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**Department of Infrastructure, Transport,
Regional Development, Communications and the Arts**

Reversing Aids

Final Impact Analysis

April 2023



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Department of Infrastructure, Transport, Regional Development, Communications and the Arts
GPO Box 594
Canberra ACT 2601
Australia

Email: publishing@infrastructure.gov.au

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Executive Summary

Reversing Collisions

The impact of road trauma is significant, costing the Australian economy over \$29 billion per annum. In terms of numbers, collisions involving a reversing vehicle and a pedestrian or another vulnerable road user (cyclist or motorcyclist) do not feature strongly in the statistics. However, the frequency of such collisions tends to be underestimated as the majority of these collisions and injuries sustained occur outside the scope of official road injury record systems, which focus on public roads. Furthermore, these crashes result in significant trauma and associated costs because many of the people involved are young children or the elderly. The specific problem considered in this Final Impact Analysis (IA) (previously known as a Regulation Impact Statement (RIS)) is reversing collisions involving vulnerable road users, particularly pedestrians.

Most reversing collisions occur at low speeds and on private property, such as car parks, schools, and around the home. 70 per cent of these crashes take place when people are parking or reversing in a driveway. Reversing collisions also occur on public roads where vehicles perform low-speed manoeuvres such as entering or leaving parking spaces, turning whilst reversing and other situations where there are obstructions to a clear view behind a reversing vehicle.

Pedestrians are the largest single road user group and comprise 13 per cent of all road fatalities in Australia (BITRE, 2015). Local research shows six per cent of all pedestrian fatalities are a result of reversing collisions (Cassell et al., 2011), we estimate this to be 9.3 fatalities per year. Additionally, based on information provided by the Georgina Josephine Foundation we expect another 4 fatalities per year occurring on road related areas. The risk of a pedestrian being struck by a vehicle increases in urban areas where high pedestrian activity and traffic densities converge. Unlike vehicle-to-vehicle collisions, where occupants can be substantially protected by vehicle safety systems, pedestrians have little to no protection when struck by a vehicle. Accidents occurring as a result of a vehicle reversing often affect small children and the elderly who are particularly vulnerable to fatality and severe or permanent injury when hit.

Some of the reasons for reversing collisions include that pedestrians fail to see the reversing vehicle, fail to anticipate its manoeuvres, or are unable to get out of the vehicle's path, whereas drivers generally fail to see the pedestrian before the collision. In the case of young children, they fail to recognise and respond to potential risks in their environment in addition to their short stature, which may also diminish their ability to see moving vehicles given impeded vision by parked cars or other obstacles.

Moreover, while serious injury or death caused by reversing vehicles happens relatively rarely in comparison with some other road crash types, other factors combine to create a particularly distressing situation for the parties involved, as well as the broader community due to the age and vulnerability of the victims and the driver often being a close family member.

Reversing Aids

Research has shown that the physical environment, education, awareness and vehicle design are instrumental in preventing reversing collisions. Road safety experts and vehicle manufacturers agree that devices that increase the driver's awareness or vision of vulnerable road users behind a vehicle, can help reduce incidences of people being killed or injured by vehicles reversing. Reversing aids include ultrasonic sensors, reversing camera systems and rear-vision mirrors.

The Department of Infrastructure, Transport, Regional Development, Communications and the Arts (the department) works to prioritise and encourage adoption of proven technological improvements for all vehicles through the development of national road vehicle standards known as the Australian Design Rules (ADRs). The department is active in the development of internationally agreed standards for new vehicle technologies, referred to as United Nations (UN) Regulations that form the basis of the ADRs. Harmonising ADRs with these UN Regulations provides Australian consumers with access to vehicles meeting the latest global levels of safety and innovation at the lowest possible cost.

Reversing detection systems became mandatory in the European Union (EU) and Japan in July 2022 for new models and will become mandatory in July 2024 for all models. In Australia, fitment rates have been positively impacted over the last decade by manufacturer initiatives and consumer choice, leading to a fitment rate of 66 per cent in 2015 (Fildes et al., 2017). This includes both new vehicles and retrofitting used vehicles. Retrofitting results in substantial variability in capability, usage and performance across the Australian vehicle fleet.

In June 2021, the United Nations (UN) World Forum for the Harmonisation of Vehicle Regulations (WP29) adopted UN Regulation No. 158 (UN R158) titled *'Uniform provisions concerning the approval of devices for reversing motion and motor vehicles with regard to the driver's awareness of vulnerable road users behind vehicles'* to avoid pedestrians and cyclists being hit by the rear of the vehicle when reversing. Harmonising reversing technology requirements ensures consistency in driver expectations of system capability and usage. This will also provide a level playing field for all manufacturers as requirements are standardised across the new vehicle fleet. As with other technologies covered by UN Regulations, harmonised minimum requirements will enhance the usability and effectiveness of reversing aids independent of familiarity with a manufacturer or a brand.

This Final IA considers three options to increase the fitment of reversing detection systems to reduce reversing collisions in Australia, namely:

- Option 1: No Regulatory Intervention (business as usual)
- Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles
- Option 3: Introduce a new ADR aligned with United Nations Regulation No. 158 for light vehicles

Note the IA released for consultative purposes only had two options, that is Option 1: No Regulatory Intervention (business as usual) and Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158.

The results of the benefit-cost analysis over a 45-year period for each of the three options (assuming an intervention policy period of 15 years and 30 years past the period of intervention to capture the benefits of the last lot of vehicles to be fitted with reversing detection systems when the intervention stops) are summarised below in Table A and B.

Policy interventions often come at a cost. This Final IA assesses the benefit of the proposed intervention against the cost imposed. If that burden is greater than the benefit, it may be appropriate to look for alternatives, reconsider the need to intervene or acknowledge the limitations of quantitative analysis and rely more on qualitative factors to make a decision. 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 is the benefit-cost ratio (BCR). This is a measure of efficiency of the proposed intervention. 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).

Consideration of submissions received required amendments to costs variables, trauma ratings and implementation timing. The effects of an acceleration of the mandate for reversing aids to 2023 and an extension to 2025 were considered. Table A and B provide a summary of results from our analysis, noting that the implementation date was extended to 2025. These changes are discussed in more detail in Section 6.5 of this IA.

Table A: Summary of benefits, costs and benefit-cost ratio for each policy option

Policy Options	Gross Benefits	Cost to Business	Cost to Government	Benefit Cost Ratio	Net Benefits
Option 1: No Regulatory Intervention	-	-	-	-	-
Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles	\$80,603,086	\$105,305,900	\$910,791	0.76	-\$25,613,606
Option 3: Introduce a new ADR aligned with United Nations Regulation No. 158 for light vehicles	\$71,854,165	\$48,489,288	\$837,928	1.46	\$22,526,948

Table B: Summary of fatalities and injuries avoided for each policy option

Policy Options	Number of Lives Saved	Severe Injuries Avoided	Minor Injuries Avoided
Option 1: No Regulatory Intervention	-	-	-
Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles	13	140	62
Option 3: Introduce a new ADR aligned with United Nations Regulation No. 158 for light vehicles	12	124	55

Government intervention through **Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles**, indicated a total of 13 lives saved, and 140 severe injuries and 62 minor injuries avoided. This option yielded the highest savings of approximately \$80.6 million and a benefit-cost ratio of 0.76.

Government intervention through **Option 3: Introduce a new ADR aligned with United Nations Regulation No. 158 for light vehicles**, indicated a total of 12 lives saved, and 124 severe injuries and 55 minor injuries avoided. This option yielded the second highest savings of approximately \$71.9 million and a benefit-cost ratio of 1.46. These are conservative estimates. Refer to Section 6.5 for further information.

Public Comment

A consultation version of this IA was circulated for a six-week public comment period, which closed on 11 May 2022. A summary of feedback and departmental responses is included at Appendix 8. Section 6.3 has a more detailed discussion of the post-consultation analysis.

Note the IA released for consultative purposes and submitted for First Pass Assessment only proposed two options, that is Option 1: No Regulatory Intervention (business as usual) and Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158. Hence, the responses received only considered these two policy options – that is to either mandate the fitment of reversing aids to light and heavy vehicles or to let market forces increase the fitment of reversing aids across the new Australian vehicle fleet under business as usual arrangements.

The applicability dates proposed for consultation purposes were March 2024 for new model vehicles and March 2026 for all new vehicles.

During the consultation period, feedback was received from members of the public, state government agencies, industry and not-for-profit organisations. A majority of the feedback strongly supported the implementation of Option 2.

- Submissions from the Queensland Family and Child Commission (QFCC), Queensland Department of Transport and Main Roads (TmR) and Transport for NSW (TfNSW) supported Option 2.
- Submissions from not-for-profit organisations for the protection of children on roads (Kidsafe Queensland and the Georgina Josephine Foundation) supported Option 2.
- Submissions from the Australasian New Car Assessment Program (ANCAP) and the peak organisation for Australia’s motoring clubs (Australian Automobile Association (AAA)) supported Option 2.
- The National Heavy Vehicle Regulator (NHVR) supported Option 2 if amendments were made.
- Australia’s peak industry body representing truck manufacturers, importers and major component suppliers (Truck Industry Council (TIC)) did not indicate support for either option.
- Australia’s peak industry organisation representing the manufacturers and importers of passenger and light commercial vehicles (the Federal Chamber of Automotive Industries (FCAI)) supported Option 1.

Industry and jurisdictions also recommended amendments to the proposed applicability dates:

- FCAI requested later applicability dates to align with the introduction of United Nations Regulation No. 158 in other major international markets, but did not specify a date.

- TIC requested applicability dates of 1 November 2024 for new models and 1 February 2027 for all models. This was to provide consistent introduction dates for heavy vehicles (category NB1, NB2 and NC) and to accommodate Australian, Japanese and USA truck manufacturers that may struggle, it was argued, to meet the proposed implementation timing.
- TmR recommended an earlier implementation timeframe of March 2024 for new model vehicles and March 2025 for all new vehicles noting that voluntary fitment rate of reversing aids is already high on LPVs.
- TfNSW recommended an accelerated implementation of timeframe of 2023 for new model light vehicles and 2025 for all new light vehicles.

Post-Consultation Analysis

Stakeholder recommendations was examined in a post-consultation analysis (see Section 6.3 of this IA). Below is a summary of changes made to the benefit-cost analysis.

1. To address concerns with the proposed implementation timing, the effects of an acceleration of the mandate for reversing aids to 2023 and an extension to 2025 were considered.
2. Responding to comments about cost and upon further research, it was determined that fitment of a reversing camera only system ensures compliance with the proposed legislation. This is also the cheapest option. It was assumed that a display is already fitted for the purpose of other technologies and therefore would not need to be costed here. This results in an effectiveness of 0.43 which was used for the benefit-cost analysis. Previously the benefit-cost analysis considered the use of sensors.
3. To address concerns of underestimation of cost variables and consideration of additional benefits the following amendments were made to the benefit-cost analysis:
 - The estimate for the cost of fitting reversing camera systems (without the display) was increased to \$75 for LPVs and LCVs, and \$500 for HVs. This was assuming that a display is already fitted in the vehicle as per point 2. above.
 - The estimate for the cost for testing of a system to United Nations Regulation No. 158 was increased by \$10,000.
 - The estimate of cost imposed on government to implement and maintain regulation was increased by \$50,000 to account for jurisdictional in-service costs.
 - Inclusion of savings associated with reduced property damage resulting from reversing collisions. It is expected that there will be an overall benefit due to the reduction of property damage from the fitment of reversing aids.
 - Inclusion of impairment compensation attributed to permanent physical and/or psychological conditions caused by reversing crashes. The unit cost of fatality was increased by \$366,900 and the unit cost of severe injury was increased by \$241,800, however the unit cost of minor injuries remains unchanged as no impairment compensation was awarded for minor impairments (TAC, 2021). This is to provide an economic value to the otherwise intangible loss from pain, grief and suffering experienced by families and dependents of a deceased or impaired person.
4. To address concerns about the voluntary fitment rate of reversing aids the following amendments were made to the benefit-cost analysis:
 - Fitment rate estimate for LCVs was increased to reflect high consumer demand.
 - Fitment rate estimate for HVs was increased accounting for increased voluntary fitment in the construction industry under the Construction Logistics and Community Safety-Australia (CLOCS-A) initiative.
5. An additional clause (Clause 3.3) was included in ADR 108/00 – Reversing Technologies exempting prime-movers from the requirements of the regulation because prime movers mostly operate with a semi-trailer attached. To reflect this, a 15 per cent reduction was applied to the new HVs sales data and registration data in the benefit-cost analysis as it was assumed that prime-movers account for 15 per cent of ADR category NC vehicles (heavy goods vehicles).
6. Data received in submissions and estimations from local research into pedestrian fatalities attributed to reversing collisions was incorporated into the benefit-cost analysis, increasing the number of fatalities to approximately 13 per year. This increases the ratio of fatalities relative to other trauma types per reversing collision impacting upon the number of trauma savings obtained from the regulation of reversing aids.

7. To reflect the increase in new vehicle brands entering the Australian market per year, the number of major brands per vehicle category was increased. This was determined to be 48, 22 and 24 major brands for LPVs, LCVs and HVs respectively.
8. The typical fatality age was changed to 24 years old – median age. Previously the benefit-cost analysis considered a typical fatality age of 4 years old.
9. A combined benefit-cost analysis for LPVs, LCVs and HVs was conducted to determine the effect of regulation on all vehicle types, as well as functioning as a sensitivity check.

Feedback from Impact Analysis – First Pass Final Assessment

The introduction of a third option, that is **Option 3: Introduce a new ADR aligned with UN R158 for light vehicles** is included in this IA to be submitted for Second Pass Final Assessment.

A third option was recommended by the Office of Impact Analysis (formerly known as the Office of Best Practice Regulation (OBPR)) in the First Pass Final Assessment. This was based on the results of the post-consultation analysis (refer to Section 6.5 for further information), where the benefit-cost analysis does not demonstrate a net benefit for Option 2 but shows a positive benefit-cost ratio for new light vehicles (LPVs and LCVs).

In response, a combined benefit-cost analysis for LPVs and LCVs was prepared to determine the effect of regulation on all light vehicles, in addition to functioning as a sensitivity check. The result of the benefit-cost analysis for a third option for light vehicles does not alter the post-consultation benefit-cost analysis as there was no changes to post-consultation variables mentioned above. Refer to Section 6.5 for further information.

Note Option 2 has now been reworded for clarity purposes to **Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles**. The applicability of Option 2 remains unchanged from pre-consultation – that is LPVs, LCVs and HVs, with exceptions for prime movers, cab-chassis, and partially completed trucks where no road safety benefit would accrue due to their use in transport or particular stage of manufacturing as a result of provision to the market conditions. Noting that cab-chassis and partially completed trucks are required to comply with the regulation upon completion.

Results from Post-Consultation Analysis and First Pass Final Assessment

Consideration of submissions required amendments to costs variables, trauma ratings and implementation timing. Also, a third option for light vehicles only was included after recommendation in First Pass Final Assessment. Table C below provides a summary of the results of an accelerated timing to 2023 and an extended timing to 2025 relative to the previously timing of 2024 (proposed in the IA released for consultative purposes) using a 7 per cent discount rate. Refer to Section 6.5 for further information.

Table C: Summary of changes from for an accelerated and extended implementation timing for each policy option

Policy Options	Year	Gross Benefits	Net Benefits	Benefit Cost Ratio	Trauma Savings
Option 1: No Regulatory Intervention	-	No change as this is the business as usual case			
Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles	2023	\$87,601,851	-\$27,066,544	0.76	15 lives saved 155 serious injuries avoided 69 minor injuries avoided
	2024 (Proposed)	\$84,097,661	-\$26,436,600	0.76	14 lives saved 147 serious injuries avoided 65 minor injuries avoided
	2025	\$80,603,086	-\$25,613,606	0.76	13 lives saved 140 serious injuries avoided 62 minor injuries avoided
Option 3: Introduce a new ADR aligned with United Nations Regulation No. 158 for light vehicles	2023	\$78,814,304	\$25,357,333	1.47	13 lives saved 139 serious injuries avoided 62 minor injuries avoided
	2024 (Proposed)	\$75,308,367	\$23,967,331	1.47	12 lives saved 130 serious injuries avoided 58 minor injuries avoided
	2025	\$71,854,165	\$22,526,948	1.46	12 lives saved 124 serious injuries avoided 55 minor injuries avoided

Through post-consultation analysis, it was determined that an accelerated implementation timing of 2023 would result in minor changes to trauma rates and the benefit-cost ratio relative to the proposed implementation time of 2024 in the IA for consultative purposes. Accordingly, an extended implementation time can be considered.

The revised implementation timing proposed for Second Pass Final Assessment would be as follows.

- November 2025 for new model vehicles
- November 2027 for all new vehicles

The new timing provides continuity of supply to the Australian market and certainty for business.

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

Recommended Option

The recommended option in this IA is Option 2, full alignment with the international regulation for reversing aids for light and heavy vehicles. This is on the basis of a more holistic policy consideration of the benefits, and government objectives than a narrowly focused economic analysis. This means that the recommended option is not strictly following the advice of the *Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)*, as the benefit-cost analysis supporting this IA does not demonstrate a net benefit for Option 2. However, the reason for this recommendation is that Option 2 fulfils the Australian Government's long-standing policy of aligning with UN Regulations and achieves other Australian Government objectives.

Under Option 2, the UN Regulation for reversing aids to prevent reversing collisions (UN Regulation No. 158) would be mandated for new light passenger vehicles, goods vehicles and heavy vehicles. These vehicles include ADR categories for passenger vehicles MA, MB and MC; omnibuses MD and ME; and goods vehicles NA, NB and NC. Harmonising the ADRs with international vehicle standards is a longstanding Australian Government policy.

Another important Australian Government objective is supporting the National Road Safety Strategy 2021-30 (NRSS) (refer to Section 1.5.4 for further information). Reaching Vision Zero, that is zero deaths and serious injuries by 2050, as agreed by Infrastructure and Transport Ministers requires stronger actions than previously if deaths and serious injuries are no longer an acceptable price of mobility. Implementing Option 2 contributes to a number of priorities identified in the NRSS, including pursuing technological improvements and uptake of safer vehicles, improving heavy vehicle safety and focusing on vulnerable road users. Notably, one area of focus for committing to Vision Zero is a target of zero deaths of children 7-years and under by 2030. Further, it strengthens the national approach to managing the risks and impacts associated with a construction project's on-road transport and logistics activities to community road safety by supporting one of the agreed measures under the Construction Logistics and Community Safety Australia (CLOCS-A) program (refer to Section 1.5.6 for further information).

Alternatively, if the benefit-cost ratio is considered unacceptable for Option 2, Option 3 should be mandated for new light vehicles as they show a positive benefit-cost ratio of 1.46 which is higher than the typical value of 1.0 for a vehicle safety regulatory proposal.

The Impact Analysis Process

This Final IA has been written in accordance with the Australian Government IA requirements. In the subsequent nine chapters, the seven assessment questions set out in the *Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)* have been addressed. In addition, measurement of regulatory burden and cost offsets are considered. The seven IA questions addressed are:

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

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

1. What is the Problem?

1.1 Introduction

Collisions caused by a vehicle reversing often occur in an urban setting and affect vulnerable groups, such as small children and the elderly, more severely. Furthermore, even though the trauma mostly happens at low speeds the collision can cause serious injury and death due to the vulnerability of those people. While a reversing vehicle causing serious injury or death is a relatively rare occurrence, a number of factors combine to make such trauma particularly distressing not only to the parties directly involved but also the broader community due to the age and vulnerability of the victims, and the driver often being a close family member.

Research has shown that the physical environment, education, awareness and vehicle design are instrumental in mitigating such trauma. Road safety experts and vehicle manufacturers agree that technologies, such as devices that increase a driver's awareness or vision of vulnerable road users behind a vehicle, can help reduce incidences of people being killed or injured by reversing vehicles. Manufacturer initiatives and consumer choices have resulted in high voluntary fitment rates in new vehicles of reversing aids. However, the lack of a mandatory standard means that the capability, usage and performance of technologies vary substantially across the Australian vehicle fleet.

1.2 The Cost of Road Trauma in Australia

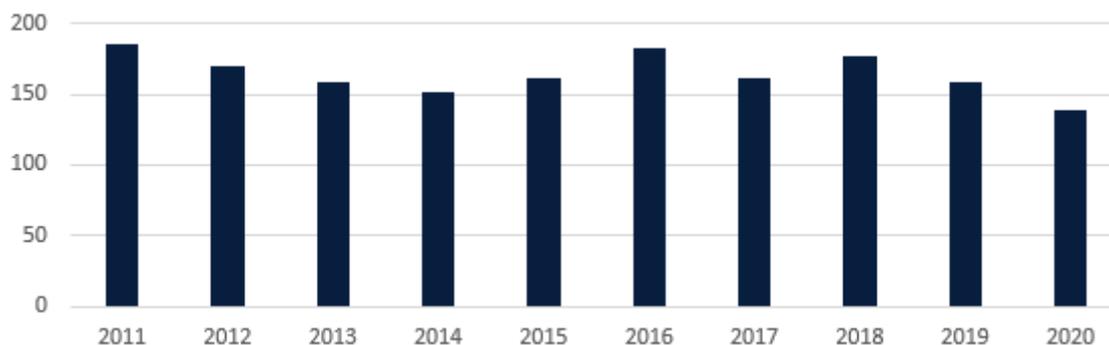
The impact of road crashes on society is significant. Individuals and families affected by road crashes must deal with pain and suffering, medical costs, lost income, higher insurance premium rates and vehicle repair costs. There is also a personal cost that cannot be measured. For society as a whole,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

1.3 Pedestrian Trauma Rates

Pedestrians comprise the largest single road user group as almost everyone is a pedestrian at some point of their travel journey. Most Australians regularly walk for leisure, to go to work, school or local shops and to access other modes of transport. Pedestrians, along with motorcyclists and pedal cyclists, are considered particularly vulnerable because they have little or no protection if struck by a vehicle.

Pedestrians travel low kilometres relative to other road user groups yet comprise 13 per cent of all road fatalities in Australia (BITRE, 2015). Local research shows six per cent of all pedestrian fatalities are a result of reversing collisions (Cassell et al., 2011), estimated to be 9.3 fatalities per year. Additionally, based on information provided by the Georgina Josephine Foundation we expect another 4 fatalities per year occurring on non-public roads. Whilst light vehicle occupant fatalities declined by 15 per cent in the ten years to 2019, the fatality rate of vulnerable road users has not significantly changed over the last decade (see Figure 1) with only a 5.1 per cent reduction observed (BITRE, 2020). The majority of pedestrian fatalities (75.8 per cent) involve a light vehicle striking a pedestrian (BITRE, 2015). The recent noticeable reduction in pedestrian trauma for two consecutive years (2019-2020) may be attributed to the impact of the COVID-19 pandemic on road transport. During the second quarter of calendar year 2020, estimated vehicle kilometres travelled (VKT) declined by 22 per cent and fatalities declined by 14 per cent. In the 3rd and 4th quarters of the 2020 calendar year, both VKT and deaths increased to historical trend levels. Compared to the 2019 calendar year, there were 6.7 per cent fewer fatalities in 2020.

Figure 1: Pedestrian fatalities 2011 - 2020 (BITRE, 2020)



1.3.1 International Research of Pedestrian Trauma Rate caused by Reversing Collisions

In France, reversing collisions account for 7 per cent of pedestrian accidents in public settings, with 73 per cent of those involved being pedestrians aged over 60 years (Brenac and Fournier, 2018). Similar findings were observed in studies undertaken in Sweden and Finland. These considered pedestrian fatalities as a whole including reversing collisions, with pedestrians aged 65 years or older over-represented among those severely or fatally injured (Kroyer, 2015). The risk of fatal injuries was found to increase when the person was over 75 years old (Malin, 2020). This research also found that the risk of fatalities was higher in those aged 25 years or younger, with Kroyer (2015) noting that an increased risk of severe injuries is observed in the youngest age group, from 0 – 6 years old. This is a result of the short stature of children that can contribute to an increased risk for serious and fatal head injuries due to the alignment of the car bumper (Rouse and Schwebel, 2019). Kroyer (2015) also noted that injury threshold varies between individuals; for example, a light collision or light impact might not cause any injuries to an adult pedestrian, where the same impact might cause severe injuries to an older and less physically strong person.

Most reversing collisions occur because pedestrians fail to see the reversing vehicle, fail to anticipate its manoeuvres, or are unable to get out of the vehicle's path, whereas drivers generally fail to see the pedestrian before the collision (Brenac and Fournier, 2018). Research in the United States of America by Rouse and Schwebel (2019) identified three risk factors that contribute to injury risk for young children in areas with low traffic speeds, such as car parks. Firstly, young children struggle to recognise and respond to potential risks in their environment – young children might not understand the meaning of reverse lights on a car, or be able to anticipate and react to the direction, distance, and speed of cars moving around them. Secondly, children's short stature may also diminish their ability to see moving vehicles given impeded vision by parked cars or other obstacles. Thirdly, young children lack the cognitive skills required to engage in safe pedestrian behaviour, even in settings with slow-moving traffic. Research undertaken in Japan by Matsui and Oikawa (2019) identified that vehicle impact speed affects the frequency of pedestrian fatalities, because pedestrian fatalities occur even when reversing at low travel speeds.

Both Matsui and Oikawa (2019) and Brenac and Fournier (2018) found that improved driver visibility can contribute to reducing pedestrian fatalities and injury rates in reversing collisions, but noted that the occurrence of such accidents cannot be fully eliminated. This is confirmed by Australian findings discussed in Section 1.4 below.

1.3.2 Social Impact of Reversing Collisions

Despite the low number of deaths per year attributed to reversing collisions, the social impacts on families and the wider community are immeasurable. This is especially the case when it involves the death of a child, as children take on great symbolic importance in terms of parent's willingness to engage in acts that promote the wellbeing of younger generations and hope for the future (Christ et al., 2003). In Australia, the seriousness of reversing collisions is evidenced by a foundation set up to provide a support network for families affected by low-speed vehicle run over accidents. The foundation works to prevent and reduce unintentional injury or death of children and adults in such accidents (Georgina Josephine Foundation, 2021). As most of these deaths and injuries are preventable, but frequently happen when a parent

or close relative is driving without seeing the child behind the vehicle, the cost in psychological terms for the family are high and often leads to extensive grief and frequently a breakdown of the family unit (Griffin et al., 2014).

There is substantial evidence that the grief of parents following the loss of a child is more intense and prolonged than that of other losses. In instances when the child dies suddenly through accidental death, parental grief is complicated by post-traumatic stress reactions from the nature of the circumstances (Raphael, 2006). This is reflected in research conducted by Fisher et al. (2020) concluding that bereavement by sudden deaths can lead to increased grief severity and depression compared to those bereaved by natural causes. Christ et al. (2003) found that in addition to grief, parents of children who die suffer a broad range of lifelong difficult mental / psychological symptoms and physical symptoms. Further, guilt and self-blame are especially pronounced as the parent's role and competence as the child's caregiver, protector and mentor is severely threatened by untimely death.

1.4 Extent of the Problem in Australia

Reversing collisions involving a vehicle and a pedestrian or another vulnerable road user, i.e. cyclist or motorcyclist, are generally rare occurrences with very low number of cases reported each year. This is reflected in a study undertaken by Monash University Accident Research Centre (MUARC) in Victoria identifying that only 6 per cent of pedestrian fatalities were due to reversing vehicles (Cassell et al., 2011). However, the prevalence of such collisions tends to be underestimated as the majority of these collisions and injuries sustained are often outside the scope of official road injury record systems which focus on public roads (Keall et al., 2018). Further confounding a more accurate estimation of the size of the problem is that reversing collisions, referred to as low speed vehicle run-over crashes in MUARC (n.d.), are not well defined, and therefore identifying and coding these crash types is difficult (MUARC, n.d. and Griffin et al., 2011).

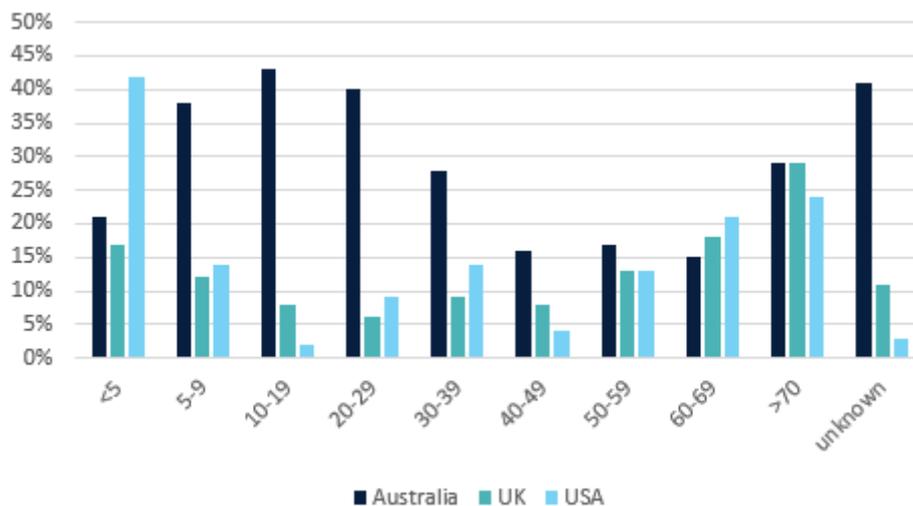
This finding is supported by the lack of data for reversing collisions involving pedestrians in national databases, such as the Australian Fatal Road Crash Database, maintained by the Victorian Institute of Forensic Medicine and the Australian Road Deaths Database published by BITRE. The same conclusion applies to most state and territory databases maintained by their transport agencies, such as the VicRoads Road Crash Information System. Hence, the true magnitude of reversing collisions is difficult to quantify. While our benefit-cost analysis noted that there were 13 fatalities and 140 serious injuries avoided for government intervention for light and heavy vehicles in 2025, it is generally accepted that these figures underestimate the true magnitude of the problem.

The findings from Fildes et al. (2017) in Figure 2 below show that there was a strong relationship between the injured pedestrian's age and their collision injury severity. For Australia and the US, very young children and older people were killed and seriously injured more often. The pattern was less clear for the UK, although pedestrians aged 60 years and older generally had similarly high rates of Killed and Serious Injury (KSI) rates across all countries.

As shown below there were the following number of pedestrians involved in a KSI crash from 2010-12:

- 1 pedestrian below 5 years old representing 21 per cent of the total Australian pedestrian sample size;
- 2 pedestrians from 5 to 9 years old representing 38 per cent of the total Australian pedestrian sample size; and
- 23 pedestrians 70 years old and above representing 29 per cent of the total Australian pedestrian sample size.

Figure 2: Per cent of all pedestrian KSIs by age and country 2010 - 2012 that were the result of reversing collisions (Fildes et al., 2017)



1.4.1 Locations for Reversing Collisions

Walking behind a reversing vehicle in car parks or driveways are common circumstances in which pedestrians were injured, as indicated by research undertaken by Cassell et al. (2010). This is similar to findings from the Transport Accident Commission (TAC) in Victoria, which concluded that 70 per cent of reversing collisions occur when people are parking or reversing from a driveway (TAC, 2018). Deaths also occur on public roads in speed zones of 50 – 60 km/h where vehicles perform all kinds of low-speed manoeuvres such as entering or leaving parking spaces, turning corners, and other situations where there are obstructions to a clear view behind a reversing vehicle (BITRE, 2012).

Of concern to parents and the wider community is the extent to which low speed locations such as car parks, schools, sports grounds and around the home, considered by many to be a safe haven, pose a threat to child safety (See Figure 1). Research has shown that children have been killed or seriously injured after being run-over by a motor vehicle performing low-speed manoeuvres, including reversing and forward motion, in these locations (BITRE, 2012). Both people and vehicles are factors influencing motor vehicle accidents around the home, as well as home design features, which create risks for children by exposing them to the movements of vehicles through unfenced driveways and doors (BITRE, 2012).

1.4.2 Pedestrian Collisions Involving the Elderly

Australian research confirms international findings that reversing collisions predominantly impact vulnerable population groups, especially the elderly that are over-represented in pedestrian fatalities and have an increased risk of severe injury, have higher recovery times and likelihood of long-term disability (Oxley et al., 2020). Although older pedestrians are generally safe and cautious in their travel behaviour, the effects of ageing on sensory, visual perceptual and cognitive abilities may increase their risk on the road (Oxley et al., 2020).

A study of traffic-related pedestrian injury undertaken by MUARC (see Figure 3) that analysed all pedestrian fatalities including reversing collisions as a subset of the fatalities, determined that 34 per cent of elderly pedestrian fatalities and hospital admissions were in the age group 75 years or older and the number of fatalities was highest in the age group 80-84 years (15 per cent of all pedestrian deaths), followed by the age group 75-79 years (12 per cent) and the age group 85+ years (8 per cent) (Cassell et al., 2011).

Figure 3: Elderly pedestrian fatalities and hospital admissions (Cassell et al., 2011)

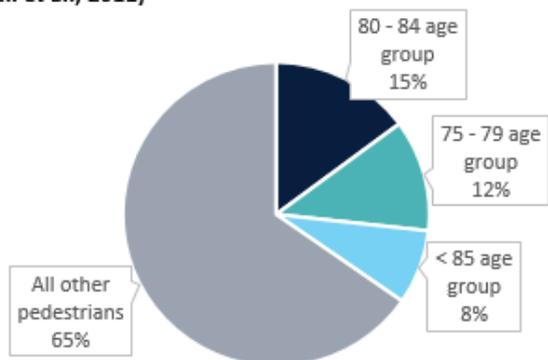


Figure 4: Fatality rate of elderly pedestrians in comparison with all age groups (Cassell et al., 2011)

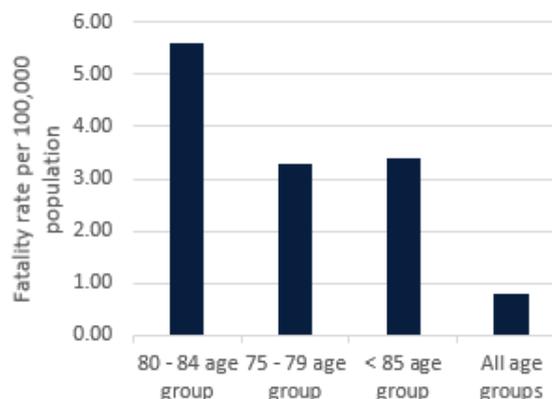


Figure 4 above shows the fatality rate was also the highest in pedestrians aged 80-84 years (5.6 per 100,000) followed by 85+ years (3.4 per 100,000) then persons aged 75-79 years (3.3 per 100,000) (Cassell et al., 2011). This is similar to findings by Oxley et al., (2020) which found that the risk of fatality is 25 per cent for pedestrians aged up to 60 years and 70 per cent for pedestrians aged 60+ years.

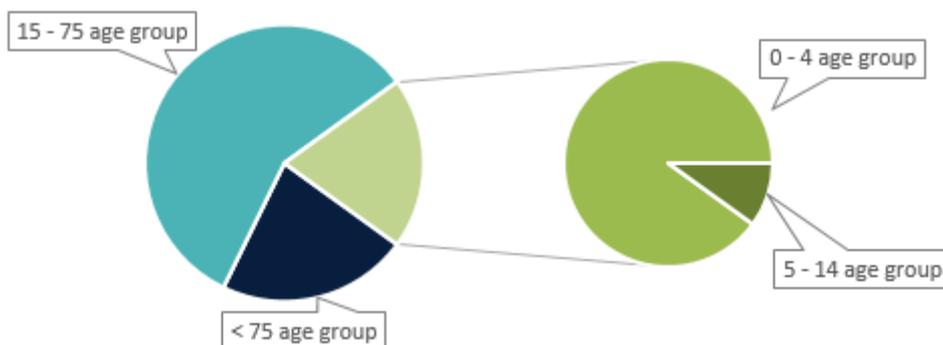
Moreover, hospital admission rates were highest among pedestrians aged 80-84 years and those aged 85 years and older, followed by those aged 75-79 years (Cassell et al., 2010). This is similar to the findings from Oxley et al. (2020) noting that people aged 70 years and older have the greatest risk of injury at 1.6 times higher than young adults (16-39 years), where they make up 15 per cent of all injury cases. Among hospital admissions in Victoria for pedestrian injuries, the head, face and neck (35 per cent) and lower extremity (35 per cent) were the most commonly injured body regions where the major injury types were fractures (46 per cent) and intracranial injuries (also known as traumatic brain injury) (14 per cent) (Cassell et al., 2010). The total hospital costs of pedestrian injury admissions over the three years 2006-2008 was \$18.3 million (\$6.1 million per year) and the average cost of pedestrian admission was \$8,525 (\$11,561 in 2020-dollar terms) compared with an average cost of \$4,721 (\$6,402 in 2020-dollar terms) for all causes of unintentional injury combined (Cassell et al., 2010). Cassell et al. (2010) found that the average length of stay of hospital admissions was 4.9 days which grew with increasing age and that the injury severity appeared related to the mass of the vehicle involved in the pedestrian collision. This is similar to results presented by Oxley et al. (2020) which stated that half of hospital admissions were less than 2 days in duration, but 32.5 per cent were for 2-7 days, 14.8 per cent were stays of 8-30 days and 1.9 per cent for hospitalisations extended for more than a month.

1.4.3 Reversing Collisions Involving Children

Reversing collisions, referred to as low speed vehicle run-overs in Griffin et al. (2011), were considered in 1996 to be the largest cause of death after pool drowning for children aged 1- 4 years old (Griffin et al., 2011). A confounding concern is that the driver of the vehicle is usually a parent, relative or family friend. It has been suggested that in 85 per cent of cases the driver may have been unable to see the child behind the vehicle and did not know that the child was close to the vehicle, assuming the child was being looked after elsewhere (Kidsafe Victoria, 2020).

Children comprise 20 per cent of all pedestrian fatalities caused by reversing collisions (Fildes et al., 2014). Children under 5 years old are at the greatest risk – accounting for 90 per cent (see Figure 5 below) of children killed and 70 per cent of those seriously injured, where many children who survive these incidents sustain severe and permanent injuries (BITRE, 2012).

Figure 5: Pedestrian fatalities by road user age group (BITRE, 2012)



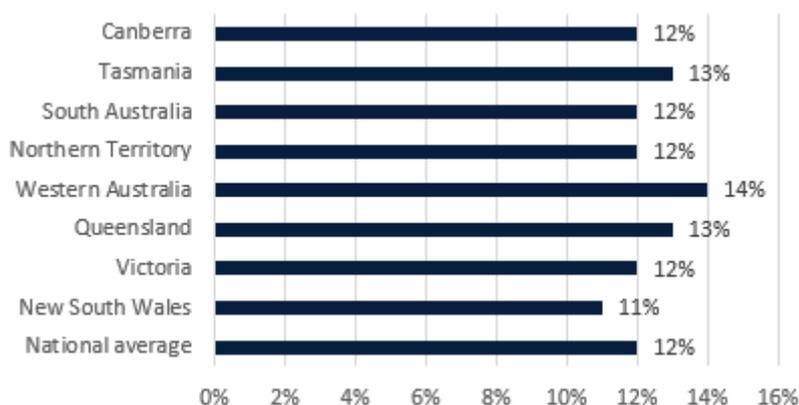
From 1999 to 2009, the incidence of reversing collision events (referred to as low speed vehicle run-overs in Griffin et al. (2014)) among 0 – 15-year old increased over time (Griffin et al., 2014). The incidence of hospitalisations resulting from reversing collisions decreased over the 11-year period but incidence of non-admissions increased, and in addition no significant change was observed with the incidence of fatalities (Griffin et al., 2014).

BITRE (2012) reported that 66 pedestrians aged 0 to 14 years were killed in the ten-year period from 2001 – 2010 and 483 seriously injured in the eight-year period from 2002/2003 to 2009/2010 due to being hit by a four-wheeled motor vehicle moving around a home. The fatality rate of pedestrians aged 0 – 4 years was highest (1.0 per 100,000), then aged 5 – 14 years (0.5 per 100,000) (BITRE, 2012). The injury rate of pedestrians aged 5 – 14 years was highest (16.8 per 100,000), then followed by 0 – 4 years (14.3 per 100,000) (BITRE, 2012). Children and their families may not fully recover from serious injuries from reversing collisions, either physically or psychologically (BITRE, 2012). Preventable injuries to children are a significant burden on society and a considerable cost to the health care system, with hospitalisation in Australia costing approximately \$504 million per annum for transport-related injuries (Mitchell et al., 2018) which translates to a cost of \$516.5 million per annum in 2020.

1.4.4 Collisions while Reversing

The Australian Associated Motor Insurers Limited (AAMI) Crash Index reveals Australia’s most common type of motor vehicle accident. The data looks at claims from one of the largest insurance companies. The 2018 Crash Index showed that collisions while reversing was the fourth most common types of accidents in Australia at 12 per cent of all crashes (Suncorp Group, 2018). Figure 6 shows the national and jurisdictional average of collisions while reversing as a percentage of all crashes.

Figure 6: Reversing collisions by jurisdiction (Suncorp Group, 2018)



1.4.5 Recommended Preventative Measures

Keall et al. (2018) stated that obscured vision from the vehicle represents a major risk factor, noting that vehicles rated with better forward and rearward visibility are less likely to hit a pedestrian. A study of visual ergonomics for a wide range of vehicle types found that even amongst vehicles with a wide visual coverage, a 60 centimetre long test cylinder was visible in the driver's rear mirror only when it was more than 3 metres from the rear of the vehicle, and that it was usually necessary to place the cylinder between 5 – 10 metres behind the vehicle before it was detectable (Neeman et al. (2002)). It further found that children ranging in height from 66 – 104 centimetres were not easily detectable at closer proximities by drivers viewing the rear-view mirror.

Fildes et al. (2014) and Fildes et al. (2017) emphasised that the most frequent cause of reversing collision occurred because the driver or the pedestrian failed to look properly during a reversing manoeuvre. They recommended improvements in visibility in addition to providing auditory backing alert on vehicles. The recommended improvements address a contributing factor to pedestrian deaths, i.e. the driver's unsafe or dangerous behaviour including lack of awareness or general failure to keep proper lookout especially when reversing (Cassell et al., 2011).

The design of the vehicle to minimise blind spots and technologies that expand the driver's field of vision are important measures to mitigate and prevent reversing collisions (Neeman et al., 2002). Reversing aids, such as cameras and sensors, reduce the likelihood of reversing collisions and assist parking manoeuvres. The best reversing cameras can cut down on dangerous blind spots and make backing out of the driveway much safer if there are children, small pets or other obstacles present. They also increase visibility of objects that cannot be seen in a conventional rear-view mirror (Fildes et al., 2014). Installing reversing camera systems can reduce reversing collisions by 41 per cent and vehicles with parking sensors are 31 per cent less likely to be involved in a reversing collision (TAC, 2018).

It is possible to fit reversing aids as aftermarket modifications to vehicles in-service, although new vehicles are increasingly fitted with such technologies, with 66 per cent of passenger vehicles fitted as of 2015 (Fildes et al., 2017). However, voluntary fitment of aftermarket technologies is not considered the best way to address the problem. This is chiefly because the performance of these technologies is unknown due to uncertainty about system functionality, whether it is functioning as intended, i.e. properly synchronised and calibrated with the Original Equipment Manufacturer (OEM) systems in the vehicle, given that each aftermarket system has manufacturer specific discrepancies, as well as the overall quality of the system.

Improvements in vehicle safety features to reduce the incidence of reversing collisions are increasingly being adopted in the new vehicle fleet. The Australasian New Car Assessment Program (ANCAP) refers to these safety features as Reversing Collision Avoidance technologies. They include reversing Autonomous Emergency Braking (AEB), Blind Spot Monitoring (BSM) and Emergency Brake Assist. To achieve a 5-star ANCAP safety rating, a vehicle must achieve a sufficiently high score in all tests and feature advanced safety assist technologies (ANCAP, 2020), which could include those mentioned above. Manufacturers increasingly fit safety technologies, such as reversing AEB and Reversing Collision Avoidance on higher-end models. However, these safety features may not be available on more affordable market entry models, and without an agreed benchmark their performance may vary considerably across all vehicle models and brands.

1.5 Government Actions to Address Pedestrian Trauma from Reversing Vehicles

Governments at all jurisdictional levels take actions to address vulnerable road user trauma from reversing vehicles. They include both regulatory and non-regulatory measures, such as public education campaigns, market forces and fleet purchasing policies. Despite such schemes, significant levels of vulnerable road user trauma remain (see Figure 1).

1.5.1 National Funding for Road Safety Initiatives

Through the Office of Road Safety, the Australian Government allocates dedicated funding for a number of road safety programs. For example, the Road Safety Innovation Fund and the Road Safety Awareness and Enablers Fund provide \$12 million and \$4 million respectively over four years from 2019-2020 to support road safety research and the development

of new road safety technologies, and road safety awareness, education and collaboration initiatives, including for the protection of vulnerable road users, such as pedestrians, cyclists and children.

Funding through the Road Safety Awareness and Enablers Fund has been given to promote driveway safety through the Georgina Josephine Foundation by conducting radio advertisements promoting education and encouraging awareness around low speed vehicle run-over incidents effecting children. The target audience is parents and carers of young children and the general motoring public.

Funding through the Road Safety Innovation Fund has been given, amongst others, to:

- HeroSeraph Pty Ltd to research, develop and test a system to detect mobility impaired pedestrians on and in the vicinity of the roadway to increase their safety and promote inclusivity; and
- Little Blue Dinosaur Foundation Limited to learn more about the trends, causes and factors that lead to road trauma in children and then implement trial programs to combat the rise and aim to reduce road trauma to zero.

1.5.2 State and Territory Government Action

State and territory governments target identified vehicle safety concerns such as reversing collisions, pedestrian and driveway safety through investment in research projects, education campaigns and strategic partnerships. Most jurisdictions have committed to 'Towards Zero' through their road safety strategies. The guiding vision is that no person should be killed or seriously injured on Australia's roads: Safe road use, Safe people, Safe speeds and Safe vehicles are the four key themes of this vision. Recognising that road safety is a complex issue, the strategies cover a range of actions, including campaigns that target:

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

Specific initiatives that target vulnerable road users in reversing vehicle situations, include:

Northern Territory:

- Government vehicle purchasing policy requires vehicles to have minimum of 5 critical safety features in addition to the 5-star ANCAP rating, one of these is reverse camera/sensors.
- Fact sheets on driveway safety.

Victoria:

- Government vehicle purchasing policy requires vehicles to have minimum of 5 critical safety features in addition to the 5-star ANCAP rating, one of these is reverse camera/sensors.
- Kidsafe Victoria, which is partly funded by the Victorian Government, focus on driveway safety as one of their key features to keep children safe.

New South Wales:

- Transport for NSW has funded the Georgina Josephine Foundation to do a series of media campaigns (TV advertising, online advertising, radio advertising and YouTube educational videos) to provide driveway safety advice to parents, carers and drivers (TfNSW, 2019). The objectives of the campaign are to raise awareness of the safety risks that driveway environments pose to young children, facilitate the use of strategies and countermeasures to help prevent driveway safety incidents and to discourage the use of driveways as play areas (TfNSW, 2019).

Western Australia:

- Launched a media campaign focusing on keeping children safe on the roads, including in driveways in 2020.
- Announced funding in September 2021 for the Constable Care Foundation to develop and deliver to schools, Aurora's House, a new safety school experience to educate children on driveway safety and vehicles reversing across footpaths.

Queensland:

- Released a guideline in 2021 for treating motor conflicts between vehicles and path users at access driveways. The guideline can be used to assess risk at existing sites and at sites where a new access driveway, or active transport infrastructure is proposed.
- Previous initiatives by the Department of Transport and Main Roads (TmR) have focused on information campaigns via social media. Between September 2018 and March 2019, a social media campaign was conducted in conjunction with the Queensland Family and Child Commission about child safety. Three of the six social media posts were dedicated to reversing on driveways. These posts had a combined reach of 735,000 people. Since then, two additional posts were dedicated to reversing and driveway safety. A post in March 2020 reached 300,000 people, while a follow up post in September 2020 reached 90,500 people. All these posts were boosted (paid) social media posts distributed across Facebook, Twitter and Instagram with the majority of reach generated by Facebook.

1.5.3 National Vehicle Standards

The Australian Government administers the *Road Vehicle Standards Act 2018 (RVSA)*, which requires that all new road vehicles, whether they are manufactured in Australia or are imported, comply with national vehicle standards known as the Australian Design Rules (ADRs), before they can be offered to the market for use in transport in Australia. The ADRs set minimum national standards for vehicle safety, emission and anti-theft performance in addition to the use of technological measures to enhance object detection.

Rear-Vision Mirrors

It has long been recognised that assisting the driver improve their visual ergonomics in all types of vehicles and eliminating objects fitted to the interior or exterior of the vehicle that are responsible for significant blind spots in the driver's field of view are important mitigating measures. Rear vision mirrors have been a feature of vehicles from an early date and a national standard has applied since the early 1990s. Australian Design Rule 14/02 – Rear Vision Mirrors (ADR 14/02) is the current version and applies to all road motor vehicles (ADR Category L, M and N). This standard is harmonised with the UN Regulation No. 46/05 titled '*Uniform provisions concerning the approval of devices for indirect vision and of motor vehicles with regard to the installation of these devices.*'

ADR 14/02 primarily serves to specify requirements for rear vision mirrors and other devices which provide the driver with a clear and reasonably unobstructed view to the rear. This relates to devices used to observe the traffic area in the rearward direction adjacent to the vehicle which cannot be observed by direct vision. The Regulation applies to compulsory and optional devices for indirect vision, for instance mirrors and devices for indirect vision other than mirrors such as camera-monitor systems. The requirement is focused on mirrors and other devices for indirect vision to be fitted in such a way that would not cause the driver to misinterpret the nature of the image perceived, either through changing the field of vision as measured or vibrating.

1.5.4 The National Road Safety Strategy 2021-30

Under the previous National Road Safety Strategy 2011-20, aligned with the United Nations Decade of Action for Road Safety, governments at all levels have worked together with communities to change the road transport system to prevent deaths and serious injuries. The Australian Government's commitment to continued action to deliver significant reductions in road trauma over the next decade from 2021 to 2030 is set out in the National Road Safety Strategy 2021-30 (NRSS).

The NRSS establishes stronger governance, transparency and accountability by all levels of government, and adopts a social model approach to deliver road safety actions, mapping out a path to foster a road safety culture across Australian society. It continues the Government commitment to the Safe Systems approach to strengthening all elements of our road transport system through improvements under three key themes: Safe roads, Safe vehicles and Safe road use, where speed management is embedded within all three themes. The NRSS sets targets to reduce the annual number of fatalities by at least 50 per cent and the annual number of serious injuries by at least 30 per cent by 2030.

The NRSS supports the Government's long-term vision towards achieving Vision Zero, that is zero deaths and serious injuries by 2050. As part of the commitment to Vision Zero, success will be demonstrated by targeting:

- Zero deaths and serious injuries by 2030; and
- Zero deaths of children 7-years and under.

Nine priorities were identified towards achieving Vision Zero and of importance to this IA are the following priorities:

- Vehicle Safety – pursuing technological improvements and uptake of safer vehicles through prioritisation and adoption of proven technological improvements for all vehicle types through new ADRs as quickly as possible;
- Heavy vehicle safety – supporting the safe movement of freight and passengers and reduce harm to all road users through regulation and promotion of heavy vehicle safety technologies; and
- Vulnerable road users – providing safe road access for all road users especially children, inexperienced drivers/riders and older road users.

It is noted in the NRSS that there are other vehicle-related safety issues such as low-speed runovers that are separate to road trauma data collections but it is intended over the life of the NRSS to develop sufficient data sets to build a national picture to support their prevention.

1.5.5 Australasian New Car Assessment Program (ANCAP)

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

Where international standards are yet to be developed, or there is not a strong case for implementation in Australia, non-regulatory programs such as ANCAP can be an effective alternative to improve safety by increasing fitment rate of new technologies. The Australian Government provides substantial funding to ANCAP for this purpose. Government support for ANCAP has been a long-standing element in the Safe vehicles theme of the National Road Safety Strategy 2011-20 which is continued in the National Road Safety Strategy 2021-30. It ensures ANCAP continues to encourage and promote voluntary uptake of the latest vehicle safety technologies ahead of regulation.

1.5.6 Construction Logistics and Community Safety-Australia (CLOCS-A)

CLOCS-A is a national approach for managing the risks and impacts associated with a construction project's on-road transport and logistics activities to community road safety. It was developed to provide a consistent framework for industry to achieve and has been inspired by the success of the Construction Logistics and Community Safety (CLOCS) program established in the United Kingdom in reducing road trauma associated with construction logistics.

The CLOCS-A program has established a safer vehicles technical group to develop supporting standards, policies and tools required in construction and transport vehicles supporting construction projects to reduce harm (CLOCS-A, 2021). Recognising the movement of construction vehicles in populated areas can present hazards for the public, particularly vulnerable road users, CLOCS-A seeks to prioritise and promote the use of safer heavy vehicles through awarding accreditation on a 3-tiered approach – that is Bronze, Silver and Gold (CLOCS-A, 2022).

Reversing aids has been identified under the Bronze tier as a low cost and easy to implement technology that forms the minimum mandatory standard for all heavy vehicles complying with the CLOCS-A technical requirements (CLOCS-A, 2022).

2. Why is Government Action Needed?

Australian businesses, governments and road user groups are working towards reducing trauma caused by vehicles. Nevertheless, the impact – economic and psychological – of reversing collisions remain significant. Devices that increase the driver’s awareness of vulnerable road users behind the vehicle when reversing can mitigate such trauma. Different technologies have been available and fitted to vehicles over the last decade, partly due to awareness campaigns and advocacy by consumer groups, including Kidsafe and ANCAP. However, while fitment rate of reversing aids has increased, the design, performance capability and usability vary across vehicle models in the Australian fleet. Where voluntarily fitted systems lack standard capability, consumers are at a disadvantage because they may not know the performance capability of their particular vehicle and gaps remain in the opportunity for reversing aids to reduce vehicle trauma. Regulation is necessary to standardise minimum reversing aid performance requirements and driver interfaces. Furthermore, by setting a minimum performance level, regulation can provide cost-effective and maximised fitment in the new Australian vehicle fleet.

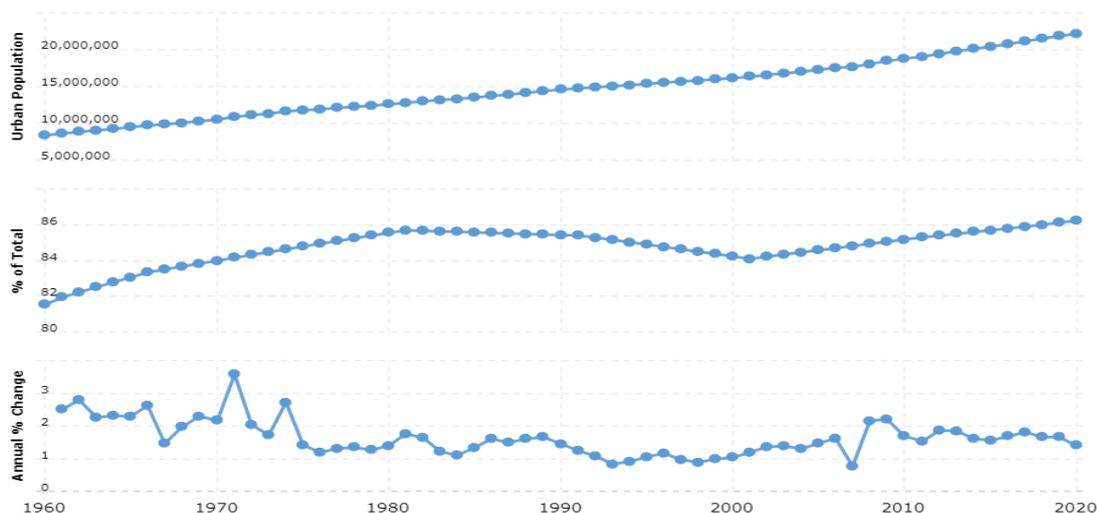
Generally, existing high voluntary fitment rates of safety features may reduce the need to intervene in the market, particularly through regulation. On the other hand, there can be strong advantages to intervention by regulation even at such high voluntary fitment rates. Particularly valuable is certainty about the capability and performance of the safety systems. While a proportion of reversing aids fitted voluntarily to vehicles at the moment will comply with the proposed UN R158, others will be fitted for other purposes such as to make parking and manoeuvring easier. Regulating will improve the performance of those devices at detecting people behind vehicles and provide further benefits. The increase in performance is estimated at 5 per cent.

2.1 Consumer Knowledge

Government action may be needed where the market fails to provide the most efficient and effective solution to a problem.

Despite the fact that road trauma is an Australian and global concern, there are still unanswered questions about how the number of accidents in urban areas scale with the population size or the population density of a given region. In recent decades the number of motor vehicles in use in Australia has risen from 12.5 million in 2001 (ABS, 2001) to 19.8 million in 2020 (ABS, 2020) leading to an increased exposure to traffic for most people. This motorisation has grown hand in hand with urbanisation. Figure 7 shows that since the late 1950s, the urban population in Australia has increased rapidly, so that in 2020, almost 90 per cent of the population live in urban areas (United Nations, Department of Economic and Social Affairs, Population Division, 2018).

Figure 7: Urban population growth in Australia (Macrotrends LLC, 2022)



Road vehicles today are complex machines which operate in a high-risk environment, leading to thousands of deaths and injuries each year. Vehicles are made of multiple, complex and sophisticated mechanical, electrical and electronic components and the average consumer is often unaware of the function of each component and its contribution to the functioning of the vehicle as a whole. For example, a consumer is unlikely to be able to assess the crashworthiness of the vehicle because the structural design determines the degree of occupant protection, with many important components concealed (e.g. side intrusion bars) and overall structural integrity influenced by the mechanical properties (e.g. yield strength, stiffness etc.) of materials used, as well as the design geometry (e.g. thickness, width etc.) and weld properties. A recent example of a new safety feature being introduced to the Australian fleet with varying performance outcomes is Advanced Emergency Braking (AEB), where testing conducted by ANCAP on a number of vehicle makes and models demonstrated variation in performance (ANCAP, 2020).

It is therefore difficult for consumers to obtain the information and understanding required to evaluate a vehicle's safety performance and make an informed decision about the appropriate vehicle to purchase. Without any intervention, the consumer would need to inform themselves of all those components to make the best choice. Moreover, some vehicle safety technologies emphasise externalities and might not be prioritised or seen as necessary by consumers, who are likely to focus on their own safety over pedestrian safety.

There is some help available for the consumer to assist with the choice of purchasing a new vehicle, including from ANCAP. Through their five-star rating program ANCAP has incentivised vehicle manufacturers and consumers to prioritise vehicle safety which means that manufacturers provide additional safety features in some vehicles. However, while the current five-star rating program does include reversing collision avoidance technologies, a consumer may not be aware of the performance capabilities of those, such as Reversing AEB, BSM or Reversing Collision Avoidance.

To provide a suitable and sufficient risk assessment of vehicles, governments around the world have converged over the past 20-30 years and have collectively leaned towards the use of a combination of regulatory, i.e. mandatory standards, and non-regulatory, e.g. New Car Assessment Programs (NCAPs), performance-based tests, as the primary policy to improve safety for vehicle occupants and vulnerable road users.

2.2 Most Effective Vehicle Technology Interventions

Awareness campaigns and advocacy activities focusing on preventing reversing collisions can be effective. However, vehicle technology is more reliable in directly mitigating such collisions by reducing the physical and cognitive demand on drivers by enhancing their attention to their environment.

The last two decades have seen an increase in the fitment of devices that improves the driver's awareness of their surroundings, such as cameras and sensors. In addition to the driver, these devices detect when a vehicle is getting close to another object or person when reversing.

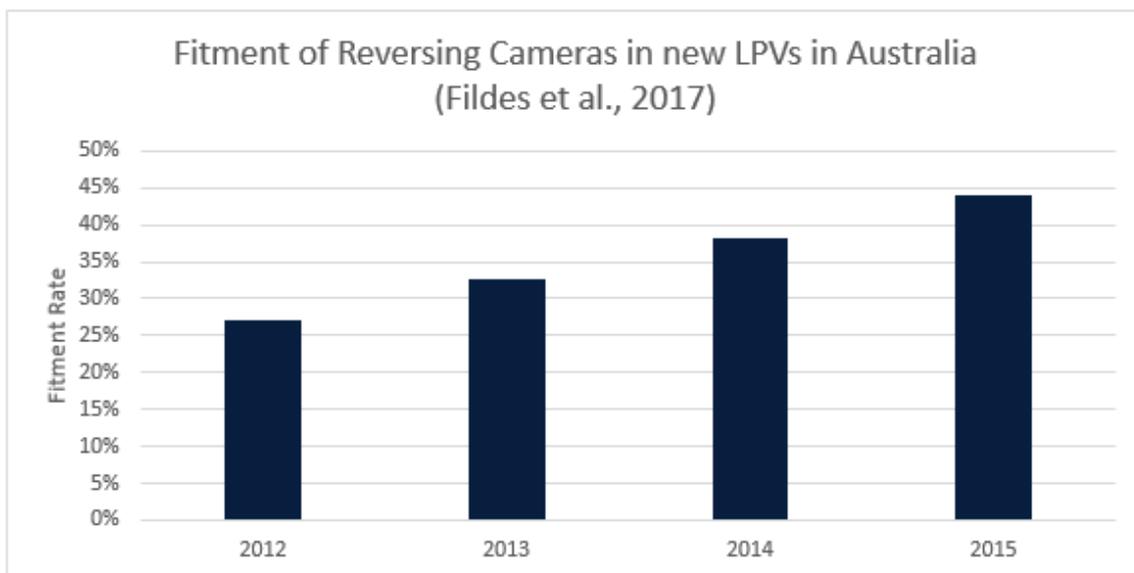
As set out in Chapter 1, reversing collisions often have a large impact on the parties involved and the broader community due to fatalities and severe injuries inflicted on very young children and the elderly. The actual number of such collisions may not be large but they have assumed a high profile in the general population and often attract significant media coverage. Reversing aids are considered a promising vehicle technology for reducing such trauma. This view is supported in the international vehicle standards development community (WP29) with the making of a new UN Regulation to improve a driver's awareness of vulnerable road users behind vehicles.

2.3 Availability and Uptake of Reversing Aids

Some manufacturers have limited new safety systems to flagship models or variants, leaving high-volume entry-level models with less sophisticated safety technologies (Nicholson, 2020). However, as the technology matures safety systems, such as reversing cameras are extended to standard model vehicles.

The Royal Automobile Club of Victoria (RACV) reports that the number of reversing cameras in new passenger cars in Australia grew from 27 per cent to 44 per cent between 2012 and 2015 and subsequently the number of vehicles with no reversing aids (cameras or reversing sensors) fell from 45 per cent to 34 per cent (Fildes et al., 2017) as shown in Figure 8 below.

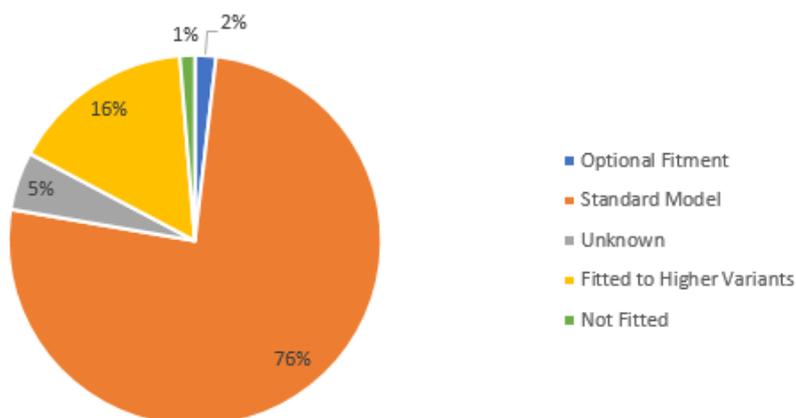
Figure 8: Fitment of Reversing Cameras in new LPVs in Australia (Fildes et al., 2017)



The continued increase is shown below through the fitment of reversing aid technologies in vehicles sold over 2020-21 (76 per cent of standard/base model vehicles and 16 per cent of higher variants) as obtained from ANCAP as shown in Figure 9 below.

Figure 9: Sales of vehicles fitted with reversing aids over the 2020-21 Financial Year. Data obtained from ANCAP.

ANCAP Data: Sales of Vehicles Fitted with Reversing Aids over the 2020-21 Financial Year



As there were no data available for the fitment rate of reversing aids for LCVs and HVs, the following assumptions were made: That the fitment rate of LCVs would be identical to that of LPVs. This assumption was based on industry input. The fitment rate of HVs was assumed to be very low prior to the commencement of the CLOCS-A initiative (refer to Section 1.5.6 of the IA) from 2023 – increasing the overall fitment rate across the HV fleet to 30 per cent from that date.

The Australian Government implemented mandatory standards for rear-vision mirrors (ADR 14/02) in 1992/93. Any recent amendments to the requirements in UN R46 (assuming alignment with the ADRs) will see manufacturers fitting additional devices for indirect vision in addition to mirrors to give drivers an increased field of vision to the rear of the vehicle. This provides a further net benefit in terms of trauma reductions to consumers as manufacturers are willing to include additional safety technologies to enhance the vehicle’s active safety performance capability.

3. Policy Options Considered

Three policy options were considered to reduce incidences of trauma resulting from reversing collisions namely, Option 1: No Regulatory Intervention (Business as Usual case); Option 2: Introduce new ADR aligned with UN R158 for light and heavy vehicles (regulatory option); and Option 3: Introduce new ADR aligned with UN R158 for light vehicles (regulatory option). Note the IA released for consultative purposes and submitted for First Pass Assessment only had two options, that is Option 1: No Regulatory Intervention (Business as Usual case); Option 2: Introduce new ADR aligned with UN R158 (regulatory option).

The result of safety campaigns and educational programs have been discussed in the first two chapters. This showed that despite concerted effort over many years that fatalities and injuries from reversing crashes are still too high, indicating that a regulatory approach is required.

The exclusion of other alternative options for the IA was agreed with the Office of Impact Analysis (OIA) (formerly known as the Office of Best Practice Regulation (OBPR)) in early 2020. The agreement recognised that a regulatory option is the only real alternative to the Business as Usual case when considering the introduction of a new national road vehicle standard.

3.1 Available Options

3.1.1 Option 1: No Regulatory Intervention

Maintain the status of the existing ADR 14/02 and let market forces provide a solution to the problem.

3.1.2 Option 2: Introduce new ADR aligned with UN R158 for light and heavy vehicles

Mandate a new national road vehicle standard requiring all new light and heavy vehicles provided under the RVSA to fit devices for means of rear visibility and detection that would improve the driver's awareness of vulnerable road users behind vehicles when reversing, based on UN R158. This would be applicable for ADR categories for passenger vehicles MA, MB and MC, omnibuses MD and ME, and goods vehicles NA, NB and NC as per the vehicle applicability in UN R158 with exceptions for prime movers, cab-chassis, and partially completed trucks where no road safety benefit would accrue due to their use in transport or particular stage of manufacturing as a result of provision to the market conditions. The relevant ADR categories are summarised in Appendix 1 - Vehicle Categories.

3.1.3 Option 3: Introduce new ADR aligned with UN R158 for light vehicles

Mandate a new national road vehicle standard requiring all new light vehicles provided under the RVSA to fit devices for means of rear visibility and detection that would improve the driver's awareness of vulnerable road users behind vehicles when reversing, based on UN R158. This would be applicable for ADR categories for passenger vehicles MA, MB and MC and goods vehicles NA. The relevant ADR categories are summarised in Appendix 1 - Vehicle Categories.

3.2 Discussion of the Options

3.2.1 Option 1: No Regulatory Intervention

The Business as Usual (BAU) option represents maintenance of the existing requirements for rear-vision mirrors / indirect vision devices that are set out in ADR 14/02. These have been in force under various arrangements since the early 1970s.

There have also been other government interventions to reduce incidences of reversing collisions such as introduction of ADR 1/00 – Reversing Lamps (2005).

The BAU case primarily relies on the market fixing the problem, the community accepting the problem, or some combination of the two. The absence of a mandatory standard would continue to depend on the effect of information campaigns and consumer education to encourage consumers to buy vehicles fitted with reversing aids as standard. The effect of current business and government fleet purchasing policies as well as state and territory government action to prevent reversing collisions is also included in the BAU option.

It has not been possible to obtain accurate data for the voluntary fitment of reversing aids in new vehicles across the fleet. The fitment rate varies across different vehicle types – there is high fitment rate for light vehicles but this is not the case for heavy vehicles. Significant benefits associated with increased voluntary fitment rate of reversing aids as aftermarket modifications in light vehicles are mentioned in Chapter 1 with the existing fitment rate being sufficient to ensure a widespread adoption of these technologies in selected vehicles.

3.2.2 Option 2: Introduce new ADR aligned with UN R158 for light and heavy vehicles and Option 3: Introduce new ADR aligned with UN R158 for light vehicles (Regulatory Options)

Australia has a strong history of government actions aimed at increasing the production, availability and consumer uptake of safer vehicles and Australian consumers have come to expect high levels of safety in their vehicles. The Australian Government's intervention to reduce road trauma through such initiatives aims to balance the expectations for safety with the importance of the most efficient and effective means of bringing vehicles to the Australian marketplace at the lowest possible cost. To achieve significant net safety and environmental benefits for the community, actions need to be taken by the Australian Government in accordance with its international obligations to endeavour to align its vehicle standards with international regulations.

Under Option 2 and 3, the Australian Government would introduce a new ADR under the RVSA based on UN R158. This ADR would apply to the approval and installation of devices for reversing motion (conventional mirrors, rear-view camera system, detection systems or other devices) that would improve the driver's visibility and awareness of vulnerable road users behind vehicles when reversing. As the ADRs only apply to new vehicles supplied to the market, implementation of this option would not affect vehicles already in-service.

3.2.2.1 Background for the Regulatory Options

The UN World Forum for the Harmonization of Vehicle Regulations (WP29) is a worldwide regulatory forum that provides the legal framework to establish regulatory instruments concerning motor vehicles and allows for the introduction of innovative vehicle technologies to the market while continuously improving global vehicle safety. Australia is a Contracting Party to two UN treaties managed by WP29. Australia has applied 62 Regulations annexed to one of those treaties, the 1958 Agreement¹, and is obliged to recognise approvals issued by other Contracting Parties (member countries of the United Nations) as evidence that vehicles and components comply with those regulations.

The UN Regulations are recognised as the peak international standards available for vehicle safety performance requirements and forms part of the vehicle standards framework in many countries and regions, including the European Union and Japan. As part of the 1958 Agreement and the World Trade Organisation Technical Barriers to Trade Agreement (WTO Agreement)², Australia is obliged to consider harmonising with the UN Regulations when making

¹ Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be fitted and/or used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the basis of these Prescriptions of March 1958

² The WTO Agreement on Technical Barriers to Trade establishes rules and procedures regarding the development, adoption, and application of voluntary product standards, mandatory technical regulations, and the procedures (such as testing or certification)

Australian Design Rules. UN Regulation No. 158 (UN R158) titled *'Uniform provisions concerning the approval of devices for reversing motion and motor vehicles with regard to the driver's awareness of vulnerable road users behind vehicles'* is one of Australia's applied regulations and must form part of any ADR we make to regulate the fitment of reversing aids.

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 capability and experience to adopt, whether by acceptance as alternative standards or by mandating, both UN Global Technical Regulations (GTR)³ and UN Regulations into the ADRs.

Harmonised Australian requirements would minimise costs associated with reversing aids development, provides manufacturers the flexibility to incorporate or adapt systems that have already been developed and tested for markets with the same requirements. It would also enable leveraging of testing and certification frameworks already conducted in other markets. The European Union and Japan has mandated these technologies for light and heavy vehicles, whereas the USA has done so for light vehicles.

Australia currently mandates approximately 77 ADRs under the RVSA. Vehicles are approved on a model (or vehicle type) basis known as a type approval, whereby the Australian Government approves a vehicle type based on tests and other information supplied by the manufacturer. 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.

3.2.2.2 Summary of UN Regulation No. 158

UN R158 sets performance requirements for reversing aids fitted to vehicles to enhance the driver's vision or awareness when reversing. It was adopted as a UN Regulation by WP29 in November 2020 and came into force in June 2021. The Regulation introduces requirements for light passenger vehicles, light commercial vehicles, buses and heavy vehicles, vehicles categories M and N corresponding to ADR categories MA, MB, MC, MD, ME, NA, NB and NC.

The specific purpose of the performance requirements of this Regulation is to detect objects behind the vehicle that are at least 80 centimetres tall and 30 centimetres wide in an area ranging from 20 centimetres to 1 metre behind the vehicle. The Regulation provides for two main technologies: ultra-sonic sensors and rear-view cameras. In the case of cameras, the Regulation establishes the requirement to ensure visibility of the area from 30 centimetres to 3.5 metres behind the vehicle. It requires that at least one means of visibility or detection shall be provided to the driver during a backing event. More information about the technical requirements of UN R158 can be found in Appendix 7.

3.2.2.3 Implementation Timing of ADRs

The ADRs are not retrospective and apply to new vehicles from dates specified in the ADR. ADRs typically use a phase-in period to give models that are already established in the market time to change their design or conduct testing. 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. Refer to Section 6.5 for the recommended implementation timing.

used to determine whether a particular product meets such standards or regulations. The aim of the Agreement is to prevent the use of technical requirements as unnecessary barriers to trade.

³ UN GTRs contain globally harmonized performance-related requirements and test procedures. They provide a predictable regulatory framework for the global automotive industry, consumers and their associations. They do not contain administrative provisions for type approvals and their mutual recognition.

4. Likely Net Benefits of Each Option

The policy options outlined in Section 3.1 of the IA namely; Option 1: No Regulatory Intervention; Option 2: Introduce new ADR aligned with UN R158 for light and heavy vehicles; and Option 3: Introduce new ADR aligned with UN R158 for light vehicles were considered viable to analyse further.

The results of Option 2 and Option 3 is compared with what would happen if there was no government intervention, that is Option 1: No Regulatory Intervention. The overall period of analysis is for the expected life of the policy option, which is around 15 years for regulation and fleet purchasing policies, in addition to the time it takes for benefits to work their way through the fleet, around 26 – 30 years past the period of intervention to capture the benefits of the last lot of vehicles to be fitted with reversing detection systems when the intervention stops.

Note the IA released for consultative purposes and submitted for First Pass Assessment only had two options, that is Option 1: No Regulatory Intervention (Business as Usual case); Option 2: Introduce new ADR aligned with UN R158 (regulatory option).

4.1 Benefit-Cost Analysis

4.1.1 General

Benefit-cost analysis (BCA) is a useful tool for evaluating the merits of different options, but it does not replace the decision process itself. The model used in this analysis is the 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 include whether the returns (benefits) on an option outweigh the resources outlaid (costs) to implement the option and indicate what, if any, this difference is. Benefit-cost ratios (BCRs) are a measure of the 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 cost \$1m but results in benefits of \$3m, the net benefit would be $3 - 1 = \$2m$ while the BCR would be $3/1 = 3$.

In the case of modelling the fitment of additional reversing aids to vehicles, there would be an upfront cost to manufacturers/consumers when the vehicles are first built, in the design of the systems and fitting of the components. Once the vehicles are in use there would be a series of benefits spread throughout the life of the vehicles as the cost of crashes and trauma are reduced. This pattern would be repeated in subsequent years as new vehicles are registered and old vehicles leave the fleet. There may also be ongoing business and government costs through the years, depending on the option being considered.

To achieve compliance with the legislation, it is assumed in the BCA that manufacturers will at least fit reversing camera systems (without the display) in their new vehicles. This is because it is the least expensive option that meets the requirements of UN R158 in accordance with research and benefit-cost analysis undertaken by the European Union Commission in 2017 (Seidl et al., 2017). Previously in the IA released for consultative purposes our benefit-cost analysis considered the fitment of parking sensors.

4.1.2 Benefits

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

For Option 2 and Option 3, the benefits were estimated based on the difference between the expected BAU level of compliance, and the level of compliance expected under implementation of regulation – 100 per cent applicable for vehicles once regulation is in force and fully phased-in.

The fitment rate of reversing aids in new passenger vehicles in Australia for the BAU case was obtained from research undertaken by MUARC and the University of Otago (Fildes et al., 2017). RACV reported that the number of reverse cameras in new LPVs in Australia has been steadily growing with the fitment rate increasing from 27 per cent to 44 per

cent between 2012 and 2015 and consequently the number of vehicles with no reversing aids (cameras or reversing sensors) fell from 45 per cent to 34 per cent (Fildes et al., 2017).

Responding to industry feedback, the fitment rate for LCVs has been increased to match the fitment rate for LPVs. While no data was provided to support the comment, the department has agreed to use this assumption as input to the model. In addition, the fitment rate of HVs was also increased to 30 per cent as of 2023 (increased by 0.0705) with a linear trend expected moving forward. This is to account for HVs used in the construction industry being fitted with reversing aids under the CLOCS-A initiative (refer to Section 1.5.6 of the IA), noting that the construction industry makes up 30 per cent of HVs use (ABS, 2015). Refer to Section 6.3 of this IA for further information.

Figures 10, 11 and 12 below show the forecasted percentage of LPVs, LCVs and HVs fitted with reversing aids over time under the no intervention (BAU case) and if government intervention occurred. The maximum fitment rate through no intervention (BAU case) is assumed to be 95 per cent of the LCV and LPV vehicle fleet and 30 per cent of the HV fleet. Without regulation, manufacturers may not fit reversing aids as standard on all future models they produce. Similarly, when purchasing vehicles, some consumers may not purchase vehicles based primarily on safety benefits, especially when the safety benefit does not directly affect any vehicle occupants.

If Option 2 (government intervention) of mandating reversing aids through regulation is decided, we can expect to see a 100 per cent fitment rate, assuming full compliance.

If Option 3 (government intervention) of mandating reversing aids through regulation is decided, we can expect to see a 100 per cent fitment rate for all LPVs and LCVs, assuming full compliance.

Figure 10: Percentage of new LPVs fitted with detection systems (such as reversing sensors) under market-driven conditions as BAU case and under government intervention in Australia

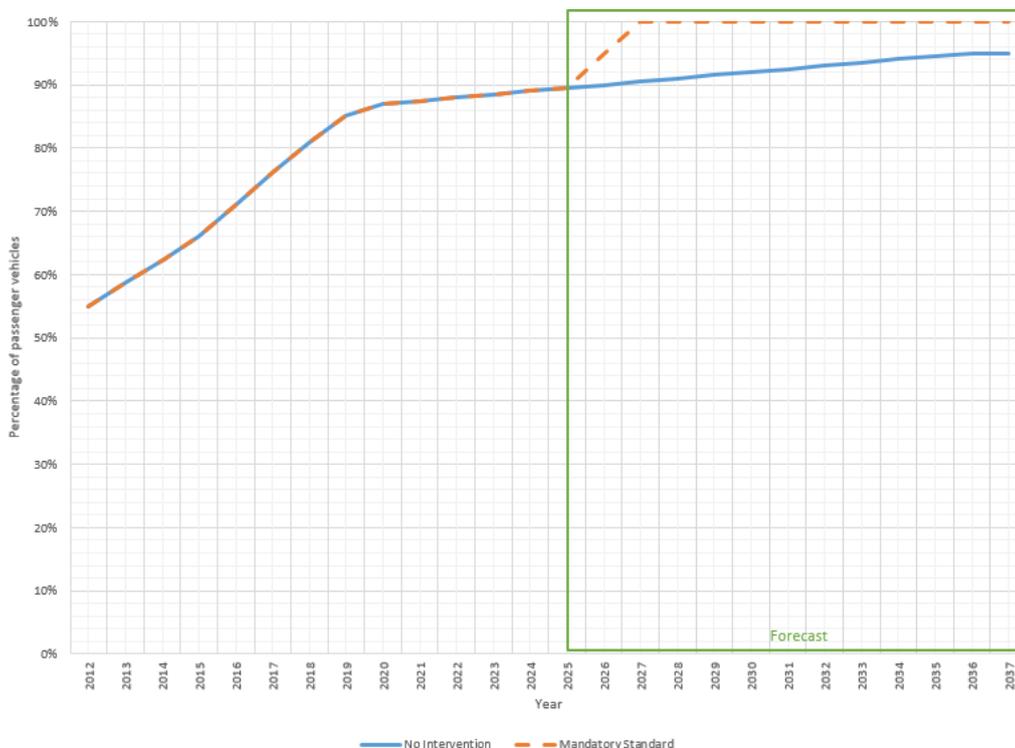


Figure 11: Percentage of new LCVs fitted with detection systems (such as reversing sensors) under market-driven conditions as BAU case and under government intervention in Australia

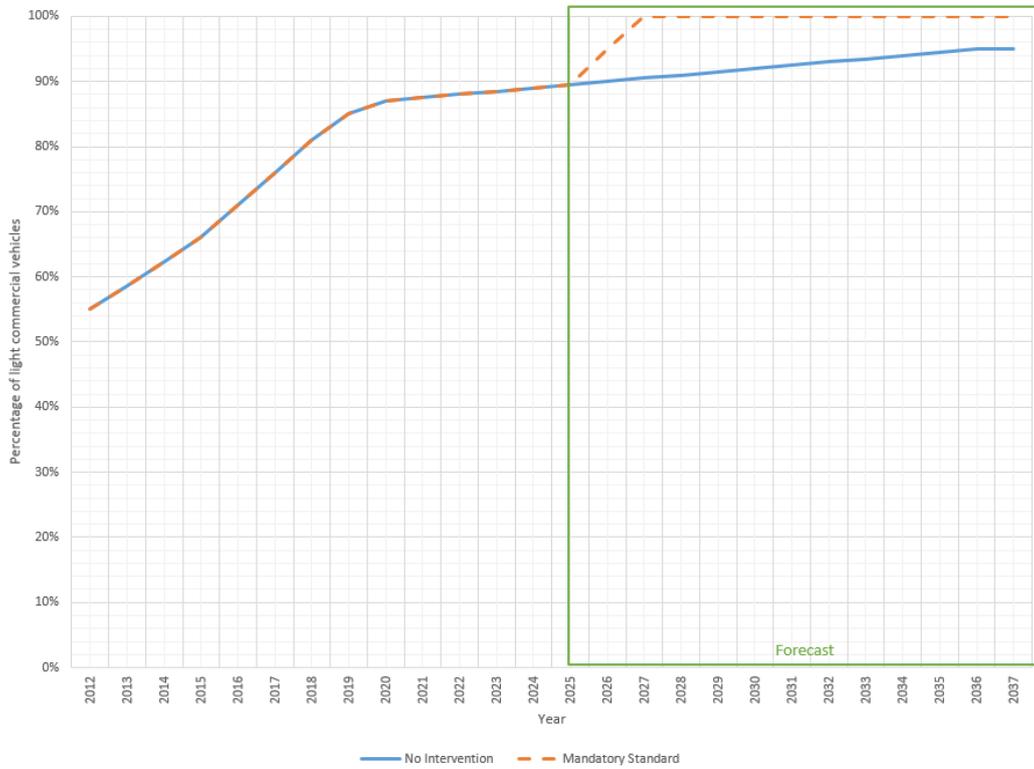
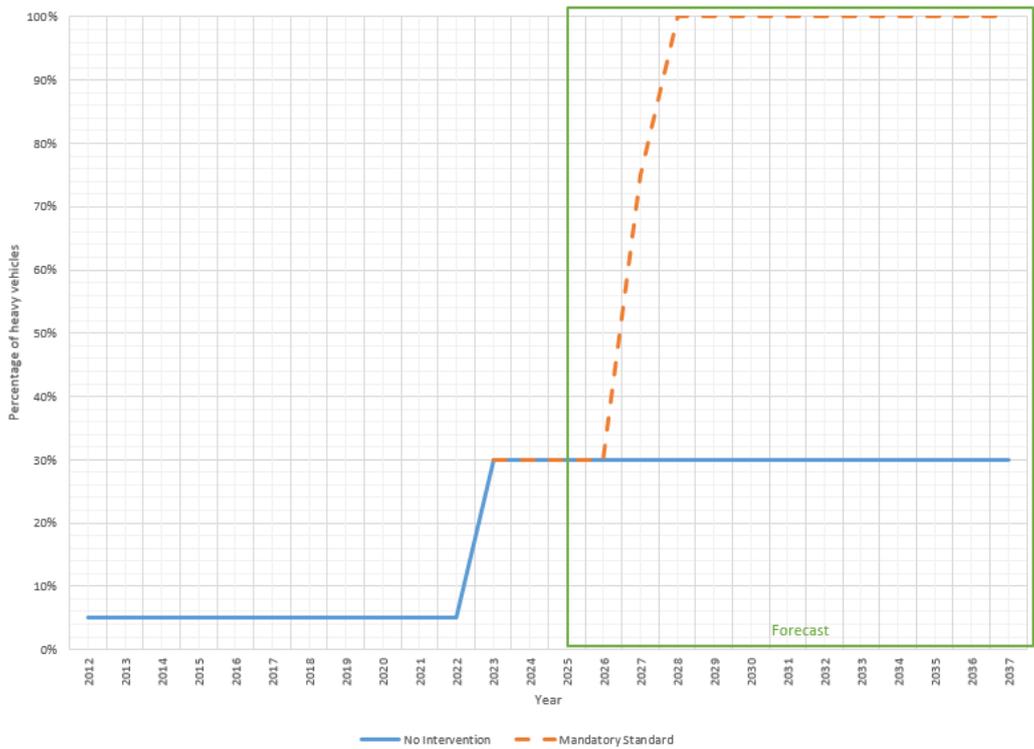


Figure 12: Percentage of new HVs fitted with detection systems (such as reversing sensors) under market-driven conditions as BAU case and under government intervention in Australia



Effectiveness of the fitment of reversing aids

For the benefit-cost analysis, it is assumed that manufacturers will most likely make their vehicles compliant with the reversing aid legislation through the fitment of reversing camera systems (without the display) because it is the cheapest option. Previously, in the IA released for consultative purposes, the benefit-cost analysis considered the fitment cost of parking sensors with an effectiveness of 0.69 (Keall et al., 2018).

Effectiveness estimates for reversing aids in reducing the likelihood of injuries resulting from reversing collisions were obtained from research conducted by MUARC – in the case of reversing camera systems without the display, the effectiveness is 0.41 (Keall et al., 2018). As effective regulation increases the performance of reversing aids due to standardisation performance requirements, a performance increase of 5 per cent is expected – hence an effectiveness of 0.43 is used for the post-consultation benefit-cost analysis.

4.1.3 Costs

4.1.3.1 Scope / Applicability

System development costs

Presently there are no ADRs for reversing aids (other than mirrors) to be tested against. Reversing aids are currently available to be fitted to new vehicles before supply to the market and/or retrofitted to vehicles as an aftermarket modification. These technologies are not spread across the whole vehicle fleet and are only fitted based on consumer demand.

It was assumed that the testing of systems to meet performance requirements in UN R158 would be an estimated cost of \$20,000 per new model (\$10,000 in IA released for consultative purposes) certified each year to mandatory standards. This was to address submissions mentioning that several cost variables were underestimated. Refer to Section 6.3 of this IA for further information.

Costs to fit the systems

Additional fitment costs to vehicles were derived from the wholesale price of reversing camera systems, without the display, available in the market in 2021. It was assumed there would be an estimated cost of \$75 for LPVs and LCVs, and \$500 for HVs for a reversing camera system per vehicle (\$40 for reversing sensor systems in the IA released for consultative purposes) that would otherwise not have the technology. This was to address submissions mentioning that several cost variables were underestimated. Refer to Section 6.3 of this IA for further information.

Other business costs

The cost of regulation compliance, including submission of forms / applications and conformity of production audits are based on the department's experience in administering such a system to be \$1,500 per new model certified each year to any mandatory standard.

Government costs

It was assumed there would be an estimated annual cost of \$100,000 per year for LPVs, LCVs and HVs combined (Option 2) and \$92,000 per year for LPVs and LCVs combined (Option 3) for governments to create, implement and maintain a regulation (\$50,000 in IA released for consultative purposes). This was then broken down into \$75,000, \$17,000 and \$8,000 per year for LPVs, LCVs and HVs respectively based on the proportion of the vehicle types in the market. This includes the initial development cost as well as ongoing maintenance and interpretation advice. This was to account for jurisdictional in-service costs as requested in submissions. Refer to Section 6.3 of this IA for further information.

Table 1: Summary of costs associated with government intervention

Item	Estimated Costs	Cost Impact
Fitment of system	\$75 per vehicle (LPVs and LCVs)	Business
	\$500 per vehicle (HVs)	
Testing of system to a regulation	\$20,000 per model	Business
Regulation compliance	\$1,500 per model	Business
Implementing and maintaining regulation	\$75,000 per year (LPVs)	Government
	\$17,000 per year (LCVs)	
	\$8,000 per year (HVs)	
	\$100,000 per year (Option 2 – LPVs, LCVs and HVs combined)	
	\$92,000 per year (Option 3 – LPVs and LCVs combined)	

Further details of assumptions and benefit-cost methodology can be found in Appendix 2.

4.1.4 Benefit-Cost Analysis Results

Appendix 3 – Benefit Cost Analysis – Details of Results shows the calculations for the benefit-cost analysis. A summary for the results is provided in Table 2 below. A 7 per cent discount rate was used.

Consideration of submissions received during public consultation required amendments to costs variables, trauma ratings and implementation timing. The effects of an acceleration of the mandate for reversing aids to 2023 and an extension to 2025 were considered. Tables 2 and 3 provide a summary of results from our post-consultation analysis, noting that the implementation date was extended to 2025. Refer to Section 6.5 for further information.

Table 2: Summary of gross benefits, net benefits and costs over fatalities and injuries avoided over 45 years under government intervention for each policy option using a 7 per cent discount rate

Policy Option	Gross Benefits	Cost to Business	Cost to Government	BCR	Net Benefits	Number of Lives Saved	Severe Injuries Avoided	Minor Injuries Avoided
Option 1	-	-	-	-	-	-	-	-
Option 2 (LPVs, LCVs and HVs combined)*	\$80,603,086	\$105,305,900	\$910,791	0.76	-\$25,613,606	13	140	62
Option 3 (LPVs and LCVs combined)*	\$71,854,165	\$48,489,288	\$837,928	1.46	\$22,526,948	12	124	55

* Refer to Table 3 below for the breakdown for each vehicle type.

Table 3: Summary of gross benefits, net benefits and costs over fatalities and injuries avoided over 45 years under government intervention for LPVs, LCVs and HVs for implementation in 2025 using a 7 per cent discount rate

Vehicle Type	Gross Benefits	Cost to Business	Cost to Government	BCR	Net Benefits	Number of Lives Saved	Severe Injuries Avoided	Minor Injuries Avoided
LPVs	\$53,013,918	\$37,037,816	\$683,094	1.41	\$15,293,008	9	96	43
LCVs	\$18,840,247	\$11,451,472	\$154,835	1.62	\$7,233,941	3	28	13
HVs	\$9,174,362	\$63,948,991	\$72,863	0.14	-\$54,847,493	2	17	8

4.1.5 Sensitivity Analysis

A sensitivity analysis was carried out to determine the effect on the outcome of various discount rates to the benefit-cost analysis. The costs were considered to be reasonably accurate, being provided through appropriate industry and government sources.

An uncertainty that could adversely affect the options was the assumed 7 per cent discount rate of the benefits and costs. A real discount rate of 3 per cent and 10 per cent were used as a sensitivity check for the BCA. Tables 4 and 5 show the results of the sensitivity check from our post-consultation analysis, noting that the implementation date was extended to 2025. Refer to Section 6.5 for further information.

Table 4: Impact of changes to the real discount rate on gross benefits, net benefits and the benefit cost ratio for each policy option for implementation in 2025 over 45 years of government intervention

Discount Rate	Option 1			Option 2 (LPVs, LCVs and HVs combined)*			Option 3 (LPVs and LCVs combined)*		
	Gross Benefits	Net Benefits	BCR	Gross Benefits	Net Benefits	BCR	Gross Benefits	Net Benefits	BCR
Low discount rate (3%)	-	-	-	\$126,967,915	-\$15,257,655	0.89	\$113,006,157	\$47,868,464	1.73
Base case discount rate (7%)	-	-	-	\$80,603,086	-\$25,613,606	0.76	\$71,854,165	\$22,526,948	1.46
High discount rate (10%)	-	-	-	\$59,844,643	-\$27,044,742	0.69	\$53,398,970	\$12,558,186	1.31

* Refer to Table 5 below for the breakdown for each vehicle type.

Table 5: Impact of changes to the real discount rate on gross benefits, net benefits and the benefit cost ratio per vehicle type for implementation in 2025 over 45 years of government intervention

Discount Rate	LPVs			LCVs			HVs		
	Gross Benefits	Net Benefits	BCR	Gross Benefits	Net Benefits	BCR	Gross Benefits	Net Benefits	BCR
Low discount rate (3%)	\$85,499,886	\$35,672,122	1.72	\$27,506,272	\$12,196,342	1.80	\$14,830,754	-\$74,646,621	0.17
Base case discount rate (7%)	\$53,013,918	\$15,293,008	1.41	\$18,840,247	\$7,233,941	1.62	\$9,174,362	-\$54,847,493	0.14
High discount rate (10%)	\$38,700,083	\$7,476,881	1.24	\$14,698,887	\$5,081,306	1.53	\$6,702,093	-\$44,124,888	0.13

4.2 Economic Aspects – Impact Analysis

Impact analysis considers the magnitude and distribution of the benefits and costs that have been calculated. It also looks at the impact of the option on the affected parties.

4.2.1 Identification of Affected Parties

In the case of reversing aids, the parties affected by the options are:

Business / Consumers

- Vehicle manufacturers or importers;
- Component suppliers;
- Vehicle owners;
- Vehicle operators; and
- Vulnerable road users.

The business / consumer parties are represented by several interest groups. Those relevant to the topic of this IA include the:

- Federal Chamber of Automotive Industries (FCAI), that represents the automotive sector and includes vehicle manufacturers, vehicle importers and component manufacturers / importers;
- Australian Automobile Association (AAA), that represents vehicle owners and operators (passenger cars and derivatives) through the various automobile clubs around Australia (RACV, RACQ, RAA, NRMA etc.);
- 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; and
- National Heavy Vehicle Regulator (NHVR), that regulates heavy vehicles in-service.

4.2.2 Impact of Viable Options

Three options were considered feasible for further examination; Option 1: No Regulatory Intervention; Option 2: Introduce a new ADR aligned with UN R158 for light and heavy vehicles; and Option 3: Introduce new ADR aligned with UN R158 for light vehicles. Note the IA released for consultative purposes and the IA submitted for First Pass Final Assessment only had two options, that is Option 1: No Regulatory Intervention (Business as Usual case); Option 2: Introduce new ADR aligned with UN R158 (regulatory option).

This section looks at the impact of these options in terms of quantifying expected benefits and costs, and identifies how these would be distributed within the community over a 45-year period of analysis (15-year life of policy / intervention and 30-year period where the remaining cohort of vehicles fitted with reversing aids in the fleet gradually exit due to crashes or by reaching the end of their service life). This is discussed below and then summarised in Tables 5 and 6 below.

Option 1: No Regulatory Intervention

In this option the government does 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. The benefits and costs of Option 2 and Option 3 are calculated relative to this BAU case, so that what would have happened anyway in the marketplace is not attributed to any proposed intervention.

Option 2: Introduce new ADR aligned with UN R158 for light and heavy vehicles

This option mandates all new vehicles, with limited exceptions, to be fitted with a reversing aid in accordance with UN R158.

It would mean that vehicle manufacturers would need to change the designs of vehicles so that they were fitted with systems in accordance with the new ADR. Vehicle manufacturers would also need to test the systems and the vehicles to ensure they comply with the requirements of the standard. For most vehicle types, the impact would be small because the vehicle types are already being supplied into other markets where the UN Regulation is mandated. For other vehicle types already fitted with reversing aids, the manufacturers will only need to test existing systems to ensure they comply. For a small proportion of vehicle types, manufacturers would need to source or design reversing aids to suit.

Option 3: Introduce new ADR aligned with UN R158 for light vehicles

This option mandates all new LPVs and LCVs to be fitted with reversing aids in accordance with UN R158. The impacts on the light vehicle industry would be the same as Option 2 above.

4.2.2.1 Benefits of Option 2 and Option 3 (Regulatory Options)

Australian Business

Vehicle manufacturers would benefit from the certainty that a harmonised vehicle standard provides. It would mean that manufacturers could provide vehicles already approved to UN R158 to the Australian market without the need for further design and testing.

There would be an indirect benefit to businesses as a result of the reduction in the number of work days lost due to employees being injured in reversing collisions. There would also be a minor reduction in recruitment, training and development costs associated with the replacement of employees (who are in age groups other than very young or elderly) killed or permanently incapacitated by reversing collisions.

Requiring vehicles to be fitted with reversing aids would reduce the costs currently incurred by business when a vehicle is damaged in a reversing collision or is not available for use after a reversing collision. However, there would be significant negative impacts to businesses in the event that a vehicle used for commercial purposes is involved in a reversing collision. This can include financial losses as a result of reputational damage for vehicle manufacturers in addition to affecting the ability of business owners to conduct their trade as the involved vehicle within the corporate fleet can be impounded / destroyed.

Other benefits to business include the creation of a level playing field for all vehicle manufacturers as requirements of the technology are standardised across the new vehicle fleet. This leads to less speculation amongst manufacturers about minimum performance of their specific technology and potentially disappointing consumer expectation if a particular technology is lacking in the vehicle preferred on other grounds.

Consumers

There would be a direct benefit to users of vehicles through reduced costs associated with reversing collisions, including legal costs, availability costs and repair costs. This benefit was able to be quantified in terms of the benefit-cost ratios determined to be 0.69 – 0.89 for Option 2 and 1.31 – 1.73 for Option 3. This can be broken down into 1.24 – 1.72, 1.53 – 1.80 and 0.13 – 0.17 for implementation in 2025 (1.47 – 2.14, 2.58 – 2.99 and 1.4 – 1.76 in the IA for consultative purposes for a 2024 implementation date) for LPVs, LCVs and HVs respectively.

There is an overall total savings of 13 lives saved and 140 serious injuries avoided for Option 2 and 12 lives saved and 124 serious injuries avoided for Option 3 post-consultation for implementation in 2025. This is broken down into an estimated 9 lives would be saved and 96 serious injuries avoided for LPVs; 3 lives saved and 28 serious injuries avoided for LCVs; and 2 lives saved and 17 serious injuries avoided for HVs.

Note that the BCR and casualty reductions in the Final IA are impacted by changes made to costs and trauma variables. Refer to Section 6.3 of the IA and see Table 5 and Table 6 below.

Community

Mandating a standard for reversing aids would provide a direct benefit to the community as a result of reduced road trauma and the cost to the community from the associated psychological pain and suffering. This benefit was able to be quantified in terms of costs reduced and would be shared between governments and the community.

There would be a monetised benefit of \$59.8m – \$127m for Option 2 and \$53.4m – \$113m for Option 3. This is broken down into \$38.7m – \$85.5m, \$14.7m – \$27.5m and \$6.7m – \$14.8m for LPVs, LCVs and HVs respectively for implementation in 2025.

Note that the monetised benefits in the Final IA are impacted by changes made to cost variables. Refer to Section 6.3 of the IA and see Table 5 and Table 6 below.

Further, other benefits to be considered with regard to implementing Option 2 and Option 3, include:

- The psychological value for the Australian community of introducing a technology that mitigates a road safety concern which disproportionately affects small children and the elderly; and
- Improving community road safety by protecting vulnerable road users, as prioritised under the NRSS 2021-30 and CLOCS-A.

These have not been monetised and are therefore not included in the BCR.

4.2.2.2 Costs

Business / Consumers and the Community

There would be a direct cost to businesses, consumers and the community as a result of fitment and testing costs for new vehicles sold with reversing aids. This cost is able to be quantified by the manufacturer and would be passed onto the consumer by businesses.

Testing and fitment would cost between \$86.1m – \$141m for Option 2 and \$40.1m – \$64m for Option 3. This is broken down into \$30.7m – \$49m, \$9.5m – \$15.1m and \$50.7m – \$89.4m for LPVs, LCVs and HVs respectively for an implementation in 2025.

Note that the costs-to business in the Final IA are impacted by changes made to cost variables. Refer to Section 6.3 of the IA and see Table 5 and Table 6 below.

Governments

There would be a cost to governments for developing, implementing and administering a regulation that requires vehicles to meet the proposed minimum level of safety performance. This would cost approximately \$0.76m – \$1.2m for Option 2 and \$0.7m – \$1.1m for Option 3. This is broken down into \$0.57m – \$0.90m, \$0.13m – \$0.20m, \$0.06m – \$0.096m for LPVs, LCVs and HVs respectively for an implementation in 2025.

Note that the costs-to business in the Final IA are impacted by changes made to cost variables. Refer to Section 6.3 of the IA and see Table 5 and Table 6 below.

4.3 Summary of Benefit-Cost Analysis Results

Table 5: Summary of the gross benefits, costs, trauma savings and benefit-cost ratio of reversing aid technologies with a 2025 implementation date for each policy option over 45 years of government intervention

	Option 1: No Regulatory Intervention		Option 2: Introduce new ADR aligned with UN R158 for all vehicles (LPVs, LCVs and HVs combined)*		Option 3: Introduce new ADR aligned with UN R158 for light vehicles (LPVs and LCVs combined)*	
	Gross Benefits	Costs	Gross Benefits	Costs	Gross Benefits	Costs
Businesses	-	-	None	\$86.1m – \$141m	None	\$40.1m – \$64m
Consumers	-		\$59.8m – \$127m		\$53.4m – \$113m	
Government	-		None	\$0.76m – \$1.2m	None	\$0.7m – \$1.1m
Lives Saved	-		13		12	
Serious Injuries Prevented	-		140		124	
Minor Injuries Prevented	-		62		55	
BCR	-		0.69 – 0.89		1.31 – 1.73	

* Refer to Table 6 below for the breakdown for each vehicle type.

Table 6: Summary of the gross benefits, costs, trauma savings and benefit-cost ratio of reversing aid technologies for a 2025 implementation date for each vehicle type over 45 years of government intervention

	LPVs		LCVs		HVs	
	Gross Benefits	Costs	Gross Benefits	Costs	Gross Benefits	Costs
Businesses	None	\$30.7m – \$49m	None	\$9.5m – \$15.1m	None	\$50.7m – \$89.4m
Consumers	\$38.7m – \$85.5m		\$14.7m – \$27.5m		\$6.7m – \$14.8m	
Government	None	\$0.57m – \$0.90m	None	\$0.13m – \$0.20m	None	\$0.06m – \$0.096m
Lives Saved	9		3		2	
Serious Injuries Prevented	96		28		17	
Minor Injuries Prevented	43		13		8	
BCR	1.24 – 1.72		1.53 – 1.80		0.13 – 0.17	

5. Regulatory Burden and Cost Offsets

The *Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)* requires that all new regulatory options are costed using the Regulatory Burden Measurement Framework (RBM). The RBM is a different measure to the full cost benefit analysis as it does not capture the benefits of reduced injury and fatality rates for consumers and the wider community. The average annual regulatory costs were established by calculating the total undiscounted (nominal) cost (including development and fitment costs) for each option over the 10-year period 2025-2035 inclusive, and dividing by 10.

As noted in the Executive Summary, submissions received recommended amendments to costs variables, trauma ratings and implementation timing. Post-consultation analysis (refer to Section 6.3 of the IA) examined the effects of an accelerated implementation time to 2023 and an extended implementation time of 2025. Table 7 provides a summary of annual regulatory costs associated with regulation, noting that the implementation date was extended to 2025. Final implementation dates will be determined by the Government as part of the relevant ADR, following consultation by the department with industry.

The average annual regulatory costs under the RBM for the three viable options: Option 1: No Regulatory Intervention (Business as Usual); Option 2: Introduce new ADR aligned with UN R158 for light and heavy new vehicles; and Option 3: Introduce new ADR aligned with UN R158 for light vehicles are set out below. There are no costs associated with Option 1. The average annual regulatory costs associated with Option 2 was estimated to be approximately \$12.3m for all vehicles and Option 3 was estimated to be approximately \$5.6m for light vehicles at post-consultation. This is broken down into \$4.3m, \$1.3m and \$6.7m for LPVs, LCVs and HVs respectively for an implementation date of 2025 as shown in Table 8.

Table 7: Regulatory burden and cost offset estimate table for each policy option

Policy Options	Cost to Businesses	Total Change in Costs
Option 1: No Regulatory Intervention	-	-
Option 2: Introduce new ADR aligned with UN R158 for all vehicles (LPVs, LCVs and HVs combined)*	\$12,352,950	\$12,352,950
Option 3: Introduce new ADR aligned with UN R158 for light vehicles (LPVs and LCVs combined)*	\$5,640,189	\$5,640,189

* Refer to Table 8 below for the breakdown for each vehicle type.

Table 8: Regulatory burden and cost offset estimate table for each vehicle type

Vehicle Type	Cost to Businesses	Total Change in Costs
LPVs	\$4,308,367	\$4,308,367
LCVs	\$1,331,823	\$1,331,823
HVs	\$6,712,761	\$6,712,761

The *Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)* sets out principles for Australian Government policy makers. One of these principles is that policy makers should consult in a genuine and timely way with affected businesses, community organisations and individuals, as well as other policy makers to avoid creating cumulative or overlapping regulatory burdens. This involves using the RBM Framework to estimate the regulatory compliance burden and to quantify offsets presented in the IA. Where it is not possible to offset regulatory burdens in the affected sector, offsets should be more broadly targeted within the relevant portfolio. It is anticipated that regulatory savings from further alignment of the ADRs with international standards (UN Regulations) will offset the additional RBM costs of this measure.

6. Consultation

6.1 General

Development of ADRs under the RVSA is the responsibility of the Vehicle Safety Policy and Partnerships Branch of the department. Development of ADRs 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 could involve the Technical Liaison Group (TLG), Strategic Vehicle Safety and Environment Group (SVSEG), Infrastructure and Transport Senior Officials' Committee (ITSOC) and the Infrastructure and Transport Minister's Meeting (ITMM).

- TLG consists of technical representatives of government (Australian and state / territory), the manufacturing and operational arms of the industry including organisations such as the Federal Chamber of Automotive Industries (FCAI) and the Truck Industry Council (TIC) and representative organisations of consumers and road users (particularly through the Australian Automobile Association (AAA) and the Australian Trucking Association (ATA)).
- SVSEG consists of senior representatives of government (Australian and state / territory), the manufacturing and operational arms of the industry and of representative organisations of consumers and road users (at a higher level within each organisation as represented in TLG).
- ITSOC consists of the chief executives of Australian and State / Territory departments of infrastructure, transport and road vehicle administrations.
- ITMM consists of Australian, State / Territory and New Zealand Ministers with responsibility for infrastructure and / or transport matters.

SVSEG and TLG are the principal consultative forums for advising on ADR proposals. Membership of the SVSEG and TLG is shown at Appendix 4 – Strategic Vehicle Safety and Environment Group and Technical Liaison Group.

6.2 Public Consultation

A version of the IA for consultative purposes, a draft version of the national road vehicle standard ADR 108/00 – Reversing Technologies based on UN R158, the ADR 108/00 – Reversing Technologies Explanatory Statement and feedback form was released on the department's website on 30 March 2022 for a six-week public comment period, which closed on 11 May 2022. An email was also sent on 30 March 2022 to inform senior representatives of state and territory governments, key industry representatives and representative organisations of consumer and road safety users. In addition, a notice was published in the Office of Road Safety newsletter and social media posts were released on 30 March 2022 from the department's official account on Twitter, Facebook and LinkedIn to increase public awareness and engagement.

Note the IA released for consultative purposes and the IA submitted for First Pass Final Assessment only proposed two options, that is Option 1: No Regulatory Intervention (business as usual) and Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158. Hence, the responses received only considered these two policy options – that is to either mandate the fitment of reversing aids to all vehicles or to let market forces increase the fitment of reversing aids across the new Australian vehicle fleet.

The department sought feedback on the proposed IA and regulation, including:

- Support for the recommended option.
- The assumptions used for the benefit-cost analysis, including data to support actual effectiveness of the technology, the costs or the assumed benefits.

- The suitability of ADR 108/00 for adoption under the Australian Design Rules, including any comments on functional and/or performance requirements, test requirements or implementation, such as the applicable vehicle categories and timing.
- Any other relevant views or information.

The department provided three ways for members of the public, industry and jurisdictions to voice their opinions which included: 1) Completing the webform and attaching the feedback form on the department’s website; 2) Emailing the feedback form to the Vehicle Standards Section email address; or 3) Mailing the feedback form to the Vehicle Standards Section postal address.

The publication of the IA for public comment is an integral part of the consultation process. This provides an opportunity for businesses and road user groups, as well as other interested parties to respond to the proposal by writing or otherwise submitting their comments to the department. Analysing proposals through the IA process assist stakeholders in identifying the likely impacts of the proposals and enables more informed debate on any issues. A summary of feedback and department responses is included at Appendix 8.

During the consultation period, feedback was received from members of the public, state government agencies, industry and not-for-profit organisations. A majority of the feedback strongly supported the implementation of Option 2. The applicability dates proposed for consultation purposes were March 2024 for new model vehicles and March 2026 for all new vehicles.

Formal submissions to the IA for consultative purposes were received from the following individuals, state and territory government agencies, organisations and industry.

State and Territory Governments

Queensland Government – Department of Transport and Main Roads (TmR)
 Queensland Government – Queensland Family and Child Commission (QFCC)
 NSW Government – Transport for NSW (TfNSW)
 Confidential submissions made by one road safety agency and one state government agency

Inter-Governmental Agency

National Heavy Vehicle Regulator (NHVR)

Manufacturer Representatives

Federal Chamber of Automotive Industries (FCAI)
 Truck Industry Council (TIC)

Vehicle Safety Organisations

Australian New Car Assessment Program (ANCAP)
 Australian Automobile Association (AAA)

Not-for-Profit Child Safety Organisations

The Georgina Josephine Foundation
 Kidsafe Queensland

Individuals

Michael Bentley
 Sebastian Tops
 David Tolson
 Anonymous submission made by one individual
 Confidential submission made by one individual

Australia’s peak industry organisation representing the manufacturers and importers of passenger and light commercial vehicles (the Federal Chamber of Automotive Industries (FCAI)) supported Option 1: No Regulatory Intervention. Their submission stated that there was no need for intervention by the Australian Government as the voluntary fitment of reversing aids will reach and remain at 100 per cent even in the absence of regulation due to high consumer demand and market expectations. The FCAI believes that the benefit / cost analysis assumed a voluntary fitment rate for LCVs that is lower than it is in reality and that the analysis should be changed to include a higher value given the breakdown of the Australian market and high consumer demand. They also noted that some cost variables in the benefit-cost analysis were underestimated. No data was provided to support these claims. They also expect that the uptake of reversing aids will continue to grow until they are effectively a standard feature across all new vehicle sales. The FCAI furthermore requested later applicability dates to align with the introduction of United Nations Regulation No. 158 in other major international markets. This is following the minimum transitional arrangements in Europe (July 2022 for new models and July 2024 for all model vehicles). They believe that this will allow manufacturers sufficient lead time to design, develop, prepare for manufacture, certify and produce vehicle models or variants for the Australian market, in addition to re-developing and certifying existing models to comply with the standard.

Australia's peak industry body representing truck manufacturers, importers and major component suppliers (the Truck Industry Council (TIC)) did not indicate support for either options. TIC provided cost figures and requested that the costing detailed for heavy vehicles in the IA be changed and the IA justification recalculated. TIC also requested applicability dates of 1 November 2024 for new models and 1 February 2027 for all models, arguing that this would provide for consistent introduction dates for heavy vehicles (category NB1, NB2 and NC) and to accommodate Australian, Japanese and USA truck manufacturers because they may struggle to meet the proposed implementation timing.

The National Heavy Vehicle Regulator (NHVR) supported Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 if amendments were made. NHVR expressed concern about the performance requirements in UN R158 (i.e. testing object dimensions and field of vision / detection requirements) and noted the unsuitability of certain testing criteria (e.g. temperature and humidity) in Australia. NHVR recommended that in-service costs and burden imposed by compliance with ADR 108/00 should also be considered. In addition, it was recommended to assess the costs associated with psychological impacts of reversing crashes imposed on businesses and drivers.

FCAI, TIC and NHVR sought guidance on how cab-chassis vehicles will be handled:

- The FCAI recommended that the department should provide a pathway allowing the approval of cab-chassis vehicles either explicitly in ADR 108/00 or through guidance material and minor and inconsequential non-compliance vehicle type approvals;
- TIC recommended exemptions for prime movers, cab-chassis vehicles, partially completed trucks and vehicles types / applications that cannot practically meet the requirements of ADR 108/00 in-service; and
- The NHVR also noted that incompatibility of UN R158 with some vehicle types' intended purpose and that this may lead to the NHVR providing exemptions. It recommends the Australian Government develop exemption criteria to provide for consistent decision making and predictable outcomes.

All of these recommendations were examined and as a result the department has amended Option 2 to provide exemptions for prime-movers and partially completed vehicles as per Clause 3.3 of ADR 108/00, noting that upon completion vehicles are required to comply with the regulation.

Submissions from the Queensland Family and Child Commission (QFCC), Queensland Department of Transport and Main Roads (TmR) and Transport for NSW (TfNSW) supported Option 2:

- QFCC supported the proposed implementation timeframe;
- TmR noted that the voluntary fitment rate of reversing aids is already high on LPVs and recommends an earlier implementation timeframe of March 2024 for new model vehicles and March 2025 for all new vehicles; and
- TfNSW encouraged the Australian Government to consider cost implications for governments who are road managers and registration authorities, and recommended an accelerated implementation timeframe of 2023 for new model light vehicles and 2025 for all new light vehicles.

Submissions from not-for-profit organisations for the protection of children on roads (Kidsafe Queensland and the Georgina Josephine Foundation) supported the recommended Option 2:

- The Georgina Josephine Foundation proposed amendments to be made to ADR 108/00 and UN R158 to include means of rear visibility (e.g. rear-cameras) as standard features in all vehicles in addition to audible detection systems (e.g. ultrasonic sensors). This was to increase the likelihood of mitigating reversing collisions as increased rear visibility allowed for drivers to assess possible obstructions to reversing if the proximity sensor is activated.

Submissions from the Australasian New Car Assessment Program (ANCAP) and the peak organisation for Australia's motoring clubs (Australian Automobile Association (AAA)) supported the recommended Option 2 maintaining the original applicability dates – March 2024 for new model vehicles and March 2026 for all new vehicles. AAA encouraged the Australian Government to contribute to the development of new and updated international standards. ANCAP highlighted that despite its best efforts, there is not universal fitting of reversing aids across all new light vehicles and to reach 100 per cent fitment rate across the market, an ADR is required.

As Australia is a party to the WTO Agreement, and harmonisation of requirements with international regulations is a means of compliance with its obligations, a notification will be lodged with the WTO for the required period, to allow for comment by other WTO members.

6.3 Post-Consultation Analysis

Information received in submissions relating to benefits, costs and implementation timing was examined in a post-consultation analysis. The main changes in assumptions are discussed below.

The effects of an acceleration of the mandate for reversing aids to 2023 and an extension 2025 were considered relative to an implementation in 2024, as proposed in the IA released for consultative purposes.

Some submissions mentioned that several cost variables (i.e. fitment cost, cost to test a system to regulation and governmental costs) were underestimated. To address these concerns the estimated cost for installation of a reversing camera system without the display was increased to \$75 for LPVs and LCVs, and \$500 for HVs per vehicle (instead of \$40 for reversing sensor systems in the IA released for consultative purposes). The fitment cost for LPVs and LCVs was derived from a benefit-cost analysis on reversing aids conducted by the U.S Department of Transportation National Highway Traffic Safety Administration (NHTSA) using \$43 – \$45 USD (2010-dollar terms) which is converted to \$75 – \$78 AUD (2020-dollar terms). The fitment cost for HVs was obtained from TIC's submission and took into account increased labour cost attributed to installation of the reversing camera, noting that aspects of HV assembly do not occur on a production line. Furthermore, the estimate for the cost of testing a system to UN R158 was increased by \$10,000 totalling to \$20,000. In addition, the estimate of the cost imposed on government to implement and maintain regulation was increased by \$50,000 to account for jurisdictional in-service costs, totalling to \$100,000 for Option 2 (LPVs, LCVs and HVs combined) and \$92,000 for Option 3 (LPVs and LCVs combined). This is broken down into \$75,000 for LPVs, \$17,000 for LCVs, and \$8,000 for HVs based on the proportion of each vehicle type in the market.

To account for the fitment of reversing camera systems rather than sensor systems, an effectiveness of 0.43 was used for the post-consultation benefit-cost analysis. This assumption anticipates that effective regulation increases the performance of reversing aids due to standardised performance requirements. A performance increase of an additional 5 per cent is expected on top of the effectiveness estimates from research conducted by MUARC – in the case of reversing camera systems, the effectiveness is 0.41 (Keall et al., 2018).

Numerous submissions emphasised that psychological impacts have to be considered in the benefit-cost analysis to provide an economic value to the otherwise intangible loss from pain, grief and suffering experienced by families and dependents of a deceased or injured person. The updated analysis therefore includes costs based on figures published by TAC in 2020 for impairment compensation attributed to permanent physical or psychological conditions caused by transport accidents awarded to families and dependents (TAC, 2021). As a consequence, the unit cost of a fatality was increased by \$366,900 and the unit cost of severe injury was increased by \$241,800 (TAC, 2021). No impairment compensation was awarded by TAC for minor physical and/or psychological impairments (TAC, 2021) hence the unit cost of minor injuries remains unchanged.

Industry recommended that the department provide exemptions for vehicles types where installation of means of rear visibility or detection is incompatible with their on-road use. This was addressed through the addition of Clause 3.3 in ADR 108/00 exempting prime-movers and partially completed vehicles from the requirements of the regulation, noting that vehicles are required to comply with the performance requirements of ADR 108/00 once completed. It was assumed that prime-movers account for 15 per cent of NC category vehicles (heavy goods vehicles). As such, a reduction of 15 per cent is applied to the new HVs sales data and HVs registration data to account for the exemption of prime-movers in the HVs benefit-cost analysis.

The light vehicle industry did not see justification for the fitment rate of LCVs to be lower than LPVs given the breakdown of the Australian market and high consumer demand. To address this, an increased fitment rate was used for LCVs identical to that of LPVs. In addition, the fitment rate of HVs were also increased to 30 per cent as of 2023 (increased by 0.0705) with a linear trend expected moving forward. This is to account for HVs used in the construction industry being fitted with reversing aids under the CLOCS-A initiative (refer to Section 1.5.6 of the IA), assuming that the construction industry makes up 30 per cent of heavy vehicle use (ABS, 2015).

To reflect the increase in new vehicle brands entering the Australian market per year, the number of major brands per vehicle category has been increased. Data on the number of major brands per vehicle type was obtained from FCAI

Vendor Field Analytical and Characterisation Technologies System (VFACTS) National Report 2020. This was determined to be 48, 22 and 24 major brands for LPVs, LCVs and HVs respectively.

The IA released for consultative purposes acknowledged that the data for fatalities and injuries from reversing crashes was underestimated due to road safety statistics only collecting data for public roads. The submission from the Georgina Josephine Foundation provided more comprehensive numbers based on collated data from the media of Low Speed Vehicle Run Over (LSVRO) incidents across Australia from 2011-2021. This shows that there were 37 reversing fatalities over 2011-2021 which is equivalent to approximately 4 fatalities per year. Local research conducted by BITRE (2015) and Cassell et al. (2011) provided an estimate of 9.3 pedestrian fatalities per year attributed to reversing collisions. To reflect this in our benefit-cost analysis, the 13.3 additional fatalities were added to the average annual number of pedestrian fatalities involved in reversing collisions over a ten-year period based on the population size in Fildes et al. (2014), which was then scaled by 1.04 to determine the number of pedestrian fatalities relative to the population in Australia (7.90 to 21.20). This forms the ratio of fatalities affecting the proportion of trauma types per reversing collision which impacts upon the number of trauma savings obtained from the regulation of reversing aid technologies. The typical fatality age was also changed to 24 years old which is the median age (4 years old was used in the IA released for consultative purposes). This change was a response to questions raised about this aspect in submissions.

In addition, in reviewing the benefit-cost model the department identified that it was necessary to include costs associated with property damage resulting from reversing collisions. This can be assessed by determining the cost of claims reported that are attributed to reversing collisions. Data obtained from the Australian Prudential Regulation Authority (APRA) and the National Transport Insurance noted that there was an average of 1,875,000 accident claims per year for domestic motor vehicles (LPVs), 320,000 accident claims per year for commercial motor vehicles (LCVs) (APRA, 2021a; APRA, 2021b) and more than 13,000 claims from truck drivers are processed each year (NHVR, 2018). As reversing collisions form 12% of all crash types in Australia is collected by AAMI (Suncorp Group, 2018), it can be inferred that an average of 225,000 accident claims per year for domestic motor vehicles (LPVs), 38,400 accident claims per year for commercial motor vehicles (LCVs) and 1,560 accident claims per year for HVs are attributed to reversing collisions. The estimated cost of damage to property arising from vehicle accidents is more than \$3000 (Legal Services Commission of South Australia, 2021). Therefore, the cost of property damage used in the benefit-cost analysis is assumed to be \$3000 for LPVs and LCVs and \$6000 for HVs. This results in an average cost of \$675,000,000 for domestic motor vehicle (LPVs), \$115,200,000 commercial motor vehicle (LCVs) and \$9,360,000 for HVs for reversing collision claims. It is expected there will be an overall cost benefit from the reduction of property damage due to the fitment of reversing aids in vehicles without the technology. The benefit generated is determined by considering the effectiveness of reversing cameras at reducing all types of collisions (0.49 for light vehicles and heavy vehicles (NHTSA, 2006)) in new vehicles that are to be fitted with the technology entering the market per year.

A combined benefit-cost analysis for LPVs, LCVs and HVs was also prepared to determine the effect of regulation on all vehicle types in addition to functioning as a sensitivity check. Whilst conducting the analysis, we have also discovered small errors in sales projection and fitment increase at sale affecting the trauma rates and benefit-cost ratio published in the IA released for consultative purposes in March 2022. This has been corrected in Section 6.5 below.

6.4 Feedback from First Pass Final Assessment

The Final IA recommended the inclusion of a separate option to mandate the installation of devices for means of rear-visibility for light vehicles only, to aid in decision making. This was based on the results of the post-consultation analysis, where the benefit-cost analysis does not demonstrate a net benefit for Option 2 (for LPVs, LCVs and HVs combined) but shows a positive benefit-cost ratio for new LPVs and LCVs.

Hence **Option 3: Introduce a new ADR aligned with UN R158 for light vehicles** is included in this IA for Second Pass Final Assessment. A combined benefit-cost analysis for LPVs and LCVs was prepared to determine the effect of regulation on all light vehicles in addition to functioning as a sensitivity check. This does not change the post-consultation benefit-cost analysis as there was no changes to post-consultation variables as per Section 6.3 above. The results of the benefit-cost analysis are shown in Section 6.5 below.

In response, Option 2 has been reworded to **Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles**. The applicability of Option 2 remains unchanged – that it is applicable for LPVs, LCVs and

HVs, with exceptions for prime movers, cab-chassis, partially completed trucks and vehicles types / applications where installation of means of rear visibility or detection is not suitable for their on-road use (as detailed in Section 6.3).

6.5 Results from Post-Consultation Analysis and First Pass Final Assessment

Table 9: Summary of fatalities, serious injuries and minor injuries avoided from post-consultation analysis for an accelerated and extended implementation timing for each policy option over 45 years of government intervention

Policy Option	Year	Lives Saved	Serious Injuries Avoided	Minor Injuries Avoided
Option 1	2023	-	-	-
	2024 (Proposed)	-	-	-
	2025	-	-	-
Option 2 (LPVs, LCVs and HVs combined)*	2023	15	155	69
	2024 (Proposed)	14	147	65
	2025	13	140	62
Option 3 (LPVs and LCVs combined)*	2023	13	139	62
	2024 (Proposed)	12	130	58
	2025	12	124	55

* Discrepancies in trauma savings compared to the individual vehicle type benefit-cost analysis is due to the increase in the number of trauma crashes affected in the combined benefit-cost analysis, noting trauma savings are rounded up. Refer to Table 10 below for breakdown per vehicle type.

Table 10: Summary of fatalities, serious injuries and minor injuries avoided from post-consultation analysis for an accelerated and extended implementation timing for each vehicle type over 45 years of government intervention

Vehicle Type	Year	Lives Saved	Serious Injuries Avoided	Minor Injuries Avoided
LPVs	2023	10	105	47
	2024 (Proposed)	10	100	45
	2025	9	96	43
LCVs	2023	3	31	14
	2024 (Proposed)	3	30	13
	2025	3	28	13
HVs	2023	2	17	7
	2024 (Proposed)	2	17	8
	2025	2	17	8

Table 11: Summary changes to the real discount rate on gross benefits, net benefits, costs and the benefit cost ratio from post-consultation analysis for an accelerated and extended implementation timing for LPVs, LCVs and HVs combined (Option 2). Refer to Table 13, 14 and 15 below for breakdown by vehicle type.

Option 2 – LPVs, LCVs and HVs combined												
Discount Rate	2023				2024 (Proposed)				2025			
	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits
Low discount rate (3%)	\$137,842,226	\$156,022,493	0.88	-\$18,180,268	\$132,376,406	\$149,165,964	0.88	-\$16,789,558	\$126,967,915	\$142,225,570	0.89	-\$15,257,655
Base case discount rate (7%)	\$87,601,851	\$114,668,395	0.76	-\$27,066,544	\$84,097,661	\$110,534,261	0.76	-\$26,436,600	\$80,603,086	\$106,216,692	0.76	-\$25,613,606
High discount rate (10%)	\$65,069,528	\$92,896,572	0.70	-\$27,827,044	\$62,460,145	\$89,988,242	0.69	-\$27,528,097	\$59,844,643	\$86,889,385	0.69	-\$27,044,742

Table 12: Summary changes to the real discount rate on gross benefits, net benefits, costs and the benefit cost ratio from post-consultation analysis for an accelerated and extended implementation timing for LPVs and LCVs combined (Option 3). Refer to Table 13 and 14 below for breakdown by vehicle type.

Option 3 – LPVs and LCVs combined												
Discount Rate	2023				2024 (Proposed)				2025			
	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits
Low discount rate (3%)	\$123,617,425	\$70,479,350	1.75	\$53,138,074	\$118,246,089	\$67,712,282	1.75	\$50,533,808	\$113,006,157	\$65,137,693	1.73	\$47,868,464
Base case discount rate (7%)	\$78,814,304	\$53,456,972	1.47	\$25,357,333	\$75,308,367	\$51,341,036	1.47	\$23,967,331	\$71,854,165	\$49,327,217	1.46	\$22,526,948
High discount rate (10%)	\$58,652,481	\$44,297,781	1.32	\$14,354,700	\$56,014,802	\$42,538,630	1.32	\$13,476,171	\$53,398,970	\$40,840,784	1.31	\$12,558,186

Table 13: Summary of changes to gross benefits, net benefits, costs and the benefit-cost ratio from post-consultation analysis for an accelerated and extended implementation timing for LPVs

LPVs												
Discount Rate	2023				2024 (Proposed)				2025			
	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits
Low discount rate (3%)	\$93,401,932	\$53,898,234	1.73	\$39,503,698	\$89,390,660	\$51,789,521	1.73	\$37,601,139	\$85,499,886	\$49,827,763	1.72	\$35,672,122
Base case discount rate (7%)	\$58,066,321	\$40,868,011	1.42	\$17,198,310	\$55,514,527	\$39,255,716	1.41	\$16,258,811	\$53,013,918	\$37,720,910	1.41	\$15,293,008
High discount rate (10%)	\$42,446,559	\$33,857,586	1.25	\$8,588,973	\$40,560,849	\$32,517,314	1.25	\$8,043,535	\$38,700,083	\$31,223,202	1.24	\$7,476,881

Table 14: Summary of changes to gross benefits, net benefits, costs and the benefit-cost ratio from post-consultation analysis for an accelerated and extended implementation timing for LCVs

LCVs												
Discount Rate	2023				2024 (Proposed)				2025			
	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits
Low discount rate (3%)	\$30,215,493	\$16,581,117	1.82	\$13,634,376	\$28,855,430	\$15,922,761	1.81	\$12,907,361	\$27,506,272	\$15,309,930	1.80	\$12,196,342
Base case discount rate (7%)	\$20,747,984	\$12,588,961	1.65	\$8,159,023	\$19,793,840	\$12,085,320	1.64	\$7,703,964	\$18,840,247	\$11,606,307	1.62	\$7,233,941
High discount rate (10%)	\$16,205,922	\$10,440,195	1.55	\$5,765,727	\$15,453,952	\$10,021,317	1.54	\$5,431,323	\$14,698,887	\$9,617,581	1.53	\$5,081,306

Table 15: Summary of changes to gross benefits, net benefits, costs and the benefit-cost ratio from post-consultation analysis for an accelerated and extended implementation timing for HVs

HVVs												
Discount Rate	2023				2024 (Proposed)				2025			
	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits	Gross Benefits	Costs	BCR	Net Benefits
Low discount rate (3%)	\$14,224,801	\$85,543,143	0.17	-\$71,318,342	\$14,533,048	\$87,487,596	0.17	-\$72,954,548	\$14,830,754	\$89,477,376	0.17	-\$74,646,621
Base case discount rate (7%)	\$8,787,546	\$61,211,423	0.14	-\$52,423,876	\$8,980,334	\$62,600,449	0.14	-\$53,620,115	\$9,174,362	\$64,021,855	0.14	-\$54,847,493
High discount rate (10%)	\$6,417,047	\$48,598,791	0.13	-\$42,181,744	\$6,558,398	\$49,700,051	0.13	-\$43,141,652	\$6,702,093	\$50,826,981	0.13	-\$44,124,888

Tables 9 and 10 above show the effect of an accelerated timing of 2023 to be minor changes in trauma savings relative to the proposed implementation time of 2024 with:

- 1 fatality, 8 serious injuries and 4 minor injuries avoided for Option 2
- 1 fatality, 9 serious injuries and 4 minor injuries avoided for Option 3
- This was broken down into 5 serious injuries and 2 minor injuries avoided for LPVs; 1 serious injury and 1 minor injury avoided for LCVs; and 1 less serious injury prevented for HVs.

The effect of an extended timing of 2025 showed minor changes in trauma savings relative to the proposed implementation time of 2024 with:

- 1 less fatality, 7 less serious injuries and 3 less minor injuries avoided for Option 2
- 6 serious injuries and 3 minor injuries avoided for Option 3
- This was broken down into 1 less fatality, 4 less serious injuries and 2 less minor injuries prevented for LPVs; 2 less serious injuries prevented for LCVs; and no change for HVs.

Tables 11 to Table 15 above show the effects of the accelerated timing of 2023 using a 7 per cent discount rate:

- Gross benefits that:
 - Increased for Option 2 to \$87.6m (from \$84.1m in 2024)
 - Increased for Option 3 to \$78.8m (from \$75.3m in 2024)
 - This is broken down into gross benefits that increased to \$58m and \$20.7m (from \$55.5m and \$19.7m in 2024) for LPVs and LCVs, and decreased to \$8.8m (from \$9m in 2024) for HVs.
- Net benefits that:
 - Decreased for Option 2 to -\$27m (from -\$26.4m in 2024)
 - Increased for Option 3 to \$25.4m (from \$24m in 2024)
 - This is broken down into net benefits that increased to \$17.2m, \$8.1m and -\$52.4m (from \$16.3m, \$7.7m and -\$53.6m in 2024) for LPVs, LCVs and HVs respectively.
- Benefit-cost ratio that:
 - Remains unchanged from 2024 at 0.76 for Option 2
 - Remains unchanged from 2024 at 1.47 for Option 3
 - This is broken down into a benefit-cost ratio of 1.42, 1.65 and 0.14 (from 1.41, 1.64 and 0.14 in 2024) for LPVs, LCVs and HVs respectively.

The effects of an extended timing of 2025 using a 7 per cent discount rate identified:

- Gross benefits that:
 - Decreased for Option 2 to \$80.6m (from \$84.1m in 2024)
 - Decreased for Option 3 to \$71.8m (from \$75.3m in 2024)
 - This can be broken down into gross benefits that decreased to \$53m and \$18.8m (from \$55.5m and \$19.7m in 2024) for LPVs and LCVs, and increased to \$9.2m (from \$9m in 2024) for HVs
- Net benefits that:
 - Increased for Option 2 to -\$25.6m (from -\$26.4m in 2024)
 - Decreased for Option 3 to \$22.5m (from \$24m in 2024)
 - This can be broken down into net benefits that decreased to \$15.3m, \$7.2m and -\$55m (from \$16.3m, \$7.7m and -\$53.6m in 2024) for LPVs, LCVs and HVs respectively.
- Benefit-cost ratio that:
 - Remains unchanged from 2024 at 0.76 for Option 2

- Decreased for Option 3 to 1.46 (from 1.47 in 2024)
- This is broken down into a benefit-cost ratio of 1.41, 1.62 and 0.14 (from 1.41, 1.64 and 0.14 in 2024) for LPVs, LCVs and HVs respectively.

As shown above, an accelerated implementation time to 2023 provides minor benefits for road trauma savings and the benefit-cost ratio relative to the proposed implementation time in 2024. Therefore, an extended implementation time was considered to take account of industry concerns relating to continuity of supply to the Australian market and certainty for business.

While most manufacturers and importers of passenger vehicles and light commercial vehicles did not support mandating reversing aids, they noted that if a regulatory option is preferred then Australia should follow an implementation timing as per the minimum transitional arrangements in Europe (24 months or greater for new models and a further 24 months or greater for all models). Truck manufacturers, importers and major component suppliers recommended a delayed implementation timing to accommodate local and international truck manufacturers that may struggle to meet the proposed implementation timing. The introduction schedule should endeavour to allow vehicle manufacturers appropriate and sufficient lead times and ensure introduction is not in advance of schedules adopted in Europe. The new proposed implementation dates meets this request.

The Infrastructure and Transport Ministers also agreed in August 2019 that “[t]he Commonwealth will endeavour to align Australian regulations with the proposed European regulatory package to commence within a similar timeframe.” Reversing aids aligned with UN R158 is one of the elements of the EU General Safety Regulation (GSR). The benefit-cost analysis supporting the EU GSR showed a similar outcome to the present analysis, that is a positive net benefit for LPVs and LCVs, but not for HVs. Regardless, HVs are included within the scope of the EU framework. Furthermore, Japan also implemented requirements for reversing aids aligned with the scope of UN R158, with implementation dates similar to the EU.

As Option 2 was the most supported option the Government will aim to harmonise national road vehicle safety standards with leading international markets for all vehicle types. Hence the revised implementation timing proposed for Second Pass Assessment is now:

- November 2025 for new model vehicles
- November 2027 for all new vehicles

7. What is the Best Option

The impacts of the following options to estimate the benefits and costs from fitting reversing aid technologies on new vehicles have been examined:

- Option 1: No Regulatory Intervention
- Option 2: Introduce new ADR aligned with UN R158 for light and heavy vehicles
- Option 3: Introduce new ADR aligned with UN R158 for light vehicles

7.1 Net Benefits

Net benefit (total benefits minus total costs in present value terms) provides the best measure of the economic effectiveness of the options. *The Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)* states that the policy option offering the greatest net benefit should always be the recommended option.

The net benefits were assessed over a period of 45 years, including the assumed 15-year period of regulation followed by a period of 30 years where the remaining cohort of vehicles fitted with reversing aids in the fleet gradually exit due to crashes or by reaching the end of their service life.

Under the base case discount rate (7 per cent), the introduction of a new ADR aligned with UN R158 had the following net benefits shown in Table 16. Net benefits in the Final IA are impacted by changes made to cost and trauma variables outlined in Section 6.3 above.

Table 16: Summary of net benefits for each policy option for an implementation date of 2025

	Option 1: No Regulatory Intervention	Option 2: Introduce new ADR aligned with UN R158 for all vehicles	Option 3: Introduce new ADR aligned with UN R158 for light vehicles
Net Benefits	-	-\$25,613,606	\$22,526,948

7.2 Benefit Cost Ratios

Under the base case discount rate (7 per cent), the introduction of a new ADR aligned with UN R158 had the following BCRs shown in Table 17.

As shown below Option 3 had the highest BCR of 1.45 whereas Option 2 had a BCR of 0.76. The BCRs in the Final IA are impacted by changes made to cost and trauma variables outlined in Section 6.3 above.

Table 17: Summary of benefit cost ratios for each policy option for an implementation date of 2025

	Option 1: No Regulatory Intervention	Option 2: Introduce new ADR aligned with UN R158 for all vehicles	Option 3: Introduce new ADR aligned with UN R158 for light vehicles
Benefit Cost Ratio	-	0.76	1.46

7.3 Casualty Reductions

The introduction of a new ADR aligned with UN R158 had the following trauma savings as shown in Table 18.

Option 2 would provide the greatest trauma reduction with 13 lives saved and 140 serious injuries avoided for implementation in 2025. Casualty reductions in the Final IA are impacted by changes made to cost and trauma variables outlined in Section 6.3 above.

Table 18: Summary of trauma savings for each policy option for an implementation date of 2025

	Option 1: No Regulatory Intervention	Option 2: Introduce new ADR aligned with UN R158 for all vehicles	Option 3: Introduce new ADR aligned with UN R158 for light vehicles
Lives Saved	-	13	12
Serious Injuries Avoided	-	140	124
Minor Injuries Avoided	-	62	55

7.4 Discussion and Scope of the Regulatory Options (Option 2 and Option 3)

Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles is the recommended option as it meets a number of Australian Government objectives, including the long-standing policy of harmonisation with UN Regulations and several priorities under the NRSS, even if it does not show the greatest net benefit as recommended by the *Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)*.

UN R158 applies to vehicles of UN categories M (power-driven vehicles having at least four wheels and used for the carriage of passengers), and N (power-driven vehicles having at least four wheels and used for the carriage of goods). This translates to Australian vehicle categories MA (passenger car), MB (forward-control passenger vehicle), MC (off-road passenger vehicle), MD (light omnibus), ME (heavy omnibus), NA (light goods vehicle), NB (medium goods vehicles) and NC (heavy goods vehicles).

For the reasons stated below, it is recommended to establish a mandate for the installation of reversing aids for LPVs, LCVs and HVs (implement Option 2) covering the vehicle categories above in accordance with the requirements of UN R158. Refer to Appendix 1 – Vehicle Categories for a summary of the ADR vehicle categories.

Further discussion of the non-monetised benefits that provide an additional rationale for introducing a regulation is outlined below:

- **Harmonisation**

With the recent adoption UN R158 by the WP29, there is an opportunity to review what can be done to further reduce the trauma associated with reversing collisions in Australia. The introduction of a new national road vehicle standard will accelerate fitment rate and force standardisation of system performance requirements among vehicle manufacturers and / or manufacturers of reversing aids.

Harmonisation with internationally agreed standards minimises costs associated with the development of reversing aids and provides manufacturers the flexibility to incorporate or adapt systems that have already been developed and tested in the regions for which the vehicle was originally designed without additional cost incurred from research and development. This should enable some leveraging of testing and certification frameworks already conducted in other markets, such as in Japan and the EU where all new model vehicles are required to be fitted with reversing aids by July 2022. It is highly feasible for manufacturers to meet this regulation given the latest capability of in-vehicle technology in addition to the widespread availability of these technologies in the market. It is expected these costs will reduce as more Contracting Parties to the UN 1958 Agreement require vehicles to be fitted with reversing aids in accordance with UN R158.

Implementing Option 2 would result in full harmonisation with UN R158 and is in-line with the Australian Government’s long-standing policy of aligning with UN Regulations. The Australian Government also applied UN R158 on 10 June 2021, in accordance with Article 1 of the 1958 Agreement. This allows Australia to fulfil its obligations as a Contracting Party under the 1958 Agreement and to also fulfil the WTO Agreement. In addition, this approach is beneficial for manufacturers certifying their vehicle models using the alternate UN certification route, as they will be

able to test and certify their vehicles to UN R158 to demonstrate compliance with the respective ADR for reversing aids under current certification arrangements under the RVSA.

Implementing Option 3 would result in partial harmonisation with UN R158, preventing Australia from fulfilling its obligations as a Contracting Party under the 1958 Agreement. This will also result in no regulatory oversight for heavy vehicles as they are not required to comply with any uniform requirements for reversing aids.

- **Fitment Rate of Reversing Aids**

Implementing Option 2 offers an important advantage to all road users and the wider community through guaranteed 100 per cent fitment of reversing aids as a standard feature to all new light and heavy vehicles sold in Australia. Whereas implementing Option 3 limits guaranteed fitment to light vehicles only, leaving market forces to provide a solution for heavy vehicles. There is also no guarantee that non-regulatory measures, such as reliance on market forces would deliver an enduring result, or that the predicted fitment of reversing aids would be reached and maintained in the absence of regulation. Monitoring the market in the absence of a regulation would bring added complications such as defining what the performance criteria should be, setting a lower limit in the market at which point intervention would have to be reconsidered, and determining what minor digressions, if any, would be tolerated.

- **Addresses psychological impact on communities caused by reversing collisions**

The psychological impacts for families and dependents of a person killed or injured in a reversing crash have been quantified and included in the benefit-cost analysis. However, the psychological impacts for the Australian community of small children, in particular, being killed and injured has not been quantified. Nevertheless, mitigating some of this pain and distress for the wider community undoubtedly has benefits, even if they are intangible.

Whilst Option 2 and Option 3 would greatly alleviate the psychological impact caused by pain, grief and suffering experienced by families and dependents of a deceased or injured person, there are limitations to the extent to which the community can benefit from the fitment of reversing aids depending on the option chosen.

In that respect, implementing Option 2 would provide far-reaching benefits to the community as it mandates the fitment of reversing aids on both light and heavy vehicles and will greatly alleviate psychological trauma from reversing collisions involving light and heavy vehicles. Whereas Option 3 mandates the fitment of reversing aids to light vehicles only and provides a limited capacity in alleviating psychological impacts to the community as psychological trauma arising from reversing collisions involving heavy vehicles are unaccounted for.

- **Supports the National Road Safety Strategy 2021-30**

The Australian Government is committed to continued action to deliver significant reductions in road trauma over the decade from 2021 to 2030 under the NRSS. Infrastructure and Transport Ministers acknowledged at their meeting in May 2021 that increased efforts are needed by all governments to reduce road trauma and stated their refusal to accept that deaths and serious injuries are an inevitable price of mobility. The NRSS supports the Infrastructure and Transport Ministers long-term vision towards achieving Vision Zero – that is no deaths and serious injuries on Australian roads by 2050. As part of the commitment to Vision Zero, the Ministers further agreed to the targets of zero deaths and serious injuries by 2030 and zero deaths of children 7-years and under.

Although both Option 2 and Option 3 provides in-principle support to the Australian Government's commitment towards Vision Zero, implementing Option 2 mandating the fitment of reversing aids to heavy and light vehicles would prove the most instrumental in achieving the said targets above. Option 2 contributes to several key priorities, including pursuing technological improvements and uptake of safer vehicles, improving heavy vehicle safety and focusing on vulnerable road users (refer to Section 1.5.4 for further information). This is of significance as heavy vehicles crashes are more likely to result in a death or serious injury, where the greater mass of these vehicles contributes a considerable amount of kinetic energy to a crash, with the other road users in the collision often suffer the worst of the impact. Future advancements in heavy vehicle safety cannot be realised if Option 3 is implemented as it only mandates fitment for light vehicles.

- **Supports the construction industry efforts to promote safer heavy vehicles**

CLOCS-A (refer to Section 1.5.6 for further information) is a national approach for managing the risks and impacts associated with a construction project's on-road transport and logistics activities to community road safety.

Recognising the movement of construction vehicles in populated areas can present hazards for the public, particularly vulnerable road users, CLOCS-A seeks to prioritise and promote the use of safer heavy vehicles through awarding accreditation on a 3-tiered approach – that is Bronze, Silver and Gold (CLOCS-A, 2022). Reversing aids has been identified under the Bronze tier as a low cost and easy to implement technology that forms the minimum mandatory standard for all heavy vehicles complying with the CLOCS-A technical requirements (CLOCS-A, 2022).

Implementing Option 2 to mandate the fitment of reversing aids to heavy vehicles supports the aim of the CLOCS-A initiative to improve road safety for all road users through providing industry with a consistent good practice standard for the management of safety in construction logistics. This may not be achieved through implementation of Option 3.

8. Implementation and Evaluation

If Option 2 or Option 3 is chosen, a new national road vehicle standard, also known as an ADR will be made under section 12 of the RVSA. The RVSA allows the Minister to determine national road vehicle standards.

Under the RVSA, the ADRs are national road vehicle standards intended to make vehicles safe to use, control the emission of gas, particles or noise, secure vehicles against theft, provide for the security marking of vehicles and promote the saving of energy. The ADRs are applied to vehicles as criteria for approval under various regulatory pathways set out in the Road Vehicle Standards legislation. Vehicles approved under these regulatory pathways can be provided to the market in Australia for use in transport.

8.1 Overview of the Regulatory Framework

The RVSA establishes a regulatory framework to regulate the importation and first supply of road vehicles to the market in Australia. The core principle of this framework is that vehicles which comply with appropriate standards are suitable for provision to the market in Australia. The ADRs have set out those standards since the early 1970s. At that time, they were applied cooperatively by the Australian Motor Vehicle Certification Board representing the Commonwealth and state and territory governments. In 1989, this arrangement was replaced by the *Motor Vehicle Standards Act 1989* (MVSA) and the ADRs were determined as national standards.

8.2 Exemption from Sunsetting

Standards made under section 12 of the RVSA, also known as Australian Design Rules (ADRs), are exempt from the sunsetting provisions of the *Legislation Act 2003*. It is appropriate that the standards remain enduring and effective to regulate ongoing road worthiness of vehicles throughout their useful life and reduce regulatory burden on vehicle manufacturers.

Source of the Exemption

A standard made under section 12 of the RVSA is not subject to the sunsetting provisions of section 50 of the *Legislation (Exemptions and Other Matters) Act 2003* through section 12 of the *Legislation (Exemptions and Other Matters) Regulation 2015* (table item 56C). A similar exemption was previously granted in respect of national road vehicle standards made under section 7 of the MVSA (item 40, section 12 of the *Legislation (Exemptions and Other Matters) Regulation 2015*). This exemption is important to ensure that ADRs continue to remain in force, and available to regulators and industry.

Intergovernmental Dependencies

The exemption concerns ADRs which facilitate the establishment and operation of the intergovernmental vehicle standard regime that Commonwealth, State and Territory governments rely on to regulate the safety of vehicles on public roads.

The Commonwealth uses the ADRs as the basis on which approvals to supply types of road vehicles to the market are granted under the *Road Vehicle Standards Rules 2019*. States and territories use the ADRs as the primary criteria on which vehicles are assessed for road worthiness. This 'in-service' aspect is dependent on the date of manufacture, which determines the applicable version of the ADRs against which the vehicle can be assessed. The ability to rely on national standards is particularly relevant given the long service life of vehicles – the average age of vehicles in Australia is 12.1 years.

While the ADRs are regularly updated to reflect changes in technology, it is not possible to apply these new standards retrospectively to vehicles that are already in use. With former ADRs kept on the Federal Register of Legislation, State and Territory governments can use them to ensure vehicles continue to comply with the ADRs that were in force when they were first supplied to the market.

In the event that the Commonwealth could not justify the maintenance of the ADRs, State and Territory governments would be compelled to create their own vehicle standards. Whilst this could mean adopting the substance of the lapsed ADRs as an interim measure, the differing needs and agendas of each State and Territory government may result in variations to in-service regulations. Having different vehicle standards across the states and territories would make the scheme operate contrary to the underlying policy intent of the Act which is to set nationally consistent performance-based standards.

Commercial Dependencies

The effect on vehicle manufacturers to redesign existing models to comply with new ADRs would present a burden and be a costly and onerous exercise. Manufacturers should not be expected to continually go back to redesign existing vehicles. Furthermore, ongoing product recalls to comply with new ADRs would undermine consumer confidence with significant financial impact to manufacturers. This exemption allows vehicle manufacturers to focus their efforts to ensure new models supplied to the market continue to comply.

8.3 Review of the National Road Vehicle Standards

While ADRs are exempt from sunseting, they are subject to review every ten years, as resources permit, and when developments in vehicle technology necessitates updates to requirements. Comprehensive parliamentary scrutiny is available through these reviews.

Reviews of the ADRs ensure the ongoing effectiveness of a nationally consistent system of technical regulations for vehicle design, which are closely aligned, wherever appropriate with leading international standards such as UN Regulations. Aligning with such standards facilitates the rapid introduction of the latest safety devices and technological advances into the Australian market, while also contributing to the industry's cost competitiveness in the domestic market. This new ADR would be scheduled for a full review on an ongoing basis and in line with this practice, including an evaluation of whether the ADR will still be required in the future.

In reviewing an existing ADR, the department relies on data and input from industry, jurisdictions and research organisations to demonstrate the continued effectiveness of the measure. The Australian Government will work with state and territory government agencies to provide reversing collision data within the official road injury record system. This allows for ongoing monitoring of road trauma attributed to reversing collisions as well as the fitment of reversing aids over time.

9. Conclusion and Recommended Option

Reversing collisions presents a significant concern due to the relatively high injury risk from the close proximity and the impact to a vulnerable road user from the rear of the vehicle. A predominantly high proportion of vulnerable road users killed or seriously injured in reversing collisions are in particularly vulnerable population groups, namely the elderly and children, especially those under 5 years old. This is attributed to limited rearward visibility and lack of driver awareness of the vulnerable road user when reversing. The number of fatalities and serious injuries are most likely underestimated because they frequently occur on private roads, such as carparks or driveways which is outside the scope of official road injury record systems, that focuses on public roads (Keall et al., 2018).

Australia has previously adopted ADR 14/02 – Rear Vision Mirrors as a national standard for all road vehicles, which is aligned with the international standard UN Regulation No. 46/05 titled '*Uniform provisions concerning the approval of devices for indirect vision and of motor vehicles with regard to the installation of these devices.*' ADR 14/02 specifies requirements for rear vision mirrors and other indirect vision devices to provide the driver with a clear and reasonably unobstructed view to the rear. However, the ADRs do not specifically address risk factors contributing to reversing collisions as there is no mandate for the fitment of reversing aids, such as ultrasonic sensors and reversing camera systems to new vehicles.

Voluntary efforts by manufacturers and consumer organisations to increase the fitment of reversing aids on new vehicles and in-service as an aftermarket modification, have not significantly reduced the likelihood of reversing collisions. Moreover, these initiatives are largely unregulated and have insufficient impact on the entire fleet. Specific concerns arising from aftermarket modifications include uncertainties as to whether the system is functioning as intended (properly synchronised and calibrated with the existing system in the vehicle) and whether the overall quality of the system is effective given the system has manufacturer specific discrepancies. There are also no existing performance criteria to which the reversing aids must demonstrate compliance. Hence, the introduction of a new national road vehicle standard, known as an ADR would not only increase fitment rates across the entire vehicle fleet but would also demand improvements in existing technologies and, as a result, increase the effectiveness of the technology as a safety measure to reduce road trauma.

This Final IA examined the case for Australian Government intervention to improve future light and heavy vehicle countermeasures to reduce trauma caused by reversing collisions. Three options to reduce the trauma of vulnerable road users from reversing collisions were considered: a non-regulatory option of no intervention and two regulatory options. It was found that there were significant benefits for mandatory fitment of reversing aids through government intervention, which would not otherwise be realised through the business as usual approach.

Option 2: Introduce a new ADR aligned with United Nations Regulation No. 158 for light and heavy vehicles is the recommended option as it meets a number of Australian Government objectives, including the long-standing policy of harmonisation with UN Regulations and several priorities under the NRSS, even if it does not show the greatest net benefit as recommended by the *Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)*. Refer to Section 7.4 for further information.

When Infrastructure and Transport Ministers agreed to move towards a goal of zero road deaths or serious injuries by 2050, they accepted that stronger action than previously was necessary. Mandating reversing aids for all light and heavy vehicles by full alignment with UN R158 through implementing Option 2, contributes to Vision Zero by addressing a number of priorities identified in the NRSS, including pursuing technological improvements and uptake of safer vehicles, improving heavy vehicle safety and focusing on vulnerable road users. Particularly notable is one of the indicators for success, namely targeting zero deaths and serious injuries by 2030 and zero deaths of children 7-years and under.

In response to industry seeking guidance on the treatment of cab-chassis vehicles, the department has amended Option 2 to provide exemptions for prime-movers and partially completed vehicles as per Clause 3.3 of ADR 108/00, noting that upon completion vehicles are required to comply with the regulation.

Feedback received during public consultation from manufacturers and importers of passenger and light commercial vehicles proposed an implementation schedule that would allow longer lead times, if regulation is the preferred option. Their proposal recommended that Australia should follow an implementation timing as per the minimum transitional arrangements in Europe (24 months or greater for new models and a further 24 months or greater for all models). Truck

manufacturers, importers and major component suppliers recommended a delayed implementation timing to accommodate local and international truck manufacturers that may struggle to meet the proposed implementation timing.

Therefore, the revised implementation timing would be as follows, thereby providing continuity of supply to the Australian market and certainty for business:

- November 2025 for new model vehicles
- November 2027 for all new vehicles

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

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Appendix 1 – Vehicle Categories

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

Passenger Vehicles (other than Omnibuses)

PASSENGER CAR (MA)

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

FORWARD-CONTROL PASSENGER VEHICLE (MB)

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

OFF-ROAD PASSENGER VEHICLE (MC)

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

- (a) Unless otherwise *'Approved'* has 4 wheel drive; and
- (b) has at least 4 of the following 5 characteristics calculated when the vehicle is at its *'Unladen Mass'* on a level surface, with the front wheels parallel to the vehicle's longitudinal centreline, and the tyres inflated to the *'Manufacturer's'* recommended pressure:
 - (i) *'Approach Angle'* of not less than 28 degrees;
 - (ii) *'Breakover Angle'* of not less than 14 degrees;
 - (iii) *'Departure Angle'* of not less than 20 degrees;
 - (iv) *'Running Clearance'* of not less than 200 mm;
 - (v) *'Front Axle Clearance'*, *'Rear Axle Clearance'* or *'Suspension Clearance'* of not less than 175 mm each.

Omnibuses

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.

HEAVY OMNIBUS (ME)

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

Goods Vehicles

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

LIGHT GOODS VEHICLE (NA)

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

MEDIUM GOODS VEHICLE (NB)

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

HEAVY GOODS VEHICLE (NC)

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

Sub-categories of Vehicle Categories

FORWARD-CONTROL PASSENGER VEHICLE (MB)

MB1 up to 2.7 tonnes 'GVM'

MB2 over 2.7 tonnes 'GVM'

OFF-ROAD PASSENGER VEHICLE (MC)

MC1 up to 2.7 tonnes 'GVM'

MC2 over 2.7 tonnes 'GVM'

LIGHT OMNIBUS (MD)

MD1 up to 3.5 tonnes 'GVM', up to 12 'Seats'

MD2 up to 3.5 tonnes 'GVM', over 12 'Seats'

MD3 over 3.5 tonnes 'GVM', up to 4.5 tonnes 'GVM'

MD4 over 4.5 tonnes 'GVM', up to 5 tonnes 'GVM'

MD5 up to 2.7 tonnes 'GVM'

MD6 over 2.7 tonnes 'GVM'

LIGHT GOODS VEHICLE (NA)

NA1 up to 2.7 tonnes 'GVM'

NA2 over 2.7 tonnes 'GVM'

MEDIUM GOODS VEHICLE (NB)

NB1 over 3.5 tonnes, up to 4.5 tonnes 'GVM'

NB2 over 4.5 tonnes, up to 12 tonnes 'GVM'

Appendix 2 – Benefit-Cost Analysis Methodology

The model used in this analysis was the Net Present Value (NPV) model. The costs and expected benefits associated with government intervention (Option 2 and Option 3) were summed over time relative to the BAU case (Option 1). The further the cost or benefit occurred from the nominal starting date, the more they were discounted. The analysis was broken up into the following steps.

1. National Passenger Vehicles (PV), SUV, LCV and heavy vehicles (HV) sales data were established using the Federal Chamber of Automotive Industries (FCAI) Vendor Field Analytical and Characterisation Technologies System (VFACTS) data. Year-on-year percentage growth/decline in sales were calculated from the given sales data for each year between 2009 and 2020 to determine the average percentage growth in sales – that is 1.57%, 1.33% and 2.33% per annum for LPVs, LCVs and HVs respectively. The average percentage growth in sales was then used to extrapolate LPV, LCV and HV vehicle sales per annum up to the year 2067.
2. The number of registered LPVs, LCVs and HVs nationally were established using the ABS motor vehicle census data for each calendar year between 2009 and 2020. Average per-annum increases in the number of registered vehicles over this period were then used to estimate future numbers of registered LPVs, LCVs and HVs for the period from 2023 to 2067 for each year of intervention.
3. The increase in fitment of reversing aids on vehicles for at sale under government intervention (Option 2 and Option 3) in comparison to BAU (Option 1) in new LPVs, LCVs and HVs was determined for each year from 2024 to 2067 (15-year policy period and 30-year life of vehicle). The difference in fitment is calculated to determine the fitment increase from government intervention at point of sale.
4. Taking the mandatory fitment increase of reversing aids at sale from government intervention from 2024 to 2067 multiplied by the likelihood of a vehicle of a given age being involved in a reversing collision, the total number of vehicles fitted with reversing aids can be determined (relative to vehicle age and year from first fitment at 2024). The total number of vehicles fitted with reversing aids is also used as the number of trauma crashes affected assuming a single vehicle is involved in a single crash.
5. The annual number of occupant fatalities and serious injuries in reversing collisions by vehicle age for the new registered LPV, LCV and HVs fleet were determined using the crash frequency by age data reported in Fitzharris and Stephan (2013). The total deaths and hospitalisation from the 12-month period ending March 2021 reported from BITRE (2021) was used assuming one crash per vehicle to be conservative.
6. The casualty crash rate was calculated using the rate of occupant fatalities and serious injuries in reversing collisions by vehicle age per annum divided by the total number of vehicles registered (ABS, 2020).
7. The likelihood of a vehicle of a given age being involved in a reversing collision was estimated as a function of the total number of LPVs, LCVs and HVs registered. This was calculated by multiplying the total number of LPVs, LCVs and HVs registered from 2024 to 2067 (prediction) with the casualty crash rate by vehicle age divided by the annual LPV registration rate from 2024 to 2067 by vehicle age.
8. The fitment rate of reversing aids in LPVs and LCVs for the BAU case was obtained from research undertaken by MUARC and the University of Otago (Fildes et al., 2017). RACV reported that the number of reverse cameras in new LPVs in Australia has been steadily growing with the fitment rate increasing from 27 per cent to 44 per cent between 2012 and 2015 and subsequently the number of vehicles with no reversing aids (cameras or reversing sensors) fell from 45 per cent to 34 per cent (Fildes et al., 2017). The maximum fitment rate through no intervention (BAU case) is assumed to be 95 per cent of the LCV and LPV vehicle fleet and 30 per cent of the HV fleet. Without regulation, manufacturers may not fit reversing aids as standard on all future models they produce.
9. The fitment cost of \$75 (LPVs and LCVs) and \$500 (HV) for reversing camera systems (without the display) refers to the wholesale cost. The fitment costs are assumed to be the minimum for manufacturers to ensure compliance with the legislation. This cost figure was used post-consultation after submissions received mentioned that the previous fitment cost of \$40 for reverse sensors was an underestimation.
10. The number of reversing collisions from LPV, LCV and HV trauma crashes that can be prevented for each year between 2024 and 2067 due to new LPVs, LCVs and HVs entering the fleet with reversing aids was estimated.

11. The cost benefit from the reduction of trauma crashes from regulation of reversing aids was determined using the total cost per trauma multiplied by the effectiveness of reversing aids on all trauma and the proportion of fatalities that occur from reversing collisions from 2024 to 2067 (15-years policy period and 30-years life of vehicle).
12. Upon post-consultation, it was identified that it was necessary to include the overall cost benefit associated with the reduction of property damage due to fitment of reversing sensors in vehicles without the technology entering the market per year. This can be assessed by taking the average cost of reversing collision claims per year for each vehicle type and multiplying it by the average cost of motor vehicle accident claims attributed to reversing collisions per year; the effectiveness of reversing camera systems at reducing all types of collision (0.49 for light vehicles and heavy vehicles (NHTSA,2006)); the difference in fitment rate from regulation relative to BAU and the percentage increase of new vehicles registered per year on a year-on-year basis.
13. The total savings from government intervention (Option 2 and Option 3) over BAU (Option 1) was determined by adding the cost benefit from the reduction of trauma crashes from regulation of reversing aids and the overall cost benefit from the reduction of property damage due to the fitment of reversing aids in new vehicles without the technology entering the market per year. This was assessed over a 15-year policy period and 30-year life of vehicle.
14. The effect of reversing aids on road trauma is 0.002592 (previously 0.003933) and is obtained by multiplying the effectiveness of the technology in reducing all sensitive trauma and the sensitivity of the crash. The sensitivity calculated is 0.0058 (previously 0.0057) using the rate of killed and serious injuries (KSI) from research conducted by MUARC (Fildes et al., 2014) divided by the total number of deaths and hospitalisations per year from BITRE (2021). The effectiveness of the reversing camera systems (without displays) in reducing all sensitive trauma is 0.43 (previously 0.69). This acknowledging that effective regulation increases the performance of reversing aids due to standardisation performance requirements. A performance increase of an additional 5 per cent is expected on top of the effectiveness estimates from research conducted by MUARC – in the case of reversing camera systems without the display, the effectiveness is 0.41 (Keall et al., 2018). This is assuming at a minimum that manufacturers will only install reversing camera systems without the display on their vehicles to comply with the government’s proposed reversing aids legislation.
15. The total cost of trauma is the sum of the cost of fatalities, serious injuries and minor injuries. The cost of fatalities, serious injuries and minor injuries is obtained by respectively multiplying the unit cost of fatalities, serious injuries and minor injuries under NPV by the proportion of fatalities, serious injuries and minor injuries from reversing collisions per year relative to the total population of Australia. NPV costs can be determined from the 2020 inflation rate provided by the Reserve Bank of Australia (RBA).
16. The proportion of fatalities, serious injuries and minor injuries from reversing collisions per year relative to the total population of Australia was calculated using crash data showing deaths and serious injuries per state from research undertaken by MUARC (Fildes et al., 2014) over a 10-year period from 2000 – 2010. The number of fatalities and serious injuries in all states were summed up and the results from the sample population were scaled up to the total population size in Australia. As of post-consultation, impairment compensation attributed to permanent psychological impacts were included in the unit cost of fatalities.
17. The unit cost of serious injuries and minor injuries was obtained from BITRE (2009) as of 2006. The unit cost of a fatality was calculated based on the typical fatality age and the average life years lost as of 2007. As of post-consultation, impairment compensation attributed to permanent psychological impacts were included in the unit cost of serious injuries.
18. The typical fatality age of 24 years old was used – median age. Previously 4 years old was used as the typical fatality age for the benefit-cost analysis for the IA released for consultative purposes.
19. Total annual costs associated with the implementation of government intervention (Option 2) for business and government were determined using the system development costs (per vehicle mode), fitment of system (per vehicle supplied), regulatory compliance costs (per vehicle model) and government and regulation costs (per year of regulatory intervention) outlined in Section 4 over the 15-year policy period. As of post-consultation, to reflect the increase of new vehicle brands entering the Australian market per year, the number of major brands per vehicle category is increased to 48, 22 and 24 major brands for LPVs, LCVs and HVs respectively based on data from the FCAI VFACTs National Report 2020 (previously 10 major brands were used). It was also assumed that a major brand produces an average of 1 new model every 3 years – hence 0.33 of a new model per year.

20. The total annual financial benefits associated with implementation of government intervention (Option 2) were determined by subtracting the costs incurred by businesses and governments from the net savings from government intervention over the BAU case.
21. For government intervention (Option 2) all calculated annual benefit and cost values were discounted and summarised, to determine the net present value of the total costs to business and government, and the net benefit to society. A real discount rate of 7% was assumed, this being in line with OIA (formerly known as OBPR) recommendations. A discount rate of 3% and 10% were used for sensitivity analysis for the recommended option.
22. The BCR was calculated for the discount rates above by determining the ratio of the NPV saved over the NPV costs incurred from government intervention

Appendix 3 – Benefit-Cost Analysis – Details of Results

1. National Passenger Vehicles (PV), SUV, LCV and heavy vehicles (HV) sales data were established using the Federal Chamber of Automotive Industries (FCAI) Vendor Field Analytical and Characterisation Technologies System (VFACTS) data.
 - 1.1 Year-on-year percentage growth/decline in sales were obtained from the given sales data for each year between 2009 and 2020 to determine the average percentage growth in sales – that is 1.57%. 1.33% and 2.33% per annum for LPVs, LCVs and HVs respectively.
 - 1.2 The average percentage growth in sales was then used to extrapolate vehicle sales per annum up to the year 2067.

Table 1: Actual and predicted new vehicle sales from 2009 to 2067 (source: FCAI VFACTS New Vehicle Sales 2009-2020)

Year	LPVs*	LCVs	HVs**	Option 2 (LPVs, LCVs and HVs)***	Option 3 (LPVs and LCVs)
2009	728715	181058	23422	933195	909773
2010	827407	179553	24322	1031282	1006960
2011	803450	176940	24022	1004412	980390
2012	884108	197331	26901	1108340	1081439
2013	899965	203838	26942	1130745	1103803
2014	883943	197372	26626	1107941	1081315
2015	924154	198464	27356	1149974	1122618
2016	927274	217168	28023	1172465	1144442
2017	915658	236127	31322	1183107	1151785
2018	873713	238590	35212	1147515	1112303
2019	799213	225353	32274	1056840	1024566
2020	676804	205271	29382	911457	882075
2021	687429	208006	19550	927356	894874
2022	698220	210777	20006	943533	907859
2023	709181	213585	20472	959992	921032
2024	720314	216430	20949	976737	934397
2025	731622	219314	21438	993775	947955
2026	743107	222235	21937	1011111	961710
2027	754772	225196	22449	1028748	975665
2028	766621	228196	22972	1046693	989822
2029	778656	231236	23508	1064952	1004185

Year	LPVs*	LCVs	HVs**	Option 2 (LPVs, LCVs and HVs)***	Option 3 (LPVs and LCVs)
2030	790879	234317	24055	1083528	1018756
2031	803295	237439	24616	1102429	1033539
2032	815905	240602	25190	1121660	1048536
2033	828713	243807	25777	1141226	1063750
2034	841723	247055	26378	1161133	1079186
2035	854936	250347	26993	1181388	1094845
2036	868357	253682	27622	1201995	1110732
2037	881989	257062	28266	1222963	1126849
2038	895835	260486	28925	1244296	1143200
2039	909898	263957	29599	1266001	1159788
2040	924182	267473	30289	1288085	1176617
2041	938690	271036	30995	1310554	1193690
2042	953426	274647	31718	1333415	1211011
2043	968393	278306	32457	1356675	1228583
2044	983595	282014	33214	1380340	1246410
2045	999036	285771	33988	1404419	1264496
2046	1014719	289578	34780	1428917	1282844
2047	1030648	293436	35591	1453843	1301458
2048	1046828	297345	36421	1479203	1320343
2049	1063261	301307	37270	1505006	1339502
2050	1079953	305321	38139	1531259	1358938
2051	1096906	309388	39028	1557970	1378657
2052	1114126	313510	39937	1585147	1398662
2053	1131616	317687	40868	1612798	1418957
2054	1149380	321919	41821	1640931	1439546
2055	1167423	326208	42796	1669555	1460435
2056	1185750	330554	43793	1698678	1481626
2057	1204364	334958	44814	1728310	1503125
2058	1223271	339420	45859	1758458	1524936
2059	1242474	343942	46928	1789132	1547063

Year	LPVs*	LCVs	HVs**	Option 2 (LPVs, LCVs and HVs)***	Option 3 (LPVs and LCVs)
2060	1261979	348524	48022	1820341	1569511
2061	1281790	353167	49141	1852095	1592286
2062	1301912	357872	50287	1884402	1615390
2063	1322349	362640	51459	1917273	1638830
2064	1343108	367471	52659	1950718	1662610
2065	1364192	372367	53886	1984746	1686735
2066	1385608	377327	55142	2019367	1711210
2067	1407360	382354	56428	2054592	1736040

* Note: The LPVs sales data is obtained from addition of passenger vehicles and SUV sales data that were separately classified.

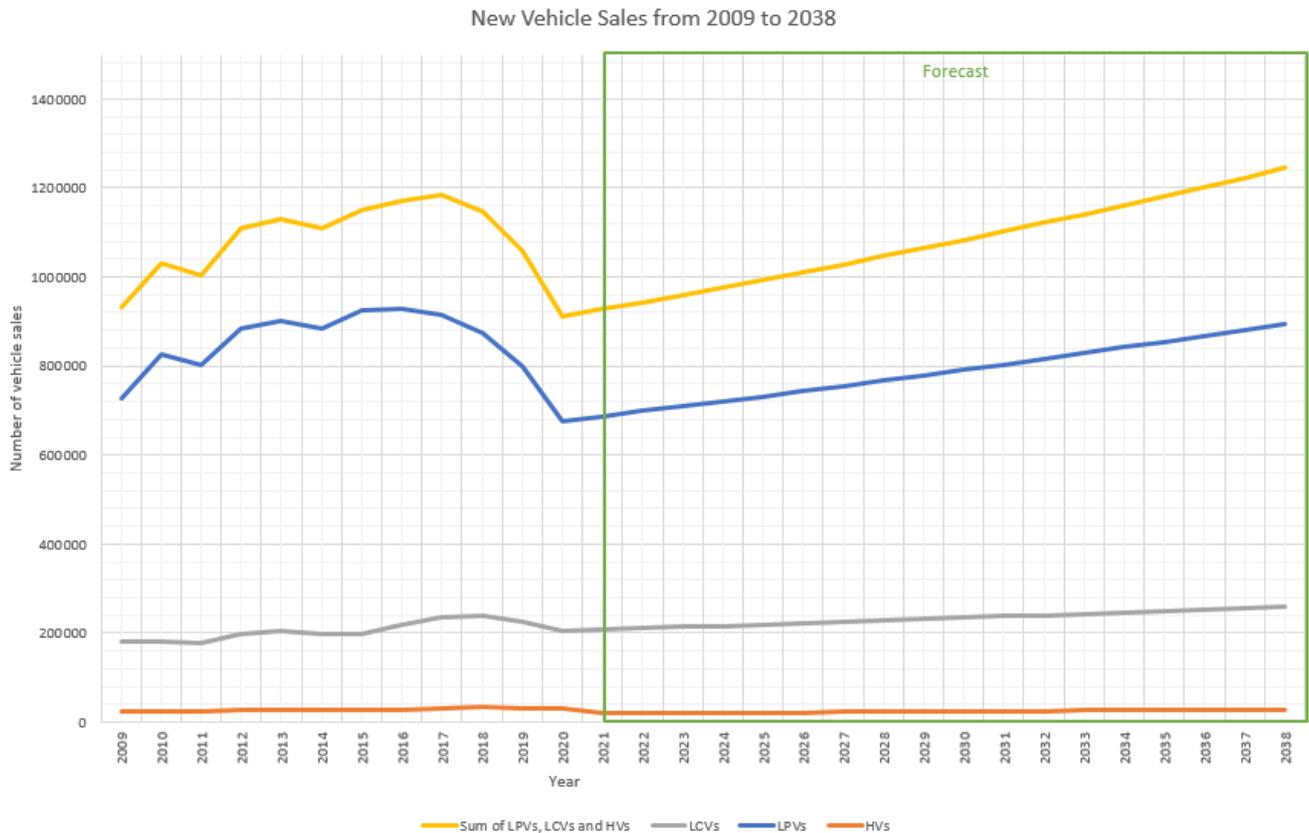
** Note: The HVs sales data has been reduced by 15 per cent to account for the exemption of prime-movers in the BCA.

*** Note: Sum of all vehicle types will be impacted by the amended Total HVs sales data.

Table 2: Percentage growth / decline of new vehicles sales from 2009 to 2020 (source: FCAI VFACTS New Vehicle Sales 2009-2020)

Year	LPVs	LCVs	HVs
2009	-	-	-
2010	34.59%	-0.83%	3.84%
2011	-1.78%	-1.46%	-1.23%
2012	28.99%	11.52%	11.98%
2013	6.74%	3.30%	0.15%
2014	-0.51%	-3.17%	-1.17%
2015	12.94%	0.55%	2.74%
2016	2.26%	9.42%	2.44%
2017	-1.87%	8.73%	11.77%
2018	-9.54%	1.04%	12.42%
2019	-18.94%	-5.55%	-8.35%
2020	-35.61%	-8.91%	-8.96%
Average	1.57%	1.33%	2.33%

Figure 1: Actual and forecasted total sales of LPVs, LCVs and HVs from 2009 to 2038



*Note that an end limit of 2038 is used for graphical representation of vehicle sales as shown in Figure 1 assuming that the actual and forecasted trend for vehicle sales is ongoing until 2067.

2. The trend in the total number of LPVs, LCVs and HVs registered for the years 2009 – 2020 was established from ABS Motor Vehicle Census data.
 - 2.1 Extrapolate data to 2067 by period assuming 1.85% growth for LPVs, 3.39% growth LCVs and 1.40% growth for HVs ongoing per-annum.
 - 2.2 Note that an end limit of 2038 is used for graphical representation of vehicle registration as shown in Figure 2 assuming that the actual and forecasted trend for vehicle registration is ongoing until 2067.

Table 3: Actual and predicted new vehicle registered from 2009 to 2067 (source: ABS Motor Vehicle Census 2009 – 2020)

Year	LPVs	LCVs	HVs*
2009	12023098	2371082	358447
2010	12269305	2460568	366586
2011	12474044	2530630	270490
2012	12714235	2617799	273798
2013	13000021	2717673	277098
2014	13297260	2824053	280044

Year	LPVs	LCVs	HVs*
2015	13549449	2907006	281944
2016	13820437.98	2985495.162	284481.6474
2017	14083026.3	3078045.512	289886.7986
2018	14336520.78	3185777.105	294524.9874
2019	14508559.02	3313208.189	300415.4872
2020	14682661.73	3405978.018	304621.304
2021	14954958.37	3521471.637	308886.0023
2022	15232304.87	3640881.539	313210.4063
2023	15514794.89	3764340.522	317595.352
2024	15802523.81	3891985.887	322041.6869
2025	16095588.8	4023959.59	326550.2705
2026	16394088.81	4160408.401	331121.9743
2027	16698124.64	4301484.068	335757.6819
2028	17007798.95	4447343.482	340458.2895
2029	17323216.31	4598148.857	345224.7055
2030	17644483.23	4754067.904	350057.8514
2031	17971708.19	4915274.025	354958.6613
2032	18305001.69	5081946.499	359928.0826
2033	18644476.27	5254270.685	364967.0758
2034	18990246.55	5432438.227	370076.6148
2035	19342429.31	5616647.269	375257.6874
2036	19701143.45	5807102.672	380511.295
2037	20066510.11	6004016.244	385838.4532
2038	20438652.66	6207606.977	391240.1915
2039	20817696.77	6418101.286	396717.5542
2040	21203770.42	6635733.266	402271.6
2041	21597003.98	6860744.949	407903.4024
2042	21997530.23	7093386.573	413614.05
2043	22405484.43	7333916.863	419404.6467
2044	22821004.32	7582603.316	425276.3118
2045	23244230.22	7839722.502	431230.1801

Year	LPVs	LCVs	HVs*
2046	23675305.04	8105560.365	437267.4026
2047	24114374.33	8380412.548	443389.1463
2048	24561586.36	8664584.719	449596.5943
2049	25017092.15	8958392.91	455890.9466
2050	25481045.49	9262163.869	462273.4199
2051	25953603.06	9576235.426	468745.2478
2052	26434924.43	9900956.864	475307.6812
2053	26925172.12	10236689.31	481961.9888
2054	27424511.67	10583806.14	488709.4566
2055	27933111.71	10942693.38	495551.389
2056	28451143.96	11313750.17	502489.1085
2057	28978783.36	11697389.15	509523.956
2058	29516208.07	12094036.98	516657.2914
2059	30063599.56	12504134.78	523890.4934
2060	30621142.68	12928138.63	531224.9604
2061	31189025.69	13366520.05	538662.1098
2062	31767440.35	13819766.6	546203.3793
2063	32356581.97	14288382.32	553850.2266
2064	32956649.49	14772888.37	561604.1298
2065	33567845.54	15273823.59	569466.5876
2066	34190376.49	15791745.06	577439.1199
2067	34824452.56	16327228.78	585523.2675

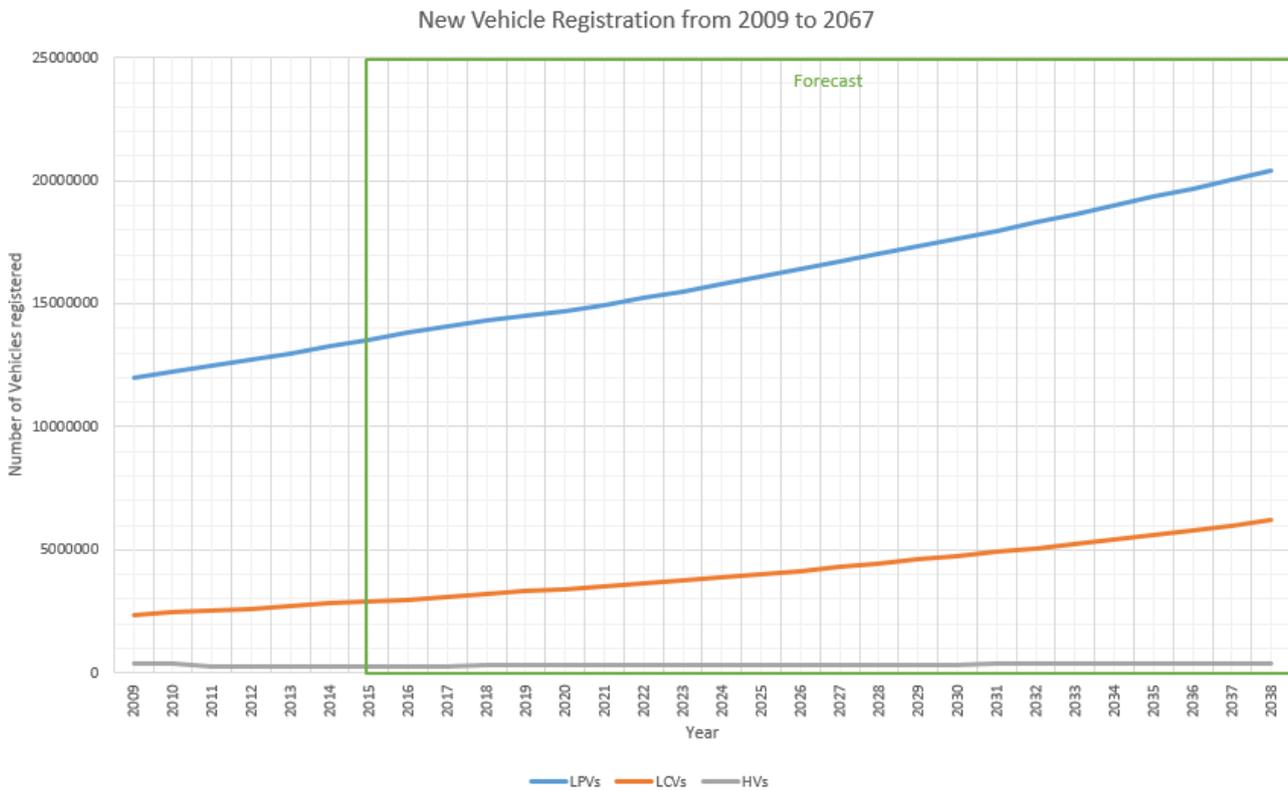
* Note: The Total HVs registration data has been reduced by 15 per cent to account for the exemption of prime-movers in the BCA.

Table 4: Percentage growth of vehicles registered from 2009 to 2020 (source: ABS Motor Vehicle Census 2009 – 2020)

Year	LPV	LCV	HV
2009	-	-	-
2010	2.00%	3.80%	2.30%
2011	2.00%	3.40%	1.10%
2012	1.90%	3.40%	1.20%
2013	2.20%	3.80%	1.20%

Year	LPV	LCV	HV
2014	2.30%	3.90%	1.10%
2015	1.90%	2.90%	0.70%
2016	2.00%	2.70%	0.90%
2017	1.90%	3.10%	1.90%
2018	1.80%	3.50%	1.60%
2019	1.20%	4.00%	2.00%
2020	1.20%	2.80%	1.40%
Average	1.85%	3.39%	1.40%

Figure 2: Actual and forecasted total registration of LPVs, LCVs and HVs from 2009 to 2038



3. The crash frequency by vehicle age for LPVs, LCVs and HVs was established.

Table 5: Crash frequency by vehicle age for LPVs, LCVs and HVs (source: Fitzharris and Stephan (2013) Appendix 8a and 8c for LPVs and LCVs, and MUARC for HVs)

Vehicle Age (years)	LPV			LCV			HV		
	Frequency	% of total	Cumulative %	Frequency	% of total	Cumulative %	Frequency	% of total	Cumulative %
0	3908	2.10%	2.10%	4827	3.80%	3.80%	377	1.91%	1.91%
1	9153	4.93%	7.03%	12860	10.12%	13.92%	1184	6.00%	7.92%
2	9008	4.85%	11.89%	12301	9.68%	23.60%	1369	6.94%	14.86%
3	9078	4.89%	16.77%	11375	8.95%	32.56%	1389	7.04%	21.90%
4	9270	4.99%	21.77%	10457	8.23%	40.79%	1340	6.80%	28.70%
5	9482	5.11%	26.87%	9159	7.21%	48.00%	1304	6.61%	35.31%
6	9401	5.06%	31.94%	8150	6.41%	54.41%	1202	6.10%	41.41%
7	9335	5.03%	36.96%	7523	5.92%	60.33%	1063	5.39%	46.80%
8	9326	5.02%	41.99%	6827	5.37%	65.70%	926	4.70%	51.50%
9	9279	5.00%	46.98%	6054	4.76%	70.47%	810	4.11%	55.61%
10	9402	5.06%	52.05%	5449	4.29%	74.76%	771	3.91%	59.52%
11	9410	5.07%	57.12%	4954	3.90%	78.66%	627	3.18%	62.70%
12	9095	4.90%	62.01%	4609	3.63%	82.29%	540	2.74%	65.44%
13	9209	4.96%	66.97%	4063	3.20%	85.48%	535	2.71%	68.15%
14	8845	4.76%	71.74%	3489	2.75%	88.23%	505	2.56%	70.71%
15	8596	4.63%	76.37%	3001	2.36%	90.59%	431	2.19%	72.90%
16	7610	4.10%	80.47%	2776	2.18%	92.78%	333	1.69%	74.59%
17	7043	3.79%	84.26%	2489	1.96%	94.74%	327	1.66%	76.24%
18	6106	3.29%	87.55%	1994	1.57%	96.30%	273	1.38%	77.63%
19	5173	2.79%	90.33%	1496	1.18%	97.48%	292	1.48%	79.11%
20	4092	2.20%	92.54%	1070	0.84%	98.32%	269	1.36%	80.47%
21	3261	1.76%	94.29%	755	0.59%	98.92%	211	1.07%	81.54%
22	2575	1.39%	95.68%	645	0.51%	99.43%	197	1.00%	82.54%
23	1957	1.05%	96.73%	381	0.30%	99.73%	194	0.98%	83.53%
24	1466	0.79%	97.52%	216	0.17%	99.90%	184	0.93%	84.46%
25	1106	0.60%	98.12%	90	0.07%	99.97%	153	0.78%	85.24%

Vehicle Age (years)	LPV			LCV			HV		
	Count	Fitment Rate	Percentage	Count	Fitment Rate	Percentage	Count	Fitment Rate	Percentage
26	792	0.43%	98.55%	42	0.03%	100.00%	110	0.56%	85.79%
27	600	0.32%	98.87%				98	0.50%	86.29%
28	477	0.26%	99.13%				83	0.42%	86.71%
29	409	0.22%	99.35%				61	0.31%	87.02%
30	287	0.15%	99.50%				55	0.28%	87.30%
31	237	0.13%	99.63%				31	0.16%	87.46%
32	190	0.10%	99.73%				32	0.16%	87.62%
33	154	0.08%	99.81%				36	0.18%	87.80%
34	101	0.05%	99.87%				22	0.11%	87.91%
35	73	0.04%	99.91%				27	0.14%	88.05%
36	55	0.03%	99.94%				21	0.11%	88.16%
37	37	0.02%	99.96%				11	0.06%	88.21%
38	30	0.02%	99.97%				6	0.03%	88.24%
39	20	0.01%	99.98%				5	0.03%	88.27%
40	9	0.00%	99.99%				4	0.02%	88.29%
41	11	0.01%	99.99%				0	0.00%	88.29%
42	4	0.00%	100.00%				4	0.02%	88.31%
43	6	0.00%	100.00%				1	0.01%	88.31%
Total	185678			127052			17413		

4. The fitment rate of reversing aid technologies (camera-monitor devices for indirect vision and / or the electromagnetic parking sensors) on new LPVs, LCVs and HVs sold between 2012 and 2037 was established.
- 4.1 For LPVs existing fitment rate from years 2012 – 2015 was obtained from Keall et al. (2018) and used in the trend for the no intervention / BAU case (Option 1) and the case for government intervention (Option 2).
- 4.2 For LCVs, upon post-consultation the fitment rate used is identical to that of LPVs as the light vehicle industry did not see justification for the fitment rate of LCVs to be lower than LPVs given the breakdown of the Australian market and high consumer demand.
- 4.3 For HVs it was assumed that the fitment rate at 2012 was almost non-existent and the maximum fitment rate for the year 2020 was 20% across the heavy vehicle fleet. As of post-consultation an additional 30% increase in fitment rate in 2023 (increased by 0.0705) with a linear trend moving forward was used to account for HVs used in the construction industry being fitted with reversing aids under the CLOCS-A initiative (refer to Section 1.5.6 of the IA) noting that the construction industry makes up 30 per cent of HVs use (ABS, 2015).
- 4.4 Note that fitment rate reaches 100% with government intervention. The maximum fitment rate through no intervention (BAU case) reaches a maximum of 95% for LPVs and LCVs fleet, and 30% for HVs fleet.

Figure 3: Forecasted fitment rate of reversing aid technologies in LPVs under no intervention / BAU (Option 1) and Government Intervention (Option 2)

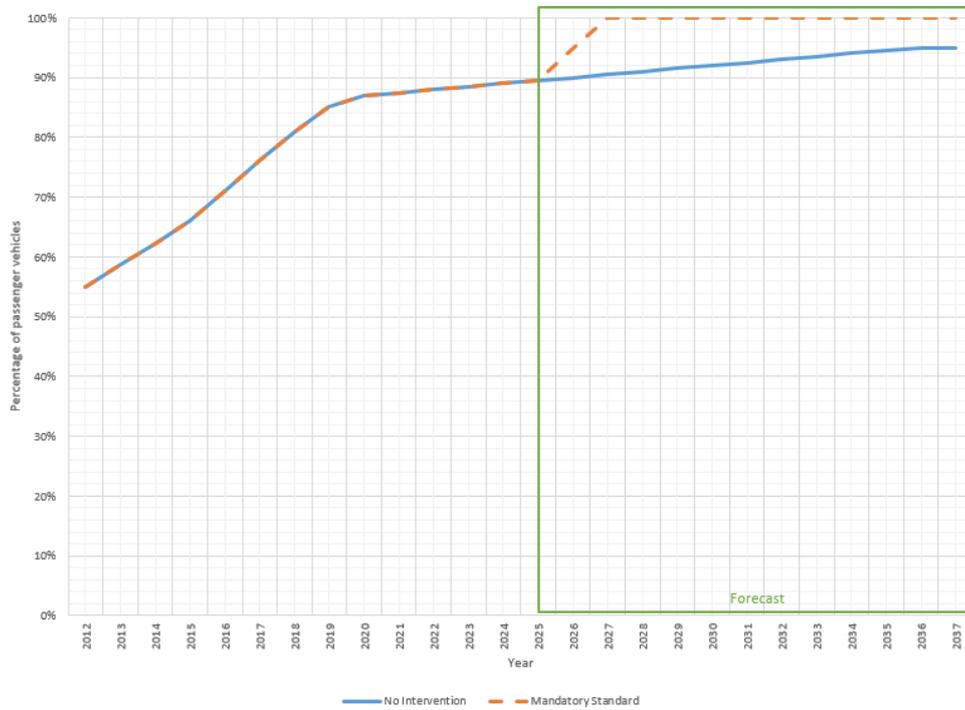


Figure 4: Forecasted fitment rate of reversing aid technologies in LCVs under no intervention / BAU (Option 1) and Government Intervention (Option 2)

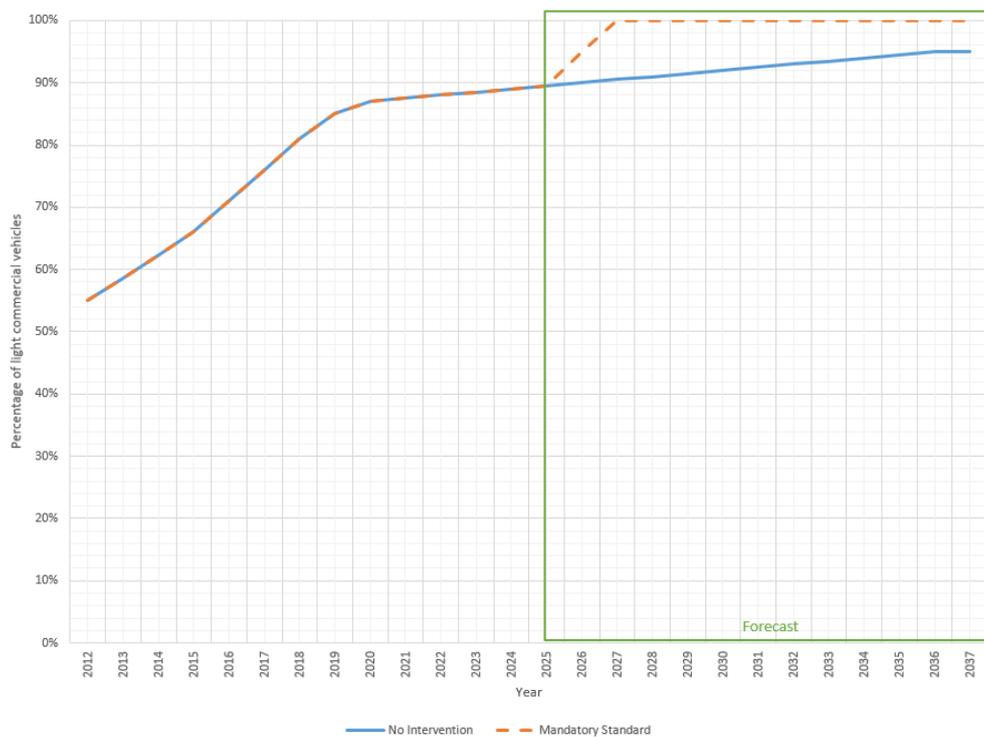
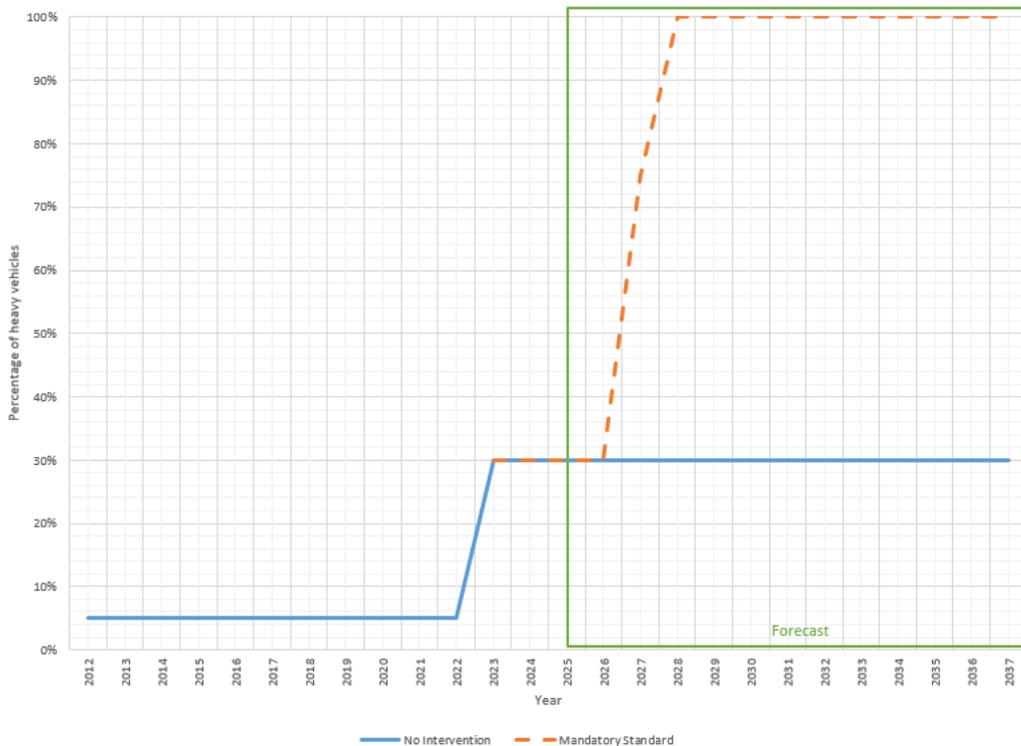


Figure 5: Forecasted fitment rate of reversing aid technologies in HVs under no intervention / BAU (Option 1) and Government Intervention (Option 2)



5. The number of LPVs, LCVs and HVs fitted at sale with reversing aid technologies under government intervention (Option 2 and Option 3) and under the BAU case (Option 1) was calculated using the fitment rate multiplied by the vehicle sales from 2025 to 2069 upon post-consultation.
6. The fitment increase at sale under government intervention was calculated by taking the difference between the government intervention and the BAU case.
7. The annual rate of occupant fatalities and serious injuries in reversing collisions by vehicle age for the new registered LPV, LCV and HV fleet was established using the crash frequency by vehicle age data multiplied by the total hospitalisation and fatalities reported from BITRE (2021).
8. The casual crash rate over the total number of registered vehicles was calculated by dividing the annual rate of occupant fatalities and serious injuries in reversing collisions by vehicle age by the total number of all vehicles registered per annum (ABS, 2020).
9. The likelihood of a vehicle of given age being involved in a reversing collision over the course of one year was assumed as a function of the total number of LPVs, LCVs and HVs registered. This was calculated by multiplying the total number of LPVs, LCVs and HVs registered with the casual crash rate over the total number of registered vehicles by vehicle age divided by the annual LPV, LCVs and HVs registered by vehicle age.
10. The number of reversing collisions trauma crashes that can be prevented for each year between 2025 and 2069 due to new LPVs, LCVs and HVs entering the fleet with reversing aids was calculated by multiplying the likelihood of a vehicle of given age being involved in a reversing collision over the course of one year as a function of the total number of LPVs, LCVs and HVs registered, with the increased fitment of reversing aids at point of sale under government intervention relative to BAU. It was assumed that one vehicle fitted with the technology can prevent a single crash hence the total number of vehicles fitted represents the number of crashes that can be prevented.

11. The unit cost of a fatality was calculated (2007 dollars) based on the typical fatality age and the average life years lost. Post-consultation, a fatality age of 24 years old was used as this was the median age, hence an average of 58 life years lost. Previously a typical fatality age of 4 years old was used for the benefit-cost analysis. Additional costs incurred in a fatality (i.e. medical costs, coronial costs etc.) was obtained from BITRE (2009).

Table 14: Unit Cost of a Fatality

Average Life Expectancy for Males	80 years
Average Life Expectancy for Females	84 years
Typical fatality age*	24 years
Average Life Years Lost	58 years

Value of a statistical life year (VLY) (BITRE, 2009) – 2007 dollars*	\$151,000
Value of a statistical Life - VSL Willingness to Pay method (WTP) – 2007 dollars	\$4,250,791

* This value of statistical life year obtained from BITRE (2009) was used for the benefit-cost analysis. At the time of analysis the *Best Practice Regulation Guidance Note Value of statistical life* published by the OIA in August 2022 was not available.

Additional Cost Variables in Fatalities	Cost
Medical costs (hospital and ambulance) (BITRE, 2009) – 2007 dollars	\$4,341
Coronial costs (BITRE, 2009) – 2007 dollars	\$2,004
Premature funeral costs (BITRE, 2009) – 2007 dollars	\$4,457
Legal costs (BITRE, 2009) – 2007 dollars	\$23,256
Correctional services costs (BITRE, 2009) – 2007 dollars	\$9,570
Recruitment and retraining (BITRE, 2009) – 2007 dollars	\$10,824
Travel delay and additional air pollution and operating costs (BITRE, 2009) – 2007 dollars	\$20,992
Police costs (BITRE, 2009) – 2007 dollars	\$1,917
Costs of fire and rescue services (BITRE, 2009) – 2007 dollars	\$2,930
Total Cost of a Fatality – 2007 dollars	\$4,747,745
WTP + Additional Costs Incurred Above	

12. The unit cost of fatalities calculated above was based on 2007-dollar value. The unit cost of serious injuries and minor injuries was obtained from BITRE (2009) based on 2006-dollar value.

- 12.1 To determine the current dollar value of unit cost per trauma for fatalities, serious injuries and minor injuries, we used the NPV formula and applied an inflation rate of 0.022 for the 2020 financial year as determined from the inflation rate calculator published by the Reserve Bank of Australia.
- 12.2 Note data is unavailable for the 2021 financial year at time of analysis.

13. Submissions received emphasised that psychological impacts have to be considered in the benefit-cost analysis to provide an economic value to the intangible loss from pain, grief and suffering experienced by families and dependents of a deceased or impaired person. This involved the inclusion of impairment compensation attributed to permanent physical or psychological conditions caused by transport accidents awarded to families and dependents by TAC in 2020 (TAC, 2021).

13.1 The unit cost of a fatality was increased by \$366,900 and the unit cost of severe injury was increased by \$241,800 in order to accommodate severe psychological impairments attributed to involvement in reversing collisions (TAC, 2021).

13.2 No impairment compensation was awarded by TAC for minor physical and/or psychological impairments (TAC, 2021) hence the unit cost of minor injuries remains unchanged.

Table 15: Current dollar value for the unit cost of trauma

Current year	2020
Inflation rate	0.022

Type of trauma	Unit cost (Non-current Dollar Value)	Unit Cost for 2020 Dollar Value (in the IA released for consultative purposes)	Unit Cost for 2020 Dollar Value (post-consultation)
Fatal	\$4,747,745 (2007)	\$6,300,123	\$6,114,124
Serious	\$266,000 (2006)	\$360,740	\$602,540
Minor	\$14,700 (2006)	\$19,936	\$19,936

14. The proportion of fatalities, serious injuries and minor injuries in pedestrians from reversing collisions in Australia was calculated using research undertaken by MUARC (Fildes et al., 2014) showing deaths, serious injuries and minor injuries per state (NSW, SA, WA, QLD, VIC) over a 10-year period from 2000 – 2010. The sum of the number of fatalities, serious injuries and minor injuries in all states over the 10-year period was based on Fildes et al. (2014) and divided by 10 to determine the number of fatalities, serious injuries and minor injuries per annum. The results were scaled up based on the sample population size shown in Fildes et al. (2014) by 1.04 to determine the number of trauma types relative to the population in Australia.

14.1 The submission from the Georgina Josephine Foundation provided collated data from media of Low Speed Vehicle Run Over (LSVRO) incidents across Australia from 2011-2021. From the data, there were 37 reversing fatalities over 2011-2021 which is equivalent to approximately 4 fatalities per year.

14.2 Local research conducted by BITRE (2015) and Cassell et al. (2011) provided an estimate of an additional 9.3 pedestrian fatalities per year attributed to reversing collisions.

14.3 To reflect this in our benefit-cost analysis, 13.3 additional fatalities were added to the average annual number of scaled the number of pedestrian fatalities relative to the population in Australia (from 7.90 in the IA released for consultative purposes to 21.20). This forms the ratio of fatalities affecting the proportion of trauma types per reversing collision which impacts upon the number of trauma savings obtained from the regulation of reversing aid technologies.

Table 16: Average annual number of pedestrians per trauma type involved in reversing collisions

	Total Population Size
Population Sample Size in Fildes et al. (2014)	24,390,000
Population of Australia	25,360,000

Total Population Size	
Scale Factor	1.04

Trauma Type	Average Annual Number of Pedestrians in Fildes et al. (2014)	Average Annual Number of Pedestrians scaled up to Australian population size (1.04 scale factor)
Fatality	7.60	21.20 (7.90 in the IA released for consultative purposes)
Serious	214.58	223.11
Minor	95.24	99.03

15. The effect of reversing aid technologies on road trauma was obtained by multiplying the effectiveness of the technology in reducing all sensitive trauma and the sensitivity of the crash. The sensitivity was calculated using the number of pedestrians killed or seriously injured (KSI) from research conducted by MUARC (Fildes et al., 2014) and divided by the total number of deaths and hospitalisations per year from BITRE (2021).
16. The effectiveness of the reversing cameras without displays in reducing all sensitive trauma was determined to be 0.43 assuming at minimum that manufacturers will only install on the technology on their vehicles to comply with the proposed reversing aids legislation. This was considering a performance increase of 5 per cent in addition to the effectiveness of 0.41 for reversing camera systems obtained from Keall et al. (2018). Previously our benefit-cost analysis considered the fitment of reversing sensors at 0.69 effectiveness (Keall et al, 2018).

Table 17: Effect of reversing aid technologies on all trauma relative to sensitivity of the technology

Total number of fatalities and hospitalisations (BITRE, 2021)	40531
1127 road deaths + 39404 hospitalisations	
KSI (Fildes et al., 2014)	244.32
21.20 total fatalities per year scaled to AUS population size (previously 7.90) + 223.11 total serious injuries per year (scaled to AUS population size)	(previously 231.02)
Effectiveness of reversing sensors in reducing all sensitive trauma (Keall et al., 2018)	0.43 (previously 0.69)
Sensitivity = KSI / Total number of fatalities and hospitalisations	0.0060 (previously 0.0057)
Effect on all trauma = Effectiveness of technology X Sensitivity	0.002592 (previously 0.003933)

17. The total cost of trauma is the sum of the cost per trauma for fatalities, serious injuries and minor injuries. The cost per trauma of fatalities, serious injuries and minor injuries was obtained by respectively multiplying the unit cost of fatalities, serious injuries and minor injuries under NPV by the proportion of fatalities, serious injuries and minor injuries from reversing collisions per year relative to the total population of Australia. NPV costs can be determined from the 2020 inflation rate provided by the Reserve Bank of Australia (RBA).

Table 18: NPV Unit Cost per Trauma

Trauma Type	Average Annual Number of Pedestrians	Ratio of Pedestrians = Average annual number of pedestrians per trauma type / 7.90	Proportion = Ratio / Total Ratio	Cost per trauma = Unit Cost in NPV X Proportion
Fatality	21.20 (previously 7.90)	1	0.062 (previously 0.024)	\$377,561 (previously \$150,844)
Serious	223.11	10.52 (previously 28.23)	0.650 (previously 0.676)	\$391,546 (previously \$243,865)
Minor	99.03	4.67 (previously 12.53)	0.288 (previously 0.300)	\$5,750 (previously \$5,982)
Total		16.19 (previously 41.77)	1.0	\$774,857 (previously \$400,690)

18. To determine the number of lives saved, severe injuries avoided and minor injuries avoided over 45 years from government intervention after 2024 under the 7% discount rate, the total number of LPVs, LCVs and HVs fitted with the technology was multiplied by the effect on all trauma and the proportion of fatality, serious injuries and minor injuries. Upon post-consultation, a 2025 implementation was proposed.

Table 19: Lives saved, severe injuries and minor injuries avoided under government intervention for LPVs, LCVs and HVs for implementation in 2025

Vehicle type	Total number of vehicles fitted	Number of Lives Saved = Total number of vehicles fitted X Effect on all trauma X Proportion of fatalities	Severe Injuries Avoided = Total number of vehicles fitted X Effect on all trauma X Proportion of serious injuries	Minor Injuries Avoided = Total number of vehicles fitted X Effect on all trauma X Proportion of minor injuries
LPVs	57006	9	96	43
LCVs	16792	3	28	13
HVs	10325	2	17	8
Option 2 (LPVs, LCVs and HVs combined)*	83330	13	140	62
Option 3 (LPVs, and LCVs combined)*	73798	12	124	55

* Discrepancies in trauma savings compared to the individual vehicle type benefit-cost analysis is due to the increase in the number of trauma crashes affected in the combined benefit-cost analysis, noting trauma savings are rounded up.

19. The total annual costs associated with the implementation of government intervention (Option 2) for business and government were determined over the 15-year policy period (2024 to 2037) using the following costs incurred.
- 19.1 As of post-consultation, to reflect the increase of new vehicle brands entering the Australian market per year, the number of major brands per vehicle category is increased to 48, 22 and 24 major brands for LPVs, LCVs and HVs respectively based on data from the FCAI VFACTs National Report 2020.
- 19.2 It was also assumed that a major brand produces an average of 1 new model every 3 years – hence 0.33 of a new model per year.
20. Submissions received mentioned that several cost variables (i.e. fitment cost, cost to test a system to regulation and governmental costs) used in the benefit-cost analysis were underestimated.
- 20.1 To address this during the post-consultation stage the fitment costs of sensors to were increased to \$75 for LPVs and LCVs, and \$500 for HVs.
- 20.2 In addition, the cost for testing of a system to a regulation was increased by \$10,000. This results in a total of \$20,000 per model.
- 20.3 The cost imposed on government to implement and maintain regulation was increased by \$50,000 to account for jurisdictional in-service costs. This results in a total of \$100,000 per year for all vehicle types which was then broken down into: \$75,000 per year for LPVs; \$17,000 per year for LCVs; \$8,000 per year for HVs.

Table 20: Cost incurred by government and businesses from implementing reversing camera systems

Cost item incurred by business	Estimated Cost
Fitment of system per vehicle that would otherwise not have the technology (wholesale cost)	\$75 per vehicle (LPVs and LCVs)
	\$500 per vehicle (HVs)
	\$40 (previously)
Testing of system to a regulation per model	\$20,000 per model
	\$10,000 per model (previously)
Regulation Compliance per model	\$1,500 per model

Cost item incurred by government	Estimated Cost
Implement and maintain regulation per year	\$75,000 per year (LPVs)
	\$17,000 per year (LCVs)
	\$8,000 per year (HVs)
	\$100,000 per year (Option 2 – LPVs, LCVs and HVs combined)
	\$92,000 per year (Option 3 – LPVs and LCVs combined)
	\$50,000 per year (previously)

21. The total savings from government intervention (Option 2) over BAU (Option 1) was determined by adding the cost benefit from the reduction of trauma crashes from regulation of reversing aids and the overall cost benefit from the reduction of property damage due to the fitment of reversing aids in new vehicles without the technology entering the market per year. This was assessed over a 15-year policy period and 30-year life of vehicle.
22. The cost benefit from the reduction of trauma crashes from regulation of reversing aids was determined using the total cost per trauma multiplied by the effectiveness of reversing aids on all trauma and the proportion of fatalities that occur from reversing collisions from 2024 to 2067 (15-years policy period and 30-years life of vehicle)

23. Upon post-consultation, it was identified that it was necessary to include the overall cost benefit associated with the reduction of property damage due to fitment of reversing sensors in vehicles without the technology entering the market per year.

- 23.1 This can be assessed by taking the average number of motor accident claims per year for domestic motor vehicles (LPVs), commercial motor vehicles (LCVs) and HVs. This was then multiplied by 12 per cent (as reversing collisions form 12 per cent of all crash types in Australia as per data collected by AAMI (Suncorp Group, 2018)). This forms the number of accident claims attributed to reversing collisions per vehicle type.
- 23.2 The estimated cost of damage to property arising from vehicle accidents was determined to be more than \$3000 (LSC, 2021).
- 23.3 Hence, the cost of damage to property arising from vehicle accidents was assumed to be \$3000 for LPVs and LCVs, and \$6000 for HVs.
- 23.4 The average cost of motor vehicle claims attributed to reversing collisions per year for each vehicle type was determined by multiplying the cost of damage to property arising from vehicle accidents by the average no. of motor accident claims attributed to reversing collisions per year.

Table 24: Variables used to determine the cost benefit associated with the reduction of property damage due to fitment or reversing cameras in vehicles

Effectiveness of reversing camera systems in reducing all types of collisions (NHTSA, 2006)	0.49 for (LPVs, LCVs and HVs)
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Vehicle Type	Average no. of motor accident claims per year	Average no. of motor accident claims attributed to reversing collisions per year	Average cost of motor accident claims attributed to reversing collisions per year
LPVs	1,875,000 (APRA, 2021a; APRA, 2021b)	225,000	\$675,000,000
LCVs	320,000 (APRA, 2021a; APRA, 2021b)	38,400	\$115,200,000
HVs	13,000 (NHVR, 2018)	1,560	\$9,360,000

24. The overall cost benefit associated with the reduction of property damage was determined by multiplying the average cost of reversing collision claims per year above by the: effectiveness of reversing sensors at reducing all types of collisions; difference in fitment rate from regulation relative to BAU; and the percentage increase of new vehicles registered per year on a year-on-year basis. This was assessed over a 15-year policy period and 30-year life of vehicle.

25. The total annual financial benefits associated with implementation of government intervention (Option 2) were determined by subtracting the net costs incurred by businesses and governments from the net savings from government intervention over the BAU case.

26. A real discount rate of 7% in line with OIA (formerly known as OBPR) recommendations was applied to the net savings, net costs and net benefits to determine the NPV of the total costs to businesses and government and the net benefit to society. A discount rate of 3% and 10% was used for sensitivity checks.

27. The NPV saved over the NPV costs was calculated to determine the BCR from government intervention over the discount rates above for the LPVs, LCVs and HVs fleet. A combined benefit-cost analysis for LPVs, LCVs and HVs was also prepared to determine the effect of regulation on all vehicle types in addition to functioning as a sensitivity check.

Table 25: Impact of changes to the real discount rate on gross benefits, net benefits, the benefit-cost ration and costs incurred by business and government over 45 years of government intervention for LPVs for implementation in 2025

Discount Rate	Gross Benefits	Fitment Cost	Testing and Regulation compliance cost	Government cost	Net Benefits	BCR
7% discount rate	\$53,013,918	\$33,936,025	\$3,101,791	\$683,094	\$15,293,008	1.41
3% discount rate	\$85,499,886	\$44,866,835	\$4,065,583	\$895,345	\$35,672,122	1.72
10% discount rate	\$38,700,083	\$28,062,420	\$2,590,326	\$570,456	\$7,476,881	1.24

Table 26: Impact of changes to the real discount rate on gross benefits, net benefits, the benefit-cost ration and costs incurred by business and government over 45 years of government intervention for LCVs for implementation in 2025

Discount Rate	Gross Benefits	Fitment Cost	Testing and Regulation compliance cost	Government cost	Net Benefits	BCR
7% discount rate	\$18,840,247	\$10,029,818	\$1,421,654	\$154,835	\$7,233,941	1.62
3% discount rate	\$27,506,272	\$13,243,592	\$1,863,392	\$202,945	\$12,196,342	1.80
10% discount rate	\$14,698,887	\$8,301,045	\$1,187,233	\$129,303	\$5,081,306	1.53

Table 27: Impact of changes to the real discount rate on gross benefits, net benefits, the benefit-cost ration and costs incurred by business and government over 45 years of government intervention for HVs for implementation in 2025

Discount Rate	Gross Benefits	Fitment Cost	Testing and Regulation compliance cost	Government cost	Net Benefits	BCR
7% discount rate	\$9,174,362	\$62,398,096	\$1,550,896	\$72,863	-\$54,847,493	0.14
3% discount rate	\$14,830,754	\$87,349,081	\$2,032,792	\$95,503	-\$74,646,621	0.17
10% discount rate	\$6,702,093	\$49,470,969	\$1,295,163	\$60,849	-\$44,124,888	0.13

Table 28: Impact of changes to the real discount rate on gross benefits, net benefits, the benefit-cost ration and costs incurred by business and government over 45 years of government intervention for Option 2 (LPVs, LCVs and HVs combined) for implementation in 2025

Discount Rate	Gross Benefits	Fitment Cost	Testing and Regulation compliance cost	Government cost	Net Benefits	BCR
7% discount rate	\$80,603,086	\$99,231,559	\$6,074,341	\$910,791	-\$25,613,606	0.76
3% discount rate	\$126,967,915	\$133,070,010	\$7,961,767	\$1,193,794	-\$15,257,655	0.89
10% discount rate	\$59,844,643	\$81,056,054	\$5,072,723	\$760,608	-\$27,044,742	0.69

Table 29: Impact of changes to the real discount rate on gross benefits, net benefits, the benefit-cost ration and costs incurred by business and government over 45 years of government intervention for Option 3 (LPVs and LCVs combined) for implementation in 2025

Discount Rate	Gross Benefits	Fitment Cost	Testing and Regulation compliance cost	Government cost	Net Benefits	BCR
7% discount rate	\$71,854,165	\$43,965,843	\$4,523,445	\$837,928	\$22,526,948	1.46
3% discount rate	\$113,006,157	\$58,110,427	\$5,928,975	\$1,098,290	\$47,868,464	1.73
10% discount rate	\$53,398,970	\$36,363,465	\$3,777,559	\$699,759	\$12,558,186	1.31

Appendix 4 – Consultation Groups

Strategic Vehicle Safety and Environment Group (SVSEG)

Manufacturer Representatives

- Australian Road Transport Suppliers Association (ARTSA)
- Bus Industry Confederation (BIC)
- Caravan Industry Association of Australia (CIAA)
- Commercial Vehicle Industry Association of Australia (CVIAA)
- Federal Chamber of Automotive Industries (FCAI)
- Heavy Vehicle Industry Australia (HVIA)
- Truck Industry Council (TIC)
- Victorian Automobile Chamber of Commerce (VACC)

Consumer Representatives

- Australian Automobile Association (AAA)
- Australasian New Car Assessment Program (ANCAP)
- Australian Trucking Association (ATA)

Government Representatives

- Department of Infrastructure, Transport, Regional Development, Communications and the Arts, Australian Government (Chair)
- Department for Infrastructure and Transport, SA
- Department of Infrastructure, Planning and Logistics, NT
- Department of State Growth, TAS
- Department of Transport and Main Roads, QLD (TmR)
- Department of Transport, VIC
- Department of Transport, WA
- Road Safety Commission, WA
- Justice and Community Safety, ACT
- Transport for NSW, NSW (TfNSW)
- New Zealand Transport Agency

Inter-Governmental Agency

- National Transport Commission (NTC)
- National Heavy Vehicle Regulator (NHVR)

Technical Liaison Group (TLG)

Manufacturer Representatives

- Australian Road Transport Suppliers Association (ARTSA)
- Bus Industry Confederation (BIC)
- Caravan Industry Association of Australia (CIAA)
- Commercial Vehicle Industry Association of Australia (CVIAA)
- Federal Chamber of Automotive Industries (FCAI)
- Truck Industry Council (TIC)

Consumer Representatives

- Australian Automobile Association (AAA)
- Australian Automotive Aftermarket Association
- Australian Motorcycle Council
- Australian Trucking Association (ATA)

Government Representatives

- Department for Infrastructure and Transport, SA
- Department of Infrastructure, Planning and Logistics, NT
- Department of Infrastructure, Transport, Regional Development, Communications and the Arts, Australian Government
- Department of State Growth, TAS
- Department of Transport and Main Roads, QLD (TmR)
- Department of Transport, VIC
- Department of Transport, WA
- Justice and Community Safety, ACT
- New Zealand Transport Agency
- Road Safety Commission, WA
- Transport for NSW, NSW (TfNSW)

Inter-Governmental Agency

- National Transport Commission (NTC)
- National Heavy Vehicle Regulator (NHVR)

Appendix 5 – Acronyms and Abbreviations

AAA	Australian Automotive Association
AAMI	Australian Associated Motor Insurers Limited
ABS	Australian Bureau of Statistics
ADR	Australian Design Rule (the national road vehicle standard)
AEB	Autonomous Emergency Braking
AIS	Abbreviated Injury Scale
ANCAP	Australian New Car Assessment Program
APRA	Australian Prudential Regulation Authority
ARTSA	Australian Road Transport Suppliers Association
ATA	Australian Trucking Association
BAU	Business as Usual
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
BIC	Bus Industry Confederation
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BSM	Blind Spot Monitoring
CIAA	Caravan Industry Association of Australia
CLOCS-A	Construction Logistics and Community Safety – Australia
CVIAA	Commercial Vehicle Industry Association Australia
ECON	Economic Connections Pty Ltd
EU	European Union
FCAI	Federal Chamber of Automotive Industries
GSR	European Union General Safety Regulations
GTR	United Nations Global Technical Regulations
HV	Heavy Vehicle
HVIA	Heavy Vehicle Industry Australia
IA	Impact Analysis (previously known as Regulation Impact Analysis (RIS))
ITMM	Infrastructure and Transport Minister’s Meeting
ITSOC	Infrastructure and Transport Senior Official’s Committee
KSI	Killed or Seriously Injuries

LCV	Light Commercial Vehicle
LPV	Light Passenger Vehicle
LSVRO	Low Speed Vehicle Run Over
MUARC	Monash University Accident Research Centre
MVSA	<i>Motor Vehicle Standards Act 1989</i>
NCAPs	New Car Assessment Programs
NHVR	National Heavy Vehicle Regulator
NHTSA	United States National Highway Traffic Safety Administration
NRMA	National Roads and Motorists' Association
NRSS	National Road Safety Strategy 2021-30
NPV	Net Present Value
NTC	National Transport Commission
OBPR	Office of Best Practice Regulation
OIA	Office of Impact Analysis (previously known as Office of Best Practice Regulation (OBPR))
OEM	Original Equipment Manufacturer
QFCC	Queensland Family and Child Commission
RAA	Royal Automobile Association of South Australia
RACQ	Royal Automotive Club of Queensland
RACV	Royal Automotive Club of Victoria
RBA	Reserve Bank of Australia
RBM	Regulatory Burden Measurement Framework
RIS	Regulation Impact Statement
RVSA	<i>Road Vehicle Standards Act 2018</i>
SUV	Sports Utility Vehicle
SVSEG	Strategic Vehicle Safety and Environment Group
TAC	Transport Accident Commission
TfNSW	Transport for New South Wales
TIC	Truck Industry Council
TLG	Technical Liaison Group
TmR	Queensland Government Department of Transport and Main Roads
UN	United Nations
UN R158	United Nations Regulation No. 158 – <i>'Uniform provisions concerning the approval of devices for reversing motion and motor vehicles with regard to the driver's awareness of vulnerable road users behind vehicles'</i>

VACC	Victorian Automobile Chamber of Commerce
VFACTS	Vendor Field Analytical and Characterisation Technologies System
VKT	Vehicle Kilometres Travelled
WP29	World Forum for the Harmonisation of Vehicle Regulations
WTO	World Trade Organisation

Appendix 6 – 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.
Abbreviated Injury Scale (AIS)	An anatomically-based injury severity scoring system that classifies each injury by body region on a 6-point scale. AIS 1 – Minor; AIS 2 – Moderate; AIS 3 – Serious; AIS 4 – Severe; AIS 5 – Critical; and AIS 6 – Maximal (currently untreatable).
Audible Warning Device	A device consisting of one or several sound emission outlets that are excited simultaneously, emitting an acoustic signal which is intended to give audible warning of the presence of a vehicle in a dangerous road traffic situation and which is intentionally operated by a driver.
Autonomous Emergency Braking (AEB)	A form of an automatic braking system that stops the vehicle if it senses that the vehicle is about to collide with an object (vehicle and / or pedestrian etc.)
Reversing Collision	Collision that occurs when the driver reverses the car into an object, person, or other car.
Benefit-Cost Analysis (BCA)	A process by which organisations can analyse decisions, systems or projects, or determine a value for intangibles. The analysis identifies the benefits of an action as well as the associated costs, and subtracting the costs from benefits. When completed, a cost benefit analysis will yield results that can be used to develop reasonable conclusion around the feasibility and / or advisability of a decision or situation.
Benefit-Cost Ratio (BCR)	The ratio of expected total (gross) benefits to expected total costs (in terms of present monetary value) for a change of policy relative to business as usual.
Blind Spot	A blind spot in a vehicle is an area around the vehicle that cannot be directly observed by the driver while at the controls, under existing circumstances.
Blind Spot Monitoring (BSM)	A system using a set of sensors mounted on the side mirrors or rear bumper to detect vehicles in adjacent lanes. If the sensors detect something, the will alert the driver via an audible and / or visual warning. Some vehicles will include a camera as the main part of the system or to complement the sensors.
Business as Usual (BAU)	The normal execution of standard functional operations within an organization.
Casualty	A person who is injured or killed in an accident.
Category L ₁ Vehicle	A two-wheeled vehicle with an engine cylinder capacity in the case of a thermic engine not exceeding 50 cm ³ and whatever the means of propulsion a maximum design speed not exceeding 50 km/h.

Category LA Vehicle	See Appendix 1 – Vehicle Categories
Category M Vehicle	Power-driven vehicles having at least four wheels and used for the carriage of passengers.
Category MA Vehicle	See Appendix 1 – Vehicle Categories
Category MB Vehicle	See Appendix 1 – Vehicle Categories
Category MC Vehicle	See Appendix 1 – Vehicle Categories
Category MD Vehicle	See Appendix 1 – Vehicle Categories
Category ME Vehicle	See Appendix 1 – Vehicle Categories
Category N Vehicle	Power-driven vehicles having at least four wheels and used for the carriage of goods.
Category NA Vehicle	See Appendix 1 – Vehicle Categories
Category NB Vehicle	See Appendix 1 – Vehicle Categories
Category NC Vehicle	See Appendix 1 – Vehicle Categories
Certification	Assessment of compliance to the requirements of a regulation / standard. Can relate to parts, sub-assemblies, or a whole vehicle.
Contracting Party	A country which is a signatory to an international agreement (e.g. the 1958 Agreement).
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.
Devices for Indirect Vision	Devices that can be used to observe the traffic area adjacent to the vehicle which cannot be observed by direct vision. These can be conventional mirrors, camera-monitors or other devices able to present information about the indirect field of vision to a driver.
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.
Emergency Brake Assist	Automobile braking technology that increases braking pressure in an emergency, when the driver pushes the brakes to execute an emergency stop.
European Union General Safety Regulation	The European Union’s regulations on vehicle safety introducing a range of mandatory safety technologies and design features for new EU approved types of vehicles.
Fatal Crash	A crash for which there is at least one death.
Fracture	A complete or partial break in bone
Gross Benefit	The sum of expected benefits in monetary terms

Gross Cost	The entire acquisition cost of an object
Hospitalised Injury	A person admitted to hospital from a crash occurring in traffic. Traffic excludes off-road and unknown location.
Impairment	Impairment is a permanent physical or psychological condition caused by transport accident injuries. For example, brain injury, fused joint, spinal cord injury, restricted shoulder movement or a permanent psychological condition.
Impairment Benefit	A one-off lump sum payment available to compensate victims, families and/or dependents for permanent loss of function and movement attributed to permanent physical or psychological conditions caused by transport accidents. Payment is made if an impairment is assessed at 11% or more and injuries must be considered stable (not expected to change over time).
Intracranial Injury (also known as Traumatic Brain Injury)	An injury to the brain caused by an external force, where it can result in physical, cognitive, social, emotional and behavioral symptoms. Outcomes can range from complete recovery to permanent disability or death. Depending on the injury, treatment required may be minimal or may include interventions such as medications, emergency surgery or surgery years later. It is a major cause of death and disability worldwide, especially in children and young adults.
Killed / Road Fatalities	A human casualty who dies immediately or within 30 days after the collision due to injuries received in the crash (International Definition adopted by the Vienna Convention 1968).
Killed or Seriously Injured (KSI)	A standard metric for safety policy, particularly in transportation and road safety.
Minor Injury	Defined as a soft-tissue injuries and / or minor psychological or psychiatric injuries. Classified as an AIS 1 on the injury severity scale.
Net Benefit	The sum of expected benefits (in monetary terms), less expected costs associated with a change in policy relative to business as usual.
Net Cost	The gross cost of an object, reduced by any financial benefits gained from owning the object.
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.
Net Savings	Savings attributable to a program's intervention in the market, exclusive of other reasons for changes
Original Equipment Manufacturer (OEM)	OEMs purchase parts from other manufacturers or suppliers and use them to assemble their finished products. OEMs also make parts and sub-assemblies that are resold to other companies who assemble them into their own finished products.
Pain and suffering	This is also known as general damages or pain and suffering compensation. It means compensation for pain and suffering, loss of amenities of life or loss of

enjoyment of life.

Pedestrian	Person travelling on foot.
Private Property	Land or belongings owned by a person or group and kept for their exclusive use.
Private Road	A road owned or controlled by a private person, persons or corporation rather than a road open to the public and owned by a government.
Property	Anything that can be owned by a person, including living things such as pets.
Property Damage	Any physical harm caused to someone else's property without their consent. This can include anything from intentional vandalism to accidental damage.
Public Road	Road or street which is commonly used by the public or any section to which the public has a right of access
Reversing Collision Avoidance	A type of collision avoidance driver-assisted system designed to prevent or reduce the severity of a rear-end collision by autonomous braking.
Serious Injury	Defined as a serious long-term impairment or loss of a body function; or permanent serious disfigurement; or severe long-term mental or severe long-term behavioural disturbance or disorder; or loss of a foetus. A serious injury may also be a permanent impairment of 30% or more and may be a single significant injury, or a combination of injuries as a result of a transport accident. Serious injuries takes into account both the injuries sustained by the vehicle occupant and the long-term impact of the transport accident on the lives of the occupant. Classified as an AIS 3+ on the injury severity scale.
Transport Accident	An incident directly caused by the driving of a motor vehicle or motor car, a railway train or a tram
Type Approval	Written approval of an authority/body that a vehicle type (i.e. model design) satisfies specific technical requirements.
World Trade Organization on Technical Barriers to Trade Agreement	World Trade Organization agreement that aims to ensure technical regulations, standards and conformity assessment procedures are non-discriminatory and do not create unnecessary obstacles to trade. Whilst recognising member countries right to implement measures to achieve legitimate policy objectives, the Agreement strongly encourages members to base their measures on international standards as a means to facilitate trade.

Appendix 7 – United Nations Regulation No. 158

Performance Requirements

United Nations Regulation No. 158 sets performance requirements for reversing aids fitted to vehicles to enhance the driver's vision or awareness when reversing. It was endorsed as a UN Regulation by WP29 in June 2021. The Regulation introduces requirements for light passenger vehicles, light commercial vehicles, busses and heavy vehicles, covering vehicle categories M and N, corresponding to ADR categories MA, MB, MC, MD, ME, NA, NB and NC. The objective is to give a clear view of the rear of the vehicle within specified fields of vision or to detect objects in the field of detection.

The specific requirements are to detect objects behind the vehicle that are at least 80 cm tall and 30 cm wide in an area ranging from 20 centimetres to 1 meter behind the vehicle. The field of vision is defined as between 30 cm to 3.5 meter behind the vehicle. The Regulation set performance criteria for two main technologies: ultra-sonic sensors and rear-view cameras.

It requires that at least one means of vision or detection shall be provided to the driver during a backing event. Devices for means of vision includes direct vision, close-proximity rear-view mirrors, rear-view camera systems or devices for indirect vision as defined in UN R46 (ADR 14/02). Means of detection other than vision may be a sensor system. Devices for means of awareness involve at least two kinds of information signals selected from audible, optical or haptic.

A reversing event starts when the vehicle transmission or drive mode is engaged in reverse and ends when one of the following forward motion conditions is met: the vehicle speed is less than 16km/h, distance travelled is less than 10 meters, continuous duration is less than 10 seconds or the vehicle's direction selector is not placed in reverse.

EXEMPTIONS

Vehicles where installation of means of rear visibility or detection is incompatible with their on-road use may be partly or fully exempt from the Regulation.

DEACTIVATION

The rear-view image shall remain visible during the backing event until either, the driver modifies the view, or the vehicle direction selector is no longer in the reverse position or the backing event is finished. Modifying the view means to switch to any other camera views.

The view can be manually switched off when the vehicle is not moving rearward. But it must default to on whenever a reversing event starts.

The system may be switched off when the vehicle detects a coupling by means of a coupling device.

Appendix 8 – Public Comments

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

Correspondent	Supported Option	Comments	Departmental Response
Michael Bentley	Neither Option 1 or Option 2	<ol style="list-style-type: none"> 1. Mentions that when reversing it is not possible to view cameras at all times (e.g. looking in mirrors and to the left and right for other vehicles). 2. Recommends fitting a warning buzzer to alert driver when vehicle / person moves into the view of the reversing camera. 	<ol style="list-style-type: none"> 1. Reversing cameras provide an additional field of view behind the vehicle that can be used in conjunction with mirrors and the driver’s line of sight, to improve driver’s awareness behind a vehicle when reversing. 2. The Department will consider reversing alarms as a separate ADR harmonisation project.
Anonymous	Option 2	<ol style="list-style-type: none"> 1. Full support of ADR 108/00. 2. Notes that reversing aids is a simple way to keep people safe, especially children walking to school by themselves. 	<ol style="list-style-type: none"> 1. Noted. Thank you. 2. Agreed.
Sebastian Tops	Option 2	<ol style="list-style-type: none"> 1. Mentions that reversing (visual aids) are useful for large (medium or heavy) vehicles. 2. Mentions that audible reversing devices raise human rights issues due to the excessive noise generated. 3. Recommends banning all ‘standard reverse beepers’ (audible reversing devices) and instead provide devices that are less noisy. 4. Recommends mandating beepers on any vehicle with low pitch noise or vibration technology that does not extend beyond 20m. 	<ol style="list-style-type: none"> 1. Noted. 2. In accordance with UN R158 in Appendix A of ADR 108/00, audible information for the driver has to comply with ISO 15006:2011. The UN R158 does not set requirements for external audible alerts. 3. See 2. above. 4. See 2. above.
David Tolson	Option 1	<ol style="list-style-type: none"> 1. Does not support the regulation of reversing cameras. 2. Concerns that the technology focuses driver attention on the screen and decreases driver’s needs to scan external mirrors and wide-angle mirrors. 3. Concerns that this increases the risk to people and properties along the sides of the trailers and within the swing areas of the prime 	<ol style="list-style-type: none"> 1. Noted. 2. Reversing aids reduces the physical and cognitive demand on drivers by means to enhance their attention to their environment. It does not replace the requirement for the driver to remain attentive in real-world driving conditions. 3. Fitment of reversing cameras does not exclude the heavy vehicle

Correspondent	Supported Option	Comments	Departmental Response
		<p>mover.</p> <ol style="list-style-type: none"> 4. Concerns that the regulation of reversing cameras make prime movers and trailers not fit for purpose. This is related to the connection between prime movers and trailers due to high failure point from pulled wires. 5. Recommends the installation of reversing lights on trucks/trailers as a low cost, low maintenance option due to increased visibility to other road users. 6. Mentions that reversing cameras installed on trailers have limited advantages that are outweighed by its disadvantages (i.e. internal screens cause distraction and at night it illuminates the cabin and reduces external vision). 	<p>driver from using external mirrors and wide-angle mirrors to monitor the environment. UN R158 requirements is to expand driver visibility towards the rear of the vehicle.</p> <ol style="list-style-type: none"> 4. Vehicle Standard (Australian Design Rule 42/05 – General Safety Requirements) 2018 stipulates requirements for the secure operation of vehicles. The ADR requires that wiring of electrical equipment must be protected from chafing etc. 5. Vehicle Standard (Australian Design Rule 1/00 – Reversing Lamps) 2005 prescribes the photometric requirements for reversing lamps which will warn pedestrians and other road users that the vehicle is about to move or is moving in the reverse direction. This is also applicable during low light conditions to aid the driver in reversing manoeuvres. The Department is also considering mandating reversing lamps on trailers as part of its review of vehicle lighting requirements. 6. In accordance with Cl. 16.1.1.1 of UN R158 in Appendix A of ADR 108/00, the operator’s manual shall provide information on how to manually adjust the luminance and contrast of rear-view camera systems.
Australasian New Car Assessment Program (ANCAP)	Option 2	<ol style="list-style-type: none"> 1. Full support of ADR 108/00. 2. Supports proposed implementation timing of ADR 108/00. 3. Notes that regulatory action via the ADR will ensure 100% fitment of reversing aids on all new light vehicles entering the market. 	<ol style="list-style-type: none"> 1. Noted. Thank you. 2. Noted. 3. Agreed.
Georgina Josephine Foundation	Option 2	<ol style="list-style-type: none"> 1. Supports ADR 108/00 if amendments are made. 2. Recommends to amend the Function of the ADR (page 3) ‘to increase the driver’s vision AND awareness of road users behind a vehicle.’ 3. Recommends to include visibility directly behind the vehicle as a minimum standard as per Appendix A UN Regulation No. 158 	<ol style="list-style-type: none"> 1. Noted. Thank you. 2. Noted. 3. Noted. In accordance with UN R158 in Appendix A of ADR 108/00, at least one means of rear visibility (e.g. rear-view camera systems) or detection (e.g. detection systems with at least two kinds of information signals selected from audible, optical and

Correspondent	Supported Option	Comments	Departmental Response
		<p>Section 15 'Requirements'. Also recommended that audible and haptic signals are included as extra tools for incident prevention.</p> <p>4. Recommends to amend Appendix A UN Regulation No. 158 Cl. 17.2.1. and 17.2.1.1. to the below</p> <p>17.2.1. The system shall have at least two kinds of information signal: 1) Optics as mandatory; 2) the other selected from audible, and haptics.</p> <p>17.2.1.1. As long as one information signal remains active, the driver may deactivate the other information signals, but this only remains so for the current reversing act. All signals reset for the next reversing act.</p> <p>5. Recommends that there should be ongoing comprehensive educational program and marketing strategy regarding the use of reversing aids and the prevention of Low Speed Vehicle Run Over incidents.</p> <p>6. Recommends the Australian Government to invest in visible promotions (i.e. television advertisements, social media, online advertising and radio promotions). Hopes for an awareness campaign in the media complementing the introduction of ADR 108/00.</p>	<p>haptics) shall be provided to the driver. The fitment of various combinations of reversing aids (i.e. reversing cameras and/or ultrasonic sensors) is at the discretion of vehicle manufacturers.</p> <p>4. Noted. These performance testing requirements are internationally agreed as acceptable. To do something differently will result in de-harmonisation of the standard, potentially creating a technical barrier to trade.</p> <p>5. Through the Office of Road Safety, the Australian Government allocates dedicated funding for a number of road safety programs. For example, the Road Safety Innovation Fund and the Road Safety Awareness and Enablers Fund provide \$12 and \$4 million respectively over four years from 2019-2020 to support road safety research and the development of new road safety technologies, and road safety awareness, education and collaboration initiatives, including for the protection of vulnerable road users, such as pedestrians, cyclists and children.</p> <p>6. Noted. See 5. above</p>
<p>Australian Automobile Association (AAA)</p>	<p>Option 2</p>	<p>1. Supports ADR 108/00.</p> <p>2. Supports proposed implementation timing of ADR 108/00.</p> <p>3. Concerns that the IA does not present a clear, high-quality justification of the proposed mandatory requirements.</p> <p>4. Notes the statement in the IA stating 'for Australia (and the US), very young children and older people were killed and seriously injured more often' is contradictory to information in Figure 2 in the IA shows 10-19 years as the age group with the highest percentage of KSI in reversing collisions in Australia.</p> <p>5. Concerns that the IA presents a narrow and restricted analysis due to the lack of other options without further justification.</p>	<p>1. Noted. Thank you.</p> <p>2. Noted.</p> <p>3. The Australian Government requires all policymakers to go through a rigorous and impartial analysis process when proposing policy solutions. This is the IA process that guides the policy journey to ensure that it is evidence-based, rigorous and ultimately the best solution for the problem is determined. The IA is an analytical document prepared to inform policymakers decision.</p> <p>4. Figure 2 of the IA shows that there were 59 per cent of fatalities and serious injuries amongst pedestrians of 0-9 years old. Note</p>

Correspondent	Supported Option	Comments	Departmental Response
		<ol style="list-style-type: none"> 6. Notes that the benefit-cost analysis of the IA does not identify how the wholesale cost of \$40 for ultrasonic sensors (at minimum compliance) is derived, how fitment costs, system integration and tuning for different vehicle types are considered. Recommends assumptions are clarified for transparency. 7. Recommends sensitivity analysis should be conducted to test the sensitivity of the benefit-cost results to the chosen effectiveness of the technology. 8. Recommends the assumed cost of the technology should be subject to sensitivity analysis. 9. Concerns as to why only young children have been taken into account in the 'Unit Cost of a Fatality', when it is reported in the IA that elderly people are also a highly vulnerable group affected by reversing collisions. Notes that this assumption is contradictory with Figure 2 and Section 7.4 of the IA that is suggestive the median age of road users killed in reversing collisions is around 24 years. 10. Recommends to explain assumptions made about the proportion of heavy vehicles (i.e. both articulated and rigid, that typically tow a trailer and have the option to temporarily disable the reversing aid device). 11. Recommends to not repeat the benefit-cost analysis. 12. Recommends that the Department takes steps to ensure future regulatory proposals have rigorous analysis and compelling justification. 	<p>that the graph has divided the first decade of life (0-4 year old and 5-10 year old) into two which may be confusing as the other age groups are indicated by decade. Equally if considering the data for fatalities and serious injuries amongst pedestrians over 60 years old, the percentage will be higher.</p> <ol style="list-style-type: none"> 5. As stated in the IA, the Office of Impact Analysis (OIA) (formerly known as the Office of Best Practice Regulation (OBPR)) has agreed that it is sufficient to analyse only two options: BAU and a regulatory option. This is recognising that a regulatory option is the only real alternative to BAU in an area where other interventions are usually implemented ahead of regulation. For example, ANCAP has been rewarding fitment of reversing aids since 2008 and various road safety advocacy groups have run awareness campaigns for the last decade. Note for Second Pass Assessment, a third option has been added upon recommendation from the OIA during First Pass Assessment. This is Option 3: Introduce a new ADR aligned with United Nations Regulation No. 158 for light vehicles. 6. A preliminary benefit-cost analysis of ultrasonic and camera backup systems (NHTSA, 2006) stated that installation cost of ultrasonic backup sensors per vehicle was \$41. Hence, a wholesale installation cost of \$40 was assumed for the benefit-cost analysis for the IA. This was based on the assumption that the cost of this kind of technology has decreased and low inflationary pressure. Please note that revised benefit/cost analyses are included in Section 6.3 Post-Consultation Analysis of the Final IA. 7. A sensitivity analysis using various discount rates (3 per cent and 10 per cent real discount rate in addition to the 7 per cent central discount rate as required by OIA (formerly known as OBPR)) was carried out to assess the results of the benefit-cost analysis. Pre-

Correspondent	Supported Option	Comments	Departmental Response
			<p>consultation, the ‘effectiveness of technology in reducing all sensitive trauma’ value of 0.69 (Keall et al., 2018) refers to the effectiveness of reversing sensors alone. Upon post-consultation we have decided to use the fitment of reversing camera systems (without the display) as it is the cheapest option based on a benefit-cost analysis conducted by the European Union Commission in 2017 (Seidl et al., 2017). The effectiveness value of the reversing camera system used for the post-consultation benefit-cost analysis is 0.43. Refer to Section 6.3 of the Final IA.</p> <p>8. Refer to Section 6.3 of the Final IA.</p> <p>9. Pre-consultation, the typical fatality age of 4 years old is used for the benefit-cost analysis, as children under 5 years old are at the greatest risk (BITRE, 2012). There are much more significant social impacts from these type of collisions on younger children. Hence, the emphasis towards this particular age group in the benefit-cost analysis. Upon post-consultation we have used a typical fatality age of 24 years old as recommended. Refer to Section 6.3 of the Final IA.</p> <p>10. The data used in the Reversing Aids IA builds upon the Heavy Vehicles AEB benefit-cost analysis data which included heavy vehicle industry supplied sales data and projects as well as VFACTS data where applicable.</p> <p>11. Noted.</p> <p>12. The Australian Government’s approach to policy making seeks to ensure that new regulation is never adopted as the default solution but rather introduced as means of last resort. Where regulation is demonstrated to be necessary, policy makers must seek practical solutions and ensure that they are well-designed, well-targeted and fit-for-purpose. The benefit-cost analysis undertaken as part of the IA quantifies the viability of the</p>

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			<p>proposed new legislation, where the interventions must express net economic benefit to society and represent the intervention with the highest net benefit when compared to no intervention. The acquisition of data to justify regulatory intervention in this IA is challenging as the majority of these collisions and injuries sustained are often outside the scope of official road injury record systems, which focus on public roads.</p>
Queensland Family and Child Commission	Option 2	1. Full support of ADR 108/00.	1. Noted. Thank you.
Kidsafe Queensland	Option 2	1. Full support of ADR 108/00.	1. Noted. Thank you.
Transport for NSW	Option 2	<ol style="list-style-type: none"> 1. Supports ADR 108/00. 2. Concerns about issues with rear attachments such as bicycle racks interfering with the effectiveness of reversing aid systems and supports further analysis into towing and attachment mechanisms (i.e. bicycle racks) available on the Australian market to ensure the reversing aid systems are compatible with them. 3. Mentions that the IA does not acknowledge other enabling work to ensure the ongoing functionality of the reversing aid systems when the vehicle is in-service which may be required by jurisdictions (i.e. establishing requirements for vehicle inspections and modifications through guidance and assessment materials) and suggests that cost implications for in-service aspects be considered. 4. Recommends an accelerated implementation timeframe of 2023 for new model light vehicles and 2025 for all new light vehicles. This would allow for an implementation lead-time of 18 months for new model vehicles and 24 months for all new vehicles. Acceleration of timeframe would realise trauma reductions associated with mandatory adoption of the ADR sooner. 	<ol style="list-style-type: none"> 1. Noted. Thank you 2. The mandate for the installation of reversing aids only concerns vehicles at first-supply. The Department will engage with jurisdictions to work towards a national approach for aftermarket modifications and its compatibility with reversing aids. 3. Noted. Changes in regulation impacts all levels of government. Hence the cost incurred by all levels of government to implement and maintain regulation has been increased to \$100,000 (an additional \$50,000) for Option 2 (LPVs, LCVs and HVs combined) and \$92,000 for Option 3 (LPVs and LCVs combined) in the post-consultation sensitivity analysis. Refer to Section 6.3 Post-Consultation Analysis in the Final IA. 4. Noted. Final implementation dates will be determined as part of ADR 108/00, taking into account all stakeholder feedback and following decision by the Minister.

Correspondent	Supported Option	Comments	Departmental Response
Queensland Government Department of Transport and Main Roads	Option 2	<ol style="list-style-type: none"> 1. Supports ADR 108/00. 2. Notes that voluntary fitment rate of reversing aids is already high on LPVs. 3. Recommends an earlier implementation timeframe of March 2024 for new model vehicles and March 2025 for all new vehicles rather than the proposed timeframe in the IA. 	<ol style="list-style-type: none"> 1. Noted. Thank you. 2. Noted. 3. Noted. Final implementation dates will be determined as part of ADR 108/00, taking into account all stakeholder feedback and following decision by the Minister.
Federal Chamber of Automotive Industries (FCAI)	Option 1	<ol style="list-style-type: none"> 1. Preference for no intervention. 2. Supports the Australian Government's decision to fully harmonise ADR 108/00 with UN R158. 3. Supports efforts to prevent road trauma in vulnerable pedestrians, such as children. 4. Recommends an adequate lead time to complete the provision of the technology across all vehicle sectors and price lines if the Australian Government decides to mandate reversing aid technologies. 5. Does not see justification for the slowdown of the current rapid uptake under Option 1. Expects that the fitment rate of reversing aids will reach and remain at 100% at the same rate as shown under Option 2 even in the absence of regulation because of consumer demand and market expectations. Also expects that the uptake of reversing aids will continue to grow at the current rate until they are effectively a standard feature across all new vehicle sales. 6. Does not see justification for the assumption that the fitment rate of LCVs is assumed to be lower than LPVs given the breakdown of the Australian market and the high consumer demand for LCVs. 7. Notes that the IA contains a number of assumptions which leads to an under-estimate of the Cost to Business. <ol style="list-style-type: none"> a. System cost is ignored even though it is an essential part of provision of any technology to market. When a 	<ol style="list-style-type: none"> 1. Noted. Thank you. 2. Agreed. The benefits of adopting an internationally agreed performance standard extends to ensuring consistent performance across different brands, increased reliability and consumer trust. 3. Noted. 4. Noted. Final implementation dates will be determined as part of ADR 108/00, taking into account all stakeholder feedback and following decision by the Minister. 5. Noted. While it is acknowledged that FCAI members have voluntarily adopted reversing aids, there is not universal fitting of reversing aids across all new vehicles. Current reversing aids performs differently depending on the manufacturer and not all vehicles fitted with reversing aids will meet all performance requirements of UN R158. Regulation will play an important role in closing the gap to a 100 per cent fitment across the market. The Australian Government has existing legislation, expertise, resources and well-established systems to administer a mandatory standard. 6. Noted. We will conduct a sensitivity analysis to align the LCV fitment rate with LPV fitment rates. 7. Noted. <ol style="list-style-type: none"> a. Harmonisation with internationally agreed standards minimises costs associated with the development of

Correspondent	Supported Option	Comments	Departmental Response
		<p>technology is mandated, manufacturers need to design, test and confirm function, effectiveness, durability and conformity to standard before any application for type approval can be made.</p> <p>b. Cost of certifying new models to the mandatory standard is estimated at \$10,000 per new model certified each year. No basis provided for this estimation. Notes that this estimate is understated. This cost should include testing of the vehicle/model/system and the administrative costs around the issuing or extension of the UN approval documents to incorporate reference to any Australian specific model codes.</p> <p>c. Effectiveness of reverse parking sensors estimated as 0.69 (Keall et al., 2018) is not effective enough to meet mandatory regulation.</p> <p>8. Benefit-cost ratio calculated in the IA is calculated on Gross Benefit rather than the Net benefit shown in the table. Notes that this is confusing and leads the Department to the assertion that regulatory intervention is justified when based on the benefit-cost ratio on Net Benefit it would not be for either LPVs or HVs.</p> <p>9. Notes that the Department should provide a pathway allowing the approval of chassis cab vehicles to ADR 108/00 either explicitly in the vehicle standard, or through guidance material and minor and inconsequential non-compliance vehicle type approvals. Recommends expanding the guidance material to include ADR 108/00 with respect to chassis cab vehicles.</p>	<p>reversing aids and provides manufacturers the flexibility to incorporate or adapt systems that have already been developed and tested in the regions that the vehicle was originally designed for. This should enable some leveraging of testing and certification frameworks already conducted in other markets (e.g. technology from Japan and the EU where all new model vehicles are required to be fitted with reversing aids by July 2022). Refer to Section 6.3 of the Final IA.</p> <p>b. We have increased the cost to ‘testing of a system to regulation’ to \$20,000 (an additional \$10,000). Refer to Section 6.3 of the Final IA.</p> <p>c. The effectiveness of 0.69 quoted from Keall et. al., 2018 is the effectiveness of the reversing sensors at reducing the likelihood of injuries (i.e. it will reduce reversing collisions by 69 per cent). Upon post-consultation we have decided to use the fitment of reversing camera systems (without the display) as it is the cheapest option based on a benefit-cost analysis conducted by the European Union Commission in 2017 (Seidl et al., 2017). The effectiveness value of the reversing camera system used for the post-consultation benefit-cost analysis is 0.43. Refer to Section 6.3 of the Final IA.</p> <p>8. The ratio of expected total (gross) benefits to expected total costs (in terms of their present monetary value) for a change in policy relative to BAU is the benefit-cost ratio. This is a measure of efficiency of the proposed intervention. The Final IA will include gross benefits for each intervention option, therefore clarifying derivation of the benefit-cost ratios.</p> <p>9. Noted. The Department will work with industry and the</p>

Correspondent	Supported Option	Comments	Departmental Response
			jurisdictions on the treatment of cab chassis vehicles with respect to ADR 108/00.
Truck Industry Council (TIC)	Does not support Option 1 or 2	<ol style="list-style-type: none"> 1. Does not support ADR 108/00 as written, but supports the introduction of a suite of reversing aids that go beyond the draft ADR 108/00. 2. Recommends implementing items A, B and C below on trucks and heavy trailers before (or in conjunction with) the current technologies detailed in ADR 108/00 and reflected in the IA analysis. <ol style="list-style-type: none"> A. Mandatory fitment of reversing lights of heavy trailers above 4.5t ATM B. Mandatory fitment of reversing alarm/beeper on trucks above 4.5t GVM (potentially above 3.5t GVM) C. Mandatory fitment of reversing alarm/beeper on heavy trailers above 4.5t ATM 3. Recommends that the costing detailed for heavy vehicles in the IA must be corrected and the IA justification recalculated, to ensure that an accurate cost-to-benefit analysis has been performed for heavy vehicles. 4. Recommends that prime movers, cab/chassis and partially completed trucks be exempt from ADR 108/00. 5. Recommends that the Department consult with operators, body builders and truck manufacturers to confirm if reverse technologies can be viably fitted to and reliably operated in-service on all vehicle types/applications. Vehicles types/applications that cannot meet these requirements should be exempt from ADR108/00. 6. Recommends that for trucks that are fitted with a device to tow a trailer, the Department consult with operators, body builders and truck manufacturers to determine what practical reversing 	<ol style="list-style-type: none"> 1. Noted. Thank you. 2. Noted. <ol style="list-style-type: none"> A. The Department is considering mandating reversing lamps on trailers as a part of its review of vehicle lighting requirements. B. The Department will consider reversing alarms as a separate ADR harmonisation project. C. See B. above 3. Noted. Revised benefit-cost analyses are included in Section 6.3 Post-Consultation Analysis of the Final IA. 4. Noted. Revised draft ADR 108/00 includes specific exemption for prime movers and partially completed vehicles such as cab/chassis vehicles. Although cab/chassis vehicles are required to comply with ADR 108/00 when fully completed. 5. Noted. The Department will consider expanding consultation to these types of industry participants. 6. See 5. above 7. Noted. In accordance with Cl. 16.1.1.3 and Cl. 17.1 in Appendix A of ADR 108/00 the rear-view camera system and detection system may be switched off when the vehicle detects a coupling by means of a coupling device. 8. Noted. See 4 above. 9. Noted. We will work with stakeholders to ensure appropriate implementation dates. 10. See 9 above. 11. Noted. Final implementation dates will be determined as part of ADR 108/00, taking into account all stakeholder feedback and

Correspondent	Supported Option	Comments	Departmental Response
		<p>technology “over-rides” could be/need to be installed in the truck to allow the practical connection of a trailer to a reversing truck.</p> <p>7. Recommends that for trucks that are fitted with a device to tow a trailer, the ADR must allow all truck reverse technologies currently called up in ADR108/00 to be disabled upon connection of a trailer to the truck.</p> <p>8. Recommends that the Department make recommendations for modifications to State, Territory and NHVR laws to ensure compliance to ADR108/00 for new Cab/Chassis and Partially Completed trucks prior to on-road use.</p> <p>9. Recommends that the Department ensure NHVR acceptance to update VSB6 at least 12 months prior to the ADR108/00 NEW vehicle introduction date. Preferably these updates to VSB6 should be in place by the ADR108/00 gazettal date. This would allow an ADR108/00 certification pathway for NB2 and NC Cab/Chassis and Partially Completed trucks from the released date of these changes to VSB6.</p> <p>10. Recommends that the Department ensure States and Territories acceptance to update VSB14 at least 12 months prior to the ADR108/00 NEW vehicle introduction date. Preferably these updates to VSB14 should be in place by the ADR108/00 gazettal date. This would allow an ADR108/00 certification pathway for NB1 Cab/Chassis and Partially Completed trucks from the released date of these changes to VSB14.</p> <p>11. Recommends to amend the ADR 108/00 implementation timing (CI 3.1.1.1. and CI. 3.1.1.2) to 1 November 2024 for new model vehicles and 1 February 2027 for all new vehicles. This is to reflect TIC’s preference for consistent introduction dates for heavy vehicles (vehicle category NB1, NB2 and NC). This is to also accommodate Australian, Japanese and USA truck manufacturers that may</p>	<p>following decision by the Minister.</p> <p>12. Noted. The expectation is that mirrors approved to ADR 14/02 would need to pass test requirements in ADR 108/00.</p> <p>13. Noted. Revised draft ADR 108/00 exempts section 4 of Appendix A.</p> <p>14. Noted. The Department will consider raising this at the UN for consideration to amend the UN Regulation.</p> <p>15. See 14. above</p>

Correspondent	Supported Option	Comments	Departmental Response
		<p>struggle to meet the proposed draft ADR108/00 timings.</p> <p>12. Recommends to revise Cl 6.4 of ADR 108/00 to clarify the use of ADR14/02 mirrors in ADR108/00, in particular ADR14/02 Appendix C mirror types.</p> <p>13. Recommends to delete Cl 4.1 requirements from Appendix A of ADR 108/00.</p> <p>14. Recommends to revise Cl 15.1.2 in Appendix A of ADR 108/00 (potentially after discussions with European regulators, to determine the intent of this clause in R158) to clearly state the intention/scope and requirements of “remote operation”.</p> <p>15. Recommends to revise Cl 17.2.1 and Cl. 17.2.1.1. in Appendix A of ADR 108/00 (potentially after discussions with European regulators, to determine the intent of these clauses in R158) to clearly state the intention/scope and requirements for the system operation requirements.</p>	
<p>National Heavy Vehicle Regulator (NHVR)</p>	<p>Option 2</p>	<ol style="list-style-type: none"> 1. Supports ADR 108/00 if amendments are made. 2. Concerns about the performance requirement in UN R158 regarding the detection of objects at 80cm tall and 30cm wide at minimum whilst reversing. Noted that World Health Organisation data indicated that a child on average does not reach 80cm height until 16-17 months and are unlikely to meet the 30cm width requirement until well into childhood based on standard domestic children clothing size in Australia. Were unable to identify whether the stated benefits in the benefit-cost analysis excluded all children who did not meet both the 80cm height requirement and 30cm width requirement. 3. Notes the IA does not consider cost to business and drivers posed by the psychological impacts of having a reversing incident. Concerns that excluding the human costs for the impacts on drivers over simplifies the assessment. 	<ol style="list-style-type: none"> 1. Noted. Thank you. 2. Noted. These dimensions thresholds are internationally agreed as acceptable. To do something differently will result in de-harmonisation of the standard creating a barrier to trade. Manufacturers are able to increase their field of view or scope of detection of their reversing aid systems beyond the minimum standard prescribed in UN R158. 3. Refer to Section 6.3 Post-Consultation Analysis of the Final IA. 4. Noted. <ol style="list-style-type: none"> a. Changes in regulation impacts all levels of government. Hence the cost incurred by all levels of government to implement and maintain regulation has been increased to \$100,000 (an additional \$50,000) in the post-consultation sensitivity analysis. Refer to Section 6.3 Post-Consultation Analysis in the Final IA.

Correspondent	Supported Option	Comments	Departmental Response
		<p>4. Notes that in-service costs imposed by compliance to ADR 108/00 must be considered in detail:</p> <ul style="list-style-type: none"> a. The cost for in-service regulators to introduce rules to require this to be checked and provide guidance to industry on how it is expected they do this. b. The cost for industry to review / assess compliance with the ADR, including any new equipment that may be needed to do this. c. The cost of OEMs to provide manufacturers guidance on how to ensure ongoing compliance as part of body building guides. This cost may be covered by compliance and testing costs already included in the assessment. <p>5. Concerned with Cl. 1.4 of UN R158 due to incompatibility with vehicles (cab-chassis) road use may lead to exemption. Recommends for consistent application of publicly known exemption criteria required for predictable applicability outcomes.</p> <p>6. Concerned with Cl. 15 of UN R158 due to field of vision boundary and detection reference point being the outermost point of the rear of the vehicle as high risk individuals may not be identified as being present in the unmonitored area. Recommends considering applying a maximum height at which the rear of the vehicle is determined and apply the field of vision boundary and detection reference from that point.</p> <p>7. Concerned with Cl. 1.3.2 in Annex 9 of UN R158 as the test criteria may not be suitable in Australia. Recommends to consider providing for alternate local test criteria.</p> <p>8. Concerned with Cl. 1.1 in Annex 10 of UN R158 as the test criteria may not be suitable in Australia. Recommends to consider providing for alternate local test criteria.</p> <p>9. Recommends to consider the mandatory fitment of reversing lights</p>	<ul style="list-style-type: none"> b. Refer to Section 6.3 Post-Consultation Analysis in the Final IA. c. Agreed. <p>5. Noted. Revised draft ADR 108/00 includes specific exemption for prime movers and partially completed vehicles such as cab/chassis vehicles. Although cab/chassis vehicles are required to comply with ADR 108/00 when fully completed.</p> <p>6. Noted. These dimensions thresholds are internationally agreed as acceptable. To do something differently will result in de-harmonisation of the standard creating a barrier to trade. Manufacturers are able to increase their field of view or scope of detection of their reversing aid systems beyond the minimum standard prescribed in UN R158.</p> <p>7. Noted. These performance testing requirements are internationally agreed as acceptable. To do something differently will result in de-harmonisation of the standard creating a barrier to trade.</p> <p>8. See 7 above</p> <p>9. The Department is considering mandating reversing lamps on trailers as part of its review of vehicle lighting requirements. The Department will also consider reversing alarms as a separate harmonisation project.</p>

Correspondent	Supported Option	Comments	Departmental Response
		and alarms to all heavy vehicles (trailers included) based on previous coronial inquests following heavy vehicle reversing incidents.	

**Total of 17 submissions received (3 submissions are confidential and hence not published)
2 supported Option 1 and 13 supported Option 2. 2 did not indicate support for either option.**