Vehicle Standard (Australian Design Rule 68/01 – Occupant Protection in Buses) 2024

Made under section 12 of the *Road Vehicle Standards Act 2018*

Explanatory Statement

Approved by the Hon Anthony Chisolm, Assistant Minister for Regional Development

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1. LEGISLATIVE AUTHORITY

1.1. National Road Vehicle Standards

The Vehicle Standard (Australian Design Rule 68/01 – Occupant Protection in Buses) 2024, which may also be cited as the Australian Design Rule 68/01 – Occupant Protection in Buses or ADR 68/01, is made under section 12 of the *Road Vehicle Standards Act 2018* (the RVSA). The RVSA enables the Australian Government to establish nationally uniform standards that apply to new road vehicles or road vehicle components when they are provided to the market in Australia. The RVSA applies to vehicles or components whether they are manufactured in Australia or imported.

The making of the vehicle standards necessary for the RVSA's effective operation is provided for in section 12, which empowers the Minister to "determine standards for road vehicles or road vehicle components".

1.2. Exemption from Sunsetting

ADR 68/01 is exempt from the sunsetting provisions of the *Legislation Act 2003*.

Source of the Exemption

A standard made under section 12 of the RVSA is not subject to the sunsetting provisions of section 50 of the *Legislation (Exemptions and Other Matters) Act 2003* through section 12 of the Legislation (Exemptions and Other Matters) Regulation 2015 (table item 56C). A similar exemption was previously granted in respect of national road vehicle standards made under section 7 of the *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 Australian Design Rules (ADRs), including ADR 68/01, continue to remain in force and available to regulators, industry and the public.

Intergovernmental Dependencies

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

The Commonwealth uses the ADRs as the basis on which approvals to supply types of road vehicles to the market are granted under the Road Vehicle Standards Rules 2019. States and territories and the National Heavy Vehicle Regulator use the ADRs as the primary criteria on which vehicles are assessed for road worthiness. This 'in-service' aspect is dependent on the date of manufacture, which determines the applicable version of the ADRs against which the vehicle can be assessed. The ability to rely on national standards is particularly relevant given the long service life of vehicles – the average age of vehicles in Australia is over 10 years.

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

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

Commercial Dependencies

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

Reviews of Australian Design Rules

ADRs are subject to regular reviews, as resources permit, and when developments in vehicle technology necessitates updates to requirements. Reviews of the ADRs ensure the ongoing effectiveness of a nationally consistent system of technical regulations for vehicle design, which are closely aligned, wherever appropriate with leading international standards such as United Nations (UN) regulations. This method facilitates the rapid introduction of the latest safety devices and technological advances into the Australian market, while also contributing to the industry's cost competitiveness in the domestic market. Where a review results in a new or amended ADR, these changes are subject to full parliamentary scrutiny.

2. PURPOSE AND OPERATION

2.1. Overview of the Regulatory Framework

The RVSA establishes a regulatory framework to regulate the importation and first supply of road vehicles to the market in Australia. The core principle of this framework is that vehicles which comply with appropriate standards are suitable for provision to the market in Australia. The ADRs have set out those standards since the early 1970s. At that time, they were applied cooperatively by the Australian Motor Vehicle Certification Board representing the Commonwealth and state and territory governments. In 1989, this arrangement was replaced by the MVSA and the Australian Design Rules were determined as national standards. The RVSA commenced in full and replaced the MVSA on 1 July 2021. A two-year transition period was provided between 1 July 2021 and 30 June 2023.

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

2.2. Overview of the ADR

The function of this ADR is to specify requirements for seatbelts, the strength of seats, seat-anchorages, seatbelt anchorages, child restraint anchorages, and provisions for protecting occupants from impact with seat backs, accessories on seats and armrests. The requirements apply to certain omnibuses, i.e. those that are not specially designed with space for standing passengers and not equipped with any passenger seatbelt assemblies.

Background to ADR 68/00

In 1989, it was agreed that a new Australian Design Rule (ADR) 66/00, based on UN Regulation No. 80, would be implemented. This ADR would require improved seats, seat-anchorage strength and padding aimed at both cushioning and restraining the occupant without the use of seatbelts. This requirement was intended to offer protection in crashes with heavy vehicles at urban speeds, or with lighter vehicles at highway speeds. However, two tragic bus crashes in Australia at highway speeds towards the end of 1989 focused attention on the provision of lap-sash seatbelts in long distance coaches. These crashes initiated the development of the Vehicle Standard (Australian Design Rule 68/00 – Occupant Protection in Buses) 2006 which requires lap-sash seatbelts integrated into the bus seat for passengers and provides protection at deceleration levels up to 20g.

Considerable research and effort went into determining the requirements for bus seats, lap-sash seatbelts and the 20g dynamic loads with restrained occupants plus impact by unrestrained occupants to the rear. The requirement to mandate lap-sash seatbelts was based on full scale crash tests of school buses conducted by the National Highway Traffic Safety Administration (NHTSA) in the United States of America. This revealed high risk of serious neck injury with lap only belts, whereas there was a slight risk with no belts and good protection with lap-sash seatbelts. These full-frontal crashes were conducted at 50km/h and are equivalent to a head-on collision between similar vehicles, each travelling at 60km/h. Such a crash produced a peak deceleration of about 12g in the vehicle body. This test supported the Australian conclusion that 20g restraint systems are needed for 100km/h head-on crashes between heavy vehicles.

Clause 5 Requirements

Clause 5.1 states that all seats, other than that of the bus driver, must meet the requirements set out in ADR 68/01. These include both static and dynamic testing elements.

Clause 5.2 describes the technical requirements for dynamic testing in accordance with Clause 7 and the injury criteria determined in accordance with Clause 9. The static testing requirements of seat strength are provided in Appendix 1 and 2.

The purpose of setting dynamic and static testing requirements for seat strength is to minimise passenger injury through ensuring that seats stay in place in the event of a frontal crash and to reduce passenger impact with the seat back in front. In essence, these testing requirements ensure that vehicle seat backs are strong enough and have sufficient energy absorbing properties to prevent any structural failure of the seat back

in front from unrestrained occupants being propelled forward into the seat back in front in a severe frontal collision.

Clause 5.3 states that seat-anchorages are required to withstand the forces, which result from the dynamic and static tests specified in Clause 7 or Appendix 1. This rule also allows for seat-anchorage strength to be tested as specified in Clause 8 using the forces detailed in Clause 7 or Appendix 1.

The purpose of this clause is to ensure that the seats remain fastened to the bus body in the event of a severe crash. Therefore, the seat-anchorages need to be structurally adequate, even after many years of service, considering the long life of buses in the fleet. A critical difference between ADR 5, which specifies general requirements for seatbelt anchorages and ADR 68 requirements is that ADR 5 was developed based on a sedan (passenger car) design which typically has only two rows of seating. Furthermore, seating positions to the rear in sedans have lap-sash seatbelts and wearing rates are generally higher. Whereas a MD or ME class vehicle typically has several rows of seats and crashes at high speed in Australia indicate that the occupants and seats of buses are displaced forward, causing progressive failure and increasing injuries to passengers closer to the front of the bus.

Clause 5.4 describes the requirements for seatbelt assemblies. Each seat must be equipped with a lap-sash belt that is fitted with an emergency locking retractor as specified in ADR 4/… . Rear facing seats are permitted to be equipped with a lap-sash belt or a lap-belt with an emergency locking retractor as specified in ADR 4/… .

Seatbelts are one of the most effective countermeasures available to reduce the likelihood of death and non-fatal injury. ADR 68 specifies that the belt or restraint system applied must be designed so that, when it is correctly installed and properly used by a vehicle occupant, satisfactory operation can be assured and the risk of bodily injury in the event of a collision is reduced.

International research shows lap-sash seat belts could be expected to reduce injuries in frontal, side and rollover crashes of buses. This was demonstrated in a report published by NHTSA in 2002, which showed that of the proportion of school bus passengers killed, 33 per cent was in frontal collisions and 26 per cent was a result of side collisions. The number of rollovers (without prior frontal or side collision) was unknown in the study but amounted to no more than a few per cent. It was therefore estimated that about 60 per cent of all bus crashes in which passengers are injured could be expected to be positively influenced by lap-sash seatbelts.

Other international research has confirmed concerns about the inferior protection provided by lap only seatbelts compared with lap-sash belts. Overall, lap only seatbelts are more effective at preventing serious injuries than unrestrained occupants but some serious injuries can be caused by the lap only seatbelt, including:

- Poorly adjusted lap belts can cause abdominal injuries
- Lower spine injuries can result from the extreme flexing of the torso around the lap belt
- If head contact occurs then severe cervical spine injuries can result from the combination of tension and shear forces in the neck

- Padding may not reduce the risk of such injuries because it takes only a mild shear force to cause life-threatening injury when a child's neck is under extreme tension in a frontal crash. There is a high risk of serious neck injury with lap only seatbelts where the head is able to contact an object; padding makes little difference to this risk and may exacerbate neck injury by increasing sliding resistance on head contact areas during impact.

NHTSA estimated that lap-sash seatbelts would be 50 per cent effective in reducing passenger fatalities in frontal crashes. They further concluded that properly used lap-sash belt systems have the potential to be effective in reducing fatalities and injuries in other (non-frontal) crashes in addition to being particularly effective in reducing ejection in rollover crashes.

Clause 5.5 describes the requirements for seatbelt anchorages. Seats must be equipped with seatbelt anchorages with pelvic and upper torso restraints for lap-sash belts, and pelvic restraints for lap belts. These must be able to withstand the forces resulting from the dynamic and static tests specified in Clause 7 or Appendix 1.

Seatbelt anchorages constitute an important component of the seatbelt assembly and therefore needs to be designed to transfer loads from a seatbelt assembly to the vehicle or seat during an impact. Loads in this instance include the forces generated by the restrained occupant or dummy.

Clause 5.6 states at least 6 seats in the vehicle must be fitted with child restraint anchor fittings. Manufacturers may choose to fit child restraint anchorages and child restraint anchor fittings meeting the requirements specified in ADR 34/... .

This clause details the number of fittings which allows the attachment of the attaching clip to the vehicle, which usually attaches to the child restraint anchorage using components in the child restraint anchor fitting package. The requirements in this clause ensures parents, caregivers and guardians of children are able to fit a child restraint in the bus to restrain a child passenger in the event of a vehicle crash and thus minimise the risk of bodily injury. ADR 34 prescribes requirements for top tether anchorages and their fittings so that child restraints may be adequately secured to the bus. ADR 34 may be used to comply with ADR 68 as it specifies a standard package of fitting hardware and accessibility requirements to facilitate correct installation and interchangeability of child restraints in the bus.

Clause 5.7 identifies additional tests and requirements relating to occupants located in seats installed without seat backs in front (as strikable structures) and instead have other strikable structures such as modesty panels, hand rails, etc. In such cases, the tests in clause 7 must be conducted with the previously mentioned other strikable structures installed on the test platform with rows of seats. This clause clarifies that side facing seats are not permitted and are by design unable to meet the performance requirements of this ADR. Clause 5.7 also makes clear that adjustable seats, seatbelts and sashes are required to meet the performance requirements in all positions of adjustment available to the occupant.

Clause 5.8 states each seating position must be provided with a visual warning to encourage occupant seatbelt use. Seating positions with a seat back in front of it must have the label affixed to the back of the seat. If there is no seat back in front of the seating position, the visual warning must be affixed to a part of the vehicle structure directly in front of the seating position. The front of each occupant compartment must

also have a visual warning to encourage seatbelt use. The visual warning should not interfere with the vehicle's compliance with other ADRs, including causing a distraction for the driver or other road users, through the positioning or illumination of the visual warning. The vehicle must also be equipped with an audible warning message to encourage occupant seatbelt use. The audible warning message must be heard throughout the occupant compartment.

As an option, a passenger recognition system may be fitted to support the activation of the audible warning message when passengers are boarding the vehicle but not when they are exiting. This optional requirement would minimise the number of announcements when no new passengers board the vehicle and therefore reduce audible disturbance for the driver and passengers. Passenger recognition systems are designed to provide accurate and reliable data. Whilst designed to achieve high levels of precision, it is important to acknowledge that their accuracy may be occasionally influenced by certain external factors, including lighting conditions, camera angles, passenger density, and environmental settings. As such, these external factors may result in occasional accuracy discrepancies or false positives.

Clause 6 states general accessories and armrests attached to seats must be designed so that when the test loads are applied, they do not bend or break to cause dangerous projections or edges. This is to ensure suitable provisions are made for protecting occupants from impact with seat backs, accessories on seats and arm rests during a collision, because crash test investigation of buses have identified occupants being injured or killed due to dangerous projections and edges. These requirements minimise the risk of bodily harm.

Clause 7 describes the dynamic test procedures for seats, seat-anchorages, dummy preparation, impact simulation and unrestrained occupant loading from the seat behind. This clause indirectly determines the strength of a bus structure as it must be able to support the seats, restrained and unrestrained dummies and associated components that are subjected to forces in the dynamic tests.

The dynamic tests for ADR 68 include a restrained occupant test (with injury criteria measured) and an unrestrained occupant test (with no injury criteria measurement required). The purpose of the restrained occupant test is to limit injury risk for properly restrained occupants. The purpose of testing with the unrestrained occupant is to stop seat failures that could increase injury risk to restrained occupants in the rows in front, as well as to stop any failure of any component of the seat, including total separation of the seat from the vehicle chassis.

Clause 8 describes an alternative static test procedure for checking the strength of vehicle seat-anchorages. It is also expected that seat-anchorages are required to withstand the forces which result from the static and dynamic tests specified in Clause 7 or Appendix 1. This clause clarifies that the bus floor must be strengthened and fitted with appropriate seat-anchorage fittings to retain the seat on the bus floor and therefore withstand the forces for relevant crash test requirements to be met.

Clause 9 details the determination of the Head Injury Criteria (HIC), Thorax Injury Criteria (ThIC), Femur Injury Criterion (FIC) and Sternum Injury Criteria (SIC) for dummies in the dynamic test requirements. These Injury Criteria values specify forces applied to the dummies used in testing. HIC is a measure of the likelihood of head injury to an occupant arising from an impact. HIC includes the effects of head

acceleration and the duration of the acceleration. Large accelerations may be tolerated for very short times. At a HIC of 1000, there is an 18 per cent probability of a severe head injury, a 55 per cent probability of a serious injury and a 90 per cent probability of a moderate head injury to the average adult occupant. Similar to HIC, ThIC has been developed in order to predict thoracic risk and therefore evaluate the overall effectiveness of restraint systems in an impact. Frontal collision investigations reveal a high occurrence of femur injury for occupants. A broken femur is a serious injury that requires immediate medical care. The FIC was developed to set a maximum value of the compressive load applied to the right and left thighs of the dummy. Most sternum injuries are commonly caused by blunt, anterior chest-wall trauma and deceleration injuries in vehicle collisions. SIC is an evaluation of chest injury risk.

By way of background, ADR 5 was developed well before research into severe bus crashes revealed that nothing less than 20g anchorages would provide adequate protection and that such anchorages were feasible. Furthermore studies have shown that 10g systems are likely to fail in a severe crash for buses.

For these reasons the dynamic test requires three rows of seats on a test platform with restrained Hybrid IIIs installed in the middle row and unrestrained dummies in the rear row. The intent here is to ensure that the introduction of stronger seats (with the introduction of ADR 68/00) should not unduly increase the hazard to unrestrained occupants striking the seat in front in the event of a crash.

Clause 10 describes technical requirements for seat backs and seat restraining device strength. This requirement is to ensure that the seat backs meet minimum strength requirements for seated occupants during normal operation and a frontal impact.

Crash history shows that unrestrained occupants become a hazard to restrained occupants in severe bus crashes. This clause ensures seat backs are of sufficient strength to withstand forces during a crash whilst retaining a restrained occupant.

Clause 11 describes the technical requirements for the provision (number) and location of anchorages and sash guides, to ensure they are adequate and positioned effectively for seated occupants. This clause ensures suitable adjustments can be made by adult occupants of varying stature to restrain themselves properly in the bus.

Clause 12 describes the width of the seat cushion required to be recognised as one seating position or multiple seating positions. These requirements ensure passenger comfort while undertaking a journey.

Appendix 1 details the static test procedures for occupant protection in buses. This includes the preparation of seats, application of test loads for seats, seat back tests, as well as the use of body block loads used to replicate occupant loads on seats. The static test prescribed in this Appendix may be more demanding than the dynamic test and would potentially result in much stronger anchorages and heavier structures than are necessary to withstand 20g dynamic loads.

In this static test, cylinders are to be simultaneously pushed against the seat back at two heights and for each seating position. At the same time a load is applied to two body blocks that represent a restrained adult and a further load representing the inertia of the seat (may be added to the lap belt body block). Limits are set for the horizontal displacement of the loading systems.

Appendix 2 details the requirements for the seat back energy-dissipating test. This includes head form dimension and positioning, details of points of contact and requirements of the seat back. It also details the test setup, apparatus, recording instrument accuracy, test procedure and method for recording test results to ensure results are accurate and relevant. This requirement is to ensure the surface of rear parts of seats or any other contactable surface must have acceptable energy dissipation properties and must not exhibit dangerous roughness or sharp edges likely to increase the risk or severity of injury to the occupants. This test sets a limit on headform deceleration.

3. MATTERS INCORPORATED BY REFERENCE

3.1. Legislative Instruments

Clause 4 includes a reference to the Vehicle Standard (Australian Design Rule Definitions and Vehicle Categories) 2005 (which may also be cited as the Australian Design Rule – Definitions and Vehicle Categories). This sets out definitions for many terms used in the ADRs, including the vehicle categories used in ADR applicability tables.

In accordance with paragraph 12(2)(b) of the RVSA, this ADR is incorporated as in force or existing from time to time.

The ADRs may be freely accessed online through the Federal Register of Legislation. The website is www.legislation.gov.au.

3.2. Other Documents

International Organization for Standardization

Clause 7.5.1 includes references to ISO 6487:2015, ISO 6487:2012, ISO 6487:2002, ISO 6487:2000, ISO 6487:1987 and ISO 6487:1980. These documents give requirements and recommendations for measurement techniques involving the instrumentation used in impact tests carried out on road vehicles.

In accordance with paragraph 14(1)(b) and subsection 14(2) of the *Legislation Act 2003*, this document is incorporated as in force on the date this national road vehicle standard is made.

ISO standards are all commercially available. While not freely available, editions of ISO 6487 are readily accessible and widely used by vehicle manufacturers and test facilities as part of their professional libraries. Subject to copyright conditions, people may view a copy of any edition of ISO 6487 incorporated by reference, at the offices of the Department of Infrastructure, Transport, Regional Development, Communications and the Arts in Canberra.

Section 12 of the RVSA allows the Minister to incorporate a broad range of documents, including as in force or existing at a particular time or as in force from time to time, when making national road vehicle standards. This ensures that Australia's legislative framework is well-prepared for future developments in the international road vehicle space.

United Nations

Appendix 2 Clause 2.1.2.3 includes a reference to the UN Regulation No. 17 (R17). This is an international standard for strength of seats, their anchorages and head restraints.

Appendix 2 Clause 2.1.2.3 includes a reference to the UN Regulation No. 25 (R25). This is an international standard for head restraints.

In accordance with paragraph 14(1)(b) and subsection 14(2) of the *Legislation Act 2003*, each of these UN documents are incorporated as in force on the date this national road vehicle standard is made.

UN Regulations and Resolutions may be freely accessed online through the UN World Forum for the Harmonization of Vehicle Regulations (WP.29). The WP.29 website is www.unece.org/trans/main/welcwp29.html.

4. CONSULTATION

4.1. General Consultation Arrangements

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.

Proposals that are regarded as significant need to be supported by an Impact Analysis (IA) meeting the requirements of the Office of Impact Analysis (OIA) as published in the *Australian Government Guide to Policy Impact Analysis* or the *Regulatory Impact Analysis Guide for Ministers' Meetings and National Standard Setting Bodies*.

4.2. Specific Consultation Arrangements

The department has consulted through the usual stakeholder consultative forums on improvements to passenger safety in buses from November 2023. The changes introduced in this ADR relating to visual and audible warning requirements for occupant seatbelt awareness were identified as an Australian Government priority in response to the bus crash in the Hunter Valley in June 2023, where 10 people died and 25 were injured.

In August 2024, the department reached an agreement with the states and territories, the Bus Industry Confederation (BIC) and industry on the new audible and visual requirements for buses through the Bus Safety Working Group (BSWG).

The department also undertook targeted consultation on the final draft of the new version of the ADR. These BSWG meetings involved nominated senior and technical representatives of government (Australian and state/territory), the manufacturing and operational arms of the bus industry.

5. REGULATORY IMPACT

5.1. Impact Analysis

The department submitted a Preliminary Impact Analysis (PIA) to the OIA to introduce these audible and visual warning requirements through a new ADR 68/01. The OIA determined that a full Impact Analysis (IA) was not required as industry, industry bodies and the state and territory governments present in the BSWG supported adding a requirement to include audible and visual reminders to passengers to wear their seatbelts in a new version of ADR 68 (ADR 68/01). The OIA reference number for this PIA is OIA24-08513.

The benefits of reminding occupants to wear seatbelts will lead to increased seatbelt use therefore reducing the number of fatalities, serious and minor injuries in crash events and other sudden bus movements (emergency braking, sharp cornering or evasive manoeuvres). There are costs associated with mandating visual and audible warning messages for bus occupants to remind them to wear seatbelts. The BIC estimated the cost of $2490 per vehicle. For reference the price of a new 57 seat bus can range from $500,000 for internal combustion engine buses and $1,000,000 for zero emission buses.

6. STATEMENT OF COMPATIBILITY WITH HUMAN RIGHTS

The following Statement is prepared in accordance with Part 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011.*

6.1. Overview

ADR 68/01 specifies requirements, for certain omnibuses, requirements for seatbelts, the strength of seats, seat-anchorages, seatbelt anchorages and child restraint anchorages, and provisions for protecting occupants from impact with seat backs and accessories on seats and armrests.

6.2. Human Rights Implications

ADR 68/01 does not engage any of the human rights and freedoms recognised or declared in the international instruments listed in section 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*.

6.3. Conclusion

ADR 68/01 is compatible with human rights, as it does not raise any human rights issues.