# Truck impact chart


Technical
Advisory
Procedure

Developed by the ATA Industry Technical Council
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### 1) Introduction

This Technical Advisory Procedure (TAP) has been developed by the ATA Industry Technical Council (ITC) to assist operators and assets managers in assessing the impact of Higher Productivity Freight Vehicles (HPFV) for a transport task on the road network.

The Truck Impact Chart (TIC) is used in comparing the impact of different vehicle combinations for a range of parameters to assist with access determination. However it is not the whole story, no matter how big or small the combination is, access still needs take into account the ability of the unit to negotiate its way through or within the area.

The original authors David Coonan (ATA, now retired) and Bob Woodward (Barkwood Consulting) published the first edition of the truck impact chart in 2010. This second edition document builds on the original and includes updated vehicle combinations, axle loadings and detailed explanations.

Western Australia and the Northern Territory have not implemented the national framework as managed by the National Heavy Vehicle Regulator and as a result there are some different arrangements there and some parts of the chart will not apply in the jurisdications.

## Part 1: Truck Impact Chart

### 2) Understanding the chart

To support the foundations of the chart, key vehicle operating information was sourced via a survey of operators covering fuel consumption, tare/payload and operational environment for the range of configurations. This foundation is sound moving into the future as the conditions and assumptions typically move relative to each other. In percentage terms, nothing changes.

### a) General comments

The key freight task benchmark is based on moving 1,000 tonnes of payload with a lead of 1,000 kilometres (a thousand kilometres out laden and a thousand kilometres back unladen). This won’t be true all of the time in the real world, but is indicative of how trucks operate and provides a consistent point for the chart’s calculations.

The base configuration (highlighted in the chart) has been lifted from a three axle rigid in the first edition to a six axle semi-trailer operating under general access mass limits for this the second edition.

Unless otherwise stated the combination is based on a tandem converter dolly. This will create a modular configuration which means that when a long combination is broken down and the tandem drive prime mover replaces the dolly, this will allow it to comply with the GML requirements.

It should be noted that general freight vehicles frequently cube out before they weigh out which means they don’t operate at the axle group’s mass limits, further reducing the pavement wear.

### b) Description of the configuration

It is useful to understand the coding used to identify the following selected longer vehicles and combinations. Descriptions are often used but can be too broad and often add confusion.

**Code breakdown**
A – Articulated unit
R – Rigid unit
T – Trailer unit
B – B trailer
n – Numbers refer to the number of axles in each axle group

A123T2B33 describes the truck shown on the front cover or more commonly referred to as an AB-triple. It is an articulated unit with a single steer axle, tandem drive pulling a 3 axle semi, plus an additional dog B-double trailer set made up of a 2 axle converter dolly, 3 axle A-trailer and 3 axle B-trailer.

For full explanation of the coding, refer to **description of truck configurations** TAP.

### c) Gross Combination Mass (GCM, tonnes)

The Australian Design Rules (ADRs) define the GCM as value specified for the vehicle by the ‘Manufacturer’ as being the maximum of the sum of the ‘Gross Vehicle Mass’ of the drawing vehicle plus the sum of the ‘Axle Loads’ of any vehicle capable of being drawn as a trailer. However, within this document we are only interested in the maximum mass of the vehicle and any trailers that may lawfully be driven on road, being the sum of the allowable axle loads.

### d) Payload (tonnes)

Maximum payload is the difference between GCM and the combination’s tare weight. Payloads used in the Truck Impact Chart are based on combination averaged tare weights and payload data based on the average of the feedback for the particular combination from the ATA operator survey.

### e) Mass limits

**General Mass Limits (GML)** – It is the heavy vehicle general axle mass limits prescribed in the Heavy Vehicle National Law (HVNL) that apply to public roads in Australia unless otherwise limited by load restriction signs.

**Concessional Mass Limits (CML)** – It is a mass exception under the HVNL which allows concessional mass limits for particular vehicles or vehicle combinations dependent on certain conditions being met (e.g. must hold NHVAS Mass Management Accreditation).

The mass exception allows tandem and tri-axle groups to be 5% above general mass limits (GML), with a maximum gross mass increase of 1.0 tonne for a vehicle up to a GCM of 55.0 tonnes and 2.0 tonne for a vehicle exceeding a GCM of 55.0 tonnes.

Refer to the National Heavy Vehicle Regulator (NHVR) website for further details – https://www.nhvr.gov.au/

**Higher Mass Limits (HML)** – It is a mass exception under the HVNL which allows higher mass limits on approved routes for particular vehicles or vehicle combinations dependent on specific conditions being met.

Typically, heavy vehicles will be allowed higher mass limits entitlements provided:-

- Operators of the vehicles or combination running HML on triaxle groups are accredited under the Mass Management Module of the National Heavy Vehicles Accreditation Scheme (NHVAS), with an accreditation label fitted to the hauling unit.
- Vehicles are fitted with certified road friendly suspensions.
- Vehicles are operating on an authorised HML route.
- Intelligent Access Program (IAP) registration may also be required.

**Road Friendly Suspensions (RFS) -** The requirements for RFS certification is cover in VSB 11 – Certification of Road Friendly Suspensions.[1] A listing of certified RFS systems is available on the Commonwealth Department of Infrastructure and Transport's website.[2] Table 1 shows a comparison of the mass limits permitted under the three mass limit regimes.

| **Comparison** | Maximum mass permitted under GML (tonnes) | Maximum mass permitted under CML (tonnes) | Maximum mass permitted under HML (tonnes) |
|---|---|---|---|
| Tandem axle group | 16.5 | 17.0 | 17.0 |
| Triaxle group | 20.0 | 21.0 | 22.5 |
| Quad axle group (Under review) | 20.0 | NA | 27.0 (PBS only) |
| Single drive axle on a bus | 9.0 | NA | 10.0 |

**Table 1: Comparison of the 3 mass limits for axle groups fitted with dual tyres**

[1] https://infrastructure.gov.au/roads/vehicle_regulation/bulletin/pdf/vsb_11.pdf
[2] https://infrastructure.gov.au/roads/vehicle_regulation/suspension.aspx

Table 2 has been provided to illustrate the different mass limits for a 9 axle B-double truck (B1233). The information has been taken from the National Heavy Vehicle Mass and Dimension Limits fact sheet, February 2014[3].

| Type of Mass Limit | Maximum Length (metres) | Allowable GVM/GCM (tonnes) | Single Steer Axle (tonnes) | Twin Steer Axle Group (tonnes) | Single Axle (tonnes) | Tandem Axle Group (tonnes) | Triaxle Group (tonnes) |
|---|---|---|---|---|---|---|---|
| **GML** | 25.0 | 62.5 | 6.0 | N/A | N/A | 16.5 | 20.0 per tri axle group |
| **CML** | 25.0 | 64.5 | 6.0 | N/A | N/A | 16.5 | 21.0 per tri axle group |
| **HML** | 25.0 | 68.0 | 6.0 | N/A | N/A | 17.0 | 22.5 per tri axle group |

**Table 2: Example to illustrate the impact of the different mass limits for B-double truck 26 m is available to eligible vehicles**

### f) Equivalent Standard Axles (ESA)

Equivalent Standard Axle (ESA) is a method of standardizing various axle configurations and loads and their effects on road pavements. ESAs are assessed by calculating the ratio of a load on an axle or axle group divided by a reference load and then raising the ratio to the fourth power.

In the TIC, ESA's are calculated using the sum of the ESA's for zero load (empty) plus the ESA's for 100% loaded and multiplied by the number of trips as required for the transport task.

The 50 percent load factor has been used as a benchmark reference. For the ESA's of a vehicle or vehicle combination this is laden to 50 percent of its payload capacity. ESA's per trip are calculated on the basis of: one way laden to gross combination mass and one way unladen (nil payload). This is typical of a lot of operations.

### g) Number of trips per 1,000 tonnes

This is the number of trips taken for the listed combination to move 1,000 tonnes of payload based on the payload estimate for the combination listed earlier in the chart.

### h) Nominal fuel / 100 kilometres (l/100 km) and fuel required per 1,000 km.

Fuel used is a predication based on feedback from the operator survey for a range of equipment within each category.

### i) $CO_2$ emissions / 1,000 tonnes

Reference is based on total fuel consumption for moving a 1,000 tonnes payload, shown in percentage terms.

### j) Driver requirement

This provides a guide to the number of drivers for the freight task and therefore the number of trucks required.

[3] www.nhvr.gov.au ….

### k) Overall length

The maximum legal allowable overall length of the combination - bumper to bumper. This does not included permitted vehicles PBS units.

### l) Road space required, new parameter

This indicates the space the combination takes up on the road moving 1,000 tonnes of payload at both 60 km/h and 100 km/h with the recommended gap between vehicles of 3 seconds, with the gap equivalent to 50 metres and 83.4 metres respectively for the speeds noted. Additionally it should be noted this is applicable for dry weather and the gap between vehicles should double in wet weather and for other hazardous conditions.

### M) Limitations with the data

An operator survey was used to collect key information about the truck fleet, including fuel consumption and tare mass. There is confidence in this data, however it is averaged and does not take into account different truck applications or operational parameters.

For example, 26 m B-Double is principally a line haul unit operating between distribution centres with little impact on urban delivery.

The truck’s application drives the need for different body types - from bulk commodities to construction material to fuel to refrigerated or dry goods. The commodity type impacts on the combination’s tare and fuel consumption.

Currently these issues are beyond the scope of this TAP.

# The Truck Impact Chart

**AUSTRALIAN TRUCKING ASSOCIATION Truck Impact Chart 12 September 2016**

| | Configuration Code (ATA TAP) | GCM (tonnes) | Payload (tonnes) | Calculated ESA's 4th Power – Load Status 0% | 50% | 100% | No Trips per 1000 tonnes | ESA's per 1000 tonnes | Nom Fuel / 100 kilometres | Fuel Required per 1000k lead | Driver Requirement | Overall Length (metres) | EAM (metres) | Emissions / 1000 tonnes | Convoy Length at 60 km/h. (kilometres) | Convoy Length at 100 km/h. (kilometres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Two Axle Rigid GML | R11 | 15.0 | 7.00 | 0.42 | 1.18 | 3.00 | 143 | 490 | 23 | 65780 | 340% | <12.5 | | 167% | 8.94 | 13.71 |
| Two Axle Rigid Euro4 | R11 | 15.5 | 7.63 | 0.43 | 1.34 | 3.57 | 132 | 529 | 23 | 60720 | 314% | | | 154% | 8.25 | 12.65 |
| Three Axle Rigid GML | R12 | 22.5 | 13.12 | 0.51 | 1.27 | 3.58 | 77 | 316 | 28 | 43120 | 183% | <12.5 | | 109% | 4.82 | 7.38 |
| Three Axle Rigid Euro4 | R12 | 23.0 | 13.69 | 0.53 | 1.46 | 4.16 | 74 | 347 | 28 | 41440 | 176% | | | 105% | 4.63 | 7.1 |
| Four Axle Rigid GML | R22 | 27.5 | 15.50 | 0.36 | 1.30 | 4.13 | 65 | 292 | 32 | 41600 | 155% | <12.5 | | 105% | 4.07 | 6.23 |
| Five Axle Rigid GML | R23 | 31.0 | 17.62 | 0.35 | 1.19 | 3.44 | 57 | 217 | 35 | 39900 | 136% | < 12.5 | | 101% | 3.57 | 5.47 |
| **Six Axle Artic GML** | **A123** | **43.0** | **24.04** | **1.68** | **2.59** | **5.54** | **42** | **304** | **47** | **39480** | **100%** | 19.0 | 10.00 | **100%** | **2.9** | **4.3** |
| Six Axle Artic HML | A123 | 46.0 | 27.04 | 1.68 | 2.59 | 5.54 | 37 | 268 | 50 | 37000 | 88% | | | 94% | 2.56 | 3.79 |
| Truck & Dog (6 Axle - 45.5T Vic) | R12T12 | 45.5 | 30.00 | 1.64 | 2.49 | 6.31 | 34 | 271 | 49 | 33320 | 81% | 19.0 | 12.50 | 84% | 2.35 | 3.48 |
| Truck & Dog (6 Axle - 48.5T NSW) | R12T12 | 48.5 | 33.00 | 1.64 | 2.64 | 7.70 | 31 | 290 | 49 | 30380 | 74% | | 15.50 | 77% | 2.14 | 3.18 |
| Truck & Dog (7 Axle) | R12T22 | 50.5 | 33.60 | 1.64 | 2.45 | 6.15 | 30 | 234 | 51 | 30600 | 71% | | 17.50 | 78% | 2.07 | 3.07 |
| Truck & Dog (20M - PBS) | R12T22 | 56.0 | 38.60 | 1.65 | 2.74 | 8.29 | 26 | 259 | 53 | 27560 | 62% | 20.0 | 17.33 | 70% | 1.82 | 2.69 |
| Truck & Dog (20M PBS) | R12T23 | 57.5 | 40.10 | 1.65 | 2.74 | 8.29 | 25 | 249 | 55 | 27500 | 60% | | 18.33 | 70% | 1.75 | 2.59 |
| 19M B.double GML | B1222 | 56.0 | 36.35 | 1.67 | 2.88 | 8.29 | 28 | 279 | 53 | 29680 | 67% | 19.0 | 17.33 | 75% | 1.94 | 2.87 |
| 19M B.double CML/HML | B1222 | 57.5 | 37.85 | 1.67 | 2.88 | 8.29 | 27 | 269 | 55 | 29700 | 64% | | | 75% | 1.87 | 2.77 |
| B.double GML | B1233 | 63.0 | 38.84 | 1.69 | 2.80 | 6.91 | 26 | 224 | 62 | 32240 | 62% | 26.0 | 21.00 | 82% | 1.98 | 2.85 |
| B.double HML | B1233 | 68.5 | 44.34 | 1.69 | 2.80 | 6.91 | 23 | 198 | 65 | 29900 | 55% | | | 76% | 1.75 | 2.52 |
| B-triple GML | B12333 | 83.0 | 52.35 | 1.71 | 3.07 | 8.29 | 20 | 200 | 68 | 27200 | 48% | 35.0 | 23.33 | 69% | 1.7 | 2.37 |
| B-triple HML | B12333 | 91.0 | 60.35 | 1.71 | 3.07 | 8.29 | 17 | 170 | 72 | 24480 | 40% | | | 62% | 1.45 | 2.02 |
| AB-triple GML | A123T2B33 | 99.5 | 64.00 | 1.84 | 3.52 | 10.36 | 16 | 196 | 75 | 24000 | 38% | 36.5/42.5 (modular) | 28.83 | 61% | 1.48 | 2.02 |
| AB-triple HML | A123T2B33 | 108.0 | 72.50 | 1.84 | 3.52 | 10.36 | 14 | 171 | 79 | 22120 | 33% | | | 56% | 1.3 | 1.77 |
| Type 1 R/train - GML | A123T23 | 79.5 | 48.73 | 1.72 | 3.25 | 8.98 | 21 | 225 | 68 | 28560 | 50% | 36.5 | 22.17 | 72% | 1.82 | 2.52 |
| Type 1 R/train - HML | A123T23 | 85.5 | 54.73 | 1.72 | 3.25 | 8.98 | 19 | 204 | 72 | 27360 | 45% | | | 69% | 1.65 | 2.28 |
| Type 2 R/train - GML | A123T23T23 | 116.0 | 73.42 | 1.76 | 3.91 | 12.42 | 14 | 199 | 80 | 22400 | 33% | 53.5 | 34.33 | 57% | 1.45 | 1.92 |
| Type 2 R/train - HML | A123T23T23 | 125.0 | 82.42 | 1.76 | 3.91 | 12.42 | 13 | 185 | 83 | 21580 | 31% | | | 55% | 1.35 | 1.78 |
| BAB Quad - GML | B1233T2B33 | 119.5 | 78.42 | 1.73 | 3.68 | 11.74 | 13 | 176 | 81 | 21060 | 31% | 51.5 | 35.50 | 53% | 1.32 | 1.76 |
| BAB Quad - HML | B1233T2B33 | 130.5 | 89.42 | 1.73 | 3.68 | 11.74 | 12 | 162 | 85 | 20400 | 29% | | | 52% | 1.22 | 1.62 |

For further information contact ATA on 02 6253 6900

The B-triple; AB-triple; & the BAB-Quad are based on modular vehicle units as agreed by ATA General Council.

**EAM (Extreme Axle Measurement)** Is the minimum dimensional requirement in regard to Axle Spacing Mass Schedule (ASMS) requirements for the stated Gross Combination Mass. The formula varies depending on the gross mass of the vehicle and whether the vehicle is a road train. In addition to EAM, internal axle groups must also comply to the appropriate ASMS.

* The data in this table is provided for general information and does not take into account your specific circumstances. You should obtain professional engineering advice before taking action.

**Australian Trucking Association and Barkwood Consulting P/L** September 2016 **Truck Impact Chart - Modular**

## Table 3: Truck impact chart

## 3) Illustrated example using the Truck Impact Chart

**Comparison of key road freight delivery configurations**

| | Semi Trailer | B-double | | A-double | |
|---|---|---|---|---|---|
| |  |  | |  | |
| GCM (tonne) GML | 43.0 | 63.0 | 147% | 79.5 | 185% |
| Maximum Combination Length (metres) | 19.0 | 26.0 | 137% | 36.5 | 192% |
| Payload (tonne) | 24.0 | 38.8 | 162% | 48.7 | 203% |
| Trips per 1,000 tonnes of payload moved | 42 | 26 | 62% | 21 | 50% |
| ESA's per 1,000 tonnes of payload moved | 304 | 224 | 74% | 225 | 74% |
| Fuel required per 1,000 km lead | 100% | 82% | | 72% | |
| Driver requirement | 100% | 62% | | 50% | |

**Table 4: Truck impact chart - summary**

Comparing three key models:-
- semi-trailer, A123
- B-double, B1233 and
- A-double A123R23.

The relative merits of the High Productivity Freight Vehicles becomes clearer with the:

B-double having about 74% of impact on road, uses 82% of fuel for 62% of the number trips to move the same amount of payload (1,000 tonnes) compared to a semi-trailer.

A-double having about 74% of impact on road, uses 72% of fuel for half the number trips to move the same amount of payload (1,000 tonnes) compared to a semi-trailer.

# Part 2: Additional supportive information

### 4) Other important areas advantaged with HPFVs.
#### a) Engine exhaust emissions

Heavy vehicle exhaust emissions are until the 1 November 2016 a generation ahead of light vehicle (car) requirements.

| | | | | | |
|---|---|---|---|---|---|
| Light vehicle – petrol | Standard | ADR79/00 | ADR79/01 | ADR79/02 | ADR79/04 |
| | Mandatory in Aust. | 1/Jan/04* | 1/Jan/06 | 1/Jul/10 | 1/Nov/16 |
| | Equivalent European requirement | Euro 2 | Euro 3 | Euro 4 | Euro 5 |
| Heavy vehicle – diesel | Standard | ADR70/00 | ADR80/00 | ADR80/02 | ADR80/03 |
| | Mandatory in Aust. | 1/Jan/96 | 1/Jan/03 | 29/Feb/08 | 1/Jan/11 |
| | Equivalent European requirement | Euro I | Euro III | Euro IV | Euro V |
| | Equivalent US requirement | EPA '91 | EPA '98 (Model Year '00) | EPA '04 | EPA '07 |

**Table 5: Comparison of exhaust emission for cars / light vehicles (GVM ≤ 3,500 kg) and trucks / heavy vehicles (GVM > 3,500 kg)**

**Notes**

* This is the applicability date for the petrol standard (ADR79/00) with diesel being mandated a year earlier.

- ADR80/01 became mandatory 1 Jan 2008 and was replaced by ADR80/02 on the 29 February 2008 with both ADRs requiring the same emission standard.
- ADR79/04 mandates the Euro 5 standard from 1 Nov 2016 for **all** cars / light vehicles (GVM ≤ 3,500 kg) with ADR79/03 mandated Euro 5 for **new** model and model families only from 1 Nov 2010.
- New emission standards introduced with a new Australian Design Rule apply initially only to any new model or model families being introduced into the market and current selling models or model families are typically allowed another year to comply to the new standard.

**One** pre ADR70/00 truck produces the same amount of noxious emissions (particulate material, PM and nitrous oxides, $NO_x$) as **seventy** ADR80/03 Euro 5 trucks produce today (see Chart 1)

Therefore introduction of HPFVs, which are new vehicles in virtually all cases, will introduce vehicles with significantly lower emissions.

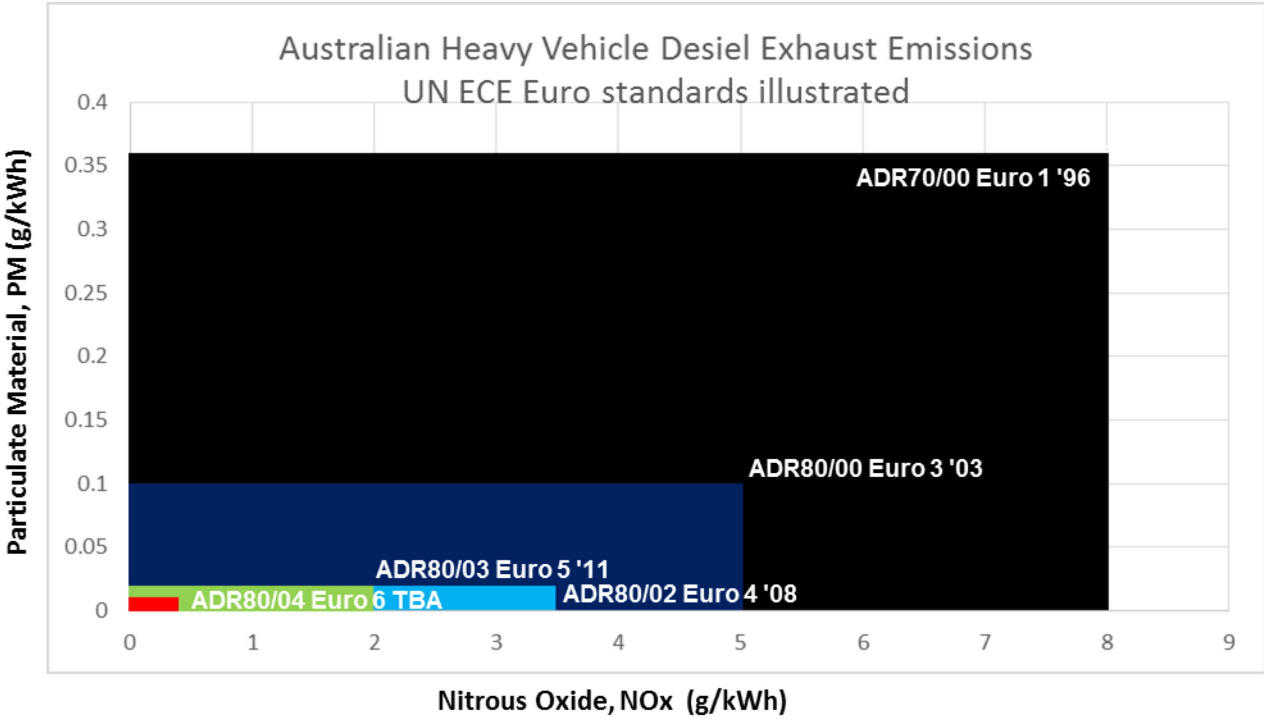



**Chart 1: Comparison of UN ECE Emission standards**

Chart 1 above only compares two of the four typical diesel noxious emissions components detailed in compliance standards. These two illustrate the key issue of emissions control of the internal combustion engine. By lowering one, the other is inherently increased.

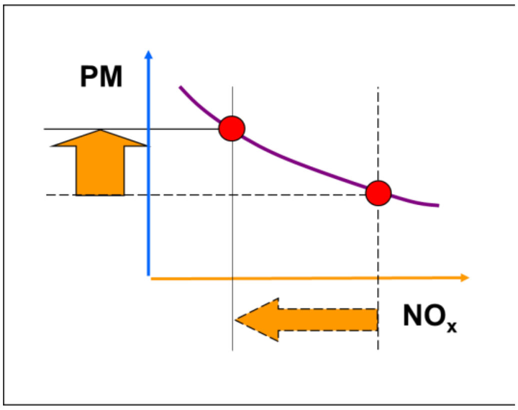



**Chart 2: Trade-off between NOx and PM**

Particulate Material (PM) is the incomplete combustion of the fuel, in a similar way that carbon monoxide is also the incomplete combustion of the fuel. Increased combustion temperature will lower PM levels.
Nitrous Oxide (NOx) Air is composed of approximately 79% nitrogen, 21% oxygen and 1% other gases. NOx results from high combustion temperature. The higher the temperature and more NOx produced within the combustion chamber. Lowering the combustion temperature will lower NOx.

In order to meet ADR80/02 or later exhaust emission standards, some form of exhaust gas after treatment system was required as part of the emission solution. There are basically two methodologies to approach to achieve compliance to ADR80/03 exhaust emission standards. For most suppliers, compliance to ADR80/04 will require all available technologies to be applied to achieve a solution that will satisfy the authority with limited impact on the vehicle’s operation.

### b) Fuel quality

Sulphur is found in all crude oil to varying degrees and is difficult to remove in the refining process. Sulphur is typically the key cause of sulphur dioxide in the exhaust pipe emissions, which leads to acid rain. It also encourages development of black smoke development and can "poison" the catalyst pollution treatment blocks in the exhaust system.

Table 5 is a comparison of the sulphur content of fuels.

**Regular unleaded petrol contains 15 times the amount of sulphur as diesel.**

| Fuel type | Sulphur content, maximum allowed (ppm) | Effective from |
|---|---|---|
| Diesel | 10 | 1 Jan 2009 |
| Petrol, Premium Unleaded (PULP) | 50 | 1 Jan 2008 |
| Petrol, Regular Unleaded (ULP) | 150 | 1 Jan 2005 |

**Table 6: Comparison of sulphur content in fuels**

Note: ppm = part per million or 0.000,1% by volume.

### c) Truck versus car fuel consumption/efficiency comparison

Australia's bestselling car for 2015, the 2015 Toyota Corolla achieved an ADR certified fuel consumption for a combined cycle of 6.1, an urban cycle of 8.0 and extra cycle of 5.0 l/100km4.

A typical B-double on the road between Melbourne and Sydney, for economic reasons achieves fuel consumption better than 1.7 km/l.

| Productivity | B-Double | A-Double | Toyota Corolla |
|---|---|---|---|
| GCM<br>Payload | 63.0 tonne<br>39 tonne | 79.5 tonne<br>49 tonne | 4 x 100 kg<br>(4 passengers & gear) |
| Fuel Consumption (km/litres) | 1.61 | 1.49 | 16.4 (or 6.1 l/100 km) |
| Metric - payload x fuel (tonne x km / litres) | 62.8 | 73.0 | 6.56 or a tenth of the efficiency of a B-double! |

**Table 7: Comparison of efficiencies**

Cars play an important part of the transport map, but as illustrated in Table 5 above they are not the most efficient means of transport no matter how convenient even when it is assumed they are fully loaded.

[4] http://www.greenvehicleguide.gov.au/GVGPublicUI/home.aspx

As a general rule a truck's fuel consumption increases at a rate slower than the equivalent increase in a truck combination's payload. However, as payload increases the combination's ability to accelerate is reduced (ie keeping up with traffic), hill climbing ability is reduced and manoeuvrability around the roads is reduced which reduces the physical road network options available for the combination to access.

### d) Driving license category and requirements

Licence categories and requirements are similar around Australia. A driver of a B-double combination requires a Multi Combination (MC) license for which the driver must have had at least one year of experience in either a Heavy Combination (HC) or a Heavy Rigid (HR) vehicle for at least 1 year, plus a further two years holding a car licence.

| Driving licence classes (> 4.5 t GVM) | What you can drive? | You are eligible for this |
|---|---|---|
| LR - Light Rigid | Rigid vehicles with a GVM of more than 4.5 tonnes, but not more than 8 tonnes | after holding a car licence for 1 year |
| MR - Medium Rigid | Rigid vehicles with 2 axles and a GVM of more than 8 tonnes. | after holding a car licence for 1 year |
| HR - Heavy Rigid | Rigid vehicle with 3 or more axles and a GVM of more than 8 tonnes. | after holding a car licence for 2 year |
| HC - Heavy Combination | Heavy combination vehicles, such as a prime mover towing a semi-trailer, or rigid vehicles towing a trailer with a GVM of more than 9 tonnes. | after holding a car licence for 2 year with at least 1 year of holding either a medium rigid or heavy rigid vehicle license |
| MC - Multi Combination | Multi combination vehicles such as road trains and B-doubles. | after holding a heavy combination or heavy rigid licence for at least 1 year |

**Table 8: Comparison of the requirements for driving license categories**

### e) Specific additional requirements for a 26 m B-double

The 26 m B-double combination was introduced in 2006 and had the mandatory requirement for the fitment of a front underrun protection device (FUPD ECE R93); ECE R29 Cab design and there was a limit on trailing length. These features were not a requirement for semi-trailer, truck/dog or road train combinations, until required by the ADRs as listed below.

### f) Safety developments and the Australian Design Rule

ADR 84/00 front underrun protection device (FUPD) were mandated as of 1 January 2012 for trucks with a GVM greater than 12 tonnes.

ADR35/04 heavy commercial truck braking mandated antilock brake systems (ABS) as of 1 January 2015. (Prime movers used in B-doubles were required to have anti-lock brakes since 1986)

### g) Safety statistics

NTI 2015 Major Accident Investigation report[5] and subsequent related presentations provides the following relevant findings:-

- B-doubles are a safer alternative with 40% share of the freight (including rigids) and only 24% of major losses.
- Over the past decade, there has been a 30% increase in the freight carried and 35% decline in the heavy vehicle related fatalities.
- Single vehicle truck accidents attributed to 72% of the losses with the balance of 28% involving collisions with third party vehicles.
- In collisions involving fatalities, the truck was not at fault on 84% of occasions.

[5] www.nti.com.au/supporting/trucking/latest-report.php

Additionally, the following table prepared by AustRoads lays out a compelling case for HPFVs.

| Accident type by severity Rate per 100 km | | Minor | Moderate | Serious | Major | Total accidents | Total serious & major accidents |
|---|---|---|---|---|---|---|---|
| Conventional Trucks | Articulated (69%) | 21 | 22 | 16 | 13 | 72 | 29 |
| | Rigid Truck (31%) | 42 | 34 | 19 | 7 | 102 | 26 |
| Conventional incident weight , total | | 27.5 | 25.7 | 16.9 | 11.1 | 81.3 | 28 |
| HPFVs | Articulated (69%) | 8 | 2 | 2 | 5 | 18 | 7 |
| | Rigid Truck (31%) | 20 | 26 | 4 | 2 | 53 | 6 |
| Observed HPFVs incident weighted total | | 11.7 | 9.4 | 2.6 | 4.1 | 27.9 | 6.7 |
| Total HPFVs incident savings (rate per 100 km) | | 15.8 | 16.3 | 14.3 | 7.1 | 53.5 | 21.4 |
| Observed HPFVs weight incident savings (%) | | 57% | 63% | 85% | 63% | 66% | 76% |

**Table 9: Quantifications of the benefits resulting from the use of HPFV. Sourced Austroads report, FS1805[6]**

[6] Austroads report, FS1805 – Quantifications of the benefits resulting from the use of HPFV. http://www.austroads.com.au/news-events/item/170-quantifying-the-benefits-of-high-productivity-vehicles

## Part 3: Performance Based Standards (PBS) and non modular configurations and their impact

PBS is an alternative heavy vehicle compliance scheme. It is intended to provide an alternative compliance path for vehicles that did not meet the size and weight limits for heavy vehicle and vehicle combinations that are prescribed in legislation.

PBS vehicles must meet sixteen safety standards and four infrastructure standards (the PBS standards) to ensure they fit the existing road network and are safe. The scheme has been in operation since October 2007.

Four of the PBS standards are outlined below:

**Static rollover threshold**
The steady-state level of lateral acceleration that a vehicle can sustain during turning without rolling over.

**Low speed swept path**
The maximum width of the vehicle combination swept path in a prescribed 90° low speed turn with an outside of tyre steer radius of 12.5 metres.

**High speed transient tracking**
The lateral distance that the last-axle on the rear trailer tracks outside the path of the steer axle in a sudden evasive manoeuvre.

**Rearward amplification**
Measures the ‘whip crack’ effect of a lane change manoeuvre

Charts 3 to 6 compare the results for vehicles of mid-range performance representing each of the generic vehicle classes.  The charts therefore indicate, in general, the relative performance for each configuration against the standards.

### a) Static rollover threshold

The steady-state level of lateral acceleration that a vehicle can sustain during turning without rolling over.

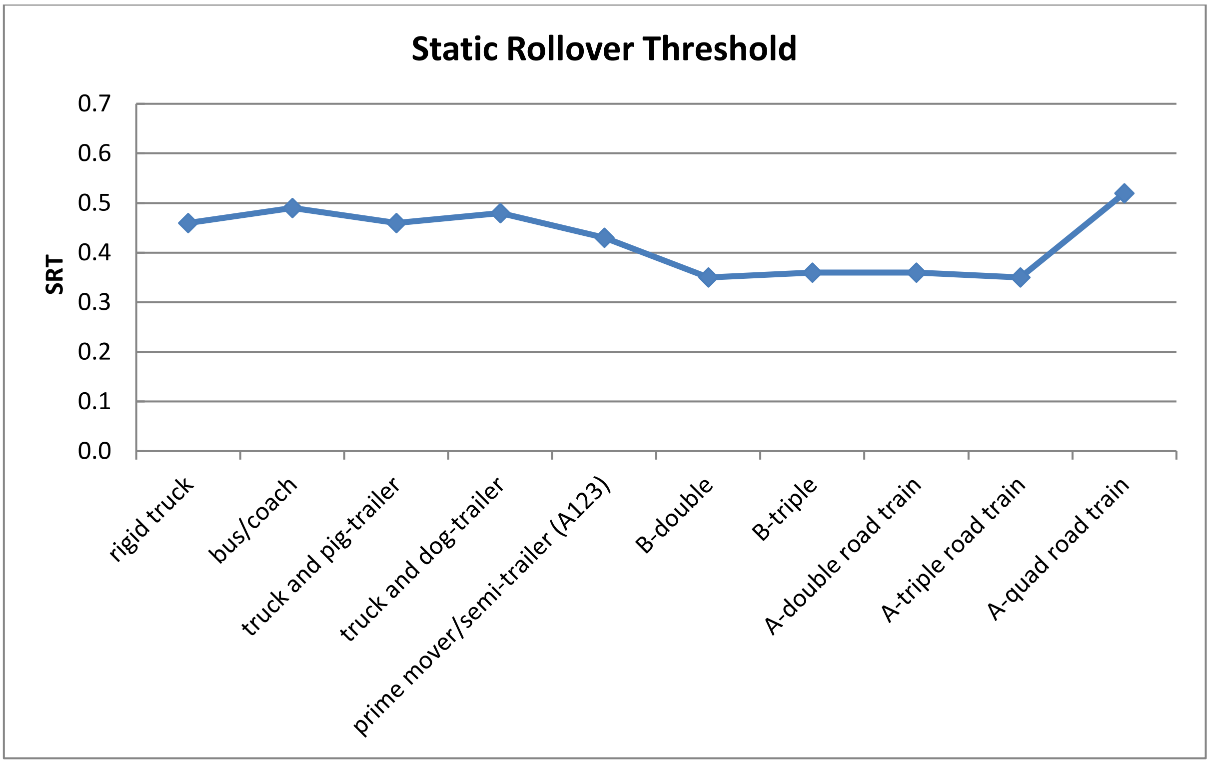



**Chart 3: Comparison of Static Rollover Threshold (SRT) for mid-range vehicle combinations**

Static Roll Threshold (SRT) is influenced by vehicle mass, the dimensions and mechanical properties of the vehicle and the centre of gravity height of the load.

The PBS standards for SRT are:

- not less than 0.40g for road tankers hauling dangerous goods in bulk and buses and coaches; and
- not less than 0.35g for all other vehicles.

The vehicles used to construct Chart 3 are generic and use similar components and therefore give a representative outcome only. Not all vehicles using the size and weight limits for heavy vehicle and vehicle combinations that are prescribed in legislation meet the Performance Based Standards for SRT.

**Rather than showing absolute values, Charts 4, 5 and 6 show the results for each configuration as a ratio compared to the result for the prime mover/semi-trailer combination, the A123.**

### b) Low speed swept path

The maximum width of the vehicle's swept path in a prescribed 90° low speed turn with an outside of tyre steer radius of 12.5 metres.

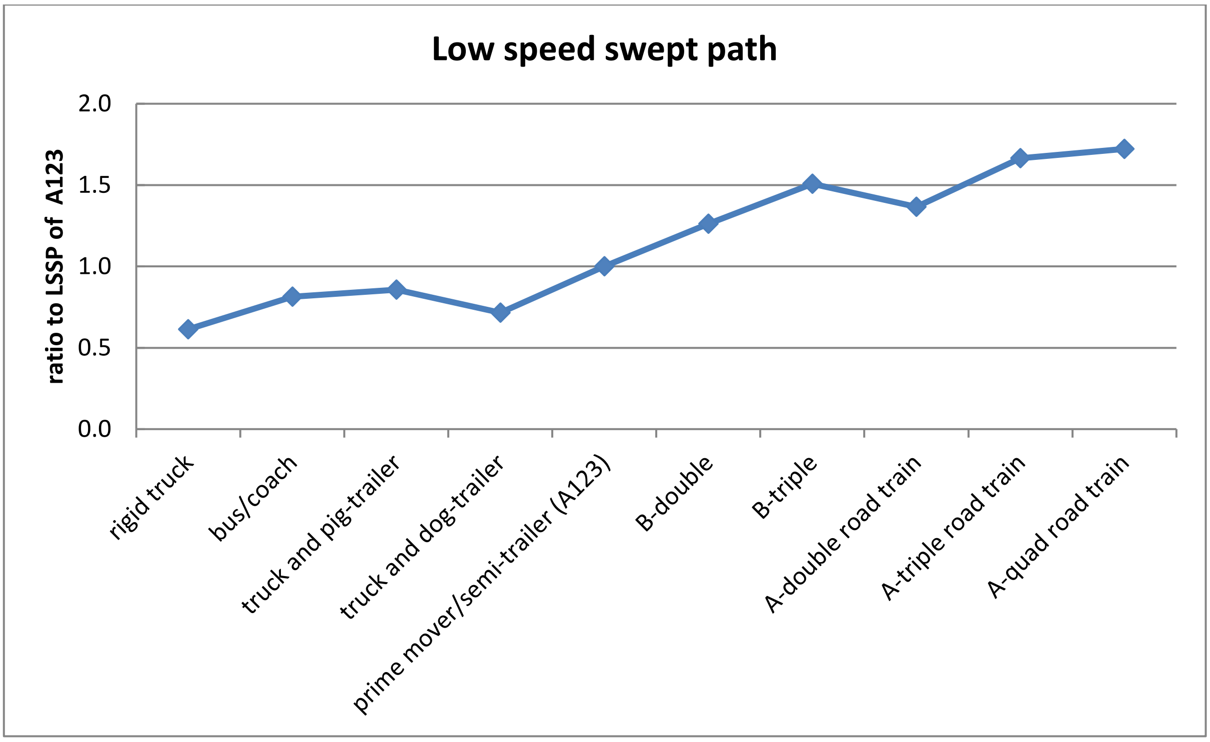



**Chart 4: Comparison of low speed swept path for mid-range vehicle combinations**

It can be seen from chart 4 that low speed swept path generally increases with vehicle length but not proportionally as low speed swept path is influenced by the length of the individual units and the number of couplings.

### c) High speed transient offtracking

The lateral distance that the last-axle on the rear trailer tracks outside the path of the steer axle in a sudden evasive manoeuvre.

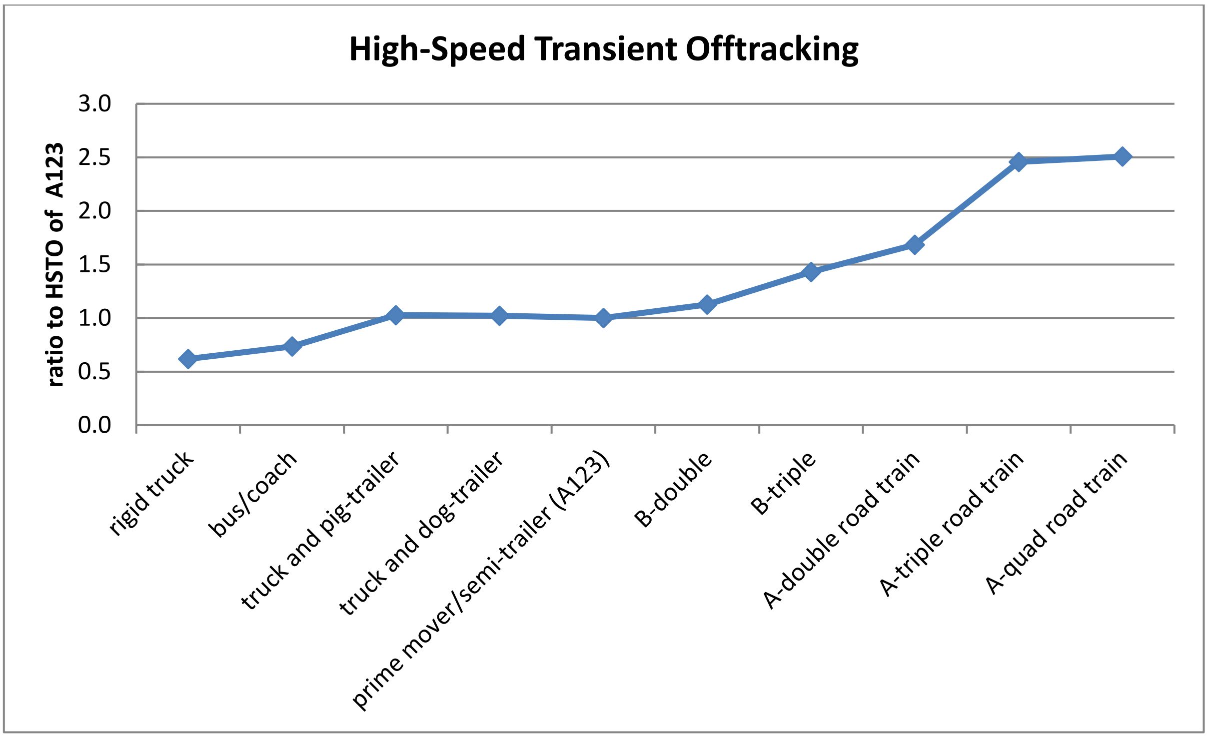



**Chart 5: Comparison of high speed transient offtracking for mid-range vehicle combinations**

Chart 5 shows that the A-coupled multi-combination vehicles have greater transient offtracking (i.e. less desirable) than similar length B-coupled vehicles

### d) Rearward amplification

Measures the 'whip crack' effect of a lane change manoeuvre, i.e. the tendency for the rear trailer to have a much larger lateral response (sideways motion), thus experiencing higher levels of lateral acceleration than the towing unit.

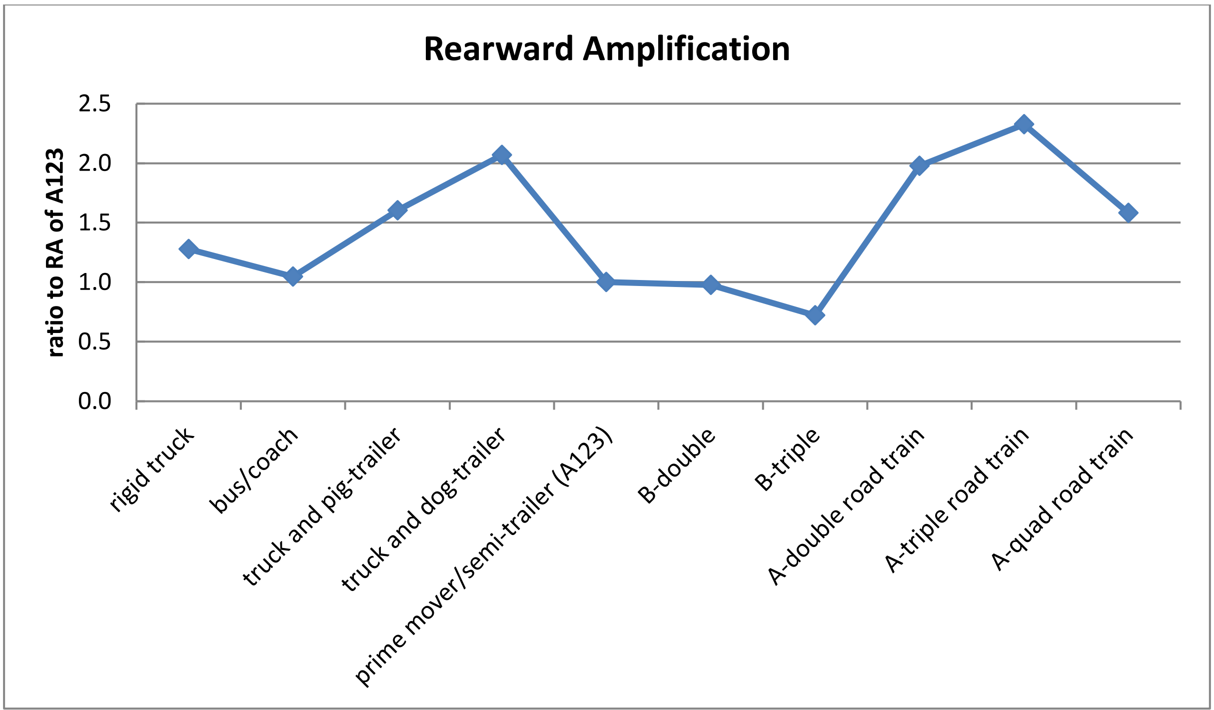



**Chart 6: Comparison of rearward amplification for mid-range vehicle combinations**

Chart 6 shows that the A-coupled multi-combination vehicles have significantly greater undesirable rearward amplification than B-coupled vehicles.

### e) Road Network Classification for PBS vehicles

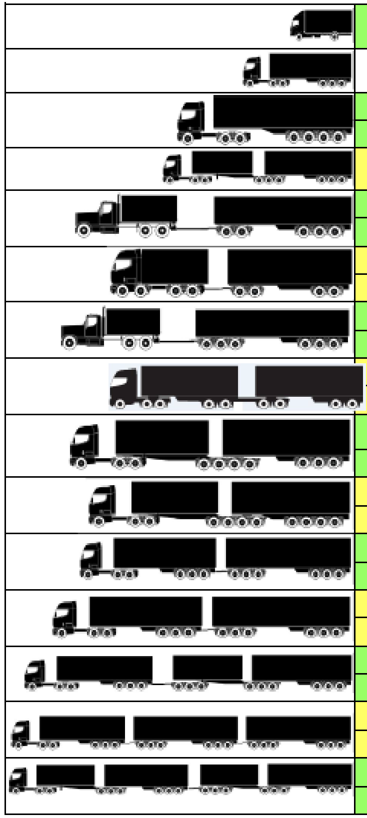
The PBS road network has been classified into four levels:

- Level 1: Similar to General access
- Level 2: Similar to B-double routes
- Level 3: Similar to Double (Type I) road train routes
- Level 4: Similar to Triple (Type II) road train routes

Seven of the PBS safety standards have different performance levels for the different levels of access, including Low Speed Swept Path and High Speed Transient Offtracking.

# Truck Impact Chart for PBS and non-modular configuration

**AUSTRALIAN TRUCKING ASSOCIATION Truck Impact Chart 16 March 2018 Non Modular**



| Configuration | Configuration Code (ATA TAP) | GCM | Payload | Calculated ESA's 4th Power – Load Status 0% | 50% | 100% | No Trips per 1000 tonnes | ESA's per 1000 tonnes | Nom Fuel / 100 kilometres | Fuel Required per 1000k lead | Driver Requirement | Overall Length (metres) | EAM ≥ (metres) | Emissions / 1000 tonnes | Convoy Length at 60 km/h (kilometres) | Convoy Length at 100 km/h (kilometres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Three Axle Rigid GML | R12 | 22.5 | 13.12 | 0.51 | 1.27 | 3.58 | 77 | 316 | 28.0 | 43120 | 183% | <12.5 | | 109% | 4.82 | 7.38 |
| **Six Axle Artic GML** | **A123** | **43.0** | **24.04** | **1.7** | **2.6** | **5.5** | **42** | **304** | **47** | **39480** | **100%** | **19.0** | **10.0** | **100%** | **2.9** | **4.3** |
| Seven Axle 124 GML | A124 | 47.0 | 26.65 | 1.6 | 2.5 | 5.4 | 38 | 267 | 50 | 38000 | 90% | 20.0 | 11.3 | 96% | 2.66 | 3.93 |
| Seven Axle 124 HML | A124 | 50.5 | 30.15 | 1.6 | 2.7 | 6.5 | 34 | 274 | 51 | 34680 | 81% | 20.0 | 11.3 | 88% | 2.38 | 3.52 |
| B.double GML | B1233 | 63.0 | 38.84 | 1.69 | 2.80 | 6.91 | 26 | 224 | 62 | 32240 | 62% | ≤ 26 metres | 21.0 | 82% | 1.98 | 2.85 |
| 8 Axle Truck & Dog Trailer - GML | R12T23 | 59.5 | 42.00 | 1.64 | 2.62 | 7.60 | 24 | 222 | 61 | 29280 | 57% | ≤ 23 metres | 19.7 | 74% | 1.76 | 2.56 |
| 8 Axle Truck & Dog Trailer - HML | R12T23 | 63.0 | 45.20 | 1.64 | 2.62 | 7.60 | 23 | 213 | 64 | 29440 | 55% | | 19.7 | 75% | 1.68 | 2.45 |
| 8 Axle Truck & Dog Trailer - GML | R22T22 | 60.5 | 42.20 | 0.36 | 1.82 | 8.26 | 24 | 207 | 61 | 29280 | 57% | ≤ 23 metres | 22.0 | 74% | 1.76 | 2.56 |
| 8 Axle Truck & Dog Trailer - HML | R22T22 | 62.0 | 43.70 | 0.36 | 1.91 | 9.04 | 23 | 216 | 64 | 29440 | 55% | | 20.3 | 75% | 1.68 | 2.45 |
| 9 Axle Truck & Dog Trailer - GML | R12T33 | 63.0 | 44.80 | 1.64 | 2.53 | 6.91 | 23 | 197 | 62 | 28520 | 55% | ≤ 26 metres | 21.0 | 72% | 1.73 | 2.5 |
| 9 Axle Truck & Dog Trailer - HML | R12T33 | 68.5 | 50.30 | 1.64 | 2.53 | 6.91 | 20 | 171 | 65 | 26000 | 48% | | 21.0 | 66% | 1.5 | 2.17 |
| 26m Short Road Train GML | A122T22 | 72.5 | 48.7 | 1.68 | 3.21 | 10.35 | 21 | 253 | 67 | 28140 | 50% | ≤ 26 metres | 19.8 | 71% | 1.6 | 2.3 |
| 26m Short Road Train HML | A122T22 | 74.5 | 50.7 | 1.68 | 3.21 | 10.35 | 20 | 241 | 68 | 27200 | 48% | | 19.8 | 69% | 1.52 | 2.19 |
| Super B.double (10 axles) GML | B1243 | 67.0 | 39.92 | 1.87 | 2.96 | 6.82 | 26 | 226 | 65 | 33800 | 62% | ≤ 30 metres | 24.7 | 86% | 2.08 | 2.95 |
| Super B.double (10 axles) HML | B1243 | 73.0 | 45.92 | 1.87 | 2.96 | 6.82 | 22 | 191 | 68 | 29920 | 52% | | 24.7 | 76% | 1.76 | 2.5 |
| Super B.double (11 axles) GML | B1244 | 71.0 | 42.78 | 1.87 | 2.95 | 6.73 | 24 | 206 | 67 | 32160 | 57% | ≤ 30 metres | 27.3 | 81% | 1.92 | 2.72 |
| Super B.double (11 axles) HML | B1244 | 77.5 | 49.28 | 1.87 | 2.95 | 6.73 | 21 | 181 | 70 | 29400 | 50% | | 27.3 | 74% | 1.68 | 2.38 |
| PBS A-Double - GML | A123T33 | 31.6 | 51.43 | 1.71 | 3.10 | 8.29 | 20 | 200 | 68 | 27200 | 48% | ≤ 30 metres | 6.2 | 69% | 1.73 | 2.4 |
| PBS A-Double - HML | A123T33 | 31.6 | 59.43 | 1.71 | 3.10 | 8.29 | 17 | 170 | 72 | 24480 | 40% | | 6.2 | 62% | 1.48 | 2.04 |
| Type 1 Road Train Triaxle Dolly - GML | A123T33 | 83.0 | 51.43 | 1.71 | 3.10 | 8.29 | 20 | 200 | 68 | 27200 | 48% | ≤ 36.5 metres | 23.3 | 69% | 1.73 | 2.4 |
| Type 1 Road Train Triaxle Dolly - HML | A123T33 | 91.0 | 59.43 | 1.71 | 3.10 | 8.29 | 17 | 170 | 72 | 24480 | 40% | | 23.3 | 62% | 1.48 | 2.04 |
| AB.Triple Triaxle Dolly - GML | A123T3B33 | 103.0 | 66.70 | 1.83 | 3.38 | 9.67 | 15 | 173 | 80 | 24000 | 36% | ≤ 42.5 metres | 30.0 | 61% | 1.39 | 1.89 |
| AB.Triple Triaxle Dolly - HML | A123T3B33 | 113.5 | 77.20 | 1.83 | 3.38 | 9.67 | 13 | 150 | 85 | 22100 | 31% | | 30.0 | 56% | 1.21 | 1.64 |
| Type 2 Road Train Triaxle Dolly - GML | A123T33T33 | 123.0 | 78.82 | 1.74 | 3.62 | 11.05 | 13 | 166 | 84 | 21840 | 31% | ≤ 53.5 metres | 36.7 | 55% | 1.35 | 1.78 |
| Type 2 Road Train Triaxle Dolly - HML | A123T33T33 | 136.0 | 91.82 | 1.74 | 3.62 | 11.05 | 11 | 141 | 87 | 19140 | 26% | | 36.7 | 48% | 1.14 | 1.51 |
| BAB Quad Triaxle Dolly - GML | B1233T3B33 | 123.0 | 81.03 | 1.72 | 3.54 | 11.05 | 13 | 166 | 84 | 21840 | 31% | ≤ 53.5 metres | 36.7 | 55% | 1.32 | 1.76 |
| BAB Quad Triaxle Dolly - HML | B1233T3B33 | 136.0 | 94.03 | 1.72 | 3.54 | 11.05 | 11 | 141 | 87 | 19140 | 26% | | 36.7 | 48% | 1.12 | 1.49 |

For further information contact ATA on 02 6253 6900

| EAM (Extreme Axle Measurement) | Is the minimum dimensional requirement in regard to Axle Spacing Mass Schedule (ASMS) requirements for the stated Gross Combination Mass. The formula varies depending on the gross mass of the vehicle and whether the vehicle is a road train. In addition to EAM, internal axle groups must also comply to the appropriate ASMS. |
|---|---|

* The data in this table is provided for general information and does not take into account your specific circumstances. You should obtain professional engineering advice before taking action.

Australian Trucking Association
and Barkwood Consulting P/L

March 2018

Truck Impact Chart Non-Modular

Table 10: Truck impact chart – non modular combinations

## TAP development process, history and validation

### The TAP development process

The ITC will approve the need for the creation of a new TAP or the triennial routine review of an existing TAP. The nominated editor(s), who are listed below, with support of the ITC and specialist industry technical members as required, will agree on the TAP content with approval by a majority vote of ITC members. A suitably qualified and experience ATA appointed peer reviewer will further review the publication and if necessary, recommended changes. These changes will then be reviewed and approved again by a majority vote of ITC members before the document is released.

### Document version control

| Edition | Date | Nature of change / comment | Editor(s) |
|---|---|---|---|
| First | June 2010 | Initial release | David Coonan, ATA, National Manager – Policy Bob Woodward – Barkwood Consulting |
| Second | Aug 2016 | Extensively updated with detailed explanations added. | Chris Loose, ATA, Senior Adviser Engineering |
| 2.1 | Sept 2016 | Minor update to the modular table for the 19 m B-double combinations. | Chris Loose, ATA, Senior Adviser Engineering |
| 2.2 | Mar 2018 | Update Non-modular combinations; common configuration reference. | Bob Woodward, ATA, Chief Engineer. |

The next is expected on or before August 2021.

### Drafting committee

| Edition | Date | Drafting | Organisation / Qualifications |
|---|---|---|---|
| Second | July 2016 | Bob Woodward | Barkwood Consulting |
| 2.1 | Sept 2016 | Bob Woodward | Barkwood Consulting |
| 2.2 | March 2018 | Bob Woodward | ATA Chief Engineer |

### Peer review

| Edition | Date | Peer Reviewer | Organisation / Qualifications |
|---|---|---|---|
| First | June 2010 | Bob Pearson | Pearsons Transport Resource Centre, BEng |
| Second | July 2016 | Bob Pearson | Pearsons Transport Resource Centre, BEng |
| 2.1 | Sept 2016 | Bob Pearson | Pearsons Transport Resource Centre, BEng |
| 2.2 | March 2018 | Bob Pearson | Pearsons Transport Resource Centre, BEng |

**About the ATA Industry Technical Council:**

The Industry Technical Council (ITC) is a standing committee of the Australian Trucking Association (ATA). The ITC's mission is to improve trucking equipment, its maintenance and maintenance management. The ITC was established in 1995.

As a group, the ITC provides the ATA with robust professional advice on technical matters to help underpin ATA policymaking. It is concerned with raising technical and maintenance standards, improving the operational safety of the heavy vehicle sector, and the development of guidelines and standards for technical matters.

ITC performs a unique service in the Australian trucking industry by bringing operators, suppliers, engineers and other specialists together in a long-term discussion forum. Its members provide expert and independent advice in the field to inform the work of the ITC. The outcomes from ITC benefit all ITC stakeholders and the industry at large.

The ITC operates under the Australian Trucking Association's Council, which formulates industry policy for the implement by the organisation.

**Joining ITC:**

We welcome applications to join the ITC. For further information,
please call the ATA (02) 6253 6900
email ata@truck.net.au
or download information from the ATA website www.truck.net.au by follow the links under the members tab to join here.

# Appendix 1: Modular combinations

**AUSTRALIAN TRUCKING ASSOCIATION Truck Impact Chart 12 September 2016**

| | Configuration Code (ATA TAP) | GCM (tonnes) | Payload (tonnes) | Calculated ESA's 4th Power (Load Status) | | | No Trips per 1000 tonnes | ESA's per 1000 tonnes | Nom Fuel / 100 kilometres | Fuel Required per 1000k lead | Driver Requirement | Overall Length (metres) | EAM (metres) | Emissions / 1000 tonnes | Convoy Length at 60 km/h. (kilometres) | Convoy Length at 100 km/h. (kilometres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0% | 50% | 100% | | | | | | | | | | |
| Two Axle Rigid GML | R11 | 15.0 | 7.00 | 0.42 | 1.18 | 3.00 | 143 | 490 | 23 | 65780 | 340% | <12.5 | | 167% | 8.94 | 13.71 |
| Two Axle Rigid Euro4 | R11 | 15.5 | 7.63 | 0.43 | 1.34 | 3.57 | 132 | 529 | 23 | 60720 | 314% | | | 154% | 8.25 | 12.65 |
| Three Axle Rigid GML | R12 | 22.5 | 13.12 | 0.51 | 1.27 | 3.58 | 77 | 316 | 28 | 43120 | 183% | <12.5 | | 109% | 4.82 | 7.38 |
| Three Axle Rigid Euro4 | R12 | 23.0 | 13.69 | 0.53 | 1.46 | 4.16 | 74 | 347 | 28 | 41440 | 176% | | | 105% | 4.63 | 7.1 |
| Four Axle Rigid GML | R22 | 27.5 | 15.50 | 0.36 | 1.30 | 4.13 | 65 | 292 | 32 | 41600 | 155% | <12.5 | | 105% | 4.07 | 6.23 |
| Five Axle Rigid GML | R23 | 31.0 | 17.62 | 0.35 | 1.19 | 3.44 | 57 | 217 | 35 | 39900 | 136% | < 12.5 | | 101% | 3.57 | 5.47 |
| **Six Axle Artic GML** | **A123** | **43.0** | **24.04** | **1.68** | **2.59** | **5.54** | **42** | **304** | **47** | **39480** | **100%** | 19.0 | 10.00 | **100%** | **2.9** | **4.3** |
| Six Axle Artic HML | A123 | 46.0 | 27.04 | 1.68 | 2.59 | 5.54 | 37 | 268 | 50 | 37000 | 88% | | | 94% | 2.56 | 3.79 |
| Truck & Dog (6 Axle - 45.5T Vic) | R12T12 | 45.5 | 30.00 | 1.64 | 2.49 | 6.31 | 34 | 271 | 49 | 33320 | 81% | 19.0 | 12.50 | 84% | 2.35 | 3.48 |
| Truck & Dog (6 Axle - 48.5T NSW) | R12T12 | 48.5 | 33.00 | 1.64 | 2.64 | 7.70 | 31 | 290 | 49 | 30380 | 74% | | 15.50 | 77% | 2.14 | 3.18 |
| Truck & Dog (7 Axle) | R12T22 | 50.5 | 33.60 | 1.64 | 2.45 | 6.15 | 30 | 234 | 51 | 30600 | 71% | | 17.50 | 78% | 2.07 | 3.07 |
| Truck & Dog (20M - PBS) | R12T22 | 56.0 | 38.60 | 1.65 | 2.74 | 8.29 | 26 | 259 | 53 | 27560 | 62% | 20.0 | 17.33 | 70% | 1.82 | 2.69 |
| Truck & Dog (20M PBS) | R12T23 | 57.5 | 40.10 | 1.65 | 2.74 | 8.29 | 25 | 249 | 55 | 27500 | 60% | | 18.33 | 70% | 1.75 | 2.59 |
| 19M B.double GML | B1222 | 56.0 | 36.35 | 1.67 | 2.88 | 8.29 | 28 | 279 | 53 | 29680 | 67% | 19.0 | 17.33 | 75% | 1.94 | 2.87 |
| 19M B.double CML/HML | B1222 | 57.5 | 37.85 | 1.67 | 2.88 | 8.29 | 27 | 269 | 55 | 29700 | 64% | | | 75% | 1.87 | 2.77 |
| B.double GML | B1233 | 63.0 | 38.84 | 1.69 | 2.80 | 6.91 | 26 | 224 | 62 | 32240 | 62% | 26.0 | 21.00 | 82% | 1.98 | 2.85 |
| B.double HML | B1233 | 68.5 | 44.34 | 1.69 | 2.80 | 6.91 | 23 | 198 | 65 | 29900 | 55% | | | 76% | 1.75 | 2.52 |
| B-triple GML | B12333 | 83.0 | 52.35 | 1.71 | 3.07 | 8.29 | 20 | 200 | 68 | 27200 | 48% | 35.0 | 23.33 | 69% | 1.7 | 2.37 |
| B-triple HML | B12333 | 91.0 | 60.35 | 1.71 | 3.07 | 8.29 | 17 | 170 | 72 | 24480 | 40% | | | 62% | 1.45 | 2.02 |
| AB-triple GML | A123T2B33 | 99.5 | 64.00 | 1.84 | 3.52 | 10.36 | 16 | 196 | 75 | 24000 | 38% | 36.5/42.5 (modular) | 28.83 | 61% | 1.48 | 2.02 |
| AB-triple HML | A123T2B33 | 108.0 | 72.50 | 1.84 | 3.52 | 10.36 | 14 | 171 | 79 | 22120 | 33% | | | 56% | 1.3 | 1.77 |
| Type 1 R/train - GML | A123T23 | 79.5 | 48.73 | 1.72 | 3.25 | 8.98 | 21 | 225 | 68 | 28560 | 50% | 36.5 | 22.17 | 72% | 1.82 | 2.52 |
| Type 1 R/train - HML | A123T23 | 85.5 | 54.73 | 1.72 | 3.25 | 8.98 | 19 | 204 | 72 | 27360 | 45% | | | 69% | 1.65 | 2.28 |
| Type 2 R/train - GML | A123T23T23 | 116.0 | 73.42 | 1.76 | 3.91 | 12.42 | 14 | 199 | 80 | 22400 | 33% | 53.5 | 34.33 | 57% | 1.45 | 1.92 |
| Type 2 R/train - HML | A123T23T23 | 125.0 | 82.42 | 1.76 | 3.91 | 12.42 | 13 | 185 | 83 | 21580 | 31% | | | 55% | 1.35 | 1.78 |
| BAB Quad - GML | B1233T2B33 | 119.5 | 78.42 | 1.73 | 3.68 | 11.74 | 13 | 176 | 81 | 21060 | 31% | 51.5 | 35.50 | 53% | 1.32 | 1.76 |
| BAB Quad - HML | B1233T2B33 | 130.5 | 89.42 | 1.73 | 3.68 | 11.74 | 12 | 162 | 85 | 20400 | 29% | | | 52% | 1.22 | 1.62 |

For further information contact ATA on 02 6253 6900

The B-triple; AB-triple; & the BAB-Quad are based on modular vehicle units as agreed by ATA General Council.

**EAM (Extreme Axle Measurement)** Is the minimum dimensional requirement in regard to Axle Spacing Mass Schedule (ASMS) requirements for the stated Gross Combination Mass. The formula varies depending on the gross mass of the vehicle and whether the vehicle is a road train. In addition to EAM, internal axle groups must also comply to the appropriate ASMS.

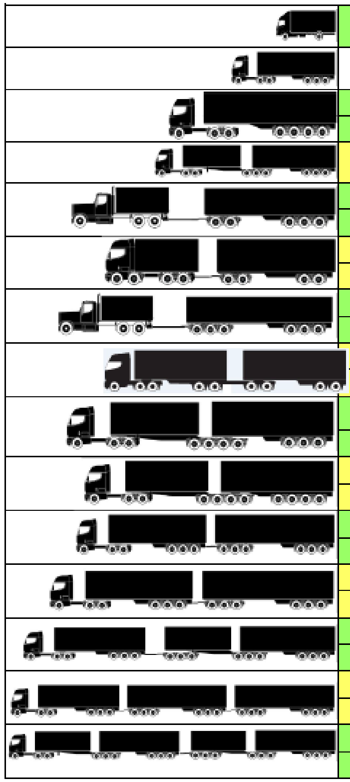
* The data in this table is provided for general information and does not take into account your specific circumstances. You should obtain professional engineering advice before taking action.



Appendix 1 – TIC modular combinations

# Appendix 2: Non modular combinations

**AUSTRALIAN TRUCKING ASSOCIATION Truck Impact Chart 16 March 2018 Non Modular**



| Configuration | Configuration Code (ATA TAP) | GCM | Payload | Calculated ESA's 4th Power – Load Status 0% | Calculated ESA's 4th Power – Load Status 50% | Calculated ESA's 4th Power – Load Status 100% | No Trips per 1000 tonnes | ESA's per 1000 tonnes | Nom Fuel / 100 kilometres | Fuel Required per 1000k lead | Driver Requirement | Overall Length (metres) | EAM ≥ (metres) | Emissions / 1000 tonnes | Convoy Length at 60 km/h (kilometres) | Convoy Length at 100 km/h (kilometres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Three Axle Rigid GML | R12 | 22.5 | 13.12 | 0.51 | 1.27 | 3.58 | 77 | 316 | 28.0 | 43120 | 183% | <12.5 | | 109% | 4.82 | 7.38 |
| **Six Axle Artic GML** | **A123** | **43.0** | **24.04** | **1.7** | **2.6** | **5.5** | **42** | **304** | **47** | **39480** | **100%** | **19.0** | **10.0** | **100%** | **2.9** | **4.3** |
| Seven Axle 124 GML | A124 | 47.0 | 26.65 | 1.6 | 2.5 | 5.4 | 38 | 267 | 50 | 38000 | 90% | 20.0 | 11.3 | 96% | 2.66 | 3.93 |
| Seven Axle 124 HML | A124 | 50.5 | 30.15 | 1.6 | 2.7 | 6.5 | 34 | 274 | 51 | 34680 | 81% | 20.0 | 11.3 | 88% | 2.38 | 3.52 |
| B.double GML | B1233 | 63.0 | 38.84 | 1.69 | 2.80 | 6.91 | 26 | 224 | 62 | 32240 | 62% | ≤ 26 metres | 21.0 | 82% | 1.98 | 2.85 |
| 8 Axle Truck & Dog Trailer - GML | R12T23 | 59.5 | 42.00 | 1.64 | 2.62 | 7.60 | 24 | 222 | 61 | 29280 | 57% | ≤ 23 metres | 19.7 | 74% | 1.76 | 2.56 |
| 8 Axle Truck & Dog Trailer - HML | R12T23 | 63.0 | 45.20 | 1.64 | 2.62 | 7.60 | 23 | 213 | 64 | 29440 | 55% | | 19.7 | 75% | 1.68 | 2.45 |
| 8 Axle Truck & Dog Trailer - GML | R22T22 | 60.5 | 42.20 | 0.36 | 1.82 | 8.26 | 24 | 207 | 61 | 29280 | 57% | ≤ 23 metres | 22.0 | 74% | 1.76 | 2.56 |
| 8 Axle Truck & Dog Trailer - HML | R22T22 | 62.0 | 43.70 | 0.36 | 1.91 | 9.04 | 23 | 216 | 64 | 29440 | 55% | | 20.3 | 75% | 1.68 | 2.45 |
| 9 Axle Truck & Dog Trailer - GML | R12T33 | 63.0 | 44.80 | 1.64 | 2.53 | 6.91 | 23 | 197 | 62 | 28520 | 55% | ≤ 26 metres | 21.0 | 72% | 1.73 | 2.5 |
| 9 Axle Truck & Dog Trailer - HML | R12T33 | 68.5 | 50.30 | 1.64 | 2.53 | 6.91 | 20 | 171 | 65 | 26000 | 48% | | 21.0 | 66% | 1.5 | 2.17 |
| 26m Short Road Train GML | A122T22 | 72.5 | 48.7 | 1.68 | 3.21 | 10.35 | 21 | 253 | 67 | 28140 | 50% | ≤ 26 metres | 19.8 | 71% | 1.6 | 2.3 |
| 26m Short Road Train HML | A122T22 | 74.5 | 50.7 | 1.68 | 3.21 | 10.35 | 20 | 241 | 68 | 27200 | 48% | | 19.8 | 69% | 1.52 | 2.19 |
| Super B.double (10 axles) GML | B1243 | 67.0 | 39.92 | 1.87 | 2.96 | 6.82 | 26 | 226 | 65 | 33800 | 62% | ≤ 30 metres | 24.7 | 86% | 2.08 | 2.95 |
| Super B.double (10 axles) HML | B1243 | 73.0 | 45.92 | 1.87 | 2.96 | 6.82 | 22 | 191 | 68 | 29920 | 52% | | 24.7 | 76% | 1.76 | 2.5 |
| Super B.double (11 axles) GML | B1244 | 71.0 | 42.78 | 1.87 | 2.95 | 6.73 | 24 | 206 | 67 | 32160 | 57% | ≤ 30 metres | 27.3 | 81% | 1.92 | 2.72 |
| Super B.double (11 axles) HML | B1244 | 77.5 | 49.28 | 1.87 | 2.95 | 6.73 | 21 | 181 | 70 | 29400 | 50% | | 27.3 | 74% | 1.68 | 2.38 |
| PBS A-Double - GML | A123T33 | 31.6 | 51.43 | 1.71 | 3.10 | 8.29 | 20 | 200 | 68 | 27200 | 48% | ≤ 30 metres | 6.2 | 69% | 1.73 | 2.4 |
| PBS A-Double - HML | A123T33 | 31.6 | 59.43 | 1.71 | 3.10 | 8.29 | 17 | 170 | 72 | 24480 | 40% | | 6.2 | 62% | 1.48 | 2.04 |
| Type 1 Road Train Triaxle Dolly - GML | A123T33 | 83.0 | 51.43 | 1.71 | 3.10 | 8.29 | 20 | 200 | 68 | 27200 | 48% | ≤ 36.5 metres | 23.3 | 69% | 1.73 | 2.4 |
| Type 1 Road Train Triaxle Dolly - HML | A123T33 | 91.0 | 59.43 | 1.71 | 3.10 | 8.29 | 17 | 170 | 72 | 24480 | 40% | | 23.3 | 62% | 1.48 | 2.04 |
| AB.Triple Triaxle Dolly - GML | A123T3B33 | 103.0 | 66.70 | 1.83 | 3.38 | 9.67 | 15 | 173 | 80 | 24000 | 36% | ≤ 42.5 metres | 30.0 | 61% | 1.39 | 1.89 |
| AB.Triple Triaxle Dolly - HML | A123T3B33 | 113.5 | 77.20 | 1.83 | 3.38 | 9.67 | 13 | 150 | 85 | 22100 | 31% | | 30.0 | 56% | 1.21 | 1.64 |
| Type 2 Road Train Triaxle Dolly - GML | A123T33T33 | 123.0 | 78.82 | 1.74 | 3.62 | 11.05 | 13 | 166 | 84 | 21840 | 31% | ≤ 53.5 metres | 36.7 | 55% | 1.35 | 1.78 |
| Type 2 Road Train Triaxle Dolly - HML | A123T33T33 | 136.0 | 91.82 | 1.74 | 3.62 | 11.05 | 11 | 141 | 87 | 19140 | 26% | | 36.7 | 48% | 1.14 | 1.51 |
| BAB Quad Triaxle Dolly - GML | B1233T3B33 | 123.0 | 81.03 | 1.72 | 3.54 | 11.05 | 13 | 166 | 84 | 21840 | 31% | ≤ 53.5 metres | 36.7 | 55% | 1.32 | 1.76 |
| BAB Quad Triaxle Dolly - HML | B1233T3B33 | 136.0 | 94.03 | 1.72 | 3.54 | 11.05 | 11 | 141 | 87 | 19140 | 26% | | 36.7 | 48% | 1.12 | 1.49 |

For further information contact ATA on 02 6253 6900

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|---|---|
| **EAM (Extreme Axle Measurement)** | Is the minimum dimensional requirement in regard to Axle Spacing Mass Schedule (ASMS) requirements for the stated Gross Combination Mass. The formula varies depending on the gross mass of the vehicle and whether the vehicle is a road train. In addition to EAM, internal axle groups must also comply to the appropriate ASMS. |

* The data in this table is provided for general information and does not take into account your specific circumstances. You should obtain professional engineering advice before taking action.

**Australian Trucking Association and Barkwood Consulting P/L** **March 2018** **Truck Impact Chart Non-Modular**

Appendix 2 TIC non modular/PBS combinations