Australian Government

Department of Infrastructure, Transport, Regional Development and Communications

REDUCING HEAVY VEHICLE LANE DEPARTURE CRASHES

Consultation Regulation Impact Statement

April 2022

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Improvements to heavy vehicle design and safety technologies have reduced the number and severity of crashes on Australian roads. However, the impact of road trauma on individuals as well as society as a whole is significant, costing the Australian economy approximately $30 billion per year (DITRDC, 2021) up from $27 billion per annum in 2014 (BITRE, 2014). This equates to around 1,200 fatalities each year on our roads, and almost 40,000 serious injuries (DITRCD, 2021) with an approximate cost of $80 million per day to the Australian economy.

Heavy vehicle crashes constitute around $1.5 billion of this, including around $63 million (Budd & Newstead, 2014) from crashes involving heavy vehicles drifting outside their lane. This is the specific road safety problem that has been considered in this Consultation Regulation Impact Statement (RIS).

Heavy vehicle drivers, other road users and the community in general will benefit from the fitment of a Lane Departure Warning System (LDWS) that warns the driver of an unintentional lane departure especially in the field of monotonous driving situations such as on national or state highways and arterial roads. The crashes prevented by LDWS include same direction and opposite direction lane departure multiple-vehicle crashes and single-vehicle roadway departures crashes.

LDWS in combination with Advanced Emergency Braking Systems (AEBS) help prevent fatigue related crashes. Research shows it can also be effective in distraction monitoring by alerting a driver at the early stages of a loss of concentration. These crash types include sideswipes, opposite sideswipes, run off road, rollover and head-on crash outcomes. Australian research notes that LDWS will be most effective in higher friction situations on edge marked roads in fine conditions and at higher speeds (Budd & Newstead, 2014).

Lane Departure Warning Systems

Heavy vehicles with advanced safety technologies are rapidly entering the marketplace and the impact of new features are transforming safety on roadways. Among the several safety related technologies currently available in the market, this RIS examines the case for mandating LDWS in heavy vehicles.

LDWS is a passive safety system and fit under the broad definition of Advanced Driver Assistance Systems (ADAS). This means that the system alerts the driver to a potential threat but does not assume control over any aspect of the vehicle. LDWS is particularly effective in situations where the road is continuously straight and drivers have a tendency not to pay sufficient attention to the road.

LDWS are vision-based, in-vehicle electronic systems that monitor the heavy vehicle's position within a roadway. Based on lane markings, LDWS warns a driver if the vehicle deviates or is about to unintentionally deviate outside of its lane.

In addition to its lane departure warning function, one of the applications for LDWS is as a fatigue monitor since tired drivers often drift on the road. Another application of LDWS is as a distraction prevention device. In either case, if the driver is distracted or tired and the heavy vehicle drifts out of its lane, the LDWS will give a warning in some form to the driver that the vehicle is about to move out of its lane.

This Consultation RIS presents the first estimations of the number of Australian crashes that could be reduced using LDWS and therefore could improve road safety outcomes. Its intention is to inform policy making and regulatory approaches to improving motor vehicle safety in Australia and to further recommend education and outreach activities to increase awareness on the benefits of LDWS.

This Consultation RIS considers two options to increase the fitment of LDWS in new heavy vehicles supplied to the Australian market; a non-regulatory option of no intervention and a regulatory option. The exclusion of other alternative options for this regulatory impact assessment considering the introduction of a new vehicle standard was agreed with the Office of Best Practice Regulation (OBPR) in early 2020.

Option 1 considers the Business As Usual (BAU) case where no intervention is made. For Option 2 the benefit-cost analysis assumes a start date (2024), followed by 15 years of regulation (after which it is assumed the Australian Design Rule (ADR) would be reviewed). The analysis includes another 20 years past the period of regulation to capture the benefits from the 20 years of the crash profile of the last lot of heavy vehicles to be fitted with LDWS when the regulation stops.

The results of the benefit-cost analysis over a 37 year period for each of these options (assuming an intervention policy period of 15 years) are summarised in Table 1 to Table 3 below. Option 2: regulation generated the highest number of lives saved (63) and serious (1,732) and minor (5,389) injuries avoided, as well as the highest likely net benefit ($17.3 million), while retaining a likely benefit-cost ratio (1.1).

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

	Gross Benefits ($m)	Net Benefits ($m)	
		Best case	Likely case
Option 1: no intervention	-	-	-
Option 2: regulation	221	58	17m

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

	Costs ($m)	Benefit-cost ratios	
		Best case	Likely case
Option 1: no intervention	-	-	-
Option 2: regulation	204	1.4	1.1

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

	Lives saved	Serious injuries avoided	Minor injuries avoided
Option 1: no intervention	-	-	-
Option 2: regulation	63	1,732	5,389

The RIS Process

This Consultation RIS has been written in accordance with Australian Government RIS requirements, addressing the seven assessment questions set out in the *Australian Government Guide to Regulatory Impact Analysis (Second edition 2020)*:

1. What is the problem you are trying to solve?

2. Why is government action needed?

3. What policy options are you considering?

4. What is the likely net benefit of each option?

5. Who will you consult about these options and how will you consult them?

6. What is the best option from those you have considered?

7. How will you implement and evaluate your chosen option?

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

Chapter 1: What is the problem?

The impact of road trauma in Australia

The impact of road crashes on society is significant. Individuals injured in crashes must deal with pain and suffering, medical costs, lost income, higher insurance premium rates and vehicle repair costs. For society as a whole, road crashes result in enormous costs in terms of lost productivity and property damage. The cost to the Australian economy is approximately $30 billion per year (DITRDC, 2021). This equates to around 1,200 people fatalities each year on our roads, and almost 40,000 serious injuries (DITRDC, 2021) with an approximate cost of $80 million per day to the Australian economy. There is also a personal cost for those affected that is not possible to measure. Road trauma from heavy vehicle crashes costs Australia approximately $1.5 billion each year. This cost is broadly borne by the general public, businesses and government.

Heavy vehicles represent almost four per cent of all registered vehicles in Australia (ABS, 2020a) and account for just under nine per cent of total vehicle kilometres travelled (VKT) on public roads (ABS, 2020b). However, they are involved in almost 16 per cent of all fatal crashes (BITRE, 2021a). While heavy vehicle crashes are lower relative to other road users, these crashes are more likely to result in a death or serious injury and contribute to disproportionate harm to other road users. Over the three years ending March 2021, an average of 186 people were killed annually in 166 crashes involving heavy trucks or buses (BITRE, 2021b). The most recent available data (2018) shows that 1,877 people were hospitalised from road crashes involving heavy trucks or buses (BITRE, 2020). Approximately 500 heavy vehicle occupants are hospitalised from road crashes annually. Of these, approximately 30 per cent are categorised with high-threat-to-life injuries (DITRDC, 2021). For these reasons, heavy vehicle crashes continue to draw attention from policy makers, road safety advocates, the general public and the heavy vehicle industry itself. Alongside this, our road freight task is increasing across major cities to support the demands of continuous economic and population growth. The most recent data indicates articulated trucks and rigid trucks travelled 78,300km and 21,200km on average in the last year in comparison with 11,000km travelled on average by passenger vehicles (ABS, 2020b). This increase in economic activity however, should not result in greater trauma if the elements of our road transport system are inherently safe.

The Australian total freight task (road, rail, sea and air) has grown more than four-fold over the four-and-a-half decades to 2016, from around 127 billion tonne kilometres in 1971 to over 725 billion tonne kilometres in 2015–16—an average rate of growth of over 3.9 per cent per annum. Figure 1 shows that over that period road freight has increased eight-fold, from around 26 billion tonne kilometres in 1970–71 to around 203 billion tonne kilometres in 2015–16. Road freight volumes are projected to grow by around 56 per cent between 2018 and 2040 (central estimate) to around 337 billion tonne kilometres by 2040—average annual growth of 2 per cent per annum (BITRE, 2019a). At the same time, the higher rates of crashes involving heavy vehicles has drawn increasing attention from policy makers, road safety advocates and the general public, as well as from the heavy vehicle industry itself.

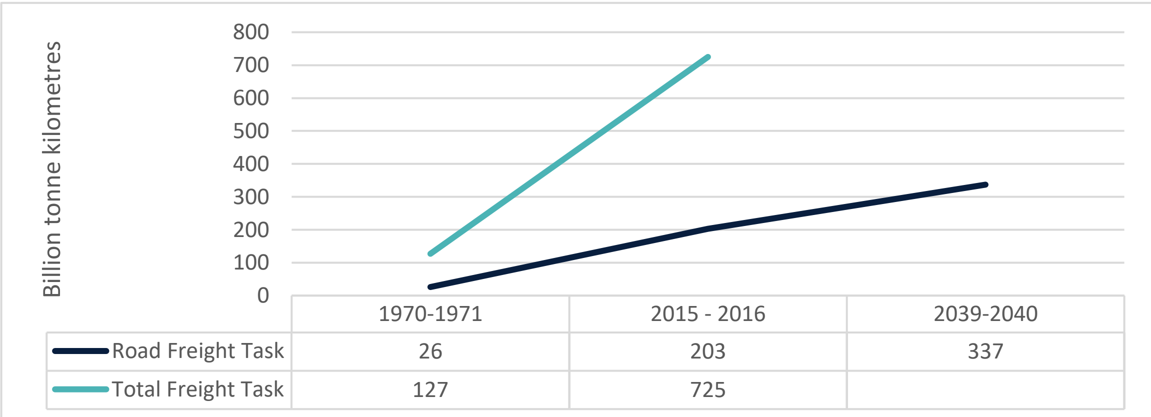


Figure 1: Australian road freight task growth (historical and predicted)

Road freight services, in particular, touch nearly every sector of the economy to varying degrees. Road transport is the predominant mode of transport for urban, inter-urban and regional freight, and part of the supply chain for most imports to Australia. Even the large mineral resource industries that rely on rail or coastal shipping for transport of their outputs, are dependent on road freight to transport machinery, capital equipment and other supplies to mine sites.

Heavy vehicles represent almost four per cent of all registered vehicles in Australia (ABS, 2020a) and account for just under nine per cent of total vehicle kilometres travelled (VKT) on public roads (ABS, 2020b). However, they are involved in almost 16 per cent of all fatal crashes (BITRE, 2021a). Heavy vehicle crashes costs the Australian economy around $1.5 billion each year, including around $63 million (Budd & Newstead, 2014) from crashes involving heavy vehicles drifting outside their lane, same direction and opposite direction lane departure multiple-vehicle crashes and single-vehicle roadway departures.

Heavy vehicles drifting outside their lane is the specific road safety problem that is considered in this RIS. Approximately half of all Australian road deaths result from head-on crashes or single vehicle runoff-road crashes - where a vehicle has run off the road into the path of another vehicle - or a collision with a fixed object such as a tree or pole (ANCAP, 2020). These may occur because a driver has been distracted or is inattentive, tired or fatigued, or simply stray too far beyond the marked lane, resulting in a serious crash or fatality.

While in fatal multi-vehicle crashes a lighter vehicle is likely to have been at fault (in up to 83 per cent of incidents according to NTARC (2019)), heavy vehicles nonetheless have characteristics that can increase both the risk and severity of both no-fault and at-fault crashes. These include a high gross mass, elevated centre of gravity, long vehicle length, reduced opportunity to manoeuvre, and relatively longer stopping distances.

A reduction in these types of crashes is particularly important in regional and remote areas of Australia, where the majority of roads are un-divided, single carriageways. 62 per cent of fatalities occur as a result of lane departure crashes (ANCAP, 2020).

Road trauma involving heavy vehicles

Fatalities

The Australian Road Deaths Database, maintained by the Bureau of Infrastructure, Transport and Regional Economics, provides basic details of road crash fatalities in Australia as reported by the police each month to the state and territory road authorities. This includes details on the number of fatal crashes and fatalities in crashes involving heavy articulated trucks (prime movers), rigid trucks and buses.

During the 12 months to the end of June 2021, 182 people died from 168 fatal crashes involving heavy trucks and buses. Over the period 2018-2021, an average of 170 people have died in 152 fatal crashes involving heavy trucks and buses each year (BITRE, 2021a).

Figure 2 shows the annual number of fatal crashes involving prime movers (articulated trucks), heavy rigid trucks, heavy trucks and buses in Australia for each year in the period 2012 to 2021, while Figure 3 shows the corresponding number of fatalities.

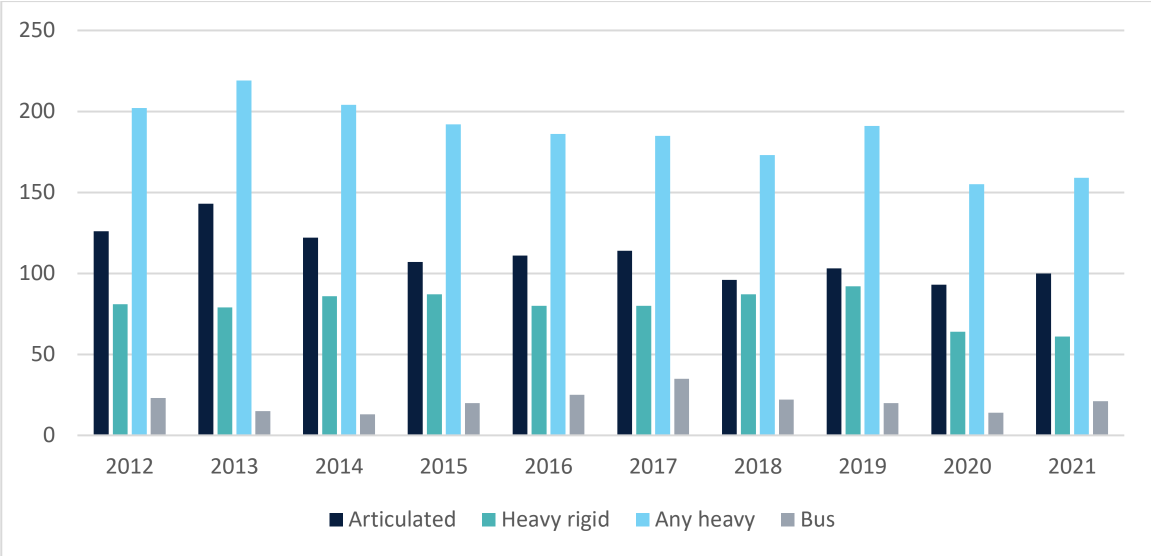


Figure 2: Fatal crashes involving heavy trucks and buses in Australia, annual totals 2012-2021

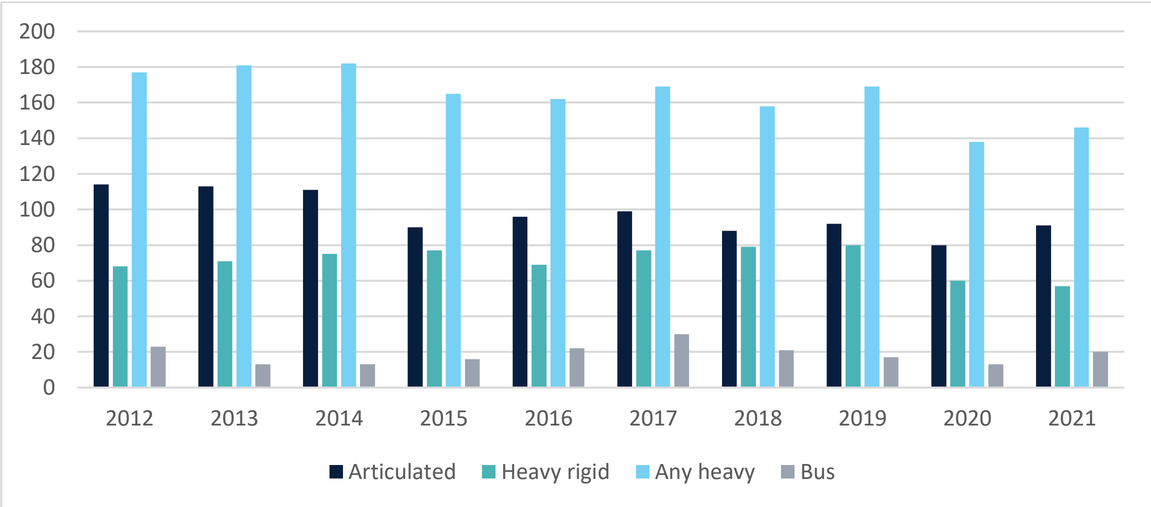


Figure 3: Fatalities in crashes involving heavy trucks and buses in Australia, annual totals 2012-2021

Historic data shows that fatalities in crashes involving prime movers (articulated trucks) decreased by nearly 40 per cent between 2007 and 2013 (DITCRD, 2019), and have been relatively constant since then up to the year 2020 (Figure 3). Fatalities in crashes involving rigid trucks and buses have been relatively constant over the last 10 years with a noticeable reduction in the last two years for the heavy rigid truck group.

The data supporting Figures 2 and 3 also shows that:

- Fatalities in crashes involving articulated trucks increased by 7.5 per cent by June 2021 when compared with the corresponding period one year earlier.
- Data trends reveal the fatalities in crashes involving articulated trucks increased by an average of 0.2 per cent per year over the last three years to June 2021.
- Fatalities in crashes involving heavy trucks also increased by 2.6 per cent by June 2021 when compared with the corresponding 12-month period one year earlier.

This increasing rate of trauma for the heavy vehicle sector is alarming considering the impact of the COVID pandemic on the Australian economy by reducing the road freight task and road use in general. During the second quarter of calendar

2020, estimated vehicle kilometres travelled (VKT) declined by 22 per cent (BITRE, 2021a). In the 3rd and 4th quarters of 2020, both VKT and deaths increased to historical trend levels.

Taking into account fatality rates and crash data, fatal crashes involving heavy trucks and buses cost the economy approximately $980 million annually (MUARC, 2020).

Serious and minor injuries

The National Injury Surveillance Unit at Flinders University, using the Australian Institute of Health and Welfare National Hospital Morbidity Database compiles data on hospitalisation due to road crashes, including those involving heavy vehicles. This shows that road injury while driving a heavy vehicle accounted for (age-standardised rates) 4 cases per 100,000 population (AIHW, 2018). 2017-2018 is the most recent data available and shows that 1,824 people were hospitalised from road crashes involving heavy vehicles (BITRE, 2019b). Prior to these two years, the previous five years of available data (2013 to 2016) in Figure 4 show that close to 1,773 people are hospitalised each year on average from road crashes involving heavy vehicles. This indicates an increasing trend in hospitalised injuries as a result of heavy vehicles on Australian roads, partly due to the growth in the road freight task over the last decade.

Figure 4: Hospitalised injuries involving heavy trucks or buses by Gender

Approximately 500 heavy truck occupants are hospitalised from road crashes each year. Of these, approximately 30 per cent are categorised with High-threat-to-life injuries (ORS, 2021).

While not a perfect measure, hospital admission provides the best available indication of serious injury crashes in Australia. With current annual serious injury rates and crash data available, serious injury crashes involving heavy trucks and buses in Australia cost approximately $520 million each year (MUARC, 2020).

Attributes of heavy vehicle crashes

Heavy vehicle factors

Heavy vehicles are defined as goods vehicles of over 3.5 tonnes Gross Vehicle Mass (vehicle and load). Heavy vehicles are over-involved in severe road crashes, since their high mass leads to severe consequences for other road users involved in the event. In view of this and the growth in heavy goods vehicle traffic internationally and locally over the last twenty-five years, the safety performance of heavy goods vehicles continues to be strictly regulated in the best performing countries in road safety.

There was a total of 20 people killed in crashes involving buses in 2019. Despite their size, transport by bus and coach is considered the safest mode of road travel. Interestingly, the trend over the last 10 years was a slight annual increase in deaths of 0.6 per cent (BITRE, 2021a).

The particular characteristics of these vehicles strongly influence – in a positive or negative way – the occurrence of road crashes and these characteristics relate to the:

- vehicle — different traction characteristics, increased dimensions and weight
- driver — professional heavy vehicle drivers spend more time driving
- vehicle use — commercial use must meet several efficiency and performance criteria

Due to the mass of heavy goods vehicles and buses/coaches, people involved in collisions with these types of vehicles suffer the most severe consequences regardless of them being occupants or outside the vehicles.

Driver factors

Distraction, fatigue, driver inexperience and error can be causal factors in heavy vehicle crashes. Risky driving behaviours and errors include excessive speed, violations of speed limits, excessive lateral acceleration on curves, unplanned lane departures, frequent hard braking, close following distances, lateral encroachment, failure to yield at intersections, distracted driving, and general disobedience of the rules of the road. Actions to reduce the extent of these factors have generally focused on heavy vehicle drivers and fleet managers. However, in fatal multi-vehicle crashes involving a heavy vehicle, another vehicle is at fault in up to 78 per cent of incidents (NTARC, 2021). This trend has been consistent with previous years of NTARC crash data. Nonetheless, heavy vehicles have physical characteristics that increase the risk and severity of crashes, including a high gross mass, elevated centre of gravity, long vehicle length, reduced ability to manoeuvre, and relatively longer stopping distances. Heavy vehicle transportation continues to grow internationally and in Australia.

The work environment for the heavy vehicle driver poses many challenges - long distances, scheduling shifts, poor road and infrastructure quality, driver fatigue and inattention and vehicle or load-related issues (NHVR, 2021). In addition, personal sleep disorders for heavy vehicle drivers such as sleep apnea can increase the risk of a heavy vehicle crash occurring (Meuleners et al., 2015). In recent years, there has been increased research and development activity focussed on producing fatigue and/or distraction detection technologies for the transport industry. In the last five years, advances in computer technology, video software analyses and automation have resulted in wide-spread availability of low-cost detection technologies with a relatively high level of accuracy in detecting unsafe and high risk in-cab behaviours. Compared with the current prescriptive hours of work laws and regulations administered by the National Heavy Vehicle Regulator (NHVR), these technologies hold considerable promise in detecting unsafe and high-risk driving behaviours with a high degree of specificity and sensitivity.

Government actions to address heavy vehicle trauma

A collective effort by the federal and state governments to increase the proportion of heavy vehicles on the road network with high quality primary safety technologies such as ABS, ESC, AEB, LKA and LDWS and secondary features such as driver, passenger and side curtain airbags and head protection technology, can achieve a progressive and significant reduction in

Australia's road trauma levels. Early adoption of existing vehicle safety technology has provided important safety gains. Through the Office of Road Safety (ORS), the Australian Government allocates dedicated funding for a number of road safety programs.

Road Safety Programs

The Australian Government manages infrastructure and non-infrastructure programs that facilitate the work towards Vision Zero by federal, state, territory and local governments and the road safety sector. This includes:

- administering the Australian Government's $25 billion, four-year road safety investment
- administering grants for sector-led road safety initiatives
- developing new programs and initiatives to support the goal of Vision Zero by 2050 and interim targets set through the National Road Safety Strategy

Heavy Vehicle Safety Initiative (HVSI)

The Heavy Vehicle Safety Initiative (HVSI) program supports implementable, value-for-money projects that deliver tangible improvements to heavy vehicle safety.

The grants program is administered by the NHVR on behalf of the Commonwealth Government, investing over $28 million in 117 projects. Of the 6 rounds funded to date, successful projects are delivering outcomes aimed at making Australia's roads safer for all users.

Organisation	Project Name	Project Description
Metro Tasmania	Intelligent Transport Advanced Driver Assistance Systems	Improve the safety of Tasmanian roads by reducing pedestrian fatalities, at fault collisions and enhancing driver performance through the installation of Mobileye advanced driver assistance technologies.
Orange City Council and Cabonne Shire Council	Power Nap - Don't Ignore the Early Warning Signs of Driver Fatigue	Intervention strategy delivering Power nap and Driver Fatigue Awareness Day, a behavioural change campaign. To improve safety and reduce stress and anxiety in Heavy Vehicle drivers.
South Australian Road Transport	Heavy Vehicle Simulator	Purchase an HVSim to provide general heavy vehicle skills training, including driving on high risk routes in South Australia, fatigue management and research.
Wodonga Institute of TAFE	Multi-media Advanced Emergency Braking (AEB) Project	Educate transport operators and drivers about the benefits of voluntary early adoption and limitations of Electronic Stability Control and Advanced Emergency Braking safety technologies.

Driver Reviver Site Upgrades

The Office of Road Safety is investing $8 million over two years to improve amenities at driver reviver locations nation-wide and to support the establishment of new sites.

Round one

Nearly $700,000 was shared by 22 organisations to purchase portable electronic variable message signs for 34 Driver Reviver sites around Australia under round one of the program.

These signs promote awareness for operational Driver Reviver sites and are available for other road safety messaging when not required at the Driver Reviver sites.

Round two

$7.2 million was committed under round two of the Driver Reviver program to upgrading 71 roadside rest areas across the country.

Activities to be completed under round two, announced in September 2021 will include improvements to shelters, picnic tables, power and water facilities, barbeques, parking, lighting and kitchen facilities.

The upgrades will assist volunteers to better support motorists manage their fatigue on long journeys, reducing the risk of crashes causing deaths and serious injuries.

State and Territory Government actions

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

- Driver distraction awareness
- Safe driving
- Road safety education and
- Drivers to consider new and proven vehicle technology when purchasing a new vehicle.

Actions taken by state and territory governments to address heavy vehicle lane departure crashes include:

Australian Capital Territory (ACT)

The ACT is currently undertaking an assessment of ACT road infrastructure for compatibility with ADAS. By digitally mapping the ACT road network using the Mobileye system, information about the suitability of the ACT road network for ADAS technologies will be gathered. This will contribute to the effectiveness of LDWS.

Victoria

As there are a number of major road and rail projects underway across Victoria, there is an increasing presence of trucks on roads as they transport material, equipment and machinery. This means more potential interactions between VRUs and trucks. In partnership with state government departments, non-government organisations and industry, the Construction Truck and Community Safety Project provides new tools and ways of working to improve safety for VRUs.

The Victorian government is working to reduce the risks to vulnerable road users through a range of approaches including:

- fitting additional safety equipment to some heavy vehicles,
- raising awareness with truck drivers on sharing the road with VRUs,
- improving the design of temporary road and footpath diversions around worksites, and

- providing information to VRUs about the safest behaviours around trucks.

To improve the safety of older vehicles, the Department of Transport (DoT) is monitoring the development and effectiveness of technology which can be retro-fitted in both light and heavy vehicles.

The Victorian government is working collaboratively with contractors to progressively fit safety equipment to some of the heavy vehicles servicing the higher risk worksites to enhance safety conditions for VRUs. This equipment includes:

- side under-run protection,
- cameras, mirrors and sensors to eliminate blind spots,
- signage warning VRUs about blind spots, and
- devices to sound a warning when the vehicle is about to turn left.

The Victorian government notes that generally, ADAS such as AEB, LKA and fatigue detection can only be fitted by the vehicle manufacturer. These technologies require extensive development and complex calibration for them to operate safely and reliably with other systems in the vehicle. Accordingly, it is expensive and often not possible for these systems to be retro-fitted.

Considerations have been made to include these advanced safety systems that cannot be easily nor readily retrofitted onto in-service heavy vehicles for future contracts. On a contract-by-contract basis where new vehicles are required to be purchased, they will require safety technologies such as LDWS. After-market products which provide audible, visual and haptic warnings to drivers continue to be monitored to assess the effectiveness and feasibility for retro-fitting.

The European Union has identified 15 safety features for vehicles (including AEB, LKA, ISA and fatigue detection technology) to be adopted for new models from 2022, and Road Safety Victoria will continue to work with the DITRDC to expedite the adoption of international regulations, including these safety features, into the ADRs.

The DoT has designed and developed two e-Learning online courses to help educate fleet owners on the importance of ADAS in reducing road trauma. The courses help participants to make informed decisions and to only purchase the safest vehicle for their needs. DoT is exploring ways to roll these courses out to the wider community including heavy vehicle fleet operators.

New South Wales

The NSW Government fleet operational guidelines (*Motor Vehicle Operational Guidelines* (NSW Government, 2021)) requires, where practicable and available, LDWS for heavy vehicles. These guidelines inform the Motor Vehicle Scheme, which covers the supply of motor vehicles to the NSW Government fleet.

Also since 2012, Transport for NSW has been promoting safety technologies such as LDWS through the *Safety Technologies for Heavy Vehicle and Combinations* publication. The latest edition was published in 2020 (TfNSW, 2020).

Tasmania

'Lane departure' crashes (run-off-road and head-on crashes) account for over two thirds of serious casualties on Tasmanian roads. Strategies to reduce lane departure crashes have the greatest potential to improve road safety in Tasmania.

The most common 'lane departure' crash type resulting in serious casualties is run-off-road crashes. Runoff-road crashes occur when a vehicle veers off the roadway or across the opposing traffic lane. Run-off-road crashes account for almost one in two serious casualties. The severity of this type of crash can be reduced by protecting roadside hazards with safety barriers or removing hazards where practicable. Improved line marking (delineation), including audible edge lines and road edge widening, can help in preventing this type of crash from occurring.

The other form of 'lane departure' crash is head-on crashes, which occur when vehicles travelling in opposing directions impact one another head/front on. Head-on crashes have increased and represent around one fifth of serious casualties. Physically separating opposing traffic with median or centerline barrier is an effective method to prevent this crash type. Improved delineation can also help in reducing head-on crashes. Active vehicle technologies such as ESC, LDWS, and AEB will increasingly play an important role in preventing lane departure crashes or reducing the severity when a crash of this type occurs

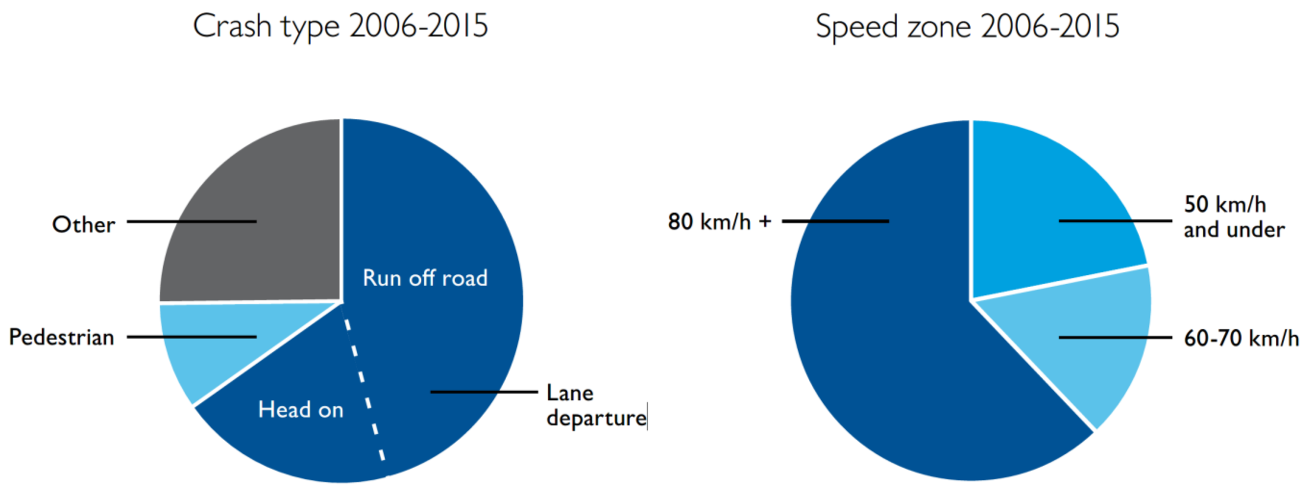


Figure 5: Towards Zero Tasmanian Road Safety Strategy 2017-2026 (DSG, 2016)

The Tasmanian government's key directions for safe roads and roadsides are:

- reduce run-off-road and head-on crashes through improved infrastructure
- reduce the severity of intersection crashes through improved infrastructure treatments
- encourage the latest thinking in safe road design (the Safe System approach)
- monitor the latest innovations in Safe System infrastructure treatments and trial in Tasmania
- reduce serious casualties through improved delineation (e.g. line marking)

National Vehicle Standards

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

Front Underrun Impact Protection Devices

When a heavy vehicle unintentionally departs from its lane and enters oncoming traffic, a head-on collision can occur between the heavy vehicle and a light vehicle causing vehicle underrun, thereby increasing the severity of the outcome. This has been mitigated as much as possible by the introduction of ADR 84 - Front Underrun Impact Protection in 2009. Front underrun protection systems reduce the severity of trauma when a head-on collision occurs between a heavy and a light vehicle, but cannot reduce the frequency of those collisions. Whereas actions targeting heavy vehicle drivers and fleet managers can help reduce the frequency of heavy vehicle at-fault crashes, technology such as LDWS can also help prevent such crashes occurring.

Chapter 2: Why is government action needed?

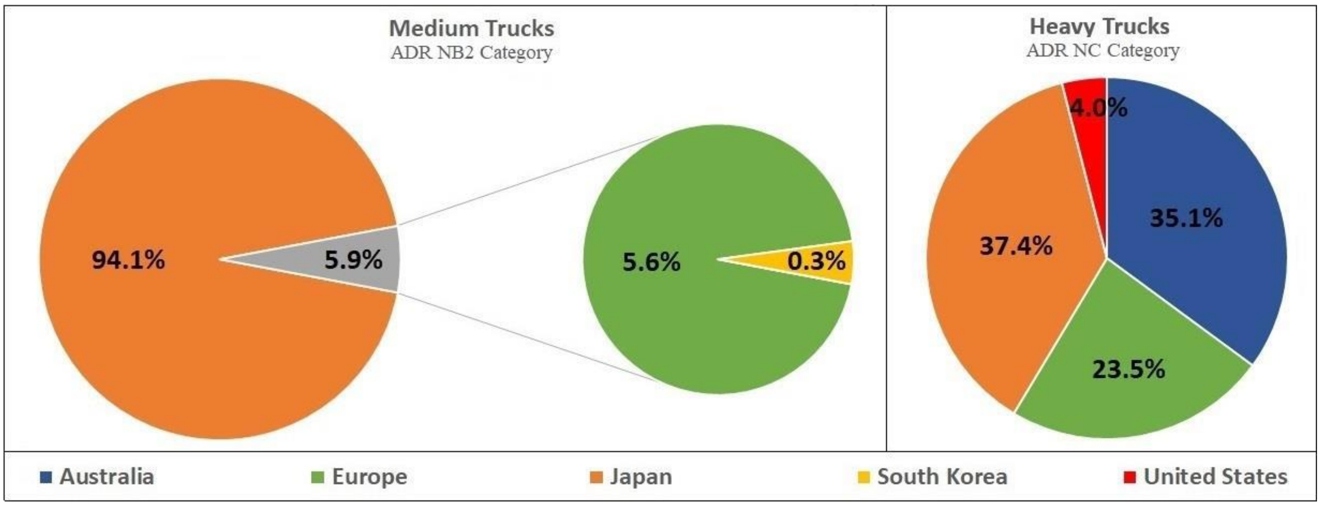
The need for government action

Government action may be needed where the market fails to provide the most efficient and effective solution to a problem. In this case the problem is that crashes involving a heavy vehicle drifting outside its lane are estimated to cost the Australian community around $63 million every year (Budd & Newstead, 2014). These crashes are not reducing as much as they could, given the availability of effective safety technologies.

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

A significant number of heavy vehicles are built in Australia specifically for the Australian market - more than 35 per cent of heavy duty trucks (see Figure 6 below), more than 80 per cent of the heavy haulage vehicles used in the mining industry and around 95 per cent of heavy trailers. Around two thirds of heavy trucks are imported, mostly from Japan or Europe. This means that the designs and regulations effective in other markets will have a lesser influence on the makeup of the Australian heavy duty truck fleet. Consequently, the rate of fitment of primary and secondary safety systems in the Australian heavy vehicle market is likely to remain relatively independent of fitment rates in other markets, in the absence of market intervention.

Figure 6: Truck sales in Australia by country/region of manufacture (Truck Industry Council,2021).



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

Australian research (Budd & Newstead, 2014) showed that although only four per cent of Australian heavy vehicle crashed vehicles were identified as sensitive to LDWS, the protection offered was greater for higher severity crashes with 11 per cent of fatal crashes sensitive to LDWS.

Availability and uptake of LDWS

LDWS was generally not fitted to heavy vehicles delivered to the Australian market prior to the middle of 2016, as reported by the Truck Industry Council (TIC). Since then, LDWS has typically been offered as part of a more expensive package of optional safety upgrades to purchasers of new heavy vehicles. This kind of advanced safety package also included AEB in most cases. Figure 7 shows a significant increase in the fitment rate for prime movers and NB1 category rigid vehicles with no market intervention, however the data shows a stagnation in the growth of the fitment rate in the last three years.

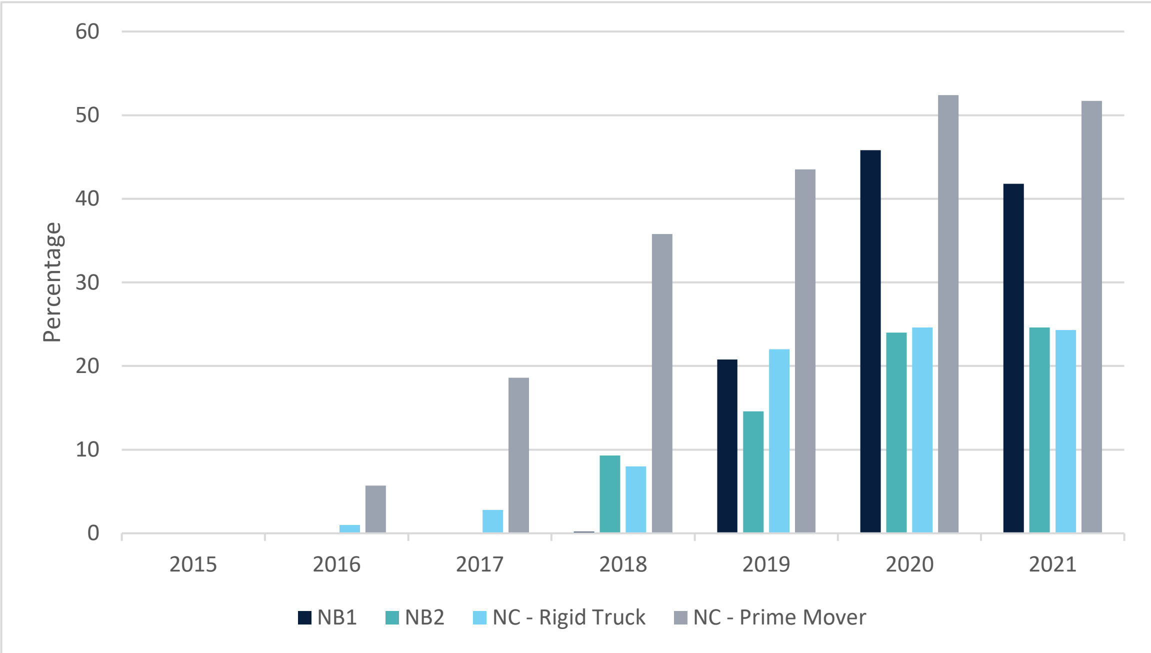


Figure 7: Australian Truck LDWS Fitment Rates 2015 – 2021 (TIC, 2021)

Heavy vehicle LDWS fitment rates have remained low with only around 36 per cent of all new heavy vehicles sold in 2021 being fitted with LDWS complying with internationally adopted standards. Table 4 below shows that most of these are in the heavy duty prime mover segment at 51.7 per cent (NC category prime mover). The remaining fitment of LDWS in new heavy vehicles sold in 2021 occurs in close to 41.8 per cent of NB1 category rigid vehicles, 24.6 per cent of NB2 category vehicles and 24.3 per cent in NC category rigid vehicles.

Table 4: Industry reported LDWS fitment to heavy vehicles (TIC, 2021)

	Total new heavy vehicle sales (as reported)				Estimated number of new vehicles fitted with LDWS (as reported)				Estimated fitment of LDWS per category (%)			
ADR Category	NB1	NB2	NC Prime	NC Rigid	NB1	NB2	NC Prime	NC Rigid	NB1	NB2	NC Prime	NC Rigid
	16225	**8135**	**6000**	**9000**	**6781**	**1997**	**3102**	**2188**	**41.8%**	**24.6%**	**51.7%**	**24.3%**

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

Consumer knowledge

Road vehicles today are complex machines which operate in a high risk environment, leading to deaths and injuries each year. Vehicles are made of multiple, complex and sophisticated mechanical, electrical and electronic components and the average consumer is often unaware of the function of each component and its contribution to the functioning of the vehicle as a whole. For example, a consumer is unlikely to be able to assess the crashworthiness of the vehicle because the structural design determines the degree of occupant protection, with many important components, 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.

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

There is some help available for the consumer to assist with the choice of purchasing a new vehicle in the light vehicle segment. The Australian New Car Assessment Program (ANCAP) publishes safety ratings for a range of new passenger, sports utility (SUV) and light commercial vehicles (LCV) entering the Australian and New Zealand markets, using a rating system of 0 to 5 stars. ANCAP has reported that the number of top 100 selling light vehicle models offered with a LDWS as standard fitment has increased from 35 per cent of the market in June 2019, to 53 per cent of the market in June 2020 (ANCAP, 2021).

Unlike the light vehicle fleet, there are no national consumer safety ratings schemes for new heavy vehicles. Despite LDWS being a demonstrated safety technology, new heavy vehicles are generally configured with an emphasis on productivity, with a lower level of passive and active safety features than is typical of light vehicles.

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

Vehicle technology interventions

As early as 2004 (MUARC, 2004), Australian experts identified the potential of several heavy truck and bus advanced safety technologies as promising countermeasures to reduce crashes involving heavy vehicles and buses. These safety technologies are commonly referred to as Advanced Driver Assist Systems (ADAS). They may use sensors or alerts to warn a driver of a possible collision, actively assume control of a vehicle in situations where a driver does not react to the threat of an imminent crash, or improve driver and fleet management (e.g., monitoring vehicle safety systems and drivers’ hours-of-service status). Although some ADAS may be effective at preventing crashes, it is also important to know whether they are cost-effective, as this information may assist consumers in purchasing advanced safety technologies and/or government regulators in mandating their use. Research suggests that LDWS fitted to heavy vehicles may reduce up to six per cent of fatal heavy vehicle crashes (TfNSW, 2020).

On-board safety systems for heavy commercial vehicles have been developed and implemented over a considerable period of time, ranging from anti-lock braking systems (ABS) and speed control, through stability control (ESC, RSC), forward collision warning (FCW), adaptive cruise control (ACC) and driver drowsiness monitoring, to crash-imminent braking (AEB). Improvements to heavy vehicle design and safety features therefore have contributed to reducing the number and severity of heavy vehicle crashes. Some technologies have additional benefits such as improving driver and passenger comfort. Some of the more advanced technologies come at a cost but many are inexpensive over the longer term and practical to integrate into the heavy vehicle architecture at the design and production phase of a new heavy vehicle.

Crash avoidance features are safety technologies that assist the driver to reduce the likelihood of a crash. Other crash avoidance features actively intervene in the driving task to prevent or mitigate a crash. Research (Budd et al., 2015) has shown these systems to be effective in reducing crashes – in some cases, highly effective – and implementation has taken place through the voluntary action of manufacturers and fleets, and in other cases through government-mandated requirements for new vehicles.

Lane Departure Warning Systems

Lane departure warning systems (LDWS) have been in development by industry for over 20 years. LDWS are generally visual devices that look at the lane line markers to compute a predicted moment of lane departure and alert the driver when unintended lane departures are about to occur without causing undue false warnings due to subtle lateral lane position changes. Beginning with simple line scan video, LDWS have developed into sophisticated lane marker identification and lane boundary projection systems that provide the driver with a warning if the vehicle has a trajectory that will take it out of its lane. While most LDWS apply video technology, other methods include infrared, Lidar, magnetic, and electronic mapping technologies.

Initial LDWS development was for standalone systems, but with the mandate for ESC (ADR 35/06 – Commercial Vehicle Brake Systems) systems on heavy vehicles in Australia, OEMs are looking toward future sensor fusion, or combining LDWS, Forward Collision Warning (FCW), and Blind Spot Warning (BSW)with stability controls. These integrated perimeter sensing systems would then provide the driver with warnings from 360-degrees of roadway observations, rather than just a narrow look ahead. Once integrated, the sensor array may be further infused into the stability control systems (ESC, RSC, ABS) and future vehicle-to-vehicle and vehicle-to-infrastructure intermodal communications. These combined systems would enhance crash avoidance mitigation solutions, and play important roles in setting pre-crash conditions that would reduce crash related trauma (NHTSA, 2014).

LDWS offer significant safety benefits as a large number of heavy vehicle crashes involve a single vehicle running off the road. A LDWS warns a driver when the vehicle unintentionally crosses a distinguishable lane boundary. The system uses optical signal processing techniques to determine the position of the vehicle within the lane as well as monitoring the driver's input through their steering and indicator use. If the driver takes no action when the vehicle deviates from the lane, the system will warn the driver. Unless there is an immediate response, the system will activate a steering shudder to further alert the driver. This system combines very effectively with an AEB system. A LDWS cannot function on roads where lane delineation is poor or non-existent. LDWS can assist in fatigue and distraction monitoring by alerting a driver at the early stages of a loss of concentration. A LDWS can be retrofitted.

Summary of UN Regulation No. 130

Since attaining WP.29 endorsement in 2013, the recognised international standard for LDWS for heavy vehicles is *UN Regulation No. 130 (R130) – Uniform provisions concerning the approval of motor vehicles with regard to the Lane Departure Warning System (LDWS)*. It is applicable to omnibuses (UN category M_2 and M_3 vehicles), and goods vehicles with a maximum mass over 3.5 tonnes (UN category N_2 and N_3 vehicles).

To meet UN R130, a LDWS must be active at vehicle speeds above 60 km/h (unless manually deactivated). If the means (e.g. a switch) is provided to manually deactivate the LDWS, the LDWS function must be automatically reactivated at the start of each new ignition on (run) cycle, and a constant optical warning must be provided to inform the driver when the LDWS is deactivated. The LDWS is required,when active, to warn the driver if the vehicle crosses over a visible lane marking, when there has been no purposeful demand to do so.

Conclusion

The reasons why government should intervene in the market and introduce a new regulation to mandate the fitment of LDWS for new heavy vehicles have been demonstrated in this and the previous chapter. In the first chapter it was shown that there are still an unacceptably high rate of people getting killed and seriously injured from unintentional lane departures. Such crashes include sideswipes, opposite sideswipes, run off road, rollover and head-on collisions.

The availability of an international standard for LDWS and the introduction of ESC for heavy vehicles in Australia makes it viable to examine the introduction of a regulation to mitigate and prevent such crashes.

Chapter 3: Policy options considered

Two options to increase the fitment of LDWS to new heavy vehicles supplied to the Australian market were considered; a non-regulatory option of no intervention and a regulatory option. The exclusion of other alternative options for this regulatory impact assessment considering the introduction of a new vehicle standard was agreed with the Office of Best Practice Regulation (OBPR) in early 2020.

Summary of options

Non-regulatory Options

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

Regulatory Options

Option 2: *Road Vehicle Standards Act 2018* (regulation)	Mandate a standard requiring the fitment of LDWS to new heavy vehicles under the RVSA based on the UN Regulation No. 130 (regulatory—mandatory).

Discussion of options

Option 1: No Intervention (Business As Usual)

The Business As Usual (BAU) case relies on the market fixing the problem, the community accepting the problem, or some combination of the two. The state of current voluntary fitment of LDWS to all new heavy vehicles is around 36 per cent with heavy duty prime movers having the highest fitment rate of around 51.7 per cent.

These fitment rates have arisen without regulation in Australia, including due to many heavy vehicle manufacturers and operators recognising the benefits of the technology to their businesses and/or the broader community. However, it is also important to note that fitment of these technologies is significantly higher in some other markets, most notably Europe were fitment has been mandatory (subject to some limited exemptions) for all new heavy vehicles since 2015.

In examining this case, European Commission requirements on the fitment of heavy vehicle LDWS in the EU and its flow on effect to the Australian market was considered. This included decreasing production costs of LDWS components as well as reduced development and testing costs over the years as the technology (as a warning system) has fully matured and best practice methods of application, development and implementation become widespread.

Actions undertaken by state and territory governments towards improving heavy vehicle safety include investment in research projects, education campaigns, and strategic partnerships. They also include increased stringency in safety requirements and access arrangements, particularly for access to government work contracts. These actions mostly address road user behaviour and infrastructure countermeasures, and only include some localised influences on the fitting of technology through contracts or by trading for road access. Thus, these measures are expected to have limited national impact on reducing heavy vehicle crashes as a result of drifting unintentionally outside their lane. Nationally, ADR 35/05 – Commercial Vehicle Brake Systems and ADR 38/05 – Trailer Brake Systems are two standards that mandate ESC, ABS and RSC on heavy vehicles and trailers to ensure safe braking under normal and emergency conditions. These technologies help reduce the severity of heavy vehicle related trauma due to loss of control. Other proven technologies to date include AEB (ADR 97/00 – Advanced Emergency Braking (AEB) for Omnibuses, and Medium and Heavy Goods Vehicles) and LDWS. The broad introduction of technology such as LDWS is not practical through state and territory government efforts as there is no national consumer safety ratings scheme for new heavy vehicles (unlike ANCAP for light vehicles).

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

Option 2: Mandatory Standards under the RVSA—Regulation

Under Option 2, the Australian Government would mandate the fitment of LDWS to new heavy vehicles supplied to the market via a new national standard (ADR) under the RVSA. This new ADR would adopt the technical requirements of UN Regulation No. 130, incorporating up to the latest series of amendments. The ADR would also include a requirement that the LDWS be fitted as prescribed. As new ADRs only apply under the RVSA to new vehicles, implementation of this option would not affect vehicles already in service.

LDWSs from various manufacturers use a variety of techniques and sub-systems to detect heavy vehicle lane departures. As such, an agreed international standard would further simplify system design and enhance quality. It is therefore important to adopt an effective standard, otherwise the benefits of LDWS will be uncertain. Research has shown UN Regulation No. 130 is effective in an Australian context (Budd & Newstead, 2014 and Budd et al., 2015). As this option is considered viable, and has been pursued internationally, the introduction of a mandatory standard was analysed further in terms of expected benefits to the community.

Background

The UN World Forum for the Harmonization of Vehicle Regulations (WP. 29) is a worldwide regulatory forum that provides the framework to establish regulatory instruments concerning motor vehicles, that allows for the introduction of innovative vehicle technologies to the market while continuously improving global vehicle safety.

Australia is one of the Contracting Parties (member countries of the United Nations) to the UN Regulations annexed to *the 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* (the 1958 Agreement) and is obliged to accept vehicles that comply with the requirements of the international standard UN Regulation No. 130 (UN R130) titled '*Uniform provisions concerning the approval of motor vehicles with regard to the Lane Departure Warning System (LDWS)*'. The UN Regulations are recognised as the peak international standards available for vehicle safety performance requirements. Most Contracting Parties applying type approval certification systems, such as Australia, would consider UN Regulation under any examination of the case to mandate domestically. This allows for conformity in vehicle production and the mutual recognition of type approvals by the Contracting Parties.

A program of harmonising the ADRs with international standards, as developed through the UN, began in the mid-1980s and has recently been accelerated. Harmonising with UN requirements provides consumers with access to vehicles meeting the latest levels of safety and innovation, at the lowest possible cost. The Australian Government has the capability and experience to adopt, whether by acceptance as alternative standards or by mandating, both UN Global Technical Regulations (GTR) and UN Regulations into the ADRs.

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

Australia 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 test and other information supplied by the manufacturer. Compliance of vehicles built under that approval is ensured by the regular audit of the manufacturer's production, design and test facilities. This includes auditing the manufacturers' quality systems and processes.

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

If this option were implemented, the requirements LDWSs would adopt the requirements of UN Regulation No. 130.

Australian research has found that LDWSs could alleviate or reduce the severity of almost five per cent of all Australian heavy vehicle crashes, predominantly those involving a heavy vehicle drifting outside its lane, same direction and opposite direction lane departure multiple-vehicle crashes and single-vehicle roadway departures. The research highlighted although only five per cent of Australian heavy vehicle crashed vehicles were identified as sensitive to LDWS, the protection offered was greater for higher severity crashes with 11 per cent of fatal crashes sensitive to LDWS. Sensitivity to injury crashes were almost double that of property damage only crashes. (Budd & Newstead, 2014). Furthermore, LDWS technology was found to be more sensitive to the crashes of articulated trucks and road trains than to those of rigid trucks and buses.

Scope/Applicability

This option was considered in relation to the scope of vehicles for which mandatory requirements for LDWS could be applied under the ADRs. This option directly aligned with the requirements of UN Regulation No. 130, which would require a new ADR to be implemented to require fitment of LDWS for new heavy vehicles of ADR categories NB1, NB2, NC, MD and ME (Goods Vehicles and Omnibuses).

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 November 2024 for new model vehicles; and
- 1 November 2026 for all new vehicles.

These lead-times are considered suitable to allow for the scope of design change and testing needed for a heavy vehicle supplier/manufacturer to incorporate an LDW system considering technology has matured significantly with regard to lane detection.

Chapter 4: Likely net benefit of each option

Benefit-cost analysis

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

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

The results of Option 2 were compared with what would happen if there was no government intervention, that is, Option 1: no intervention (BAU). The period of analysis covers the expected life of the policy option (15 years of intervention) plus the time it takes for benefits to work their way through the fleet (around 30 years, the approximate maximum lifespan of a heavy vehicle).

Given that the function of UN Regulation No. 130 is to enhance heavy vehicle safety, including a focus on the safety benefit from expected reductions in trauma. It should be noted that many operators would be likely to obtain other benefits (for example, alleviation of property damage and reductions in trauma as a result of the LDWS partially acting as a fatigue monitor) that have not been included in this RIS. The net benefit and the benefit-cost ratio for each option are therefore likely to be conservative estimates. Limitations exist with regard to collecting the data required to account for and tracking the VKT of heavy vehicles and road trains in this Benefit Cost Analysis; this is another benefit that is unaccounted for in this analysis.

Economic aspects - impact analysis

Impact analysis considers the magnitude and distribution of the benefits and costs among the affected parties. In the case of LDWSs for heavy vehicles, the parties affected by the options are:

Business

- Vehicle manufacturers and importers;
- Component manufacturers and suppliers
- Vehicle owners; and
- Vehicle operators.

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

- Australian Livestock and Rural Transporters Association (ALRTA), that represents road transport companies based in rural and regional Australia;
- Australian Road Transport Suppliers Association (ARTSA), that represents suppliers of hardware and services to the Australian road transport industry;

- Australian Trucking Association (ATA), that represents trucking operators, including major logistics companies and transport industry associations;
- Bus Industry Confederation (BIC), that represents the bus and coach industry;
- Commercial Vehicle Industry Association Australia (CVIAA), that represents members in the commercial vehicle industry;
- Heavy Vehicle Industry Australia (HVIA), that represents manufacturers and suppliers of heavy vehicles and their components, equipment and technology;
- Truck Industry Council (TIC), that represents truck manufacturers and importers, diesel engine companies and major truck component suppliers;
- Federal Chamber of Automotive Industries (FCAI) which represents the automotive sector and includes vehicle manufacturers, vehicle importers and component manufacturers/importers; and
- Federation of Automotive Products Manufacturers (FAPM) which represents the automotive component manufacturers/importers.

Governments

Australian state and territory governments and their represented communities.

Impact of viable options

There were two options that were considered viable for further examination: Option 1: no intervention and Option 2: regulation. This section looks at the impact of these options in terms of quantifying expected benefits and costs, and identifies how these would be distributed among affected parties. These were summarised previously and are discussed in more detail below.

Option 1 - No intervention

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

Option 2 - Regulation

As Option 2 involves direct intervention by the Australian Government to compel a change in the safety performance of heavy vehicles supplied to the marketplace, and the benefits and costs are those that would occur over and above those of Option 1. The fitment of LDWS would no longer be a commercial decision within this environment.

Overall benefits

The indirect and direct benefits are estimated at $221.2 million under Option 2 (over and above Option 1). These benefits would be shared among the community and as cost savings to governments.

The measure is estimated to save 63 lives and 1,732 serious and 5,389 minor injuries.

Benefits - Business - Heavy vehicle owners and operators

There would be a direct benefit through a reduction in road crashes (over and above that of Option 1) for the heavy vehicle owners/operators who purchase and/or operate new heavy vehicles equipped with LDWS due to a mandated standard. A significant proportion of the estimated 63 lives and 1,732 serious and 5,389 minor injuries under Option 2 would be occupants of heavy vehicles in highway conditions. There would also be direct benefits to business (including owners/operators and/or insurance companies) through reductions in compensation, legal costs, driver hiring and training, vehicle repair and replacement costs, loss of goods, and in some cases, fines relating to spills that lead to environmental contamination.

Benefits - Business - Heavy vehicle manufacturers and component manufacturers/suppliers

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

Benefits – Governments and Community

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

There would be a direct benefit to the community through a reduction in road crashes (over and above that of Option 1) as a consequence of new heavy vehicles equipped with LDWS due to a mandated standard.

An estimated 63 lives would be saved and 1,732 serious and 5,389 minor injuries reduced under Option 2. This would be more broadly felt in the general community as other road users are often the victims in heavy vehicle crashes due to their inherently more destructive outcomes.

Costs - Business - Heavy vehicle owners and operators

There would be a direct cost to heavy vehicle manufacturers (over and above that of Option 1) as a result of design/development, fitment and testing costs for the additional heavy vehicles sold fitted with LDWS due to a mandated standard. This would likely cost $203.5 million under Option 2 (over and above Option 1). It is likely that manufacturers would pass this increase in costs on at the point of sale to heavy vehicle owners/operators who would then absorb some of it (but, as noted above, would also receive a portion of the benefits) and pass on some through increased supply chain costs.

Costs - Governments

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

Fitment effect of Option 2

Figure 8 shows the forecast percentage of fleet fitment under the analysed intervention Option 2 in comparison to BAU (Option 1). The BAU projected fitment rates up to early 2022 were provided by industry. For Option 2, though fitment rates are known to remain close to 100 per cent after a technology is mandated, a decay factor in fitment back to BAU rates after a 15-year policy lifespan has been incorporated (to account for example for any future policy variation and/or technology redundancy), conservatively reducing the benefits in the post-intervention run-out period of 35 years by up to 50 per cent.

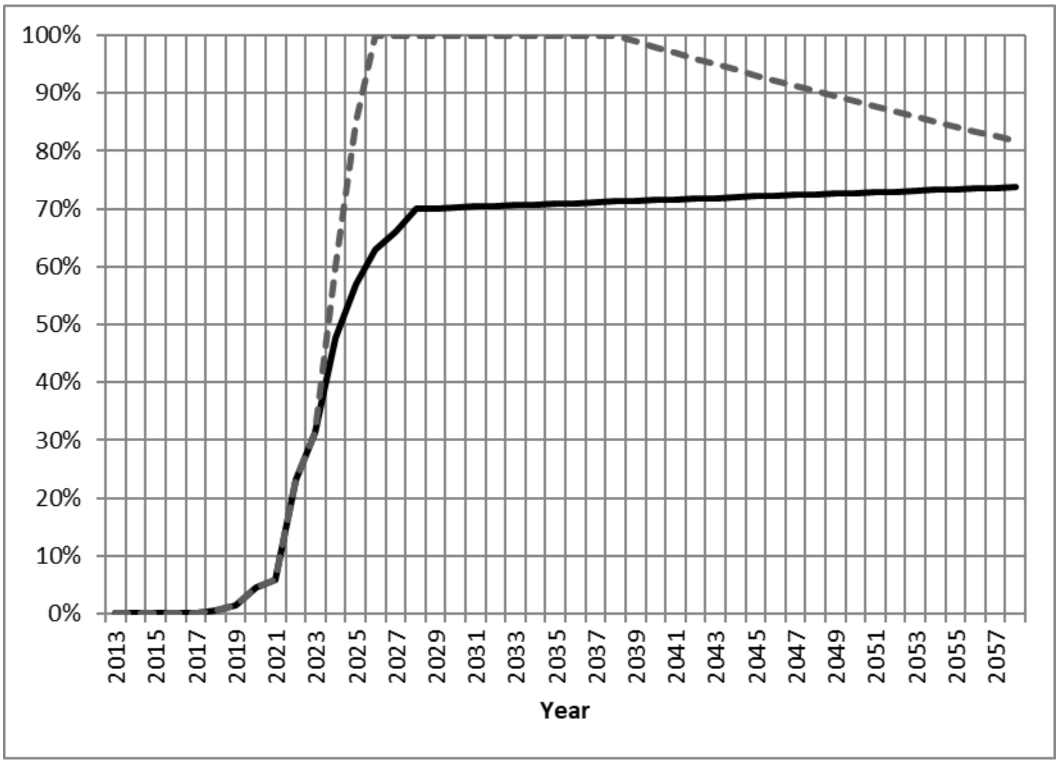


Figure 8: Fitment via Option2 compared to BAU

Impact of LDWS when fitted to a heavy vehicle

Sensitivity

Monash University Accident Research Centre (MUARC, 2015) reported on the impact of LDWS for heavy vehicles in Australia. Crash and crash injury benefits were modelled on police reported crash data on crashes occurring in Australia between 2013-2016 inclusive. The classification of sensitive crashes, those potentially mitigated by LDWS, was applied to crashes occurring in Australia.

Four per cent of Australian heavy vehicle crashed vehicles were identified as sensitive to LDWS, the protection offered was greater for higher severity crashes with 11 per cent of fatal crashes sensitive to LDWS. Sensitivity to injury crashes was almost double that of property damage only crashes.

Effectiveness

LDWS work well with Autonomous Emergency Braking Systems (AEBS) and help prevent fatigue related crashes. Lane departure crashes sensitive to LDWS include, single-vehicle roadway departure crashes and same direction and opposite direction lane departure multi-vehicle crashes. These crash types include side-swipes, rollover and head-on crashes. (MUARC, 2015) carried forward work done by Robinson in 2010 where a LDWS effectiveness of 20-60% reduction was assumed. As fatigue related crashes are not accurately identifiable in Australian crash databases, MUARC (MUARC, 2015) used the approach developed by Anderson in 2011 to estimate fatigue warning system efficacy. In this study MUARC assumed that efficacies in specific types of heavy vehicles may be applied to all heavy vehicle and bus (>4.5 t GVM) types in all severity injuries resulting from LDWS sensitive crashes. MUARC (MUARC, 2015) noted that Houser in 2009 assessed efficacy (in large trucks) in reducing the LDWS sensitive crashes as: 23-53 per cent for single vehicle roadway departure collisions, 24-50 per cent for single vehicle roadway departure rollovers, and 23-46 per cent for same direction lane departure and other direction lane departure over-the-lane-line multi-vehicle collisions. The lower figure of the range was evaluated from a Mack field operation test studying single vehicle run-off road crashes and rollovers not caused by an impact. The upper figure resulted from motor carrier information. MUARC applied these efficacies equally across crashes of all severities. MUARC (MUARC, 2015) deduced since Houser's range of values is almost the same for each crash type, for simplicity, the study used the modest efficacy range of 23-50 per cent on all sensitive crashes equally.

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

MUARC found that LDWS technologies were more sensitive to the crashes of articulated trucks and road trains than to those of rigid trucks and buses. Though LDWS effectiveness is typically higher in high severity (for example, highway/high speed) crashes, low severity crashes occurring in lower speed areas (above 60 km/h up to 80 km/h) are higher in frequency. This biases the expected effectiveness in an arbitrary crash towards lower ranges. On the basis of the above, the adopted effectiveness values were 30 per cent for all sensitive trauma crashes and 40 per cent for higher severity (fatal and serious injury) crashes.

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 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 2026-2035 inclusive. This total was then divided by 10.

The average annual regulatory costs under the RBM of Option 2 is set out in Table 5. There are no costs associated with Option 1 as it is the BAU case. The average annual regulatory cost associated with Option 2 is estimated to be $18.2 million.

Table 5: Regulatory burden and cost offset estimates - Options 1 and 2

Average annual regulatory costs (relative to BAU)				
Change in costs ($ million)	**Business**	**Community organisations**	**Individuals**	**Total change in costs**
Total, by sector **Option 1**	-	-	-	-
Total, by sector **Option 2**	**$18.2 m**	**-**	**-**	**$18.2 m**

Chapter 5: Consultation

Consultative committees

It has been longstanding practice to consult widely on proposed new or amended vehicle standards. For many years, there has been active collaboration between the Commonwealth and the state/territory governments, as well as consultation with industry and consumer groups. Much of the consultation takes place within institutional arrangements established for this purpose. The analysis and documentation prepared in a particular case, and the bodies consulted, depend on the degree of impact the new or amended standard is expected to have on industry or road users.

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

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

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

Public comment

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

In line with the *Australian Government Guide to Regulatory Impact Analysis (second edition 2020)* it is intended that the Consultation RIS be circulated 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. Public comment will be sought by publishing the RIS on the Department's website and by providing it to the consultative committees outlined above. Comment will be sought from the public on the following:

- Support for the recommended option.
- Views on the benefit-cost analysis, including the use of crash data, research or assumptions on effectiveness of the technology, the costs, or the assumed benefits.

- The suitability of UN R130 for adoption under the ADRs, including any concerns on functional and/or performance requirements, test requirements or implementation, such as the applicable vehicle categories and timing.
- Any other relevant views or information which could assist decision making.

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

Chapter 6: What is the best option?

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

- Option 1: no intervention;
- Option 2: mandatory standards under the RVSA (regulation).

Net benefits

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

Option 2: regulation provides the highest likely net benefit of the options examined at $17.3 million and a likely to best BCR range of 1.1-1.4. For Option 2 the benefit-cost analysis assumes a reasonably accurate and generous start date (2024), followed by 15 years of regulation (after which it is assumed the ADR would be reviewed). The analysis includes another 20 years past the period of regulation to capture the benefits from the 20 years of the crash profile of the last lot of heavy vehicles to be fitted with LDWS when the regulation stops.

The benefit would be spread over a 15-year period of regulation followed by a period of around 20 years over which the overall percentage of heavy vehicles fitted with these LDWS in the fleet continues to rise as older vehicles without LDWS are deregistered at the end of their service life. The results of the benefit-cost analysis are plotted over a 37 year period.

Casualty reductions

Of the regulatory options, Option 2 provides the greatest reduction in road crash casualties, with 63 lives saved and 1,732 serious and 5,389 minor injuries avoided.

Recommendation

This Consultation RIS identified the road safety problem in Australia of crashes involving heavy vehicles drifting out of their lane and that the problem can be substantially alleviated via fitment of LDWS. Although market uptake for all new heavy duty prime movers is around 51.7 per cent and increasing very slowly. The current overall fitment across the fleet is relatively low with around 36 per cent of all new heavy vehicles (NB1, NB2, NC prime and NC rigid) fitted with LDWS. The current low fitment rate and the number and severity of heavy vehicle lane departure related crashes indicates a need for intervention.

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

Option 2 (regulation) provides the greatest reduction in road crash casualties, with 63 lives saved and 1,732 serious and 5,389 minor injuries avoided. It would also adopt the requirements UN Regulation No. 130, harmonising Australian requirements with internationally agreed standards. Harmonisation minimises costs associated with LDWS development, and provides manufacturers with the flexibility to incorporate or adapt systems that have already been developed and tested in the markets that the vehicle was originally designed for. This should enable some leveraging of testing and certification frameworks already conducted in other markets.

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

Option 2 offers the important advantage of being able to guarantee 100 per cent fitment of LDWS to applicable vehicles. There would be no guarantee in the BAU case, Option 1 that the predicted take-up of LDWS would be reached and then maintained. Given there is currently a low uptake of this technology (Figure 7), there is good reason to conclude that, under BAU, sections of the market will continue to offer LDWS only as an extra - often as part of a more expensive package of optional safety upgrades. If regulation had to be considered again in the future, there would also be a long lead time (likely to be greater than two years to redevelop the proposal, as well as the normal implementation, programming, development, testing and certification time necessary for implementing LDWS in line with a performance based standard).

As Option 2 (regulation) offers the greatest net benefit it is the recommended option. It would guarantee LDWS provision to warn heavy vehicle drivers of the in-lane tracking performance of their heavy vehicles during monotonous and highway driving situations in Australia.

Scope of the recommended option

It is recommended that vehicle categories applicable under UN Regulation No. 130 be adopted for heavy vehicles supplied for use in Australian road transport. UN Regulation No. 130 covers prime movers and rigid vehicles greater than 12 tonnes GVM (ADR subcategory NC), goods vehicles greater than 3.5 tonnes GVM (ADR subcategory NB) and omnibuses (ADR subcategory MD and ME).

Timing of the recommended option

The proposed heavy vehicle LDWS implementation timeframe is

- 1 November 2024 for applicable new model vehicles
- 1 November 2026 for all applicable new vehicles.

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

Chapter 7: Implementation and Evaluation

New ADRs or amendments to the ADRs are determined by the responsible Minister under section 12 of the RVSA.

Development of safety-related ADRs under the RVSA is the responsibility of the Vehicle Safety Policy and Partnerships (VSP&P) Branch of the Department of Infrastructure, Transport, Regional Development and Communications. It is carried out in consultation with representatives of the Australian Government, state and territory governments, manufacturing and operating industries, road user groups and experts in the field of road safety. Under the RVSA, the Minister may consult with state and territory agencies responsible for road safety, organisations and persons involved in the road vehicle industry and organisations representing road vehicle users before determining an ADR.

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

In addition, UN regulations are revised on an ongoing basis and so in time it may be possible to expand the requirements in UN Regulation No. 130 to specifically provide active steering effort to heavy vehicles that unintentionally depart from the lane. The Department reviews the possible adoption of UN regulations and their revisions into the ADRs as they become available.

Sunsetting of ADRs

A standard (ADR) made under section 12 of the RVSA is not subject to the sunsetting provisions of section 50 of the *Legislation (Exemptions and Other Matters) Act 2003* through section 12 of the *Legislation (Exemptions and Other Matters) Regulation 2015 (table item 56C)*. A similar exemption was previously granted in respect of national road vehicle standards made under section 7 of the *Motor Vehicle Standards Act 1989* (MVSA) (item 40, section 12 of the *Legislation (Exemptions and Other Matters) Regulation 2015*). This exemption is important to ensure that ADRs continue to remain in force, and available to regulators and industry.

It is appropriate that standards made under section 12 of the RVSA remain enduring and effective to regulate ongoing road worthiness of vehicles throughout their useful life and reduce regulatory burden on vehicle manufacturers.

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

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

Requiring vehicle manufacturers to redesign existing models to comply with new ADRs would be a costly and onerous exercise. Vehicle manufacturers should not be expected to continually redesign existing vehicles. Ongoing product recalls of vehicles in the fleet would be needed to comply with new ADRs and this would undermine consumer confidence, with significant financial impact to vehicle manufacturers. The exemption from sunsetting allows vehicle manufacturers to focus their efforts on ensuring new models supplied to the market comply with the ADRs.

The exemption from sunsetting does not mean that ADRs do not undergo regular evaluations. ADRs are subject to regular reviews, as resources permit, and when developments in vehicle technology necessitates updates to requirements. Comprehensive parliamentary scrutiny is available through these reviews.

Chapter 8: Conclusion and recommended option

Conclusion

The various road safety parameters examined in this Consultation RIS and its benefit-cost analysis revealed that the occupants of heavy goods vehicles and buses/coaches are a special group of road users, with different safety needs and characteristics than other road users, due to their specificities, but also due to their different mobility behaviour. With a national road freight task projected to grow steadily into the future, effort to reduce Australia's road trauma requires consideration of every aspect of heavy vehicle safety.

Reducing the occurrence of crashes due to heavy vehicles unintentionally departing their lane is the specific road safety problem that has been considered in this RIS. These crashes cost the community $63 million annually. Heavy vehicle LDWSs capable of warning the driver of an unintentional lane departure especially in the field of monotonous driving situations, such as on national or state highways and arterial roads, are a mature technology for which international standards exist (UN Regulation No. 130).

Around 36 per cent of all new heavy vehicles are fitted with LDWS. Though fitment has been mandatory in other major markets such as Europe since November 2015, this has not strongly influenced the fitment rate in the Australian heavy vehicle fleet. Furthermore, the rate at which the technology is being fitted has begun to reduce.

This RIS considered two intervention options, Option 1 being the BAU case to increase fitment of LDWS to the heavy vehicle fleet. It was found that the most significant (and only positive) net benefits are to be gained by mandating LDWS fitment for new heavy vehicles.

Option 2, mandatory regulation adopting the internationally-agreed requirements of UN Regulation No.130, is expected to yield benefits of $221.2 million over the BAU case, with a likely case benefit-cost ratio of 1.1 (best case up to 1.4). Option 2 would save 63 lives and mitigate 1,732 serious and 5,389 minor injuries.

In line with the *Australian Government Guide to Regulatory Impact Analysis (second edition 2020)* (2020) and the *Regulatory Impact Analysis Guide for Ministers' Meetings and National Standard Setting Bodies* (2021), the policy option offering the greatest net benefit should always be the recommended option. Therefore, Option 2: regulation is the recommended option. Under this option, fitment of LDWS would be mandated for all new heavy goods vehicles greater than 3.5 tonnes Gross Vehicle Mass (GVM) and all omnibuses. The proposed Australian vehicle categories are those covered by UN Regulation No.130 – equivalent ADR subcategories NB1, NB2, NC, MD and ME (Goods Vehicles and Omnibuses). The proposed implementation timing is:

- 1 November 2024 for new model vehicles; and
- 1 November 2026 for all new vehicles.

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

Appendix A – References

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Appendix B – Strategic Vehicle Safety and Environment Group

The prime purpose of the Strategic Vehicle Safety and Environment Group (SVSEG) is to consider how governments, industry and road user organisations will ensure that vehicles sold in Australia are both safe and environmentally friendly. SVSEG is an advisory body of ITSOC, which is primarily responsible for advising the Council on road safety matters of national concern. SVSEG will coordinate work on national vehicle issues on behalf of ITSOC and government representatives of SVSEG will serve as the Austroads Safety Task Force (ASTF) Safe Vehicles Theme Group (SVTG).

Manufacturer Representatives

Australian Road Transport Suppliers Association (ARTSA)

Bus Industry Confederation (BIC)

Commercial Vehicle Industry Association of Australia (CVIAA)

Caravan Industry Association of Australia Ltd (CIAA)

Federal Chamber of Automotive Industries (FCAI)

Heavy Vehicle Industry Australia (HVIA)

Truck Industry Council (TIC)

Victorian Automobile Chamber of Commerce (VACC)

Consumer Representatives

Australasian New Car Assessment Program (ANCAP)

Australian Automobile Association (AAA)

Australian Trucking Association (ATA)

Government Representatives

Department of Infrastructure, Transport, Regional Development and Communications

Department of Transport and Main Roads, QLD

Road Safety Commission, WA

Department of Transport, WA

Department of Transport, VIC

Transport for NSW, NSW

Department for Infrastructure and Transport, SA

Department of Infrastructure, Planning and Logistics, NT

Department of State Growth, TAS

Justice and Community Safety, ACT

New Zealand Transport Agency

Intergovernmental Representatives

National Transport Commission (NTC)

National Heavy Vehicle Regulator (NHVR)

Appendix C – Technical Liaison Group

The Technical Liaison Group (TLG) has two principal roles: to advise the Strategic Vehicle Safety and Environment Group (SVSEG) on detailed technical issues relating to the implementation and development of the ADRs for vehicles, and to advise SVSEG on detailed technical issues relating to regulatory and non-regulatory approaches to improving vehicle safety and environmental performance.

Manufacturer Representatives

Australian Road Transport Suppliers Association (ARTSA)

Bus Industry Confederation (BIC)

Commercial Vehicle Industry Association of Australia (CVIAA)

Caravan Industry Association of Australia Ltd

Federal Chamber of Automotive Industries (FCAI)

Heavy Vehicle Industry Australia (HVIA)

Truck Industry Council (TIC)

Victorian Automobile Chamber of Commerce (VACC)

Consumer Representatives

Australasian New Car Assessment Program (ANCAP)

Australian Automobile Association (AAA)

Australian Trucking Association (ATA)

Registered Automotive Workshop Scheme Association

Australian Imported Motor Vehicle Industry Association (AIMVIA)

Government Representatives

Department of Infrastructure, Transport, Regional Development and Communications

Department of Transport and Main Roads, QLD

Department of Transport, VIC

Transport for NSW, NSW

Department for Infrastructure and Transport, SA

Department of Infrastructure, Planning and Logistics, NT

Department of State Growth, TAS

Justice and Community Safety, ACT

New Zealand Transport Agency

Intergovernmental Representatives

National Transport Commission (NTC)

National Heavy Vehicle Regulator (NHVR)

Appendix D – UN Regulation No. 130 performance requirements

The performance of the LDWS is assessed in a series of four tests conducted at a speed of 65 ± 3 km/h. Two of these tests are performed by gently drifting the vehicle to the left, so that the vehicle crosses the lane markings at two different rates of departure within the range 0.1 to 0.8 m/s. The other two tests are performed by gently drifting the vehicle to the right, so that the vehicle crosses the lane markings at two different rates of departure within the range 0.1 to 0.8 m/s. In all tests, the required warnings must be provided before the outside of the tyre on the front wheel closest to the lane markings passes more than 0.3 m beyond the outside edge of the lane markings. UN R130 also includes failure warning signal and deactivation warning signal tests for the LDWS.

Warning and activation

Summary of the requirements for the test vehicles and conditions. LDWS is required (when active) to warn the driver if the vehicle crosses over a visible lane marking, when there has been no purposeful demand to do so (including for both straight sections, and curved sections having an inner lane marking with a radius ≥250 m. The LDWS is active above road speeds of 60 km/h providing it has not manually been deactivated by a switch within the cabin.

Test conditions: -

- On a flat dry asphalt or concrete surface.
- Ambient temperature shall be between 0° and 45°.
- Visible lane markings.
- The vehicle tested with recommended vehicle manufacture tyre pressures.

The vehicle test weight: -

- The vehicle maybe tested at any condition of load.
- The distribution of the mass among the axles being that stated by the vehicle manufacturer.
- This must not exceed any of the maximum permissible mass for each axle.
- No alteration shall be made once the test procedure has begun.
- The vehicle manufacture shall demonstrate through the use of documentation that the system works at all conditions of load.

Whenever a LDWS active to warn the driver if the vehicle crosses over a visible lane marking in the lane the vehicle is driven in. A noticeable warning by the driver and be provided by: -

- At least two warning means out of optical, acoustic and haptic.
- Or, one warning means out of haptic and acoustic, with spatial indication about the direction of unintended drift of the vehicle.
- Where an optical signal is used for the LDWS, it uses the failure warning signal in a flashing mode.

- The optical warning signal shall be yellow.
- The optical warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat.

In the case where the LDWS is equipped with a user-adjustable warning threshold, the Lane Departure Warning System shall be performed with the warning threshold set at its maximum lane departure setting. No alteration shall be made once the test procedure has begun.

The performance of the Lane Departure Warning System (LDWS) is assessed in a series of four tests.

Drive the vehicle at a speed of 65 km/h +/- 3 km/h into the center of the test lane in a smooth manner so that the attitude of the vehicle is stable.

Target 65 ± 3 km/h The vehicle crosses the lane markings at two different rates of departure within the range 0.1 to 0.8 m/s		
Range one drifting to the left 0.1 – 0.8 m/s (first rate)	Passing lane marking >0.3m	Drivers warning occurs
Range two drifting to the left 0.1 – 0.8 m/s (second rate, different to the first rate)	Passing lane marking >0.3m	Drivers warning occurs
Range one drifting to the right 0.1 – 0.8 m/s (first rate)	Passing lane marking >0.3m	Drivers warning occurs
Range two drifting to the right 0.1 – 0.8 m/s (second rate, different to the first rate)	Passing lane marking >0.3m	Drivers warning occurs

In all tests, the required warnings must (when active) to warn the driver before the outside of the tyre on the front wheel closest to the lane markings passes more than 0.3 m beyond the outside edge of the lane markings.

The LDWS optical warning signals shall be activated either when the ignition (start) switch is turned to the "on" (run) position or when the ignition (start) switch is in a position between the "on" (run) and "start" that is designated by the manufacturer as a check position (initial system (power-on)). This requirement does not apply to warning signal shown in a common space.

A constant optical warning signal shall inform the driver that the LDWS function has been deactivated. A yellow warning signal.

Failure Warning

When the driver is provided with an optical warning signal to indicate that the LDWS is temporarily not available, for example due to inclement weather conditions, the signal shall be constant.

At a periodic technical inspection, it shall be possible to confirm the correct operational status of the LDWS by a visible observation of the failure warning signal status, following a "power-ON" (off-system OK, on-system fault present).

Failure Detection

Summary of requirements for LDWS failure. Disconnecting the power source to any LDWS component or disconnecting any electrical connection between LDWS components. The electrical connections for the failure an optical warning signal shall be constant. The LDWS disable control (manually deactivated) shall not be disconnected when simulating a LDWS failure.

The failure optical warning signal shall be constant and remain constant while the vehicle is being driven. It is to be reactivated after a subsequent ignition “off” ignition “on” cycle as long as the simulated failure exists.

Deactivation test

If the vehicle is equipped with means to deactivate the LDWS, turn the ignition (start) switch to the “on” (run) position and deactivate the LDWS. The optical warning signal shall be constant. Turn the ignition (start) switch to the “off” position. Again, turn the ignition (start) switch to the “on” (run) position and verify that the previously activated warning signal is not reactivated, thereby indicating that the LDWS has been reinstated and the optical warning signal is extinguished. If the ignition system is activated by means of a “key”, the above requirement shall be fulfilled without removing the key.

European mandate of UN Regulation No. 130

Mandatory fitment of LDWS to new heavy vehicles and buses complying with UN Regulation No. 130 has been implemented across the European market since 1 November 2015, followed by mandates in Japan and Korea. Today, the European mandate had taken full effect for all new heavy vehicles covered by UN Regulation No. 130 (with exemptions including urban buses and off-road or agricultural vehicles). Though now well established, the European mandate has not strongly influenced Australian market fitment rates, in part due to the bespoke sale configurations selected by Australian operators. However, the mandate has reduced and mitigated heavy vehicle head-on and single vehicle runoff-road crashes in Europe, providing useful European data on the effectiveness of the technology that has been used to support Australian research.

Appendix E – Benefit-cost analysis

The model used in this analysis was the Net Present Value (NPV) model. The costs and expected benefits associated with government intervention (Option2) 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. Tables 1, 2 and 3 summarises the outcomes from this analysis.

1. The number of new registered vehicles in ADR categories covered by UN Regulation No. 130 were established for each year between 1968 and 2021 inclusive, utilising available Australian Bureau of Statistics Motor Vehicle Census (report series 9309.0) data (Australian Bureau of Statistics, 2017a), and registrations per capita for years prior to availability of census data:

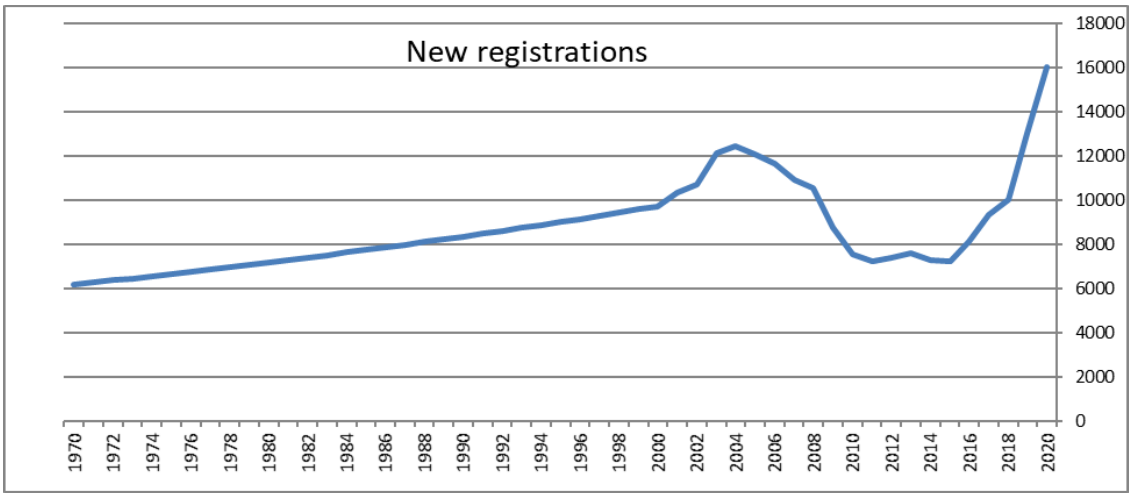


Figure 9: New Australian heavy vehicle registrations, categories covered by UN Regulation No. 131 to 2021.

2. Data from MUARC was used to determine the typical crash frequency by age for vehicle categories covered by UN Regulation No. 130:

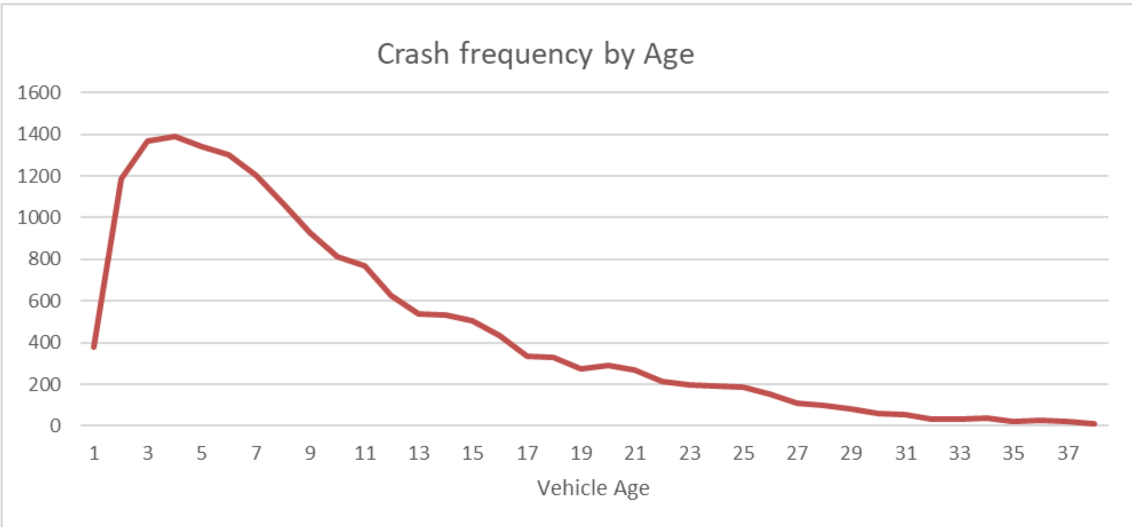


Figure 10: Crash frequency by vehicle age

3. Data from steps 1 and 2 were used to determine the likelihood of a vehicle of a given age being involved in a casualty crash over the course of 1 year as a function of the registered vehicles of a given age:

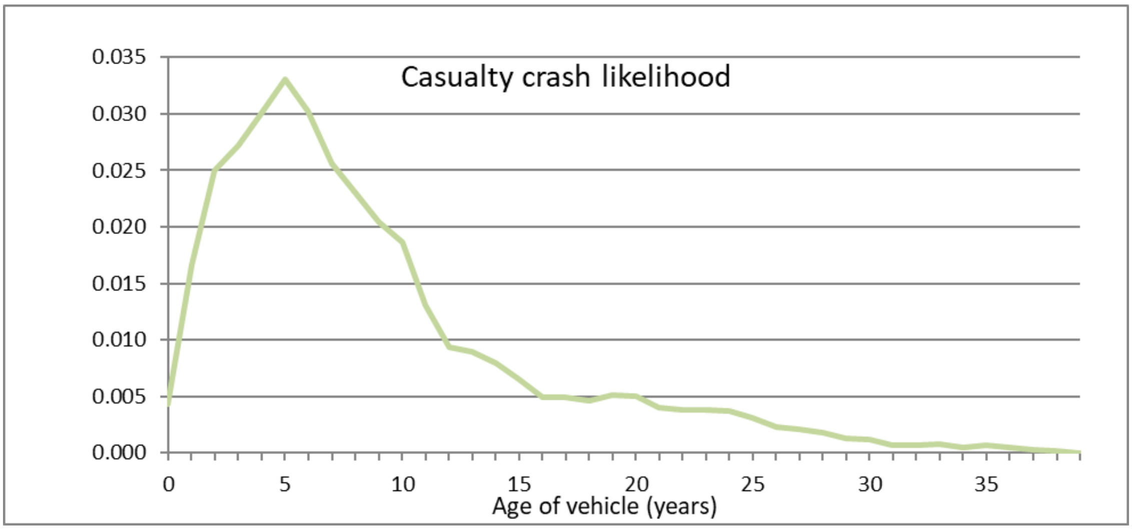


Figure 11: Crash likelihood by age

4. New combined vehicle sales data for applicable vehicle categories was established:

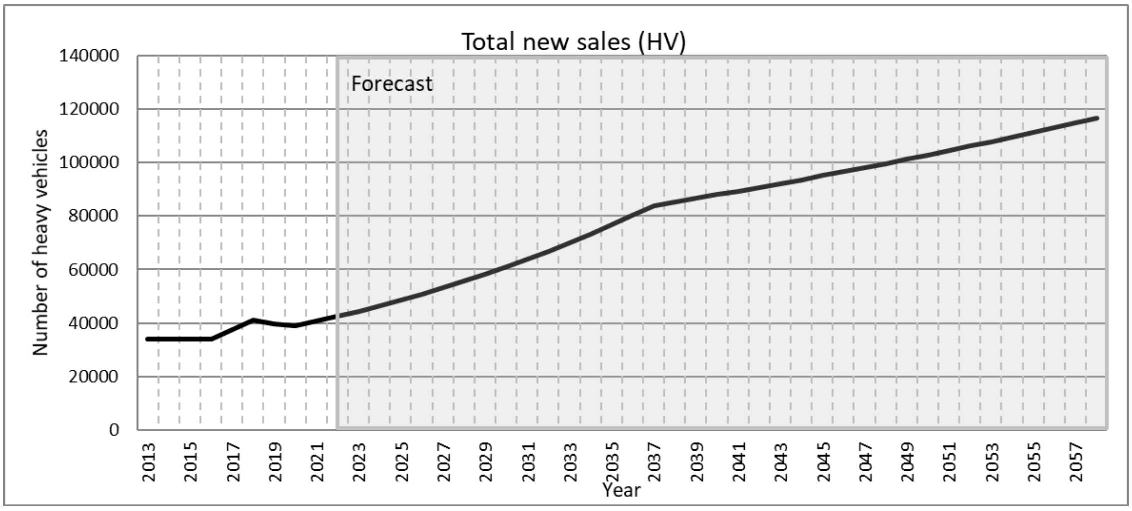


Figure 12: Past and projected heavy vehicle sales

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

5. The projected increased fitment rate at sale was established for Option 2 (solid line – BAU):

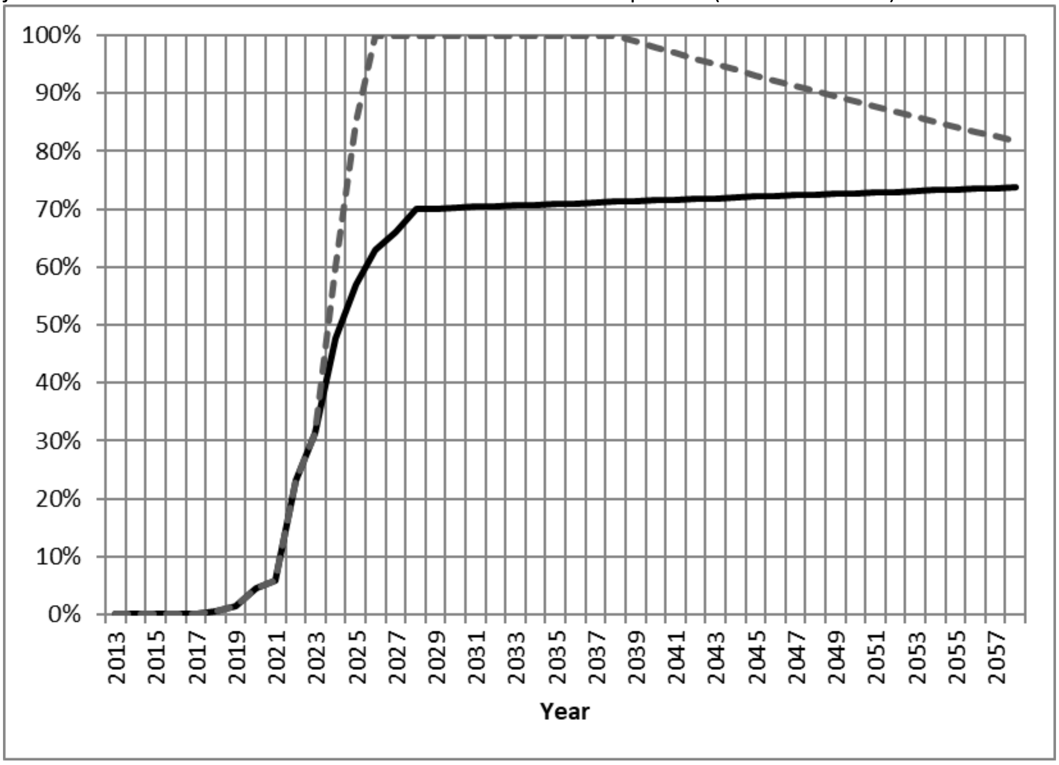


Figure 13: Projected fitment effect

6. Fitment increase by year is determined from available sales data (step 4) and fitment data (step 5):

Fitment increase over BAU at sale	
Year	Option 2
2024	5,772
2025	13,600
2026	18,750
2027	18,022
2028	16,633
2029	17,332
2030	18,062
2031	18,824
2032	19,619
2033	20,449
2034	21,315
2035	22,219
2036	23,163
2037	24,148
2038	24,421
2039	23,832
2040	23,227
2041	22,606
2042	21,969
2043	21,315
2044	20,645
2045	19,957
2046	19,251
2047	18,527
2048	17,786
2049	17,025
2050	16,245
2051	15,446
2052	14,627
2053	13,788
2054	12,929
2055	12,048
2056	11,146
2057	10,222

7. The table below shows for each year of fitment increase at sale due to intervention, the additional fitment costs calculated over the intervention period (15 years):

Additional fitment costs ($)	
Year	Option 2
2024	7,214,507
2025	16,999,733
2026	23,437,537
2027	22,528,049
2028	20,790,712
2029	21,665,043
2030	22,577,544
2031	23,529,896
2032	24,523,856
2033	25,561,257
2034	26,644,009
2035	27,774,111
2036	28,953,646
2037	30,184,788
2038	30,526,104

8. From the first year of intervention (November 2024), the number of crashes affected by the increased fitment was determined for each year over a 37 year period (2 year implementation and 35 years of analysis), for the viable intervention option as shown in the tables below. The crashes affected each year are the product of the likelihood of a crash at the vehicle's age (from step 3) with the increased fitment at sale (step 5), summed as they infiltrate the fleet over time.

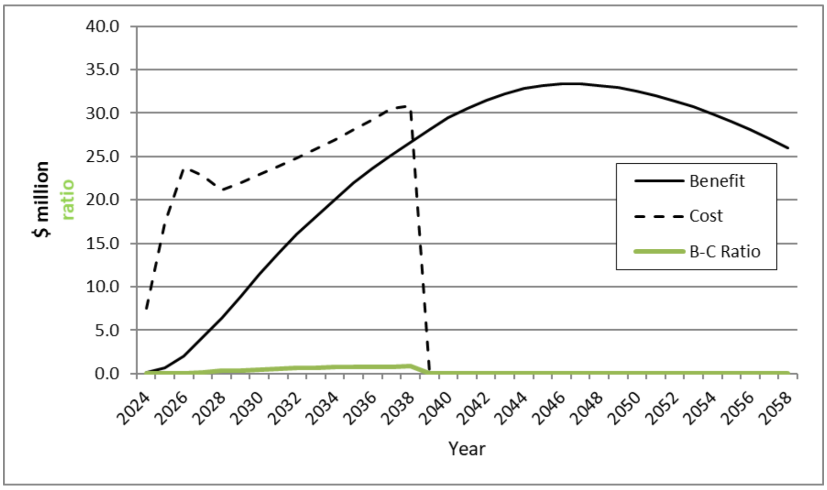
Year	Vehicle Age																																	Total vehicles
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	..	..	36	37	
1	25																													..	..			25
2	96	59																												..	..			154
3	144	226	81																											..	..			451
4	157	340	312	78																										..	..			886
5	174	370	468	300	72																									..	..			1383
6	191	409	510	450	277	75																								..	..			1911
7	174	450	564	490	415	288	78																							..	..			2459
8	148	411	620	542	452	433	300	81																						..	..			2987
9	133	348	567	596	500	471	451	313	84																					..	..			3463
10	118	312	480	545	550	521	491	470	326	88																				..	..			3902
11	108	278	431	461	503	573	543	512	490	340	92																			..	..			4331
12	75	254	384	414	425	524	598	566	534	511	354	96																		..	..			4734
13	54	178	350	369	382	443	546	623	590	556	532	369	100																	..	..			5092
14	52	128	245	336	340	398	462	569	649	615	580	555	385	104																..	..			5417
15	46	122	176	236	310	355	415	481	593	677	641	604	578	401	105															..	..			5740
16	38	107	168	169	217	323	370	432	502	618	705	668	630	603	406	103														..	..			6059
17	28	89	148	161	156	226	337	385	451	523	644	735	697	657	610	396	100													..	..			6343
18	28	67	123	142	149	163	236	351	402	470	545	672	766	726	664	595	386	97												..	..			6582
19	27	67	92	118	131	155	169	246	366	419	490	568	700	799	734	648	580	376	95											..	..			6780
20	30	63	93	88	109	137	161	177	256	382	436	510	592	730	808	717	632	564	365	92										..	..			6942
21	29	70	87	89	81	113	143	168	184	267	398	455	532	618	738	788	698	615	548	354	89									..	..			7066
22	23	69	97	84	82	85	118	149	175	192	279	415	474	555	625	720	768	680	597	532	343	86								..	..			7148
23	22	55	95	93	77	86	88	123	155	183	200	290	432	494	561	610	702	748	661	580	515	332	83							..	..			7185
24	22	52	76	91	86	81	89	92	128	162	191	208	303	451	500	547	594	683	727	641	561	498	320	80						..	..			7183
25	21	52	72	73	84	89	84	93	96	134	168	199	217	316	456	488	534	578	664	705	621	543	481	308	77					..	..			7151
26	18	50	72	69	67	88	93	88	97	100	139	176	207	226	319	445	475	519	562	644	683	600	524	463	296	73				..	..			7092
27	13	42	69	69	64	70	91	97	91	101	104	145	183	216	229	311	433	463	505	545	624	660	579	504	444	283	70			..	..			7006
28	12	31	58	66	63	66	73	95	101	95	105	109	151	191	218	224	304	422	450	490	528	603	637	557	484	425	270	66		..	..			6895
28	10	28	42	56	61	66	69	76	99	106	99	110	113	158	193	213	218	295	410	436	474	510	582	613	535	463	406	257	63	..	..			6762
30	8	24	38	41	52	64	69	72	79	103	110	103	114	118	160	188	208	212	287	398	423	458	492	560	588	512	442	386	243	..	..			6612
31	7	18	33	37	38	54	66	72	75	82	108	115	108	119	120	156	184	202	206	279	385	408	442	474	538	563	489	420	365	..	..			6446
32	0	16	25	32	34	39	56	69	75	78	86	112	120	112	121	117	152	179	196	200	270	372	394	426	455	515	537	464	398	..	..			6261
33	0	0	23	24	29	36	41	58	72	78	81	90	117	125	114	118	114	148	174	191	194	261	359	379	409	435	491	511	440	..	..			6055
34	0	0	0	22	22	31	37	43	61	75	81	85	93	122	126	111	115	111	144	168	185	187	252	346	364	391	416	467	484	..	..			5833
35	0	0	0	0	20	23	32	39	44	63	78	85	88	97	124	123	108	112	108	139	163	178	181	242	332	348	373	395	442	..	..			5599
36	0	0	0	0	0	21	24	33	40	46	66	82	88	92	98	121	120	105	108	104	135	158	172	174	232	318	332	355	374	..	..	36		5355
37	0	0	0	0	0	0	22	25	35	42	48	69	85	92	93	96	118	117	102	105	101	130	152	166	167	222	303	316	336	..	..	138	31	5099

9. From the number of crashed affected determined in the previous step, the trauma alleviated by Option 2 by year as the product of effectiveness for each trauma type and the impact of the technology is determined:

Year	Option 2		
	Fatal	Major	Minor
2024	0.40	11.08	34.48
2025	0.61	16.76	52.16
2026	0.81	22.23	69.16
2027	1.00	27.41	85.28
2028	1.18	32.38	100.76
2029	1.35	37.13	115.53
2030	1.51	41.42	128.89
2031	1.64	45.21	140.67
2032	1.77	48.64	151.37
2033	1.89	51.94	161.64
2034	2.01	55.26	171.97
2035	2.13	58.64	182.49
2036	2.25	61.90	192.63
2037	2.36	64.77	201.55
2038	2.44	67.14	208.93
2039	2.51	69.01	214.76
2040	2.56	70.45	219.24
2041	2.60	71.46	222.38
2042	2.62	72.01	224.07
2043	2.62	72.09	224.34
2044	2.61	71.82	223.49
2045	2.59	71.32	221.92
2046	2.57	70.61	219.73
2047	2.53	69.66	216.78
2048	2.49	68.48	213.09
2049	2.44	67.10	208.79
2050	2.38	65.55	203.98
2051	2.32	63.85	198.68
2052	2.25	61.94	192.74
2053	2.18	59.82	186.15
2054	2.09	57.53	179.03
2055	2.01	55.13	171.54
2056	1.91	52.62	163.73
2057	1.82	49.99	155.55
2058	1.72	47.24	146.99

10. From demographic information provided by MUARC (MUARC, 2019) and the totals established in step 9, the typical age of a sensitive fatality was used to determine the cost to society due to loss of life according to the Willingness to Pay (WTP) method. The typical cost of a serious and minor injury was established using methods outlined in BITRE Report 102.

11. Summary plot for Option 2 by year:



Appendix F – Acronyms and abbreviations

ABS	Antilock Brake System
AEB/AEBS	Autonomous (Advanced) Emergency Braking (System)
ADAS	Advanced Driver Assistance Systems
ADR	Australian Design Rule
ALRTA	Australian Livestock and Rural Transporters Association
ARTSA	Australian Road Transport Suppliers Association
BAU	Business as Usual
BCR	Benefit-Cost Ratio
BIC	Bus Industry Confederation
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BSW	Blind Spot Warning
BTE	Bureau of Transport Economics (now BITRE)
CCA	Competition and Consumer Act 2010
CEO	Chief Executive Officer
C'th	Commonwealth
CVIAA	Commercial Vehicle Industry Association Australia
EPA	Environment Protection Authority
ESC	Electronic Stability Control
EU GSR	European Union General Safety Regulation
FCW	Forward Collision Warning
FMVSS	Federal Motor Vehicle Safety Standard
GVM	Gross Vehicle Mass
ISA	Intelligent Speed Assist
ITMM	Infrastructure and Transport Ministers Meeting
ITSOC	Infrastructure and Transport Senior Officials' Committee
LDWS	Lane Departure Warning System
LKA	Lane Keep Assist
MUARC	Monash University Accident Research Centre
MVSA	Motor Vehicle Standards Act 1989
NHTSA	National Highway Traffic Safety Administration
NPV	Net Present Value
NRSS	National Road Safety Strategy 2021-2030
NTARC	National Truck Accident Research Centre
NTC	National Transport Commission
OEM	Original Equipment Manufacturer
OBPR	Office of Best Practice Regulation
ORS	Office of Road Safety
PBS	Performance Based Standards
RBM	Regulatory Burden Measurement
RIS	Regulation Impact Statement

RSC	Roll Stability Control
RVSA	Road Vehicles Standards Act 2018
SCA	Side Curtain Airbag
SPECTS	Safety, Productivity & Environment Construction Transport Scheme
SVSEG	Strategic Vehicle Safety and Environment Group
TfNSW	Transport for New South Wales
TIC	Truck Industry Council
TISOC	Transport and Infrastructure Senior Officials' Committee
TLG	Technical Liaison Group
UN	United Nations
US	United States
WP.29	UN World Forum for the Harmonization of Vehicle Regulations

Appendix G – Glossary of terms

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

Net Present Value (NPV)	The difference between the present economic value (determined using an appropriate discount rate) of all expected benefits and costs over time due to a change of policy relative to business as usual.
Road Crash Fatality	A person who dies within 30 days of a crash as a result of injuries received in that crash.
Rear-end Crash	Denotes a scenario involving two vehicles, where the second vehicle strikes the rear of the first vehicle.
Type Approval	Written approval of an authority/body that a vehicle type (i.e., model design) satisfies specific technical requirements.

Appendix H – Heavy vehicle categories

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

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

OMNIBUSES (M)

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

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

LIGHT OMNIBUS (MD)

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

Sub-category MD1 – up to 3.5 tonnes '*Gross Vehicle Mass*'

MD2 – up to 3.5 tonnes 'Gross Vehicle Mass'

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

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

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

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

HEAVY OMNIBUS (ME)

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

GOODS VEHICLES (N)

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

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

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

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

MEDIUM GOODS VEHICLE (NB)

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

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

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

HEAVY GOODS VEHICLE (NC)

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