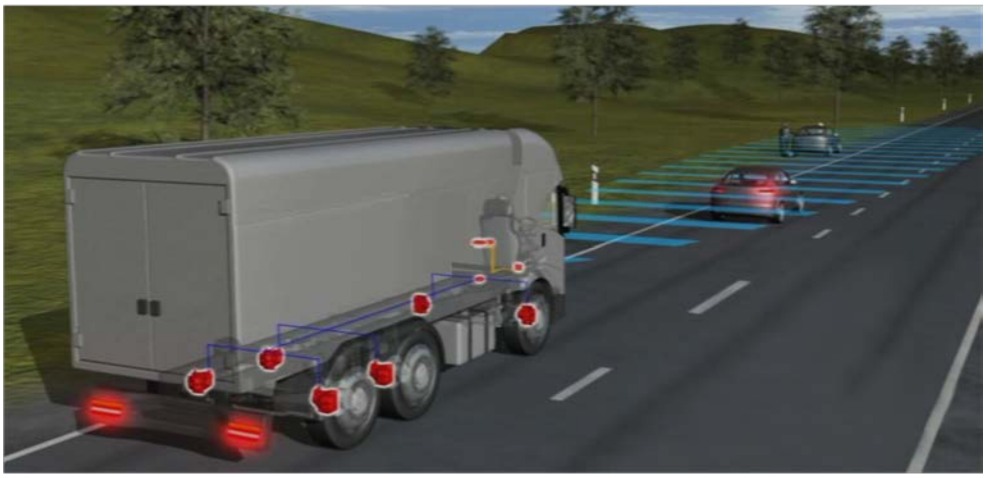
Australian Government

Department of Infrastructure, Transport, Regional Development and Communications

Regulation Impact Statement

Autonomous Emergency Braking for Reducing Heavy Vehicle Rear Impact Crashes[1]



July 2020

[1] Includes consideration of expanding the adoption of Electronic Stability Control systems, as recommended by *Regulation Impact Statement: National Heavy Vehicle Braking Strategy Phase II* (Australian Government, 2018).

Report Documentation Page

Report No.	Report Date	File No.	OBPR Reference No.
INFRA/VSS02/2019	July 2020	19/684	25313

Title and Subtitle

Regulation Impact Statement
Autonomous Emergency Braking for Reducing Heavy Vehicle Rear Impact Crashes

Organisation Performing Analysis

Standards Development and International
Vehicle Safety Standards Branch
Department of Infrastructure, Transport, Regional Development and Communications

Regulatory Agency

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Key Words	Distribution Statement
Australian Design Rule, ADR, Autonomous Emergency Braking, Advanced Emergency Braking, AEB, AEBS, Electronic Stability Control, ESC, Heavy Vehicle, Braking	This document was available online for the duration of public consultation at: https://www.infrastructure.gov.au/vehicles/design/adr_comment.aspx

Security Classification	No. Pages	Price
Official	112	No charge

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EXECUTIVE SUMMARY

Road crash trauma involving heavy vehicles

The impact of road crashes on individuals as well as society as a whole is significant, costing the Australian economy over $27 billion per annum (BITRE, 2014). Heavy vehicle crashes constitute around $1.5 billion of this, including around $200 million from crashes involving a heavy vehicle impacting the rear of another vehicle. This is the specific road safety problem that has been considered in this Regulation Impact Statement (RIS).

Heavy vehicles represent 3 per cent of all registered vehicles in Australia (ABS, 2018a) and account for just over 8 per cent of total vehicle kilometres travelled on public roads (ABS, 2018b). However, they are involved in 17 per cent of all fatal crashes. Over the last three years (2017-2019), an average of 199 people were killed annually in 180 fatal crashes involving heavy trucks or buses (BITRE, 2019a). The most recent available data (2016-2017) shows that 1,832 people were hospitalised from road crashes involving heavy vehicles (BITRE, 2019b). Heavy vehicle crashes continue to draw increasing attention from policy makers, road safety advocates, the general-public and the heavy vehicle industry itself.

Distraction, fatigue, driver inexperience and error can be causal factors in heavy vehicle crashes. Actions to reduce the extent of these factors have generally focused on heavy vehicle drivers and fleet managers. However, in fatal multi-vehicle crashes involving a heavy vehicle, another vehicle is at fault in up to 83 per cent of incidents (NTARC, 2019). Nonetheless, heavy vehicles have physical characteristics that increase the risk and severity of crashes, including a high gross mass, elevated centre of gravity, long vehicle length, reduced ability to manoeuvre, and relatively longer stopping distances. Heavy vehicles have a reduced risk of being impacted at the rear, given that they decelerate more gradually than other vehicles. For the same reason, they have an increased risk of impacting a vehicle in front of them.

Autonomous Emergency Braking (AEB)

When rear-end collisions occur between an impacting heavy vehicle and a light vehicle, vehicle underrun can occur, increasing the severity of the outcome. This has been mitigated as much as possible by the introduction of Australian Design Rule (ADR) 84 - Front Underrun Impact Protection in 2009. Front underrun protection systems reduce the severity of trauma when a collision occurs, but cannot reduce the frequency of those collisions. Though actions targeting driver and fleet managers can help reduce the frequency of heavy vehicle at-fault crashes, technology such as AEB can also help in the event of an otherwise imminent collision.

The internationally agreed standard for heavy vehicle AEB systems is the United Nations (UN) Regulation No.131. The regulation sets requirements for detecting vehicles in a heavy vehicle's forward impact zone. UN regulations are revised on an ongoing basis and so in time it may be possible to expand the requirements to specifically detect road users such as pedestrians and cyclists. Its scope covers all heavy goods vehicles greater than 3.5 tonnes Gross Vehicle Mass (GVM) and all omnibuses.

Australian research has found that AEB systems meeting the requirements of UN Regulation No. 131 could alleviate or reduce the severity of almost 15 per cent of all Australian heavy vehicle crashes, predominantly those involving a heavy vehicle impacting the rear of another vehicle (MUARC, 2020). Moreover, it was found that in such collisions, heavy vehicle AEB reduces all forms of trauma by up to 57 per cent. However, only six per cent of new Australian heavy vehicles are sold fitted with AEB systems that would comply with UN Regulation No. 131. Most of these are in the heavy duty prime mover segment where 23 per cent of new Australian prime movers are fitted with AEB.

Mandatory fitment of AEB to commercial heavy vehicles according to UN Regulation No. 131 has been implemented across the European market since November 2013, followed by mandates in Japan and Korea. By November 2018, the European mandate had taken full effect for all new vehicles covered by UN Regulation No. 131 (with exemptions including urban buses and off-road or agricultural vehicles). Though now well established, the European mandate has not strongly influenced Australian market fitment rates, in part due to the bespoke configurations preferred by Australian operators. However, the mandate has reduced and mitigated heavy vehicle rear impact crashes in Europe, providing useful European data on the effectiveness of the technology that has been used to support the Australian research.

Within Australia, consideration of the fitment of AEB has had to wait for the other supporting technologies of Anti-lock Brake Systems (ABS) and Electronic Stability Control (ESC) to be mandated. This has been necessary to guarantee the stability of a heavy vehicle or heavy vehicle combination under the severe conditions of automatically generated braking by AEB systems. The first considerations of mandating ABS were unsuccessful before and throughout the early 2000s, due to cost and to reliability concerns by some parts of the heavy trailer industry. This situation continued through to 2014, when some ABS and the underlying electrical power and wiring requirements for advanced braking systems were mandated, in preparation for the next steps of fully implementing ABS/ESC/AEB systems.

Following the mandating of ESC for heavy vehicles under the National Road Safety Strategy 2011-2020 (NRSS) and associated National Road Safety Action Plan 2015-2017, consideration of options to increase fitment of AEB systems to Australian heavy vehicles is now a priority action under the current National Road Safety Action Plan 2018-2020 (NRSAP). As retro-fitting sophisticated technology such as AEB would generally be high cost and disruptive for current vehicle owners, the action has focused on new vehicles only.

This RIS considers six options to increase the fitment of AEB systems in the Australian heavy 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 *Motor Vehicle Standards Act 1989* (C'th) (MVSA) and then *Road Vehicle Standards Act 2018* (C'th)[1] (RVSA). Option 2 was separated into two sub-options: 2a (targeted awareness) and 2b (advertising). Option 6 was separated into two sub-options: 6a (broad scope) and 6b (narrow scope). Of these, Option 1, Option 2a, 2b, Option 6a and 6b 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 below.

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

	Gross benefits ($m)	**Net benefits ($m)**		
	Likely case	Best case	Likely case	Worst case
Option 1: no intervention	-	-	-	-
Option 2a: targeted awareness	68	-9	-34	-58
Option 2b: advertising	39	-151	-164	-177
Option 6a: regulation (broad scope)	269	123	52	-19
Option 6b: regulation (narrow scope)	235	108	47	-15

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

	Costs ($m)			**Benefit-cost ratios**		
	Best case	Likely case	Worst case	Best case	Likely case	Worst case
Option 1: no intervention	-	-	-	-	-	-
Option 2a: targeted awareness	77	101	126	0.9	0.7	0.5
Option 2b: advertising	190	203	216	0.2	0.2	0.2
Option 6a: regulation (broad scope)	146	217	250	1.8	1.2	0.9
Option 6b: regulation (narrow scope)	127	188	250	1.9	1.2	0.9

[1] Set to replace the MVSA.

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

	Lives saved	Serious injuries avoided	Minor injuries avoided
Option 1: no intervention	-	-	-
Option 2a: targeted awareness	12	339	1056
Option 2b: advertising	9	248	773
Option 6a: regulation (broad scope)	78	2152	6697
Option 6b: regulation (narrow scope)	69	1891	5883

Option 6a: regulation (broad scope) generated the highest number of lives saved (78) and serious (2,152) and minor (6,697) injuries avoided, as well as the highest likely net benefit ($52 million), while retaining a likely benefit-cost ratio (1.2) matching that of Option 6b.

Electronic Stability Control (ESC)

When braking a heavy vehicle in emergency situations, whether initiated by a driver or an AEB system, maintaining stability is critical. The role of the existing technologies of heavy vehicle ESC and trailer Rollover Stability Control (RSC) is even more critical when hard braking is accompanied by swerving (common in rear-end collisions as the driver tries to avoid the vehicle in front), when there is any road curvature, and/or when there is reduced wheel traction. For this reason, vehicles fitted with AEB are typically also fitted with ESC/RSC, often as a necessary sub-component.

ESC for heavy vehicles became mandatory from 1 July 2019 for new model heavy trailers (1 November 2019 for all new heavy trailers) and will become mandatory from 1 November 2020 for new model heavy trucks and heavy buses (1 January 2022 for all new heavy trucks and heavy buses). The mandate targeted the types of vehicles that could realise the highest benefits in terms of reduction of road trauma – mainly heavy prime movers and their short wheelbase derivatives. This minimised the regulatory burden on manufacturers and operators. As reported at the time in the associated RIS[2], the Commonwealth indicated that it would return to the consideration of ESC for the remaining types of vehicles as part of the AEB work, where there may be economies in costing of the systems, due to the integrated nature of AEB and ESC.

Expanding the current ESC requirements to all vehicle categories covered by a broad scope AEB regulation eliminates the cost of separate ESC fitment for those categories where ESC is a sub-component of AEB and so substantially reduces costs through shared system components. Expanding the current ESC requirements (described from herein as Option 6a with matching ESC fitment) would save an additional 24 lives and prevent an additional 412 serious and 320 minor injuries. This represents additional savings to society (gross benefits) of $89 million, and in combination with Option 6a requirements for AEB, raises the likely net benefit to $141 million and the likely benefit-cost ratio to 1.6.

[2] Regulation Impact Statement: National Heavy Vehicle Braking Strategy Phase II (Australian Government, 2018).

The results of the benefit-cost analysis over a 35 year period (assuming an intervention policy period of 15 years) for Option 6a and Option 6a with matching ESC fitment are summarised in Table 4 and Table 5 below.

Table 4: Summary of net benefits and benefit-cost ratios (including associated ESC benefits)

	Net benefits ($m)			**Benefit-cost ratios**
	Best case	Likely case	Worst case	Likely case
Option 6a: regulation (broad scope)	123	52	-19	1.2
Option 6a: regulation (broad scope) with matching ESC fitment	212	141	71	1.6

Table 5: Summary of number of lives saved and injuries avoided (including associated ESC benefits)

	Lives saved	**Serious injuries avoided**	**Minor injuries avoided**
Option 6a: regulation (broad scope)	78	2152	6697
Option 6a: regulation (broad scope) with matching ESC fitment	102	2564	7017

<u>Public Comment</u>

A consultation version of this RIS was circulated for a six-week public comment period, which closed on 4 October 2019. A summary of the feedback and Department responses is included at Appendix 8.

The implementation timeframe proposed for consultative purposes was 1 November 2020 for new vehicle models and 1 November 2022 for all new vehicles (for both AEB and matching ESC fitment).

During the consultation period, feedback was received from members of the public, state government agencies, industry, and road user organisations. Most feedback strongly supported the implementation of Option 6a, including in many cases with matching ESC fitment.

A number of industry submissions indicated more implementation time is needed and suggested alternative dates. The most extended of these was that proposed by the Truck Industry Council (TIC), with a phase in from November 2022 to January 2025. The effect of the TIC's suggested extended implementation timing on benefits and costs was examined in a post consultation sensitivity analysis, which also showed substantial positive benefits.

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 6a: regulation (broad scope) with matching ESC fitment offers the greatest net benefit and is therefore the recommended option. Under this option, fitment of AEB and ESC would be mandated for new omnibuses, and for new heavy goods vehicles greater than 3.5 tonnes Gross Vehicle Mass (GVM). The final implementation dates will be determined as part of the relevant ADRs by the Government.

The RIS Process

This RIS has been written in accordance with Australian Government RIS requirements, addressing the seven assessment questions as set out in the Australian Government Guide to Regulation (2014):

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 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.

1. WHAT IS THE PROBLEM?

1.1. Road Trauma Involving Heavy Vehicles

The impact of road crashes on society is significant. Individuals injured in crashes must deal with pain and suffering, medical costs, lost income, higher insurance premium rates and vehicle repair costs. For society as a whole, road crashes result in enormous costs in terms of lost productivity and property damage. The cost to the Australian economy has been estimated to be at least $27 billion per annum (BITRE, 2014). This translates to an average of over $1,100 per annum for every person in Australia. There is also a personal cost for those affected that is not possible to measure. Road trauma from heavy vehicle crashes costs Australia approximately $1.5 billion each year. This cost is broadly borne by the general public, businesses and government.

In 2015-16, the Australian domestic road freight task reached 219 billion tonne-kilometres, increasing by more than 23 per cent since 2006-07. At the same time, the higher rates of crashes involving heavy vehicles has drawn increasing attention from policy makers, road safety advocates and the general-public, as well as from the heavy vehicle industry itself.

Heavy vehicles represent 3 per cent of all registered vehicles in Australia (Australian Bureau of Statistics, 2018a) and account for over 7 per cent of total vehicle kilometres travelled on public roads (Australian Bureau of Statistics, 2018b). However, on average they are involved in around 17 per cent of fatal crashes and 5 per cent of serious injury (hospital admission) crashes. These crashes are estimated to cost the Australian economy around $1.5 billion each year (in 2018 dollar terms), including approximately $200 million from crashes involving a heavy vehicle impacting the rear of another vehicle.

Heavy vehicles impacting the rear of another vehicle is the specific road safety problem that has been considered in this RIS. According to data from MUARC (MUARC, 2020), these types of crashes accounted for almost 15 per cent of all heavy vehicle injury crashes in Australia. While in fatal multi-vehicle crashes a lighter vehicle is likely to have been at fault (in up to 83 per cent of incidents according to NTARC, 2019), heavy vehicles nonetheless have characteristics that can increase both the risk and severity of both no-fault and at-fault crashes. These include a high gross mass, elevated centre of gravity, long vehicle length, reduced opportunity to manoeuvre, and relatively longer stopping distances.

Fatal crashes

The Australian Road Deaths Database, maintained by the Bureau of Infrastructure, Transport and Regional Economics, provides basic details of road crash fatalities in Australia as reported by the police each month to the state and territory road authorities. This includes details on the number of fatal crashes and fatalities in crashes involving heavy articulated trucks (prime movers), rigid trucks and buses. During the 12 months to the end of December 2019, 206 people died from 189 fatal crashes involving heavy trucks and buses. Over the last three years (2017-2019), an average of 199 people died in 180 fatal crashes involving heavy trucks and buses each year (BITRE, 2019a).

Figure 1 shows the annual number of fatal crashes involving heavy trucks and buses in Australia for each calendar year in the period 2010 to 2019, while Figure 2 shows the corresponding number of fatalities.

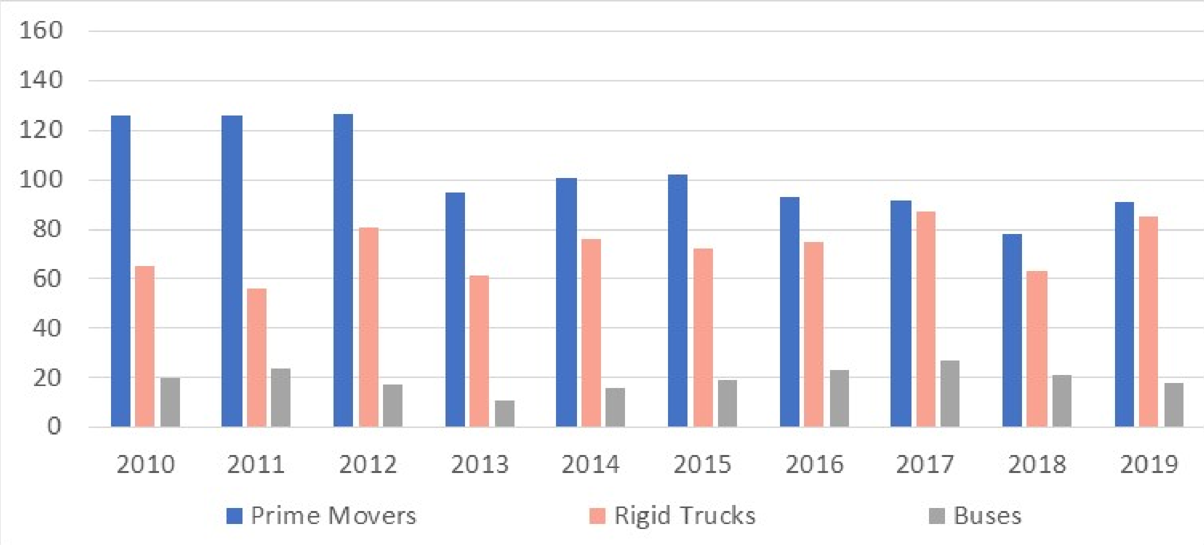

Figure 1: Fatal crashes involving heavy trucks and buses in Australia, annual totals 2010-2019 (source: Australian Road Deaths Database)

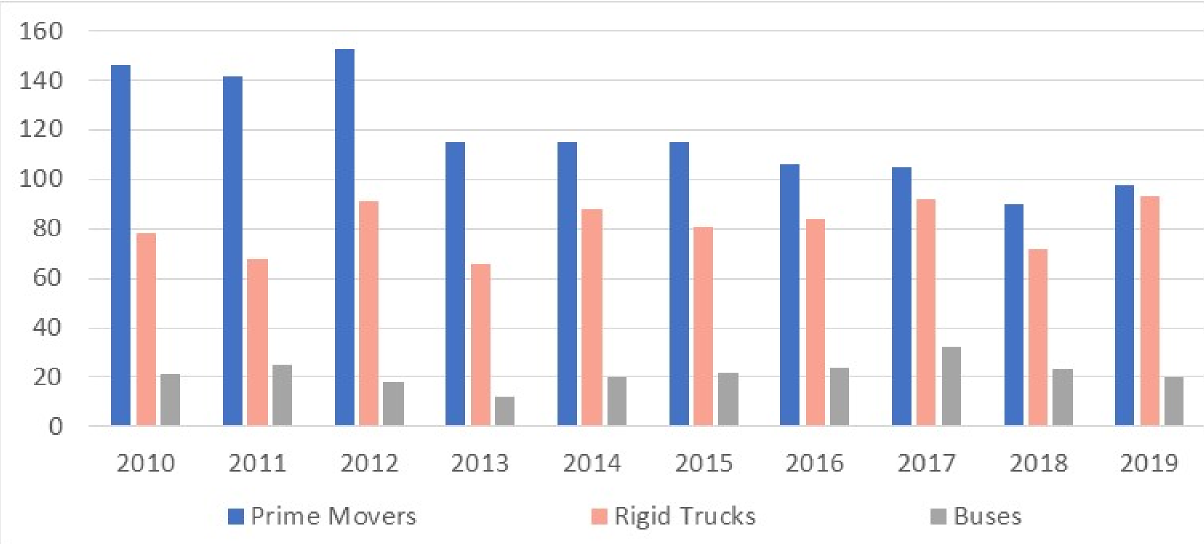

Figure 2: Fatalities in crashes involving heavy trucks and buses in Australia, annual totals 2010-2019 (source: Australian Road Deaths Database)

It can be seen that fatalities in crashes involving prime movers decreased by around 20 per cent between 2010 and 2013, but have been relatively constant, with a very gradual downward trend, over the last seven years. Fatalities in crashes involving rigid trucks and buses have been relatively constant over the 10 years (with some year to year fluctuations).

Over the last three years (2017-2019), the proportions of fatal heavy vehicle crashes involving a prime mover, rigid truck or bus were 46 per cent, 42 per cent and 12 per cent respectively. Taking into account fatality rates and crash data, fatal crashes involving heavy trucks and buses cost the economy approximately $980 million annually (MUARC, 2020).

Serious and minor injury crashes

Data compiled by the National Injury Surveillance Unit at Flinders University, using the Australian Institute of Health and Welfare National Hospital Morbidity Database provides details on hospitalisation due to road crashes, including those involving heavy vehicles. Road injury while driving a heavy vehicle accounted for age-standardised rates of 4 cases per 100,000 population (AIHW, 2018). The most recent year of data available (2016-2017) shows that 1,832 people were hospitalised from road crashes involving heavy vehicles (BITRE, 2019b). Prior to this available data, the two most recent years of available data (2012-13 and 2013-14) show that close to 1,750 people are hospitalised each year from road crashes involving heavy vehicles (AIHW, 2015). This indicates an increasing trend in hospitalised injuries as a result of heavy vehicle presence on Australian roads. While not a perfect measure, hospital admission provides the best available indication of serious injury crashes in Australia.

With current annual serious injury rates and crash data available, serious injury crashes involving heavy trucks and buses in Australia cost approximately $520 million each year (MUARC, 2020).

1.2. Government Actions to Address Heavy Vehicle Crashes

Government actions to address trauma in crashes involving heavy vehicles include the following initiatives, which are described further below:

- Setting national vehicle standards.
- Heavy Vehicle National Law and Performance Based Standards road network access controls.
- Chain of responsibility, Work Health and Safety (vehicle as a workplace).
- Infrastructure upgrades.
- Other state and territory government initiatives such as research projects, education and partnerships.

National Vehicle Standards

The Australian Government administers the MVSA[3], 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 set minimum standards for safety, emissions and anti-theft performance.

Within Australia, consideration of the fitment of AEB has had to wait for the other supporting technologies of Anti-lock Brake Systems (ABS) and Electronic Stability Control (ESC) to be mandated. This has been necessary to guarantee the stability of a heavy vehicle or heavy vehicle combination under the severe conditions of automatically generated braking by AEB systems. The first considerations of mandating ABS were unsuccessful before and

[3] Set to be replaced by the RVSA.

throughout the early 2000s, due to cost of the technology and to reliability concerns by some parts of the heavy trailer industry. This situation continued through to the 2014 implementation of ABS for trucks, where further exemptions from ABS were sought for heavy trailers, as well as for the Commonwealth to consult at length on any reliability issues. However, the underlying electrical power and wiring requirements for advanced braking systems were mandated at this time, in preparation for the next steps of fully implementing ABS/ESC/AEB systems.

Following the completion of this first Phase (Phase I) of what became the National Heavy Vehicle Braking Strategy (NHVBS) under the NRSS, the Department consulted as agreed with industry regarding the advantages and disadvantages, including reliability, of other advanced braking systems e.g. ESC and Roll Stability Control (RSC), to support the development of a RIS under Phase II of the NHVBS in 2018. Following the RIS, the Government introduced requirements for advanced ESC based systems for new heavy vehicles and RSC for trailers. These requirements were introduced in order to reduce the cost of road trauma to the community from heavy vehicle rollover and loss of control crashes. The RIS examined five options in addition to the business as usual case to increase fitment of ESC and RSC to the heavy vehicle fleet. It found there were significant benefits to be gained in the reduction of rollover and loss of control crashes by mandating ESC/RSC fitment. This could not otherwise be realised either through the business as usual approach or various other non-regulatory options. The benefit cost analysis found that there was a case for the provision of ESC and RSC systems for heavy vehicles and heavy trailers through government intervention, in the form of ADRs based on UN Regulation No. 13/11, that incorporates a performance standard adapted from US Federal Motor Vehicle Safety Standard (FMVSS) 136. The positive net benefits of this intervention over the business as usual case were estimated at $217 million with potential to save 126 lives and see a reduction of 1,101 serious injuries following a 15 year period of regulation.

In addition to improved braking, passive safety systems can also mitigate the severity of heavy vehicle crashes. For instance, when rear-end collisions occur between an impacting heavy vehicle and a light vehicle, vehicle underrun can occur, increasing the severity of the outcome. This has been mitigated as much as possible by the introduction of Australian Design Rule (ADR) 84 - Front Underrun Impact Protection in 2009. Front underrun protection systems reduce the severity of trauma when a collision occurs, but cannot reduce the frequency of those collisions.

Heavy Vehicle National Law and Performance Based Standards

The Heavy Vehicle National Law (HVNL) was established in 2014 to provide nationally consistent arrangements for regulating the use of heavy vehicles to improve safety, and better manage the impact of heavy vehicles on the environment, road infrastructure and public amenity. The HVNL also aims to promote the safe transport of goods and passengers, and improve the heavy vehicle industry's productivity, efficiency, innovation and safe business practices. It is administered by the National Heavy Vehicle Regulator (NHVR) in all states and territories except for Western Australia (WA) and the Northern Territory (NT). WA and the NT instead continue with their own local arrangements.

The Australian Government was fundamental in the establishment of the NHVR and continues to provide support to it with respect to heavy vehicle road safety reforms. It has committed $15.9 million funding to the NHVR for heavy vehicle safety initiatives, including the installation of new monitoring systems, as part of a national compliance and enforcement network. Other initiatives include industry education on chain of responsibility obligations that have been strengthened under the HVNL, and assisting with the development of Industry codes of practice to strengthen safe business practices.

The Australian Government committed over $800,000 over two years to fund a joint heavy vehicle driver fatigue research project between the Cooperative Research Centre for Alertness, Safety and Productivity and the National Transport Commission (NTC). These organisations will work together to undertake research to evaluate the impact of HVNL fatigue provisions on road safety risks.

The Performance Based Standards (PBS) scheme is administered by the NHVR to offer the heavy vehicle industry the potential to achieve higher productivity and safety through innovative and optimised vehicle combination design. To obtain PBS approval, heavy vehicles must meet 16 additional safety standards and four additional infrastructure standards. Vehicles meeting these requirements can then be exempted from requirements relating to their dimensions and configuration (including length, width, height, rear overhang, retractable axles and tow coupling overhang/location etc.) and/or be permitted for operation at higher mass limits on approved routes. The PBS scheme has been in operation since October 2007.

WHS and Chain of Responsibility

On 18 May 2018, the Council of Australian Governments' Transport and Infrastructure Council agreed a framework for developing a 20-year national Freight and Supply Chain Strategy (the Strategy). On 6 April 2019, the Australian Government published a paper (Delivering on Freight) showing its commitment to address industry’s priorities, including improving heavy vehicle access to local roads, improving availability and sharing of freight data and investing to address pinch points in key freight corridors, without compromising on safety. A national approach is essential to ensure freight systems and infrastructure work across state and territory borders to enable the safe and efficient delivery of goods wherever they are required across Australia. The Commonwealth, state, territory and local governments are working together to develop the Strategy for implementation from 2019.

Safe Work Australia is an Australian government statutory body established in 2008 to develop national policy relating to Work Health and Safety (WHS) and workers compensation. The Australian Work Health and Safety Strategy 2012–2022 (SWA, 2018a) has identified road freight transport as a priority due to the high number and rate of work-related fatalities, injuries and illnesses. The Australian Work Health and Safety Strategy 2012-2022 provides a framework to drive improvements in work health and safety in Australia. It promotes a collaborative approach between the Commonwealth, state and territory governments, industry and unions and other organisations to achieve the vision of healthy, safe and productive working lives. The Strategy aims to reduce the incidence of serious injury by at least 30 per cent nationwide by 2022, and reduce the number of work-related fatalities due to injury by at least 20 per cent. The transport industry will play a critical role in meeting these targets.

The number of workers in the road transport industry grew by 16 per cent over the 13 years from 2003 to 2015 (SWA, 2019). In 2015, 74 per cent of transport workers were classed as employees and were covered by workers' compensation schemes. There have been significant reductions in the number and rate of injuries and fatalities in the transport industry over the past decade. However it remains a high risk industry.

While the frequency of serious claims in the road transport industry remains comparatively high, there have been substantial improvements over the last five years. The rate remained relatively stable with little improvement from 2007-08 and 2011-12 but has since fallen significantly by 36 per cent. Figure 3 shows that there has also been a significant fall in the number of worker fatalities and the fatality rate since 2007, however, there has been considerable volatility year-on-year and a plateauing over the last three years (SWA, 2018b).

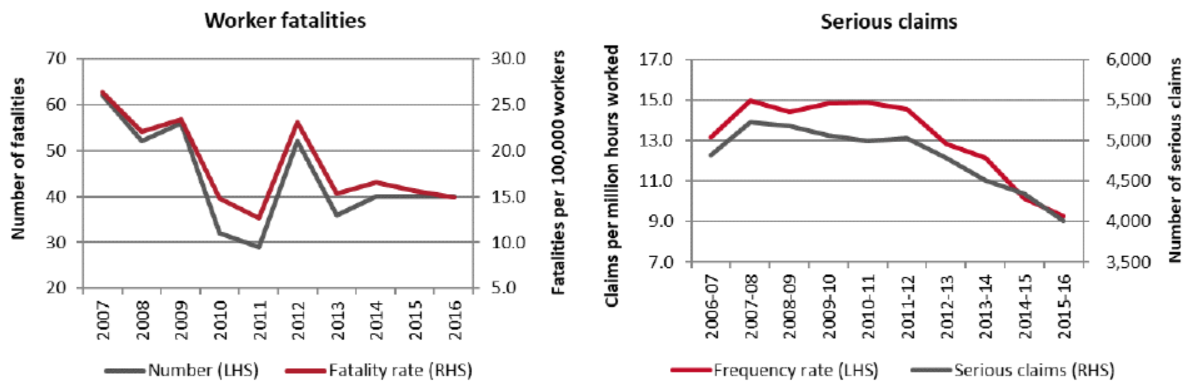

Figure 3: Fatalities and Serious claims -Safe Work Australia, Road Transport Industry Statistics (SWA, 2018b)

Work diaries and Electronic Work Diaries (EWDs) improve safety for the heavy vehicle industry though improved data accuracy and transparency for drivers, transport operators and authorised officers. They are also an important tool in reducing operator fatigue related crashes. EWDs are a voluntary alternative to written work diaries, approved by the NHVR, to monitor and record the work and rest times of a driver while significantly reducing administrative burden. In its public consultation on the EWD Policy Framework and Standards, the NHVR received majority support for commencing EWD services and in 2018 released a Notice of Final Rule Making allowing the use of EWDs.

Infrastructure Upgrades

The Australian Government has also extended the Heavy Vehicle Safety and Productivity Programme (HVSPP) and will provide $40 million per year from 2021-22 onwards, building on the current $328 million investment from 2013-14 to 2020-21. The HVSPP is an initiative to fund infrastructure projects that improve productivity and safety outcomes of heavy vehicle operations across Australia. The Government contributes up to 50 per cent of the total project cost, through national partnership agreements with state and territory governments. Examples of current safety projects include road freight route upgrades/improvements and the construction of more roadside rest areas for heavy vehicle drivers.

State and Territory Government Actions

Actions undertaken by state and territory governments towards improving heavy vehicle safety include investment in research projects, education campaigns, and strategic partnerships. They also include increased stringency in safety requirements and access arrangements, particularly for access to government work contracts. For instance, in NSW and Victoria most buses and many heavy trucks used in major infrastructure projects are subject to increased stringencies.

Building a safety culture and improving safety through partnerships are priorities identified in the NSW Government's Road Safety Plan 2021 (RSP) released in February 2018. The RSP commits to the development of a new heavy vehicle safety strategy and partnerships with the heavy vehicle industry, including champions of change, to improve safety of the freight task across NSW. Initiatives taken by the NSW Government include projects such as:

- Fleet CAT - The field stage of the Fleet Collision Avoidance Technology Trial (Fleet CAT) project was completed, with drivers in the project travelling 363,000 km and receiving 117,000 alerts from the collision avoidance system.
- SPECTS - The Safety, Productivity & Environment Construction Transport Scheme (SPECTS) is a voluntary scheme designed to improve the safety, environmental performance and productivity of heavy vehicles used by the construction industry in NSW. SPECTS is administered and maintained by Roads and Maritime Services (RMS).

Towards Zero is a strategy and action plan that the Victorian Government has committed to. This action plan involves governments, communities, vehicle manufacturers, road authorities and transport companies working together to reduce the road toll. Through this plan, the Victorian Government aims to influence heavy vehicle companies to purchase or lease vehicles with advanced safety features such as AEB, Lane Departure Warning (LDW) or Lane Keep Assist (LKA).

The Heavy Vehicle Safety Action Plan 2019-2020 delivered by the Queensland Government was developed in consultation with Queensland Trucking Association, National Heavy Vehicle Regulator and Queensland Police Service. The plan aims to reduce heavy vehicle fatalities and identifies 36 heavy vehicle safety interventions. This includes the adoption of current and emerging safety technologies, standards and schemes such as:

- Inform a national review of the PBS scheme, and the increased presence of PBS vehicles on suitable road networks.
- Advocate for fast-tracking mandatory safety technologies for new heavy vehicles including, collision avoidance systems, stability control for prime movers weighing 12 tonnes, stability control for trailers weighing more than 10 tonnes, autonomous emergency braking and underrun protection.

- Investigate options to include improved/increased heavy vehicle safety standards as part of Queensland government funded construction contracts.
- Inform a national review of current heavy vehicle accreditation scheme arrangements.
- Encourage the increased uptake of telematics and other safety technologies for business and/or regulatory purposes.

Towards Zero Together, South Australia's Road Safety Strategy 2020, was launched in 2011 to set a new approach to road safety by the South Australian Government. The associated Action Plan 2018-2019 continues the focus established under Towards Zero Together and previous action plans. It responds to emerging trends from a review of road crash data, and developments in knowledge and technology that supports new solutions. It also recognises the directions set nationally through the NRSS. The Action Plan includes priority actions to be delivered by the end of 2019, of which one Priority Action is the introduction of an independent vehicle inspection scheme for heavy vehicles registered in SA.

Towards Zero: Getting there together 2008-2020 was launched by the Western Australian Government and builds on the progress achieved under the previous strategy Arriving Safely. One of four key initiatives is Safe Vehicles – promoting the uptake of safer vehicles and key safety features, particularly by government and corporate fleets. This initiative includes the following measures:

- Prevent death and serious injury by increasing the purchase of safe vehicles and specific safety features in vehicles.
- Promote community take up of safer vehicles and vehicle safety features
- Encourage corporate fleets to purchase safe vehicles and vehicle safety features.
- Strongly encourage making safe vehicles and specific safety features such as ESC, and side and curtain airbags compulsory for government vehicles.
- Undertake an ongoing research and development program to identify and progress future technological opportunities (improved alcohol interlocks, fatigue warning systems and safety based route navigation).

The Towards Zero Strategy and Towards Zero Action Plan 2017-2019 targets the Tasmanian Government's highest risk areas and deliberately focuses on those road safety initiatives that will gain the greatest reductions in serious injuries and deaths. On 2 July 2018, the Department of State Growth in Tasmania transferred responsibility for direct delivery of heavy vehicle compliance and enforcement to the National Heavy Vehicle Regulator (NHVR).

Towards Zero Road Safety Action Plan 2018- 2022 (Towards Zero) is a five year road safety action plan of the Northern Territory Government which has been developed through extensive community consultation. Towards Zero focuses on road safety actions to address the key priority areas for NT. Actions within this plan include:

- Continually monitoring, evaluating, and introducing emerging technology that assists in achieving the vision of the plan.
- Mandatory Vehicle inspection regimes for private, business and heavy vehicles.
- Safe driving awareness campaigns that include sharing the road safely with heavy vehicles.
- Promote bike education for school students and safe cycling with groups, such as heavy vehicles.

1.3. Rear-end Crashes Involving an Impacting Heavy Vehicle

Heavy vehicles have a reduced risk of being struck from the rear as they decelerate more gradually than other vehicles. However, for the same reason, they have an increased risk of being the impacting vehicle in a rear-end collision. Consequently, collisions involving a heavy vehicle impacting the rear of another vehicle are one of the most common type of heavy vehicle crash, accounting for almost 15 per cent of all heavy vehicle trauma (MUARC, 2020). Like most heavy vehicle crashes, rear-end crashes involving an impacting heavy vehicle are typically severe.

Common contributing factors of heavy vehicle rear-end crashes include other vehicles aborting a manoeuvre at the last moment (for example at traffic lights); cutting-in during peak traffic periods as well as the usual issues of tailgating, driver distraction and driver inattention. These are exacerbated by the decreased vision generally available to and around a heavy vehicle.

Based on detailed injury crash data (Austroads, 2015), it is estimated that the average annual rear-end crash count for fatal and serious injury across all vehicle types in Australia is 2449. Of this average, approximately 84 per cent were in urban areas with 16 per cent of rear end crashes occurring in rural areas. These figures equate to approximately 39 fatal and serious injury related rear end crashes per week in urban areas and approximately 8 in rural areas. Further, approximately 26 of these each year are from crashes involving a heavy vehicle.

According to data from Budd and Newstead (2014), rear-end crashes accounted for 26 per cent of all heavy vehicle injury crashes in Australia over the period 2008 to 2010 (including 34 per cent involving rigid trucks, 26 per cent involving prime movers and 18 per cent involving road trains for total injury rear-end crashes). Due to the prevalence of these types of crashes, AEB systems were considered valuable, with the expectation that they would prevent at least some of the more serious trauma crashes from occurring. The study predicted that at the maximum efficacy, one quarter of all heavy vehicle fatal crashes could be prevented from the mandating of AEB systems. This translated to an annual saving of costs to Australian society of $187 million. The study concluded that the injuries and property damage associated with heavy vehicles may be dramatically reduced in metropolitan regions by fitting AEB technology to heavy vehicles as more than half of all severe and more than 70 per cent of fatal crashes were deemed to be potentially prevented by AEB systems. However, this crash sensitivity included a broad set of scenarios. Budd and Newstead (2014) defined ‘narrowly’ sensitivity crashes as crashes with vehicles travelling in the same direction which were hit in the rear, crashes whilst reversing in traffic and crashes with objects or vehicles parked/stopped on path. ‘Broadly’ sensitive were crashes which involved a collision with something in the path which was either not a vehicle or not travelling in the same direction. This set potentially included crashes with trains/level-crossings, pedestrians, animals and other objects in a vehicle’s path, crashes at intersections, crashes with vehicles heading in the opposite direction, crashes whilst manoeuvring when entering or leaving parking or footways or U-turning into a fixed object and crashes whilst overtaking including only head on, pulling out, cutting in or turning. This study and other early research were primarily based on the maximal potential of AEB systems to detect vulnerable road users, objects and/or infrastructure crash detection and operation in all road/environmental conditions.

In 2017, the NSW Centre for Road Safety, Transport for NSW independently reviewed crash avoidance technologies including AEB. The report (Transport for NSW, 2017) estimated that AEB could prevent up to 25 per cent of all heavy vehicle fatalities. Research recently commissioned by the Government (MUARC, 2020) has considered the effect of the technology conforming to the minimum requirements of UN Regulation No. 131. The study found that 5.5 per cent of the 200 heavy vehicle fatalities per year could be prevented.

Although there are currently a number of existing government actions to improve heavy vehicle safety, these are mostly road user behaviour or infrastructure related, and only include a limited number of localised measures to encourage fitting of technology through contracts and/or more favourable road access arrangements. The existing government actions are therefore likely to have only a limited impact on national fitment rates of AEB systems conforming to UN Regulation No. 131, which can directly prevent or mitigate heavy vehicle rear impact crashes. Together with the ongoing trend of these crashes occurring in Australia and the reported success of the technology where mandated in other countries, this has led to increased deployment of AEB being prioritised as an action under the National Road Safety Strategy 2011-2020. As retro-fitting sophisticated technology such as AEB would generally be high cost and disruptive for current vehicle owners, the action has concentrated on influencing the new vehicle market only.

1.4. The National Road Safety Strategy 2011-2020

Under the National Road Safety Strategy (NRSS) 2011-2020, the Australian Government and state and territory governments have agreed on a set of national road safety goals, objectives and action priorities through the decade 2011-2020 and beyond (Transport and Infrastructure Council, 2011). The NRSS aims to reduce the number of deaths and serious injuries on the nation’s roads by at least 30 per cent by 2020 (relative to the baseline period 2008-2010 levels), as endorsed by the Transport and Infrastructure Council (the Council), in 2011. As Future Steps, the NRSS includes, subject to RIS outcomes, consideration of mandating AEB for heavy vehicles.

An updated National Road Safety Action Plan 2018-20 (the Action Plan) developed cooperatively by federal, state and territory transport agencies, was endorsed by the Council in May 2018 (National Road Safety Strategy, 2018). The Action Plan supports the broader 10-year agenda of the NRSS by ensuring that national efforts in the final three years of the NRSS are focused on strategically important initiatives. The Action Plan contains nine Priority Actions that all jurisdictions have agreed must be completed and will assist to meet the targets for road trauma reduction contained in the NRSS. This plan 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 about effective approaches to reduce road trauma.

Priority Action 4 of the Action Plan is to increase deployment of AEB in both heavy and light vehicles. The case for this Priority Action was based on the potential for AEB systems to reduce death and injury through a demonstrated reduction in rear-end crashes. The action tasks the Commonwealth examining international standards for AEB for heavy vehicles for implementation in the Australian new vehicle fleet, and finalise a regulatory package through the ADRs, subject to RIS outcomes.

Priority 9 is to increase the market uptake of safer new and used vehicles and emerging vehicle technologies with high safety benefits. This follows the success of the Australasian New Car Assessment Program (ANCAP), Used Car Safety Ratings (UCSR) and related safety research showing the benefits to consumers of choosing safer vehicles. A large proportion of new vehicle purchases are made for private and government fleets, being turned over to the general fleet after 2–3 years. Influencing fleet operators to purchase the safest vehicles was determined as one of the quickest ways to improve the safety of the Australian fleet overall. 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 including AEB, Lane Keep Assist, Lane Departure Warning and Adaptive Cruise Control; and other beneficial technologies, where available.

Other Critical Action K aims to require contractors on government-funded construction projects to improve the safety of vulnerable road users around heavy vehicles through safety technology and education programs. The case for this Action was based on evidence of heavy vehicles featuring prominently in crashes causing deaths and serious injuries to vulnerable road users in urban areas. Furthermore, there is a large amount of major infrastructure construction currently underway or planned across Australia. As much of this increased activity is in city and suburban areas, it brings increased risk to vulnerable road users (VRUs). Implementation of this action includes use of vehicle safety technologies and standards through government construction contracts, for technologies such VRU detection, improved driver field of view, warning systems, and advanced forms of AEB, that could better protect VRUs sharing the roads with the heavy trucks that are used in construction in urban areas.

2. WHY IS GOVERNMENT ACTION NEEDED?

Government action may be needed where the market fails to provide the most efficient and effective solution to a problem. In this case the problem is that heavy vehicle crashes are estimated to cost the Australian community around $200 million every year. These crashes are not reducing as much as they could, given the availability of effective safety technologies.

In Australia, the introduction of safety technologies through market action alone is significantly slower for heavy vehicles than it is for light vehicles. A major reason for this is the nature of construction of heavy vehicles. In comparison to light vehicles (for example cars and Sports Utility Vehicles), heavy vehicles are more likely to be built to order, with engines, drivetrains, suspensions, brakes, axles and safety systems individually specified by the purchasing business. Heavy vehicles constitute a substantial financial investment and are generally configured for business use. Purchasers may in some instances focus primarily on maximising economic productivity rather than on the safety of other road users.

A significant number of heavy vehicles are built in Australia specifically for the Australian market. For example, about 50 per cent of heavy duty trucks (see Figure 4 below), more than 80 per cent of the heavy haulage vehicles used in the mining industry and around 95 per cent of heavy trailers are built in Australia. This means that the designs and regulations effective in other markets will have a lesser influence on the makeup of the Australian heavy duty truck fleet. This means that rate of fitment of safety systems in the Australian market is likely to remain relatively independent of fitment rates in other markets, in the absence of market intervention.

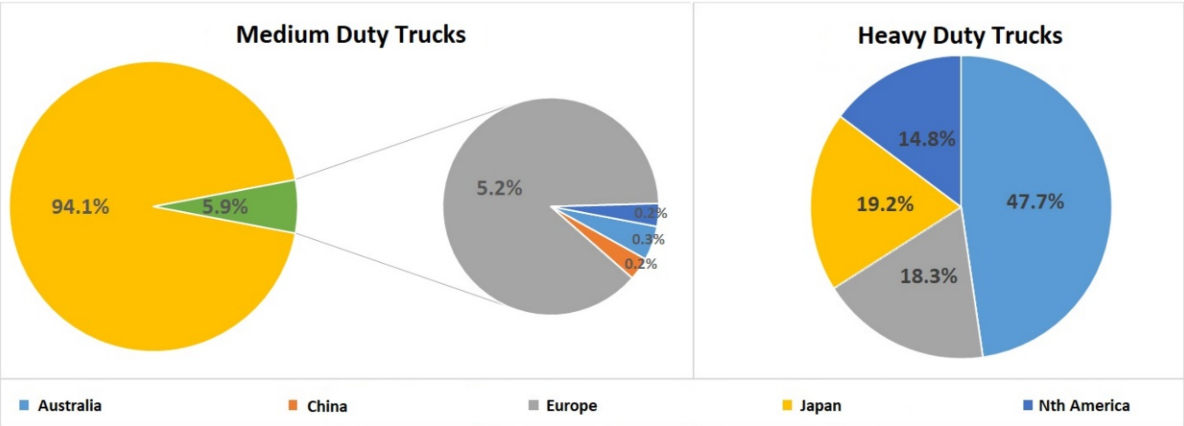

Figure 4: Truck Sales in Australia (2014) by Country/Region of Manufacture (source: TIC, 2015)[4]

Businesses profit from the manufacture of heavy vehicles and from their operation on Australia's public road network. However, heavy vehicle trauma and associated financial costs are borne by all road network users and the broader Australian community more generally. Though actions around driver and fleet managers can reduce the frequency of heavy vehicle at-fault crashes, technology such as Anti-lock Braking Systems (ABS), ESC, AEB and LKA can also alleviate crashes and/or mitigate crash severity.

[4] Medium duty trucks have a GVM >8 tonnes and a GCM ≤ 39 tonnes. Heavy duty trucks have a) 3 or more axles; or b) 2 axles, a GVM >8 tonnes, and a GCM > 39 tonnes.

In the case of AEB, researchers have found that in collisions involving a heavy vehicle impacting the rear of another vehicle, it reduces all forms of trauma of vehicle occupants by up to 57 per cent (MUARC, 2020). However, heavy vehicle AEB fitment rates have been low with only around six per cent of all new Australian heavy vehicles sold in 2018 being fitted with AEB systems complying with internationally adopted standards. Table 6 shows that based on heavy vehicle industry reported sales and fitment data most of these are in the heavy duty prime mover segment at 23 per cent (NC category prime mover (PM)). The remaining fitment of AEB occurs in close to four per cent of NC category rigid vehicles and 0.15 per cent of NB category vehicles.

Table 6: Industry reported heavy vehicle AEB fitment (2018)

Total Number of New Vehicle Sales (as reported)				Estimated Number of New Vehicles Fitted (as reported)				Estimated AEB Fitment (%)			
NB1	NB2	NC-PM	NC-Rigid	NB1	NB2	NC-PM	NC-Rigid	NB1	NB2	NC-PM	NC-Rigid
10938	7846	7525	10509	0	11	1760	379	0	0.15	23.38	3.61

In Australia, the fitment of AEB systems is significantly higher for NC category heavy duty prime movers than for other vehicle categories. The reason for this is not clear, but it may relate to the higher value of these trucks and the loads that they carry. A fleet owner is more likely to order the technology if its cost is less relative to the overall cost of the truck. Another factor may be the awareness of owners that because heavy duty prime movers have a greater exposure to high loads and highway speeds, there are greater consequences should a crash occur.

ANCAP publishes safety ratings for a range of new passenger, sports utility (SUV) and light commercial vehicles (LCV) entering the Australian and New Zealand markets, using a rating system of 0 to 5 stars. ANCAP has reported that the number of top 100 selling LPV models offered with AEB as standard increased from 3 per cent of the market in 2015, to 31 per cent of the market in 2018. The latest available data indicates fitment rates of approximately 40 per cent of the top 100 selling models in the Australian light vehicle fleet.

Unlike the light vehicle fleet, there are no national consumer safety ratings schemes for new heavy vehicles. Despite AEB being an increasingly available fitment (or part of a fitment package upgrade), new heavy vehicles are generally configured with an emphasis on productivity, with a lower level of passive and active safety features than is typical of light vehicles.

Mandatory fitment of AEB to commercial heavy vehicles according to UN Regulation No. 131 has been implemented across the European market since November 2013, followed by mandates in Japan and Korea. By November 2018, the European mandate had taken full effect for all new vehicles covered by UN Regulation No. 131 (with exemptions including urban buses and off-road or agricultural vehicles). Though now well established, the European mandate has not strongly influenced Australian market fitment rates, in part due to the bespoke sale configurations selected by Australian operators. However, the mandate has reduced and mitigated heavy vehicle rear impact crashes in Europe, providing useful

European data on the effectiveness of the technology that has been used to support the Australian research.

2.1. Autonomous Emergency Braking Systems for Heavy Vehicles

Like other Advanced Driver Assistance Systems (ADAS), an AEB system reads inputs from a variety of devices to monitor the environment. In the event that a collision with a vehicle (and in some instances other road users such as pedestrians) is predicted, the driver is warned via an acoustic alarm. 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 built on top of an ESC platform and is integrated with its ABS, ensuring that an emergency stop doesn't lead to, for example, rollover.

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.

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 and cameras, to identify potential collisions. 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.

When braking a heavy vehicle in emergency situations, whether initiated by a driver or an AEB system, maintaining stability is critical. The role of heavy vehicle ESC and trailer RSC is even more critical when hard braking is accompanied by swerving (common in rear-end collisions as the driver tries to avoid the vehicle in front, when there is any road curvature, and/or when there is reduced wheel traction. For this reason, vehicles fitted with effective AEB are typically also fitted with ESC/RSC, often as a necessary sub-component.

The effectiveness of AEB systems for heavy vehicles is likely to be greater than for passenger vehicles as a result of frequency and severity of impacting heavy vehicle rear-end collisions.

2.2. Available Standards

Australia participates in the peak 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 of UN Regulations (the 1958 Agreement) and Global Technical Regulations (GTRs) (the 1998 Agreement). The adoption of international regulations as a basis for national or regional standards results in the highest safety levels at the lowest possible cost.

Since attaining WP.29 endorsement in 2013, UN Regulation No. 131 has remained the internationally agreed standard covering heavy vehicle AEB. It sets requirements for detecting vehicles in the impact zone, while operating up to the full speed of the heavy vehicle under highway conditions. UN regulations are revised on an ongoing basis and so in time it may be possible to expand the requirements to specifically detect road users such as pedestrians and cyclists. However, this is outside the scope of this RIS.

Six per cent of new Australian heavy vehicles are already sold fitted with AEB systems that would comply with UN Regulation No. 131.

2.3. Summary of UN Regulation No. 131

Scope

UN Regulation No. 131 covers AEB systems fitted to vehicles greater than 3.5 tonnes Gross Vehicle Mass (GVM) applicable to UN vehicle categories M2, M3, N2 and N3, corresponding to ADR subcategories MD, ME, NB and NC. These systems automatically detect a potential forward collision, provide the driver with a warning and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating the severity of a collision in the event that the driver does not respond to the warning.

System Capability

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, the system must achieve the specified requirements of the braking phase.

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, e.g. by a steering action or an accelerator kickdown or operating the direction indicator control, take control and override the system.

Since UN Regulation No. 131 cannot include all the 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). In addition, the AEB system may be temporarily not available due to adverse weather conditions. In this instance the driver must be 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.

Test Conditions

The application for approval of a vehicle type with regard to AEB systems requires testing the subject vehicle to warning and activation test requirements. The applicability of a vehicle subcategory to the requirements in these tests is dependent upon the GVM and brake system type (pneumatic or hydraulic) fitted to the vehicle. The AEB performance requirements applicable to heavier vehicles are more stringent than those applicable to lighter vehicles. In particular, the speed of the target vehicle for the moving target test is much higher; 67 km/h versus 12 km/h. Appendix 4 summarises these performance requirements.

There are two types of tests; stationary target and moving target. Test conditions are summarised in Table 7.

Table 7: UN Regulation No. 131 – Summary, AEB Test conditions

Test Condition	Description
Surface	Flat, dry concrete or asphalt affording good adhesion.
Temperature Range	0 – 45 deg. Celsius
Lighting Conditions	Horizontal visibility range shall allow the target to be observed throughout test. Test when there is no wind liable to affect the results.
Subject Vehicle Mass	The vehicle shall be tested in a condition of load (loaded to manufacturer specifications).

The regulation includes a clause specifying that requirements will be reviewed before 1st November 2021. This has commenced under WP.29 and is expected to increase performance requirements for some vehicle types. However, implementation dates would be several years away. For this reason, the benefits of the current UN Regulation No. 131 are considered in this RIS. The Department will review any amendments to the regulation in line with UN revisions, as they become available.

Test Targets

A target is the object being detected by the AEB system. Certification tests utilise the high volume series production passenger car UN category M1 AA 'saloon body shape' (equivalent to ADR sub-category MA), comprising not more than 9 seats including driver's seat. A soft target may be used that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a testing collision. For the moving target test, the target travels at a constant speed in the same direction and in the centre of the same lane of travel. For the stationary target test, a target at standstill facing the same direction is positioned on the centre of the same test lane of travel as the subject vehicle.

Guidance on Exemptions

In the introduction (for information) of UN Regulation No. 131 it is stated that the intention of this regulation is to establish uniform provisions for AEB systems fitted to motor vehicles of the UN categories M2, M3 (omnibuses), and N2 and N3 (goods vehicles over 3.5 tonnes) primarily used under highway conditions. It is also noted in this section that there are sub-groups of vehicles where the benefit is rather uncertain because they are primarily used in conditions other than highway conditions (e.g. buses with standing passengers (i.e. UN class A, I and II vehicles), off-road vehicles (i.e. UN category G vehicles) and construction vehicles), and there are other sub-groups where the installation of AEBS would be technically difficult regardless of the benefit (e.g. position of the sensor on off-road vehicles and special purpose vehicles, etc.). This information is provided to assist countries to decide which vehicles (if any) to exempt when incorporating this regulation into regional or national law.

2.4. European Mandate of UN Regulation No. 131

European Commission Regulation No. 661/2009 set an ambitious target to fit AEB systems (termed AEBS) to all new types of M2, M3, N2 and N3 category vehicles from 1 November 2013 and to all new vehicles of these categories from 1 November 2015. The first technical requirements and test procedures for AEB systems were subsequently published in the EU implementing regulation No. 347/2012. Recognising that some additional time would be required to fully develop effective AEB systems, especially for certain types and configurations of vehicles, mandatory AEB fitment requirements were introduced in two stages.

For the first stage, applicable from 1 November 2013 for new vehicle types/models and from 1 November 2015 for all new vehicles, the AEB requirements were only applied to M3 category vehicles, larger N2 category vehicles with a GVM greater than 8,000 kg and N3 category vehicles that are equipped with pneumatic or air/hydraulic braking systems and with pneumatic rear axle suspension systems.

For the second stage, applicable from 1 November 2016 for new vehicle types/models and from 1 November 2018 for all new vehicles, the AEB requirements were extended to cover all M2, M3, N2 and N3 category vehicles, other than those specifically exempted. The stringency of the AEB system performance requirements was also increased for M3 category vehicles, N2 category vehicles with a GVM greater than 8,000 kg and N3 category vehicles.

Exemptions are provided for semi-trailer towing vehicles with a maximum mass not exceeding 8 tonnes, buses with provision for standing passengers (i.e. UN class A, I and II vehicles), vehicles with more than three axles, vehicles designed for off-road use (i.e. UN category G vehicles) and certain other special purpose vehicles.

Much discussion over the AEB system performance requirements for M2 category vehicles and N2 category vehicles with a GVM not exceeding 8,000 kg took place between industry and governments to ensure full alignment between the EU requirements and those contained in UN Regulation No. 131.

2.5. 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.

The objective of this RIS is to examine the case for government intervention to reduce heavy vehicle rear impact crashes. Specifically, it is to improve the in-lane crash avoidance capability of the new heavy vehicle fleet in Australia by increasing the fitment rate of AEB systems. This is in order to reduce the cost of road trauma to the community from these types of crashes.

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 RIS. The requirements are set out in the Australian Government Guide to Regulation (Australian Government, 2014a).

3. WHAT POLICY OPTIONS ARE BEING CONSIDERED?

A number of options were considered to increase the fitment of AEB systems to new heavy 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 MVSA and then RVSA.

3.1. Available Options

Non-Regulatory Options

Option 1: no intervention
Allow market forces to provide a solution (no intervention).

Option 2: user information campaigns
Information campaigns to inform consumers and operators about the benefits of AEB systems.

Option 3: fleet purchasing policies
Permit only heavy vehicles fitted with AEB systems for government fleet purchases (economic approach).

Regulatory Options

Option 4: codes of practice
Allow heavy vehicle supplier associations, with government assistance, to initiate and monitor a voluntary code of practice for the fitment of AEB systems to new heavy vehicles. (regulatory—voluntary). Alternatively, mandate a code of practice (regulatory—mandatory).

Option 5: mandatory standards under the Competition and Consumer Act 2010 (CCA)
Mandate standards for fitment of AEB systems to new heavy vehicles under the *Competition and Consumer Act 2010* (CCA) (regulatory—mandatory).

Option 6: mandatory standards under the MVSA and then RVSA (regulation)
Mandate standards requiring the fitment of AEB systems to new heavy vehicles under the MVSA and then RVSA based on UN Regulation No. 131 (regulatory—mandatory).

3.2. Discussion of the Options

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 state of current voluntary fitment of AEB systems to heavy vehicles is around six per with heavy duty prime movers having a fitment rate of around 23 per cent. These fitment rates have arisen without regulation in Australia, including due to many heavy vehicle manufacturers and operators recognising the benefits of the technology to their businesses and/or the broader community. However, it is also important to note that fitment of these technologies is significantly higher in some other markets, most notably Europe were fitment is now mandatory (subject to some limited exemptions) for all new vehicles. The mandate in Europe has not strongly influenced the Australian market in that the increase in AEB systems as a result of manufacturers fitting the technology in Europe since 2013 has not translated into rapidly increasing fitment rates in Australia.

In examining this case, European Commission requirements on the fitment of heavy vehicle AEB in the EU and its flow on effect to the Australian market was considered. This included decreasing production costs of AEB equipment as well as reduced development and testing costs over the years as the technology improves and best practice methods of application, development and implementation become widespread.

Actions undertaken by state and territory governments towards improving heavy vehicle safety have been described earlier and include investment in research projects, education campaigns, and strategic partnerships. They also include increased stringency in safety requirements and access arrangements, particularly for access to government work contracts. These actions are mostly road user behaviour or infrastructure countermeasures, and only include a limited number of localised measures to encourage fitting of technology through contracts or more favourable road access arrangements. They are therefore expected to have only a limited impact in reducing the overall number of heavy vehicle rear impact crashes across Australia. Nationally, ADR 84 - Front Underrun Impact Protection is a technology that been mandated for a number of years that helps reduce the severity of trauma when a collision occurs. The only other proven technology to date is AEB. The broad introduction of technology such as AEB is not practical through state and territory government efforts as there is no national consumer safety ratings scheme for new heavy vehicles (unlike ANCAP for light vehicles).

Under Option 1, voluntary fitment by industry of AEB systems to new heavy vehicles is projected (based on recent trends and regulation in other markets) to increase year on year to some degree, with marked initial increases. The BAU option was analysed in detail in order to establish the baseline for comparison with other options.

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 — *Targeted 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.

Appendix 3 — *Advertising 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.

Table 8 provides a summary of the costs and effectiveness of the information campaigns used in the benefit-cost analysis (Section 4).

Table 8: Estimation of campaign costs and effectiveness

Campaigns	*Estimated campaign cost ($m) per year*	*Expected effectiveness*
Awareness – targeted	3	77 per cent fitment of AEB to new heavy vehicles
Advertising	18	8 per cent increase in AEB fitment rate relative to BAU fitment rate

Targeted awareness campaigns (Option 2a) could include the promotion of AEB for heavy vehicles as well as market incentives, including at point of sale. Such campaigns can be tailored to a specific user group. With the existing BAU fitment rates expected for AEB for heavy vehicles, it was determined that targeted awareness campaigns would remain relevant for up to the full 15 year policy intervention. This would be considered an unusually long period for such campaigns. This means advertising fatigue would need to be considered together with varying annual implementation costs to increase accuracy in forecasting. However, in order to conservatively estimate the best case outcome for comparison to other options, fatigue and cost variations were not included in 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 heavy vehicles.

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

Option 3: Fleet Purchasing Policies

The Australian Government could intervene by permitting only heavy 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.

However, as the Australian Government heavy vehicle fleet is small (only 1066 heavy commercial vehicles as at 30 June 2013 - less than 0.2 per cent of all registered heavy vehicles) and operators order bespoke, rather than standard configured vehicles, Government fleet purchasing policies are not considered an effective means to increase the penetration of AEB systems more generally in the Australian heavy vehicle fleet.

This option was not considered in further detail.

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.

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 heavy 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 heavy 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 heavy 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 heavy vehicles, taking into account the severity of typical crashes, a breach could have serious consequences, including increased road trauma.

For safety critical matters such as AEB systems for heavy vehicles, voluntary codes of practice are a high risk and cost proposition in terms of both monitoring and detecting breaches and being able to take timely action to intervene.

This sub-option was therefore not considered any further.

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 heavy vehicles, the responsible government agency (the 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.

Because of the above, this option was not considered in further detail.

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 heavy 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 therefore not considered any further.

Option 6: Mandatory Standards under the MVSA and then RVSA—Regulation

Under Option 6, the Australian Government would mandate the fitment of AEB systems to new heavy vehicles supplied to the market via a new national standard (ADR) under the MVSA, which would then continue in force as an ADR under the RVSA. This new ADR would adopt the technical requirements of UN Regulation No. 131, incorporating the latest (01) series of amendments. The ADR would also include a requirement that the AEB system be fitted as prescribed. As new ADRs only apply to new vehicles, implementation of this option would not affect vehicles already in service.

AEB systems from various manufacturers react differently to potential crash situations. As such, a mutually agreed international standard would further simplify system design and enhance quality. In terms of alleviating trauma, AEB performance across the fleet, particularly in common crash scenarios, can be as critical as fitment rates. It is therefore important to adopt an effective standard, otherwise the benefits of AEB would be uncertain. Research has shown UN Regulation No. 131 is effective in an Australian context (MUARC, 2020).

As this option is considered viable, and has been pursued internationally, the introduction of a mandatory standard was analysed further in terms of expected benefits to the community. This option has two sub-options; 6a - mandatory for all heavy vehicles and 6b - mandatory for all heavy vehicles excluding buses.

Background

Australia currently mandates approximately sixty active ADRs under the MVSA. 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 continue to be the case with the replacement of MVSA with the RVSA. Further, each ADR in force under the MVSA, immediately before commencement of the RVSA, will continue in force under 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. The Australian Government has the skill 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 heavy vehicles contributes to several Priority Actions in the NRSAP to increase the percentage of safer vehicles in the fleet. This proposed action also constitutes action towards increasing the uptake of advanced safety features under the NHVBS (see section 1.2).

Mandatory fitment of AEB to commercial heavy vehicles according to UN Regulation No. 131 has been implemented across the European market since November 2013, followed by mandates in Japan and Korea. By November 2018, the European mandate had taken full effect for all new vehicles covered by UN Regulation No. 131 (with exemptions including urban buses and off-road or agricultural vehicles). These mandates are now well established.

Australian research has found that AEB systems meeting the requirements of UN Regulation No.131 could alleviate or reduce the severity of almost 15 per cent of all Australian heavy vehicle crashes, predominantly those involving a heavy vehicle impacting the rear of another vehicle (MUARC, 2020). Moreover, it was found that in such collisions, heavy vehicle AEB reduces all forms of trauma by up to 57 per cent.

Scope/Applicability

The internationally agreed standard for heavy vehicle AEB systems is the United Nations (UN) Regulation No.131. This regulation sets requirements for detecting vehicles in the forwards impact zone, making it particularly effective in heavy vehicle rear-end collisions. Its scope covers all heavy goods vehicles greater than 3.5 tonnes Gross Vehicle Mass (GVM) and all omnibuses.

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.

Two sub-options were considered relevant in relation to the scope of vehicles for which mandatory requirements for AEB systems could be applied under the ADRs. A broad scope option directly aligned with the technical requirements of the UN Regulation No. 131, and a narrow scope option considering cost savings that would be associated with the exemption of all omnibuses. These options are:

- Option 6a: regulation (broad scope) — a new ADR would be implemented to require fitment of an AEB system for omnibuses, and goods vehicles over 3.5 tonnes GVM (ADR category MD, ME, NB and NC vehicles).
- Option 6b: regulation (narrow scope) — a new ADR would be implemented to require fitment of an AEB system for goods vehicles over 3.5 tonnes GVM (ADR category NB and NC vehicles).

Both sub-options 6a and 6b were analysed further in terms of expected benefits to the community as well as costs to business and consumers.

Extension of the base option 6a to include matching ESC fitment

When braking a heavy vehicle in emergency situations, whether initiated by a driver or an AEB system, maintaining stability is critical. The role of the existing technologies of heavy vehicle ESC and RSC is even more critical when hard braking is accompanied by swerving (common in rear-end collisions as the driver tries to avoid the vehicle in front), when there is any road curvature, and/or when there is reduced wheel traction. For this reason, vehicles fitted with AEB are typically also fitted with ESC or RSC, often as a necessary sub component.

ESC for heavy vehicles became mandatory from 1 July 2019 for new model heavy trailers (1 November 2019 for all new heavy trailers) and will become mandatory from 1 November 2020 for new model heavy trucks and heavy buses (1 January 2022 for all new heavy trucks and heavy buses). The mandate targeted the types of vehicles that could realise the highest benefits in terms of reduction of road trauma – mainly heavy prime movers and their short wheelbase derivatives. This minimised the regulatory burden on manufacturers and operators. As reported at the time in the associated RIS[5], the Commonwealth indicated that it would return to the consideration of ESC for the remaining types of vehicles as part of the AEB work, where there may be economies in costing of the systems, due to the integrated nature of AEB and ESC.

Expanding the current ESC requirements to all vehicle categories covered by a broad scope AEB regulation would eliminate the cost of separate ESC fitment for those categories where ESC is a sub-component of AEB and so substantially reduce costs through shared system components. An additional Option 6a with matching ESC fitment was therefore also analysed further in terms of expected benefits to the community as well as costs to business and consumers.

[5] Regulation Impact Statement: National Heavy Vehicle Braking Strategy Phase II (Australian Government, 2018).

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 implementation timetable (for AEB and where applicable matching ESC fitment) in the consultation RIS was:

- 1 November 2020 for new model vehicles; and
- 1 November 2022 for all new vehicles.

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

4. WHAT ARE THE LIKELY NET BENEFITS OF EACH OPTION?

4.1. Benefit-Cost Analysis

The benefit-cost methodology used in this 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 particular 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.

Three of the policy options outlined in Section 3.2 of this RIS (Option 1: no intervention; Option 2: user information campaigns; and Option 6: mandatory standards under the MVSA (and then RVSA) (regulation), 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 is 45 years. This covers the expected life of the policy option (15 years of intervention) plus the time it takes for benefits to work their way through the fleet (around 30 years, the approximate maximum lifespan of a heavy vehicle).

Given that the function of UN Regulation No. 131 is to enhance heavy vehicles safety, the included benefits focus on the safety benefit from expected reductions in trauma. However, it should be noted that many operators would be likely to obtain other benefits (for example, alleviation of property damage) that have not been included in this RIS. The net benefit and the benefit-cost ratio for each option are therefore likely to be conservative estimates.

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 heavy 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 heavy vehicle crashes whose severity could be reduced by AEB - common to all options) and the effectiveness of the technology in mitigating trauma when fitted.

Fitment effect of each option

Figures 5 to 7 show the anticipated level of fitment for each of the analysed options (2a, 2b, 6a and 6b) across the intervention period (2020-2035) compared to BAU. The BAU fitment for each year up to 2024 was determined from AEB fitment data (actual and projected) from heavy vehicle manufacturers. Much of the increased fitment over this period will be due to manufacturers opting to fit AEB at the same time they are required by ADR 35/06 to fit ESC to heavy buses, prime movers and short wheelbase rigid trucks. Industry will also likely have been factoring in a probable mandate of AEB for heavy vehicles in determining production plans for the period 2021 to 2024. However, in the absence of any intervention in the market, the AEB fitment rate would be very unlikely to continue to increase much above 70 per cent beyond 2024. This is because there is no ANCAP for heavy vehicles to encourage higher fitment rates and these vehicles are more likely (compared to light vehicles) to be built to order, with safety systems such as AEB able to be individually specified by the purchaser. Many purchasers (at least 30 per cent) will focus on maximising productivity for the money they spend. Further, a significant number of heavy vehicles are built in Australia and/or specifically for the Australian market (for example, nearly half of heavy trucks). This means that the designs and regulations of other countries will have a lesser influence on the makeup of the Australian heavy vehicle fleet. The actual AEB fitment rates for some types of heavy trucks have also been very low to date (for example, only 3.6 per cent of heavy rigid trucks in 2018 – refer Table 6 in section 2 above). Because of all these factors, the Department assumed there would only be a gradual increase in the AEB fitment rate under BAU from 66 per cent in 2024 to 71 per cent in 2035.

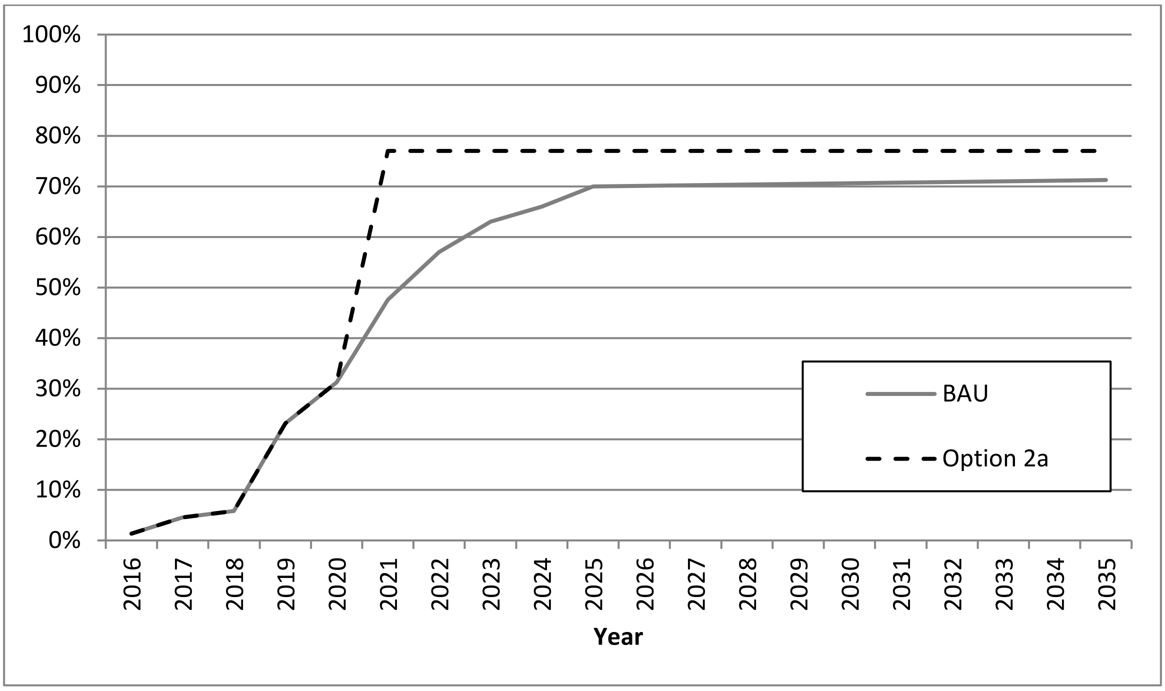

Figure 5 – Fitment via Option 2a compared to BAU

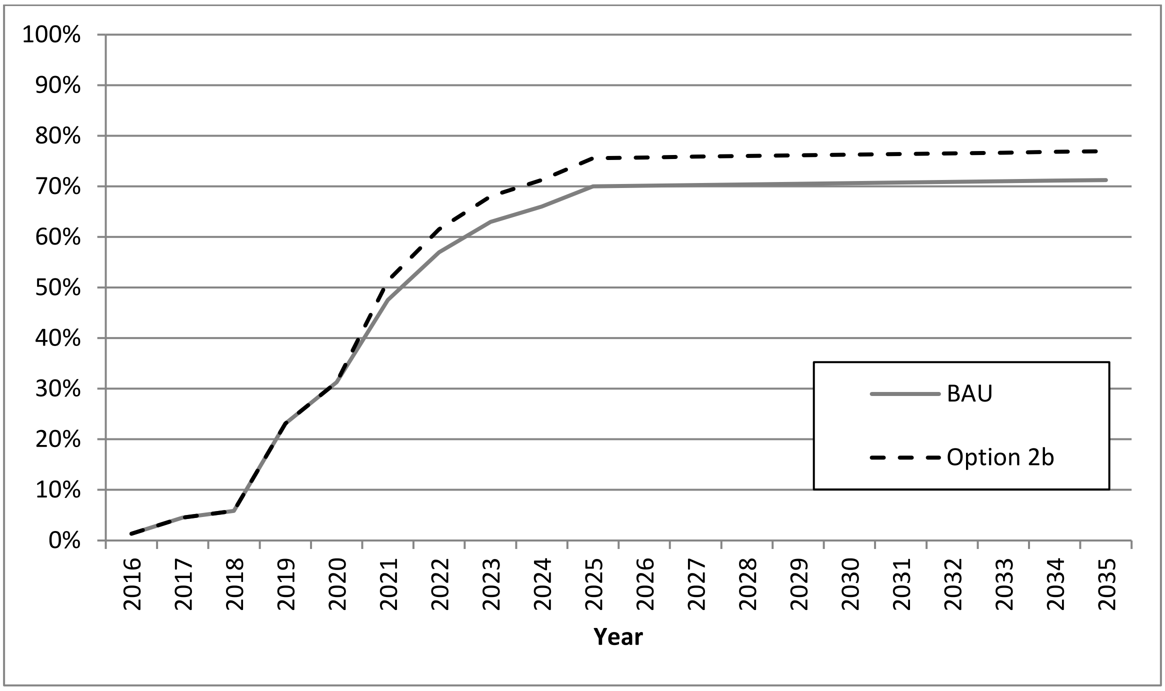

Figure 6 - Fitment via Option 2b compared to BAU

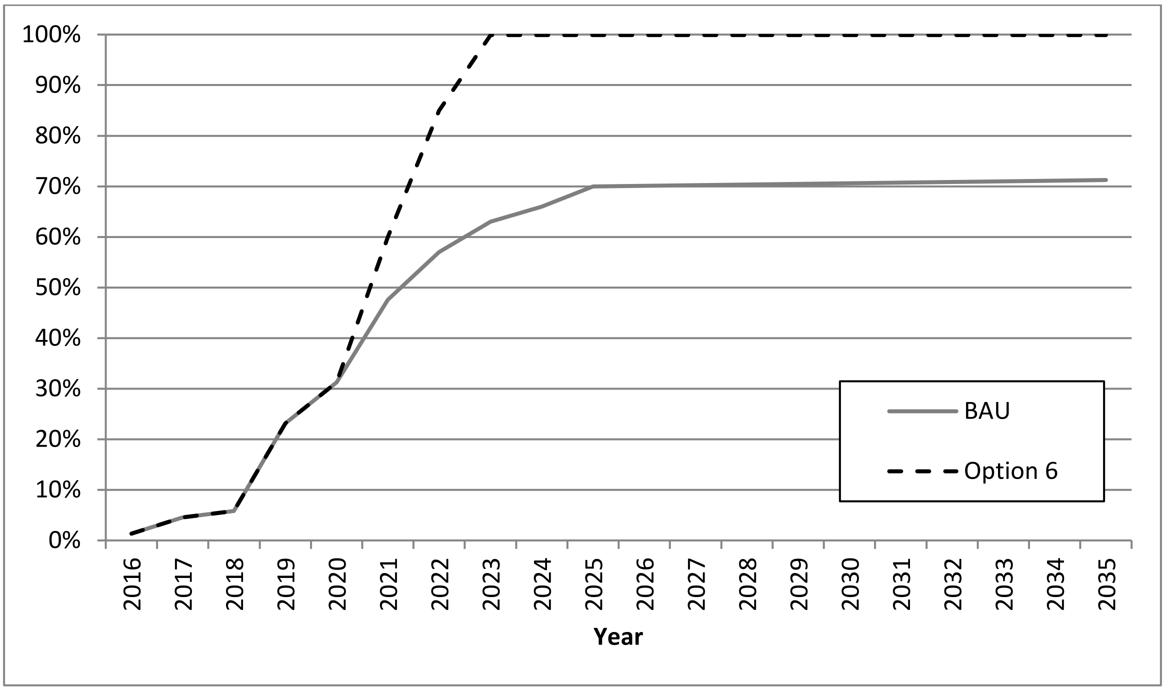

Figure 7 - Fitment via Options 6 (a and b) compared to BAU

Impact of AEB when fitted to a heavy vehicle

<u>Sensitivity</u>

Monash University Accident Research Centre (MUARC) reported on the impact of AEB for heavy vehicles in Australia. Crash and crash injury benefits were modelled on police reported crash data on crashes occurring in Australia between 2013-2016 inclusive. The classification of sensitive crashes, those potentially mitigated by AEB, was applied to crashes occurring in Australia. The analysis did not include crashes involving vulnerable road users such as pedestrians and cyclists. Though their inclusion would increase the percentage of sensitive crashes substantially, the agreed international standard for AEB does not yet include vulnerable road users so it was assumed that typical AEB systems currently in the fleet do not mitigate these crashes.

Around fifteen per cent (14.8 per cent) of all heavy vehicle crashes were classified as sensitive to avoidance or mitigation with AEB. This figure incorporates narrowly sensitive heavy vehicle crashes only, i.e., those crashes exhibiting a high degree of confidence that AEB would alleviate or mitigate the crash and not those crashes where there was only some or minor evidence.

MUARC found that, on average, for every sensitive fatal crash, 28 serious and 111 minor injury sensitive crashes also occurred.

Effectiveness

MUARC determined the effectiveness of AEB for heavy vehicles by building on empirical literature, as data to allow direct estimation of crash reductions associated with the technology from Australian heavy vehicle crash data was not available. Crash reductions in sensitive crashes associated with heavy vehicle AEB fitment estimated from existing international literature were between 22 and 57 per cent. The overall effectiveness of heavy vehicle AEB against trauma has been modelled using the lower end of this range.

Like other vehicle safety technologies, AEB effectiveness is expected to be 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 outcomes and for which data is available.

Though AEB effectiveness is typically higher in high severity (for example, highway/high-speed) crashes, low severity crashes occurring in lower speed areas are higher in frequency. This biases the expected effectiveness in an arbitrary crash towards lower ranges.

On the basis of the above, the adopted effectiveness values were 33 per cent for all sensitive trauma crashes and 43 per cent for higher severity (fatal and serious injury) crashes.

Overall Impact on Australian Heavy Vehicle Trauma

The overall impact of AEB when fitted against all heavy vehicle road trauma is the product of sensitivity and effectiveness. The result is 4.9 per cent effectiveness against all heavy vehicle trauma crashes, and 6.4 per cent against all heavy vehicle fatal and serious trauma crashes.

Crash Savings

The economic benefits of increased fitment of AEB (and where applicable ESC) to new Australian heavy 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 heavy vehicle AEB fitment were projected to have a modest positive effect on trauma alleviation over the modelled period. Option 2a is expected to save 12 lives, 339 serious injuries and 1,056 minor injuries amounting to trauma alleviation savings of approximately $68 million. Option 2b is expected to save 9 lives, 248 serious injuries and 773 minor injuries, amounting to trauma alleviation savings of approximately $39 million.

Regulation of AEB (and where applicable ESC) for heavy vehicles was projected to have a substantially greater effect. Option 6a was expected to yield the greatest trauma reductions of the base (AEB) options with 78 lives saved, 2,152 serious injuries and 6,697 minor injuries alleviated, which amounts to $269 million in trauma savings. Option 6b was expected to yield 69 lives saved, 1,891 serious injuries and 5,883 minor injuries alleviated, which amounts to $235 million in trauma savings. Expanding the base option 6a to include matching ESC fitment would save an additional 24 lives and prevent an additional 412 serious and 320 minor injuries, which amounts to $358 million in trauma savings.

Appendix 5 includes further detail on the calculation of road crash casualty reductions and the resulting trauma savings for each of the intervention options analysed. Table 9 summarises the road crash casualty 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 9: Summary of lives saved and serious and minor injuries avoided

	Lives saved	Serious injuries avoided	Minor injuries avoided
Option 1: no intervention	-	-	-
Option 2a: targeted awareness	12	339	1,056
Option 2b: advertising	9	248	773
Option 6a: regulation (broad scope)	78	2,152	6,697
Option 6a: regulation (broad scope) with matching ESC fitment	102	2,564	7,017
Option 6b: regulation (narrow scope)	69	1,891	5,883

Costs

System development costs

No additional system development cost was added for options 2a and 2b, as it was assumed that the heavy vehicle owners/operators persuaded by information campaigns to purchase heavy 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 6a and 6b. Preliminary industry consultation indicated that the incremental AEB development cost is reduced substantially due to prior fitment of 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 initially examined to cover validation and testing for certification, as well as a further $10,000 per model for additional/other regulatory expenses as an extension of a manufacturer's regulatory and certification administration process. During the consultation, the TIC suggested that the AEB validation test cost should be increased to $30,000 to $50,000 per model. The Department accepted this industry feedback, and raised the base testing and certification cost from $10,000 to $50,000 per model. Additional/other regulatory expenses of $10,000 per model were retained, as per the analysis in the consultation RIS.

System fitment cost

A wholesale AEB system fitment cost range from $1,000 (low/best case) to $2,000 (high/worst case) was adopted, with $1,500 used as the likely fitment cost. 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. 131, and not the more advanced systems that may be able to detect stationary objects, infrastructure, vulnerable road users such as pedestrians or cyclists, and flora and fauna. The fitment cost adopted was a conservative average of cost estimations obtained from survey responses from heavy vehicle manufacturers with regards to existing system fitment costs. The adopted fitment cost is conservative in comparison to other estimates of $300 to $400 for existing systems (MUARC, 2014).

Fitment costs were allocated for each additional heavy vehicle equipped with AEB as a consequence of government intervention under all options.

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, as well as for the National Heavy Vehicle Regulator (NHVR), WA and NT to develop processes for its in-service use, such as vehicle modification requirements. This includes the initial development cost, as well as ongoing maintenance and interpretation advice. The value of this cost was based on Department experience.

Summary of Costs

Table 10 provides a summary of the various costs associated with the implementation of Options 2a, 2b, 6a and 6b.

Table 10: Summary of costs associated with the implementation of each option

Costs related to:	Cost relative to BAU			Option(s)	Applicability	Impact
	Best Case	Likely Case	Worst Case			
Development of systems	$50,000	$75,000	$100,000	6a, 6b	Per model	Business
Fitment of systems	$1,000	$1,500	$2,000	2a, 2b, 6a, 6b	Per vehicle	Business
Testing of systems		$50,000		6a, 6b	Per model	Business
Certification of system		$10,000		6a, 6b	Per model	Business
Implement and maintain policy		$1,000,000		2a	Per year	Government
Implement and maintain policy		$18,000,000		2b	Per year	Government
Implement and maintain regulation		$50,000		6a, 6b	Per year	Government

Benefit-Cost Analysis Results

Appendix 5 details the calculations for the benefit-cost analysis. A summary of the results is provided below in Table 11. A 7 per cent discount rate was used for summarised options.

Table 11: Summary of benefits, costs, lives saved and serious injuries avoided under each option

Case	Gross Benefits ($m)	Net Benefits ($m)	Cost to Business ($m)	Cost to Government ($m)	BCR	Number of Lives Saved	Serious Injuries Avoided	Minor Injuries Avoided
				Option 2a				
Best		-9	49	27	0.9			
Likely	68	-34	74	27	0.7	12	339	1056
Worst		-58	99	27	0.5			
				Option 2b				
Best		-151	26	164	0.2			
Likely	39	-164	39	164	0.2	9	248	773
Worst		-177	52	164	0.2			
				Option 6a				
Best		123	145	0.50	1.8			
Likely	269	52	216	0.50	1.2	78	2152	6697
Worst		-19	288	0.50	0.9			
				Option 6a with matching ESC fitment				
Best		212	145	0.50	2.5			
Likely	358	141	216	0.50	1.6	102	2564	7017
Worst		71	288	0.50	1.4			
				Option 6b				
Best		108	126	0.50	1.9			
Likely	235	47	187	0.50	1.2	69	1891	5883
Worst		-15	250	0.50	0.9			

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 6a was also run with a rate of 3 per cent and 10 per cent. Table 12 shows that the net benefits and the BCR remained positive under all three discount rates.

Table 12: Impact on Net Benefits and BCR of changes to the real discount rate (Option 6a with matching ESC fitment)

	Net Benefits ($m)	BCR
Low discount rate (3%)	412	2.4
Base case discount rate (7%)	141	1.6
High discount rate (10%)	55	1.3

Next, the effectiveness of heavy 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 13, despite analysing an unrealistically low effectiveness (equivalent to the lowest rate reported by MUARC for the worst performing systems in the fleet), the net benefits and the BCR remained positive. It was noted that varying the effectiveness was less significant than varying the discount rate.

Table 13: Impact on Net Benefits and BCR of changes to effectiveness of AEB for heavy vehicles (Option 6a with matching ESC fitment)

	Net Benefits ($m)	BCR
Low effectiveness (-5%)	100	1.5
Base case effectiveness	141	1.6
High effectiveness (+5%)	182	1.8

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 heavy vehicle AEB systems. As shown in Table 14, the net benefits and the BCR remained positive in both the high and the low BAU fitment rate scenarios.

Table 14: Impact on Net Benefits and BCR of changes to the BAU fitment rate of AEB for heavy vehicles (Option 6a with matching ESC fitment)

	Net Benefits ($m)	BCR
Low BAU fitment rate (10% decrease)	158	1.6
Base case fitment rate	141	1.6
High BAU fitment rate (10% increase)	127	1.8

Finally, the fitment cost range was varied, incrementing the fitment cost range upwards by $500 to $1,500 - $2,500. The net benefits and BCRs remained positive, as shown in Table 15.

Table 15: Impact on Net Benefits and BCR of changes to unit fitment cost of AEB for heavy vehicles (Option 6a with matching ESC fitment)

	Net Benefits ($m)	BCR
Base case cost (likely)	141	1.6
High cost (Base case +$500)	71	1.2

Post-consultation analysis

During consultation, the TIC suggested that the benefit-cost analysis should be revised to include ESC validation test costs. To account for this other possible source of costs, a post-consultation sensitivity analysis was undertaken to evaluate the effects of ESC validation test costs up to $200,000 per model (see Table 16). Notably, less than a 4 per cent reduction in net benefits was observed for each $100,000 increase in the per model validation test cost and the benefit-cost ratios remained constant (to one decimal place). This indicates that the benefit-cost analysis is not particularly sensitive to variations in ESC validation test cost. Further, the recommended option remains the same.

Table 16: Impact on Net Benefits and BCR of increases in ESC validation test costs (Option 6a with matching ESC fitment)

	Net Benefits ($m)	BCR
Base case ($10,000 per model)	141	1.6
Increased cost (1) ($100,000 per model)	138	1.6
Increased cost (2) ($200,000 per model)	133	1.6

In addition, the BIC, Daimler Truck and Bus, the FCAI, HVIA, Knorr-Bremse Australia and the TIC all indicated more implementation time is needed and suggested alternative dates. A post-consultation sensitivity analysis was undertaken to evaluate the effects of changes in implementation timing (Table 17). Whilst the benefit-cost ratio improves slightly due to a reduced number of vehicles required to fit mandatory AEB, the postponed timing results in a 9 per cent reduction in lives saved and an almost 18 per cent reduction in total (gross) economic benefits.

Table 17: Impact on Gross Benefits and BCR of changes to implementation timing (Option 6a with matching ESC fitment)

	Gross Benefits ($m)	BCR
Base case implementation dates (Nov 2020 new models, Nov 2022 all vehicles)	358	1.6
Alternative implementation dates (November 2022 new models, January 2025 all vehicles)	304	1.9

4.2. Economic Aspects—Impact Analysis

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

Identification of Affected Parties

In the case of AEB (and where applicable ESC) systems for heavy vehicles, the parties affected by the options are:

Business

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

There is an overlap between businesses and consumers when considering heavy vehicles. Unlike light vehicles, heavy vehicle owners and operators, in general, are purchasing and operating these vehicles as part of a business. This is distinct to businesses that manufacture the vehicles or supply the components.

The affected businesses are represented by a number of peak bodies, including:

- The Australian Livestock and Rural Transporters Association (ALRTA), that represents road transport companies based in rural and regional Australia;
- The Australian Trucking Association (ATA), that represents trucking operators, including major logistics companies and transport industry associations;
- The Bus Industry Confederation (BIC), that represents the bus and coach industry;
- Commercial Vehicle Industry Association Australia (CVIAA); that represents members in the commercial vehicle industry;
- Heavy Vehicle Industry Australia (HVIA), that represents manufacturers and suppliers of heavy vehicles and their components, equipment and technology; and
- The Truck Industry Council (TIC), that represents truck manufacturers and importers, diesel engine companies and major truck component suppliers.

Governments

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

Impact of Viable Options

There were three options that were considered viable for further examination: Option 1: no intervention; Option 2: user information campaigns; 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 11 previously and are discussed in more detail below.

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.

Option 2: user information campaigns

Under this option, heavy vehicle owners and operators would be informed of the benefits of AEB for heavy 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>

Business — heavy vehicle owners/operators

There would be a direct benefit through a reduction in road crashes (over and above that of Option 1) for the heavy vehicle owners/operators who are persuaded by information campaigns to purchase and/or operate heavy vehicles equipped with AEB. This would save an estimated 12 lives and 339 serious and 1,056 minor injuries under Option 2a, and 9 lives and 248 serious and 773 minor injuries under Option 2b (over and above Option 1).
A proportion of these would be occupants of a heavy vehicle. 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.

Business — manufacturers/component suppliers

There would be no direct benefit to heavy vehicle manufacturers (as a collective). Heavy vehicle owners/operators persuaded by the campaign would simply choose from existing truck and trailer models already equipped with AEB. This could lead to some shift in market share between the respective heavy 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 heavy vehicles sold. Component suppliers may benefit directly in terms of increased income/revenue from supplying additional equipment to heavy 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 heavy vehicles and omnibuses equipped with AEB, achieved as a result of the information campaigns.

This would have benefits of $68 million under Option 2a and $39 million under Option 2b over and above Option 1. These benefits would be shared by the community and as cost savings to governments.

Costs

Business

There would be a direct cost (over and above that of Option 1) to the heavy vehicle owners/operators who are persuaded by information campaigns to purchase and/or operate heavy vehicles equipped with AEB. This is due to the additional cost of purchasing a vehicle equipped with these technologies. This is likely to cost $74 million for Option 2a and $39 million for Option 2b (over and above Option 1). The heavy vehicle owners/operators would be likely to absorb most of this cost (but, as noted above, would also receive a proportion of the benefits).

Governments

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

Option 6: regulation

As this option, including each of the sub options, involves direct intervention to compel a change in the safety performance of heavy 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 (and where applicable ESC) would no longer be a commercial decision within this changed environment.

Benefits

Business — heavy vehicle owners/operators

There would be a direct benefit through a reduction in road crashes (over and above that of Option 1) for the heavy vehicle owners/operators who purchase and/or operate new heavy vehicles equipped with AEB (and where applicable ESC) due to a mandated standard. This would save an estimated 78 lives and 2,152 serious and 6,697 minor injuries under Option 6a, 102 lives and 2,564 serious and 7,017 minor injuries under Option 6a with matching ESC fitment, and 69 lives and 1,891 serious and 5,883 minor injuries under Option 6b (over and above Option 1). A proportion of these would be occupants of heavy vehicles. 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.

Business — manufacturers/component suppliers

There would be no direct benefit to heavy vehicle manufacturers (over and above that of Option 1). Component suppliers would benefit directly in terms of increased income/revenue from supplying additional equipment to heavy vehicle and omnibus 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 heavy vehicles equipped with AEB (and where applicable ESC) systems due to a mandated standard. This would have benefits of $269 million under Option 6a, $358 million under Option 6a with matching ESC fitment, and $235 million under Option 6b (over and above Option 1). These benefits would be shared among the community and as cost savings to governments.

Costs

Business

There would be a direct cost to heavy vehicle manufacturers (over and above that of Option 1) as a result of design/development, fitment and testing costs for the additional heavy vehicles sold fitted with AEB (and where applicable ESC) due to a mandated standard. This would likely cost $216 million under Option 6a (including with matching ESC fitment) and $188 million under Option 6b (over and above Option 1). It is likely that manufacturers would pass this increase in costs on at the point of sale to heavy vehicle owners/operators 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 for each sub-option.

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 totalling 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 of the six viable options, Options 1, 2a, 2b, 6a and 6b are set out in the Tables 19 to 23. There are no costs associated with Option 1 as it is the BAU case. The average annual regulatory costs associated with base Options 2a, 2b, 6a and 6b are estimated to be $8.0 million, $4.0 million, $22.5 million and $19.1 million respectively.

Table 18: Regulatory burden and cost offset 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 19: Regulatory burden and cost offset 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	$8.0 m	-	-	$8.0 m

Table 20: Regulatory burden and cost offset 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	$4.0 m	-	-	$4.0 m

Table 21: Regulatory burden and cost offset estimate — Option 6a

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	Business	Community organisations	Individuals	Total change in costs
Total, by sector	$22.5 m	-	-	$22.5 m

Table 22: Regulatory burden and cost offset estimate — Option 6b

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	Business	Community organisations	Individuals	Total change in costs
Total, by sector	$19.1 m	-	-	$19.1 m

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.

Post-consultation sensitivity analysis

As noted in Section 4.1, the BIC, Daimler Truck and Bus, FCAI, HVIA, Knorr-Bremse Australia and the TIC all indicated more implementation time is needed and suggested alternative dates. The most extended of these was that proposed by the TIC, with a phase in from November 2022 to January 2025. Table 23 below shows that this timetable would reduce the average annual regulatory costs associated with the recommended option to $15.4 m.

Table 23: Regulatory burden and cost offset estimate — Recommended option with delayed implementation

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	Business	Community organisations	Individuals	Total change in costs
Total, by sector	$15.4 m	-	-	$15.4 m

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.

It is likely that under any new ADR the regulatory costs of the implemented option will fall in the range of $15.4 m (under the dates proposed by the TIC) to $22.5 m (under the indicative dates proposed in the consultation RIS).

6. WHAT IS THE BEST OPTION?

The following options were identified earlier in this RIS as being viable for analysis:

- Option 1: no intervention;
- Option 2: user information campaigns; and
- Option 6: mandatory standards under the MVSA and then RVSA (regulation).

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 6a: regulation (broad scope) with matching ESC fitment had the highest net benefit of the options examined, at $141 m for the likely case. This benefit would be spread over a period of around 45 years, including the assumed 15 year period of regulation followed by a period of around 30 years over which the overall percentage of heavy vehicles fitted with AEB and ESC in the fleet continues to rise as older vehicles without these technologies are deregistered at the end of their service life.

Options 6a: regulation (broad scope) and 6b: regulation (narrow scope) also had positive net benefits of $52 m and $47 m respectively for the likely case. However, Options 2a (targeted awareness) and 2b (advertising) had negative net benefits, which indicates the costs of implementing these options would exceed the benefits.

6.2. Benefit-Cost Ratios

Option 6a with matching ESC fitment had the highest BCR of 1.6 (likely case).

Options 6a and 6b also both had a favourable BCR of 1.2 (likely case). However, Options 2a (targeted awareness) and 2b (advertising) had BCRs less than 1, which indicates the costs of implementing these options would exceed the benefits.

6.3. Casualty Reductions

Option 6a with matching ESC fitment would provide the greatest reduction in road crash casualties, including 102 lives saved and 2,564 serious and 7,017 minor injuries avoided. The next best reduction in casualties would be for the base option 6a, with 78 lives saved and 2,152 serious and 6,697 minor injuries avoided, followed by Option 6b with 69 lives saved and 1,891 serious and 5,883 minor injuries avoided.

The road casualty reductions for user information campaigns would be much lower than regulation, with 12 lives saved and 339 serious and 1,056 minor injuries avoided under option 2a, and only nine lives saved and 248 serious and 773 minor injuries avoided under option 2b.

6.4. Recommendation

This RIS identified the road safety problem in Australia of crashes involving a heavy vehicle impacting the rear of another vehicle, which can be substantially alleviated via fitment of AEB. Although market uptake is increasing, the current overall fitment across the fleet is still relatively low with around 6 per cent of new heavy vehicles fitted with AEB. The current low fitment rate and the number and severity of rear-end crashes indicates a need for intervention.

There is a strong case for government intervention to increase the fitment of AEB to heavy vehicles via broad scope regulation. Analysis shows that such an intervention will provide significant reductions in road trauma while achieving the maximum net benefit for the community.

Of the base (AEB) options considered, Option 6a (regulation – broad scope) provides the largest net benefit ($78 million) as well as the greatest reduction in road crash casualties, including 78 lives saved and 2,152 serious and 6,697 minor injuries avoided. In terms of efficiency of regulation, the BCR for Option 6a is 1.2.

Expanding the base option 6a to incorporate ESC requirements for all vehicle categories covered by a broad scope AEB regulation (Option 6a with matching ESC fitment) eliminates the cost of separate ESC fitment for those categories where ESC is a sub-component of AEB and so substantially reduces costs through shared system componentry. While having minimal overall cost effects on Option 6a, expanding ESC requirements to the covered vehicle categories would save an additional 24 lives and prevent an additional 412 serious and 320 minor injuries. This represents additional savings to society of $89 million, and in combination with the Option 6a requirements for AEB, raises the total net benefits to $141 million and the BCR to 1.6.

Manufacturers and operators are likely to be impacted via additional AEB fitment costs for new heavy vehicles. However such businesses also receive substantial benefits. Heavy vehicle crashes are relatively expensive on average, due to the size and mass of these vehicles. Crash alleviation will play an important role in contributing to Australia's freight productivity and the success of the heavy vehicle industry.

Option 6a with matching ESC fitment offers the important advantage of being able to guarantee 100 per cent fitment of AEB and ESC to applicable vehicles. There would be no guarantee that non-regulatory options, such as Option 2, would deliver an enduring result, or that the predicted take-up of AEB (or ESC) would be reached and then maintained. Given there is currently a low uptake of this technology, there is good reason to conclude that, under BAU, sections of the market will continue to offer AEB and/or ESC only as an extra – often as part of a more expensive package of optional upgrades. If regulation had to be considered again in the future, there would also be a long lead time (likely to be greater than two years to redevelop the proposal, as well as the normal implementation, programming, development, testing and certification time necessary for implementing systems in line with a performance based standard).

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. Option 6a - regulation (broad scope) with matching ESC fitment is therefore the recommended option. It represents an effective option that would guarantee on-going provision of improved rear impact outcomes in the new heavy vehicle fleet in Australia.

6.5. Impacts

Business/consumers

The three options considered would have varying degrees of impact on consumers, business and the government. The costs to manufacturers would be passed on to operators (purchasers of new heavy vehicles) who would mostly absorb them. Much of the benefit would be directly received by heavy vehicle operators through reductions in road trauma and other road crash related costs, with the remainder shared between governments and the wider community.

Option 6 may normally be considered the most difficult option for the vehicle manufacturing industry, because it would involve regulation-based development and testing with forced compliance for all applicable models. However, in the case of AEB and ESC, Europe and Japan have each mandated standards for these systems on heavy vehicles. This would give manufacturers flexibility to adapt many AEB and ESC systems from their home markets to the vehicles they supply in Australia. This should enable some leveraging of testing and certification already conducted in other markets, which will help to minimise design and development costs as much as possible.

Governments

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.

6.6. Scope of the Recommended Option

The relevant international standard for AEB systems on heavy vehicles is the UN Regulation No. 131. The vehicle categories for which this regulation applies are the UN vehicle categories of M2 and M3 (omnibuses), and N2 and N3 (goods vehicles — GVM exceeding 3.5 tonnes). There are various exemptions recommended in the introduction of this regulation, and which have been adopted in other markets including the European Union (EU) and Japan. For example, in Europe there are exemptions for semi-trailer towing vehicles with a maximum mass not exceeding 8 tonnes (uncommon vehicles in Australia), buses with provision for standing passengers, vehicles with more than three axles, vehicles designed for off-road use and certain other special purpose vehicles.

A new ADR 97/00 would be implemented to require AEB for new omnibuses, and new goods vehicles greater than 3.5 tonnes GVM. These vehicles are represented by ADR vehicle categories MD, ME, NB and NC. The relevant ADR categories are summarised in Appendix 1. Exemptions from fitment of AEB would apply under ADR 97/00 for articulated and route service buses, and trucks and buses which have four or more axles and/or are ‘designed for off-road use’ (note: ‘designed for off-road use’ would be defined for relevant vehicle categories in an appendix to the ADR). Further exemptions may be given according to 19(3) of the RVSA for special purpose vehicles that comply with the ADRs to an extent that makes them suitable for use on a public road in Australia.

The relevant international standard for ESC systems on heavy vehicles is the UN Regulation No. 13, and the heavy vehicle categories for which stability control requirements apply under this regulation are the UN vehicle categories of M2 and M3 (omnibuses), N2 and N3 (goods vehicles — GVM exceeding 3.5 tonnes), as well as O3 and O4 (trailers — GTM exceeding 3.5 tonnes). There are various exemptions, including for buses with provision for standing passengers, articulated buses, vehicles with more than three axles, and vehicles designed for off-road use.

ESC will become mandatory from 1 November 2020 for new model heavy prime movers and their short-wheelbase derivatives as well as heavy buses. Expanding the existing ESC requirements to all vehicle categories covered by a broad scope AEB regulation would eliminate the cost of separate ESC fitment for those vehicles where ESC is a sub-component of AEB and so would substantially reduce costs through shared system components.

The existing ADR 35/06 ESC requirements would be expanded to apply to all vehicle categories covered by a broad scope AEB regulation. This would be implemented by adopting the same requirements as for short-wheelbase derivatives of prime movers (i.e. functional requirements only), for the expanded set of heavy vehicles through a new ADR 35/07. This would keep the certification requirements relatively simple and so would not add to the regulatory burden for these types of vehicles. It would be in line with the reduced crash risk of these types of vehicles in the first place, in part due to the relatively better stability of a rigid vehicle over an articulated one (e.g. prime mover). Exemptions from the mandatory fitment of ESC would continue to apply under the new ADR 35/07 for articulated and route service buses, and ADR category NC trucks which have four or more axles, as well as trucks and buses which are ‘designed for off-road use’ (note: ‘designed for off-road use’ would be defined for relevant vehicle categories in an appendix to the ADR).

6.7. Timing of the Recommended Option

The proposed implementation timeframe for consultative purposes was:

- 1 November 2020 for new model vehicles; and
- 1 November 2022 for all 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. Final implementation dates (and therefore also final annual regulatory costs) will be determined by the Government as part of the relevant ADRs, following further consultation by the Department with industry on alternative implementation dates.

7. CONSULTATION

7.1. General

Development of the ADRs for safety and anti-theft under the MVSA and RVSA is the responsibility of the Vehicle Safety Standards 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.

The Department undertakes public consultation on significant proposals. 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), Transport and Infrastructure Senior Officials' Committee (TISOC) and the Transport and Infrastructure Council (the Council).

- 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).
- TISOC 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.
- The Council 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 still the principal consultative forum for advising on the more detailed aspects of ADR proposals.

7.2. Public Comment

The publication of an exposure draft 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 submitting their comments to the Department. Analysing proposals through the RIS process assists stakeholders in identifying the likely impacts of the proposals and enables more informed discussion on any issues.

In line with the Australian Government Guide to Regulation (2014) the proposal was circulated for a six-week public comment period, which closed 4 October 2019. Formal feedback was received from the following organisations and individuals:

State governments

Department of Transport and Main Roads (TMR) QLD

NSW Government – Transport for NSW

Industry

Bus Industry Confederation (BIC)

Daimler Truck and Bus

Federal Chamber of Automotive Industries

Heavy Vehicle Industry Association (HVIA)

Knorr-Bremse Australia

Truck Industry Council (TIC)

Road users / heavy vehicle operators

Australian Automobile Association (AAA)

Australian Trucking Association (ATA)

Boral Logistics

National Road Transport Association (NatRoad)

Toll Group

Consumer

Australasian New Car Assessment Program (ANCAP)

Individuals

Andrew Corney

Brett Green

Camille Jago

TMR QLD, the NSW Government, the BIC, Daimler Truck and Bus, HVIA, the AAA, the ATA, Boral Logistics, Toll Group, Andrew Corney, ANCAP, and Camille Jago all supported Option 6a (regulation – broad scope) in the RIS. NatRoad and Brett Green both supported Option 1 (no intervention). Brett Green recommended light vehicle driver education and advertising campaigns and increased police action in regard to light vehicle driver behaviour around heavy vehicles. NatRoad recommended further research on AEB and proposed a new option to require AEB to be fitted to vehicles meeting Euro VI emissions standards only. The FCAI and the TIC were both supportive of AEB as a technology which offers significant road safety benefits.

TMR QLD, the NSW Government, HVIA, the AAA, the ATA, Boral Logistics, and ANCAP all also indicated support for Option 6a with matching ESC fitment. NatRoad, while not supporting a broad scope AEB regulation, also supported mandating ESC for the broader range of heavy vehicles proposed in the RIS.

The TIC also supported broadening uptake of ESC on trucks, but suggested that the benefit-cost analysis should be revised to include further ESC costs. The Department conducted a post-consultation sensitivity analysis to evaluate the effects of ESC validation test costs up to $200,000 per model (see Table 16 in Section 4.1). Notably, less than a 4 per cent reduction in net benefits was observed for each $100,000 increase in the per model validation test cost and the benefit-cost ratios remained constant (to one decimal place). This indicates that the benefit-cost analysis is not particularly sensitive to variations in ESC validation test cost.

The BIC supported exemptions for buses carrying standees and unrestrained passengers and the TIC supported exemptions for trucks with four or more axles, off-road/all-wheel drive trucks and special purpose vehicles to align with the European exemptions. The Department updated the RIS post consultation to clarify the exemptions that would apply under the recommended option and how these would align with those in Europe.

In terms of implementation timing, there was support from several stakeholders for the dates proposed in the consultation RIS. However, the BIC, Daimler Truck and Bus, the FCAI, HVIA, Knorr-Bremse Australia and the TIC suggested longer lead times will be needed and proposed extended implementation timetables. The most extended of these was that proposed by the TIC, with applicability dates of 1 November 2022 for new models and 1 January 2025 for all (new) vehicles. Further, both the BIC and the TIC recommended that the introduction of AEB be aligned with the introduction of Euro VI (and equivalent) emissions standards for heavy vehicles.

As noted earlier in the RIS, the Department will consult further with peak industry bodies on implementation timing, and final implementation dates will be determined by the Government as part of the relevant ADRs. To ensure that the decision is fully informed by the RIS, an additional sensitivity analysis was conducted based on the dates proposed by the TIC (see Table 17 in Section 4.1). Under this alternative implementation scenario, Option 6a with matching ESC fitment would still provide a substantial positive net benefit and remains the recommended option.

A more detailed summary of public comment together with Department responses is included at Appendix 8.

8. IMPLEMENTATION AND EVALUATION

New ADRs or amendments to the ADRs can be determined by the responsible minister under section 7 of the MVSA or 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. The new ADRs 97/00 and 35/07 to implement the recommended option 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 regularly publishes road crash statistics for Australia, including quarterly and annual summaries of trauma from road crashes in which one or more heavy trucks or buses were involved. Each state and territory also publishes police reported road crash data, including for crashes involving heavy 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 addition, UN Regulation No. 131 includes a clause specifying that requirements will be reviewed before 1 November 2021. UN regulations are revised on an ongoing basis and so in time it may be possible to expand the requirement to specifically detect road users such as pedestrians and cyclists. The Department reviews adopted regulations in line with UN amendments as they become available.

9. CONCLUSION AND RECOMMENDED OPTION

Heavy vehicle rear impact crashes are the specific road safety problem that has been considered in this RIS. These crashes cost the community $200 million annually. Heavy vehicle AEB systems are a mature technology capable of mitigating rear impact crashes.

This RIS examined the case for government intervention to increase fitment rates of AEB for new heavy vehicles. Research shows that AEB is relevant to 14.8 per cent of all heavy vehicle trauma crashes, and if fitted in such crashes reduces trauma by up to 57 per cent. In Australia, around 6 per cent of new heavy vehicles are fitted with AEB. Though fitment is mandatory in the major market of Europe, this has not strongly influenced the fitment rate in the Australian market.

This RIS considered five intervention options in addition to the BAU case to increase fitment of AEB to the heavy vehicle fleet. It found the most significant (and only positive) net benefits are to be gained by mandating AEB fitment for new heavy vehicles. This could not otherwise be realised either through the business as usual approach or various other non-regulatory options such as user information campaigns.

Option 6a: regulation (broad scope) generated the highest net benefits ($52 million) of the base (AEB) options examined as well as the highest number of lives saved (78) and serious injuries avoided (2,152), with a likely BCR of 1.2 (best case up to 1.8). Expanding the base option 6a to incorporate ESC requirements for all vehicle categories covered by a broad scope AEB regulation (Option 6a with matching ESC fitment), would save an additional 24 lives and prevent an additional 412 serious and 320 minor injuries. This represents additional savings to society (gross benefits) of $89 million, and in combination with the Option 6a requirements for AEB, raises the total net benefits to $141 million and the likely BCR to 1.6 (best case up to 2.5).

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 6a - regulation (broad scope) with matching ESC fitment is the recommended option. Under this option, fitment of AEB and ESC would be mandated for new omnibuses, and for new heavy goods vehicles greater than 3.5 tonnes Gross Vehicle Mass (GVM).

A draft RIS was released for a six-week public consultation period, which closed 4 October 2019. The majority of feedback received during this period strongly supported the implementation of Option 6a, including in many cases with matching ESC fitment. The proposed implementation timing for consultative purposes was:

- 1 November 2020 for new model vehicles; and
- 1 November 2022 for all new vehicles.

During the consultation period, the BIC, Daimler Truck and Bus, the FCAI, HVIA, Knorr-Bremse Australia and the TIC proposed an extended implementation timetable. The most extended of these was that proposed by the TIC, with a phase in from November 2022 to January 2025. The effect of extending the implementation timetable was examined in a sensitivity analysis, which showed there would still be a positive net benefit for the dates proposed by the TIC.

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. However, in this case offsets will be identified to reduce or eliminate this cost through other harmonisation and/or deregulation initiatives.

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

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APPENDIX 1 - HEAVY 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.

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* (Heavy Vehicles).

OMNIBUSES (M)

A passenger vehicle having more than 9 seating positions, including that of the driver.

An omnibus comprising 2 or more non-separable but articulated units shall be considered as a single vehicle.

LIGHT OMNIBUS (MD)

An omnibus with a '*Gross Vehicle Mass*' not exceeding 5.0 tonnes.

Sub-category

MD1 – up to 3.5 tonnes '*Gross Vehicle Mass*'

MD2 – up to 3.5 tonnes '*Gross Vehicle Mass*'

MD3 – over 3.5 tonnes, up to 4.5 tonnes '*Gross Vehicle Mass*'

MD4 – over 4.5 tonnes, up to 5 tonnes '*Gross Vehicle Mass*'

MD5 – up to 2.7 tonnes '*Gross Vehicle Mass*'

MD6 – over 2.7 tonnes, up to 5 tonnes '*Gross Vehicle Mass*'

HEAVY OMNIBUS (ME)

An omnibus with a '*Gross Vehicle Mass*' exceeding 5.0 tonnes.

GOODS VEHICLES (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.

A vehicle constructed for both the carriage of persons and the carriage of good shall be considered to be primarily for the carriage of goods if the number of seating positions times 68 kg is less than 50 per cent of the difference between the '*Gross Vehicle Mass*' and the '*Unladen Mass*'.

The equipment and installations carried on certain special-purpose vehicles not designed for the carriage of passengers (crane vehicles, workshop vehicles, publicity vehicles, etc.) are regarded as being equivalent to goods for the purposes of this definition.

A goods vehicle comprising two or more non-separable but articulated units shall be considered as a single vehicle.

MEDIUM GOODS VEHICLE (NB)

A goods vehicle with a '*Gross Vehicle Mass*' exceeding 3.5 tonnes but not exceeding 12.0 tonnes.

Sub-category

NB1 – over 3.5 tonnes, up to 4.5 tonnes '*Gross Vehicle Mass*'

NB2 – over 4.5 tonnes, up to 12 tonnes '*Gross Vehicle Mass*'

HEAVY GOODS VEHICLE (NC)

A goods vehicle with a '*Gross Vehicle Mass*' exceeding 12.0 tonnes.

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 Heavy 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 heavy vehicle fleet. Unlike the examples given in Appendix 3, heavy 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:

1) 14 million brochures were published in English, Japanese, Chinese, Korean & Malay and were distributed to airports, airlines, duty free outlets and travel agents
2) 1200 Posters, 1700 counter top signs, 57000 pocket cards, 36 banners and 5000 information kits were prepared.
3) Radio and television Interviews
4) Items in news bulletins
5) Advertising in major metropolitan and regional newspapers
6) A website, hotline number and email address were established to provide travellers with a ready source of information.

7) 5 million resealable plastic bags were distributed to international airports
8) 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 Heavy 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 heavy vehicle campaign be run, there would be a similar narrow target market; new heavy vehicle and bus 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 heavy vehicle sales locations and in print media (e.g. magazines) specifically covering heavy vehicles.

The scale of the above example would be too large for a campaign targeting an Australian heavy 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. 131 PERFORMANCE REQUIREMENTS

Warning and activation for a stationary target

A summary of the requirements of the Stationary Target Test Type 1 and Type 2 are shown in Table 24 and Table 25 respectively. The subject vehicle is travelling at a speed of 80 km/h and is at a distance of at least 120m from the stationary target. The subject vehicle to target centreline offset of not more than 0.5m. The total speed reduction of the subject vehicle, specified in the Emergency Braking Phase, is at the time of impact with the stationary target.

Table 24: Stationary Target Test Type 1

Target 0km/h			
ADR Subcategory (Subject Vehicle) 80km/h	**Collision Warning Phases** Total speed reduction shall not exceed 15 km/h or 30 per cent of the total subject vehicle speed reduction		**Emergency Braking Phase**
	At least 1 warning not later than 1.4 s before emergency braking phase	At least 2 warnings not later than 0.8 s before emergency braking phase	This phase shall not start before a Time To Collision (TTC) of 3 s or less
NC	Haptic or Acoustic	Haptic or Acoustic	Speed reduction ≥ 20 km/h
NB > 8 Tonnes	Haptic or Acoustic	Haptic or Acoustic	Speed reduction ≥ 20 km/h
NB ≤ 8 Tonnes With pneumatic braking systems	Haptic or Acoustic	Haptic or Acoustic	Speed reduction ≥ 20 km/h
ME With pneumatic braking systems	Haptic or Acoustic	Haptic or Acoustic	Speed reduction ≥ 20 km/h
MD With pneumatic braking systems	Haptic or Acoustic	Haptic or Acoustic	Speed reduction ≥ 20 km/h

Table 25: Stationary Target Test Type 2

Target 0km/h *Manufacturers may elect to gain vehicle Type Approval to requirements in Stationary Target Test Type 1			
ADR Subcategory (Subject Vehicle) 80 km/h	**Collision Warning Phases** Total speed reduction shall not exceed 15 km/h or 30 per cent of the total subject vehicle speed reduction		**Emergency Braking Phase**
	At least 1 warning not later than 0.8 s before emergency braking phase	At least 2 warnings before emergency braking phase	This phase shall not start before a Time To Collision (TTC) of 3 s or less
*NB ≤ 8 Tonnes With hydraulic braking systems	Haptic or Acoustic or Optical	Haptic or Acoustic or Optical	Speed reduction ≥ 10 km/h
ME With hydraulic braking systems	Haptic or Acoustic or Optical	Haptic or Acoustic or Optical	Speed reduction ≥ 10 km/h
*MD With hydraulic braking systems	Haptic or Acoustic or Optical	Haptic or Acoustic or Optical	Speed reduction ≥ 10 km/h

Warning and activation for a moving target

A summary of the requirements of the Moving Target Test Type 1 and Type 2 are shown in Table 26 and Table 27 respectively. The subject vehicle is travelling at a speed of 80 km/h, the moving target at 12 km/h (or 67 km/h), and a separation distance of at least 120m between them. The subject vehicle to target centreline offset of not more than 0.5m. The Emergency Braking Phase shall result in the subject vehicle not impacting with the moving target.

Table 26: Moving Target Test Type 1

Target 12km/h			
ADR Subcategory (Subject Vehicle) 80km/h	**Collision Warning Phases** Total speed reduction shall not exceed 15 km/h or 30 per cent of the total subject vehicle speed reduction		**Emergency Braking Phase**
	At least 1 warning not later than 1.4 s before emergency braking phase	At least 2 warnings not later than 0.8 s before emergency braking phase	This phase shall not start before a Time To Collision (TTC) of 3 s or less
NC	Haptic or Acoustic	Haptic or Acoustic	No Impact
NB > 8 Tonnes	Haptic or Acoustic	Haptic or Acoustic	No Impact
NB ≤ 8 Tonnes With pneumatic braking systems	Haptic or Acoustic	Haptic or Acoustic	No Impact
ME With pneumatic braking systems	Haptic or Acoustic	Haptic or Acoustic	No Impact
MD With pneumatic braking systems	Haptic or Acoustic	Haptic or Acoustic	No Impact

Table 27: Moving Target Test Type 2

Target 67km/h ***Manufacturers may elect to gain vehicle Type Approval to requirements in Moving Target Test Type 1**			
ADR Subcategory (Subject Vehicle) 80km/h	**Collision Warning Phases** Total speed reduction shall not exceed 15 km/h or 30 per cent of the total subject vehicle speed reduction		**Emergency Braking Phase**
	At least 1 warning not later than 0.8 s before emergency braking phase	At least 2 warnings before emergency braking phase	This phase shall not start before a Time To Collision (TTC) of 3 s or less
*NB ≤ 8 Tonnes With hydraulic braking systems	Haptic or Acoustic or Optical	Haptic or Acoustic or Optical	No Impact
ME With hydraulic braking systems	Haptic or Acoustic or Optical	Haptic or Acoustic or Optical	No Impact
*MD With hydraulic braking systems	Haptic or Acoustic or Optical	Haptic or Acoustic or Optical	No Impact

False reaction test

A summary of the requirements of the False Reaction Test is shown in Table 28. The subject vehicle is travelling at a speed of 50 km/h, two stationary targets with a distance of 4.5m between them shall be positioned to face in the same direction of travel as the subject vehicle. The rear of both target vehicles shall be aligned with the other.

The subject vehicle shall travel for a distance of at least 60m, at 50 km/h, to pass centrally between the two stationary targets. The AEB system shall not provide a collision warning and shall not initiate the emergency braking phase.

Table 28: False Reaction Test with Two Stationary Targets

Two Targets 0km/h (4.5m apart)			
ADR Subcategory (Subject Vehicle) 50km/h	**Collision Warning Phases** Total speed reduction shall not exceed 15 km/h or 30 per cent of the total subject vehicle speed reduction		**Emergency Braking Phase**
NC , NB , ME , MD	No warning provided	No warning provided	No emergency braking applied

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. Table 36 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. 131 were established for each year between 1968 and 2018 inclusive, utilising available Australian Bureau of Statistics Motor Vehicle Census (report series 9309.0) data (Australian Bureau of Statistics, 2017a), and registrations per capita for years prior to availability of census data (Figure 8):

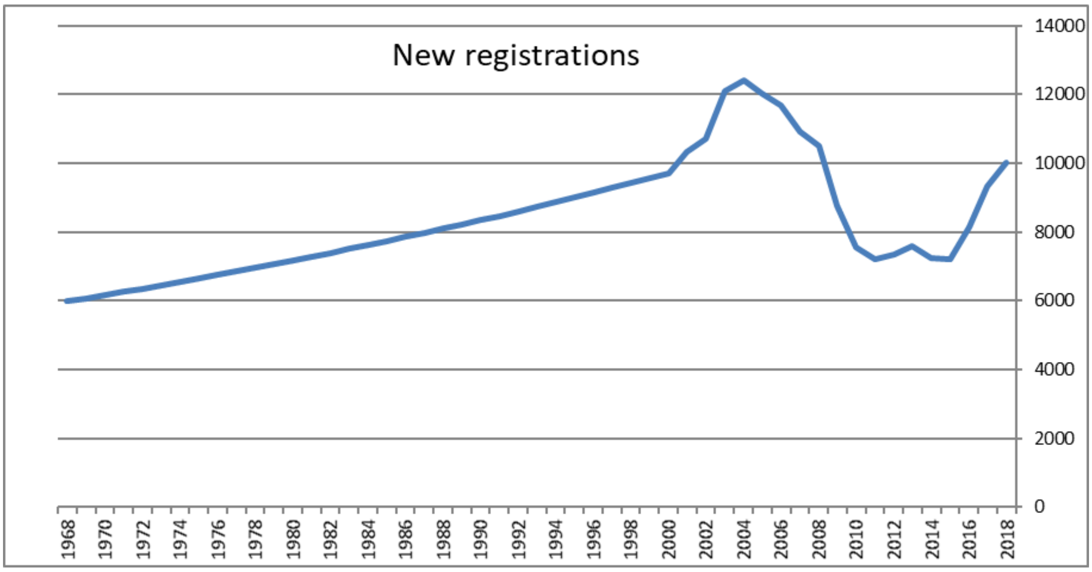

Figure 8: New Australian heavy vehicle registrations, categories covered by UN Regulation No. 131 to 2018.

2. Data from MUARC 2020 was used to determine the typical crash frequency by age for vehicle categories covered by UN Regulation No. 131 (Figure 9):

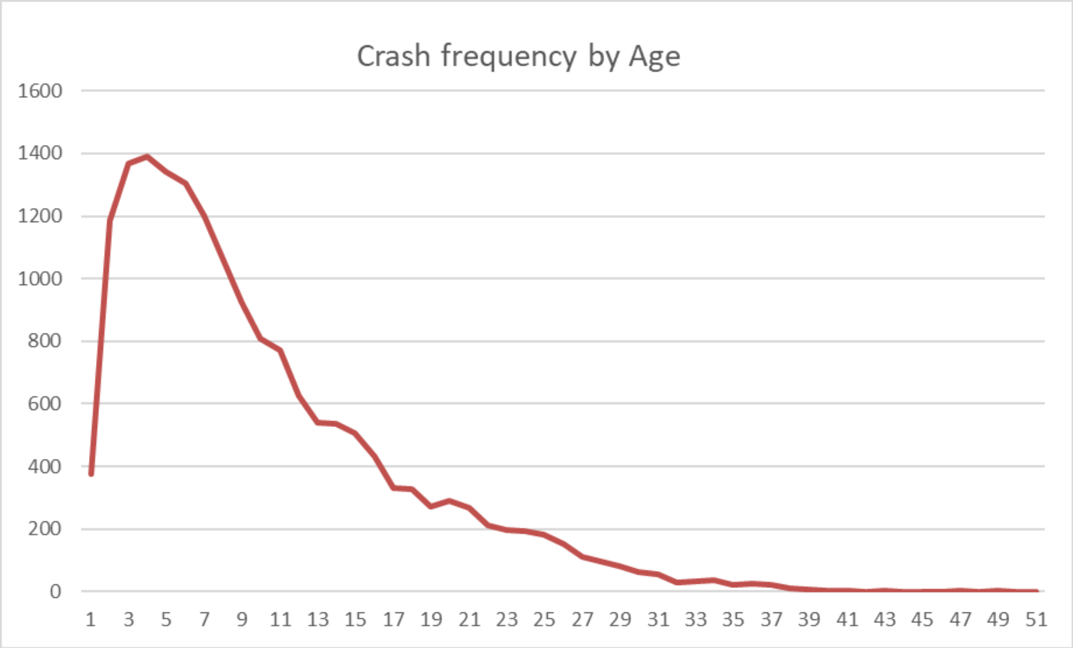

Figure 9: Crash frequency by vehicle age, categories covered by UN Regulation No. 131.

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 10):

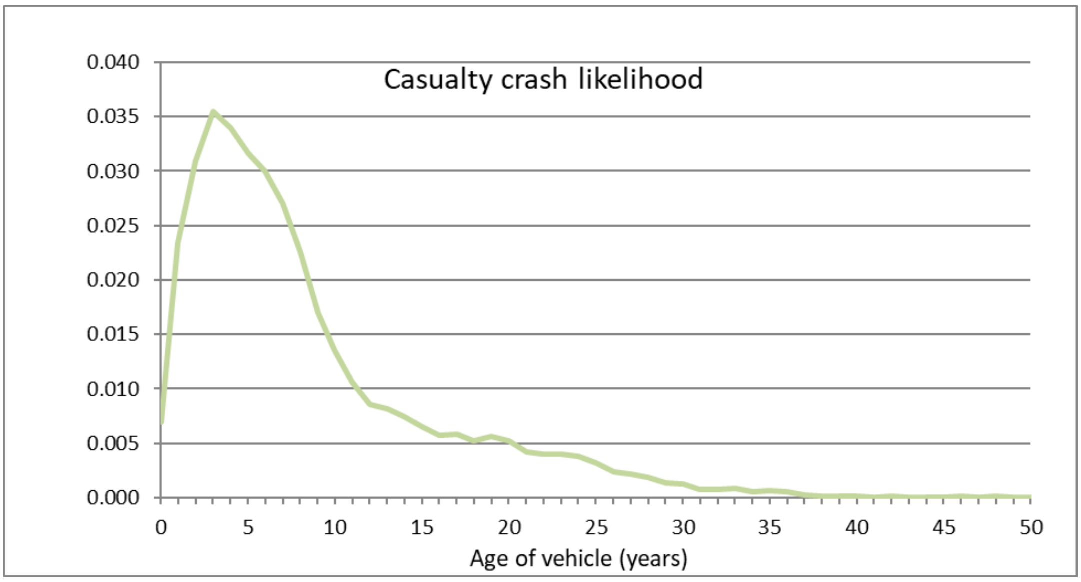

Figure 10: Crash likelihood by vehicle age, categories covered by UN Regulation No. 131.

4. Recent new vehicle combined sales data for the relevant vehicle categories was established (Figure 11):

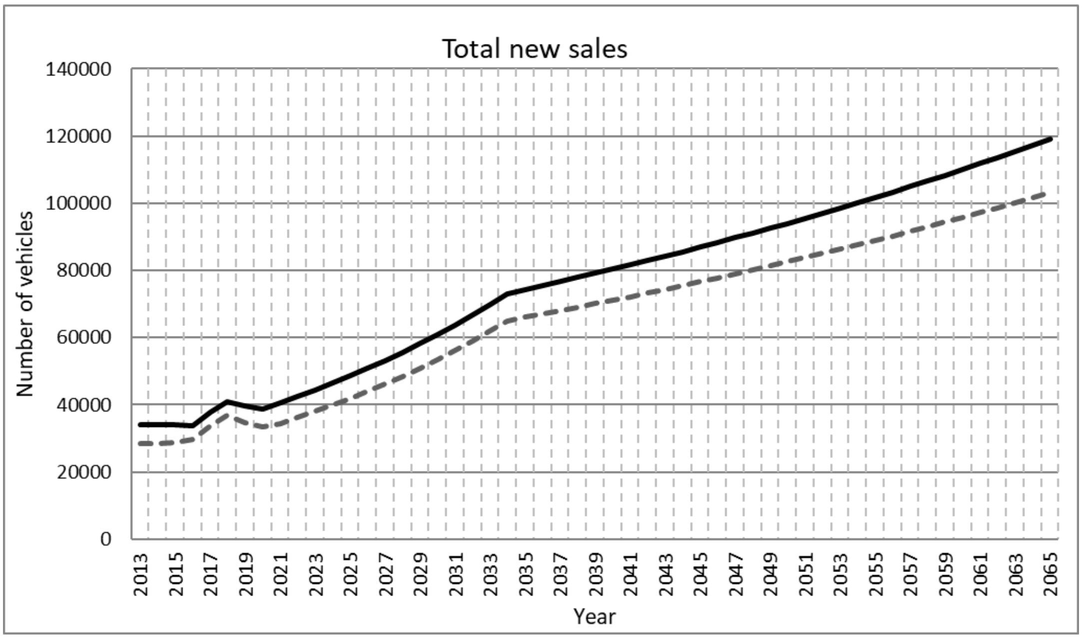

Figure 11: Past and projected vehicle sales; Option 6b (dashed), other options (solid).

Short to medium term forecast sales were obtained from industry bodies, beyond which growth rates were projected from NTC statistics (*Who moves what where*, 2016), heavy duty vehicle industry (*Heavy Duty sales,* 2018), Bus Industry Council's *National Technical Suppliers Summit 2017* and VFACTS.

5. The projected increased fitment rates at sale was established for each intervention option (solid line – BAU) (Figures 12 to 14):

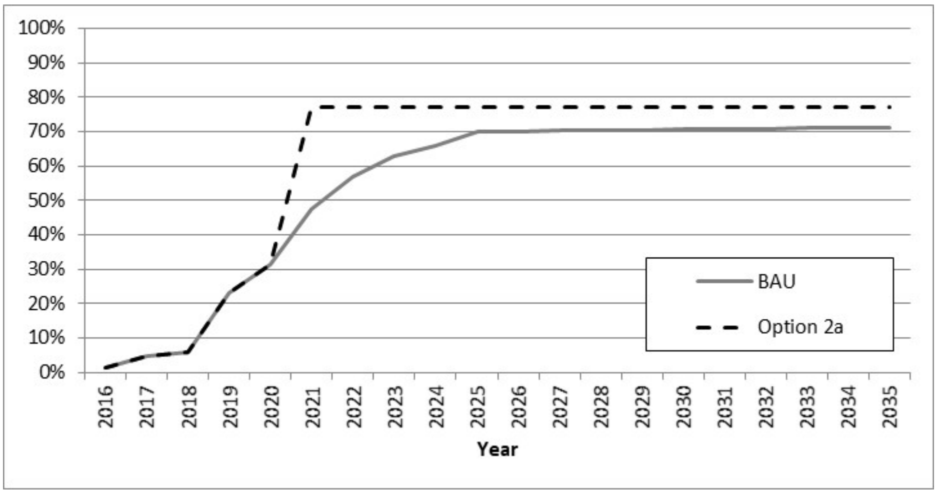

Figure 12: Projected fitment effect, Option 2a

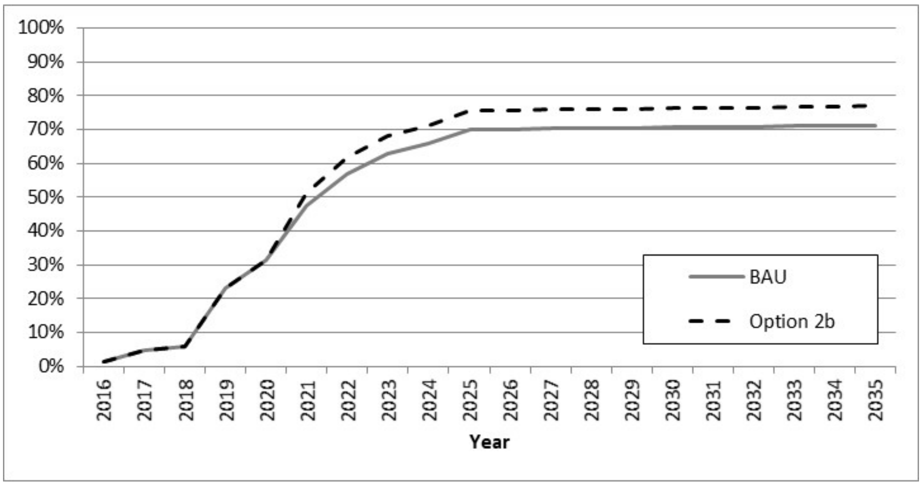

Figure 13: Projected fitment effect, Option 2b

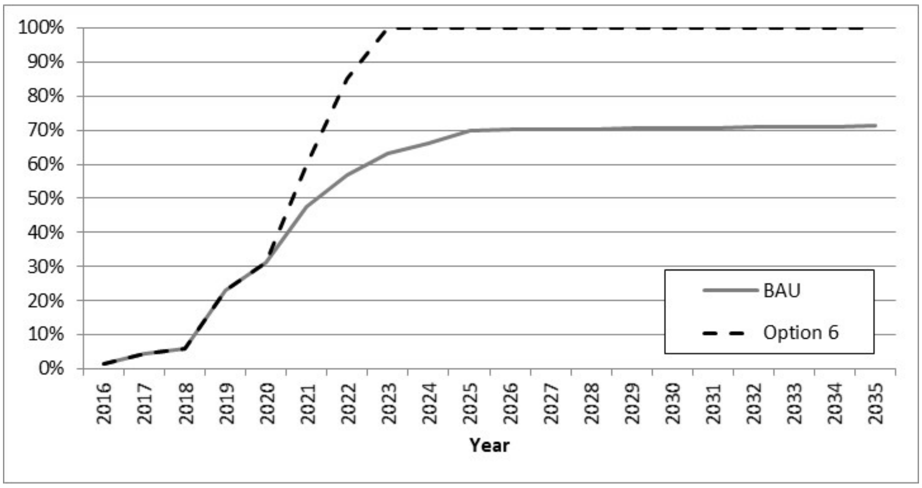

Figure 14**: Projected fitment effect, Option 6a, 6b**

6. From sales data (step 4) and fitment data (step 5), determine the fitment increase by year due to each option (Table 29):

	Fitment Increase at Sale			
Year	Option 2a	Option 2b	Option 6a	Option 6b
2021	11,944	1,544	5,045	4,287
2022	8,488	1,935	11,884	10,140
2023	6,215	2,237	16,380	14,032
2024	5,107	2,452	15,740	13,535
2025	3,400	2,720	14,523	12,535
2026	3,493	2,851	15,130	13,107
2027	3,589	2,988	15,763	13,705
2028	3,685	3,132	16,424	14,329
2029	3,784	3,283	17,114	14,982
2030	3,883	3,442	17,834	15,664
2031	3,985	3,609	18,585	16,377
2032	4,087	3,784	19,369	17,122
2033	4,191	3,968	20,187	17,901
2034	4,296	4,161	21,041	18,715
2035	4,271	4,234	21,280	18,913
2036		3,489	20,768	18,443
2037		2,682	20,242	17,962
2038		1,849	19,702	17,470
2039			19,148	16,965
2040			18,579	16,448
2041			17,995	15,919
2042			17,397	15,377
2043			16,782	14,822
2044			16,153	14,254
2045			15,507	13,673
2046			14,844	13,079
2047			14,165	12,470
2048			13,469	11,848
2049			12,756	11,211
2050			12,025	10,560
2051			11,276	9,894
2052			10,509	9,213
2053			9,723	8,516
2054			8,917	7,804
2055			8,093	7,076
2056			7,248	6,332
2057			6,383	5,572
2058			5,498	4,795
2059			4,591	4,000
2060			3,663	3,189
2061			2,713	2,360
2062			1,741	1,513
2063			746	647
2064			272	236
2065			1,314	1,139

Table 29: Fitment increase at sale.

7. Table 30 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):

Year	Additional Fitment Costs ($)			
	Option 2a	Option 2b	Option 6a	Option 6b
2021	17,915,883	2,316,650	7,567,075	6,431,050
2022	12,732,642	2,903,042	17,825,699	15,210,466
2023	9,321,879	3,355,876	24,569,809	21,047,483
2024	7,661,150	3,677,352	23,610,270	20,303,121
2025	5,099,920	4,079,936	21,783,943	18,802,846
2026	5,240,100	4,275,921	22,694,395	19,660,450
2027	5,382,808	4,481,686	23,644,483	20,556,809
2028	5,527,965	4,697,728	24,635,951	21,493,651
2029	5,675,477	4,924,568	25,670,620	22,472,786
2030	5,825,235	5,162,757	26,750,392	23,496,101
2031	5,977,112	5,412,872	27,877,249	24,565,565
2032	6,130,964	5,675,521	29,053,263	25,683,235
2033	6,286,628	5,951,342	30,280,594	26,851,258
2034	6,443,920	6,241,005	31,561,497	28,071,875
2035	6,406,299	6,350,592	31,920,080	28,369,178

Table 30: Additional fitment cost by option.

8. From year 1 of intervention (2021), 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 as shown in Table 31-34. 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	83																													..	..			83
2	279	59																												..	..			338
3	370	198	43																											..	..			611
4	424	263	145	35																										..	..			867
5	406	301	192	119	24																									..	..			1042
6	378	288	221	158	79	24																								..	..			1148
7	359	268	211	181	105	82	25																							..	..			1231
8	323	255	196	173	121	108	84	26																						..	..			1286
9	270	230	187	161	115	124	111	86	26																					..	..			1310
10	203	192	168	153	107	119	127	114	88	27																				..	..			1299
11	161	144	140	138	102	110	122	131	117	91	28																			..	..			1285
12	126	115	106	115	92	105	113	125	134	120	93	28																		..	..			1273
13	102	90	84	87	77	95	108	116	128	138	123	95	29																	..	..			1272
14	98	72	66	69	58	79	97	111	120	132	141	127	98	30																..	..			1296
15	89	69	53	54	46	59	81	100	114	123	135	145	130	100	30															..	..			1328
16	78	64	51	43	36	47	61	83	102	117	126	139	149	133	100	0														..	..			1329
17	68	56	46	42	29	37	48	63	85	105	120	129	142	153	132	0	0													..	..			1256
18	70	49	41	38	28	30	38	50	64	88	108	123	132	146	152	0	0	0												..	..			1155
19	62	49	36	33	25	29	31	39	51	66	90	111	126	136	145	0	0	0	0											..	..			1028
20	67	44	36	29	22	26	29	31	40	52	68	92	113	129	135	0	0	0	0	0										..	..			915
21	63	48	32	30	19	23	27	30	32	41	54	70	95	116	128	0	0	0	0	0	0									..	..			807
22	50	45	35	26	20	20	24	28	31	33	42	55	71	97	116	0	0	0	0	0	0	0								..	..			692
23	47	36	33	29	18	20	21	24	28	32	34	43	57	73	96	0	0	0	0	0	0	0	0							..	..			590
24	47	34	26	27	19	18	21	21	25	29	33	35	44	58	73	0	0	0	0	0	0	0	0	0						..	..			509
25	46	34	25	21	18	20	19	21	22	25	30	33	36	45	58	0	0	0	0	0	0	0	0	0	0					..	..			452
26	38	32	25	20	14	18	20	19	22	22	26	31	34	37	45	0	0	0	0	0	0	0	0	0	0	0				..	..			404
27	28	27	24	20	13	15	19	21	20	23	23	27	31	35	36	0	0	0	0	0	0	0	0	0	0	0	0			..	..			362
28	25	20	20	19	13	14	15	19	21	20	23	23	27	32	35	0	0	0	0	0	0	0	0	0	0	0	0	0		..	..			329
28	22	18	15	16	13	14	14	15	20	22	21	24	24	28	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			298
30	16	16	13	12	11	13	14	15	16	20	22	21	24	25	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			267
31	15	12	11	11	8	11	14	15	15	16	21	23	22	25	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			243
32	0	11	8	9	7	8	12	14	15	15	17	21	24	22	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			209
33	0	0	8	7	6	7	8	12	14	15	16	17	22	24	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			180
34	0	0	0	6	5	6	8	9	12	15	16	16	18	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			157
35	0	0	0	0	4	5	7	8	9	13	15	16	17	18	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..			133
36	0	0	0	0	0	4	5	7	8	9	13	16	17	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..	0		113
37	0	0	0	0	0	0	4	5	7	8	9	13	16	17	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	..	..	0	0	97

Table 31: Infiltration of fitted vehicles, Option 2a

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	11																													..	..			11
2	36	13																												..	..			49
3	48	45	15																											..	..			108
4	55	60	52	17																										..	..			184
5	52	69	69	57	19																									..	..			266
6	49	66	79	76	64	20																								..	..			353
7	46	61	76	87	84	67	21																							..	..			442
8	42	58	71	83	97	88	70	22																						..	..			530
9	35	52	67	77	92	101	92	73	23																					..	..			614
10	26	44	61	74	86	97	106	97	77	24																				..	..			690
11	21	33	51	66	82	90	101	111	102	80	25																			..	..			762
12	16	26	38	55	74	86	94	106	117	107	84	26																		..	..			829
13	13	20	30	42	61	77	90	99	111	122	112	88	27																	..	..			894
14	13	16	24	33	46	64	81	94	104	117	128	117	93	29																..	..			959
15	12	16	19	26	37	48	67	85	99	109	123	134	123	97	29															..	..			1023
16	10	14	18	21	29	38	51	71	89	103	114	128	141	129	99	24														..	..			1080
17	9	13	17	20	23	30	40	53	74	93	108	120	135	148	131	81	19													..	..			1114
18	9	11	15	18	22	24	32	42	56	78	98	114	125	141	150	108	63	13												..	..			1119
19	8	11	13	16	20	23	25	33	44	59	81	102	119	132	144	124	83	43	7											..	..			1088
20	9	10	13	14	18	21	24	27	35	46	61	85	107	125	134	118	95	57	23	0										..	..			1024
21	8	11	12	14	16	19	22	26	28	36	49	64	90	113	127	110	91	66	31	0	0									..	..			931
22	6	10	13	13	16	16	20	23	27	29	38	51	67	94	115	105	85	63	35	0	0	0								..	..			826
23	6	8	12	14	14	17	17	21	25	28	31	40	54	71	96	94	81	58	34	0	0	0	0							..	..			718
24	6	8	9	13	15	15	17	18	22	26	29	32	42	56	72	79	73	56	31	0	0	0	0	0						..	..			619
25	6	8	9	10	14	16	15	18	19	23	27	31	34	44	57	59	61	50	30	0	0	0	0	0	0					..	..			530
26	5	7	9	10	11	15	17	16	19	20	24	28	32	35	45	47	46	42	27	0	0	0	0	0	0	0				..	..			455
27	4	6	9	10	11	12	16	18	17	20	21	25	30	34	36	37	36	31	22	0	0	0	0	0	0	0	0			..	..			393
28	3	5	7	9	11	11	12	16	18	18	21	22	26	31	35	30	28	25	17	0	0	0	0	0	0	0	0	0		..	..			346
28	3	4	5	8	10	11	12	13	17	19	19	22	23	27	32	29	23	20	13	0	0	0	0	0	0	0	0	0	0	..	..			310
30	2	4	5	6	9	11	12	12	14	18	20	20	23	24	28	26	22	16	10	0	0	0	0	0	0	0	0	0	0	..	..			281
31	2	3	4	5	6	9	11	12	13	14	19	21	21	24	24	23	20	15	8	0	0	0	0	0	0	0	0	0	0	..	..			256
32	0	2	3	4	6	7	10	12	13	14	15	20	22	22	25	20	18	14	8	0	0	0	0	0	0	0	0	0	0	..	..			234
33	0	0	3	3	5	6	7	10	13	14	14	16	21	23	22	20	15	12	7	0	0	0	0	0	0	0	0	0	0	..	..			212
34	0	0	0	3	4	5	6	7	11	13	14	15	17	22	24	18	16	11	6	0	0	0	0	0	0	0	0	0	0	..	..			192
35	0	0	0	0	3	4	5	7	8	11	14	15	16	17	22	20	14	11	6	0	0	0	0	0	0	0	0	0	0	..	..			172
36	0	0	0	0	0	4	4	6	7	8	12	14	16	16	18	18	15	10	6	0	0	0	0	0	0	0	0	0	0	..	..	0		153
37	0	0	0	0	0	0	4	4	6	7	8	12	15	16	17	15	14	10	5	0	0	0	0	0	0	0	0	0	0	..	..	0	0	135

Table 32: Infiltration of fitted vehicles, Option 2b

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	35																													..	..			35
2	118	82																												..	..			200
3	156	278	113																											..	..			547
4	179	368	383	109																										..	..			1039
5	171	422	507	368	101																									..	..			1568
6	159	403	582	487	339	105																								..	..			2076
7	152	376	556	559	449	353	109																							..	..			2554
8	137	357	518	534	516	468	368	114																						..	..			3012
9	114	322	492	498	493	537	488	384	119																					..	..			3445
10	86	268	443	473	459	514	560	508	400	124																				..	..			3834
11	68	202	370	426	436	478	535	583	530	416	129																			..	..			4174
12	53	160	279	355	393	455	498	558	608	552	434	134																		..	..			4479
13	43	125	221	268	328	409	474	519	581	633	575	452	140																	..	..			4769
14	41	101	173	212	247	342	427	493	541	605	660	599	471	146																..	..			5059
15	38	97	139	166	196	257	356	444	514	564	631	688	625	491	147															..	..			5354
16	33	89	134	134	153	204	268	371	463	536	587	658	717	651	497	144														..	..			5639
17	29	78	123	129	124	160	213	279	386	483	558	612	685	747	659	485	140													..	..			5889
18	29	68	107	118	119	129	166	222	291	403	503	582	638	714	756	643	473	136												..	..			6097
19	26	69	94	103	109	124	134	173	231	303	420	524	606	665	723	737	627	460	133											..	..			6261
20	28	61	95	90	95	113	129	140	181	241	316	437	546	632	673	705	719	610	447	129										..	..			6388
21	27	67	85	92	83	99	118	134	146	188	251	329	456	569	639	656	687	700	593	434	125									..	..			6477
22	21	62	92	81	85	87	103	123	140	152	196	261	343	475	576	624	640	669	680	575	420	121								..	..			6526
23	20	50	86	88	75	88	90	108	128	146	158	204	272	358	480	562	608	623	650	660	557	406	116							..	..			6535
24	20	47	69	83	82	78	92	94	112	133	152	165	213	284	362	469	548	592	605	631	639	538	392	112						..	..			6511
25	19	47	65	66	76	85	82	96	98	117	139	158	172	222	287	353	457	533	575	587	611	618	519	377	107					..	..			6467
26	16	45	65	62	61	79	89	85	100	102	122	145	165	179	225	280	344	445	518	558	569	591	596	500	362	103				..	..			6406
27	12	38	63	62	58	63	83	92	89	104	106	127	151	172	181	219	273	335	432	503	541	550	570	573	480	347	98			..	..			6322
28	11	28	53	60	58	60	66	86	96	92	108	111	132	157	174	177	214	266	326	419	487	523	531	548	551	459	331	93		..	..			6217
28	9	25	39	51	55	60	63	69	90	100	96	113	116	138	159	170	172	208	258	316	406	471	504	511	526	527	438	315	88	..	..			6093
30	7	22	35	37	47	58	62	65	72	94	104	100	118	120	139	155	165	168	202	251	306	393	454	485	490	504	503	417	298	..	..			5955
31	6	16	30	33	34	49	60	65	68	75	98	109	104	123	122	136	151	161	163	196	243	296	379	437	466	469	481	478	395	..	..			5802
32	0	15	22	29	31	36	51	63	68	71	78	102	113	109	124	119	133	147	157	158	190	235	285	365	420	446	448	457	453	..	..			5630
33	0	0	20	21	27	32	37	53	65	71	74	81	106	118	110	121	116	129	143	152	153	184	226	275	350	402	426	426	433	..	..			5440
34	0	0	0	20	20	28	34	39	55	68	74	77	84	111	120	107	118	113	125	139	147	148	177	218	264	335	383	405	403	..	..			5233
35	0	0	0	0	18	21	29	35	40	57	71	77	80	88	112	117	105	115	110	122	135	142	143	170	209	252	320	364	383	..	..			5016
36	0	0	0	0	0	19	22	30	36	42	60	74	80	83	89	109	114	102	112	106	118	130	137	138	164	200	241	304	345	..	..	50		4790
37	0	0	0	0	0	0	20	22	31	38	44	62	77	83	84	87	106	111	99	108	103	114	126	132	132	157	191	229	288	..	..	169	44	4552

Table 33: Infiltration of fitted vehicles, Option 6a

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	30																													..	..			30
2	100	70																												..	..			170
3	133	237	97																											..	..			467
4	152	314	328	94																										..	..			888
5	146	360	434	316	87																									..	..			1343
6	136	344	498	419	293	91																								..	..			1781
7	129	321	476	481	388	306	95																							..	..			2195
8	116	305	444	460	445	406	320	99																						..	..			2594
9	97	274	422	428	426	465	424	335	104																					..	..			2974
10	73	229	380	407	396	445	487	443	350	109																				..	..			3318
11	58	172	317	366	377	414	465	509	464	366	113																			..	..			3621
12	45	137	239	306	339	394	433	487	532	485	382	119																		..	..			3897
13	37	107	189	230	283	355	412	453	509	556	507	400	124																	..	..			4161
14	35	86	148	183	213	296	371	430	474	532	581	530	418	130																..	..			4427
15	32	83	119	143	169	223	309	388	450	495	556	608	554	437	131															..	..			4698
16	28	76	115	115	132	177	233	324	405	471	518	581	636	579	442	128														..	..			4959
17	25	66	105	111	107	138	185	244	338	424	492	541	608	664	585	431	124													..	..			5188
18	25	58	92	101	102	112	145	193	255	354	443	514	566	635	672	571	420	121												..	..			5378
19	22	59	80	89	94	107	117	151	202	266	370	463	538	592	642	655	556	408	118											..	..			5529
20	24	52	82	77	82	98	112	122	158	211	279	387	484	562	598	626	638	541	396	114										..	..			5644
21	23	57	73	79	72	86	103	117	128	165	221	291	404	506	568	583	610	620	525	384	110									..	..			5725
22	18	53	79	70	73	75	90	107	122	133	173	231	304	423	512	554	568	593	602	509	372	107								..	..			5768
23	17	42	74	76	65	76	78	94	112	128	139	181	242	318	427	499	540	552	576	584	493	359	103							..	..			5775
24	17	40	59	71	70	68	80	82	98	117	134	146	189	252	322	416	486	525	536	558	565	476	346	99						..	..			5753
25	16	40	56	57	66	74	71	83	86	103	123	140	152	197	255	314	406	473	510	520	540	546	459	333	95					..	..			5713
26	14	39	56	54	52	69	77	74	87	90	107	128	146	159	200	249	305	394	459	494	503	522	526	441	319	91				..	..			5656
27	10	33	54	54	50	55	72	80	77	91	94	112	134	153	161	195	242	297	383	445	478	486	503	506	423	305	86			..	..			5581
28	9	24	45	52	50	52	57	75	84	81	95	98	117	140	155	157	190	236	289	371	431	462	469	484	485	405	291	82		..	..			5486
28	8	22	33	44	48	52	54	60	79	88	85	100	102	123	142	151	153	184	229	280	359	416	445	451	464	464	386	277	78	..	..			5375
30	6	19	30	32	40	50	54	57	63	82	92	89	104	107	124	138	147	149	179	222	271	347	401	428	432	444	443	367	262	..	..			5251
31	5	14	26	29	29	42	52	57	59	66	86	96	93	109	108	121	134	143	144	174	215	262	335	386	411	413	423	421	347	..	..			5115
32	0	13	19	25	27	31	44	55	59	62	69	90	101	97	110	106	118	131	139	140	168	207	252	322	370	393	394	402	398	..	..			4962
33	0	0	18	18	23	28	32	46	57	62	65	72	94	105	98	107	103	114	127	134	136	162	200	242	309	354	375	375	381	..	..			4792
34	0	0	0	17	17	24	29	34	48	60	65	68	75	98	106	95	105	100	111	123	130	131	156	192	233	295	337	356	354	..	..			4609
35	0	0	0	0	16	18	25	30	35	50	63	68	71	78	99	104	93	102	97	108	119	126	126	150	184	222	282	321	337	..	..			4416
36	0	0	0	0	0	16	19	26	32	37	53	65	71	74	79	97	101	90	99	94	104	115	121	121	144	176	212	267	303	..	..	44		4215
37	0	0	0	0	0	0	17	20	27	33	39	55	68	74	75	77	94	98	88	96	91	101	111	117	116	138	168	201	253	..	..	148	39	4004

Table 34: Infiltration of fitted vehicles, Option 6b

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 35):

Year	Option 2a			Option 2b			Option 6a			Option 6b		
	Fatal	Major	Minor	Fatal	Major	Minor	Fatal	Major	Minor	Fatal	Major	Minor
2021	0.04	1.03	3.21	0.00	0.13	0.42	0.02	0.44	1.36	0.01	0.37	1.15
2021	0.15	4.22	13.12	0.02	0.62	1.92	0.09	2.50	7.77	0.08	2.13	6.62
2023	0.28	7.63	23.73	0.05	1.35	4.21	0.25	6.83	21.25	0.21	5.83	18.13
2024	0.39	10.83	33.69	0.08	2.30	7.15	0.47	12.96	40.34	0.40	11.08	34.48
2025	0.47	13.01	40.48	0.12	3.33	10.35	0.71	19.58	60.93	0.61	16.76	52.16
2026	0.52	14.33	44.60	0.16	4.41	13.72	0.94	25.91	80.63	0.81	22.23	69.16
2027	0.56	15.37	47.83	0.20	5.52	17.17	1.16	31.89	99.22	1.00	27.41	85.28
2028	0.58	16.06	49.97	0.24	6.62	20.59	1.37	37.59	116.99	1.18	32.38	100.76
2029	0.60	16.36	50.90	0.28	7.66	23.85	1.56	43.01	133.84	1.35	37.13	115.53
2030	0.59	16.22	50.47	0.31	8.62	26.82	1.74	47.86	148.94	1.51	41.42	128.89
2031	0.58	16.04	49.90	0.35	9.51	29.60	1.90	52.10	162.13	1.64	45.21	140.67
2032	0.58	15.89	49.45	0.38	10.35	32.22	2.03	55.91	173.98	1.77	48.64	151.37
2033	0.58	15.88	49.40	0.41	11.16	34.73	2.17	59.53	185.24	1.89	51.94	161.64
2034	0.59	16.18	50.34	0.44	11.97	37.24	2.30	63.16	196.53	2.01	55.26	171.97
2035	0.60	16.58	51.59	0.46	12.77	39.75	2.43	66.84	207.99	2.13	58.64	182.49
2036	0.60	16.59	51.61	0.49	13.48	41.95	2.56	70.39	219.05	2.25	61.90	192.63
2037	0.57	15.67	48.77	0.51	13.91	43.27	2.67	73.52	228.77	2.36	64.77	201.55
2038	0.52	14.42	44.86	0.51	13.96	43.46	2.77	76.10	236.82	2.44	67.14	208.93
2039	0.47	12.83	39.94	0.49	13.59	42.28	2.84	78.15	243.20	2.51	69.01	214.76
2040	0.42	11.43	35.56	0.47	12.78	39.78	2.90	79.74	248.13	2.56	70.45	219.24
2041	0.37	10.08	31.36	0.42	11.63	36.18	2.94	80.85	251.61	2.60	71.46	222.38
2042	0.31	8.64	26.87	0.37	10.31	32.08	2.96	81.47	253.51	2.62	72.01	224.07
2043	0.27	7.36	22.92	0.33	8.97	27.90	2.97	81.57	253.84	2.62	72.09	224.34
2044	0.23	6.35	19.77	0.28	7.72	24.03	2.96	81.28	252.92	2.61	71.82	223.49
2045	0.21	5.64	17.55	0.24	6.62	20.60	2.94	80.73	251.23	2.59	71.32	221.92
2046	0.18	5.05	15.71	0.21	5.68	17.67	2.91	79.96	248.83	2.57	70.61	219.73
2047	0.16	4.51	14.05	0.18	4.91	15.27	2.87	78.92	245.58	2.53	69.66	216.78
2048	0.15	4.11	12.78	0.16	4.32	13.44	2.82	77.60	241.48	2.49	68.48	213.09
2049	0.14	3.72	11.56	0.14	3.87	12.04	2.77	76.06	236.69	2.44	67.10	208.79
2050	0.12	3.33	10.37	0.13	3.50	10.90	2.70	74.33	231.31	2.38	65.55	203.98
2051	0.11	3.03	9.42	0.12	3.20	9.96	2.63	72.43	225.39	2.32	63.85	198.68
2052	0.09	2.61	8.11	0.11	2.92	9.07	2.56	70.29	218.72	2.25	61.94	192.74
2053	0.08	2.24	6.98	0.10	2.65	8.23	2.47	67.90	211.31	2.18	59.82	186.15
2054	0.07	1.96	6.09	0.09	2.39	7.45	2.38	65.33	203.28	2.09	57.53	179.03
2055	0.06	1.66	5.18	0.08	2.15	6.69	2.28	62.62	194.85	2.01	55.13	171.54
2056	0.05	1.41	4.40	0.07	1.91	5.95	2.17	59.79	186.05	1.91	52.62	163.73
2057	0.04	1.21	3.78	0.06	1.68	5.23	2.07	56.82	176.82	1.82	49.99	155.55
2058	0.04	1.02	3.18	0.05	1.46	4.55	1.95	53.72	167.16	1.72	47.24	146.99
2059	0.03	0.82	2.56	0.05	1.25	3.87	1.84	50.47	157.06	1.61	44.36	138.05
2060	0.02	0.63	1.96	0.04	1.04	3.24	1.71	47.09	146.52	1.50	41.37	128.74
2061	0.02	0.47	1.45	0.03	0.85	2.66	1.58	43.57	135.58	1.39	38.27	119.07
2062	0.01	0.35	1.08	0.02	0.68	2.12	1.45	39.93	124.26	1.28	35.06	109.09
2063	0.01	0.24	0.73	0.02	0.52	1.63	1.32	36.17	112.55	1.15	31.74	98.78
2064	0.01	0.14	0.43	0.01	0.38	1.19	1.17	32.29	100.48	1.03	28.33	88.16
2065	0.00	0.07	0.21	0.01	0.26	0.82	1.03	28.29	88.05	0.90	24.82	77.24

Table 35: Trauma alleviated by each viable intervention option by year

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 Figures 15 to 18:

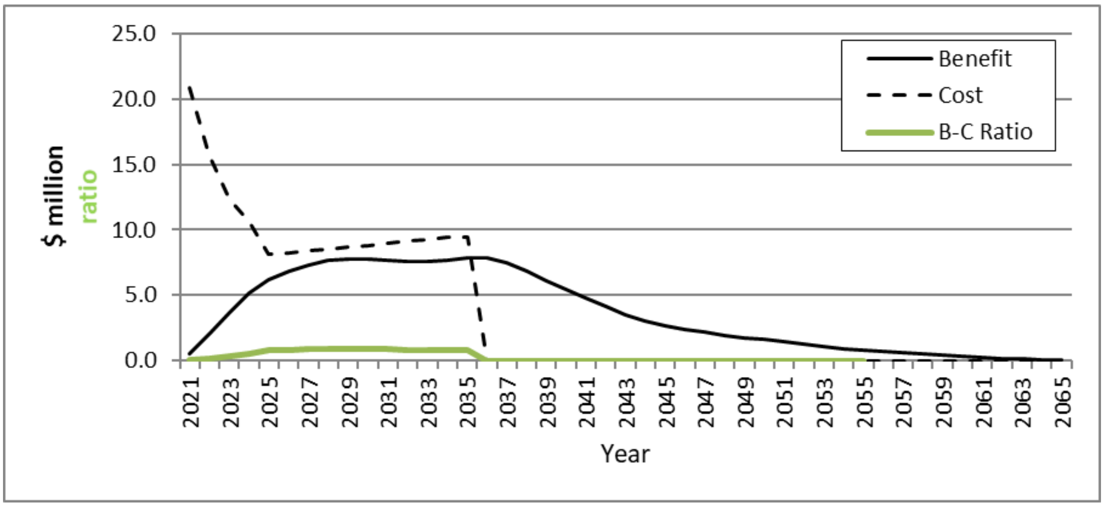

Figure 15: Summary, Option 2a

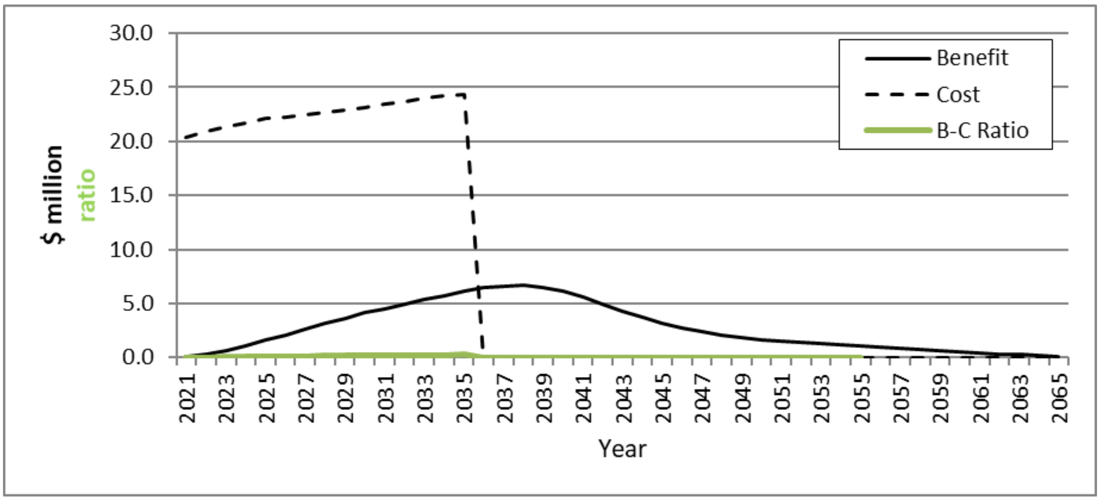

Figure 16: Summary, Option 2b

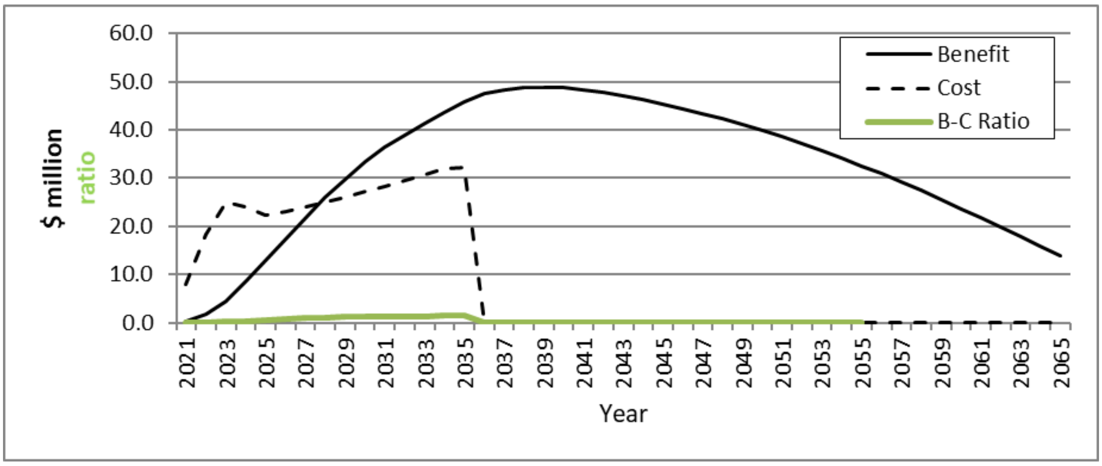

Figure 17: Summary, Option 6a

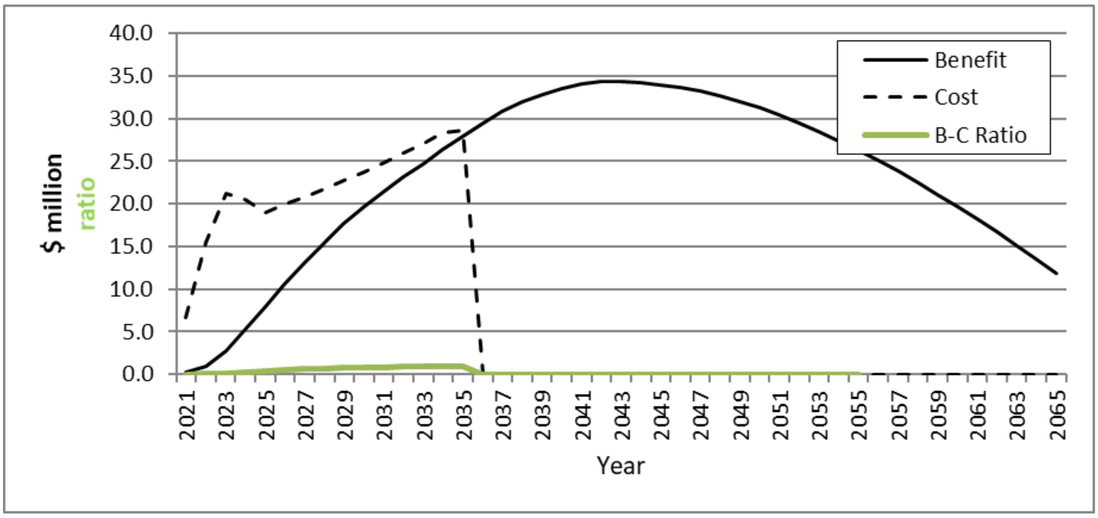

Figure 18: Summary, Option 6b

Summary

Table 36: Summary of benefits, costs, lives saved and serious injuries avoided under each option

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	-9	49			0.9			
Likely	-34	74	27	68	0.7	12	339	1056
Worst	-58	99			0.5			
Option 2b								
Best	-151	26			0.2			
Likely	-164	39	164	39	0.2	9	248	773
Worst	-177	52			0.2			
Option 6a								
Best	123	145			1.8			
Likely	52	216	0.5	269	1.2	78	2152	6697
Worst	-19	288			0.9			
Option 6a with matching ESC fitment								
Best	212	145			2.5			
Likely	141	216	0.5	358	1.6	102	2564	7017
Worst	71	288			1.4			
Option 6b								
Best	108	126			1.9			
Likely	47	188	0.5	235	1.2	69	1891	5883
Worst	-15	250			0.9			

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
HVIA	Heavy Vehicle Industry Association
HVNL	Heavy Vehicle National Law
HVSPP	Heavy Vehicle Safety and Productivity Programme
MUARC	Monash University Accident Research Centre
MVSA	Motor Vehicle Standards Act 1989
NHTSA	National Highway Traffic Safety Administration
NHVBS	National Heavy Vehicle Braking Strategy
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
SPECTS	Safety, Productivity & Environment Construction Transport Scheme
SVSEG	Strategic Vehicle Safety and Environment Group
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.
Heavy Vehicle	For the purposes of this RIS, any vehicle in a category (or equivalent ADR category) covered by UN Regulation No. 131.
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.
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

Summary of Consultation Feedback

A summary of the comments received and the Department response are included in the Table 37 below. Comments submitted in confidence have not been tabled for publication but have been considered in analysing the options.

Table 37: Summary of benefits, costs, lives saved and serious injuries avoided under each option

Correspondent	Supported Option	Summary of Comments	Department Response
Andrew Corney	Option 6a	1. Congratulates the Australian Government for examining the case for change in the area of regulation of heavy vehicles. 2. Highlights additional personal costs that are not measurable. 3. Encourages the Department to push for Option 6a in the RIS.	1. Noted. 2. Noted. 3. Agreed.
Australian Automobile Association (AAA)	Option 6a	1. Supports the recommendation in the RIS to mandate AEB for heavy goods vehicles over 3.5 tonnes GVM by adopting the requirements of UN Regulation No. 131 as an ADR. 2. Supports the recommendation in the RIS to expand ESC functional requirements currently in ADR 35/06 to all heavy goods vehicles over 3.5 tonnes GVM.	1. Agreed. 2. Agreed. 3. Noted. 4. Noted. A separate UN regulation has recently been developed for blind spot information systems for the detection of bicycles. 5. Noted.

		3. Recommends that Australia actively participates in any future UN work to revise UN Regulation No. 131 to recognise Australian needs. 4. Recommends that the Australian Government supports a review of UN Regulation No. 131 to expand performance requirements to include vulnerable road user safety. 5. Recommends that the Australian Government consider the braking compatibility of truck and trailer combinations. 6. Recommends that the Australian Government consider Australian capability to conduct testing in accordance with UN Regulation No. 131.	6. Noted.
Australasian New Car Assessment Program (ANCAP)	Option 6a	1. Supports the recommendation in the RIS to mandate the fitting of AEB on heavy goods vehicles over 3.5 tonnes GVM and all categories of buses. 2. Supports the recommendation in the RIS to expand the ESC requirement to all heavy goods vehicles over 3.5 tonnes GVM and all categories of buses. 3. Encourages the Australian government to support a review of UN Regulation No. 131 to expand its scope to address additional truck to car crash scenarios and truck to pedestrian (and other vulnerable road user) impacts.	1. Agreed. 2. Agreed. 3. Noted. A separate UN regulation has recently been developed for blind spot information systems for the detection of bicycles. 4. Noted.

		4. Notes that market surveys undertaken by ANCAP demonstrate manufacturers are introducing both AEB and ESC for goods vehicles over 3.5 tonnes GVM.	
Australian Trucking Association (ATA)	Option 6a	1. Supports Option 6a in the consultation RIS, subject to other recommendations in the submission (see below). 2. Continues to argue for mandating of ESC for rigid trucks as soon as possible. 3. Recommends the Department undertake further consultation regarding bull bar compatibility with AEB systems and develop guidance material to ensure compatibility. 4. Recommends the Department undertake further consultation regarding the effectiveness of AEB systems under Australian rural conditions. 5. Proposes mandatory AEB for prime movers should be delayed until November 2021 for new vehicle models and November 2023 for all new vehicles.	1. Noted. 2. Noted. 3. Bull bar mounting options compatible with AEB are available. Also see 4 below. 4. The Department will continue to engage with the ATA and other heavy vehicle industry groups regarding any need for additional technical guidance on AEB for operators. 5. Noted. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. An additional sensitivity analysis, based on implementation timing, has been included in the RIS to inform the decision making process.

Bus Industry Confederation (BIC)	Option 6a	1. Supports the adoption [mandating] of UN Regulation No 131 through a new ADR, subject to other feedback in the submission. 2. States that the implementation timing proposed in the consultation RIS is not achievable and is not in keeping with established new ADR implementation timeframes. 3. Proposes alternative timing of 1 November 2021 for new model vehicles and 1 January 2024 for all new vehicles. 4. Proposes adoption of exemptions applicable to UN Regulation No. 131, including for buses carrying standees and unrestrained passengers. 5. Argues that the RIS underestimates the complexity and cost of AEB testing and development that is needed to cover a range of body types for each bus chassis. 6. Notes AEB systems are typically only provided on Euro VI bus chassis, which can cost $5,000 to $10,000 more than Euro V versions. 7. Proposes that mandatory AEB be introduced in conjunction with Euro VI.	1. Noted. 2. Noted. See 3 below. 3. Noted. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. An additional sensitivity analysis, based on implementation timing, has been included in the RIS to inform the decision making process. 4. Agreed. 5. The Department accepts that the overall AEB development and testing cost for each bus chassis is likely to be much higher than the value used in the benefit-cost analysis. However, most of these development and testing costs are already being incurred under BAU, including because of mandatory standards already in place in Europe and Japan. The value used in the benefit-cost analysis is an allowance for any additional development and testing that may be needed following the implementation of a new ADR (i.e. over and above those already occurring under BAU).

			6. AEB is available on some heavy vehicles that do not meet Euro VI (or equivalent) emission requirements. The fitment costs are for the AEB system itself on either a Euro V or a Euro VI vehicle. The Department accepts that manufacturers may choose to fit a Euro VI engine together with AEB for commercial reasons, including that ongoing research and development will become more and more limited for Euro V engines. 7. Noted. See 3 above.
Boral Logistics	Option 6a	1. States that ESC has been the single biggest advance in heavy vehicle safety in the last 40 years and that AEB will add another layer of safety on top of that. 2. Supports mandatory AEB – "the sooner the better".	1. Agreed. 2. Noted.
Brett Green		1. Recommends light vehicle driver education and advertising campaigns showing the consequences of bad driving behaviour. 2. Recommends increased police action regarding light vehicle driver behaviour around heavy vehicles.	1. Noted. Governments are addressing this through Priority Actions 5 and 7, and Other Critical Actions D, E, F, G and J of the NRSAP 2018-20. 2. Noted. Also see 1 above.

Camille Jago	Option 6a	1. Supports Option 6a in the RIS. 2. Requests that implementation timing not be delayed into the future. 3. Expresses disappointment that Australia has waited until full implementation has occurred in Europe before starting the process. 4. Would prefer that all heavy vehicles (current fleet included) are fitted with AEB. However, understands that retrospective fitment is not viable.	1. Agreed. 2. Noted. Implementation timing will be determined as part of the ADR, taking into account all stakeholder feedback. 3. Noted. 4. Noted.
Daimler Truck and Bus (DTB)	Option 6a	1. Supports Option 6a in the RIS, subject to other recommendations in the submission (see below). 2. Suggests alternate implementation timing: • NB1, NB2 and NC Category – 1/11/2021 for new models and 1/01/2024 for all models. 3. Recommends certification via both approvals to UN Regulation No. 131 or by a registered test facility certifying that a vehicle meets equivalent technical requirements to allow for non-ECE based vehicles. 4. Requests relevant approval forms are made available prior to intended implementation dates.	1. Noted. 2. Noted. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. An additional sensitivity analysis, based on implementation timing, has been included in the RIS to inform the decision making process. 3. Agreed. Industry have been separately consulted on the technical details of an ADR, including certification pathways. 4. Agreed.

Department of Transport and Main Roads (TMR) QLD	Option 6a	1. Supports a broad mandating of AEB for heavy vehicles and the broadening of the mandate for ESC, as proposed in the RIS. 2. Urges mandating of AEB for light vehicles (ADR category MA, MB, MC and NA vehicles) as soon as possible. 3. Recommends AEB implementation timing for all new vehicles of 1 January 2022 to match the timing of the ESC requirements on heavy trucks. 4. Notes that the introduction of AEB in the Australian fleet is already delayed by 2 to 3 years compared to the EU market despite that vehicles supplied to Australian market are either manufactured in EU countries or are built by global manufacturers for the EU market.	1. Agreed. 2. Noted. As part of Priority Action 4 of the NRSAP 2018-2020, the Department will also be releasing a RIS for the adoption of AEB in the light vehicle fleet. 3. Noted. Implementation timing will be determined as part of the ADR, taking into account all stakeholder feedback. 4. Noted. However, not all vehicles supplied to the Australian market are built by manufacturers for the EU market.
Federal Chamber of Automotive Industries (FCAI)		1. Recognises the potential of AEB to provide significant safety benefits to Australia through reductions in rear end crashes. 2. Notes that not all vehicle models that are supplied to the Australian market are common with a European specification model. Mismatches between Australian and European configurations may result.	1. Agreed. 2. Noted. AEB is available on non-European and European models. Fitment costs were based on these configurations.

		3. Recommends an implementation timeframe of not less than two years following the publication of the final rule for new models and not less than two years following the new models date for all [new] vehicles.	3. Noted. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. An additional sensitivity analysis, based on implementation timing, has been included in the RIS to inform the decision making process.
Heavy Vehicle Industry Association (HVIA)	Option 6a	1. Supports mandating AEB on heavy vehicles, as well as Antilock Brakes and Stability Control across all heavy vehicle types, including for both trucks and trailers. 2. Suggests the Department provide more adequate time for adaptation and testing, which is further compounded by limited test facility access in Australia. 3. Recommends alternate implementation timing for AEB and ESC: • 1 November 2022 for new models • 1 November 2024 for all new vehicles 4. Recommends further research on AEB in the lead up to implementation to help address possible issues such as trailer and roadside infrastructure compatibility.	1. Noted. 2. Agreed. Also see 3 below. 3. Noted. Implementation timing will be determined as part of the ADR, taking into account all stakeholder feedback. 4. Noted. The Department will continue to engage with heavy vehicle industry groups regarding any need for additional technical guidance on AEB for operators. 5. The Government is considering options to accelerate regulatory technology adoption. The uptake of effective technologies is also being promoted under Other Critical Action K of NRSAP 2018-20. 6. Noted. Also see 4 above. 7. Noted.

		5. Identifies ways that Government could reduce the average age of the heavy vehicle fleet. Suggestions included: • Changes to taxation policy • Relaxations in requirements for road asset use 6. Proposes the Department prepare information to increase industry knowledge of how AEB operates in certain conditions. 7. Suggests further research on the effect of known tyre issues and their impact on AEB performance when developing appropriate regulations.	
Knorr-Bremse Australia	Option 6b	1. Suggests harmonising ADR terminology with that in UN Regulation No. 131. 2. Recommends a longer implementation time for vehicle manufacturers to find suitable test venues, purchase test equipment and complete testing in accordance with UN Regulation No. 131. 3. Suggests AEB could be mandated for the vehicles which ESC has already been mandated in ADR 35/06 (i.e. prime movers and short wheelbase rigid trucks) from 1 November 2022 for new and existing models (to align with the all vehicles date in ADR 35/06). 4. Offers to support government and industry stakeholders in training on safety systems.	1. Agreed. 2. Agreed. 3. Noted. Implementation timing will be determined as part of the ADR, taking into account all stakeholder feedback. 4. Noted.

National Road Transport Association (NatRoad)	Option 1	1. Proposes a new option to require AEB to be fitted to vehicles meeting Euro VI emissions standards only, so AEB fitment will increase as the market sees an increase in Euro VI vehicles. 2. Recommends further research on AEB in Australian rural and regional conditions. 3. Supports mandating ESC for the broader range of heavy vehicles proposed in the RIS. 4. Requests further clarity on exemptions before implementation.	1. Noted. AEB is available on heavy vehicles that do not meet Euro VI requirements. 2. Noted. The Department will continue to engage with heavy vehicle industry groups regarding any need for additional technical guidance on AEB for operators. 3. Noted. 4. Agreed. Exemptions are clearly set out in the ADR, as consulted on separately with stakeholders to implement the recommended option.
NSW Government – Transport for NSW	Option 6a	1. Supports Option 6a in the RIS as this is most effective at reducing deaths and serious injuries. 2. Also supports the proposal in the RIS to extend Option 6a to require ESC to be fitted to all heavy vehicles required to be fitted with AEB. 3. Does not support the non-regulatory Option 2 in the RIS because it could create an environment where there would be a mix of vehicles with and without AEB systems, which could create compatibility issues.	1. Agreed. 2. Agreed. 3. Noted.

Toll Group	Option 6a	1. Completely supports the introduction of mandatory AEB. 2. Recommends revisions to the RIS to highlight the benefits lost in the six year lag in adoption of AEB in comparison to international jurisdictions. 3. Recommends streamlining the process of implementing ADRs for proven safety technologies where mandated internationally. 4. Proposes incentives to offset implementation costs, including an increase in axle load limits.	1. Agreed. 2. The RIS including the benefit-cost analysis has been prepared in accordance with the Australian Government Guide to Regulation. Further, mandatory AEB requirements did not fully enter into force in Europe for the majority of heavy vehicle categories until November 2018. Please see RIS section 2.4. 3. Noted. The Department is exploring options to streamline the ADR development process. The uptake of effective technologies is also being promoted under Other Critical Action K of the NRSAP 2018-20. 4. Noted. Like all stringency increases, regulatory costs are to be balanced by a range of regulatory offsets. Axle mass limits are being considered as part of Other Critical Action L of the NRSAP 2018-20.
Truck Industry Council (TIC)		1. Supports the adoption of AEB and the broadening of ESC uptake on trucks. 2. Recommends the introduction of AEB be aligned with the introduction of Euro VI (and equivalent) emissions standards for heavy vehicles.	1. Noted. 2. Noted. Also see 3 below.

		3. Proposes implementation timing of 1 November 2022 for new models and 1 January 2025 for all [new] vehicles; subject to at least 2 years implementation time from the publication of the final rule, other necessary guidance material and application forms for new models; plus a further 2 years for all [new] vehicles. 4. Suggests adding other costs to the benefit-cost analysis, including (i) the cost of producing a Euro VI (or equivalent) truck in order to bring AEB to market; (ii) the cost of lost payload for the trucks upgraded to Euro VI (or equivalent) to bring AEB to market; (iii) other ESC development, test and hardware costs for longer wheelbase rigid trucks; and (iv) increasing the AEB validation test cost to $30,000 to $50,000 per model. 5. Requests that the Department review its road vehicle certification database and determine the number of truck models that may require foundation brake system upgrades in order to meet the performance requirements of UN Regulation No. 131. 6. Recommends that European AEB (and ESC) exemptions for trucks with 4 or more axles, off-road/all-wheel drive trucks and special purpose vehicles, be recognised and applied in Australian regulations for AEB (and ESC).	3. Noted. Final implementation dates will be determined as part of the ADR, following further consultation by the Department with industry and decision by the Minister. An additional sensitivity analysis, based on implementation timing, has been included in the RIS to inform the decision making process. 4. (i) AEB is available on some heavy vehicles that do not meet Euro VI (or equivalent) emission requirements. The fitment costs are for the AEB system itself on either a Euro V or a Euro VI vehicle. The Department accepts that manufacturers may choose to fit a Euro VI engine together with AEB for commercial reasons, including that ongoing research and development will become more and more limited for Euro V engines. (ii) Axle mass limits are being considered as part of Other Critical Action L of the NRSAP 2018-20. (iii) There is no mandatory test proposed for longer wheelbase rigid trucks. Nevertheless the Department accepts some validation testing will be conducted by manufacturers when fitting ESC to these vehicles. An ESC validation test cost of $100,000 to $200,000 per model has been

		7. Requests the Department's assistance in locating suitable heavy vehicle AEB test facilities in Australia. 8. Proposes financial incentives and axle mass limit increases to offset the financial cost of purchasing a Euro VI or equivalent truck with AEB, as well as payload mass loss. 9. Requests the Department's assistance to review [possible] trailer compatibility issues for trucks fitted with AEB. 10. Requests the Department's assistance in the development and dissemination of education programs to raise awareness of the performance limitations of AEB, including for different truck/trailer combinations.	included in a post consultation sensitivity analysis, to inform the decision making process. (iv) Accepted. The AEB validation test cost has been increased to $50,000 per model. 5. Road vehicle certification system data for new models of category NB and NC vehicles over the last two years indicates that the majority (at least 89% of category NC trucks and at least 97% of category NB trucks) either meet or would be expected to meet the stopping distance requirements in the UN Regulation No. 13. Further, any truck with foundation brakes just meeting the minimum deceleration requirements of ADR 35/06, should with the right calibration of the AEB control system (i.e. early enough commencement of the emergency braking phase within the 3 second limit), be able to meet the performance requirements of UN Regulation No. 131 anyway.

			6. Agreed. Exemptions are clearly set out in the ADR, for trucks with 4 or more axles and off-road/all-wheel drive trucks, as consulted on separately with stakeholders to implement the recommended option. Further exemptions may be given according to 19(3) of the RVSA for special purpose vehicles that comply with the ADRs to an extent that makes them suitable for use on a public road in Australia. 7. Noted. 8. Noted. Like all stringency increases, regulatory costs are to be balanced by a range of regulatory offsets. Axle mass limits are being considered as part of Other Critical Action L of the NRSAP 2018-20. 9. Noted. The Department will continue to monitor the situation and will engage further with heavy vehicle industry groups regarding any need for additional technical guidance on AEB for operators. 10. Noted. Also see 9 above.