BIC PAPER ON Dimensions and Mass for Low and Zero Emissions Buses and Coaches

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Contents

1. Introduction

This paper reviews the status of heavy vehicle body mass and dimensions as it relates to buses and coaches. Consequently, the paper also provides an update on the BIC position for wider vehicles (specifically 2.5 to 2.55 m body width) as it relates to the Australian bus industry.

2. Zero and Ultra Low Emission Bus and Coach Mass Effects

With the introduction of both zero emissions buses, as well as ultra-low emission Hybrid, Euro VI and beyond diesels, buses are getting heavier. This effect is well known, and the EU have long recognised this such that they have provided increases in operating mass allowances for zero emission buses and coaches of up to 2.5 tonne per bus type and that such allowances have been in place since 2015 (these allowances are significantly above the current Australian limits).

The EU allowances were provided so that the new technology buses could achieve equivalent passenger carrying capacity when compared to diesel powered buses. And although buses are typically only fully loaded a small percentage of the time (such as towards the end of a trip), reductions in passenger capacity (per bus) typically requires an additional bus, or coach, to address such shortfalls

(Note: the positive emissions effect of a new ZEB, which has reduced passenger capacity, are reduced as additional buses are needed for peak service times).

In Australia, two axle buses are limited to 18 tonne, three axle buses are limited to 23 tonne and articulated buses are limited to 26 tonne. Although these Australian mass limits worked with traditional diesel type buses, such limits do not work with the heavier zero, and ultra-low, emission bus technologies.

3. Status of the BIC Position on Body Width

The BIC position on body dimensions has been to support the 2.5 m body width as determined by ADR 43/04 and where suppliers wanted to provide 2.55 m product to market (or in turn operators wanted to utilise such buses or coaches), then the established PBS processes could be utilised. Also, recent updates in the controlled access routes have given certain 2.55 m heavy vehicles and 2.55 m rigid buses general access status.

However, with the expanding local ZEB and ultra-low bus emissions market, the BIC continues to support the PBS processes, but the recent decision from the BIC council is that in addition, the BIC is to seek ADR changes to allow for wider 2.55 m buses.

The main reason for this change in policy being the combinations of increased axle mass limits and low floor accessible passenger access needed is leading to a general use of wider independent front suspension systems as discussed in Section 6 of this paper.

4. Background to SVSEG and Safer Heavy Vehicles

The National Road Safety Action Plan 2018-2020 included a commitment to investigate the introduction of safer, cleaner heavy freight vehicles by minimising regulatory barriers, and commencing in 2018, discussions were held with the Department of Infrastructure, Transport, Regional Development and Communications, Vehicle Standards Section (the Dept.), and industry stakeholders in regard to how this commitment could be achieved. These discussions were propagated through the Strategic Vehicle Safety and Environment Group (SVSEG) and were aimed at both the truck and bus industries.

The trucking industry responded to this with the overall position that they needed an increase in body width to allow for the broader uptake of safer and cleaner heavy freight vehicles and a series of papers were provided to this effect.

The BIC presented its position on this issue at SVSEG in December 2018, which reflected the BIC policy that buses and coaches were already achieving the required, and highest, safety and emission reduction requirements within the ADR bus body dimension requirements. The only over width or dimensional items were things such as external CCTV cameras, and sensors for assisted driver vision systems.

Further negotiations took place over the intervening two-year period, and these led to the Dept. proposing a set of ADR changes to accommodate the positions posed by both the truck and bus industries. The ADR changes are being implemented as discussed below.

4.1 RIS on Safer Freight Vehicles

In 2021, the Dept. released a RIS that considered a possible range of changes to the ADRs to facilitate an increased take up of safer and/or more efficient heavy freight vehicles in Australia. This included options for:

- Vehicles with enhanced devices for indirect vision and/or monitoring devices to detect other road users;
- More productive and safer wider freight vehicles – including four options (with 2.55 and/or 2.6 m), each with proposed new safety requirements; and
- Freight vehicles with more efficient and/or productive axle configurations.
- Buses were excluded from the wider body allowances as the BIC position at this time was that buses and coaches with a body width of 2.5 m can, and already did, employ the advanced safety features.
- The only dimensions issues for buses were the ADR changes needed to formally address the extra width and length required to accommodate items such as sensors and cameras used with these new safety systems.
- The BIC also advised that that an increase in the actual body width did not then result in increased bus/coach carrying capacity as passenger capacity increases are governed by body length and the current Controlled Access Bus regulations allow for high capacity rigid buses and coaches.

- The RIS contained four options these being:
  - *Option 1a – Increase the width limit to 2.55 m for goods vehicles and trailers over 4.5 tonnes.*
  - *Option 1b – Increase the width limit to 2.55 m for goods vehicles over 4.5 tonnes only.*
  - *Option 2a – Increase the width limit to 2.6 m for goods vehicles and trailers over 4.5 tonnes.*
  - *Option 2b – Increase the width limit to 2.6 m for goods vehicles over 4.5 tonnes only.*
- Submissions for the RIS closed on Wednesday 30 June 2021.
- During the negotiations period, meetings were held with the Dept, and noted issues were:
  - The Dept. accepted the trucking industry position that safety needs extra body width.
  - Overall, the main caveat for the added width was that any wider vehicles must have all the required safety features to offset the increased risk of the wider body.
  - There was some discussion regarding electric buses needing to be 2.55 m wide, but no approaches were made to BIC from any members on this issue at that stage.
- The outcome from the RIS process was the adoption of Option 1a – Increase the width limit to 2.55 m for goods vehicles and trailers over 4.5 tonnes only.
- These ADR changes also allow for buses and coaches to fit range of equipment to the exterior of the body that can be outside the 2.5 m limit, such as CCTV cameras and radar sensors for safer vision systems such as vulnerable road user sensing systems.

  (Note: The details on these amendments are provided in Appendix A of this paper and it needs to be noted that whether the body width is 2.5 or 2.55 m, these safety system exterior components need extra width, therefore a 2.5 m body has in effect an overall width of 2.55 m, and a 2.55 m body would then have an overall width of 2.6 m with these systems fitted).

5. Current Compliance Process for New Local Manufactured and Imported Buses/Coaches

Currently the options for compliance and access rights for a new bus or coach into the Australian market in terms of dimensions, these being:

a) **Standard Rigid Bus/Coach:** To supply a rigid bus/coach that is within the ADR limits of 2.5 m and 12.5 m. Such a vehicle has full network access rights.

b) **Standard Articulated Bus/Coach:** To supply an articulated bus/coach that is within the ADR limits of 2.5 m and 18.0 m. Such a vehicle has full network access rights.

c) **Rigid Bus/Coach over 12.5 m (ADR limit for rear overhang):** To supply a bus/coach that is within the ADR limits of 2.5 m but is over the 12.5 m length and less than 14.5 m in length plus with a rear overhang compliant to the ADR limits. This type of vehicle receives an over dimension (OD) ADR compliance and is then required to apply via the NHVR for a Class 2 Controlled Access Bus (CAB) approval. Given this approval, the bus can then operate on the CAB Network.

d) **Rigid Bus/Coach over 12.5 m (in excess of ADR limit for rear overhang):** To supply a bus/coach that is within the ADR limits of 2.5 m but is over the 12.5 m length and less than 14.5 m in length plus with a rear overhang outside the ADR limits. This type of vehicle receives an over dimension (O.D.) ADR compliance and is then required to apply via the NHVR for a Class 3 Controlled Access Bus (CAB) approval. Given this approval, the bus can then operate on the CAB Network.

   It should be noted that the ADR O.D. approval and then the CAB process provides the industry with a simpler and consistent process to compliance a bus/coach and then to register and operate that vehicle. (The PBS process, which is only required when a bus is outside these ADR limits, has not been a popular option for the bus industry and there are only limited numbers of coaches that are operating under the PBS process).

e) **Bus/Coach over ADR dimension in Width, Height or Length (for example were the body or axle(s) are over width):** The final option is to supply a bus/coach that is outside of the ADR dimensions in some way. That is it is outside the ADR width, length, or height limits, then such a bus/coach is typically given a non-standard ADR approval and is then required to apply to the NHVR for a nonstandard access permit or undergo the PBS process with the view of achieving PBS approved access rights.

(Note: these standards allow for the use of established higher productivity buses and coaches and for vehicles outside these established norms, the PBS processes are available).

6. Current Issues for Chassis Suppliers

In recent times, chassis suppliers have raised issues where they are having difficulties with the supply of new technology chassis that meet the current Australian 2.5 m width requirement. As reported, there are a number of factors making the supply of such chassis possible but more complex, with the main issues being higher axle mass requirements in combination with accessible bus requirements.

These issues are given in the following and although these issues are EU centric, all major international chassis and complete bus suppliers comply with the EU market requirements (or their respective home country equivalents):

Higher Axle Mass Requirements:

- With the wider introduction of both zero emissions buses, hybrids, as well as new generation Euro VI and beyond diesel buses, buses are getting heavier.
- In the EU, via Regulations 2015/718, 2015/719 and 2019/1242, the axle mass limits have been increased for zero emission and alternative fuelled buses. These increased limits are:
    - Two Axle buses low emission buses have increased from 18 to 19.5 tonne GVM.
    - Three Axle rigid buses have increased from 26 tonne to 27 tonne for alternative fuelled and 28 tonne GVM for zero-emission technology.
    - Articulated buses have increased from 27 tonne to 28 tonne for alternative fuelled and 30 tonne GVM for zero-emission technology.

- Axle limits do apply based on various combinations and the front axle width has increased to allow for independent front suspension that can accept these higher axle limits.

(Note: Australian limits are; two axle 18 tonne, three axle 22 tonne and articulated 26 tonne regardless of engine or drive line type).

EU Changes to Accessible Bus Requirements:

- The EU has implemented various Disability Accessibility Strategies (2010 to 2020 and now 2020 to 2030) that have increased the stringency of requirements for bus accessibility such that chassis suppliers have had to increase the clear width between the front axle wheelarches to 900 mm (this is a result of changes to R107 Annex 8 Accommodation and accessibility for passengers with reduced mobility).

To address the above issues, chassis suppliers have progressed to higher capacity independent front suspension that also need to be sufficiently wide to accommodate the above front wheelarch widths. Additionally, the higher axle limits are also requiring the use of wider section tyres, which is also effecting axle width.

6.1 How to Address These Issues?

To address the above issues, the BIC considered several options, the first to seek extra ADR width allowances for specific bus axle combinations and the second to seek extra ADR width allowances for the complete bus or coach (that is for the BIC to align with the Safer Heavy Vehicles width allowances).

Following an extended review, the BIC council decided on the second option, being that the is to BIC seek an ADR change that allows buses or coaches to be built to 2.55 m body and axle width (in conjunction with an ADR change to allow for the external addons such as cameras and sensors to go to 2.6 m).

Noting that other general outcomes from such a change could be:

- An ADR change to allow 2.55 m buses and coaches, would allow a clearer path for suppliers to import wider fully built-up product.
- An ADR change in width would also allow for wider front axle configurations, with wider section higher mass rated tyres, even on 2.5 m bodies.
- It should also be noted that current state government bus supply contracts limit body width to 2.5 m, but this could change over time.

Considering the above, the BIC council has also agreed that the BIC Executive need to seek ongoing support for local manufacturing of buses and coaches regardless of the configuration.

7. Effects on Local Manufacturing

While there is recognition that the change in the body width allowance may have an effect on the local bus builders, State Government Procurement Policies for the purchasing of Buses for Public

Transport Contracts are heavily weighted towards local content. This also extends to sub-component suppliers for example; seats, electronic bus equipment and bus door manufacturing.

In addition, the BIC council have requested that the BIC Executive pursue a program to develop an industry approved process for the calculation of local content for the various components used within the bus manufacturing industry. This would be intended to assist the State Government Procurement Bodies with the voracity of the local content claims put forward by suppliers during tendering and assessment processes.

8. Proposed ADR Width Increase Package

The BIC considers that any request for an ADR change to allow for an increase in overall bus and coach width to 2.55 m, needs to be part of a package that would not only ensure the ongoing high level of bus and coach safety, but also to address known operating mass issues for both increased bus mass but also the increasing per passenger mass (population getting heavier).

Therefore, the BIC suggests the following package be considered as part of an ADR change to 2.55 m:

- **Masses:** Implement a modular axle mass approach, that being:
    - **Two axle rigid:** 7 tonne front axle, 12.5 tonne rear axle, gross 19.5 tonne for ZEB's, or Ultra Low Emission buses being Euro VI and above.
    - **Three axle rigid:** 7 tonne front axle, 6.5 tonne tag axle and 12.5 tonne drive axle for tonne for alternative fuelled and 25 tonne GVM for ZEB's, or Ultra Low Emission buses being Euro VI and above.
    - **Articulated:** 7 tonne front axle, 12.5 tonne centre and 12.5 tonne rear axle, but 30 tonne gross (floating 2 tonne), for ZEB's, or Ultra Low Emission buses being Euro VI and above.
- **Axle widths:** Chassis with 2.55 m axles can be used with either a 2.5 or 2.55 m bus body.
- **Use of Wide Tyre Sections:** Wide 315 section type tyres, for example 315/80R22.5 on all steer and tag axles (min 295/80R22.5 on duals).
- **Recalculation of Passenger Masses:** The BIC current 65 and 80 kg per person issue to be addressed and that the use of 80 kg for passenger capacity is formally adopted for all passenger mass calculations for buses and coach using the higher mass limits (currently the 80 kg is a guide only).
- **Vehicle Safety Systems:** As these systems evolve over time, and that the bus and coach industry have a proven history for being early implementers of all such systems, that a general commitment would be given that buses and coaches utilising the increased mass allowances would also need to have set safety packages (given that these packages will evolve over time for new vehicles).

The types of systems that are currently in general use on newer buses and coaches are given below and to allow for innovation, the BIC would suggest that an agreed minimum set of features be reached with regulators, and then some form of continuous implement plan be put in place for new vehicles that utilise the higher masses.

Currently adopted safety systems include those listed below and such systems could form part of agreed safety packages:

- **Advanced Suspension and Braking Systems:** Such as Anti-collision system - AEBS 'Advanced Emergency Braking System' provided on the chassis, EBS 'Electronic Braking System', ESP 'Electronic Stability Program', ABS 'Antilock Braking System', ASR 'Acceleration Skid Control'.
- **Advanced Vision Systems:** On board CCTV with remote access, venerable road user systems, reversing and low speed driver vision assistance.
- **Active Driver Assistance:** Lane Keeping System (departure warning), Active Cruise Control (keeping a set time gap to the vehicle in front), Collision warning System with Automatic Emergency Braking (AEBS).
- **Fire Safety Systems:** Use of active fire monitoring and protection system in engine bays, smoke detectors and tyre pressure monitoring as per BIC Fire Mitigation Advisory.

Appendix A: Safer Freight Vehicles Outcome

Option 1a – Increase the width limit to 2.55 m for goods vehicles and trailers over 4.5 tonnes

Under this option (wording provided from draft ADR papers released by the Dept.):

- The vehicle width limit for goods vehicles (i.e. trucks) over 4.5 tonnes GVM and trailers over 4.5 tonnes ATM (ADR category NB2, NC, TC (over 4.5 tonnes) and TD vehicles), would be increased from 2.5 m to 2.55 m.
- Permanently fixed webbing-assembly-type devices (such as curtain-side devices) would be excluded from the measurement of the vehicle width, provided the maximum distance across the body of the vehicle, including any part of the devices, is not more than 2.6 m.
- The wider goods vehicles (those exceeding the current 2.5 m limit) would be required to:
  - meet a new ADR 14/03 – Devices for indirect vision (refer Appendix 3), incorporating the technical requirements of the latest version of the relevant international standard (UN R46/04), with additional provisions to allow for US style crossover mirrors (refer Glossary in Appendix 1) to be used on bonneted trucks in place of UN style front-view mirrors, provided these allow the driver to see at least 900 mm past the extreme outer edge of the left-hand (near) side of the vehicle;
  - meet a new ADR 35/07 – Commercial Vehicle Brake Systems, which is currently being developed to extend the scope of the mandatory ESC requirements (referred to in the ADR as a Vehicle Stability Function) to apply to a broader range of heavy vehicles (refer Appendix 4) – note: this would include exemptions from fitting ESC to trucks with four or more axles and trucks designed for off-road use, as per UN R13 and ADR 35/06;
  - meet a new ADR 97/00 – Advanced Emergency Braking (refer Appendix 5) for Omnibuses, and Medium and Heavy Goods Vehicles, incorporating the technical requirements of the latest version of the relevant international standard (UN R131/01) – note: this would include exemptions for trucks with four or more axles and trucks designed for off-road use, as per the EU requirements and as recommended in UN R131;
  - meet a new ADR 99/00 – Lane Departure Warning Systems (refer Appendix 6), incorporating the technical requirements of the relevant international standard (UN R130) – note: this would include exemptions for trucks with four or more axles and trucks designed for off-road use, as per the EU requirements and as recommended in UN R130;

  - meet a new ADR 105/00 – Blind Spot Information Systems (refer Appendix 7), incorporating the technical requirements of the relevant international standard (UN R151) – note: this ADR would only apply to goods vehicles over 8 tonnes GVM, as per UN R151 (and from a later date than the other proposed new ADRs – see below);
  - meet a new ADR 106/00 – Side Underrun Protection (refer Appendix 8), incorporating the technical requirements of the latest version of the relevant international standard (UN R73/01) – note: this ADR would not apply to prime movers, as per UN R73; and
  - if over 7.5 tonnes GVM (and excluding prime movers), be fitted with conspicuity markings (refer Appendix 9) in accordance with ADR 13/00 (or any later version of this ADR).

- The wider trailers (those exceeding the current 2.5 m limit) would be required to:
  - meet a new ADR 106/00 – Side Underrun Protection (refer Appendix 8), incorporating the technical requirements of the latest version of the relevant international standard (UN R73/01); and
  - be fitted with conspicuity markings (refer Appendix 9) and reversing lamps in accordance with ADR 13/00 (or any later version of this ADR).

The new ADRs/ADR requirements for devices for indirect vision, AEB, ESC, LDWS, and side underrun protection, would be mandatory for goods vehicles exceeding the current 2.5 m width limit (with some limited exemptions – as noted above), from the same date the ADR amendment to allow wider vehicles (under standard approval processes) commences. These ADRs/ADR requirements would all be optional for vehicles not exceeding the current 2.5 m width limit, unless mandated through a separate ADR development process (e.g. as is currently being considered for AEB for heavy vehicles) to this proposal or where already a mandatory requirement (e.g. ESC for prime movers and shorter wheelbase rigid trucks). The same principles would be applied in regard to the applicability of the new ADRs for wider trailers – these would be mandatory for trailers exceeding the current 2.5 m width limit, and optional for trailers within the current limit (unless mandated through a separate ADR development process to this proposal).

It is proposed the new ADR for blind spot information systems (for detection of bicycles) would be mandatory for new heavy goods vehicles over 8 tonnes GVM and exceeding the current 2.5 m width limit, from 1 July 2024 for new models and 1 January 2025 for those models existing in the market prior to the new models date (1 July 2024). This is because this is a relatively new UN regulation, which will not be mandatory for all new heavy goods vehicles (over 8 tonnes maximum permissible mass) in the EU until July 2024.

If this option is implemented, a special allowance for refrigerated bodywork up to 2.6 m wide and/or a more general move to a 2.6 m width limit could still be considered at a later stage.