ECONOMIC CONNECTIONS (P/L)

Submission to the Transport for NSW Inquiry to improve bus safety

Anthony Ockwell and John Gaffney

November 2023

Economic Connections Pty Ltd (ECON) has prepared this Submission to assist Transport for NSW to assist in their Inquiry on bus safety following the Hunter Valley bus crash, and to support those impacted by that crash through the on-going work of the group ***"Stop Bus Tragedies"****. The authors are Anthony Ockwell and John Gaffney.*

This submission is supplied in good faith and reflects the knowledge and experience of the consultants involved. To the extent lawful, Economic Connections Pty Ltd accepts no responsibility whatsoever for any loss occasioned by any person acting or refraining from action as a result of reliance on this report. Where such liability cannot be excluded, it is reduced to the full extent lawful. Respondents should use their own judgment and skill when using information contained in this submission.

The submission is based on the information and industry advice available at the time of writing. We acknowledge the use of published information as background material in the preparation of this submission.

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Overview

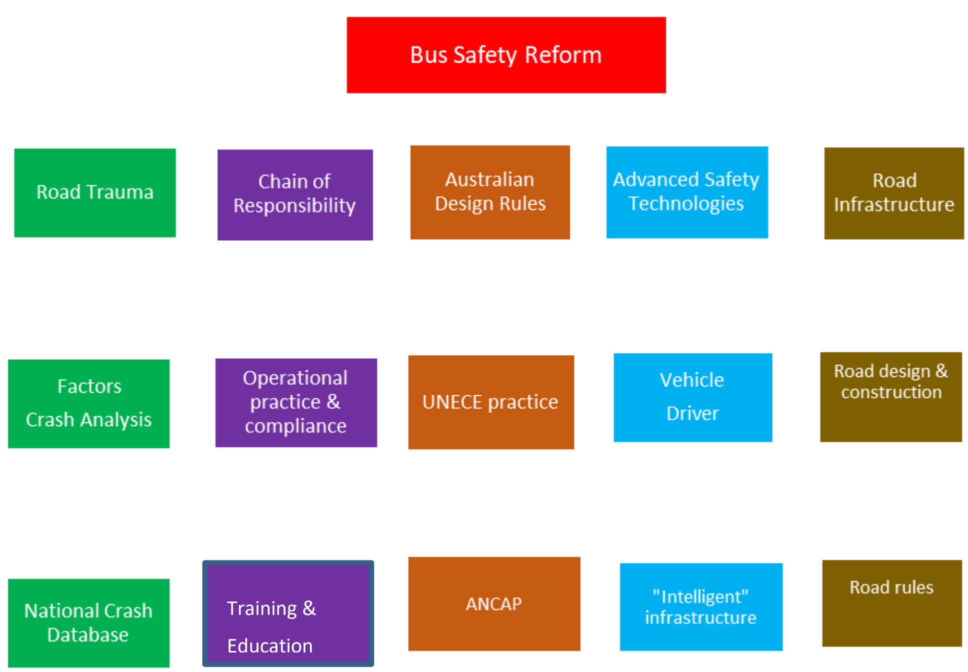
The Hunter Valley bus crash which occurred on 11 June 2023 at approximately 11:30pm had a devastating impact on the bus occupants, families and friends of those who were on the bus, and first responders (police, paramedics, fire fighters, civilians). The second-round impacts on road infrastructure, the legal system, transport services/providers/users, and local communities will, like the direct impact on those directly affected, continue to reverberate through the lives of many people for decades to come.

The preliminary indicative economic cost of the road trauma generated by this bus crash is estimated at $(2023)61.672 million. This cost is based on a “willingness to pay” approach as used by ECON 2017 (and many OECD countries), and subsequent on-going work undertaken by ECON on road trauma. This is not to infer that human tragedy can be costed – only those impacted have some understanding of the deep value that a daughter, son, or friend contributed to the lives of those around them. Rather, it is to try to put into perspective the economic cost of such road trauma against the cost of measures that could be implemented to hopefully mitigate the likelihood of such levels of road trauma re-occurring.

This submission covers five key areas considered to be critical in supporting the NSW Government’s inquiries into the Hunter Valley bus crash, and their commitment to improve road safety. These areas include:

1. Road trauma
2. Chain of responsibility
3. Australian Design Rules (ADRs)
4. Telematics and road safety
5. Road infrastructure

The broad dimensions of the possible factors that should be investigated in the aftermath of the Hunter Valley bus crash to improve bus safety in Australia are summarised in the following figure.



RECOMMENDATIONS

1. Road trauma

Recommendation 1.1:

The Commonwealth Government, through the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) should consider the re-establishment of a dedicated group that examines coroners' reports covering all fatal road crashes in order to develop a consolidated database on factors contributing to crashes to provide a sound base for future road safety policy development. This was a primary focus of the former Federal Office of Road Safety (FORS) until its incorporation as part of the Australian Transport Safety Bureau (ATSB). This unit could either be part of the DITRDCA, or an independent research unit housed within an existing organisation, such as the Monash University Research Centre (MUARC) or the Australian Institute of Health and Welfare (AIHW), and fully funded by the Commonwealth Government.

Recommendation 1.2:

Under Commonwealth leadership, establish a national approach to the development and establishment of a fatal crash reporting system, including a major review of the crash record with a view to broadening and automating the collection of data relating to the crash scene. This should also encompass guidelines on the form and content of coroners' reports on fatal crashes. As part of this review, the Commonwealth and the States/Territories should revisit the concepts and principles detailed in the ATC Report (ATC 2004) on establishing a National Transport Data Framework on access to and exchange of transport data to complement the National Exchange of Vehicle and Driver Information System (NEVDIS) established under Austroads in 1998.

Recommendation 1.3:

A detailed study of bus crashes in Australia should be undertaken, which employs a system methodology and which includes factors leading up to a bus crash, factors involved in the crash and factors associated with post-crash outcomes (fatalities, serious injuries, minor injuries, property damage only).

Recommendation 1.4:

All fatal crashes should be the subject to a specialised crash investigation team to better understand the critical role that relevant factors may have played in contributing to the outcome. This could be the domain of the ATSB. This should be undertaken independently of police investigations, and encompass factors such as: driver behaviour and passengers (age profile), vehicle standards (VIN, technology, telematics, age, types, after-market modifications, lights on/off, seat belts fitted/worn), road infrastructure (standard, line of sight, proximity of trees, roadside barriers, road markings, speed limit, presence of wildlife, roadside signage, etc) and weather conditions. These data points should be included in the development of a national road safety data base, as suggested in Recommendation 1 above.

2. Chain of responsibility

Recommendation 2.1:

This submission supports the following recommendation contained in the PC report (PC 2020):

> RECOMMENDATION 6.2 – CLARIFYING HEAVY VEHICLE CHAIN OF RESPONSIBILITY OBLIGATIONS
>
> The Council of Australian Governments should endorse amendments to the Heavy Vehicle National Law to clarify the obligations of regulated parties under Chain of Responsibility laws. The amendments to the Heavy Vehicle National Law should empower the National Heavy Vehicle Regulator to:
>
> - publish 'acceptable means of compliance' with Chain of Responsibility laws for transport operators and other parties in the supply chain
> - accredit other approaches to compliance, with the costs of accreditation to be borne by the regulated parties.

Recommendation 2.2:

The "acceptable means of compliance" should also include driver responsibility and access to information covered by the Australian Government Fair Work Ombudsman relevant to the appointment of new employees where the safety of other road users may be at risk based on past behavior. This should include access to driving history.

Recommendation 2.3

Formation of a joint industry/government working group, including the NTC, under the NVHR that focuses on HV safety with a strong emphasis on bus safety.

3. Australian Design Rules (ADRSS)

Recommendation 3.1:

Support the current review of the ADR process, and the need to streamline the ADR process by maintaining direct engagement with UNECE on directions for the adoption of advanced vehicle/driver safety technologies.

Recommendation 3.2:

Promote the adoption of advanced safety features such as seat belt monitoring systems for passenger buses, fatigue monitoring systems, roll-over warning devices by adopting, where appropriate, proven technologies where supported by evidence/protocols introduced by Euro NCAP, UNECE regulations. The introduction of complementary safety technologies, such as eCall, also warrant inclusion in reducing road trauma.

Recommendation 3.3:

ANCAP has played a significant role in leading the new car market in its access and availability of safer vehicles, ahead of the ADR process. Governments should continue to support ANCAP in its work to advance vehicle safety through vehicle testing and publication of its ratings for new vehicles, including heavy vehicles (trucks and passenger buses).

Recommendation 3.4:

Establish a bus safety testing facility in Australia being an extended version of ANCAP with an aim to test rollovers structural strength, passenger ejection, passenger egress and window integrity, as well as for testing advance safety assistance technologies (SAT).

4. Telematics and road safety

Recommendation 4.1:

Australia should review relevant UNECE regulations with a view to fast tracking the adoption of the EU Bus Safety Regulations, through interim adoption where appropriate. A clear timeframe for the full implementation of these regulations should be prepared with any of these regulations not adopted by 2025 being the subject of a detailed publicly available report covering the technical and economic factors not supporting implementation.

Recommendation 4.2:

UNECE regulation R165/2014 requires tachographs to be fitted to passenger and goods vehicles over 7.5 tonnes. Consideration should be given to having this installed on all buses less than 10 years old and also on all coaches travelling in regional areas, with the necessary backend monitoring systems put in place.

Recommendation 4.3:

Consideration be given to have UNECE R160/2021 covering Vehicle Event Data Recorders (VEDR) to record critical details in the event of a crash on all new buses (up to 8 passengers, excluding the driver). It would also seem to be important to extend this in Australia to cover heavy goods vehicles greater than 4.5 t GVM and ME class buses (greater than 5 t GVM).

Recommendation 4.4:

The Commonwealth Government should consider commissioning research, similar to that undertaken by the Transport Research Laboratory for TfL), to monitor developments in safety technologies, and their adoption overseas, to improve the operational safety and performance of buses in Australia. Such international experience could be drawn upon as part of any revised process to streamline the approach to implementing new/revised ADRs in Australia. This could be undertaken by an organisation such as ANCAP.

5. Road infrastructure

Recommendation 5.1

The Austroads road construction guidelines and standards, together with Austroads road rules, need to be reviewed with the aim of reaching agreement across all jurisdiction to provide clear and consistent signals to drivers using road networks.

Recommendation 5.2

Roads with extensive use of guardrail on curves requires investigation in relation to their design standards and where solutions cannot be developed to constrain heavy vehicles, their speed in these locations should be reduced.

Recommendation 5.3

While NSW in its response to the first Inquiry Report on the Hunter Valley Bus Crash has announced the implementation of greater enforcement measures for non-compliance with seat belt wearing, with over 15% of Australia's road fatalities related to non-compliance, a sustained national awareness campaign of promoting road safety is required.

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Abbreviations

AAA	Australian Automobile Association
ABS	Australian Bureau of Statistics
AEB	Autonomous Emergency Braking
ANCAP	Australasian New Car Assessment Program
ATSB	Australian Transport Safety Bureau
BITRE	Bureau of Infrastructure, Transport and Research Economics
CASR	Centre for Automotive Safety Research
CPI	Consumer price index
ECON	Economic Connections Pty Ltd
ESC	Electronic Stability Control
GTR	Global Technical Regulation
GVM	Gross vehicle mass
HGV	Heavy goods vehicle exceeding 12 tonnes GVM
HV	Heavy vehicle exceeding 4.5 tonnes GVM (heavy buses are outside scope)
km	Kilometre
kph	Kilometres per hour
LCV	Light commercial vehicle (up to 3.5 tonnes GVM)
LKA	(Active) Lane Keep Assist
LV	Light vehicle of up to 3.5 tonnes GVM
MUARC	Monash University Accident Research Centre
NHVR	National Heavy Vehicle Regulator
N(R)TC	National (Road) Transport Commission
Euro NCAP	European New Car Assessment Program
na	Not applicable
OBPR	Office of Best Practice Regulation
SI	Serious, or hospitalised, injury
SUV	Sports utility vehicle
vkt	Vehicle kilometres travelled
VRU	Vulnerable road user

1. Road Trauma

1.1 Background

Between 1970 and 2015, distance travelled on the nation's roads tripled, from 19.2 billion vkt to 59.7 billion vkt (ABS 2015, 2017). From 1971 to 2015, average vkt per vehicle declined by 8.8 per cent from 14,686 km per vehicle to 13,400 km per vehicle, or at an average annual rate of 0.2 per cent. More recently, average vkt per vehicle declined by 11 per cent to 12,100 over the five years to 2020 (all vehicles), or an average annual rate of -2.2 per cent.

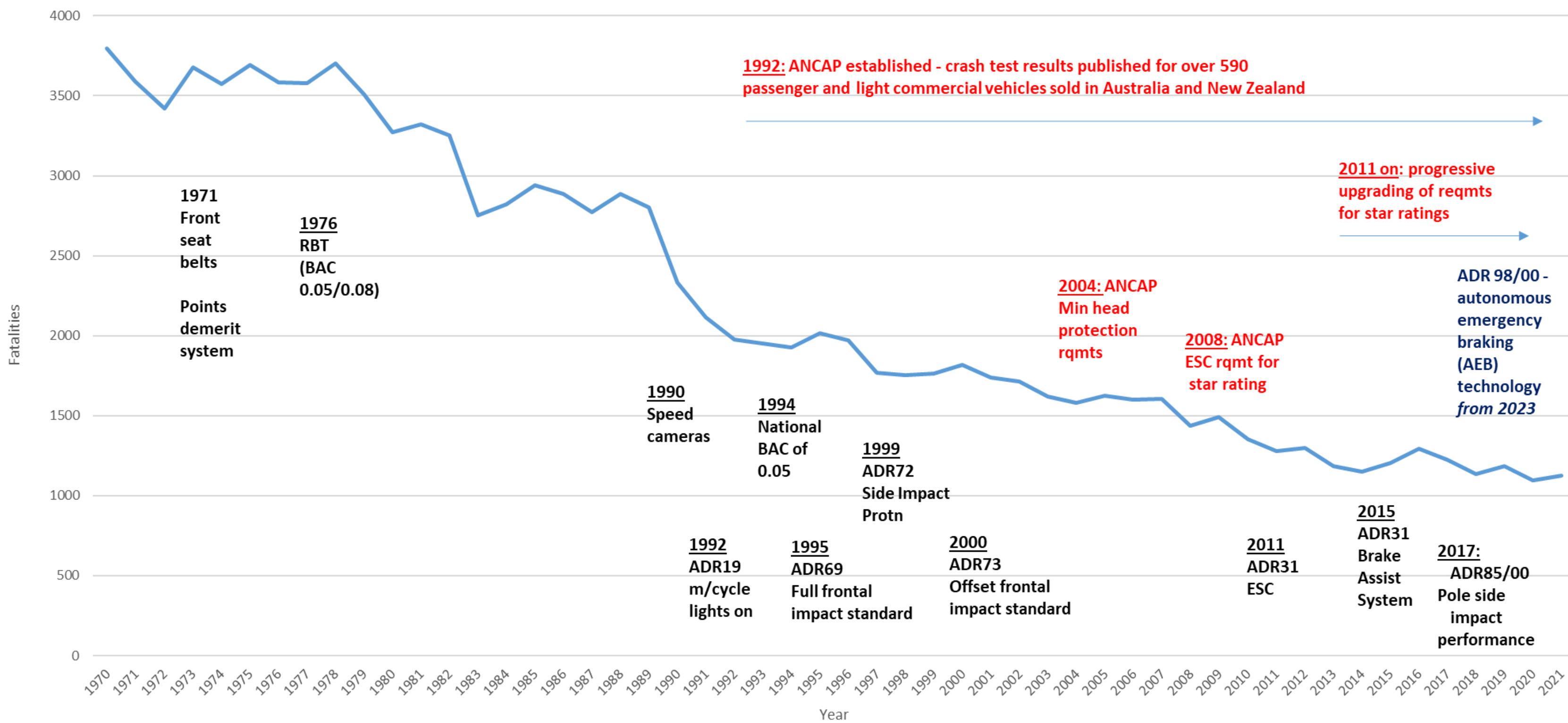
Despite a 63 per cent increase in average vkt per person between 1971 and 2015, from 6,080 to 9,220 km per person, the fatality rate per 100,000 population declined markedly, from 27.6 in 1971 to 5.1 in 2015. Road fatalities have witnessed a long-term downward trend since peaking at 3,798 in 1970 and falling to 1,205 in 2015 (Figure 1). Since 2015, the fatality rate has declined further to 4.3 per 100,000 population in 2021 or 1,123 fatalities (and 1,118 fatalities or an estimated 4.5 fatalities per 100,000 population in 2022).

As shown in Figure 1, a number of key factors have contributed to the long-term decline in road trauma in Australia:

- Introduction of compulsory wearing of seat belts in light vehicles (1972)
- Changes in driver behaviour as a result of enhanced law enforcement policies and procedures (e.g. random breath testing for alcohol and drugs, national blood alcohol concentration of 0.05 down from 0.08, speed and red light cameras, speed monitoring/limits such as 40 kilometre per hour speed limits around schools and shopping areas)
- Changes in vehicle design and regulations to ensure vehicle safety – Australian Design Rules (ADRs) and active involvement of ANCAP since 1992
- Greater focus on vulnerable road users (e.g. compulsory wearing of cyclist helmets)
- Targeted investment by state and Commonwealth governments in improving road infrastructure to address crash blackspots
- Introduction of improved vehicle safety technologies, including Electronic Stability Control (ESC), Autonomous Electronic Braking (AEB), Side Impact Protection Systems, Intelligent Speed Adaptation, Advanced Driver Assistance (ADAS), Fatigue Warning/Management (FMS), Side blind-spot/lane change warnings (LCW), Lane Departure Warning systems (LDW), and Forward Collision Warning/Alert (FCW) (MUARC undated)
- Improved emergency response (coverage and reduced delays) and triage, and improved post-crash medical interventions and care leading to reduced mortality and morbidity.

Hospitalised injuries increased at an average rate of growth of 1.6 per cent a year between 2008 and 2019. Absolute increases were recorded in three principal road user groups: passenger vehicle occupants, motorcyclists and pedal cyclists. The (fourth largest) pedestrian group showed a small reduction, from 2,777 to 2,635 hospitalisations. Hospitalised (serious) injuries increased from around 34,000 in 2008 to just under 40,000 in 2018.

Figure 1: Road fatalities and key countermeasures, Australia, 1970 to 2021



As shown in Table 1, the share of fatalities attributable to bus related crashes averaged 1.6% of total road fatalities between 2012 and 2022. From Table 2, the number of fatalities per bus related crash averaged 1.11 from 2012 to 2022 which was higher than the average for all fatal road crashes at 1.08 over the same period.

Table 1: Fatal crashes in Australia 2012 to 2022 by heavy vehicle type

Calendar year	Articulated truck involved	Heavy rigid truck involved	Any heavy truck involved	Bus involved	All fatal road crashes	Bus Share of Total
2012	130	87	212	19	1,190	1.6%
2013	95	61	151	11	1,101	1.0%
2014	101	76	176	16	1,051	1.5%
2015	102	72	170	19	1,100	1.7%
2016	93	75	164	23	1,198	1.9%
2017	93	87	170	27	1,126	2.4%
2018	78	63	136	21	1,054	2.0%
2019	95	81	173	14	1,100	1.3%
2020	86	63	147	13	997	1.3%
2021	96	63	156	14	1,049	1.3%
2022	80	90	166	17	1,118	1.5%
AV./YEAR No.	92	73	161	18	1,089	
AV./YEAR %	8.4	6.7	14.8	1.6		1.6

Source: BITRE 2023 and ECON analysis

Table 2: Fatalities per heavy vehicle crash in Australia 2012 to 2022

Calendar year	Articulated truck involved	Heavy rigid truck involved	Any heavy truck involved	Bus involved	All fatal road crashes
2012	1.21	1.07	1.16	1.16	1.09
2013	1.21	1.08	1.17	1.09	1.08
2014	1.14	1.16	1.15	1.25	1.10
2015	1.13	1.13	1.12	1.16	1.09
2016	1.14	1.12	1.13	1.04	1.08
2017	1.14	1.06	1.10	1.19	1.09
2018	1.15	1.14	1.14	1.10	1.08
2019	1.07	1.10	1.09	1.14	1.08
2020	1.20	1.08	1.15	1.08	1.10
2021	1.10	1.06	1.09	1.00	1.08
2022	1.11	1.12	1.11	1.00	1.07
AVERAGE 2012-22	1.15	1.10	1.13	1.11	1.08
AVERAGE 2015-19	1.13	1.11	1.11	1.12	1.08

Source: BITRE 2023 and ECON analysis

The PC Inquiry (PC 2020) on transport reforms covering the heavy vehicle sector included all heavy vehicles with a GVM of greater than 4.5 tonnes (trucks and passenger buses). The PC concluded that the decline in heavy vehicle related road crashes is related to factors other than what could be attributed to the reform process, *viz*. road infrastructure and maintenance, driver education and training, enforcement of roads rules, and improvements in vehicle design, reliability and safety features (PC 2020). These factors are relevant to all vehicles types.

In Table 3, estimates of the number of fatalities that may be attributable to a restraint not being used are presented. For the period 2012 to 2020, an average of 15% of total road fatalities are related to non-compliance with restraint usage.

Table 3: Restraint not used as a percentage of known seatbelt wearing rates related fatalities

Year	Restraint Used	Restraint not Used	Unknown or not Applicable	Total Road Fatalities	Total Fatalities less "Unknowns"	Restraint not used/Knowns)
2012	510	156	204	1300	1096	14%
2013	446	142	169	1187	1018	14%
2014	437	160	164	1151	987	16%
2015	484	177	147	1204	1057	17%
2016	533	156	142	1292	1150	14%
2017	506	133	162	1222	1060	13%
2018	426	124	175	1134	959	13%
2019	444	140	189	1186	997	14%
2020	414	154	155	1096	941	16%
Av./Year						**15%**

In the case of buses/coaches, for the period 2006 to 2019 from Victorian data, estimates of the total number of people killed, seriously injured or suffered minor injuries associated with seat belt compliance/non-compliance are shown. The estimates are based on the following:

$$\text{Total killed and injured (\%)} = \frac{\text{Restraint Used}}{\text{[Total Killed or Injured Seatbelt – (Seatbelt Not Fitted – Seatbelt Wearing Not Appropriate - Seatbelt Wearing Unknown)]}}$$

and,

$$\text{Total killed and injured (\%)} = \frac{\text{Restraint Not Used}}{\text{[Total Killed or Injured Seatbelt – (Seatbelt Not Fitted – Seatbelt Wearing Not Appropriate - Seatbelt Wearing Unknown)]}}$$

This suggests that for bus/coach occupants, where seatbelts were fitted, approximately one-third of known cases of total fatalities/injuries related to passengers who were non-seatbelt compliant (Table 4).

Table 4: Bus/Coach Occupants with Injuries (killed, seriously injured or other injury): known wearing rates of seatbelts based on Victorian data 2006 to 2020

Year	Seatbelt Worn	Seatbelt Not Worn	Seatbelt Not Fitted	Seatbelt Wearing Not Appropriate	Seatbelt Wearing Unknown	Total "Unknowns" (D+E+F)	Net total killed or Injured where seatbelts usage was known	Total Killed or Injured
2006	13	6	15	10	33	58	19	77
2007	13	16	27	5	37	69	29	98
2008	9	12	6	22	42	70	21	91
2009	28	17	17	3	77	97	45	142
2010	27	13	27	3	41	71	40	111
2011	22	7	11	19	53	83	29	112
2012	13	8	2	9	51	62	21	83
2013	14	12	19	9	33	61	26	87
2014	23	12	26	14	30	70	35	105
2015	39	11	4	19	54	77	50	127
2016	26	6	7	15	32	54	32	86
2017	38	13	1	16	33	50	51	101
2018	8	7	2	8	6	16	15	31
2019	38	15	3	14	45	62	53	115
2020 *	5	1	1	0	27	28	6	34
Total	**316**	**156**	**168**	**166**	**594**	**928**	**472**	**1400**
Worn of known (%)	**67%**							
Not worn of known (%)		**33%**						

*** incomplete**

In the case of minibus occupants, where seatbelts were fitted, approximately 11% of known cases of total fatalities/injuries related to passengers who were non-seatbelt compliant (Table 5).

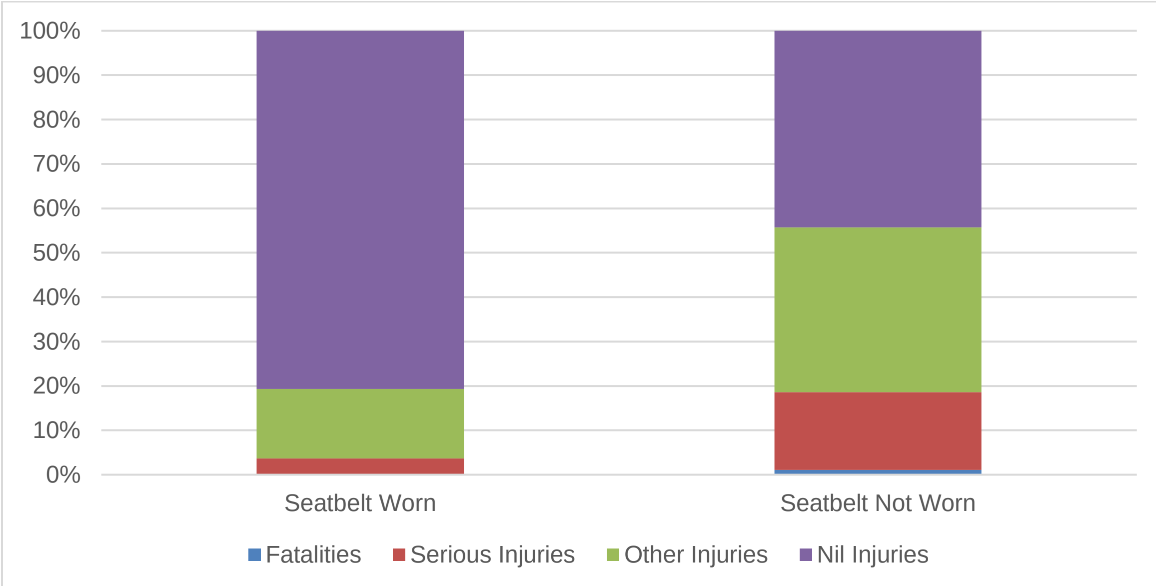
Table 5: Minibus Occupants with Injuries (killed, seriously injured or other injury): known wearing rates of seatbelts based on Victorian data 2006 to 2020

Year	Seatbelt Worn	Seatbelt Not Worn	Seatbelt Not Fitted	Seatbelt Wearing Not Appropriate	Seatbelt Wearing Unknown	Total "Unknowns" (D+E+F)	Net total killed or Injured where seatbelts usage was known	Total Killed or Injured
2006	35	2	0	0	19	19	37	56
2007	8	1	0	0	14	14	9	23
2008	9	3	0	0	6	6	12	18
2009	31	2	0	0	6	6	33	39
2010	11	2	0	0	14	14	13	27
2011	23	2	0	0	4	4	25	29
2012	11	0	0	0	10	10	11	21
2013	8	1	0	0	4	4	9	13
2014	19	2	0	0	6	6	21	27
2015	38	4	0	0	5	5	42	47
2016	8	0	0	1	4	5	8	13
2017	19	0	0	0	10	10	19	29
2018	20	5	1	2	16	19	25	44
2019	17	7	1	4	10	15	24	39
2020*	2	1	0	0	2	2	3	5
Total	**259**	**32**	**2**	**7**	**130**	**139**	**291**	**430**
Worn of known (%)	**89%**							
Not worn of known (%)		**11%**						

*** Incomplete**

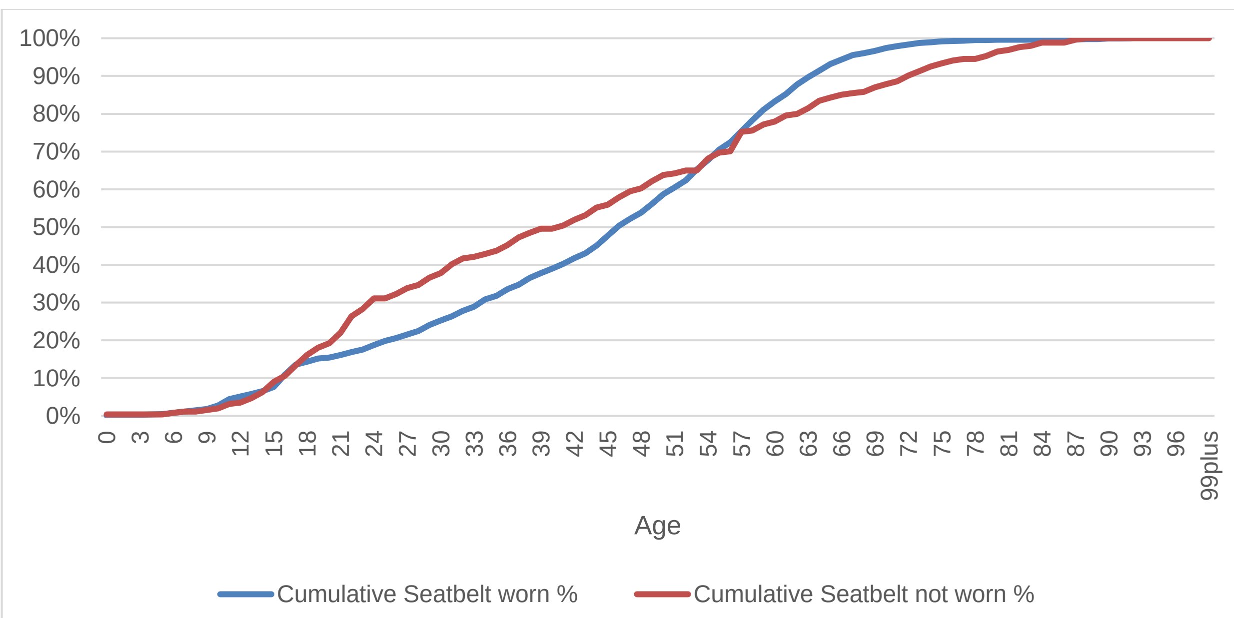
A comparison of injury outcomes of those wearing a seatbelt and those known not to be wearing a seatbelt is shown in Figure 2. For those wearing a seatbelt the probability of a non-injury outcome is > 80.7%, being almost twice that of non-seatbelt wearing (44.3%). In terms of "minor injury" 15.6% associated with seatbelt compliance compared to 37.1% for non-seatbelt compliance (2.5 times safer) and for those receiving a "serious injury" or "fatality", 3.7% compared to not wearing a seatbelt being 18.6% (5 times safer).

Figure 2: Bus/Coach Occupants comparison of Injuries (killed, seriously injured or other injury): known wearing rates of seatbelts based on Victorian data 2006 to 2020



Shown in Figure 3 is the cumulative percentage of bus occupant age comparing seatbelt and non-seatbelt wearing and which reveals that between about 18 and 25 years of age there is a marked jump (15% increase) in this age group. After Age 60 there is also a marked reduction in non-seatbelt wearing which may be a product of the intensive education programs on seatbelt wearing that occurred in the 1970's when seatbelt introduction drastically reduced fatal crashes and serious injuries (as shown in Figure 1)

Figure 3: Bus/Coach cumulative % of Bus/Coach Occupant Age comparing seatbelt wearing and non-seatbelt: known wearing rate based on Victorian data 2006 to 2020



Note: Based on Victorian Crash Data 2006 to 2020(2020 data are incomplete).

1.2 Issues

At the national level, time series data on crashes involving heavy vehicles (buses and trucks) are disjointed and require major overhaul if they are to properly serve the development of road safety policy in Australia.

A central issue surrounding the estimation of benefits likely to flow from the fitment of safety technologies relates to the lack of data on vehicles involved in crashes including specific model details, gross vehicle mass to allow adequate classification and safety technologies fitted to each vehicle. If the latter were available, this could provide a better understanding of the role such technology could play in crash avoidance, and mitigating crashes and serious outcomes resulting from crashes. The implications of this for vehicle design, road safety policy and programs could include:

- Awareness of the benefits of technologies for the protection of road users
- Facilitating an accelerated rate of adoption of vehicles fitted and purchased with safety technologies
- Providing greater impetus to the enactment of relevant ADRs
- Supplying greater leverage to the direction of road safety policy and infrastructure programs to tackle the most urgent road safety priorities
- Improved reporting of crashes targeting levels of non-fatal injuries.

Gaps and inconsistencies in injury data continue to limit road safety research. Minor injury data, for the most part, appears to be characterised by lack of a standard definition that could be implemented and applied nationwide in order to develop a cohesive approach to the collection of injury data (including types of injuries (such as front passenger left side arm serious wound). While hospitalisation data appears to be in a better state than minor injuries, albeit with many hospitalised injuries currently not being reported to police and consequently not having crash circumstances recorded, both sets of data could benefit from improvement in this area. In particular, self-reporting to a local GP or hospital outpatients seems to result in a loss of data in many cases.

Data collected from the crash scene has often been assumed to help understand the crash cause. This is often not the case in investigation such as aviation crashes where much broader investigations are undertaken. Very little details in the crash record cover aspects such as traffic and weather conditions at the time of the crash, including sun angles and shadows, road geometry and shoulder widths, pavement type and condition, visibility at time of the crash, emergency vehicle response time and rating of the medical centre where patients are transferred, vehicle modifications (engine, wheels and suspension), nor the many factors that may have contributed to driver fatigue. With many modern vehicles it is possible to interrogate engine management systems to record factors such as speed, braking and steering etc. Furthermore, there is rarely an adequate photographic record of the crash scene stored for future use by road designers and traffic engineers, although the police often store their photos in a separate police system.

The University of Adelaide's Centre for Automotive Research (CASR: https://set.adelaide.edu.au/centre-for-automotive-safety-research/crash-investigation) has made significant in-roads to addressing the issues of collecting and assembling crash data and undertaking comprehensive investigations on factors contributing to road crashes for which an ambulance has been required. At the same time, many of the above listed data attributes could be automatically recorded and referenced at the crash site with appropriate computer applications that timestamp and accurately position the crash and link to Bureau of Meteorology and to traffic counters or traffic loops etc., and a special light meter could be used to record visibility. Much of the data collected at the crash scene by the police with their smarter computer applications could automatically and instantly create a crash record in the crash databases rather than manual entry, often 12 to 18 months after the crash where often errors are introduced. Hence the Australian crash data are relatively limited in scope and hence conclusions are often limited in their scope which has in turn limited the scope of road safety programs.

In Australia, over the past 30 years there have been very few detailed bus crash studies especially ones using a system methodology, and hence it is timely that a detailed study of bus crashes is undertaken in Australia. Whilst Coroners' reports are more detailed they often lack detail around many of the factors included in the paragraph above. The German GIDAS (see: https://www.gidas.org/start-en.html) study which has undertaken detailed investigation of up to 2000 crashes annually for 25 years provides a framework for investigating crashes which should form the basis for future Australian bus crash investigations.

This highlights two points:

- The need for an ongoing approach to crash investigations which could by undertaken by an organisation such as the Australian Transport Safety Bureau (ATSB).
- The development of a nationally integrated approach to the collection and availability of road crash data, including organisations such as MUARC, CASR, the Transport Accident Commission of Victoria (TAC), state transport agencies (e.g., TfNSW NSW Crash Data Hub). Such as approach was initially recommendation by the ATC Working Group on the National Transport data Framework (ATC 2004).

1.3 Recommendations

Recommendation 1.1:

The Commonwealth Government, through the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) should consider the re-establishment of a dedicated group that examines coroners' reports covering all fatal roads crashes in order to develop a consolidated database on factors contributing to crashes to provide a sound base for future road safety policy development. This was a primary focus of the former Federal Office of Road Safety (FORS) until its incorporation as part of the Australian Transport Safety Bureau. This unit could either be part of the DITRDCA, or an independent research unit housed within an existing organisation, such as the Monash University Research Centre (MUARC) or the Australian Institute of Health and Welfare (AIHW), and fully funded by the Commonwealth Government.

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2. Chain of Responsibility

2.1 Background

The Productivity Commission (PC 2020) recently completed a review of benefits resulting from the transport reform agenda – road transport, rail and maritime. As part of that review, the PC examined the outcomes flowing from the enactment of Chain or Responsibility (CoR) legislation. Part of the focus of the review on road transport included the impact of road transport reforms on improving road safety.

The PC concluded that "while heavy vehicles share the road with other road users…, most fatalities that are associated with heavy vehicles are not the fault of the heavy vehicle driver" (PC 2020). However, a significant outcome of the PC Inquiry was that "the evidence does not support a conclusion that the shift to national regulation [under Heavy Vehicle National Law – HVNL] has produced a step change in the number of fatalities" PC 2020). At the same time, the PC recognised that progress has been made in the area of chain of responsibility and fatigue management which could lead to future improvements in safety (PC 2020).

The PC Inquiry (PC 2020) summarised CoR as:

> "Under CoR laws, parties in the supply chain other than the driver (for example, transport operators and clients) have a general duty to ensure that breaches of transport laws do not occur. These parties can be held accountable for breaches or safety incidents where they have influenced non-compliance.
>
> CoR was a component of the original HVNL framework. Before an amendment to the law in 2018, CoR laws were prescriptive, imposing different duties on different parties that sometimes did not include the most responsible party (NTC 2015, pp. 4–5). Under the new law, CoR is based on a non-transferable duty of care, which requires all parties in the supply chain to do whatever is 'reasonably practicable' to ensure safe and compliant driving."

2.2 Issues

Key issues emerging from the PC Inquiry pertaining to CoR included:

- Uncertainty surrounding interpretation and legal ramifications arising from the application of a general duty of care and measures which may be regarded as reasonably responsible
- Clear guidance from the National Heavy Vehicle Regulator (NHVR) on compliance and interpretation of a "common sense" approach to interpreting the requirements
- The impact of a risk aversion approach to meeting requirements under CoR on the cost of compliance burdens, including customers imposing additional information requirements and audits

CoR laws place the onus of responsibility on transport operators and clients, which appears to leave a grey area around drivers employed by operators. This could raise questions pertaining to driving record, incidents, licencing requirements, particularly in those cases where drivers are relocating from one operator to another, and access to information on performance. The Privacy Act 1988 (Privacy Act) - the principal piece of Australian legislation protecting the handling of personal information about individuals – encompasses the collection, use, storage and disclosure of personal information by one company in the federal public sector and in the private sector. In some situations, the handling of employee records by an organisation in relation to current and former employment relationships ***may not*** be covered under the Privacy Act.

The Australian Government Fair Work Ombudsman (https://www.fairwork.gov.au/tools-and-resources/best-practice-guides/workplace-privacy) states that:

> "You won't breach Commonwealth privacy laws if you provide personal information that relates directly to the employee's employment, but you can still ask for their consent. This can usually be assumed if they have already asked you to be a referee. If they haven't, you should consider seeking their consent before disclosing information about them.
>
> "Consider what information is appropriate to provide in a reference. Keep your comments focused on the employment relationship to avoid any possible privacy issues. This includes the employee's skills, performance, conduct, their type of employment and length of employment."

The National Heavy Vehicle Regulator (NHVR 2022) has established a regional industry engagement model to engage with participants from across the heavy vehicle industry on strategic national and industry issues. This includes three Regional Working Groups (RWGs):

- Southern Region (the ACT, South Australia, Tasmania, and Victoria metropolitan and regional)
- Central Region (New South Wales metropolitan and regional)
- Northern Region (Queensland metropolitan and regional).

The RWGs supplement and support other forms of engagement. Membership is by invitation, and usually includes stakeholders with relevant knowledge and experience from various sectors of the heavy vehicle industry. Key strategic issues raised at RWG meetings are considered by the NHVR's peak industry advisory body, the Industry Reference Forum (IRF). The IRF also provides a platform to discuss key issues and areas of national and strategic importance.

To facilitate the engagement of transport agencies (including those in the Northern Territory and Western Australia) and police agencies in the strategy and operations of the NHVR (NHVR 2022), three groups have been established:

- National Operational Planning Group (NOPG)
- National Operations Group (NOG) (of which the Northern Territory and Western Australia are not members)
- National Strategy and Policy Group (NSPG).

The first two are operationally focused, while the NSPG is the mechanism the NHVR uses to consider and develop nationally significant heavy vehicle regulatory policy, strategy, standards and initiatives. All three groups have representation from jurisdictions, with the NTC and police agencies invited as observers on the NSPG. Police also attend the NOPG and, by exception, the NOG. There is a separate police forum with senior police representatives from across the country. The NHVR also have Memoranda of Understanding with complementary regulators, including police and Safe Work Australia (NHVR 2022).

Since 2016, the NHVR has administered the Heavy Vehicle Safety Initiative (HVSI) program on behalf of the Australian Government, as part of the Government's commitment to improving road safety to move towards zero fatalities and serious injuries on our roads. This discretionary, merit-based funding program supports projects that align with heavy vehicle and road safety priorities identified by governments, the NHVR and industry stakeholders, and which deliver tangible improvements in heavy vehicle safety. Over the past six years, the program has provided more than $28.3 million for 117 grants. The 2021–22 program's annual commitment of $5.5 million funding supported 28 projects. A further $5.6 million was made available in 2022–23, with submissions required to address at least one of three criteria – safer drivers, safer vehicles and safer journeys (NHVR 2022).

The predecessor of the NHVR, the National (Road) Transport Commission established in 1991, operated on the basis of a series of industry and government working groups to progress the national road transport reform agenda under the Hawke/Keating Government of 1983-1996.these working groups were specific in nature in focusing on key issues such as heavy vehicle charging, mass and dimensions, working hours, etc. The underlying common principle of these groups was that of enhancing road safety. The N(R)TC later morphed into the National Transport Commission (NTC) which provided the springboard for the National Road Safety Partnership Program (NRSPP) established under Monash University Accident Research Centre (MUARC). The NRSPP comprises a broad range of industry and government representatives; the Commonwealth DITRDCA is not a member of the NRSPP (see: MUARC, https://www.nrspp.org.au/partners/).

The above structures appear to lack the advisory basis that characterised the N(R)TC, and the focus on safety provided by the NRSPP. This suggests that consideration should be given to the formation of a working group under the NVHR that focuses on HV safety with a strong emphasis on bus safety. It is worth noting that in its Annual Report 2021-22 (NHVR 2022), three of the four indicators for safety performance targets set by the NHVR have not been met, which is consistent with the conclusion reached by the PC (PC 2020). Such a working group should be comprised of government and industry members, including representatives from the NRSPP. Whether or not a regionally focused RWG has the capability of addressing bus safety needs to be reviewed

2.3 Recommendations

Recommendation 2.1:

This submission supports the following recommendation contained in the PC report (PC 2020):

> RECOMMENDATION 6.2 – CLARIFYING HEAVY VEHICLE CHAIN OF RESPONSIBILITY OBLIGATIONS
>
> The Council of Australian Governments should endorse amendments to the Heavy Vehicle National Law to clarify the obligations of regulated parties under Chain of Responsibility laws. The amendments to the Heavy Vehicle National Law should empower the National Heavy Vehicle Regulator to:
>
> - publish ‘acceptable means of compliance’ with Chain of Responsibility laws for transport operators and other parties in the supply chain
> - accredit other approaches to compliance, with the costs of accreditation to be borne by the regulated parties.

Recommendation 2.2:

The “acceptable means of compliance” should also include driver responsibility and access to information covered by the Australian Government Fair Work Ombudsman relevant to the appointment of new employees where the safety of other road users may be at risk based on past behaviour. This should include access to driving history.

Recommendation 2.3

Formation of a joint industry/government working group, under the NTC, under the NVHR that focuses on HV safety with a strong emphasis on bus safety.

3. Australian Design Rules (ADR's)

3.1 Background

The Australian Design Rules (ADRs) are generally performance based and cover issues such as occupant protection, structures, lighting, noise, engine exhaust emissions, braking and a range of miscellaneous items prescribed under the *Road Vehicle Standards Act 2018*. The First Edition of the standards released under the ADR process was effectively a voluntary code of practice. Since then, the Second and Third editions have been released and form a mandatory set of standards to improve vehicle design. The ADRs classify heavy vehicles broadly as having a gross vehicle mass (GVM) greater than 3.5 tonnes. GVM is the maximum laden mass of a motor vehicle as specified by the manufacturer. Heavy vehicles not used to transport people are generally considered to be goods vehicles and not omnibuses. Tables 3.1 and 3.2 focus on the principal categories of omnibuses covered by the ADR's.

Table 6: Second edition ADR – principal "bus" categories (1 January 1969 to 30 June 1988

FC	Forward Control Passenger Vehicle
OM	Omnibus
OM4	GVM over 4.5 tonnes

Table 7: Third edition ADR – principal "bus" categories (on or after 1 July 1988)

MB	Forward Control Passenger Vehicle (up to 9 seats)
MC	Off-Road Passenger Vehicle (up to 9 seats with off road capabilities)
MD4	Light Omnibus (more than 9 seats) exceeding 4.5 tonnes GVM and up to 5.0 tonnes GVM
ME	Heavy Omnibus (more than 9 seats) exceeding 5.0 tonnes GVM

There are two parallel definitions of the 'heavy vehicle' term that are used Australia: on the one hand, the Heavy Vehicle National Law (HVNL) and its attendant regulations relating to the use of freight and passenger road vehicles of more than 4.5 tonnes GVM and, on the other, vehicle standards regulations through the ADR process, which, in line with United Nations Economic Commission for Europe (UNECE) international vehicle standards, differentiate freight and passenger vehicles of more than 3.5 tonnes GVM from freight and passenger vehicles of up to this limit. There is a significant lag of up to nine years in the mandating of safety technologies, such as Electronic Stability Control (ESC) in light vehicles *vis-à-vis* heavy vehicles in Australia.

There is a further discontinuity between the Commonwealth's categorisation of vehicles and those used by States and Territories. For example, Victoria and the Commonwealth use different categorisations for buses: Victoria records buses in a 9 to 13 seat category and the Commonwealth use 10 seats and above in their crash database. Hence it is very hard to obtain consistent data across Australia. The NHVR includes the driver in seat numbers; however, whether this holds across all jurisdictions is unclear.

New ADR legislation 'brings into effect two Australian Design Rules (ADRs): ADR 97/00 – Advanced Emergency Braking (AEB) for Omnibuses, and Medium and Heavy Goods Vehicles. AEB and ESC systems must be installed from November 1, 2023 for all new models of heavy vehicles. ADR 35/07 - Commercial Vehicle Brake Systems: this ADR was revised to expand the requirement of vehicle stability functions of Electronic Stability Control (ESC) and roll over control to cover all buses and goods vehicles above 3.5T GVM. This revision of ADR 35 was needed to support the adoption of ADR 97/00" (BigRigs March 10, 2022). In contrast, ESC was mandated for all new passenger cars in 2013.

Safety technologies in both heavy and light vehicles have delivered substantial benefits to society in contributing to the reduction in road trauma (ECON 2017). In the first instance, the identification and assessment of these benefits has entailed detailed understanding of fitment rates by vehicle manufacturers, and the purchasing decisions of road users. Second, intervention by ANCAP has played a significant role in lifting the adoption rates prior to the mandatory fitment of technologies by manufacturers through relevant ADRs for light vehicles. Third, vehicle fleet age profile has been shown to be a critical variable in the penetration of these technologies through the vehicle fleet in realising long term reductions in road trauma.

The safety of a vehicle is based on three key areas (ANCAP 2018):

- ***Structural integrity*** – how the shell of a vehicle withstands and channels crash forces away from occupants. This varies substantially from make to make and model to model and in light of point of impact. A sound structure is vital when it comes to saving lives.
- ***Passive safety features*** – built-in safety features such as airbags, seat belt pre-tensioners, collapsible steering columns, active head restraints and padded surfaces help prevent or manage the forces of impact. All are critical features and work in combination with the vehicle structure.
    - ***Safety Assist Technologies (SAT)*** – also known as active safety technologies, advanced safety assist technologies help the driver in avoiding or reducing the severity of a crash. These include antilock braking systems (ABS), electronic stability control (ESC), autonomous emergency braking (AEB), lane departure warning (LDW) (see Houser *et al* 2009), blind spot monitoring (BSM), fatigue monitoring systems (FMS) and Lane Support Systems (LSS).

Australian Design Rules (ADRs) Status compared with UNECE

The comparator list provided to the Bus Safety Roundtable held in Melbourne in August 2023 by the Commonwealth Government, listing ADRs applicable to buses compared to the United Nations Economic Commission for Europe (UNECE) regulations identifies that some 20 UNECE regulations for which Australia does not currently have a corresponding regulation. This is further compounded by the time lag of some other ADR's regulations being considerably behind that of UNECE regulations.

However, this comparator list is somewhat incomplete and notably excludes a number of important UNECE regulations that typically cover all vehicles which are currently not covered by ADR's yet can make a significant gain for road safety in Australia. Examples of these include:

1. UNECE 144/2018 covering eCall which relates to Automated Emergency Response
2. UNECE 165/2014 covering digital tachographs (discussed in Section 4) for HV and Buses only
3. UNECE 141/2017 covering Tyre Pressure Monitoring Systems
4. UNECE 117/2011 covering tyre adhesion, testing in wet cold conditions (below 10degC)

These UNECE regulations relate to vehicle safety, vehicle monitoring, monitoring driver compliance with regulations, and passenger safety in the event of an emergency. These UNECE regulations are particularly important for bus safety and are compulsory in all heavy vehicles and buses in Europe.

Automated Emergency Response (eCall)

Emergency response should be automated with an eCall/bCall type system operating in Australia compliant with UNECE Regulation 144/2018 This is a regulation that had its conception in 1999 and this regulation is now compulsory for all vehicles in Europe and Japan. In the case of the Hunter Valley Bus Crash the first responders were four people from the wedding, who were travelling several minutes behind the bus. In the event of such a crash in cold weather and darkness, most mobile phones had been separated from the passengers and passengers were often too dazed and shocked to think and respond efficiently given the serious injuries and cries for help, to enact an emergency response call to authorities, hence precious minutes can be lost. Also, when a crash of this nature occurs the first action of survivors is caring for the immediate safety of those around them and getting people out of the bus before it catches fire. These are the primary human responses in such a crisis.

Hence the Federal Minister for Minister for Infrastructure, Transport, Regional Development and Local Government needs to establish as a priority a national eCall type system working together with the Australian States by first deciding on the communication technologies and allocating the bandwidths and frequencies as necessary and setting up the supporting systems, processes and infrastructure to see up an eCall type system in Australia. This is a simple technological solution, however is an initiative that has spent too long in discussions and has lacked the leadership at various governmental levels to make it happen despite rapid emergency response being proven to be one of the most important road safety initiatives in the past 4 decades but has generally sat outside of safe system thinking.

Tyre Monitoring Systems

UNECE 141 requires tyre pressure monitoring systems to be fitted to M1, M2 and M3 buses. Such a system gives drivers a heads-up warning when tyre pressures is reducing and provides time for the driver to be alerted in the event of a sudden tyre failure. Primarily this system can detect a tyre that is likely to fail from under inflation or likely to have reduced performance when braking or steering etc.

Tyres Adhesion

UNECE Regulations 117 requires different tyres for winter and snow however the key performance is the grip in cold wet conditions and the need for different tyre rubber compounds that provide added grip in temperatures 0 to 20degC (average temp 10degC) compared to normal tyres being designed for 5 to 35 deg C (average temp 20degC). Many parts of Australia experience cold and wet conditions and adhesion of tyres in cold weather and wet/damp roads is important. Thus, Australia's ADRs need to be extended to cover the requirements of UNECE 117 together with practical advice on operations (e.g., night driving in winter in many parts of the country have increased likelihood of nighttime crashes for which driver need to be educated). Given the higher likelihood of bus/truck rollover and crashes in cold weather which occurs primarily at night and in winter months, we need to consider the use of different tyre compounds that provide additional adhesion in cold weather. This regulation is also applicable to the entire vehicle fleet especially in those parts of Australia that experience overnight temperatures below 10 deg C. The commonly occurring combination of cold weather, damp roads, cold tyres and cold brakes when travelling at higher speeds is deadly. This is well understood in car racing but overlooked in crash investigation and driver education programs.

Ensuring ADRs implementation work collectively to improve Road Safety

Whilst the timely introduction of the best possible set of ADR's is one of the most important and often overlooked aspects for delivering road safety in Australia, having ADR's (a written document) on their own do not provide for safer vehicles or a safer road system. It is how the ADR's are applied and implemented as a holistic system which will ensure the vehicles licensed to access our road network meet and continue to deliver safer roads. Vehicles must continue to meet these standards throughout their entire operational life. Older non-compliant vehicles need to be either regularly upgraded or an effective management regime is required to ensure their early retirement from passenger transport.

Furthermore, there are aspects evident from the Hunter Valley bus crash that whilst the 2009 Volvo BR7 bus may have met most or all of the ADR requirements when it was new, or even some of the current standards, it was not as safe as it could have been. The bus fleet can be designed to performed much better in preventing such a crash or the rollover occurring in the first place, and also as a collective (holistic) system especially in regards to saving lives and reducing injuries through improved: integrity of the bus superstructure, design that reduces the likelihood of passenger ejection including window integrity; reducing dangerous aspects of sharp and flying glass which also hampers emergency rescue; and in passenger egress and emergency response access, removing the injured from the overturned bus.

It is an imperative to ensure safety that both vehicles and their drivers are compliant with regulations and road rules at all times throughout their operational life, with the provision of adequate monitoring, compliance checking and enforcement regimes. As discussed in Section 4 there is also the need to have an ADR covering vehicle and driver performance monitoring systems to ensure safe outcomes on the road such that vehicle maintenance matters can be identified in real-time. Such systems can also identify poor driver behaviour, driver distraction or lack of concentration, driver fatigue levels and can be brought to the attention of bus operators in real-time.

Need for a Dedicated Peak Government/Industry Body to Oversee Bus Safety in Australia

Australia has more than 100,000 registered buses of which more than 43,600 buses operate on a commercial basis carrying passengers. In 2018/19 (prior to COVID) the total passenger kilometres travelled by buses was more than 22 billion (pass.km/year – BITRE 2023) forming a vital role in Australia's road transport system. These buses are either fully imported (33.6%) or have an imported monocoque chassis where the bus coachwork is undertaken in Australia (67.4%). Buses are unique vehicles specially designed to carry people, their design and operations are considerably different to that of other heavy vehicles and hence require specialised oversight in Australia. It is likely that many bus safety systems can be implemented easier than in many heavy vehicles, as they generally do not tow trailers. Trailers of different makes and models often result in incompatible safety systems or differing levels of safety performance.

Importantly, the safety of road travel in Australia relies not only on having ADRs on the shelf and applying them, it is a continuous learning cycle, where testing vehicles performance and understanding of what factors contributed to crashes. This requires robust feedback loop to address limitations in the design and operations of the bus fleet, as well as learning that leads to improved driver selection and education and compliance with road rules.

To this end Australia currently lacks a dedicated peak joint government/industryvbody and a bus testing facility where compliance with ADRs can be independently assessed, bus safety systems developed and tested, crashworthiness standards continually assessed and improved and where continuous improvement in driver recruitment and education, driver compliance with road rules is reviewed and improved. Hence Australia needs a dedicated Bus Safety entity (potentially within one of the existing peak bodies) to solely focus on closing the gap on the many safety issues identified in this report. This could be an expanded form of NCAP type facility, with an additional focus on operations and drivers.

Leadership requires leading safety rather than relying on other jurisdictions to lead and then lag the adoption of standards, with further delays in implementation, followed by Australia's limited independent compliance checking regime. Such initiatives need to be at the centre of, rather than at the periphery of, the safe system domain. Australian road safety programs must become focused on the fast tracking of vehicle safety standards, and initiatives which lead to improved regulations and compliance. This requires a much broader focus and more detailed issue identification process than the priority areas indicated in the current National Road Safety Strategy 2021-2030 (NRSS 2021). This is of critical importance for buses and heavy vehicles, as is the urgent need to develop an Automated Emergency Response System for Australia covering all vehicles.

3.2 Issues

The key issues pertaining to bus safety and the ADR process may be summarised as:

- The apparent long lead time to enact an ADR: this includes the manufacturing and initial importation of a (heavy) vehicle with improved safety features, the important role played by ANCAP in promoting improved safety standards in vehicles, the completion of a Regulatory Impact Statement (RIS) by Government to support an ADR covering that feature, the drafting of a Bill and the passage of legislation, and finally mandating the introduction date for the feature to become effective in the importation and sale of new vehicles.
- The lack of a proactive approach to structural integrity by governments in acting upon identified areas of reform such as window glazing standards, egress and emergency access standards
- Uniformity and consistency in the enactment of ADRs addressing seat belts, roll-over warning systems,
- The long service life of a bus and service contacts (up to 28 years) results in many bus services operating with old buses which lack current day safety systems, hence the need to need to turn-over the bus fleet more rapidly or have a regime where buses more than x years old are refurbished with current practice safety systems.

Australia lacks a dedicated bus safety entity and does not have an independent bus safety standards assessment and testing facility, where compliance with ADRs can be assessed and the holistic design of the bus as a system can be assessed for safety, and where advanced Safety Assist Technologies can be tested and evaluated. Neither does it have an entity which focuses on bus driver selection and education and which focuses on improving driver compliance with road rules.

3.3 Recommendations

Recommendation 3.1:

Support the current review of the ADR process, and the need to streamline the ADR by maintaining direct engagement with UNECE on directions for the adoption of advanced vehicle/driver safety technologies.

Recommendation 3.2:

Promote the adoption of advanced safety features such as seat belt monitoring systems for passenger buses, fatigue monitoring systems, roll-over warning devices by adopting, where appropriate, proven technologies where supported by evidence/protocols introduced by Euro NCAP, UNECE regulations. The introduction of complementary safety technologies, such as eCall, also warrant inclusion in reducing road trauma.

Recommendation 3.3:

ANCAP has played a significant role in leading the new car market in its access and availability of safer vehicles, ahead of the ADR process. Governments should continue to support ANCAP in its work to advance vehicle safety through vehicle testing and publication of its ratings for new vehicles, including heavy vehicles (trucks and passenger buses).

Recommendation 3.4:

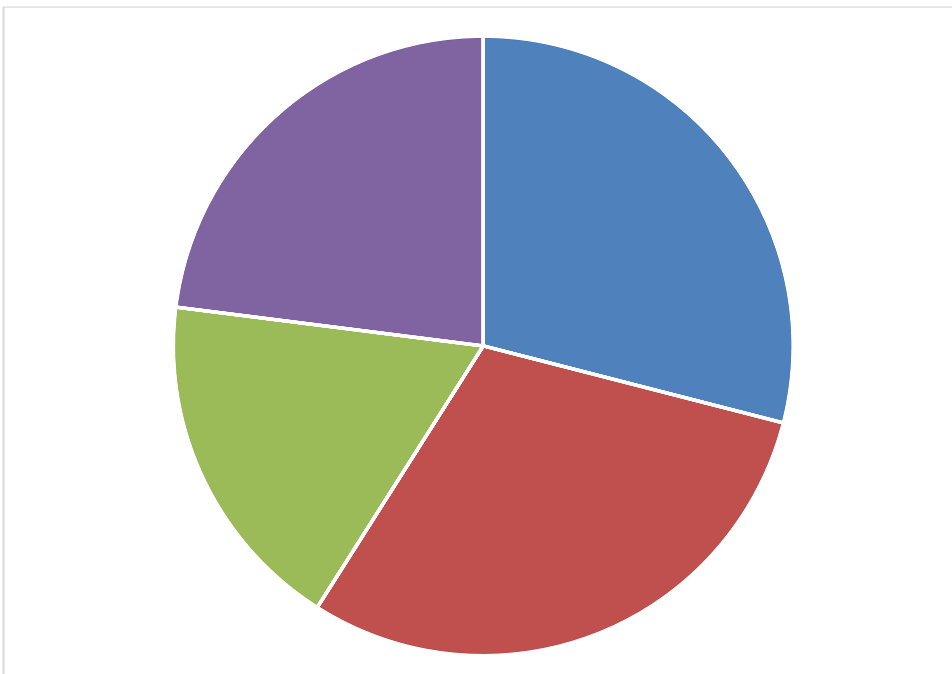
Establish a bus safety testing facility in Australia being an extended version of ANCAP with an aim to test rollovers structural strength, passenger ejection, passenger egress and window integrity, as well as for testing advance safety assistance technologies (SAT).

4. Safer Vehicles and Drivers through use of Telematics

4.1 Background

The age profile of the heavy vehicle fleet is significantly different to that of the light vehicle fleet, with the average ages of the fleets being 14.8 years and 10.3 years, respectively. The average age of Australia's bus fleet is 10.9 years old with 29% of the fleet being 6 years old or less (Figure 2.9). 23% of the fleet remains 17 years old or more—in government contracted environments, these are usually dedicated to exclusive school and charter fleets (BIC 2021). This reflects a large percentage of the fleet performing the passenger task in vehicles that offer very little in the way of modern safety and comfort features for passengers compared with new buses and operate with Euro III or less emission standards.

Figure 4: Age profile of all buses 4.5 t GVM (2019)



Legend: **29% - 0 to 6 years; 30% - 7 to 11 years; 18% - 12 to 16 years; 23% - 17 to 26 years**

Source: BIC (2021), *Moving People > Australian Bus and Coach Industry: a snapshot*, Bus Industry Confederation Inc., Canberra.

In the period Jan 2017 to Feb 2020 36.3% of buses were fully imported and 63.7% were built locally on either imported chassis or as a monocoque. Reported bus deliveries average around 1,500 per year. Between 2008 and 2019, 9.5% of route buses, 65.9% of school buses, 71.5% of charter buses and 63.9% of long distance and tour buses were delivered fitted with seat belts (BIC 2021).

The BIC analysis identifies 43,684 'commercial-use' buses operating in the bus and coach industry delivering public transport, school and other government contracted services, tour, charter, long distance and other commercial services. The vehicle's full life cycle, if maintained to specification, can be up to 25 years. 23% of the Australian bus fleet is 17 years or older and operate with Euro III or less emission standards. The average age of the public transport and school bus fleet should be 12 years with a maximum age of 25 years. It is important that the integrity of the bus frame at 20 years is assured by industry best-practice maintenance regimes (BIC 2021).

The implication here is the long-time lag that underlies complete fleet turnover that results in safety technologies filtering through to school bus services daily transporting our some of our most vulnerable road users – school children.

Tachographs/Telematics/Data Loggers and Event Recorders

For over three decades Australia has been presented with the opportunity to have tachograph type technologies fitted to heavy vehicles and buses, to ensure drivers and their vehicles are effectively monitored for compliance with regulations, and road rules as well as monitoring vehicle maintenance requirements and faults everywhere they travel. Such initiatives were discussed at high levels in Australia in the 1980s in relation to road user charging, and in the 1990's following the Grafton and Kempsey bus crashes. Discussions have occurred many times over these decades often in the context of concerns about heavy vehicle and bus safety in Australia, yet there has been little progress towards having these types of technologies required to be fitted to buses and heavy vehicles, despite the positive benefits seen overseas. The safety performance and maintenance benefits (less down time and improved reliability and fuel efficiency) realised by leading private Australian freight and bus companies justifies their deployment.

The United Nations and European Union have required Tachographs to be installed in certain vehicles especially heavy vehicles and buses since the mid-1980s, and were introduced in the USA in December 2017 (Trans.Info 2017). Tachographs accurately record data related to the driver, the driver activities and the vehicle to ensure compliance with regulations. The technologies associated with these types of products are continually developing with current capabilities of these technologies being digital where vehicles are connected in real-time to the owner of the vehicle fleet to provide real time updates including warnings and alarms regarding vehicle location, speed and driver indiscretions. The current European Union Regulation covering tachographs is R165/2014 of the European Parliament. The regulation requires tachographs to be fitted to passenger and goods vehicles over 7.5 tonnes.

More advanced systems deployed today monitor many more aspects of vehicle performance including many of the vehicle's mechanical and safety systems, as well as monitoring driver behaviour including fuel consumption, braking and steering behaviour and driver aggression levels, distraction and fatigue etc, in real-time using cameras and other on-board sensor technologies. Systems today could be used by crash investigators to determine the many factors involved in the event of a crash. Such technologies can operate proactively to avoid crashes occurring by industry monitoring the drivers in their fleet, and ensuring their vehicles is in a safe operating condition and/or in need of maintenance, and through discipline and education of drivers who routine violate road rules and regulations.

Furthermore, and in a similar vein, UNECE R160/2021 requires Vehicle Event Data Recorders (VEDR) to record critical details in the event of a crash. This regulation applies to all passenger cars up to 8 seats and/or have a mass not exceeding 3.5 tonnes; the system could also be mandatory in all buses and heavy vehicles. This provision concerns the minimum collection of data, its storage and crash survivability of a motor vehicle and is intended to enable crash investigators to understand more factors involved in a crash with a view to improving safety.

4.2 Issues

In 2018, Transport for London (TfL) introduced a Bus Safety Standard (BSS) focussing on vehicle design and safety system performance. This set a target to achieve zero road collision deaths involving buses in London by 2030. It marked a fundamental change in the approach to safety for London's buses by establishing a Bus Safety Innovation Challenge comprising two principal elements (see TfL 2018: https://www.trl.co.uk/Uploads/TRL/Documents/PPR872-Bus-Safety-Standard---Executive-Summary.pdf):

- Assess the safety performance of buses using the London network to better align the design of buses with safety risk, and (re-)allocate higher risk buses to routes with lower risk exposure
- To encourage and guide the development of the vast range of safety improvements both on offer and emerging technologies to facilitate their early adoption based on evidence for TfL to consider allowing or requiring such technologies on London buses.

A two-stage approach is used to assess the submission to TfL to support the implementation of a technology:

- The first stage covers a description of the innovation and how it works, alongside a description of the safety problem and casualty population that it is intended to avoid or mitigate.
- The second stage is more complex, with three sections:
  - Evidence of how the innovation has been tested should be used to demonstrate its effectiveness and suitability for buses,
  - Estimate and describe the expected benefit in terms of the number of casualties it is expected to avoid in real service.
  - Finally, any real world evidence should be use to quantify the observed safety benefits that were actually achieved, operational implications such as driver or passenger reactions to the system, and costs (TfL 2018).

The estimation of adoption rates for advanced safety technologies in heavy vehicles in Australia is very dependent on the availability of data on market access by manufacturers and rates of adoption of those technologies by operators in their fleet purchasing decisions. Published industry information would assist in this area, both in terms of purchasing decision for operators and road safety policy, in targeting uptake.

The improved safety of buses is imperative for reducing road fatalities and road trauma. Improved operations requires that both vehicles and drivers are monitored in real-time to ensure compliance with road rules and regulations as well as to ensure timely maintenance when vehicle safety issues are identified. The principles of UNECE regulation r165/2014 are scheduled to be introduced in Australia under ADR 108 from 1 March 2024 for new model vehicles, and from 1 March 2026 for all vehicles (Australian Government 2021).

Appendix A provides a summary of EU Mandatory Requirements for Buses scheduled for introduced from July 2024, and other measures to improve bus safety.

4.3 Recommendations

Recommendation 4.1:

Australia should review relevant UNECE regulations with a view to fast tracking the adoption of the EU Bus Safety Regulations, through interim adoption where appropriate. A clear timeframe for the full implementation of these regulations should be prepared with any of these regulations not adopted by 2025 being the subject of a detailed publicly available report covering the technical and economic factors not supporting implementation.

Recommendation 4.2:

UNECE regulation R165/2014 requires tachographs to be fitted to passenger and goods vehicles over 7.5 tonnes. Consideration should be given to having this installed on all buses less than 10 years old and also on all coaches travelling in regional areas, with the necessary backend monitoring systems put in place.

Recommendation 4.3:

Consideration be given to have UNECE R160/2021 covering Vehicle Event Data Recorders (VEDR) to record critical details in the event of a crash on all new buses (up to 8 passengers, excluding the driver). It would also seem to be important to extend this in Australia to cover heavy goods vehicles greater than 4.5 t GVM and ME class buses (greater than 5 t GVM).

Recommendation 4.4:

The Commonwealth Government should consider commissioning research, similar to that undertaken by the Transport Research Laboratory for TfL), to monitor developments in safety technologies, and their adoption overseas, to improve the operational safety and performance of buses in Australia. Such international experience could be drawn upon as part of any revised process to streamline the approach to implementing new/revised ADRs in Australia. This could be undertaken by an organisation such as ANCAP.

5. Road Infrastructure

5.1 Background

Serious (hospitalised) injuries on Australian roads have remained relatively constant from 32,054 in 1980 to 33,524 in 2008, despite an active road safety program and significant investment in road infrastructure. Notable in the past two decades is that few road safety program objectives have been met. One of the reasons for an ineffective road safety program is the failure to understand context changes and the changing nature of road crashes in Australia. For example, over the past two decades or so there have been many gradual and subtle changes to the roles and usage of urban, peri-urban and rural roads (refer Appendix A, Table A-1).

Although these changes have impacted road safety outcomes, their contribution to increased crash risk has not been fully appreciated, nor have they been adequately addressed by road safety programs. Furthermore, many road safety strategies that appeared be effective in previous decades are proving to be less effective today, and few strategies have been reviewed to understand why this is the case.

Since 2016, there has not been any real progress in reducing road fatalities in Australia. Regrettably, the significant focus primarily on fatality crashes by road safety leaders in the public arena has masked the 1.7% average annual growth in serious injuries between 2008 and 2020 (41,199). This is evidenced in the economic cost of road crash injuries now outweighing the cost of fatalities.

Increased Driving Exposure on Sub-standard Rural Roads

Around 60% of Australia's road fatalities occur on rural roads. Today many rural roads carry much higher traffic volumes than they did a decade or two ago on roads not designed to carry these volumes. Too many of these substandard roads have posted speed limits of 100km/h, a similar speed limit to the higher standard motorways with divided carriageways, wide lanes, generous geometry and generous shoulders.

France has recently undertaken a major review of national speed limits (Government of France 2019), including two major reform: reduction in the speed limit on single carriageway from 90 km/h to 80 km/h, and a reduction in the speed limit across the entire city Paris to 30 kph (Transport Infrastructure Ireland 2022).

The Problem of Reduced Road Maintenance over Many decades

Compounding the road safety problem in Australia is the quality of the road asset in many Australian jurisdictions, many of which have had their road maintenance budgets progressively reduced over the past three decades despite the much higher traffic volumes and increased axle loads. A system wide approach to collecting road safety data is required. Data need to be collected on the condition of the road network, traffic volumes and the continually changing and quite varied environmental conditions that drivers experience, with variations even occurring in the course of a single day.

Transforming Australia's approach to Road Safety

A new approach to addressing road safety objectives, as contained in the first National Road Safety Action Plan 2023–2025 (NRSAP 2022) for the National Road Safety Strategy 2021–30 (NRSS), will require re-assessing the current Australia road network and applying an appropriate speed regime, and equipping vehicles and drivers with the most advanced on-board safety systems to provide drivers with another set of eyes and another set of hands to better negotiate the spatiotemporal risks and avoid crashes occurring. Furthermore, where intelligent transport systems are already present in the road (e.g., Variable Speed Limits Systems), greater use of these dynamic systems is required to reduce speed limits when certain spatiotemporal risks are present, such as heavy traffic conditions and inclement weather conditions.

Reform of Maximum Speed Limits for Buses

European countries have typically adopted lower maximum general speed limits for buses which are reduced further when passengers are standing. An example from Germany is shown below in Table 8 below. Germany also has a 50m headway rule requiring the bus when travelling at speed to keep 50m behind the vehicle in front together with other special requirements for overtaking. Belgium has 30km/h speed limit for buses in residential areas and 20km/h near schools and streets with cycle paths. Some countries e.g., France, reduce speed limits for buses when it is raining which is a significant step forward, however there are several other environmental conditions that would benefit if all drivers reduced their speed (e.g., fog, mist, strong winds, sun glare, twilight and driving in darkness etc).

Table 8: Germany Speed Limits Regime for Buses

Country	Buses - urban roads	Buses - non-urban roads	Buses - expressways	Buses - motorways
Germany	50 km/h	80 km/h 60 km/h Buses with standing room for passengers	80 km/h 60 km/h Buses with standing room for passengers 100 km/h Buses with special technical equipment	80 km/h 60 km/h Buses with standing room for passengers 100 km/h Buses with special technical equipment

Source: European Commission (2015), Road rules and safety - Germany
https://europa.eu/youreurope/citizens/travel/driving-abroad/road-rules-and-safety/germany/index_en.htm#speed_limits

The European Commission has argued that, while such measures are important, various studies indicate that awareness campaigns surrounding changes in regulations such as speed limits or promoting seatbelt compliance work much better (or even only) in combination with additional measures such as enforcement, rewards, legislation, or education (European Commission 2021).

In Australia, buses can legally travel at the speed limit with passengers standing holding on to handles, strap or poles, when operating in heavy traffic and congested conditions, through heavy rain, on damp pavements, on narrow two-way sealed and many unsealed single lane roads, on roads where roadside shoulders are non-existent, and where guardrail is inadequate to constrain a heavy vehicle or bus.

Hence, bus speed limits should be reviewed along the lines of the speed regime shown above for Germany as well as linking speed limits to the road's design standard, especially lane and shoulder widths discussed above. Bus safety speeds should be reviewed when travelling under any of the following conditions:

- On roads without a four- or five-star safety rating, or which do not meet Austroads Standards for the traffic volumes
- When lane widths are narrower than 3.5m
- When road shoulders are not present or narrow
- On roads where guardrail is inadequate to constrain a heavy vehicle discussed below
- In heavy or congested traffic conditions – easy to set thresholds for, based on traffic density
- When the headway to the vehicle is front is less than 50m
- In a wide-range of inclement weather conditions – see Gaffney ACRS climate papers 2022, 2022, 2023
- When bus passengers are standing or not wearing seat belts
- When driving in twilight conditions and at night where much of the day time detail is not visible to drivers, especially for older drivers because night vision reduces with driver age
- When ambient temperatures are below 8degC and/or when tyres and brakes are cold.

Roadside barriers - the Greta Interchange

The guardrail at the Greta interchange at a number of locations within this interchange, including near where the barrier was hit, had the support posts protruding above the rail (refer Figure 5) – this is not a correct installation and potentially contributed to the damage on the left side of the bus and the number of fatalities and injuries to passengers. Furthermore, when driving around NSW this misalignment of the safety barriers seems to be wide spread. These posts can be dangerous for motorcyclist who have a tendency to hit the back of posts – See Sweden's motorcycle/barrier testing. This is either an initial installation matter and/or a maintenance matter and needs to be remedied and road maintenance workers trained on the proper installation. Such installation should never have passed a road safety audit and this needs to be followed up by the NSW government to see whether photographs and reports on this interchange at the road opening showed the correct installation of the barriers.

Figure 5: Incorrect installation of safety barrier at Hunter Valley Bus Crash site

5.2 Issues

Appendix B summarises some context changes relating to the use of Australia's road network in recent decades which encompass the following:

- Drivers are poor at assessing risk when moving from one road standard to the next
- The road manager's and the driver's perspective of risk is considerably divergent
- Roads that do not meet Austroads road design requirements should have their speed limits reduced
- Road crashes are generally systemic occurring anytime and anywhere on the road network
- A systemic problem requires a systemic solution where safety travels with the vehicle and with the driver providing another set of eyes and hands to assist with crash avoidance
- The outcome of any crash and any speed cannot be guaranteed and hence crash avoidance is the most important objective to bring the road toll down
- The speed-limit of buses need to be reduced to a maximum of 80km/h except when on non-motorway standard rural roads and reduced to 50km/h in urban areas. When driving on rural motorways at speeds above 80km/h a headway of at least 50m should be maintained to the vehicle in front. Speeds need to be reduced further when passengers are standing and when adverse environmental conditions are present
- A review of guardrail installation and maintenance practices is required.
- A review of heavy vehicles operating speed is required especially when guardrail is present on curves and corners.

5.3 Recommendations

Recommendation 5.1

The Austroads road construction guidelines and standards, together with Austroads road rules, need to be reviewed with the aim of reaching agreement across all jurisdiction to provide clear and consistent signals to drivers using road networks.

Recommendation 5.2

Roads with extensive use of guardrail on curves requires investigation in relation to their design standards and where solutions cannot be developed to constrain heavy vehicles, their speed in these locations should be reduced.

Recommendation 5.3

While NSW in its response to the first Inquiry Report on the Hunter valley Bus Crash has announced the implementation of greater enforcement measures for non-compliance with seat belt wearing, with over 15% of Australia's road fatalities related to non-compliance, a national awareness campaign of promoting road safety is required, including a targeted approach to seatbelt compliance.

Appendix A

Fast-tracking the Adoption of EU Bus Safety Systems in Australia

The EU continues to progress rapidly with bus safety with many initiatives already implemented with more on the way. The current bus safety reforms came into effect in July 2022, for every new truck and bus registered from July 2024. The reforms include eight specific automatic driver assistance safety features listed below and shown in Appendix A. The EU law has provisions for three further mandatory safety functions for 2026 and 2029 implementation.

The EU also recognises the "**complexities of modern traffic"** understanding that drivers need automated technology systems to help keep bus passengers and other road users and pedestrians safe.

Australia should review these UNECE regulations with a view to fast tracking the adoption of the EU Bus Safety Regulations, through interim adoption where appropriate. A clear timeframe for the full implementation of these regulations must be prepared with any of these regulations not adopted by 2025 being the subject of a detailed publicly available report detailing the technical and economic factors not supporting implementation.

EU Mandatory Requirements for Buses from July 2024

1. **Emergency stop signal:** A flashing light that indicates vehicle is suddenly slowing down or braking heavily.

2. **Tyre pressure monitoring system:** A system that constantly monitors all the tyres' pressures as the vehicle is in use and warns the driver when a tyre is under or over-inflated.

3. **Blind spot information system:** This warns the driver of a possible collision with pedestrians and/or bicycles beside the vehicle.

4. **Reversing information system:** Camera and/or sensor technology that shows the driver if there are objects or people behind the vehicle when they are reversing.

5. **Moving off information system**: Warns the driver of a potential collision with pedestrians and/or cyclists that are in the proximity of forward blind spot of the vehicle.

6. **Alcohol Interlock Facilitation Installation:** A standardised interface that allows the fitting of the various aftermarket alcolock devices, preventing drivers over the legal limit from driving their vehicle.

7. **Driver drowsiness and inattention warning**: Warns the driver if the system assesses that they are not as alert and may be tiring. (Advanced Driver Distraction Warning (ADDW)) and Driver Attention Detection (DAD)

8. **Intelligent speed assistance:** Warns the driver from exceeding the speed limit by using cameras and GPS-linked map databases.

Additional EU Bus Safety Measures 2026 to 2030

1. **Driver assist – helping the driver to avoid or mitigate the severity of incidents**

2. Advanced emergency braking (AEB) systems utilise sensors such as LiDAR, radar, camera or fusions of data from more than one sensor to identify the risk of an imminent collision. AEB will brake only if an emergency arises and the driver is not able to take control. Already widely fitted on HGVs and cars, considerable attention has been given to providing the balance between collision avoidance and the risk of injury to both seated and standing passengers.

3. Intelligent speed assistance (ISA) is based on a digital speed limit map of London. The system interprets the speed limits for the bus position and prevents the driver from accelerating above them.

4. Improved direct and indirect vision involves an assessment of the area around the bus that can be seen by the driver. Improvements are achieved by better direct (eye-line) vision through windows, indirect vision via the use of mirrors, or blind-spot information systems and camera monitor systems (CMS) in the future**.**

5. Pedal application error uses a variety of measures to help a driver prevent or recover from an unidentified acceleration incident, where they have pressed the accelerator pedal instead of the brake.

6. Runaway bus prevention is a system of interlocks to stop the bus from rolling away if exceptional circumstances lead to the driver forgetting to apply the parking brake when leaving the seat. (See: https://transportsafety.vic.gov.au/__data/assets/pdf_file/0003/81624/Human-factors-analysis-of-bus-rollaways.pdf)

Ongoing Development of EU Bus Safety Measures

Based on task analysis workshops with drivers, human factors experts at Transport for London (TfL) have generated a new checklist to govern the system's performance and improve the Bus Safety Standard (BSS).

1. **Partner assist – helping other road users involved to avoid a collision**

2. **Acoustic vehicle alerting system (AVAS)** has been reviewed so that a quiet running (e.g. electric) bus is as noticeable as a standard diesel bus, to help pedestrians and cyclists detect its presence. In addition, visibility has been assessed to help vulnerable road users detect the presence of a bus and the collision risk it represents before starting to cross the road. For both measures, TRL has developed evaluation procedures in order to identify which solutions are most effective in reducing casualties.

3. **Partner protection – reducing the severity of injuries for road users outside the bus in a collision:** This includes a review of the front-end design of a bus, such as impact protection, energy absorption, and run over prevention measures. It also covers the impact performance of wing mirrors and their potential replacement with a **camera monitor system (CMS)**.

4. **Occupant protection – reducing the severity of injuries for people onboard the bus:** The BSS assessed the protection provided for passengers, including a visual inspection of the interior to design out potentially injurious features and encourage better positioning and selection of features. Research has evaluated whether higher back seats may be of benefit in the event of an impact, with simulations and physical seat testing providing new evidence.

Justification for Bus Safety Systems

The EU has undertaken the foundational research and justification for these advanced bus safety systems and bus design features. This foundation research and justification should be reviewed to facilitate adoption in Australia.

All the data, detailed analysis and justification for these tools being implemented in the EU can be found at: Lhttps://tfl.gov.uk/corporate/publications-and-reports/bus-safety-data#on-this-page-1.

Associated Business Case: https://op.europa.eu/en/publication-detail/-/publication/ed4aff17-49c5-11e8-be1d-01aa75ed71a1/language-en?utm_source=ETSC&utm_campaign=51839e192d-20180517_pr_mobpackiii&utm_medium=email&utm_term=0_3a7b55edbf-51839e192d-177749785

Performance Requirements and Test Methods: https://op.europa.eu/en/publication-detail/-/publication/6987b729-a313-11eb-9585-01aa75ed71a1

Appendix B

Table B-1: Some context changes relating to the use of Australia's road network in recent decades

Attribute	Description
Vehicle Fleet	• Larger (wider, longer), heavier and taller (higher centre of gravity) fleet, creating instability particularly in emergency manoeuvres and stopping. Heavier vehicles have longer stopping distances due to kinetic energy (not considered in vehicle safety testing) (Gaffney, 2018) • Increasingly, private vehicles are now SUV, larger 4WD or utility vehicles (which are more like commercial vehicles so don't have the same stability and braking performance of cars) • Changes and improvements to vehicle safety standards, resulting in stronger, thicker, and wider A, B and C pillars in vehicles, restricting visibility • Taller and wider vehicles in high density traffic restrict the forward vision of drivers, creating more blind spots affecting forward, side, and rear vision • Vehicle technologies and/or their deployment have not adequately advanced to cover the additional risks associated with context change (multi-lane, high "flow", and high-density)
Traffic Conditions	• Doubling of daily traffic volumes, with increased exposure to high "flow" and high-density traffic conditions leading to longer periods of peak travel demand (increased from 1-2 hours over five days to 3-8 hours seven days a week). Much of the urban arterial road network reached capacity in the early 2000's. • Changing trip patterns especially on motorway from carrying longer trips (average of 20-30 km) to shorter trip (averaging 10-15 km) as they now undertake much of the arterial road function due to congestion on arterial roads). Shorter trips mean higher concentrations and turnover of trips with many more vehicle interactions (lane changes, smaller gaps) to be negotiated by drivers • Increased exposure to heavy traffic conditions accelerates driver fatigue
Trip Purpose	• Change in trip purpose from transition to a service-based economy, with increased consumption of goods and services per capita linked to rising affluence, with urban motorways now being a more efficient conduit for cross-city and cross-suburb distribution and delivery to homes and businesses • Around 80% of road travel is not commuting-related and the delivery of services and goods has shifted from being between the 500,000 premises of industry, business, and retail to all 2 million residential dwellings now potentially being daily service points with online shopping and many home-based services including delivery of meals and supermarket shopping. These daily service-based trips generally only require a driver (no passengers) and this is reflected in the increase in single-occupant crashes in Victoria (83% in 2021 compared to 70% in 1999) • Changed driving patterns where people who drive for a living face different and often unfamiliar driving patterns everyday as they navigate to various businesses, suburbs, neighbourhoods and dwellings

Attribute	Description
Road Geometry	• Some roads especially urban motorways have been progressively widened from 2-3 lanes to 4-6 lanes, resulting in a non-linear increase in conflict points and necessary lane changes, markedly increasing lateral friction in the carriageway. The increased induced lane changing, when exposed to high-density traffic, compounds the complexity for drivers • Often when widening urban motorways, running lanes and/or emergency lanes have been narrowed, leaving less room for vehicles to manoeuvre in emergency braking situations

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