Australian Government

Department of Infrastructure, Transport, Regional Development and Communications

Regulation Impact Statement

Lane Keeping Systems for Light Vehicles

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Executive summary

Road crash trauma light vehicles

The impact of road trauma is significant, costing the Australian economy over $29 billion per annum, with light vehicle crashes constituting almost $13 billion of this. 11 per cent of road crashes are caused by unintentional lane departure and can include head on collisions, side-swipes, and single car run-off road crashes. These types of crashes result in 55 per cent of all road fatalities: this number increases to 72 per cent at highway speeds. The specific road safety problem of crashes caused by unintentional lane departure has been considered in this Regulation Impact Statement (RIS).

The top five pre-crash risk factors in fatal light vehicle crashes in Australia (often referred to as the "Fatal Five") are distraction, fatigue, intoxication, speeding, and unrestrained occupants (ATSB, 2004). Many of these behaviours may result in a vehicle unintentionally leaving its lane, thereby placing its occupants and others at risk of being involved in a serious crash. Lane keeping technologies such as Lane Departure Warning (LDW), and Lane Keeping Aid (LKA) can warn the driver when the vehicle is leaving its lane, and provide steering input to keep the vehicle in its lane.

Lane Keeping Systems (LKS)

There are two driver aids that comprise LKS, these are LDW and LKA.

LDW alerts the driver of an unintentional drift of the vehicle out of its travel lane. It provides visual, audible or haptic feedback to the driver warning them of lane departure. It uses a camera often mounted behind the windshield to identify lane markings, enabling the system to determine the vehicle's position within the lane.

LKA provides directional intervention to prevent a vehicle from unintentionally leaving its lane, and is often used in conjunction with LDW. When the system detects the vehicle is departing the lane it provides the driver with a warning using LDW, and if the vehicle continues to depart the lane LKA will provide steering input to keep the vehicle in the lane. LKA is not an automated lane keeping system that takes steering control from the driver and LKA will disable itself if it detects the driver does not have their hands on the steering wheel.

The Department of Infrastructure, Transport, Regional Development and Communications (the department) works to increase the uptake of effective safety technologies (like LKS) through the development of national vehicle standards known as the Australian Design Rules (ADRs).

One of the nine priorities for reducing fatalities and serious injuries proposed in the draft National Road Safety Strategy 2021-2030 (NRSS) is pursuing technological improvements and the uptake of safer vehicles. This includes prioritising the adoption of proven road safety technologies as quickly as possible through new ADRs subject to Regulatory Impact Statements, with LKS identified as a proven technology.

The department is also active in the development of internationally agreed standards for new vehicle technologies through the world forum for harmonization of vehicle regulations (WP.29) and these international (UN) regulations form the basis of many ADRs. Harmonising ADRs with international regulations provides Australian consumers with access to vehicles meeting the latest global levels of safety and innovation at the lowest possible cost.

The current ADR 90/00 – steering system (ADR 90) is based on the UN Regulation No. 79 – steering equipment (UN R79) and has general safety requirements for vehicles where LKA is fitted, however does not require LKA fitment. In April 2021, the European Union (EU) introduced Regulation No. 2021/646 – Emergency Lane Keep Systems (EU 2021/646) which mandates the fitment of LDW and LKA on light vehicles. It sets performance requirements for these systems, and it also mandates that they shall be active every time the vehicle is 'started'. EU 2021/646 is complementary to UN R79 and benefits from the general safety requirements within it.

Since 2011, LDW and LKA have been fitted to light vehicles in Australia. Voluntary fitment in new vehicles has risen from 7 per cent in 2013 to 61 per cent in 2021. Non regulatory programs, such as ANCAP, may have influenced voluntary uptake by requiring the fitment of lane support systems to achieve a five-star rating. These could be either LDW or LKA and there is no specific standard that these systems need to meet.

Recent research from the Monash University Accident Research Centre (MUARC) has shown that LKA is very effective in reducing road trauma resulting from crashes caused by unintentional lane departure. The research showed a 22 per cent reduction in fatal crashes brought about by an unintentional lane departure, resulting in a 11.9 per cent reduction in light vehicle fatalities.

This consultation RIS considers two options to increase the fitment of LKS to light vehicles:

- Option 1: No intervention (BAU)
- Option 2: Mandate a new standard under the *Road Vehicle Standards Act 2018* (RVSA), requiring LKS fitment to all new light vehicles (regulation), based on EU 2021/646

The results of the benefit-cost analysis over a 35 year period for each of these options (assuming an intervention policy period of 15 years) are summarised in Table 1 and Table 2.

There were no benefits provided by Option 1, however Option 2 resulted in 6,989 lives saved, and 23,648 serious injuries avoided. It provided a likely net benefit of $2,442 million, and a Benefit-Cost Ratio (BCR) of between 3.7 and 7.8.

Table 1: Summary of lives saves and injuries avoided for each option

	Lives saved	Serious injuries avoided	Minor injuries avoided
Option 1: BAU	-	-	-
Option 2: Regulation	6,989	23,648	7,385

Table 2: Summary of gross and net benefits for each option and Benefit-Cost Ratios (BCR)

	Gross benefit ($m)	Costs ($m)	Net Benefits ($m)		BCR	
			Best case	Likely case	Best case	Likely case
Option 1: BAU	-	-	-	-	-	-
Option 2: Regulation	3,055	613	2,664	2,442	7.8	5.0

Public comment

In line with the *Australian Government Guide to Regulatory Impact Analysis Second Edition* (2020), this consultation RIS is published for six weeks' public comment. A summary of the feedback and department responses will be included in the Final RIS.

The implementation timeframe proposed for consultative purposes is:

- 1 March 2024 for new model vehicles
- 1 March 2026 for all new vehicles

Recommended option

In accordance with the *Australian Government Guide to Regulatory Impact Analysis Second Edition* (2020), the policy option offering the greatest net benefit is the recommended option. Option 2, mandatory regulation, offers the greatest net benefit. Under this option a new national vehicle standard would be a requirement for new light passenger and commercial vehicles up to 3.5 tonnes Gross Vehicle Mass (GVM). These vehicles include ADR categories passenger vehicles MA, MB, MC and light goods vehicles NA1 and NA2. The relevant ADR categories are summarised in Appendix C – Vehicle categories. The final implementation dates will be determined as part of the ADR by the Government.

The RIS process

This RIS has been written in accordance with Australian Government RIS requirements. In the subsequent 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 base assessment questions addressed are:

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

1. What is the problem?

Trauma caused by light road vehicles occurs more frequently than trauma associated with other vehicle types, such as heavy vehicles and motorcycles. This is primarily because light vehicles make up around 75 per cent of the Australian vehicle fleet. A large proportion of light vehicle trauma is caused by unintentional lane departure. Distraction and fatigue increase the chance of such trauma that often manifests as run-off road and head-on crashes (ORS, 2021). 55 per cent of fatalities occur in rural areas with the majority of these coming from these types of crashes. Australia wide crashes from unintentional lane departure result in 42 per cent of fatal crashes and 55 per cent of fatalities with 72 per cent of fatalities occurring at highway speeds (MUARC, 2021).

Research has shown that the physical environment, education awareness and vehicle design are instrumental in mitigating such accidents. Road safety experts and vehicle manufacturers agree technologies that alert the driver to an unintentional lane departure can help reduce incidences of people being killed or injured by the vehicle leaving the lane unintentionally. Manufacturer initiatives and consumer choices have resulted in high voluntary fitment rates of this technology in new vehicles. However, the lack of an international standard means that the capability, usage and performance of the technology varies substantially across the Australian vehicle fleet.

1.1. The cost of road trauma in Australia

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

1.2. Light road vehicle trauma rates

Light passenger and light commercial vehicles (light vehicles) represent over 73.7 per cent of the 20.1 million registered motor vehicles in the national fleet with an annual growth rate of 1.2 per cent (ABS, 2021). In Australia, light vehicles also account for more road kilometres travelled than any other vehicle type. In the 12 months ending June 2020, light vehicles travelled 215,212 million kilometres, accounting for 90.2 per cent of annual kilometres travelled on road with each vehicle travelling an average 12 thousand kilometres per year (ABS, 2020a).

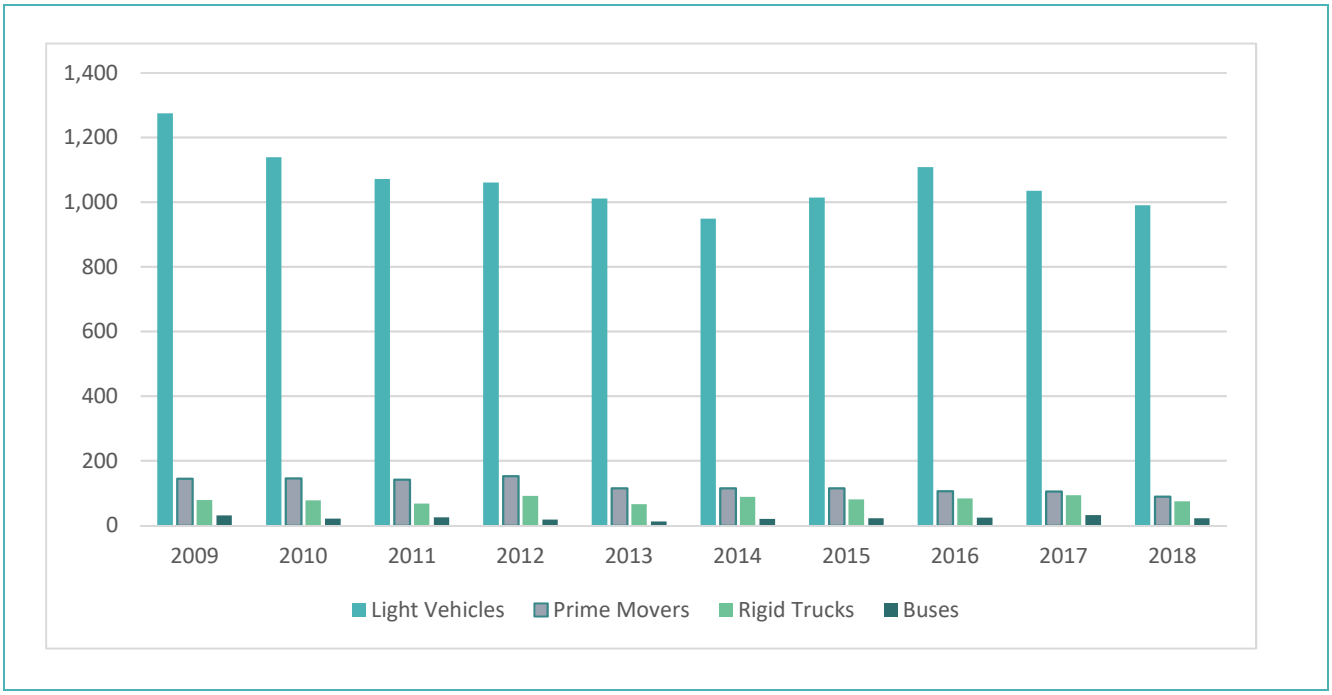
Light vehicles are mostly driven for personal use (54 per cent) followed by travel to and from work (25 per cent), with fewer kilometres travelled for business purposes (21 per cent). In line with light vehicle registrations and the proportion of kilometres they travel, 71 per cent of crashes causing road trauma involve light vehicles (BITRE, 2019). Recent research commissioned for this study indicates these crashes cost the Australian economy almost $13 billion each year.

1.2.1 Fatal crashes

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

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

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



1.2.2. Serious and minor injury crashes

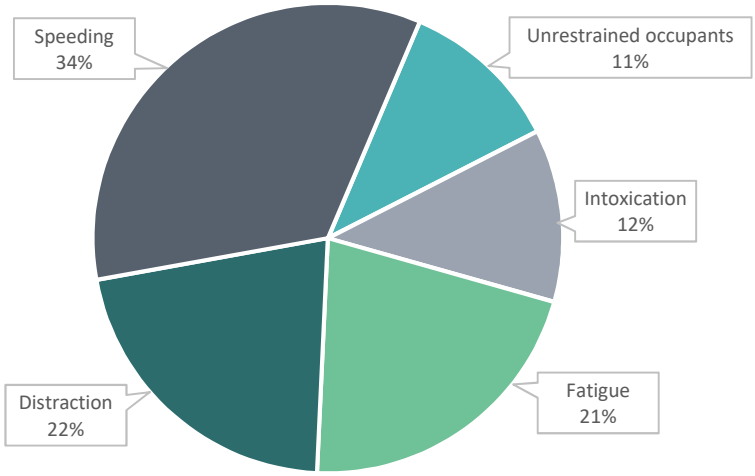
The National Injury Surveillance Unit at Flinders University, using the Australian Institute of Health and Welfare National Hospital Morbidity Database, provides data on hospitalisations due to land transport incidents. Patients hospitalised following a road crash were most likely to have been injured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

1.3. Characteristics of light vehicle crashes

1.3.1. Pre-crash factors

Up to 90 per cent of road crashes in Australia result from human error (NTC, 2017). Numerous factors have been identified as increasing the risk of a driver being involved in a car accident. The top five pre-crash risk factors in fatal light vehicle crashes in Australia (often referred to as the 'fatal five') are speeding, intoxication, fatigue, distraction and unrestrained occupants (ATSB, 2004). Figure 2 uses data from the National Road Safety Partnership Program (NRSPP) to show how the 'fatal five' contributes to road crashes. It shows that speeding is the highest contributor at 34 per cent, distraction with 22 per cent and fatigue with 21 per cent. More than one of the 'fatal five' pre-crash factors can be present at a single crash, for example, a crash can be caused by a driver that is speeding and intoxicated.

Figure 2: Fatal five statistics (NRSPP, 2016)



**In 2016 there as a total of 1295 road fatalities – from these, 1404 'fatal five' pre-crash factors were found*

1.3.2. Crash causes

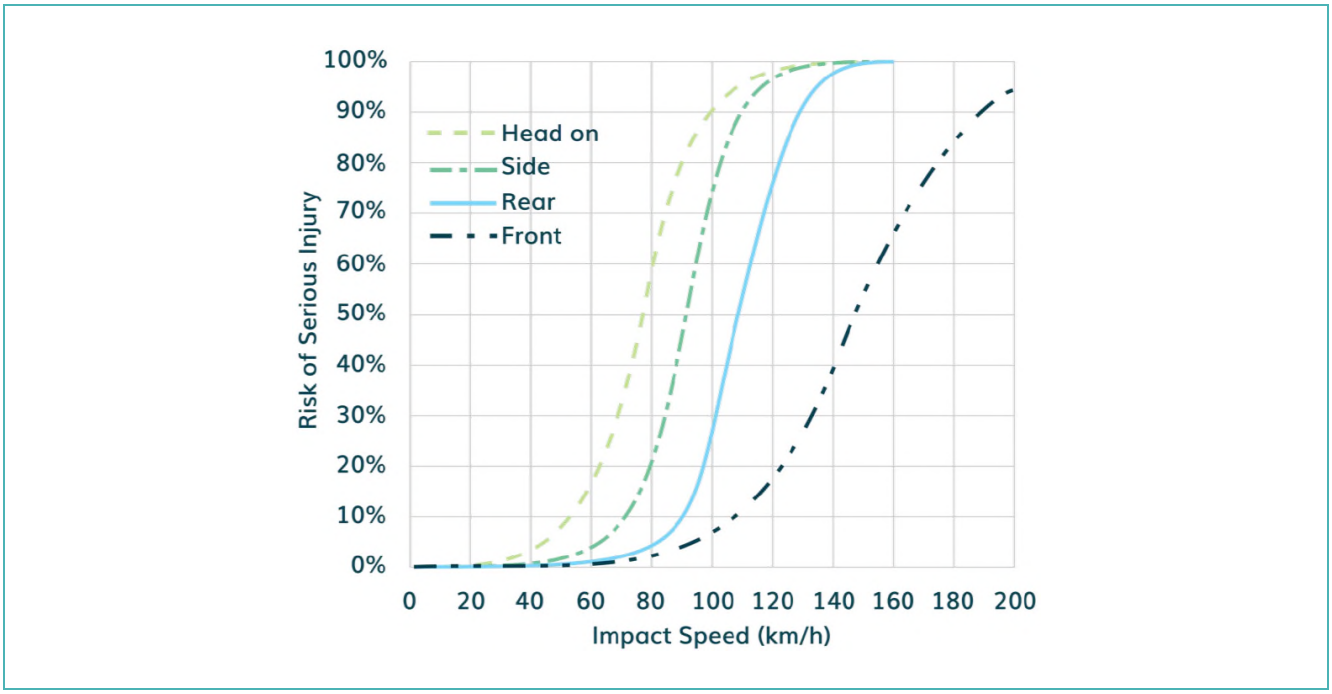
There are a number of different ways that fatal crashes can be caused, and may be a result of pre-crash factors. One commonly seen crash cause is unintentional lane departure. Crashes caused by unintentional lane departure represent 11 per cent of light vehicle road crashes with disproportionately high consequences as they result in 55 per cent of road fatalities (MUARC, 2021).

1.3.2.1. Unintentional lane departures

Unintentional lane departures can result in run-off road, head on and side swipe crashes and often occur at high road speeds. Run-off road crashes are when the vehicle leaves the road and crashes into trees, poles, embankments, or vulnerable road users on the side of the road or in emergency lanes. Head on crashes are when the vehicle leaves its lane into oncoming traffic and crashes into a vehicle travelling in the opposite direction. Side swipe crashes are when two vehicles that are traveling in the same direction collide and can result in a more serious crash with vehicles then being involved in a run-off road or head on crash.

Figure 3 shows these crash types have a high risk of trauma with side impacts having an 80 per cent chance of serious injury, and head on crashes a 90 per cent chance of serious injury at 100 km/h (ORS, 2021).

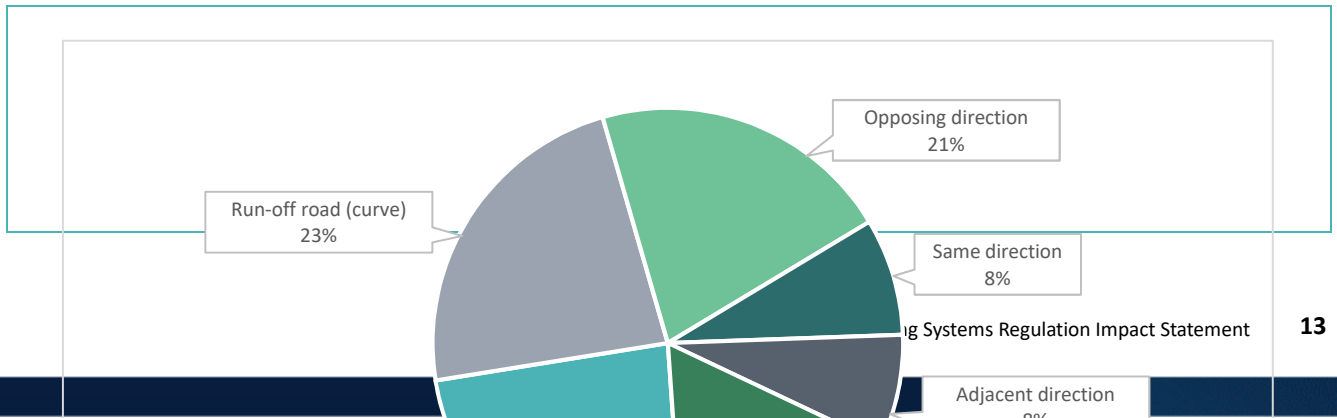
Figure 3: Comparison of impact speed and risk of serious injury for front, side and rear impacts (ORS, 2021)



1.3.3. Fatality crash types

In addition to recognised pre-crash risk factors, Australian state and territory governments examine crash data reported by police so that common crash types can be identified and addressed. The main crash types that result in fatalities are, run-off road which are single car crashes that occur either on straight or curved roads, crashes between cars in the same, adjacent and opposite directions, and crashes that include pedestrians. The distribution of fatalities by crash type is shown in Figure 4. As mentioned earlier crashes caused by unintentional lane departures represents a high proportion of fatal crashes and can include run-off road, head on and side swipe crash types, with these crash types resulting in 800 fatalities in 2019 (BITRE, 2020).

Figure 4: Fatalities by crash type (BITRE, 2020)



1.4. Government actions to address light vehicle trauma

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

1.4.1 National funding for road safety initiatives

The Australian Government allocates dedicated funding for a number of road safety programs. For example, the road safety awareness and enablers fund provides $4 million over four years from 2019–20 for grants to fund road safety awareness, education and collaboration initiatives such as to the Australasian college of road safety, the Australian road safety foundation, driver reviver Australia, the campervan and motorhome club of Australia, the traffic management association of Australia, the safer Australian roads and highways group, and fatality free Friday (ORS, 2019).

1.4.2. Infrastructure upgrades

The Australian Government's infrastructure investment agenda focuses on funding land transport infrastructure that delivers safer and efficient connections for all road users. This involves investing $110 billion over 10 years from 2021-2022 through its rolling infrastructure plan to help manage Australia's growing population, meet the national freight challenge and get Australians home sooner and safer. It includes $2 billion for local projects under the road safety plan with funding in the 2021–22 Budget for new projects and initiatives across every state and territory (Australian Government, 2021). An additional $1 billion was announced in the 2021-22 Budget to continue the Road Safety Program into 2022-2023.

The Road Safety Program is targeted at reducing the number of deaths and serious injuries on Australia's roads. The $3 billion funding is dedicated to infrastructure improvements of rural and regional roads and to provide greater protection for vulnerable road users like cyclists and pedestrians in urban areas. The program focuses on safety improvements on state highways and arterial roads, through the application of safety treatments including shoulder sealing and rumble strip markings to support the safe return of vehicles from the shoulder into the travel lane. Funding is also available for physical barriers to prevent run-off road crashes and median treatments to prevent head-on vehicle collisions.

The Road Safety Program builds on the $500 million Targeted Road Safety Works, announced in June 2020, which is supporting a wide variety of road improvement projects around Australia.

Road planning, design operation and improvements are generally managed by Australian government agencies and provide opportunities to ensure that infrastructure and vehicle designs are complementary. For example, use of road furniture and intersection geometries that maximise vehicle occupant outcomes in crashes. Funding is allocated to national infrastructure upgrades and projects that improve productivity and road safety outcomes.

A component of the ongoing work to develop, finalise and implement elements of the National Road Safety Strategy (NRSS) and National Road Safety Action Plan (NRSAP) related to road infrastructure is being carried out through the Austroads road safety program. Austroads is the peak organisation of Australasian road transport and traffic agencies. Austroads members are collectively responsible for the management of a majority of Australian roads.

Key nationally focused infrastructure research and development projects being undertaken by Austroads and other partners include (DITRDC, n.d.):

- Australian national risk assessment model provides a system to implement a nationally-consistent risk-based road assessment program, to identify road sections with the highest risk of severe crashes.
- Austroads project 'safe system infrastructure on mixed use arterials' will investigate how the safe system approach can be applied to urban arterials.
- Austroads project 'understanding and improving safe system intersection performance' will provide guidance to road agencies on options for design and retrofit of intersections so they better align with Safe System principles.
- Austroads project 'translating safe system infrastructure research and knowledge into practice' (SS2016) will produce a guidance document and a series of workshops for road practitioners outlining knowledge and research about designing, managing and operating roads and roadsides within a Safe System environment.
- The Australian Road Assessment Program (AusRAP) is an analysis of the major highways and motorways in Australia, as defined in the National Land Transport Network Determination 2014. AusRAP is a program run by the Australian Automobile Association (AAA) and the state and territory motoring clubs.

1.4.3. State and territory government action

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

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

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

Work is underway on driver education campaigns targeting driver behaviour or encouraging the uptake of effective vehicle technology are other examples of measures taken to mitigate unintended lane departures, such as the Western Australian 'Distance of Distraction' advertising campaign targeting distracted driving, or Queensland Government's street smarts app that provides advice for car buyers on safety based on the type of driving and budget.

The States and Territories also acknowledge road design as a way to prevent unintended lane departure, with the New South Wales government launching a $400 million road safety campaign for infrastructure upgrades to mark roads with rumble strips to alert drivers when they are moving out of their lanes and make upgrades to barriers to reduce the severity of run-off road crashes.

1.4.4. The National Road Safety Strategy 2021-2030 (NRSS)

The Australian Government also works closely with state and territory governments to implement commitments under the NRSS. The draft NRSS released for public consultation proposed to reduce fatalities by 50 per cent and serious injuries by 30 per cent by 2030. This is a stepping stone to the long term vision of zero deaths and serious injuries by 2050. The strategy is focused on three themes; safe roads, safe vehicles, and safe road use, with safe speeds underpinning the three themes (ORS, 2021).

The draft NRSS outlines that improvements to vehicle safety is a priority and that safety systems are now increasingly focused on crash avoidance technology, such as lane keeping support and blind spot detection. This includes technology that assists drivers stay in their lane and systems that provide warnings when drivers are drowsy or distracted are identified.

The National Road Safety Action Plan 2021–2025 (NRSAP) is intended to support implementation of the NRSS. It will detail national priorities to be undertaken by governments over the first half of the NRSS from 2021 to 2025. The Commonwealth, and State and Territory governments are working to finalise the NRSAP, in consultation with the Australian Local Government Association.

The relevant proposed priority area of the NRSS is vehicle safety. This targets the implementation of priority vehicle safety standards through the ADRs and promoting the market uptake and knowledge of vehicle technologies with high safety benefits. One of the proposed priority actions identified is LKS for light vehicles.

1.4.5. National road vehicle standards

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

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

There are also vehicle technologies available that can help the driver stay in their lane and are designed to prevent crashes caused by unwanted lane departure such as Lane Departure Warning (LDW) and Lane Keeping Aid (LKA) however there are currently no ADRs that require their fitment. There are different vehicle technologies some having similar and overlapping features and some performing the same function but with different nomenclature depending on the country of origin or the vehicle manufacturer.

1.4.6. Australasian New Car Assessment Program (ANCAP)

ANCAP is an independent vehicle safety authority that publishes consumer education information covering a range of new passenger, sports utility and light commercial vehicles entering the Australian and New Zealand markets, using a rating system of 0 to 5 stars. These ratings are continually reviewed and are displayed with a date stamp in order to keep pace with technology developments and to ensure that star ratings reward the most effective technologies. Some vehicles with an older date stamped rating will not have been tested to the latest, most stringent, standards. ANCAP works in partnership with 23 member organisations including the Australian Commonwealth, State and Territory governments. In 2018 ANCAP added Lane Support Systems (LSS) which is similar to LKS (discussed in section 2.4.1.) as one of the minimum requirements to achieve a five-star rating.

Where international standards are yet to be developed, or there is not a strong case for implementation in Australia, non-regulatory programs such as ANCAP can be an effective alternative to improve safety. The Government provides substantial funding to ANCAP for this purpose. Government support for ANCAP is outlined under the vehicle safety priority of the NRSS and ensures ANCAP continues to encourage the latest vehicle safety innovations.

1.5. Conclusion

Light vehicles represent over 73.7 per cent of registered motor vehicles (ABS, 2021) and constitute approximately 75 per cent of all single vehicle crash fatalities and 68 per cent of all multiple vehicle crash fatalities (BITRE, 2019), this road trauma costs the Australian economy an estimated $13 billion per year. A major contributor to light vehicle fatalities are crashes caused by unintentional lane departure which, although they represent 11 per cent of light vehicle road crashes, result in 55 per cent of road fatalities (MUARC, 2021). A reduction in the number of crashes caused by unintentional lane departures will have a significant impact on the number of fatalities in light vehicles, and due to the high representation of light vehicles on Australian roads, will have a significant impact on the total number of road fatalities.

The Australian Government is investing $110 billion over 10 years which includes $3 billion for load road projects, and $500 million in targeted road safety works. State and territory governments have invested in research projects, education campaigns, and strategic partnerships, and most have made a commitment to 'Towards Zero' which has as its guiding vision that no person should be killed or seriously injured on Australia's roads. This investment in improving the safety of Australia's road infrastructure, and driver education can contribute to a reduction in crashes caused by unintentional lane departures however has not shown to deliver a measureable reduction in these.

The NRSS identifies that improvements in vehicle safety are a priority to enable the reduction of fatalities by 50 per cent and serious injuries by 30 per cent by 2030. The strategy promotes the adoption of vehicle technologies with high safety benefits with one of those being LKS which aid in the reduction of crashes resulting from unintentional lane departure. Fitment of LKS in vehicles is voluntary and has increased since it first appeared in 2013, there is no regulation in Australia that requires LKS to be fitted to light vehicles. In 2018 ANCAP recognised the importance of lane keeping technology for improvements in vehicle safety and it was included as one of the minimum requirements to achieve a five-star rating.

As set out above, there is a strong commitment by federal, state, territory and local governments to improve road safety in Australia, to continue driver education programs and voluntary LKS fitment. Nevertheless, the number of deaths and serious injuries on Australian roads in light vehicles due to unintentional lane departures remains unacceptably high and continues to be a major contributor to all road trauma.

2. Why is government action needed?

Though Australian businesses and governments work towards reducing light vehicle trauma, the cost of trauma from unintended lane departure is significant, but LKS can help to mitigate such trauma. The draft NRSS proposed as one of its priorities the need to pursue technological improvements to vehicle safety. This includes adopting proven technological improvements for all vehicle types through new ADRs as quickly as possible for systems that assist drivers to stay in their lane, and systems that provide warnings when drivers are drowsy or distracted. LKS provides both a warning and intervention to assist drivers to stay in their lane.

The uptake of LKS fitment is increasing partly through the work of ANCAP to incentivise its uptake by informing consumers about the safety benefits and making it a condition of a five-star rating. However, while LKS fitment remains unregulated, the design, performance capability and usability of LKS systems vary across vehicle models in the Australian fleet. Also, voluntarily fitted systems can be permanently disabled rendering the technology ineffective. Regulation is necessary to ensure that LKS defaults to be active and to standardise minimum performance requirements. Furthermore, by setting a standard minimum performance level, regulation can provide cost-effective and maximised fitment in the new Australian light vehicle fleet.

2.1. The Need for Government Action

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

Road vehicles are complex machines which operate in a high risk environment, leading to a number of deaths and injuries each year. They are made of multiple, complex and sophisticated mechanical, electrical and electronic components and the general consumer will be unaware of the function of each component and its contribution to 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, e.g. side intrusion bars, concealed 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. As such, it is difficult for vehicle buyers to independently obtain the information and understanding required to evaluate the vehicle's safety performance and make an informed decision on the appropriate vehicle to purchase. Without any intervention, the consumer would need to inform themselves of all those components to come to a considered 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 make that difficult choice, including from ANCAP. New car buyers and the automotive industry have prioritised vehicle safety with manufacturers providing additional safety features to ensure their respective vehicle models are capable of receiving a five-star rating. In the case of an unintentional lane departure, a buyer may not be aware of the technological capabilities of a vehicle, such as driver assist technologies (e.g. Advanced Emergency Braking (AEB), Blind Spot Monitoring or LDW) in terms of their functionality and in some cases how to use those technologies.

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 crash tests, as the primary policy to improve the safety for occupants and vulnerable road users of vehicles entering the market.

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 vehicle fleets. The Australian Government's intervention to reduce road trauma aims to balance these expectations for safety with the importance of focusing on the most efficient and effective means of bringing vehicles to the Australian marketplace at the lowest possible cost. To achieve a 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.

2.2. Vehicle Technology Interventions

Awareness campaigns and advocacy activities focusing on helping the driver stay in their lane can be effective. However, vehicle technology is more reliable in directly mitigating crashes caused by unwanted lane deviation. Fitment of technology that prevent run-off road, head on and side-swipe road crashes has been increasing over the past decade. Lane keep systems, such as LDW and LKA, are considered promising vehicle technologies for reducing such trauma. This view is supported by the development of regulations in major markets that set out functional specifications.

2.2.1. Lane Departure Warning (LDW)

LDW alerts the driver of an unintentional drift of the vehicle out of its travel lane. The system can provide visual, audible or haptic feedback to the driver, warning them of a lane departure. It uses a camera often mounted behind the windshield to identify lane markings, thereby enabling the system to determine the vehicle's position within the lane. LDW systems are normally active at road speeds above 65 km/h, and to enable the driver to change lanes without a false warning is momentarily disabled when the lane change indicator is switched on. LDW is a warning system only and does not provide intervention to prevent lane departure.

2.2.2. Lane Keeping Aid (LKA)

LKA provides directional intervention to prevent a vehicle from unintentionally leaving its lane. LKA is often used in conjunction with LDW where the driver is provided with a warning using LDW as a first step when the system detects the vehicle is departing the lane. If the vehicle continues to depart the lane, LKA will intervene using either a steering or differential braking input to keep the vehicle in the lane.

LKA is only intended to provide momentary intervention for the driver and that the driver is to be actively involved in the driving task at all times. It is not a form of vehicle automation and it does not take command of the driving task. The system constantly monitors for steering inputs from the driver, if the system cannot detect a steering input it will initiate an alert, and if there is no response the alert will continue to sound and the system will transition away from LKA assistance.

LKA systems can normally be activated at road speeds above 70 km/h and (like LDW) enables the driver to change lanes without a false intervention by being momentarily disabled when the lane change indicator is switched on.

2.2.3. Lane Keeping Systems (LKS)

LKS is a safety system that combines both LDW and LKA systems. LKS is the main system that will be discussed throughout this RIS.

2.3. Available lane keep standards

Australia participates in the peak UNECE (UN) World Forum for Harmonization of Vehicle Regulations (WP.29) that sets both the framework and technical requirements for international vehicle standards. The Australian Government has been involved for over thirty years and is a signatory to the two major treaties for the development of UN Regulations (the 1958 Agreement) and Global Technical Regulations (GTRs) (the 1998 Agreement). The adoption of international regulations as a basis for national or regional standards results in the highest safety levels at the lowest possible cost.

Since attaining WP.29 endorsement in 2017, UN R79 series 02 and later has remained the internationally agreed standard for regulating LKS where the system is fitted. EU 2021/646 was implemented on 6 April 2021 and will be required for all new vehicles from 7 July 2024, this regulation sets performance requirements for LKS.

2.3.1. Australian Design Rule 90/00 – Steering System (ADR 90)

ADR 90 is currently in force and applies to the steering systems of tricycles, cars, buses, and commercial vehicles. This ADR references the construction and test provisions of UN R79 and also accepts it as an alternative standard (up to and including the 02 series of amendments).

2.3.2. UN Regulation No. 79 - steering equipment (UN R79)

UN R79 covers steering systems for vehicles applicable to UN vehicle categories M, N and O, which is for cars, commercial vehicles, and trailers and corresponds to ADR categories M, N and T. General safety requirements for vehicles where LKA is fitted was introduced into UN R79 in the series 02 amendments on 14 September 2017.

In UN R79 the term for the lateral steering component of the system is Automated Steering Corrective Function (ASCF) of category B1 and is defined as *'a function which assists the driver in keeping the vehicle within the chosen lane, by influencing the lateral movement of the vehicle'* (UNECE, 2017). This feature is analogous to LKA.

This regulation does not require the fitment of LKA, and also does not require it to default to being active however it does have general safety requirements that apply where LKA is fitted.

2.3.3. EU Regulation No. 2021/646 - Emergency Lane Keeping System (EU 2021/646)

In April 2021 the EU introduced EU 2021/646 which requires the fitment of ELKS to passenger cars and light commercial vehicles. This regulation establishes performance requirements for these systems, and mandates that they shall default to be active every time the vehicle is *'started'*.

ELKS is defined as *'a driver assisting system that should provide warning to the driver and correct the trajectory only when the driver is unintentionally leaving the lane'* (EU, 2021). ELKS systems have specific requirements under this regulation and it is a complete system that incorporates both LDW and a Corrective Directional Control Function (CDCF) which is the lateral steering control of this system and is analogous to LKA. Steering intervention can occur through either direct steering input or through differential braking and was a request from consultation in 2018.

All applicable vehicles in EU member states will need to have ELKS by 7 July 2024. A grace period of two years has been granted for vehicles equipped with hydraulic power steering however they will still require LDW fitment from 7 July 2024.

EU 2021/646 is complimentary to UN R79 and benefits from the general safety requirements within it.

2.3.4. Australian Design Rule 107/00 – Lane Keeping Systems 2021 (ADR 107)

One of the options of this RIS proposes the Australian Government would mandate the fitment of LKS to new light vehicles supplied to the market due to regulation through the creation of ADR 107 under the RVSA.

The proposed ADR 107 is based on the performance requirements of the EU 2021/646 and enables safety requirements for LKS in ADR 90 (based on UN R79). This would result in the requirement for new light vehicles to be fitted with LKS (both LDW and LKA) and that the system defaults to on every key cycle.

There is more information on ADR 107 at Appendix D - Australian Design Rule 107/00 – Lane Keeping Systems) 2021.

2.4. LKS fitment rates for light vehicles

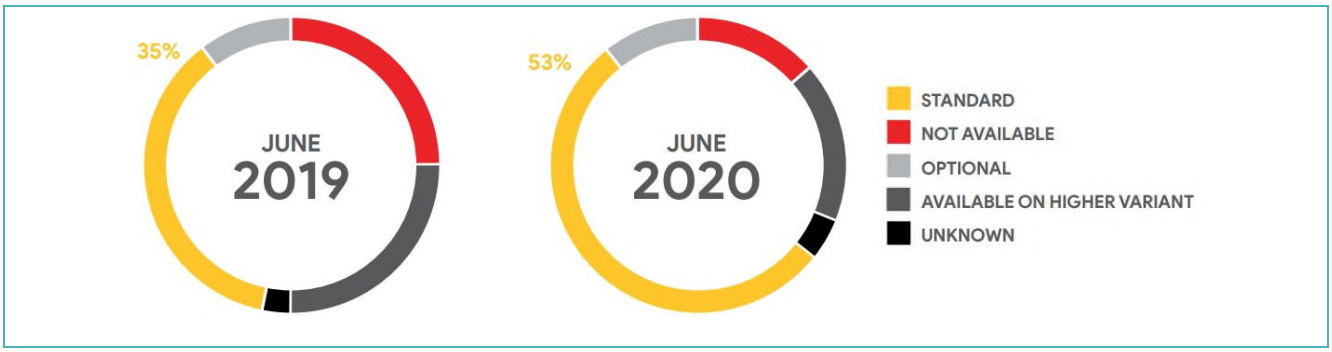
When fitment rates are discussed they represent the percentage of new vehicles sold in a calendar year that are equipped with lane safety technology for light vehicles weighing less than 3.5 tonnes: categories, MA, MB, MC and NA. It is not possible to assess if the LKA and LDW systems fitted are compliant with international regulations as this is not identified in sales data.

2.4.1. ANCAP Lane Support System (LSS) fitment rate

ANCAP provides fitment data on LSS which can include LDW, LKA or both. ANCAP's beyond the stars report (ANCAP, 2020) shows that standard fitment rates of LSS in 2019 were 35 per cent and in 2020 were 53 per cent of light vehicles as shown in

Figure 5. The 2020 data also shows that LSS was optional on about 10 per cent of vehicles and for 20 per cent of vehicles available in a higher variant. As ANCAP's data can include either LDW or LKA technologies and indicates that it is optional on some vehicles it provides an indication on LKA fitment rates however it is not accurate enough to use for a benefit cost analysis.

Figure 5: ANCAP LSS Fitment rates

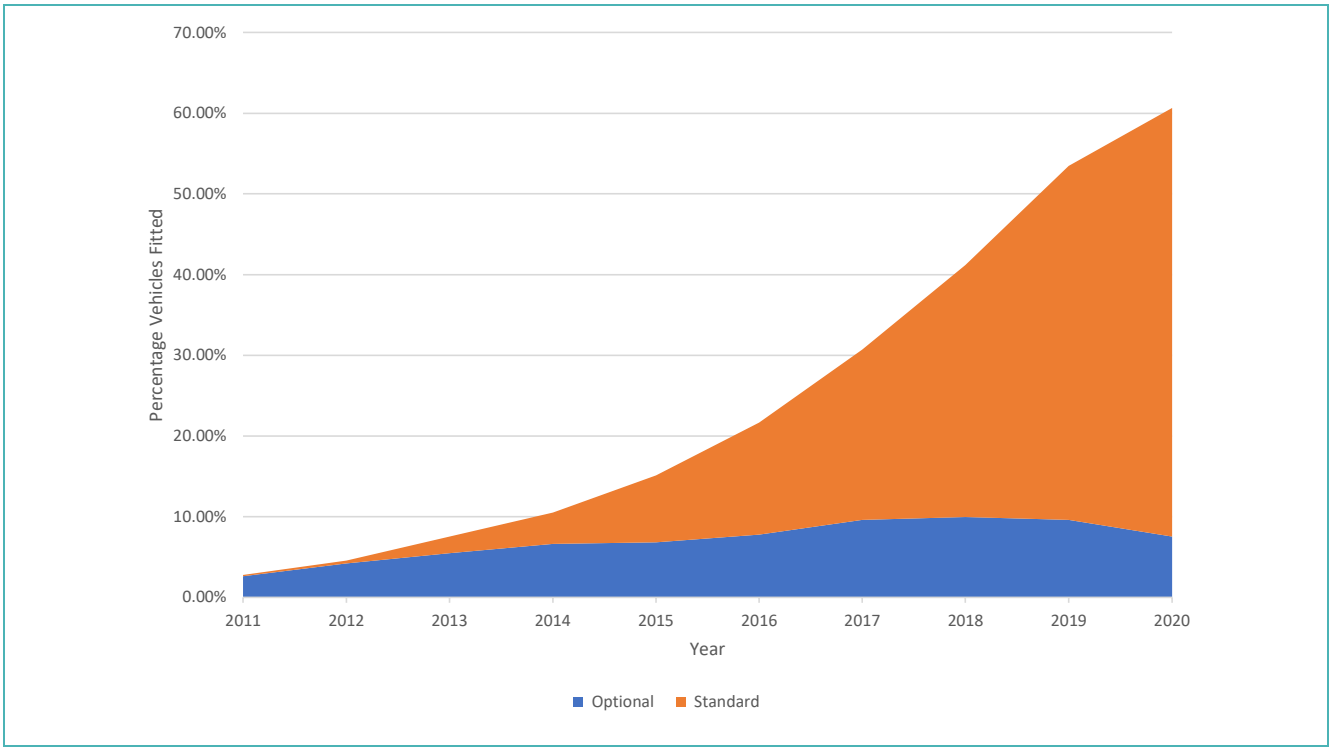


2.4.2. Monash University's Accident Research Centre's (MUARC) estimated LKA fitment rate

MUARC published LKA fitment rates for light vehicles that combines both standard and optional fitment of LKA.

Figure 6 shows the estimated LKA fitment rate over time and that in 2020 just over 60 per cent of vehicles had either standard or optional fitment of LKA (MUARC, 2021). With MUARC combining both optional and standard fitment of LKA this will be the highest possible fitment rate of LKA with actual fitment likely being lower.

Figure 6: MUARC estimated LKA fitment rate



2.4.3. The department's LKS fitment rate

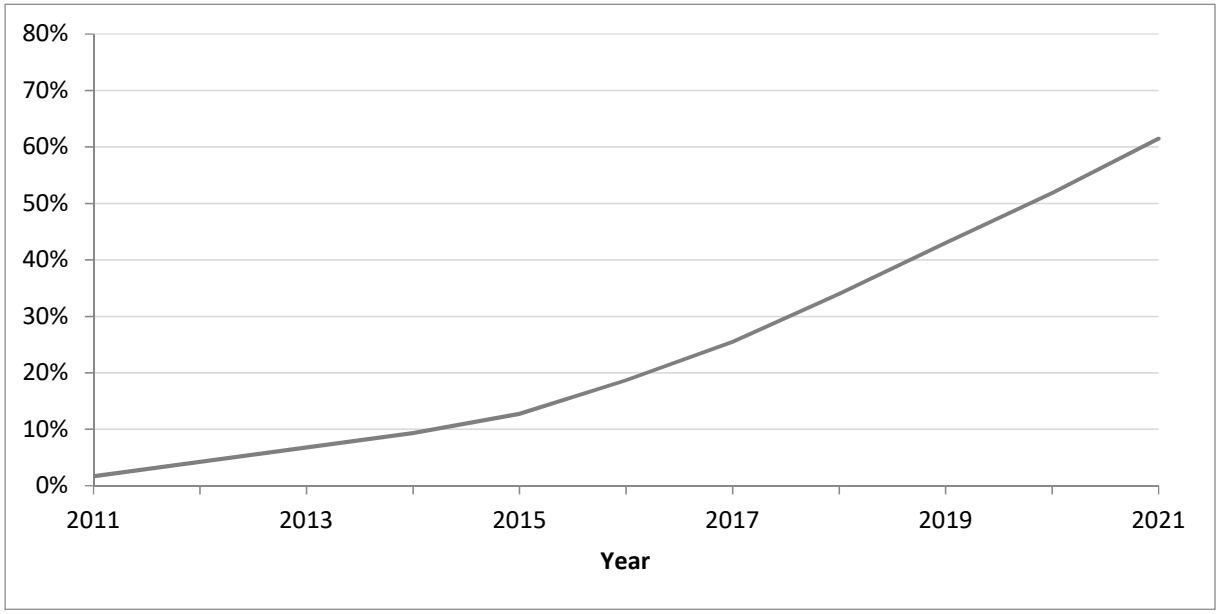
To provide additional data on LKS fitment rates the department gathered sales data from VFACTS for the top 10 selling nameplates for light vehicles (FCAI, 2021). This showed April 2021 sales figures for Ford Ranger (5,021), Toyota RAV4 (4,506), Toyota HiLux (4,222), Toyota Land Cruiser (2,595), Mitsubishi Triton (2,458), Mazda CX-5 (2,353), Toyota Corolla (2,073), Mitsubishi ASX (2,028), Hyundai i30 (2,005), and Isuzu D-Max (1,999). This totalled 29,260 vehicles which represented 32.9 per cent of the 88,954 light vehicles sold in April 2021.

To understand the LKS fitment rate of the top 10 selling nameplates vehicle specification data from each manufacturer's sales website was used to determine the percentage of variants for each nameplate that are fitted with LKS or an equivalent system, and this percentage was then multiplied by the vehicle sales for that nameplate. From this analysis the number of vehicles sold in April 2021 fitted with LKS was 17,809 which is 60.86 percent of the vehicles analysed. This figure is based on the assumption that the sales figures for nameplate variants is equal, and that LKS fitment rates in the top ten nameplates are representative of the whole light vehicle market segment.

Comparatively, the LKS fitment rate from this analysis is slightly lower than the 2021 adjusted number from the MUARC report (approximately 70 per cent), and is between the standard and optional LSS fitment rates from the ANCAP data. For this reason, a 2021 LKS fitment rate of 60.86 per cent is being used for this RIS's benefit cost analysis. The fitment rate derived from this calculation is shown in

Figure 7.

Figure 7: DITRDC LKS fitment rate

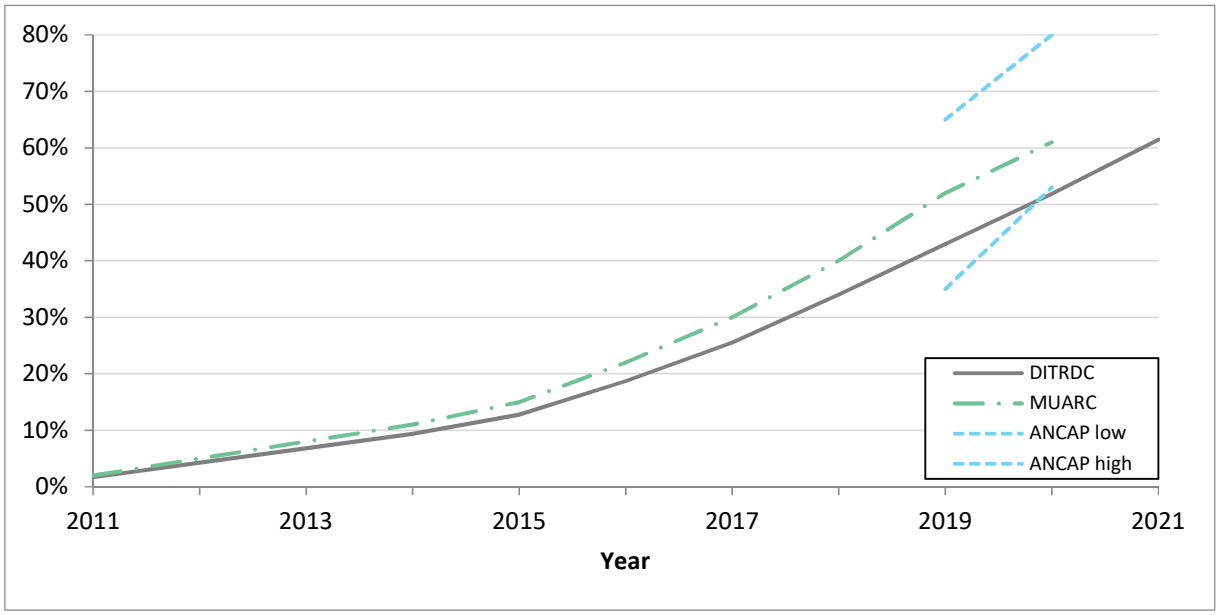


2.4.4. LKS fitment rate comparison

A comparison of the different fitment rates discussed above is shown in

Figure 8 which includes fitment rates from the department (LKS), MUARC (LKA - compulsory and optional), and ANCAP (LSS - low and high fitment rates also including the fitment of LDW only).

Figure 8: DITRDC LKS fitment vs. MUARC LKA fitment vs. ANCAP LSS fitment



2.5. Objective of government action

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

The objective of this RIS is to examine the case for government intervention to prevent crashes caused by unwanted lane deviation. More specifically to reduce run-off the road, head-on and side swipe crashes in light vehicles in Australia by increasing the fitment rate of LKS. This is to reduce the cost of road trauma to the community from these types of crashes.

Where intervention involves the use of regulation, the World Trade Organisation Agreement on Technical Barriers to Trade requires Australia to adopt international standards where they are available or imminent. Where the decision maker is the Australian Government's Cabinet, the Prime Minister, minister, statutory authority, board or other regulators, Australian Government RIS requirements apply. This is the case for this RIS. The requirements are set out in the *Australian Government Guide to Regulatory Impact Analysis Second Edition (2020)*.

3. What policy options are being considered?

Two different options were considered to increase the fitment of LKS to light vehicles;

- Option 1: No intervention (BAU)
- Option 2: Mandate a new standard under the RVSA, Australian Design Rule 107/00 – Lane Keeping Systems 2021 (ADR 107), requiring LKS fitment to all new light vehicles (regulation).

The exclusion of alternative options in regulatory impact assessments considering the introduction of new vehicle standards were agreed with the Office of Best Practice Regulation (OBPR) in early 2020.

3.1. Option 1: No intervention (BAU)

Under Option 1, there is no intervention (BAU) and it relies on the market fixing the problem, the community accepting the problem, or a combination of the two.

BAU includes continuing to certify light vehicles to ADR 90/00 for steering systems (based on UN R79) which does not require fitment of LKS, and where fitted it does not require it to default to active, however it does have broad safety requirements for LKS when fitted.

BAU includes the effect of information campaigns and ANCAP consumer education activity which encourages manufacturers to fit LKS to new vehicles as well as informing consumers of the benefits of purchasing vehicles fitted with LKS. It also includes the effect of current business and government fleet purchasing policies as well as state and territory actions to promote road safety. As a consequence of these existing activities the voluntary fitment of LKS to light vehicles has increased rapidly since it was first available in 2013 to a current fitment rate of 61 per cent. By 2027 we estimate that fitment rates grow to approximately 85 per cent, however after that it will plateau.

This option provides a baseline for comparison with Option 2.

3.2. Option 2: Mandatory standards under the RVSA (regulation)

Under Option 2, the Australian Government would mandate the fitment of LKS to new light vehicles supplied to the market due to regulation through the creation of ADR 107 under the RVSA. ADR 107 is based on the performance requirements of the EU 2021/646 and enables safety requirements for LKS in ADR 90 (based on UN R79). More information on ADR 107 is at Appendix D - Australian Design Rule 107/00 – Lane Keeping Systems 2021, and minimum Compliance Information (CI) requirements are at Appendix E – Minimum evaluation requirements. As ADRs apply to new vehicles, implementation of this option would not affect vehicles already in service.

Due to the effectiveness of LKS in reducing road trauma, mandatory standards for LKS through ADR 107 will create a major reduction in road trauma when compared to Option 1.

3.2.1. Background

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

The ADRs apply equally to new imported vehicles and new vehicles manufactured in Australia. No distinction is made based on country of origin/manufacture and this has been the case since the introduction of the *Motor Vehicle Standards Act 1989* (MVSA) and continues under the RVSA.

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

Harmonised Australian requirements would minimise costs associated with LKS development and provides manufacturers with 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 the testing and certification frameworks already in use in other markets.

The Australian Government has the capability and experience to adopt, whether by acceptance as alternative standards or by mandating, international regulations into the ADRs. As discussed earlier, consideration of the case for mandating LKS systems for light vehicles contributes to priority actions in the NRSS and advances the government's regulatory program.

3.2.2. Scope / applicability

The internationally agreed standard for the safety requirements of LKS is UN R79. This sets the minimum requirements for LKS, where fitted. The European Union has introduced EU 2021/646 that sets performance requirements for LKS and also mandates fitment. These standards are complementary and create standardised performance, operational, and safety requirements for LKS. All light passenger vehicles and light goods vehicles covered under UN vehicle categories M1 and N1, corresponding to ADR subcategories MA, MB, MC, NA1 and NA2 would be in scope and are outlined in more detail in Appendix C.

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

3.2.3. Implementation timing

The ADRs only apply to new vehicles and typically use a phase-in period to give models that are already established in the market time to change their design. The implementation lead time of an ADR is generally no less than 18 months for models that are new to the market (new model vehicles) and 24 months for models that are already established in the market (all new vehicles), but this varies depending on the complexity of the change and the requirements of the ADR.

The proposed applicability dates under this option are:

- 1 March 2024 for new model vehicles
- 1 March 2026 for all new vehicles

Final implementation dates will be determined by the Government as part ADR 107 development, following consultation by the department with industry on implementation dates.

4. What are the likely net benefits?

Benefit-cost analysis is a useful tool for evaluating the feasibility of implementing new technology, but it does not replace the decision process itself.

4.1. Benefit-cost analysis

The methodology used in this benefit-cost analysis is a Net Present Value (NPV) model. Using this model, the flow of benefits and costs are reduced to one specific moment in time. The time for which benefits are assumed to be generated is over the life of the vehicle(s). Net benefits indicate whether the returns (benefits) on a project outweigh the resources outlaid (costs) and indicate what, if any, this difference is. Benefit-Cost Ratios (BCRs) are the 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 costs $1 million but results in benefits of $3 million, the net benefit would be 3-1 = $2 million while the BCR would be 3/1 = 3.

In the case of adding specific safety features to vehicles, there will be an upfront cost (by the vehicle manufacturers) when the vehicles are first built, in system design and component fitment. 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 are reduced. This pattern would be repeated in subsequent years as additional new vehicles are registered. There may also be other ongoing business and government costs through the years, depending on the option being considered.

The period of analysis covers the expected life of the policy option (up to 15 years of intervention) plus the time it takes for benefits to work their way through the fleet (around 35 years, the approximate maximum lifespan of a light vehicle). Included benefits focus on the safety benefit from expected reductions in trauma. It should be noted that other benefits (for example, alleviation of property damage) would also occur but have not been included in this RIS. The net benefit and the benefit-cost ratio for each option are therefore conservative estimates.

4.2. Benefits

The benefit has been established using the expected fitment levels under Option 1 (BAU) as a base line, as a result, Option 1 provides no benefit. When a benefit is discussed it is for Option 2 (regulation) and the level of fitment expected under regulation. The benefit is derived from the expected fitment effect and the overall impact of the technology when fitted, which is the product of sensitivity (the proportion of light vehicle crashes that could be reduced by LKS) and the effectiveness of the technology in mitigating trauma when fitted.

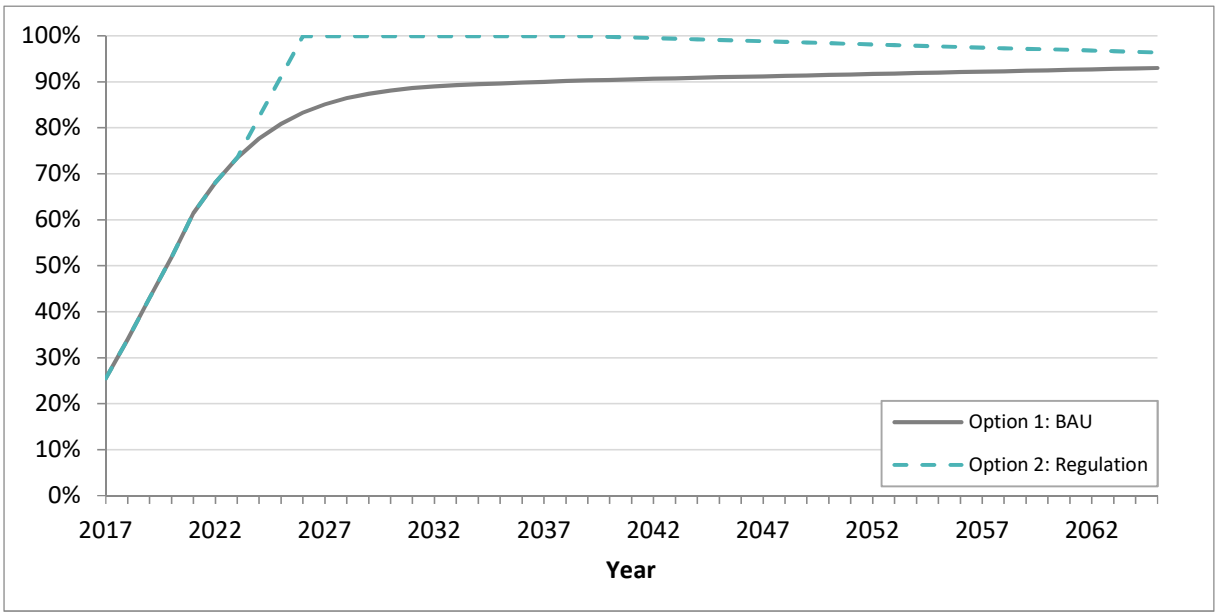
4.3. Fitment effect

Figure 9 shows forecast fitment rates for both Option 1 and Option 2. Current fitment rates up to 2021 were sourced from vehicle sales and manufacturer data as outlined in Section 3.1.3 and compared with data from MUARC and ANCAP. Future projections have been done following trends from existing fitment. Under BAU, non-regulatory technology interventions generally exhibit an uptake limit below 100 per cent fitment. Without regulation, manufacturers may not fit LKS as a standard feature on all future models they produce. Similarly, when purchasing vehicles, some consumers may for instance choose to purchase vehicles based on purchase price rather than safety benefits. For this reason, BAU fitment is modelled to continue to climb rapidly increasing from the current 60.8 per cent to up to approximately 85 per cent of new vehicles sold in 2027, and following this it is expected that fitment rates will begin to plateau.

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

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

Figure 9: Regulatory intervention in comparison with BAU



4.4. Impact of LKS when fitted to light vehicles

When the impact of LKS fitted to light vehicles is discussed it is for Option 2 and is in relation to the baseline Option 1.

4.4.1. Sensitivity

In 2021 MUARC completed a research project on the impact of LKA for light vehicles in Australia titled *The Potential Benefits of Lane Keep Assist Systems in Australian Light Vehicles:* (MUARC, 2021). The study was commissioned by the Victorian Government's Department of Transport and analysed crash data from five major jurisdictions to calculate the potential road safety benefits that can be derived through the mandatory fitment of LKA. The research done by MUARC on LKA directly correlates to LKS as it is discussed in this RIS.

Crash and crash injury benefits were modelled on police reported crash data occurring in Australia between 2013 and 2019. Classification of sensitive crashes included those where trauma could potentially be mitigated by LKA. The effects of LKA were calculated using an induced exposure evaluation design. The relative number of crashes involving vehicles with LKA was compared to the overall number of vehicles in the fleet with LKA. All of the vehicles chosen for analysis were equipped with ESC because LKA and ESC target similar crash types. ESC is a system which maximises the vehicle's grip on the road during cornering or sudden steering inputs. Vehicles without ESC would be more prone to a loss of vehicle control situations that may result in run-off road or head on collisions where the driver suddenly steers at the last minute. Only having vehicles equipped with ESC in the study removes this variable from the results.

Analysis was only performed on crashes occurring at speeds above 70kph which is the start of the proposed mandated operational range for LKA in the new ADR. The analysis also only involved crashes that were of a type that could be mitigated using LKA technology including, single-vehicle, multi-vehicle head-on, and sideswipe crashes, and did not include crashes caused by changing lanes, merging, passing, turning or backing before the crash. The analysis only involved crashes on sealed roads, and roads not covered in snow or ice.

MUARC found 11 per cent of all Australian light vehicle trauma crashes are sensitive to LKA. This number may seem low, however, due to the types of crashes that are LKA sensitive this results in 42 per cent of all fatal crashes, and 15 per cent of all serious injury crashes. The level of trauma created by these crashes is higher resulting in 55 per cent of fatalities, and 23 per cent of serious injuries. MUARC found that LKA sensitive crashes were more prevalent at highway speeds (at or above 100 km/h) resulting in 67 per cent and 72 per cent of sensitive fatal crashes and fatalities respectively.

4.4.2. Claimed benefits of LKS

MUARC (2021) determined the effectiveness of LKA for light vehicles using Australian light vehicle crash data. Reductions in sensitive crashes associated with LKA fitment in light vehicles was determined to be 16 per cent against all sensitive trauma crashes and 22 per cent against fatal crashes. This results in an overall 1.76 per cent reduction in trauma crashes, and 2.2 per cent reduction in trauma. It also represents a 9.09 per cent overall reduction in fatal crashes, and 11.9 per cent reduction in fatalities.

The research from MUARC shows that LKA is particularly effective at highway speeds (at or above 100 km/h) where 67 per cent of fatal crashes at these speeds are sensitive, and LKA can reduce overall fatal crashes and fatalities at highway speeds by 14.5 per cent and 15.8 per cent respectively.

LKA has shown higher effectiveness for fatal and serious injuries than for minor injuries. This is due in part to the crash types LKA mitigates and it is most effective at high road speeds where crashes are more likely to result in severe trauma or fatalities. This is supported by data from the NRSS which shows the risk of serious injury from a head on crash is 30 per cent at 70km/h and increases to 90 per cent at 100km/h (ORS, 2021).

The findings from the MUARC research are likely to be conservative as LKA systems that conform to UN R79 are not required to default to being active and can be permanently disabled by the driver. It is likely there are the vehicles in the crash pool equipped with LKA that did not have LKA activated as it requires a conscious decision by the driver to enable it. This is one of the benefits of EU 2021/646 where LKA and LDW default to being active every time the vehicle is started resulting in a higher likelihood these technologies will be active while driving, further increasing the overall safety benefit.

Prior to the MUARC study there were only relatively few research studies on LKS technologies with their findings listed in Table 3.

Table 3: Previous research on LDW and LKA (MUARC, 2021)

Study	Type	Techniques	Crash type reduced	Crash reduction
Cicchino 2018	LDW	2009-2015 police reported passenger vehicle crashes	Single vehicle, or two-vehicle head on & sideswipe 40 mph speed limit No snow, no ice on road, visible markings, no intentional lane changes, no vehicle-to-pedestrian or bicyclist	All crash: 11% Injury crash: 21%
Kusano 2014	LDW	Real world, crash data plus simulation	Single vehicle 40 mph speed limit No snow, visible markings, no prior loss of control, drift road departure crash	Real world: 28.9% Simulated: 24.3%
Sternlund 2017	LDW or LKA	Real World crash data, induced exposure	Head on & single vehicle only 70-120 km/hr speed limit No snow, visible markings, no prior loss of control	Targeted injury: 53% Head-on and single vehicle injury: 30%

4.4.3. Overall Impact on Australian light vehicle trauma

The overall impact of LKS when fitted against all light vehicle road trauma is the product of sensitivity and effectiveness. The result is 2.24 per cent effectiveness against all light vehicle trauma, 4.98 per cent against all light vehicle serious trauma, and 11.9 per cent against all light vehicle fatalities.

4.5. Crash savings

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

The regulation of LKS for light vehicles is projected to provide very significant trauma reductions with 6,989 lives saved, 23,648 serious injuries and 7,385 minor injuries alleviated, amounting to $3,055 million in trauma savings. The assumptions of the Value of Statistical Life (VSL) used are shown in Appendix F: Benefit-cost analysis, Step 9.

Table 4 summarises the trauma reductions associated with each option. These savings do not incorporate other benefits from crash alleviation expenses such as property and infrastructure damage, road closures, police investigations, etc.

Table 4: Summary of trauma reductions and savings for each option

	Lives saved	Serious injuries avoided	Minor injuries avoided	Trauma savings ($m)
Option 1: BAU	-	-	-	-
Option 2: Regulation	6,989	23,648	7,385	3,055

4.6. Costs

4.6.1. System development costs

A development cost of $50,000 to $100,000 was added for each additional vehicle model for which LKS would be developed. Many vehicle manufacturers already have developed LKS and provide them to the market as a standard or optional feature. Where a new system needs to be developed some sensors or camera(s) required for AEB are also required for LKS.

The estimated development cost included design, logistics, production line floor area allocation, and other overheads, for those models where LKS is not an existing optional fitment. An additional $10,000 per model was added to cover validation and testing, as well as a further $10,000 per model for certification and regulatory expenses as an extension of a manufacturer's regulatory and certification administration process.

4.6.2. System fitment cost

The system fitment cost represents the average incremental wholesale cost of fitting a LKS system. LKS requires camera(s) to detect lane markings and camera(s) used for AEB can also be utilised for this, thereby reducing fitment costs. AEB is a requirement for light vehicles from March 2023. Information from two studies was used to calculate fitment costs.

A report from Robinson et al. (2011) has the wholesale cost per vehicle for a LDW system of between £100 - £300 ($190 and $560). These costs are for whole system fitment including camera(s) that would normally be fitted with AEB so these costs could be reduced. A report from Seidl et al. (2017) has wholesale costs per vehicle between €186 - €249 ($300 and $400), and has the costs for camera(s) used for AEB at €47 - €62 ($75 - $100). This reduces costs down to a range of between $200 and $325.

The costs were adjusted to current values (RBA, n.d.) and based on the information above a likely wholesale LKS system fitment cost of $345 has been used for the benefit cost analysis with a range from $220 (low/best case) to $470

(high/worst case). More emphasis has been placed on the fitment costs from the Seidl et al. study as it is for LKA and more current, and it identifies the cost savings from utilising existing AEB cameras.

4.6.3. Government costs

It was assumed there would be an estimated annual cost of $50,000 for the department to create, implement and maintain regulations per annum. This includes the initial development cost, as well as ongoing standards maintenance and interpretation advice. The value of this cost was based on departmental experience.

4.6.4. Summary of costs

Table 5 provides a summary of the costs associated with the implementation of Option 2 (regulation).

Table 5: Summary of costs associated with the implementation

Cost related to	Best case ($)	Likely case ($)	Worst case ($)	Applicability	Impact
System development	50,000	-	100,000	Per model	Business
System testing		10,000		Per model	Business
System certification		10,000		Per model	Business
System fitment	220	345	470	Per vehicle	Business
Regulation implementation and maintenance		50,000		Per year	Government

4.7. Benefit-cost analysis results

Appendix F details the calculations for the benefit-cost analysis. A summary of the results is provided below in Table 6. A 7 per cent discount rate was used for summarised options.

Table 6: Summary of benefits, costs, lives saved and serious injuries avoided

	Gross benefit ($m)	Net benefit ($m)	Cost to community ($m)	Cost to Gov. ($m)	BCR	Lives saved	Serious injuries avoided	Minor injuries avoided
Best case	3,055	2,664	391	0.5	7.8	6,989	23,648	7,385
Likely case	3,055	2,442	613	0.5	5.0			

4.7.1. Sensitivity analysis

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

4.7.1.1. Impact of discount rate

While a 7 per cent (per annum) real discount rate was used, the benefit-cost analysis for regulatory intervention was also tested with a rate of 3 per cent and 10 per cent.

Table 7 shows that the BCR remained positive under all three discount rates.

Table 7: Impact on BCR of changes to the real discount rate

	Net benefit ($m)	BCR
Low discount rate (3%)	5,194	7.6
Base case discount rate (7%)	2,442	5.0
High discount rate (10%)	1,490	3.9

4.7.1.2. Impact of LKS effectiveness

Next, the effectiveness of LKS systems was varied to establish its effect on the analysis, using both high (increment 5 per cent) and low (decrement 5 per cent) effectiveness scenario. As shown in

Table 8 despite analysing an unrealistically low effectiveness the BCR remained positive. It was noted that varying the effectiveness was less significant than varying the discount rate.

Table 8: Impact on BCR of changes to the effectiveness of LKS for light vehicles

	Net benefit ($m)	BCR
Low effectiveness (-5%)	2,290	4.7
Base effectiveness	2,442	5.0
High effectiveness (+5%)	2,595	5.2

4.7.1.3. Impact of BAU fitment rates

The BAU fitment rate was also subjected to a sensitivity analysis, including both a high and a low fitment rate scenario (BAU fitment curves adjusted +/- 10 per cent), to account for variations in the market uptake of light vehicle LKS systems. As shown in Table 9, the net benefits and BCR remained positive in both the high and the low BAU fitment rate scenarios.

Table 9: Impact of fitment rates on net benefits and BCR

	Net benefit ($m)	BCR
Low BAU fitment (-10%)	4,133	5.4
Base case BAU fitment	2,442	5.0
High BAU fitment (+10%)	752	3.6

4.7.1.4. Impact of fitment cost

Finally, the fitment cost range was varied, incrementing the fitment cost range upwards by 50 per cent. The BCRs in the likely to best case ranges remained positive. As shown in Table 10, the BCRs would remain positive for the entire increased range.

Table 10: Impact of fitment costs on net benefits and BCR

	Net benefit ($m)	BCR
Base case fitment cost	2,442	5.0
High fitment cost (+50%)	2,329	4.2

4.8. Economic aspects impact analysis

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

4.8.1. Identification of affected parties

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

Business

- vehicle manufacturers or importers; and
- component suppliers.

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

- Federal Chamber of Automotive Industries (FCAI) which represents the automotive sector and includes vehicle manufacturers, vehicle importers and component manufacturers/importers;
- Federation of Automotive Products Manufacturers (FAPM) which represents the automotive component manufacturers/importers; and

Individuals

- vehicle owners; and
- vehicle operators.

The affected businesses are represented by:

- The Australian Automobile Association (AAA) which represents vehicle owners and operators (passenger cars and derivatives) through the various automobile clubs around Australia (RAC, RACV, NRMA etc.).

Government

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

4.8.2. Impact of regulation

This section looks at the impact of regulation in terms of quantifying expected benefits and costs, and identifies how these would be distributed among affected parties. These were summarised in Section 4 and are discussed in more detail below.

Option 1 relies on market forces to provide a solution to the problem and the government would not intervene. As this option is the BAU case, there are no new benefits or costs allocated. Option 2 is calculated relative to Option 1 so that what would have happened anyway in the marketplace is not attributed to any proposed intervention.

Option 2 involves direct government intervention to compel a change in the safety performance of light vehicles supplied to the marketplace, the benefits and costs are those that would occur over and if no intervention occurred. The fitment of LKS would not be a commercial decision within this environment. The benefits and costs of this are outlined below.

4.8.2.1. Benefits

Business

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

Individuals

There would be a direct benefit for light vehicle owners and operators using new light vehicles equipped with LKS through a reduction in road crashes. These would be higher in areas where vehicles are driven at highway speeds. Regulation would save an estimated 6,989 lives and 23,648 serious and 7,385 minor injuries when compared to no intervention. There would also be direct benefits to owners (and/or insurance companies) through reductions in compensation, legal costs, vehicle repair and replacement costs, loss or damage of property, and in some cases fines.

Governments/community

There would be an indirect benefit to governments from the reduction in road crashes that would follow the increase in the number and percentage of new light vehicles equipped with LKS due to a mandated standard. This would provide benefits of $3,055 million being shared among the community and as cost savings to governments.

4.8.2.2. Costs

Business

Vehicle manufacturing occurs outside of Australia and the costs in the RIS are focused on those that affect the Australian community. Manufacturers will have increased costs resulting from design/development, fitment and testing costs for the additional light vehicles sold with LKS. These costs are likely be passed onto vehicle owners at the point of sale and not borne by manufacturers.

Individuals

There is an estimated $613 million increased cost for fitment of LKS in vehicles which are likely to be passed on from manufacturers to vehicle owners at the point of sale through an increased purchase price. The increased cost from LKS fitment is proportionally small in comparison to total vehicle cost and is unlikely to affect the choices made by most car buyers.

Governments

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

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 (RBM) Framework. Under the RBM Framework, the regulatory burden is the cost of a proposal to business and the community (not including the cost to the government). It is calculated in a prescribed manner that usually results in it being different to the overall costs of a proposal in the benefit-cost analysis. In line with the RBM Framework, the average annual regulatory costs were calculated for this proposal by totalling the undiscounted (nominal) cost (including development and fitment cost) for each option over the 10-year period 2024-2033 inclusive. This total was then divided by 10.

The average annual regulatory costs under the RBM Framework for regulatory intervention is set out in Table 11. The average annual regulatory costs are estimated to be $65 million.

Table 11: Average annual regulatory burden and cost estimate

Sector	Change in costs ($m)
Business	-
Community organisations	-
Individuals	70
Total change in costs	**70**

One of the principles in the *Australian Government Guide to Regulatory Impact Analysis Second Edition* (2020) 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 RIS. 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 the further alignment of the ADRs with international standards will offset the additional RBM costs of this measure.

6. Consultation

6.1. Purpose

The purpose of consultation for this RIS is to understand if there are any concerns from industry bodies, state and territory governments, and the public arising from this RIS and to identify any additional areas of consideration.

Comment is sought on the following:

- Support for the recommended option.
- Views on 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 107 for adoption under the ADRs, 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 that could assist decision making.

6.2. Consultation plan

This RIS will undergo targeted consultation with industry groups, the states and territories, and also will undergo full public consultation. In line with the *Australian Government Guide to Regulatory Impact Analysis Second edition* (2020), this consultation RIS will be published for six weeks' public comment.

A summary of public comment input and departmental responses will be included in the final RIS that is used for decision making by the responsible minister. This RIS will be published on the department's website and distributed to the SVSEG and TLG consultative forums.

6.3.1. Targeted consultation

There are groups that will be contacted directly for feedback on this RIS. ADR development is the responsibility of the Vehicle Standards Section of the department and 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 groups that will be contacted for targeted consultation are;

- The Technical Liaison Group (TLG). The TLG consists of technical representatives of government (Australian and state / territory), the manufacturing and operational arms of the industry (including organisations such as the FCAI and the Truck Industry Council (TIC) and representative organisations of consumers and road users (particularly through the AAA and the Australian Trucking Association (ATA)).
- Strategic Vehicle Safety and Environment Group (SVSEG). 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).

SVSEG and the TLG are the principal consultative forums for advising on ADR proposals. Membership of the SVSEG is shown at Appendix G - Strategic Vehicle Safety and Environment Group (SVSEG), and membership of the TLG is shown at Appendix H – Technical Liaison Group (TLG).

6.3.2. Full public consultation

The publication of an exposure draft of the proposal for full 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 RIS process assist stakeholders in identifying the likely impacts of the proposals and enables more informed debate on any issues. To enable this the RIS and feedback mechanisms will be published on the department's website for the duration of the consultation period.

7. What is the best option?

The impacts of the following options have been examined:

- Option 1: No intervention (BAU).
- Option 2: Mandate a new standard under the RVSA, ADR 107, requiring LKS fitment to all new light vehicles (regulation)

7.1. Benefits

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

Option 2 provides the highest likely net benefit of the options examined at $2,442 million and a BCR range of 5.0 (likely) to 7.8 (best). The benefit would be spread over a 15-year period of regulation followed by a period of around 35 years over which the overall percentage of light vehicles fitted with LKS in the fleet continues to rise as older vehicles without LKS are de-registered at the end of their service life.

7.2. Casualty reductions

Option 2 provides the greatest reduction in road crash casualties, including 6,989 lives saved and 23,648 serious and 7,385 minor injuries avoided.

7.3. Recommendation

This RIS identifies the road safety problem in Australia of involving light vehicles that have run-off road, head on, or side swipe crashes resulting from unintentional lane departure that can be substantially alleviated via the fitment of LKS. Although market uptake is increasing, the current standard fitment of LKS is moderate at 60.8 per cent of all new light passenger, sports utility and light commercial vehicles sold. The potential for fitment rate improvements, standardisation of LKS use and performance, and the number and severity of crashes resulting from unintended lane departure indicates a need for intervention.

There is a strong case for government intervention to increase the fitment of LKS to light vehicles through regulation. Analysis shows that such an intervention will provide significant reductions in road trauma while achieving the maximum net benefit for the community. Most benefit derives from the effectiveness of LKS reducing trauma and particularly fatalities at highway speeds. ANCAP has included the fitment of LKS as one of the requirements to achieve a five-star rating. However, despite ANCAP's best efforts, there is not universal fitting of LKS across all new light vehicles. To reach a 100 per cent fitment rate across the market, a mandatory standard is required to close the gap.

ADR 107 requires fitment of LKS to light vehicles providing a significant reduction in road crash casualties, including 6,989 lives saved, 23,648 serious and 7,385 minor injuries avoided. ADR 107 is based on the performance requirements of EU 2021/646 and enables the safety requirements of UN R79 aligning Australian requirements with agreed standards from major markets. Basing the ADR 107 performance requirements on EU 2021/646 minimises the costs associated with LKS development and provides manufacturers with the flexibility to incorporate or adapt systems that have already been developed and tested. During vehicle certification this also enables manufacturers to apply EU 2021/646 as an alternate standard to ADR107.

Regulatory intervention offers the important advantage of being able to guarantee 100 per cent fitment of LKS to all light vehicles. There would be no guarantee that relying on no intervention and an increase in fitment rate through market forces would deliver the same result. Regulatory intervention may also fully address the variability in existing LKS performance and ensures that LKS default to being active. Furthermore, in a BAU scenario sections of the market may continue to offer LKS as an option only, often as part of a more expensive upgrade package.

Option 2 offers the greatest net benefit and is therefore the recommended option. It represents an effective option to influence the new light vehicle fleet in Australia that would guarantee the on-going provision of improved reduction in trauma caused by unintentional lane departure.

7.4. Impacts of the recommended option

With regulatory intervention, the fitment of LKS would no longer be a commercial decision within this changing environment. This intervention would result in businesses and the government being impacted by both benefits and costs.

The Australian community benefits from a significant reduction in road crash casualties, including 6,989 lives saved, 23,648 serious and 7,385 minor injuries avoided resulting in a total benefit of $3,055 million. There will a $613 million increased cost for fitment of LKS in vehicles which are likely to be passed on from manufacturers to vehicle owners at the point of sale through an increased purchase price. There would also be a cost to governments of $0.5 million for developing, implementing and administering regulations (standards) that mandate the fitment of LKS.

7.5. Scope of the recommended option

The recommended option would require legislating ADR 107 under the RVSA mandating the fitment of LKS. ADR 107 is based on the performance requirements of EU Regulation No. 2021/646 and enables the safety requirements of UN R79. ADR 107 would be a requirement for all MA, MB, MC, and NA category vehicle after the implementation dates.

7.6. Timing of the recommended option

The proposed ADR 107 implementation timeframe for consultative purposes are:

- 1 March 2024 for new model vehicles
- 1 March 2026 for all new vehicles

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

8. Implementation and Evaluation

New ADRs or amendments to the ADRs are determined by the responsible minister under Section 12 of the RVSA. As Australian Government regulations, ADRs are subject to review every ten years, as resources permit. This ensures that they remain relevant, cost effective and do not become a barrier to the importation of safer vehicles and vehicle components. If ADR 107 implementation is chosen as the best option, it would be scheduled for a full review on an ongoing basis and in line with this practice.

The introduction schedule will endeavour to allow vehicle manufacturers appropriate and sufficient lead times and ensure introduction is not in advance of schedules adopted in Europe. There is a phased approach where initially only vehicles applying for a new vehicle type approval will be required to meet this new standard, and 24 months later it would be applicable to all vehicles. This provides vehicle manufacturers with enough time to implement LKS in their vehicles where it doesn't already exist.

A more detailed implementation and evaluation strategy will be developed following the outcomes from consultation.

9. Conclusion and recommended option

The impact of road trauma is significant, costing the Australian economy over $29 billion per annum, with light vehicle crashes constituting almost $13 billion of this. 11 per cent of road crashes are caused by unintentional lane departure and can include head on collisions, side-swipes, and single car run-off road crashes. These types of crashes result in 55 per cent of all road fatalities: this number increases to 72 per cent at highway speeds. The specific road safety problem of crashes caused by unintentional lane departure has been considered in this Regulation Impact Statement (RIS).

Lane keeping technologies can help reduce unintended lane departures from occurring. MUARC determined the effectiveness of LKA (analogous to LKS) for light vehicles using Australian light vehicle crash data. Reductions in sensitive crashes associated with LKA fitment in light vehicles was determined to be 16 per cent against all sensitive trauma crashes and 22 per cent against fatal crashes. This results in an overall 1.76 per cent reduction in trauma crashes, and 2.2 per cent reduction in trauma. It also represents a 9.09 per cent overall reduction in fatal crashes, and 11.9 per cent reduction in fatalities.

Since 2011, lane keeping systems have been fitted voluntarily to light vehicles in Australia rising from 7 per cent fitment in 2013 to 61 per cent in 2021. Non regulatory programs, such as ANCAP, may have influenced voluntary uptake by requiring the fitment of lane support systems to achieve a five-star rating. It is estimated that voluntary fitment of lane keeping systems would continue to increase to approximately 85 per cent by 2027 and then begin to plateau.

In this RIS the impacts of the following options have been examined:

- Option 1: No intervention
- Option 2: Mandate a new standard under the RVSA (ADR 107) requiring LKS fitment to all new light vehicles

A benefit cost analysis was performed for Option 2 as compared against Option 1. Option 2 had a likely cost of $568 million, it provided a gross benefit of $3,055 million and a BCR range of 5.0 (likely) to 7.8 (best). It is estimated that it will save 6,989 lives, and avoid 23,648 serious injuries during the 15-year policy period.

According to the *Australian Government Guide to Regulatory Impact Analysis Second Edition* (2020), the policy option offering the greatest net benefit should be the recommended option. Therefore, Option 2 - Mandate a new standard under the RVSA (ADR 107) requiring LKS fitment to all new light vehicles is recommended.

This consultation RIS will be released for a six-week public comment period. The feedback received during the public consultation will be considered and included in the Final RIS to be published by the Office of Best Practice Regulation.

The indicative implementation timetable for consultative purposes is:

- 1 March 2024 for new model vehicles
- 1 March 2026 for all new vehicles

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11. Appendices

Appendix A: Abbreviations

Abbreviation	Term
AAA	Australian Automobile Association
ABS	Anti-lock Braking Systems
ABS	Australian Bureau of Statistics
ACSF	Automated Steering Corrective Function
ADR	Australian Design Rule
ADR 90	Australian Design Rule 90/00 – Steering System) 2018
ADR 107	Australian Design Rule 107/00 – Lane Keeping Systems) 2021
AEB	Advanced Emergency Braking
ANCAP	Australian New Car Assessment Program
ATA	Australian Trucking Association
AusRAP	Australian Road Assessment Program
BAU	Business as Usual
BCR	Benefit-Cost Ratio
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CDCF	Correctional Directional Control Function
CI	Compliance Information
DITRDC	The Department of Infrastructure, Transport, Regional Development and Communications
ELKS	Emergency Lane Keeping Systems
ESC	Electronic Stability Control
EU	European Union
EU 2021/646	EU Regulation No. 2021/646 (Emergency Lane Keeping Systems)
FCAI	Federal Chamber of Automotive Industries
FAPM	Federation of Automotive Products Manufacturers
GTR	Global Technical Regulation
GVM	Gross Vehicle Mass
ITMM	Infrastructure and Transport Minister's Meeting
ITSOC	Infrastructure and Transport Senior Official's Committee
LDW	Lane Departure Warning
LKA	Lane Keeping Aid

Abbreviation	Term
LKS	Lane Keeping Systems
LSS	Lane Support Systems
MUARC	Monash University Accident Research Centre
MVSA	*Motor Vehicle Standards Act 1989*
NCAP	New Car Assessment Program
NPV	Net Present Value
NRMA	National Roads and Motorists' Association
NRSAP	National Road Safety Action Plan 2021-2025
NRSS	National Road Safety Strategy 2021-2030
OBPR	Office of Best Practice Regulation
RAC	Royal Automotive Club of Western Australia
RACV	Royal Automotive Club of Victoria
RBM	Regulatory Burden Measurement
RIS	Regulation Impact Statement
RVSA	*Road Vehicle Standards Act 2018*
SVSEG	Strategic Vehicle Safety and Environment Group
TIC	Truck Industry Council
TLG	Technical Liaison Group
the department	The Department of Infrastructure, Transport, Regional Development and Communications
UN	United Nations
UN R79	UN Regulation No. 79 - Steering systems
VSL	Value of Statistical Life
WP.29	World Forum for the Harmonisation of Vehicle Regulations
WTP	Willingness To Pay

Appendix B: Glossary of terms

Term	Description
1958 agreement	UN Agreement Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations of March 1958.
1998 Agreement	UN Agreement concerning the establishing of global technical regulations for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles, done at Geneva on 25 June 1998.
Australasian New Car Assessment Program (ANCAP)	An independent vehicle safety authority that publishes consumer education information using a rating system of 0 to 5 stars.
Australian Design Rule (ADR)	National standards for vehicle safety, anti-theft and emissions. The standards apply to vehicles newly manufactured in Australia or imported as new or second hand vehicles, and supplied to the Australian market.
Australian Design Rule 90/00 – Steering System 2018 (ADR 90)	This vehicle standard prescribes requirements to ensure safe steering under normal operating and failure conditions. This standard incorporates requirements from UN Regulation No. 79.
Australian Design Rule 107/00 – Lane Keeping Systems 2021 (ADR 107)	The proposed standard to mandate the fitment of LKS to light vehicles. This standard incorporates technical requirements from EU 2021/646.
Anti-lock Braking Systems (ABS)	A safety anti-skid braking system that prevents the wheels from locking up during braking, thereby maintaining traction with the road allowing the driver to maintain more control over the vehicle.
Advanced 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, pedestrian etc.).
Benefit-cost analysis	This analysis identifies the benefits of an action as well as the associated costs and provides a comparison between two. A benefit-cost analysis provides results which can be used to support conclusions 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
Business As Usual (BAU)	The standard functional operations within an organization.
Category M vehicle	Power-driven vehicles having at least four wheels and used for the carriage of passengers.
Category MA vehicle	See Appendix C – Vehicle categories
Category MB vehicle	See Appendix C – Vehicle categories
Category MC vehicle	See Appendix C – 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 C – Vehicle categories
Category NB vehicle	See Appendix C – Vehicle categories

Term	Description
Certification	The process for granting approvals for either vehicles or components. Through this process the applicant may need to provide evidence of compliance with standards or regulations.
Contracting party	A country which is a signatory to an international agreement (e.g. the 1958 Agreement).
Commercial vehicle	A class of vehicle which is intended for the carriage of goods. A commercial vehicle is based on its classification not by its use. Commercial vehicles (i.e. utes) are also frequently purchased for use as a personal vehicle.
Compliance Information (CI)	Information that is collected by the department from a vehicle type approval applicant to support the certification process.
Crash	Any collision between a vehicle and, another vehicle, an object, or a vulnerable road user.
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.
Electronic Stability Control (ESC)	A computerized technology that improves a vehicle's stability mainly while cornering by detecting and reducing a loss of traction.
EU Regulation No. 2021/646 - Emergency Lane Keeping System (EU 2021/646)	The EU regulation which requires the fitment of LKS to passenger cars and light commercial vehicles and came into force in April 2021.
Fatality	A death that occurs as a result of a crash.
Gross benefit	The sum of expected benefit provided in monetary terms.
Gross cost	The entire acquisition cost without any deductions.
Gross Vehicle Mass (GVM)	The maximum laden mass of a motor vehicle as specified by the manufacturer.
Haptic	Related to the sense of touch. Haptic feedback is where the vehicle can indicate warnings through inducing vibration.
Head on collision	A crash of two vehicles that are moving directly toward each other.
Hospitalisation	A person admitted to hospital from a crash occurring in traffic. Traffic excludes off-road and unknown location.
Key cycle	A key cycle is where in traditional vehicles the ignition key is turned to OFF, removed from the ignition lock, re-inserted and turned to ON. Many modern vehicles don’t use mechanical keys however the term is still used to indicate this change of state.
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).
Lane Departure Warning (LDW)	A system that alerts the driver of an unintentional drift of the vehicle out of its travel lane.
Lane Keeping Aid (LKA)	A system that provides directional intervention to prevent a vehicle from unintentionally leaving its lane.
Lane Keeping Systems (LKS)	A system that combines the functionality of both LDW and LKA.

Term	Description
Lane Support Systems (LSS)	A broad term for a group of active safety technologies that aim to keep your car within its lane.
Light vehicles	Passenger vehicles (M category) and commercial vehicles (N category) with a GVM of less than 3,500 kg.
Minor injury	Defined as a soft-tissue injuries and / or minor psychological or psychiatric injuries.
***Motor Vehicle Standards Act 1989* (MVSA)**	The *Motor Vehicle Standards Act* (1989) was the enabling legislation for the regulation of road vehicles in Australia until it was replaced by *The Road Vehicle Standards Act 2018* (RVSA) on 1 July 2021.
Nameplate	The model name or marque of a motor vehicle.
Net benefit	The outcome from the sum of all benefits and subtracting the sum of all costs.
Net cost	The gross cost, 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.
Net savings	Savings attributable to a program's intervention in the market.
Passenger vehicle	Vehicles designed for transporting people (M category)
Real discount rate	see discount rate
Regulatory Burden Measurement (RBM)	A calculation of the compliance costs of regulatory proposals on business, individuals and community organisations using an activity-based costing methodology as outlined by the Office of Best Practice Regulation (OBPR).
Road trauma	Any injury or fatality that occurs as a result of a crash.
***Road Vehicle Standards Act 2018* (RVSA)**	The enabling legislation for the regulation of road vehicles in Australia. *The Road Vehicle Standards Act 2018* (RVSA) replaced the *Motor Vehicle Standards Act 1989* (MVSA) on 1 July 2021.
Run-off road	Crashes that occur at bends and on straight sections of road where the vehicle leaves the road and can hit objects such as trees, poles or buildings or into or off a steep embankment or cliff. These are more common at higher road speeds.
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.
Side swipe	An impact between the side of one vehicle and the side of another.
Trauma	Used interchangeably with road trauma.
Type approval	Written approval of an authority/body that a vehicle type (i.e. model design) satisfies specific technical requirements.
Unintentional lane departure	Where a vehicle leaves its lane and the driver is unaware. This can result in head on, side swipe and run-off road crashes.

Term	Description
UN Regulation No. 79 - steering equipment (UN R79)	The UN regulation that covers steering systems and from series 02 has general safety requirements for vehicles where Lane Keeping Aid (LKA) is fitted.
VFACTS	Vehicle sales information that is published by the Federal Chamber for Automotive Industries (FCAI).
Voluntary fitment rate	The rate of fitment of safety technology without regulatory intervention.
Vulnerable road user	Road users not in a car, bus or truck, generally considered to include pedestrians, bike riders and motorbike riders. In the event of a crash, VRUs have little to no protection from crash forces.
Willingness To Pay (WTP)	The maximum price a customer is willing to pay for a product or service.
World forum for harmonization of vehicle regulations (WP.29)	In existence for more than 50 years, and with participants coming from all over the world, the World Forum for Harmonization of Vehicle Regulations (WP.29) offers a unique framework for globally harmonized regulations on vehicles. The benefits of such harmonized regulations are tangible in road safety, environmental protection and trade.
World Trade Organization Agreement on Technical Barriers to Trade	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 C: Vehicle categories

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

Passenger vehicles (other than omnibuses) (M)

Passenger car (MA)

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

Forward-control passenger vehicle (MB)

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

MB1 up to 2.7 tonnes Gross Vehicle Mass (GVM)

MB2 over 2.7 tonnes GVM

Off-road passenger vehicle (MC)

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

MC1 up to 2.7 tonnes GVM

MC2 over 2.7 tonnes GVM

Goods vehicle (N)

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

Light goods vehicle (NA)

A goods vehicle with a GVM not exceeding 3.5 tonnes.

NA1 up to 2.7 tonnes GVM

NA2 over 2.7 tonnes GVM

Appendix D: Australian Design Rule 107/00 – Lane Keeping Systems 2021 (ADR 107)

Purpose

ADR 107 applies to MA, MB, MC and NA vehicle categories, as defined in the Australian Design Rule – Definitions and Vehicle Categories. Under the *Road Vehicle Standards Rules 2019*, new vehicles must meet the applicable national road vehicle standards (the Australian Design Rules or ADRs) to satisfy the requirements for entry on the Register of Approved Vehicles via the type approval pathway. As this vehicle standard is made under the *Road Vehicle Standards Act 2018*, it only applies to vehicles subject to this Act.

Overview

ADR 107 prescribes requirements for Lane Keeping Systems (LKS) which includes Lane Departure Warning (LDW) and Lane Keeping Assist (LKA) which in the standard is called the Corrective Directional Control Function (CDCF). ADR 107 is based on the EU Regulation No. 2021/646 - Emergency Lane Keeping System (EU 2021/646) and accepts vehicles that already have an EU 2021/646 approval as an alternative standard. ADR 107 enables safety requirements for LKS that are in Australian Design Rule 90/00 – Steering System (ADR 90) which is based on UN Regulation No. 79 - steering equipment (UN R79).

LKS is a driver aid intended to reduce unintentional lane departures and crashes that an occur as a result of this. LKS provides the driver with a warning when they are coming to the edge of their lane and if it detects that the vehicle is leaving the lane it will intervene to try and keep the vehicle in the lane. LKS has level 1 capability as categorised by SAE J3016 '*Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles'* (2021). This means that LKS is only intended to provide momentary intervention for the driver and that the driver is to be actively involved in the driving task at all times. This is not a form of vehicle automation and it does not take command of the driving task.

Activation and deactivation

For vehicle safety technologies to be effective they need to be used by the driver. ADR 107 ensures that LKS defaults to active with the requirement that it is automatically and fully reinstated upon each activation of the vehicle master control switch. ADR 107 also prevents accidental deactivation of the system by requiring at least two deliberate actions, e.g. press and hold on a button, or select and confirm on menu option.

Lane markings

Most LKS systems use cameras to detect lane markings so the system can identify the vehicle's position within its lane. Lane markings can differ between countries and it is important that Australian lane markings are considered during system design. Appendix B of ADR 107/00 has details of Australian lane markings based on AS1742.2 and it is a requirement that the system is tested against these.

Speed range

ADR 107 has a minimum speed range requirement for LDW and LKA systems. When active, at a minimum LDW must be functional between 65 km/h and 130 km/h, and LKA between 70 km/h and 130 km/h. If the maximum speed of the vehicle is lower than 130 km/h, then the upper range for functionality is the maximum speed of the vehicle.

Driver detection

LKS requires the driver to be active in the driving task at all times. Vehicles that are certified to ADR 107/00 have safety requirements regarding driver detection for LKS in ADR 90/00. This requires that the vehicle shall be fitted with a means to detect if the driver is holding the steering wheel. If the system cannot detect driver input, the system will provide acoustic and optical warnings. If there is still no driver detected, then LKS will be temporarily deactivated.

Appendix E: Minimum evaluation requirements

The Australian Government certifies vehicles for use on Australian roads using a type approval system. This requires manufacturers to provide evidence of compliance with ADRs or to have an approval of accepted international standards.

The manufacturer is required to record all of the information required to demonstrate compliance with ADR 107. The CI to be collected as a part of the certification process on LKS for each vehicle type approval includes, but is not limited to, the following;

- Evidence type
  - Apply applicable approval(s)
  - Full evidence
- Approval(s) number(s)
- Speed range of LDW (km/h)
- Speed range of LKA (km/h)
- Lane detection sensor type
- Steering intervention method
- Steering control effort to override directional control (N)
- Method to deactivate LKS

Appendix F: Benefit-cost analysis

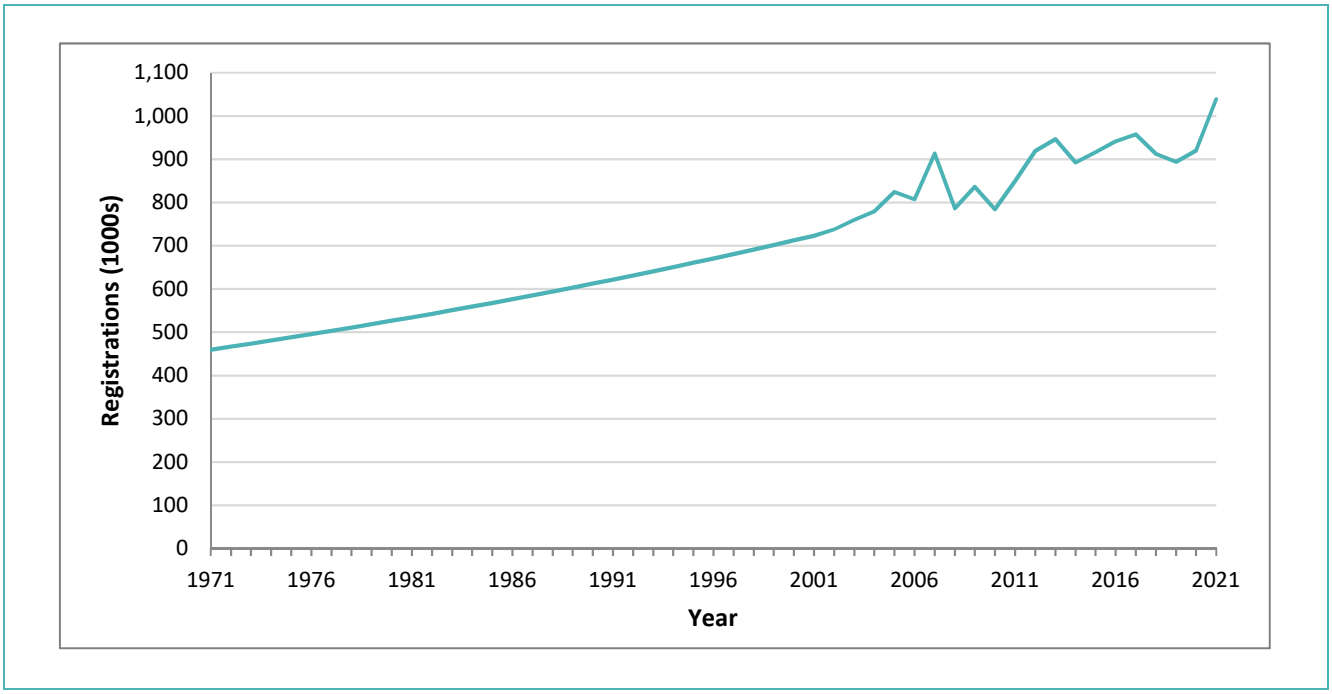
The model used in this analysis was the Net Present Value (NPV) model. The costs and expected benefits associated with a number of options for government intervention were summed over time. The further the cost or benefit occurred from the nominal starting date, the more they were discounted. This allowed all costs and benefits to be compared equally among the options, no matter when they occurred. The Table 20 and Table 21 at the end of this appendix summarises the benefit and the cost from this analysis.

The analysis was broken up into the steps outlined below.

Step 1: New vehicle registrations

The number of newly-registered vehicles in ADR categories outlined in Appendix C were established for each year between 1971 and 2021 inclusive, utilising available Australian Bureau of Statistics (ABS) Motor Vehicle Census (report series 9309.0) data (ABS, 2021), and registrations per capita for years prior to availability of census data (Figure 10).

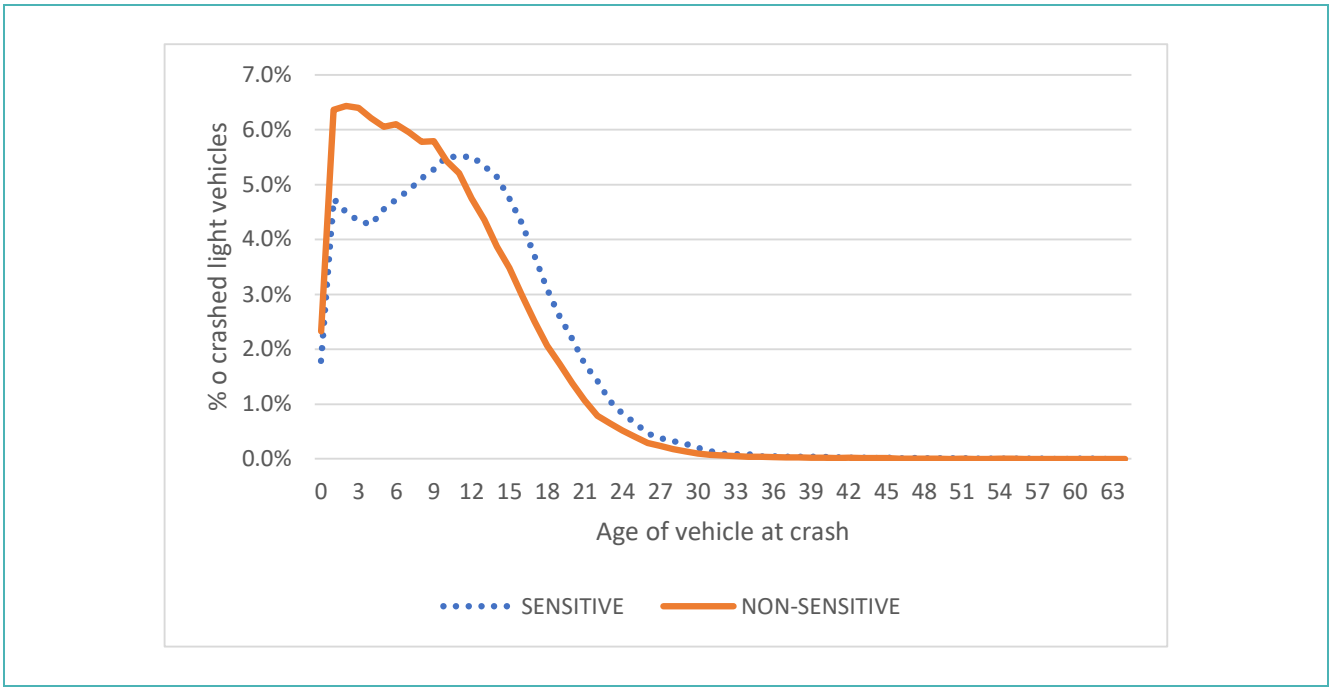
Figure 10: New vehicle registrations



Step 2: Typical crash frequency by vehicle age

Data from MUARC (2021) was used to determine the typical crash frequency by age for both sensitive and non-sensitive crashes for vehicle categories outlined in Appendix C and is shown below in Figure 11:

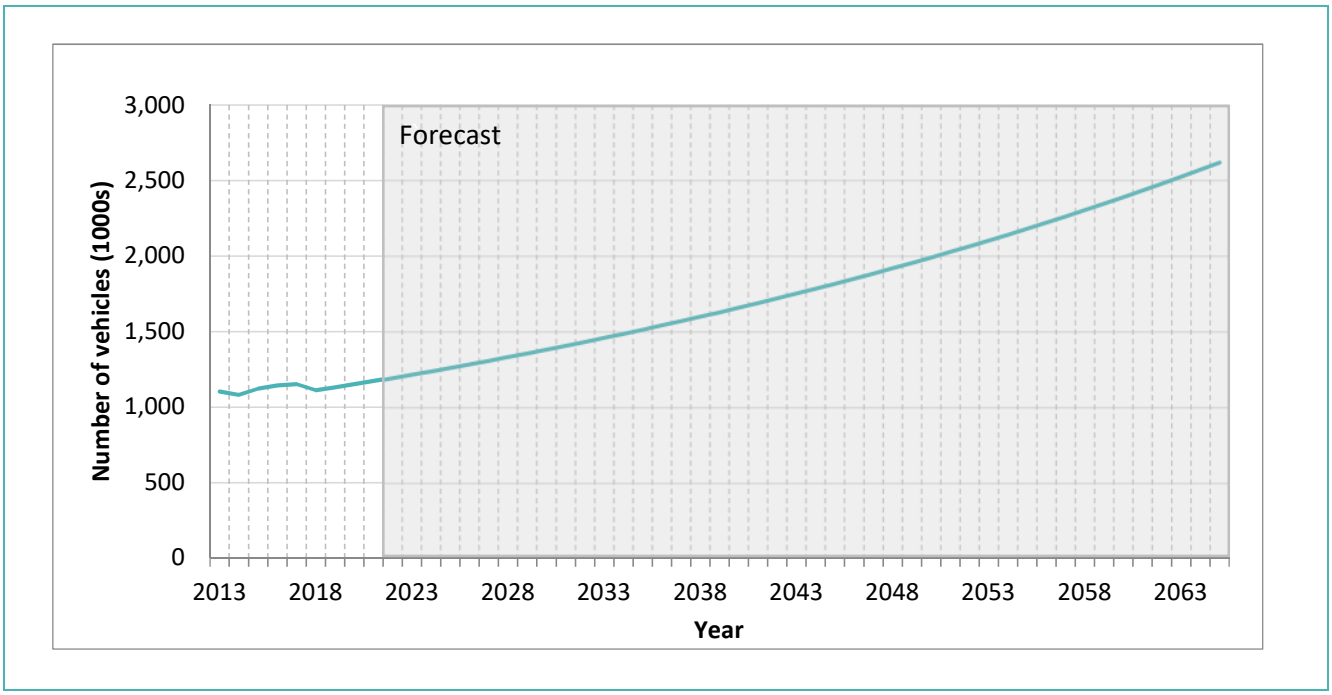
Figure 11: Typical crash frequency by age



Step 3: Forecast vehicle sales

Recent new vehicle combined sales data for the relevant vehicle categories was established (Figure 10). Short to medium term forecast sales were derived from industry data of past sales (VFACTS) and growth factors approximated using data from the ABS, and forecast vehicle sales figures are shown below in Figure 12.

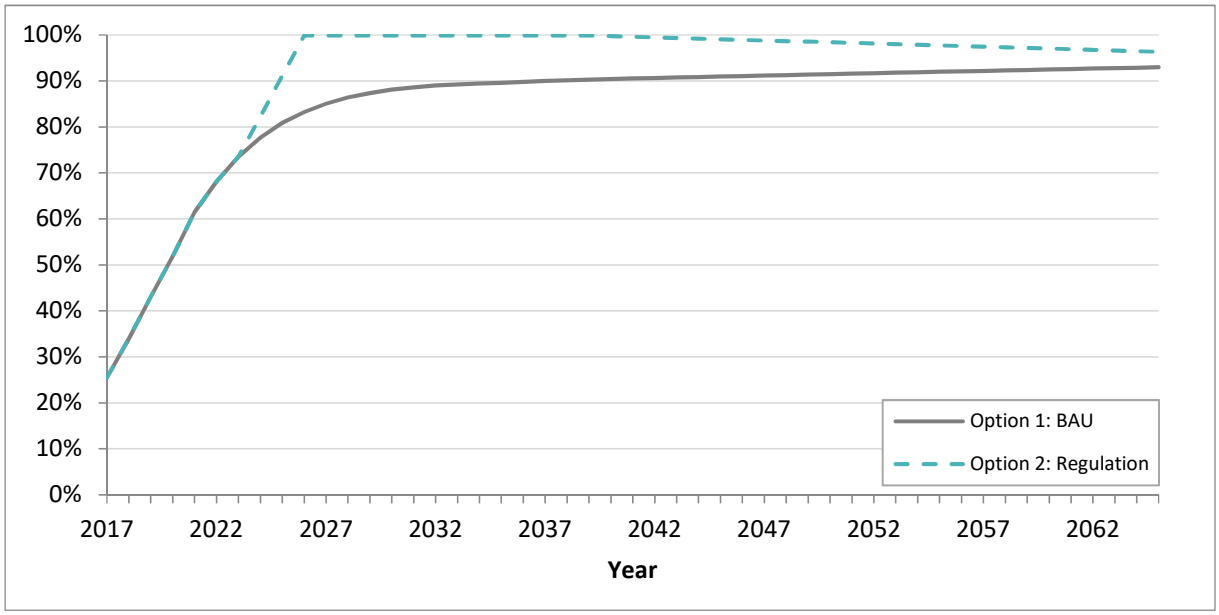
Figure 12: New vehicle combined sales data



Step 4: Projected LKS fitment rates

The projected fitment rates at sale were estimated for both options and are shown below in Figure 13.

Figure 13: Projected fitment rates



Step 5: LKS fitment increase by year

From sales data (Step 3) and fitment data (Step 4) the fitment increase was determined by year and is shown in Table 12.

Table 12: Fitment increase by year

Fitment increase		
Year	Option 1	Option 2
2024	-	146,279
2025	-	222,225
2026	-	275,112
2027	-	249,047
2028	-	221,479
2029	-	201,158
2030	-	186,498
2031	-	176,193
2032	-	169,203
2033	-	164,719
2034	-	162,123
2035	-	160,944
2036	-	160,831
2037	-	161,522
2038	-	161,221
2039	-	161,324
2040	-	159,464
2041	-	157,737
2042	-	156,082
2043	-	154,451
2044	-	152,810
2045	-	151,131
2046	-	149,395
2047	-	147,584
2048	-	145,686
2049	-	143,691
2050	-	141,589
2051	-	139,373
2052	-	137,037
2053	-	134,574
2054	-	131,979
2055	-	129,246
2056	-	126,371
2057	-	123,348
2058	-	120,172
2059	-	116,839
2060	-	113,343
2061	-	109,680
2062	-	105,843
2063	-	101,829
2064	-	97,632
2065	-	93,245
2066	-	88,636
2067	-	83,803
2068	-	78,746

Step 6: Additional fitment costs

The additional fitment costs were calculated using the fitment increase by year (Step 5), and the fitment cost per vehicle shown in Table 13, and the total fitment cost per year for LKS over the intervention policy period (15 years) and is shown below in Table 14.

Table 13: Additional fitment costs per vehicle

Case	Option 1 ($)	Option 2 ($)
Best case	-	220
Likely case	**-**	**345**
Worst case	-	470

Table 14: Additional fitment per year

Year	Option 1 ($m)	Option 2 ($m)
2024	-	50
2025	-	77
2026	-	95
2027	-	86
2028	-	76
2029	-	69
2030	-	64
2031	-	61
2032	-	58
2033	-	57
2034	-	56
2035	-	56
2036	-	55
2037	-	56
2038	-	56

Step 7: Number of crashes affected by fitment - Option 2

From year 1 of intervention (2023), the number of crashes affected by the increased fitment was determined for each year over a 37 year period (2 year implementation plus 35 year analysis) for Option 2 as shown below in Table 15. The crashes affected each year are the product of the likelihood of crash at the vehicle's age (Step 2) with the increased fitment at the sale (Step 5), summed as they infiltrate the fleet over time.

Table 15: The number of crashes affected by fitment - Option 2

Year	Vehicle Age																																		Total vehicles
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
1	537																																				537
2	1748	816																																			2564
3	1749	2656	1010																																		5415
4	1693	2657	3288	915																																	8553
5	1619	2572	3289	2977	813																																11271
6	1670	2460	3185	2978	2647	739																															13678
7	1744	2537	3046	2883	2648	2404	685																														15947
8	1703	2649	3141	2757	2564	2405	2229	647																													18095
9	1575	2587	3280	2843	2452	2329	2230	2106	621																												20023
10	1556	2393	3203	2969	2528	2227	2159	2107	2022	605																											21770
11	1502	2364	2963	2900	2641	2296	2065	2040	2023	1969	595																										23357
12	1487	2282	2927	2682	2579	2398	2129	1951	1959	1969	1938	591																									24892
13	1194	2260	2825	2650	2385	2342	2223	2011	1873	1907	1938	1924	591																								26123
14	1143	1814	2797	2557	2356	2166	2171	2101	1932	1824	1877	1924	1922	593																							27177
15	880	1736	2246	2532	2274	2140	2009	2051	2017	1880	1795	1863	1923	1930	592																						27870
16	887	1337	2149	2033	2252	2065	1984	1898	1970	1964	1851	1782	1862	1931	1927	592																					28484
17	748	1347	1656	1945	1808	2045	1915	1875	1822	1918	1933	1837	1781	1870	1928	1928	586																				28941
18	663	1137	1668	1499	1730	1642	1896	1809	1800	1774	1887	1919	1836	1788	1866	1929	1906	579																			29329
19	539	1007	1408	1510	1333	1571	1522	1792	1737	1752	1746	1874	1917	1844	1785	1867	1907	1885	573																		29570
20	428	819	1247	1274	1342	1211	1457	1438	1721	1691	1725	1733	1872	1926	1841	1786	1846	1886	1865	567																	29675
21	347	649	1014	1128	1133	1219	1122	1376	1381	1675	1665	1712	1732	1881	1922	1842	1765	1826	1866	1846	561																29664
22	285	527	804	918	1004	1029	1130	1060	1322	1345	1649	1652	1711	1740	1877	1923	1820	1746	1807	1847	1826	555															29577
23	203	433	653	728	816	911	954	1068	1018	1287	1323	1637	1651	1718	1736	1878	1901	1801	1728	1788	1827	1806	549														29415
24	177	308	536	591	647	741	845	901	1026	991	1266	1314	1635	1658	1715	1737	1857	1881	1782	1710	1769	1807	1786	542													29223
25	129	269	381	485	526	588	687	798	866	998	976	1257	1313	1642	1655	1716	1717	1836	1861	1763	1692	1749	1786	1764	535												28992
26	103	196	333	345	431	477	545	649	767	843	983	969	1256	1319	1639	1656	1697	1699	1817	1841	1744	1673	1729	1765	1741	528											28746
27	60	156	243	302	307	392	443	515	624	746	829	976	968	1262	1316	1640	1637	1678	1681	1798	1822	1725	1654	1708	1742	1717	520										28461
28	50	91	193	220	268	279	363	418	495	607	735	823	975	972	1259	1317	1621	1620	1661	1663	1779	1802	1706	1634	1686	1718	1692	512									28159
29	41	76	112	175	196	244	258	343	402	481	597	729	823	979	970	1260	1302	1604	1603	1643	1646	1760	1781	1685	1613	1663	1693	1666	503								27849
30	32	63	95	102	156	178	226	244	329	391	474	593	729	826	977	971	1246	1288	1587	1586	1626	1628	1739	1760	1663	1591	1639	1666	1638	494							27535
31	19	49	77	86	91	141	165	213	235	321	385	470	593	732	825	978	960	1232	1274	1571	1569	1608	1609	1718	1737	1640	1568	1613	1638	1608	485						27208
32	0	29	60	70	76	82	131	156	205	228	316	382	470	595	730	825	967	949	1219	1261	1554	1552	1589	1589	1696	1713	1616	1543	1586	1609	1577	475					26852
33	0	0	35	54	62	69	76	124	149	199	225	313	382	472	594	731	816	956	939	1206	1247	1537	1534	1570	1569	1673	1688	1591	1517	1558	1578	1545	464				26476
34	0	0	0	32	48	57	64	72	119	145	196	223	313	383	471	594	723	807	946	930	1194	1234	1519	1515	1550	1548	1648	1662	1564	1490	1528	1545	1510	453			26084
35	0	0	0	0	29	44	52	61	69	116	143	195	223	314	383	471	588	715	799	936	920	1180	1220	1501	1496	1529	1525	1623	1634	1536	1461	1496	1511	1474	441		25683
36	0	0	0	0	0	26	41	50	58	67	114	142	195	224	314	383	466	581	707	790	926	910	1167	1205	1481	1475	1506	1501	1595	1604	1507	1431	1463	1475	1436	429		25270
37	0	0	0	0	0	0	24	38	48	57	66	113	142	196	223	314	378	461	575	700	782	916	899	1153	1189	1461	1454	1483	1476	1567	1573	1475	1399	1428	1437	1396	416	24840

Step 8: Trauma reduction

From the number of crashes affected (Step 7) and the effectiveness of LKS for each trauma type as outlined in the MUARC report (2021) and shown in Table 16, results in the trauma reduction by year and shown below in Table 17.

Table 16: Trauma reduction by type for all crashes

Trauma type	Option 1	Option 2
Fatality	-	11.90%
Major	-	4.98%
Minor	-	1.14%

Table 17: Trauma reduction by year

	Option 1			Option 2		
Year	Fatality	Major	Minor	Fatality	Major	Minor
2024	-	-	-	1.82	14.72	4.60
2025	-	-	-	20.77	70.24	21.94
2026	-	-	-	43.86	148.34	46.33
2027	-	-	-	69.27	234.28	73.17
2028	-	-	-	91.28	308.74	96.42
2029	-	-	-	110.77	374.68	117.01
2030	-	-	-	129.15	436.82	136.42
2031	-	-	-	146.55	495.67	154.80
2032	-	-	-	162.16	548.48	171.29
2033	-	-	-	176.30	596.32	186.24
2034	-	-	-	189.16	639.80	199.81
2035	-	-	-	201.58	681.83	212.94
2036	-	-	-	211.56	715.56	223.47
2037	-	-	-	220.10	744.45	232.49
2038	-	-	-	225.70	763.40	238.41
2039	-	-	-	230.68	780.23	243.67
2040	-	-	-	234.38	792.76	247.58
2041	-	-	-	237.52	803.37	250.90
2042	-	-	-	239.47	809.97	252.96
2043	-	-	-	240.32	812.84	253.86
2044	-	-	-	240.23	812.56	253.77
2045	-	-	-	239.53	810.18	253.03
2046	-	-	-	238.22	805.73	251.64
2047	-	-	-	236.66	800.47	249.99
2048	-	-	-	234.79	794.14	248.02
2049	-	-	-	232.80	787.41	245.91
2050	-	-	-	230.49	779.60	243.47
2051	-	-	-	228.05	771.34	240.89
2052	-	-	-	225.53	762.83	238.24
2053	-	-	-	222.99	754.23	235.55
2054	-	-	-	220.35	745.29	232.76
2055	-	-	-	217.46	735.53	229.71
2056	-	-	-	214.42	725.23	226.49
2057	-	-	-	211.24	714.50	223.14
2058	-	-	-	208.00	703.52	219.71
2059	-	-	-	204.65	692.20	216.18
2060	-	-	-	201.17	680.43	212.50
2061	-	-	-	197.54	668.14	208.66
2062	-	-	-	193.73	655.27	204.65
2063	-	-	-	189.74	641.77	200.43
2064	-	-	-	185.55	627.61	196.01
2065	-	-	-	181.16	612.74	191.36
2066	-	-	-	176.55	597.14	186.49
2067	-	-	-	171.71	580.77	181.38
2068	-	-	-	166.63	563.59	176.01
Total	**-**	**-**	**-**	**6,989**	**23,648**	**7,385**

Step 9: Value of Statistical Life (VSL)

Using data from the ABS (2020b) an average life expectancy of 80.9 for males and 85.0 for females was used. Demographic information provided by MUARC (2021) showed that 68 percent of sensitive fatalities were males, and 32 per cent were females, and the typical fatality age was 38. Using the ABS and MUARC data an average life expectancy for sensitive crashes weighted by gender is 82.2 years and results in an average life years lost of 44.2 and this data is shown in Table 18.

Table 18: Average life expectancy and life years lost

Description	Years
Average life expectancy male	80.9
Average life expectancy female	85.0
Average life expectancy weighted by gender (sensitive crashes)	82.2
Typical fatality age	38.0
Average life years lost	44.2

The VSL was determined according to the Willingness to Pay (WTP) method. The typical cost of a serious and minor injury was established using methods outlined in Road Crash Costs in Australia report 102 (BTE, 2000) and road fatality costs were taken from Cost of Road Crashes report 118 (BITRE, 2006). The cost to society for each fatality with an average of 44.2 life years lost, and the cost of each serious and minor injury have been adjusted to current values (RBA, n.d.) and are shown in Table 19.

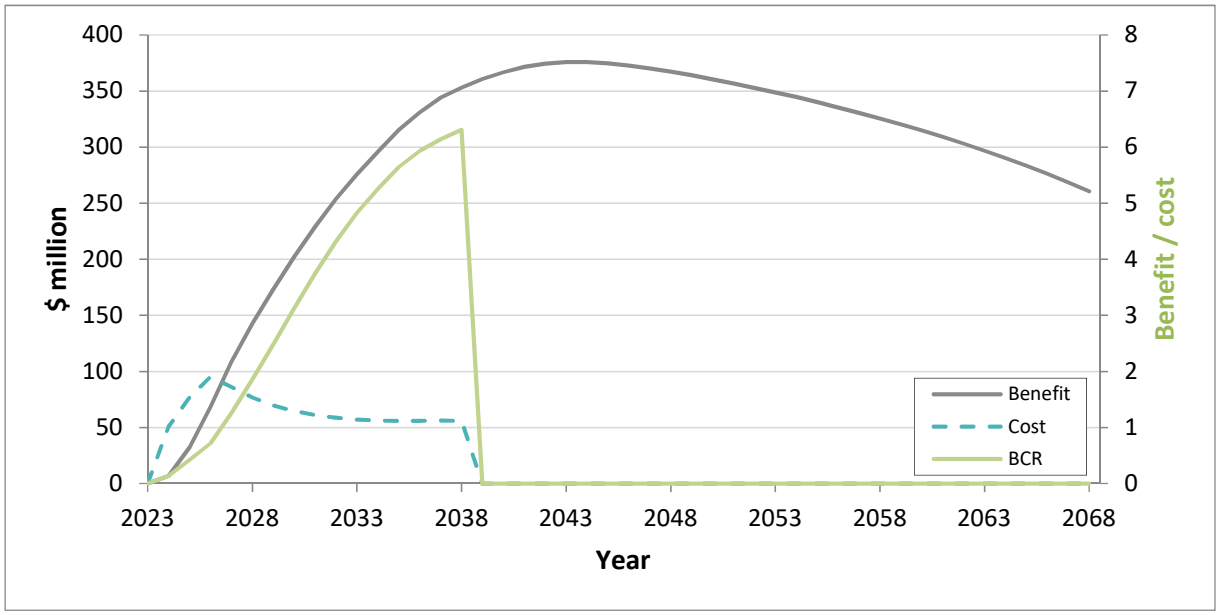
Table 19: VSL for each fatality, serious injury and minor injury

Description	Cost ($)
Fatality	5,218,245
Serious injury	368,357
Minor injury	20,413

Step 10: Benefit-cost analysis summary

A summary plot for Option 2 by year is shown below in Figure **14**. There's no BCR for Option 1 as it is BAU.

Figure 14**: Benefit-cost analysis summary plot - Option 2**



The figures for the benefit and cost for both options are listed below in Table 20 and Table 21.

Table 20: Summary of benefit-cost analysis for Option 1 (BAU)

Case	Net benefit ($m)	Cost to com. ($m)	Cost to Gov. ($m)	Total cost ($m)	BCR	Lives saved
Best case	-	-	-	-	-	
Likely case	**-**	**-**	**-**	**-**	**-**	**-**
Worst case	-	-	-	-	-	

Table 21: Summary of benefit-cost analysis for Option 2 (regulation)

Case	Net benefit ($m)	Cost to com. ($m)	Cost to Gov. ($m)	Total cost ($m)	BCR	Lives saved
Best case	2,999	355	0.5	356	7.8	
Likely case	**2,442**	**613**	**0.5**	**613**	**5.0**	**6,989**
Worst case	2,573	781	0.5	782	3.7	

Appendix G: Strategic Vehicle Safety and Environment Group (SVSEG)

Manufacturer Representatives

- Australian Automobile Association (AAA)
- Australasian New Car Assessment Program (ANCAP)
- Australian Road Transport Suppliers Association (ARTSA)
- Australian Trucking Association (ATA)
- 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)

Government Representatives

- Department of Infrastructure, Transport, Regional Development and Communications, Australian Government
- National Heavy Vehicle Regulator, Australian Government
- Department of Planning, Transport and Infrastructure, SA
- Department of Infrastructure, Planning and Logistics, NT
- Department of State Growth, TAS
- Department of Transport and Main Roads, QLD
- Department of Transport, VIC
- Department of Transport, WA
- Road Safety Commission, WA
- Justice and Community Safety, ACT
- Transport for NSW, NSW
- New Zealand Transport Agency

Inter-Governmental Agency

- National Transport Commission (NTC)

Appendix H – Technical Liaison Group (TLG)

Manufacturer Representatives

- Australian Automotive Aftermarket Association (AAAA)
- Australian Automobile Association (AAA)
- Australian Motorcycle Council
- Australian Road Transport Suppliers Association (ARTSA)
- Australian Trucking Association (ATA)
- Bus Industry Confederation (BIC)
- Caravan Industry Association of Australia (CIAA)
- Commercial Vehicle Industry Association of Australia (CVIAA)
- Federal Chamber of Automotive Industries (FCAI)
- Federation of Automotive Product Manufacturers (FAPM)
- Truck Industry Council (TIC)
- Consumer Representatives

Government Representatives

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

Inter-Governmental Agency

- National Transport Commission (NTC)