1340														..	..			47508
17	0	1327	2375	2382	2545	2652	3388	3605	4032	3827	3746	3606	3799	3715	3684	3682	1324													..	..			49688
18	0	1178	2170	2251	2245	2566	2673	3415	3633	4064	3856	3774	3633	3827	3742	3643	3638	1307												..	..			51615
19	0	1007	1927	2057	2122	2264	2587	2695	3442	3661	4095	3885	3802	3659	3854	3700	3599	3591	1289											..	..			53235
20	0	810	1646	1827	1939	2140	2282	2607	2716	3469	3689	4125	3914	3829	3685	3811	3656	3553	3542	1270										..	..			54510
21	0	633	1324	1560	1722	1955	2157	2300	2628	2737	3495	3717	4156	3942	3857	3644	3766	3609	3505	3490	1250									..	..			55447
22	0	512	1035	1255	1471	1736	1971	2174	2318	2648	2758	3521	3744	4186	3971	3814	3601	3718	3560	3453	3435	1229								..	..			56110
23	0	420	837	982	1183	1483	1750	1986	2191	2336	2668	2779	3547	3772	4216	3926	3768	3555	3667	3507	3399	3378	1207							..	..			56557
24	0	299	687	793	925	1193	1495	1764	2002	2208	2354	2688	2799	3573	3799	4169	3880	3720	3506	3613	3452	3342	3317	1184						..	..			56762
25	0	261	489	651	748	933	1203	1507	1778	2018	2225	2372	2708	2820	3599	3756	4119	3830	3669	3455	3556	3394	3282	3253	1160					..	..			56784
26	0	190	427	463	614	754	940	1212	1518	1792	2033	2242	2389	2728	2840	3559	3712	4067	3777	3615	3400	3496	3333	3219	3186	1134				..	..			56642
27	0	152	311	405	437	619	760	948	1222	1530	1805	2048	2258	2407	2747	2808	3516	3664	4011	3722	3559	3343	3434	3269	3153	3116	1107			..	..			56351
28	0	88	248	295	382	440	624	766	955	1231	1542	1819	2063	2275	2424	2717	2775	3471	3614	3952	3664	3499	3283	3368	3202	3083	3043	1079		..	..			55902
28	0	74	144	235	278	385	444	629	772	963	1241	1553	1832	2078	2291	2397	2684	2739	3424	3561	3890	3602	3436	3220	3298	3132	3011	2966	1050	..	..			55329
30	0	61	121	137	222	281	388	447	633	778	970	1250	1565	1846	2093	2266	2368	2650	2702	3373	3505	3825	3537	3370	3154	3226	3058	2935	2885	..	..			54664
31	0	47	99	115	129	223	283	391	451	638	784	977	1259	1576	1859	2070	2238	2338	2614	2662	3321	3446	3756	3469	3301	3085	3150	2981	2855	..	..			53906
32	0	28	77	94	108	130	225	285	394	454	643	790	985	1268	1588	1838	2045	2210	2306	2575	2620	3265	3384	3684	3398	3228	3012	3070	2900	..	..			53044
33	0	0	45	73	89	109	131	227	287	397	458	648	796	992	1277	1570	1816	2019	2180	2272	2535	2576	3206	3319	3608	3323	3152	2936	2987	..	..			52070
34	0	0	0	43	69	89	110	132	229	290	400	461	653	802	999	1263	1551	1793	1992	2148	2236	2492	2530	3145	3251	3529	3245	3072	2856	..	..			51010
35	0	0	0	0	41	69	90	111	133	230	292	403	465	658	807	988	1248	1531	1768	1962	2114	2199	2448	2481	3080	3179	3446	3163	2989	..	..			49884
36	0	0	0	0	0	41	70	91	112	134	232	294	406	468	662	798	976	1232	1510	1742	1932	2078	2159	2401	2430	3012	3104	3359	3077	..	..	806		48692
37	0	0	0	0	0	0	41	70	92	113	135	234	296	409	471	655	789	963	1215	1488	1715	1899	2041	2118	2351	2377	2941	3026	3267	..	..	2215	765	47433

9. From the number of crashes affected determined in step 8, determine the trauma alleviated by each viable intervention by year as the product of effectiveness for each trauma type and the technology impact (Table 23):

Year	Option 2a			Option 2b			Option 6		
	Fatal	Major	Minor	Fatal	Major	Minor	Fatal	Major	Minor
2022	0.89	31.24	112.11	0.35	12.40	44.49	0.33	11.77	42.24
2023	1.32	46.40	166.53	0.63	22.21	79.71	1.47	51.58	185.14
2024	1.60	56.29	202.03	0.93	32.82	117.78	2.93	103.11	370.10
2025	1.80	63.32	227.26	1.26	44.19	158.60	4.33	152.13	546.05
2026	1.89	66.48	238.60	1.58	55.60	199.56	5.71	200.79	720.70
2027	2.00	70.43	252.80	1.93	67.66	242.85	7.08	248.98	893.65
2028	2.12	74.55	267.60	2.28	80.27	288.10	8.48	297.97	1,069.52
2029	2.26	79.37	284.89	2.67	93.77	336.58	9.94	349.33	1,253.83
2030	2.28	80.28	288.15	3.03	106.63	382.73	11.49	403.84	1,449.48
2031	2.26	79.40	284.98	3.39	119.29	428.15	12.98	456.23	1,637.53
2032	2.10	73.76	264.73	3.71	130.34	467.82	14.36	504.70	1,811.52
2033	1.96	68.85	247.12	4.02	141.26	507.00	15.53	546.00	1,959.73
2034	1.81	63.63	228.38	4.31	151.47	543.66	16.59	583.19	2,093.23
2035	1.68	59.22	212.55	4.59	161.45	579.51	17.59	618.15	2,218.72
2036	1.57	55.11	197.80	4.77	167.71	601.95	18.52	650.84	2,336.05
2037	1.44	50.54	181.42	4.71	165.66	594.60	19.37	680.72	2,443.28
2038	1.30	45.55	163.49	4.54	159.58	572.76	20.12	707.11	2,538.01
2039	1.13	39.88	143.14	4.34	152.46	547.24	20.75	729.31	2,617.69
2040	0.97	34.05	122.20	4.10	143.98	516.77	21.25	746.78	2,680.39
2041	0.82	28.75	103.19	3.84	134.98	484.49	21.61	759.61	2,726.45
2042	0.69	24.23	86.98	3.56	125.15	449.22	21.87	768.69	2,759.05
2043	0.57	19.91	71.45	3.24	114.03	409.29	22.05	774.82	2,781.04
2044	0.47	16.57	59.46	2.89	101.68	364.96	22.13	777.62	2,791.11
2045	0.38	13.49	48.42	2.54	89.41	320.93	22.13	777.92	2,792.18
2046	0.31	10.91	39.17	2.21	77.78	279.17	22.08	775.97	2,785.19
2047	0.24	8.45	30.33	1.93	67.75	243.18	21.96	772.00	2,770.91
2048	0.19	6.54	23.48	1.67	58.74	210.84	21.79	765.84	2,748.80
2049	0.15	5.10	18.32	1.43	50.37	180.79	21.57	758.00	2,720.66
2050	0.11	3.96	14.23	1.21	42.56	152.75	21.31	748.89	2,687.97
2051	0.09	3.00	10.76	1.00	35.16	126.20	21.01	738.50	2,650.67
2052	0.06	2.03	7.27	0.81	28.36	101.78	20.68	726.69	2,608.31
2053	0.04	1.35	4.85	0.64	22.40	80.39	20.30	713.35	2,560.41
2054	0.03	0.90	3.24	0.50	17.45	62.64	19.88	698.82	2,508.25
2055	0.02	0.61	2.18	0.38	13.52	48.54	19.44	683.39	2,452.89
2056	0.01	0.41	1.48	0.30	10.38	37.26	18.98	667.07	2,394.31
2057	0.01	0.27	0.98	0.22	7.80	28.00	18.49	649.83	2,332.40
2058	0.00	0.17	0.62	0.17	5.85	21.00	17.97	631.67	2,267.25
2059	0.00	0.11	0.38	0.12	4.28	15.36	17.43	612.60	2,198.80
2060	0.00	0.06	0.21	0.09	3.03	10.88	16.86	592.62	2,127.06
2061	0.00	0.03	0.10	0.06	2.07	7.45	16.27	571.70	2,052.00
2062	0.00	0.01	0.03	0.04	1.43	5.13	15.64	549.86	1,973.61
2063	0.00	0.00	0.01	0.03	0.97	3.48	15.00	527.08	1,891.82
2064	0.00	0.00	0.00	0.02	0.58	2.09	14.32	503.32	1,806.55
2065	-	-	-	0.01	0.27	0.98	13.62	478.57	1,717.73

10. From demographic information provided by MUARC (MUARC, 2020) and the totals established in step 9, the typical age of a sensitive fatality was used to determine the cost to society due to loss of life according to the Willingness to Pay (WTP) method. The typical cost of a serious and minor injury was established using methods outlined in BITRE Report 102.
11. Summary plot for each option by year are shown in Figure 23 to Figure 25:

Figure 23: Summary plot option 2a



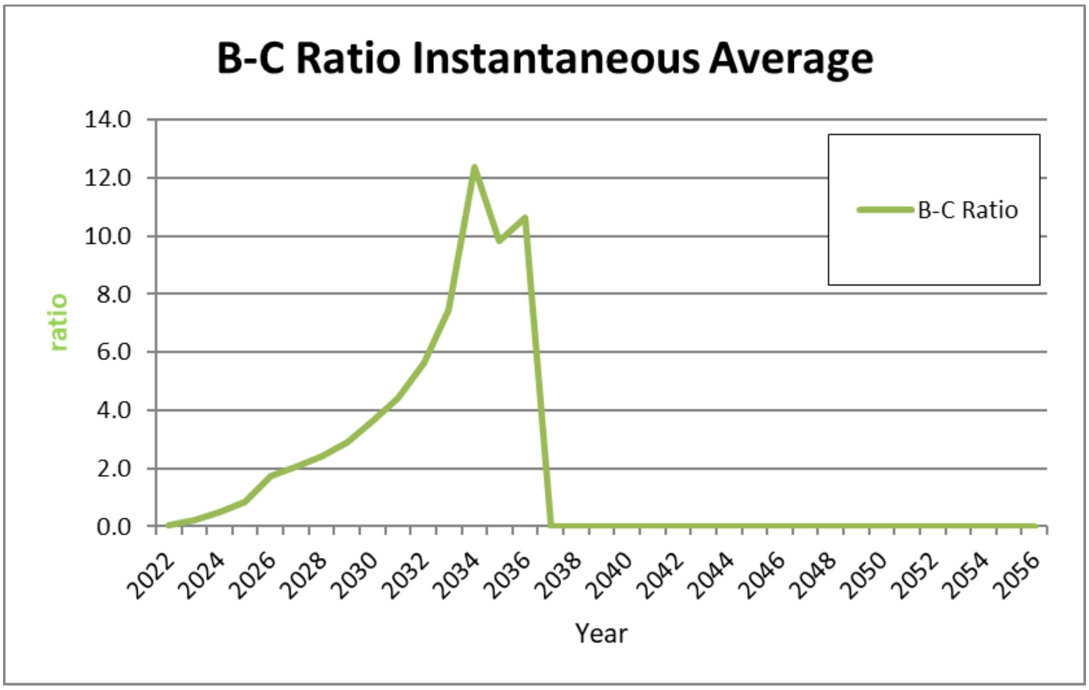
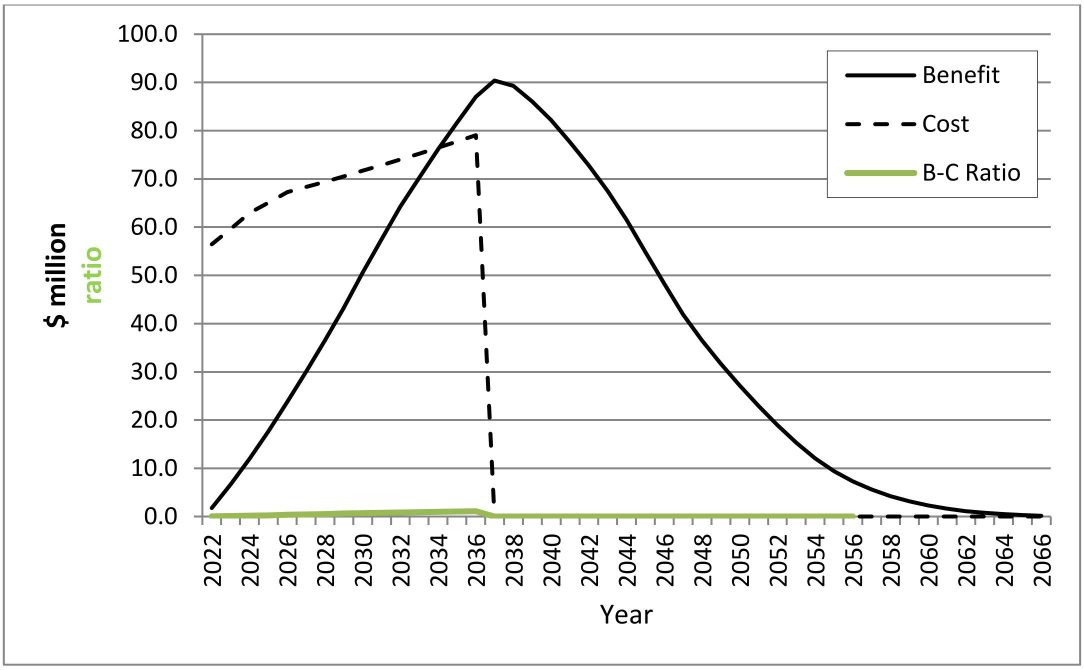


Figure 24: Summary plot option 2b



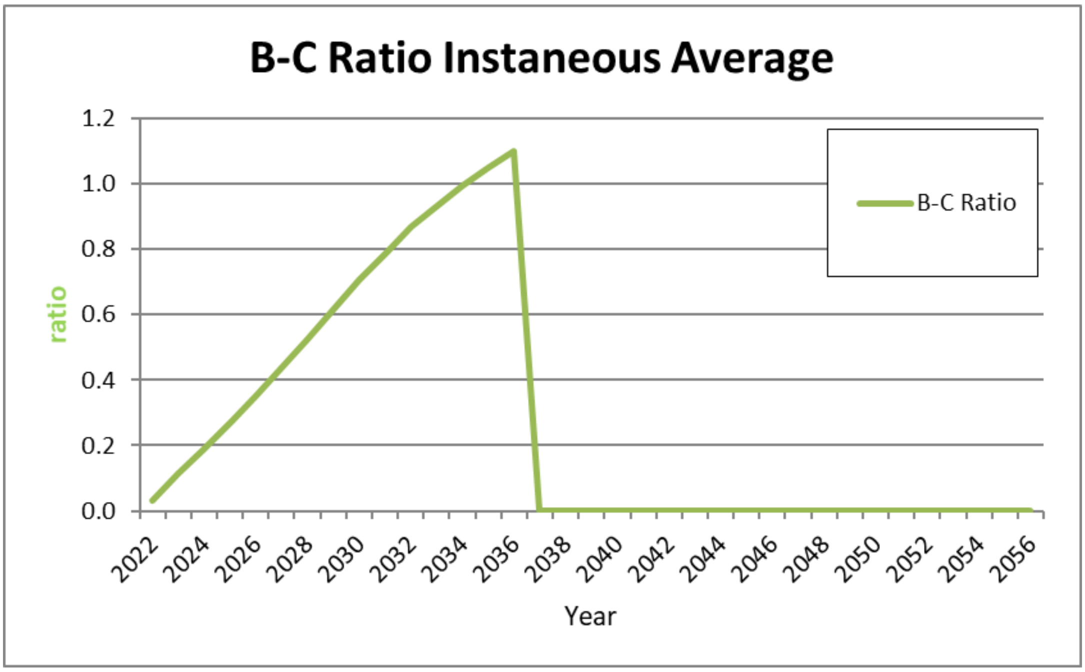
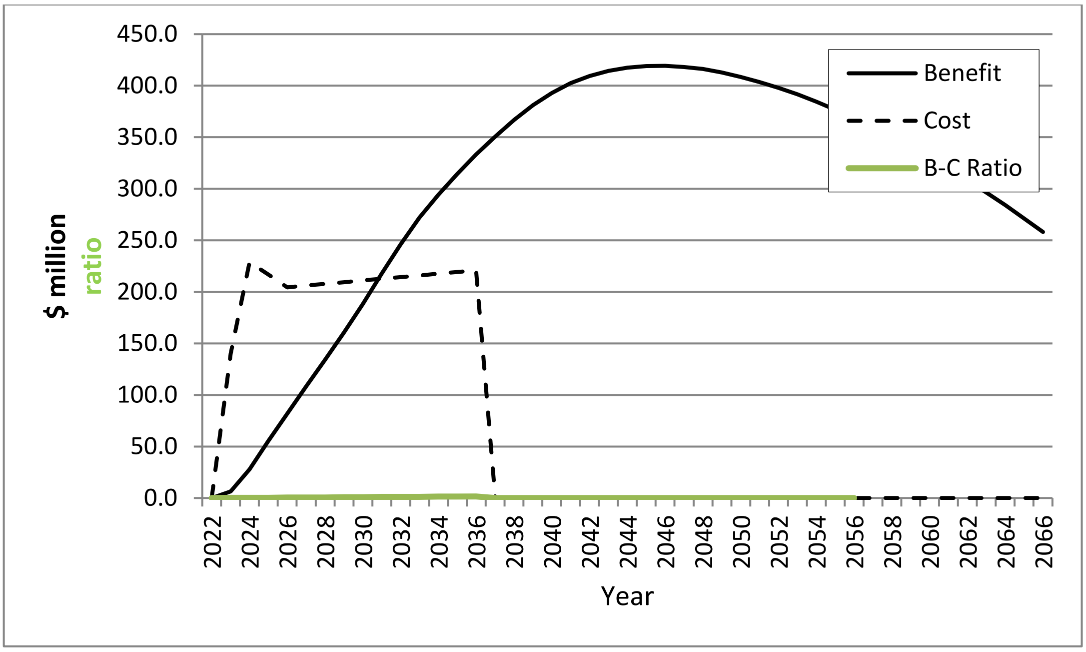
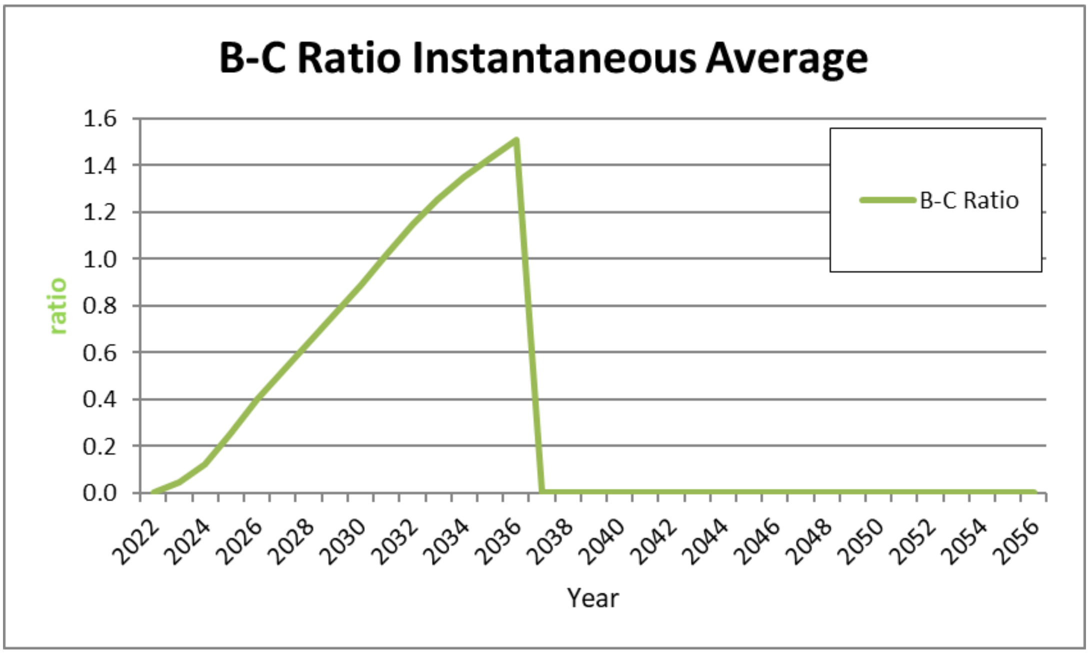


Figure 25: Summary plot option 6





Summary of Benefit Cost Analysis

Case	Net Benefits ($m)	Cost to Business ($m)	Cost to Government ($m)	Gross Benefits ($m)	BCR	Number of Lives saved	Serious Injuries Avoided	Minor Injuries Avoided
				Option 1				
Best	-	-			-			
Likely	-	-			-	-	-	-
Worst	-	-			-			
				Option 2a				
Best	92	214			1.4			
Likely	28	278	27	334	1.1	37	1,294	4,644
Worst	-96	343			0.9			
				Option 2b				
Best	40	350			1.1			
Likely	-65	455	164	554	0.9	86	3,009	10,802
Worst	-170	560			0.8			
				Option 6				
Best	1,477	1,296			2.1			
Likely	1,089	1,592	0.5	2,681	1.7	582	20,524	73,868
Worst	699	2,073			1.3			

Appendix 6 - Acronyms And Abbreviations

ABS	Antilock Brake System
AEB/AEBS	Autonomous (Advanced) Emergency Braking (System)
ADR	Australian Design Rule
ALRTA	Australian Livestock and Rural Transporters Association
ARTSA	Australian Road Transport Suppliers Association
BAU	Business as Usual
BCR	Benefit-Cost Ratio
BIC	Bus Industry Confederation
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BTE	Bureau of Transport Economics (now BITRE)
CCA	Competition and Consumer Act 2010
CEO	Chief Executive Officer
C'th	Commonwealth
CVIAA	Commercial Vehicle Industry Association Australia
EPA	Environment Protection Authority
ESC	Electronic Stability Control
FMVSS	Federal Motor Vehicle Safety Standard
GVM	Gross Vehicle Mass
MUARC	Monash University Accident Research Centre
MVSA	Motor Vehicle Standards Act 1989
NHTSA	National Highway Traffic Safety Administration
NPV	Net Present Value
NRSS	National Road Safety Strategy 2011-2020
NTARC	National Truck Accident Research Centre
NTC	National Transport Commission
OBPR	Office of Best Practice Regulation
PBS	Performance Based Standards
RBM	Regulatory Burden Measurement
RIS	Regulation Impact Statement
RSC	Roll Stability Control
RVSA	Road Vehicles Standards Act 2018
SCA	Side Curtain Airbag
SPECTS	Safety, Productivity & Environment Construction Transport Scheme
SVSEG	Strategic Vehicle Safety and Environment Group
TfNSW	Transport for New South Wales
TIC	Truck Industry Council
TISOC	Transport and Infrastructure Senior Officials' Committee
TLG	Technical Liaison Group
UN	United Nations
US	United States
WP.29	UN World Forum for the Harmonization of Vehicle Regulations

Appendix 7 - Glossary Of Terms

1958 Agreement	UN Agreement Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations, of March 1958.
1998 Agreement	UN Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles, of June 1998.
Autonomous (Automatic) Emergency Braking (AEB)	A combination of a vision-sensing control system and actuators that forms a safety system which is designed in specific conditions to reduce the severity of an accident or avoid a collision altogether by taking control of the vehicle braking from the driver.
Antilock Brake System (ABS)	A portion of a service brake system that automatically controls the degree of rotational wheel slip relative to the road at one or more road wheels of the vehicle during braking.
Benefit-Cost Ratio (BCR)	The ratio of expected total (gross) benefits to expected total costs (in terms of their present monetary value) for a change of policy relative to business as usual.
Bus (or Omnibus)	A passenger vehicle having more than 9 seating positions, including that of the driver.
Certification	Assessment of compliance to the requirements of a regulation/standard. Can relate to parts, sub-assemblies, or a whole vehicle.
Crash	Any apparently unpremeditated event reported to police, or other relevant authority, and resulting in death, injury or property damage attributable to the movement of a road vehicle on a public road.
Discount Rate	A rate of interest used to translate costs which will be incurred and benefits which will be received across future years into present day values.
Fatal Crash	A crash for which there is at least one death.
Gross Vehicle Mass (GVM)	The maximum laden mass of a motor vehicle as specified by the manufacturer.
Light Vehicle	For the purposes of this RIS, any vehicle in a category (or equivalent ADR category) covered by UN Regulation No. 152.
Hospitalised Injury	A person admitted to hospital from a crash occurring in traffic. Traffic excludes off-road and unknown location.
Lane Keep Assist (LKA)	Provides steering input to help keep the vehicle in the middle of a detected lane and provides visual and tactile alerts if the vehicle is detected drifting out of the lane.
Net Benefit	The sum of expected benefits (in monetary terms), less expected costs associated with a change of policy relative to business as usual.
Net Present Value (NPV)	The difference between the present economic value (determined using an appropriate discount rate) of all expected benefits and costs over time due to a change of policy relative to business as usual.
Road Crash Fatality	A person who dies within 30 days of a crash as a result of injuries received in that crash.

Rear-end Crash	Denotes a scenario involving two vehicles, where the second vehicle strikes the rear of the first vehicle.
Type Approval	Written approval of an authority/body that a vehicle type (i.e., model design) satisfies specific technical requirements.

Appendix 8 - Public Comment, Consultation RIS

A summary of the comments received and the Department response are included in the Table 19 below.

Comments submitted in confidence have not been tabled for publication but have been considered in analysing the options.

Table 18: Summary of consultation feedback

Correspondent	Supported Option	Comments	Departmental Response
ACT Government Transport Canberra and City Services	Option 6	1. Highlights that inclusion of AEB as a mandatory safety feature within an ADR is the appropriate policy option to implement. 2. Notes that many manufacturers of light vehicles have already developed AEB systems for many of their light vehicle models, but the feature is often not available as an option on some more cost effective variants within a model range. As these variants of a model are often those selected by people who are more vulnerable and/or have the potential to be involved in more road incidents (such as young people and senior citizens) mandating this safety feature has the potential to have significant impact on the reduction of road trauma. 3. Notes that AEB also provides a potential increase in safety for vulnerable road users such as pedestrians, who are not participants in the consumer choice of vehicle owners but are potentially affected by the outcomes of those choices. 4. Notes that as the ADRs set the minimum safety requirement across the vehicle fleet, implementation at this level ensures the broadest benefit of the technology.	1. Agreed 2. Agreed 3. Agreed 4. Agreed
Audi Australia	Option 1	1. Audi already delivers an AEBS system to Australia, called Front Assist that may not as yet be completely	1. The benefits of adopting an internationally agreed performance standard extends to ensuring

		compliant to UN R152 but still provides a good improvement on safety. 2. Highlights that Australia always benefits fully from the standard safety features that are delivered to other key markets, and as such, and at least for the High Premium vehicles, would normally receive the same systems as EU markets as standard, and hence in this case, the same performance as UN R152. 3. Highlights that since Australia is a rich and developed market especially for Premium vehicles, voluntary adoption of AEB is very high. Notes that regulation to push for higher safety is unnecessary. 4. Recommends that if the decision is to mandate AEB, it would be mutually beneficial to harmonise the implementation dates in line with the EU. 5. Recommends that Australia align with the European staged introduction of Car to Car (C2C), Car to Pedestrian (C2P) followed by Car to Bicycle (C2B) if UN R152 is mandated. 6. Notes that AEBS C2B is a very complex and novel technology, therefore would strongly not recommend earlier adoption of this requirement before the EU, and to support timely introduction of the technology against the cycle plans of the existing old platforms. Encourages Australia Government to delay C2P and especially C2B to 2028 or 2030.	consistent performance across different brands, increased reliability, and consumer trust. 2. The purpose of this RIS is to examine the case for government intervention to reduce trauma related to in lane rear impact collisions with another vehicle or a pedestrian for all light vehicle types. Limiting the fitment of UN R152 compliant AEBS to High Premium vehicles would not yield the full benefits and trauma reductions considered in this RIS. 3. It was noted in this RIS that fitment of AEBS has been increasing steadily in recent years. However, currently AEBS performs differently depending on the manufacturer and not all vehicles fitted with AEBS will meet all occupant/pedestrian injury risk derived performance requirements of UN R152. It is these performance based limits that will deliver the large majority of benefits outlined in this RIS. 4. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. 5. Noted. 6. Noted.
Australian Automobile Association (AAA)	Option 6	1. Urges the Australian Government to ensure the proposed implementation timelines can be met. 2. Urges the Government to continue its participation in updates to the UN Regulation to expand AEBS	1. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister.

		performance requirements, including the incorporation of cyclist detection, and ensure updates are suitable for Australian application and can be implemented in Australia without delay. 3. Supports the Government's efforts to keep in step with the development of new international vehicle standards and their implementation in Australia. 4. Notes that non-regulatory options would not establish uniform minimum performance of AEB systems and highlights that the performance testing conducted by ANCAP as part of its rating system illustrates the variation in performance levels and capabilities of current AEB systems offered between vehicle makes and models. 5. Supports the view expressed in the RIS that regulation is necessary to standardize minimum AEB performance requirements and driver interfaces. 6. Notes that the RIS does not identify costs to car owners or consumers associated with Option 6. The AAA is of the view that the cost of regulation will ultimately be borne by the consumer. The RIS acknowledges this, however does not include a direct cost to consumers for option 6. The AAA suggests a direct cost to the consumer be included. 7. Recommends that the Government incorporate consumer education of AEB systems to ensure understanding among consumers. 8. Recommends that the Government consider the Australian application of technologies and design features identified for regulation in Europe as soon as possible, with a view to ensure new regulatory standards can be adopted in Australia.	2. Noted. 3. Noted. 4. Agreed. ANCAP published test results in November 2020 obtained through vehicle comparisons. They show a great difference in effectiveness of AEB systems across models. 5. Agreed. While voluntary regimes can have a positive effect, they represent a sub-optimal way of improving the safety of the entire new vehicle fleet. 6. Noted. While new safety technologies can be expensive, progressive fitment and increased production lowers the price of the feature over time. Therefore, while there may be some initial increases in pricing on specific models, this will usually be absorbed into the price of the vehicle during its production life. 7. The Department will work with state and territory governments, road safety advocates and organisations, such as ANCAP to expand its advocacy and community education activities on AEBS. As part of its community education and advocacy role, ANCAP has conducted a number of community engagement activities to promote and explain the availability, function, benefits

			and limitations of ADAS currently available on new vehicles. 8. Noted. In February 2021 the Department consulted on a paper on proposed ADR development priorities for the National Road Safety Action Plan 2021-2025, for consideration by the SVSEG.
Australasian New Car Assessment Program (ANCAP)	Option 6	1. Supports the proposal to mandate AEB on all MA, MB, MC, NA1 and NA2 category vehicles by introducing UN R152 as an ADR in the same timeframe as the EU: • 1 July 2022 for new model vehicles • 1 July 2024 for all new vehicles 2. Highlights that the uptake of new vehicle safety technology, such as AEBS will play a significant role in reducing crashes and resultant injuries in cities and urban areas. 3. Notes that there is not universal fitting of AEB across all new light vehicles. 4. Notes that to reach a 100 per cent fitting rate, an ADR requiring the compulsory fitting of AEB is required. 5. Notes that the EU plan to expand the AEB regulatory requirement for enhanced capability of detecting pedestrians and cyclists. 6. Encourages the Australian Government's participation in updating UN R152 to cater for additional AEB test scenarios, and subsequent adoption of an updated UN R152.	1. Noted. 2. Agreed. 3. Agreed. 4. Agreed. 5. Agreed. 6. Noted.
BMW Australia Ltd	Option 1	1. Urges the Government to consider the two-step approach for introducing AEBS C2C, C2P and C2B as suggested in the European General Safety Regulation (GSR). • Proposes adopting the EU GSR timeline as follows:	1. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further

		a) C2C i. July 2022 for new models ii. July 2024 for all models b) C2P/C2B i. July 2024 for new models ii. July 2026 for all models 2. Requests an exemption for small scale series vehicles (e.g. less than 2500 cars of a vehicle type sold per year in Australia)	consultation by the Department with industry and decision by the Minister. 2. Noted. Exemptions will be clearly set out in the ADR, as consulted on separately with stakeholders to implement the recommended option.
Caravan Industry Association of Australia	Option 6	1. Strongly encourages the Department to consider the future regulation of light motor vehicle systems and how they are designed and programmed to adapt certain systems when towing a trailer. 2. Since the majority of light trailer brake controllers take a trigger signal from the tow-vehicle brake light circuit, industry needs to be informed of the optional flashing brake light provisions in ADR13/00 Appendix A section 6.23 that may be used in AEB. This flashing function may impact the effectiveness of the light trailer brakes in an emergency situation.	1. Noted. The Department will continue to engage with the light vehicle industry groups regarding any need for additional technical guidance on AEBS for trailer manufacturers and operators. 2. Noted. Also see 1 above.
Department of Transport and Main Roads (TMR) QLD	Option 6	1. Supports the applicable vehicle categories and the mandate based on UN R152 as outlined in this RIS. 2. Suggests alternative implementation timing noting that fitment rates are already high and to not impose unrealistic burden on vehicle manufacturers: • 1 July 2022 for new model vehicles • 1 July 2023 for all new vehicles	1. Noted. 2. Noted. Implementation timing will be determined as part of the ADR, taking into account all stakeholder feedback.

Federal Chamber of Automotive Industries (FCAI)	Option 1	1. Welcomes the Commonwealth's decision to examine the case for regulating the introduction of AEB to the Australian market. 2. Highlights that the Australian automotive industry is committed to continuing to make a strong contribution to national efforts to improve road safety and reduce road trauma. 3. Notes that if the Government chooses to mandate the provision of any specific technology to the Australian market by regulation, then Australia should harmonise safety standards with leading international markets. 4. Recommends the implementation timing must allow suppliers appropriate and sufficient lead times. It is essential for uninterrupted supply of vehicles to this market that introduction is not in advance of schedules adopted in markets overseas. 5. Highlights that given that the anticipated safety benefits of adopting UN R152 for light duty vehicles are already being achieved by FCAI members' voluntary adoption of AEB technologies. Believes that Option 1, No Intervention is the most effective and appropriate response.	1. Noted. 2. Noted. 3. Agreed. The benefits of adopting an internationally agreed performance standard extends to ensuring consistent performance across different brands, increased reliability, and consumer trust. 4. Noted. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. 5. While it is acknowledged that FCAI members have voluntarily adopted AEB technologies there is not universal fitting of AEBS across all new light vehicles. Regulation will play an important role in closing the gap to a 100 per cent fitting rate across the market. Business as usual fitment rates and AEB effectiveness values have been fully factored into the analysis. As such, this RIS has accounted for the contribution of FCAI members in reducing road trauma, as well as other factors (i.e. advertising campaigns, ANCAP) in the uptake of AEBS. Regarding voluntary adoption of AEBS, detecting a reduction in performance of AEBS would be

			difficult to detect. This would usually only be detected through failures in the field or by expert third party reporting and the consequences could be very serious in terms of an increased number of injuries or deaths from road crashes relative to a mandated standard. Furthermore, once detected, further breaches would be difficult to control either by manufacturers' associations or by the Government. Even mandating standards at the time breaches were detected would not address reduced performance in vehicles that had already entered service. Finally, the Government has existing legislation, expertise, resources and well-established systems to administer a mandatory standard.
Government of South Australia Department of Infrastructure and Transport - Road and Marine Services	Option 6	1. Welcomes the Australian Government's decision to examine the case for regulating the introduction of AEB to the Australian market. 2. Recommends the Department consult with the aftermarket industry on the recommended option to mandate UN R152.	1. Noted. 2. Noted. The Department will continue to engage with the vehicle industry groups regarding any need for additional technical guidance on AEBS for aftermarket manufacturers. The Department will engage with jurisdictions to work towards a national approach to aftermarket modifications.
Honda Australia	Option 1	1. Welcomes this initiative with a minor concern on timing alignment with other markets. 2. Highlights that Australian consumers will directly benefit if the timing is aligned with Europe as it mitigates excessive cost impacts caused by development for a single, low volume market.	1. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. 2. Agreed. Also see 1 above.

		3. Recommends that if AEB is to be mandated, it should be by way of a staged introduction of UN R152/00 and with dates no earlier than European introduction.	3. Agreed. Also see 1 above.
Isuzu Ute Australia PTY Ltd	Option 1	1. Recommends there is no earlier enforcement date than in other countries, especially the EU. 2. Requests that timing of enforcement aligned with UN R 152 series 00 to 02 in each step (as step by step). 3. Notes that they do not support an earlier enforcement request in advance of the EU or the establishment of regulation that does not separate C2C and C2B. 4. Notes that the enforcement of a regulation without separating C2C and C2B will create a unique Australian regulation, and it will be a unique specification not aligned with other countries.	1. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. 2. Noted. Also see 1 above. 3. Noted. Also see 1 above. 4. Agreed.
Lotus Cars Ltd	Option 6	1. Supports the clarity that mandatory standards provide, in this instance those based upon the UN R152. 2. Requests exemptions from this standard being mandatory across all vehicles in M1 classification. Proposes: • Specialist and Enthusiast Vehicles be exempt • Vehicles manufactured in limited volumes be excluded. Suggests the EU Small Series limited to registrations (imports) of 1,500 units per type per year.	1. Agreed. 2. Noted. Exemptions are clearly set out in the ADR, as consulted on separately with stakeholders to implement the recommended option.
Confidential	Option 1	1. Notes that in the event that the Australian Government decides Option 6 is warranted, they support FCAI's position that harmonisation with UN R152 is appropriate and recommend that this be achieved by applying the 00 series of the regulation. 2. Requests consideration of the following points:	1. Agreed. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. 2. Department response to each point:

		• No regulatory intervention is necessary, AEB is already widely available, with a high fitment rate on an increasing trajectory. • Should Government decide to regulate, the regulation should be harmonised with UN R152/00, with the ability to demonstrate compliance with future updates to this regulation at the manufacturer's discretion. • Preferably the implementation period to be: a) C2C i. New models 2.5yrs after ADR publication. (and not before July 2022) ii. All Models: 6.5yrs after ADR publication. (and not before July 2026) Aligning with the all models date for C2P b) C2P i. New models 4.5yrs after ADR publication. (and not before July 2024) ii. All Models: 6.5yrs after ADR publication. (and not before July 2026)	• It was noted in this RIS that fitment of AEBS has been increasing steadily in recent years. However, currently AEBS performs differently depending on the manufacturer and not all vehicles fitted with AEBS will meet all occupant/pedestrian injury risk derived performance requirements of UN R152. It is these performance based limits that will deliver the large majority of benefits outlined in this RIS. • Noted. The benefits of adopting an internationally agreed performance standard extends to ensuring consistent performance across different brands, increased reliability, and consumer trust. • Noted. Also see 1 above.
Road Safety Commission (RSC), WA Main Roads, WA Department of Transport, WA	Option 6	1. Strongly believes in the ADR development program and happy to provide support. 2. Highlights their *Driving Change* Road Safety Strategy 2020-2030 (the WA Strategy) calls for acceleration of the rate at which new vehicles with advanced safety features such as advanced collision avoidance technologies enter the market. 3. Notes that Option 6 in this RIS is most consistent with the direction set under the WA Strategy in the priority area of Safe Vehicles. 4. Supports the implementation of Option 3 immediately until AEBS is mandated for light vehicles.	1. Noted. 2. Noted. 3. Noted. 4. Noted.

		5. Notes that there are some challenges to AEB operation in some vehicles mainly because of the technology being new to market. 6. Supports the development and adoption of an internationally agreed performance standard for AEBS and therefore minimize false or unnecessary alerts or reactions (and therefore manual deactivation by drivers).	5. Noted. AEBS as a technology was introduced globally by Volvo in 2008 and to Australia in 2009. Therefore the technology has had the time to mature and be developed further. However, an AEB system meeting UN R152 performance will require the Department to engage with the light vehicle industry groups regarding any challenges faced on AEBS operation and fitment. 6. Agreed. The benefits of adopting an internationally agreed performance standard extends to ensuring consistent performance across different brands, increased reliability, and consumer trust.
Toyota Motor Corporation Australia (TMCA)	Option 1	1. Highlights that for any new regulation, implementation timing should not be less than two years for new models and four years for all new vehicles from the date of final regulation issuance. This enables adequate timing for the design, development and production readiness preparation that is required to implement new vehicle designs. 2. Notes that to ensure consistency, mandatory regulation implementation timing should not be earlier than that of leading overseas markets such as Europe and Japan given that Australia is no longer a manufacturer of vehicles. 3. Toyota believes that the below timing should be considered as more reasonable: a) C2C (assuming final regulation date of 1 January 2021) i. 1 January 2023 for new models ii. 1 January 2025 for all new vehicles	1. Noted. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. 2. Agreed. Also see 1 above. 3. Noted. Also see 1 above.

		b) C2P (as per EU timing) i. 7 July 2024 for new models ii. 7 July 2025 all new vehicles	
Transport for NSW	Option 6	1. Notes Option 6 approach is the most effective way to achieve widespread fitment and the resulting safety benefits. 2. Does not support alternative options considered, options 2a and 2b, which would only seek to provide targeted awareness or advertising campaigns to consumers and operators about the benefits of AEB. Such consumer information in advertising is already being implemented and will continue to do so through programs such as ANCAP, manufacturer advertising and state transport agencies educational collateral. The lesser returns in road trauma reduction, gross benefits and overall BCR from such non-regulatory approaches are highlighted in the DITRDC's RIS under each respective option and as such should not be considered further. 3. Identifies that there is a risk, as highlighted by the RIS that different AEB systems from various manufacturers react differently in potential crash situations and operating interfaces tend to vary.	1. Agreed. 2. Agreed. This RIS identified that fitment of AEBS has been increasing steadily in recent years. However, not all AEBS are equal and not all vehicles fitted with AEBS will meet all occupant/pedestrian injury risk derived performance requirements of UN R152. It is these performance based limits that will deliver the large majority of benefits outlined in this RIS. 3. Agreed. The benefits of adopting an internationally agreed performance standard extends to ensuring consistent performance across different brands, increased reliability, and consumer trust.
Confidential	Option 6	1. Supports the proposed implementation timing of 1 July 2022 for new model vehicles and 1 July 2024 for all new vehicles. 2. Supports the harmonisation of the requirements of the ADR for AEB with UN R152. 3. Advocates that the Department closely monitor updates to UN R152 and implement any changes as soon as possible.	1. Noted. 2. Noted. 3. Agreed.

		4. Advocates that the Department continue to work with World Forum for Harmonization of Vehicle Regulations (WP.29) on the development of standards for life-saving vehicle technology and adopt them as ADRs as soon as possible.	4. Agreed. The Department's work program and priorities are consistent with the latest development of international standards through the UN World Forum for the Harmonization of Vehicle Regulations. Australia can contribute through participation in the UN World Forum and its subsidiary Working Parties to the development of UN vehicle regulations.
Volkswagen Group Australia (VGA)	Option 1	1. Highlights that they already deliver an AEBS system to Australia, called Front Assist, that may not as yet be completely compliant to UN R152 but still provides a good improvement on safety. 2. Highlights that Australia always benefits fully from the standard safety features that are delivered to other key markets, and as such, and at least for the High Premium vehicles, would normally receive the same systems as EU markets as standard, and hence in this case, the same performance as UN R152. 3. Highlights that since Australia is a rich and developed market especially for Premium vehicles, voluntary adoption of AEB is very high. Notes that regulation to push for higher safety is unnecessary. 4. Recommends that if the decision is to mandate AEB, it would be mutually beneficial to harmonise the effectivity dates in line with the EU. 5. Recommends that Australia align with the European staged introduction of C2C, C2P followed by C2B if UN R152 is mandated. 6. Notes that AEBS C2B is a very complex and novel technology, therefore would strongly not recommend earlier adoption of this requirement before the EU, and to support timely introduction of the technology against	1. The benefits of adopting an internationally agreed performance standard extends to ensuring consistent performance across different brands, increased reliability, and consumer trust. 2. The purpose of this RIS is to examine the case for government intervention to reduce trauma related to in lane rear impact collisions with another vehicle or a pedestrian for all light vehicle types. Limiting the fitment of UN R152 compliant AEBS to High Premium vehicles would not yield the full benefits and trauma reductions considered in this RIS. 3. It was noted in this RIS that fitment of AEBS has been increasing steadily in recent years. However, currently AEBS performs differently depending on the manufacturer and not all vehicles fitted with AEBS will meet all occupant/pedestrian injury risk derived performance requirements of UN R152. It is these performance based limits that will deliver the large majority of benefits outlined in this RIS. 4. As outlined in this RIS, an ADR would be fully harmonised with the 00 series of UN R152 and

		the cycle plans of the existing old platforms. Encourages Australia Government to delay C2P and especially C2B to 2028 or 2030.	in step with the introduction of the regulation in Europe. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. 5. Noted. 6. Noted.
Volvo Car Australia	Option 6	1. Fully supports Option 6 for mandatory light vehicle AEB systems utilising UN R152 as the international standard. 2. Highlights that their AEB systems are manufactured in accordance with all the technical requirements under UN R152. 3. Highlights that based on their extensive expertise in developing accident-avoidance systems, there is no question that AEB is one of the most significant advances in car safety in the last 15 years. 4. Notes that the implementation timing of the recommended Option 6 may prove to be challenging for some manufacturers. 5. Highlights that most manufacturers operate on a five year lead time for new product development which means cars scheduled for launch in the Australian market in mid-2022 are already designed and specified.	1. Noted. 2. Noted. 3. Agreed. 4. Noted. 5. Noted.