

## AUSTRALIAN PERFORMANCE BASED STANDARDS: PAST, PRESENT AND FUTURE



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### Abstract

The initial development of the Performance Based Standards (PBS) scheme began in Australia in 1997 and 1998 with a strategy to lift the productivity to a higher level than was being delivered by the existing conventional trucking fleet. In 2006 federal and State ministers formally agreed the scheme although a significant number of High Productivity Vehicles (HPVs) had been operating successfully through State permit schemes prior the 2006 agreement. Generally, all the HPVs are heavy rigid trucks with trailers or longer articulated combinations such as Super B-Doubles, B-triples, A-Doubles, and special quad trailer combinations. PBS vehicles deliver very significant kilometre saving which is the basis for virtually all benefits being: safety, productivity, emissions savings, and potential pavement benefits. In 2013 the new National Heavy Vehicle Regulator (NHVR) became the agency to facilitate the implementation of the agreed national PBS policy across State jurisdictions. Ten years since 2013, the scheme's rollout has broken all forecast uptake records. These benefits are expected to increase as the HPV population continues to grow under the PBS scheme.

**Keywords:** High productivity vehicles, freight innovation, Performance Based Standards, safety initiative, fuel savings, road pavement benefits, fatality savings

### 1. The PBS Scheme's Growth – A popular or a good policy?

Pre the establishment of National Heavy Vehicle Regulator the National Transport Commission's PBS program had been agreed by State transport ministers in 2006 as a productivity initiative. The growth since 2013 when the scheme's implementation was handed over the new National Heavy Vehicle Regulators the scheme is set to surpass the 18,000 level by end of 2023, a decade after the handover.

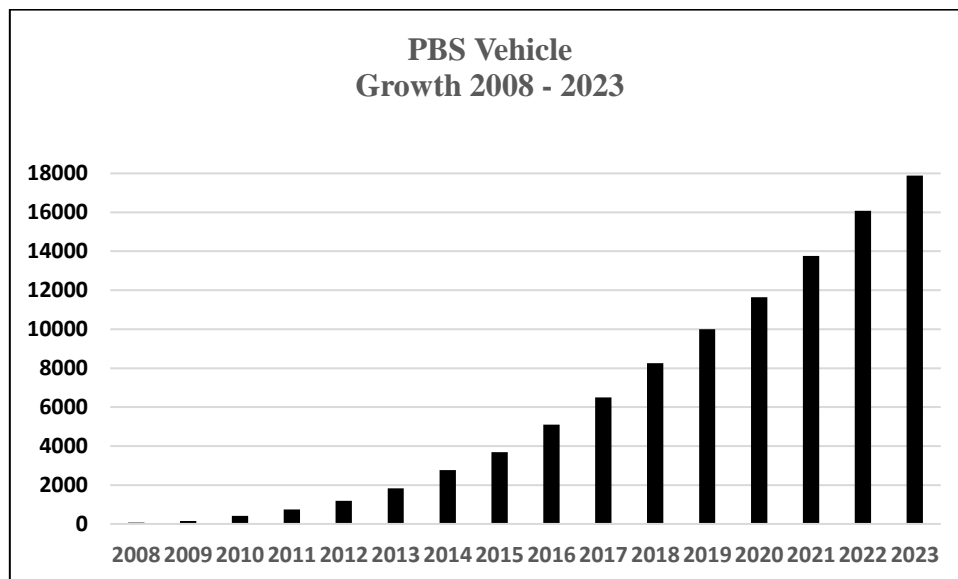
**Table 1: Growth rates for PBS vehicles: Australia 2008 - 2023**

Year	Number	% Change
2023	17889 <sup>(1)</sup>	11% <sup>(1)</sup>
2022	16075	17%
2021	13756	18%
2020	11638	16%
2019	10004	21%
2018	8253	27%
2017	6497	28%
2016	5092	38%
2015	3692	33%
2014	2771	52%
2013	1827	53%
2012	1192	62%
2011	736	80%
2010	408	176%
2009	148	103%
2008	73	na
Compounding Growth rate – 14.5 years		46.14%

Source: NHVR Pers Comm (1) First six months of 2023 na not applicable

By the end of 2023 there will almost be a tenfold increase in truck numbers since 2013. Table 1 and Figure 1 reflect this growth. As can be seen from Table 1 the double digit rates are declining and will all probability drop to single figures circa 2029. However, numbers per annum may well still grow at some 2500 to 3000 units per annum from this time

**Figure 1: Growth rates for PBS vehicles: Australia 2008 - 2023**

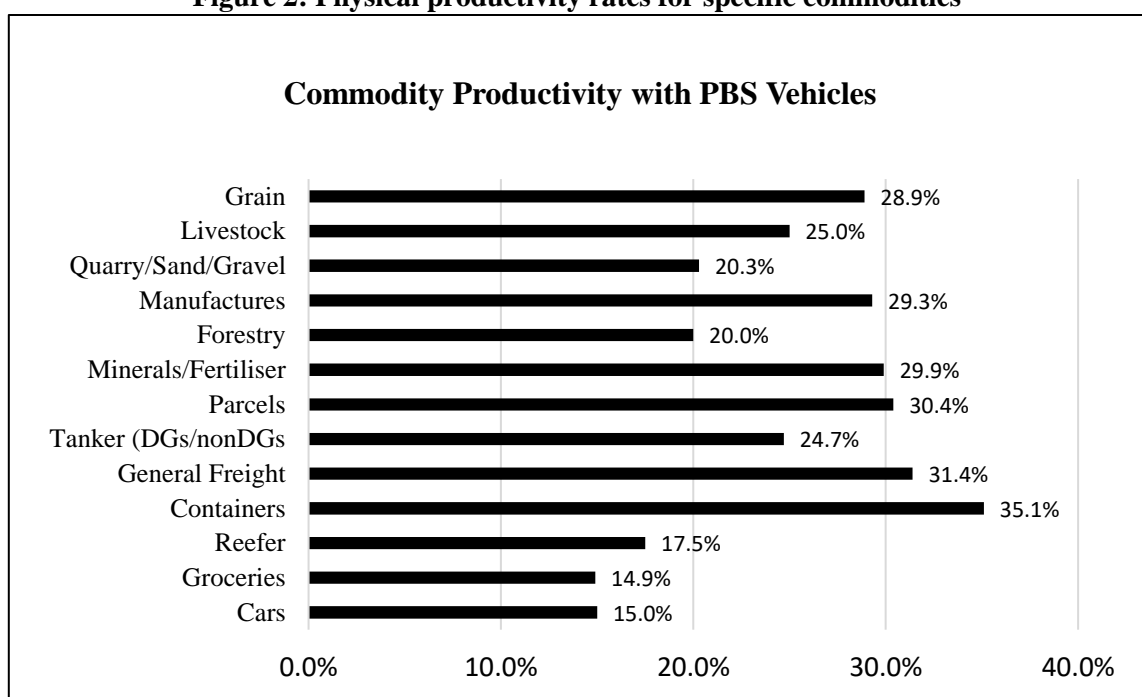


Source: Table 1

## 2. Physical Productivity

The PBS scheme was developed as a productivity initiative for the Australian trucking industry. To measure this productivity the metric chosen was ‘kilometres saved’ which was considered a ‘physical productivity’ measure. As the operators that have taken up the PBS scheme generally sit in the ‘hire and reward’ sector, to the tune of 98%, it is almost impossible to undertake a total factor productivity metric as both revenue and costs would have been virtually impossible to obtain. Figure 2 presents the kilometres saved, by a commodity user, through the use of PBS vehicles, which is effectively the ‘physical productivity’ measure shown in Figure 2.

**Figure 2: Physical productivity rates for specific commodities**



Source: NTC 2017.

## 3. Vehicle savings

The saving in vehicle kilometres by the respective PBS configurations leads to the potential savings in what would have been the vehicle numbers in a conventional fleet. Table 2 presents these savings. The basic finding suggests that for every 1000 commissioned PBS vehicles some 296 conventional vehicle would not be required to undertake the same task.

With the adoption of the higher classes of articulated PBS vehicles both the productivity and vehicle savings will incrementally grow above the 29% level which up to this time is largely dominated by the rigid truck and dog trailer combinations.

The comparative kilometres travelled by conventional and PBS vehicles can be found in the previous PBS Safety reports, 2014,2017 and 2021 done for the various regulatory entities.

**Table 2: Vehicle savings based on kilometres saved**

Year	PBS Numbers	Conventional Truck numbers if no PBS	Vehicle Savings
2008	73	89	16
2009	148	181	33
2010	408	500	92
2011	736	901	165
2012	1192	1460	268
2013	1827	2365	538
2014	2771	3588	817
2015	3692	4780	1088
2016	5092	6593	1501
2017	6497	8412	1915
2018	8253	10685	2432
2019	10004	12952	2948
2020	11638	15068	3430
2021	13756	17810	4054
2022	16075	20812	4737
<b>Per 1000 PBS Vehicles</b>		<b>Savings</b>	<b>296 (29.6%)</b>

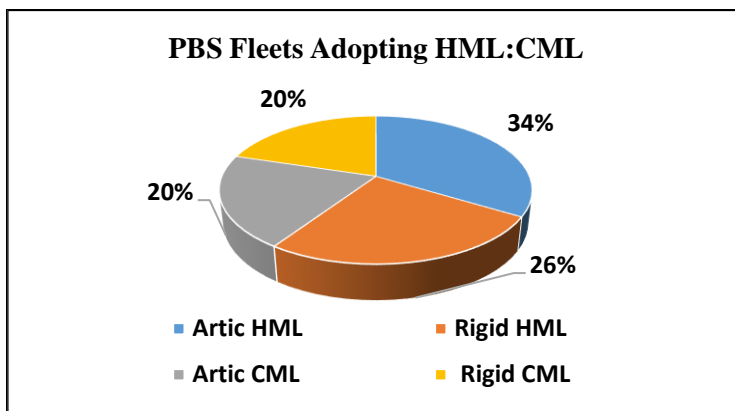
Source: Derived and extrapolated from Austroads 2014 truck reduction regressions

#### 4. Gross Tonne Kilometre savings

The benefits of kilometres saved especially with fewer trucks has a calculable gross tonne kilometre benefit. (Gtkm). Gtkms are a measure of work and are useful in estimating eventual road pavement damage along with other inputs such as pavement type, thickness, weathering etc.

One important consideration was to establish what percentage of the PBS fleet was operating on the Higher Mass Limits (HML) or Concessional Mass Limits (CML) Schemes? This task was undertaken in NTC 2017 and Figure 3 presents the results, although this is an overestimate for the CML scheme as PBS operators were considered to be in one scheme of the other. As this is not universally true the Gtkm benefits will be even greater than presented in Table 3.

**Figure 3: PBS use of mass limit increases**



Source: NTC, 2017

**Table 3: Million Gross Tonne Kilometres**

Year	PBS Trucks	Vehicles Saved	% mill GTKM Savings over non PBS fleet
2013	1827	538	2.4%
2014	2771	817	3.7%
2015	3692	1088	4.9%
2016	5092	1501	6.8%
2017	6497	1915	8.7%
2018	8253	2432	11.1%
2019	10004	2948	13.4%
2020	11638	3430	15.6%
2021	13756	4054	18.4%
2022	16075	4737	21.5%
<b>Savings per 1000 PBS Vehicles</b>		<b>Savings</b>	<b>4.54%</b>

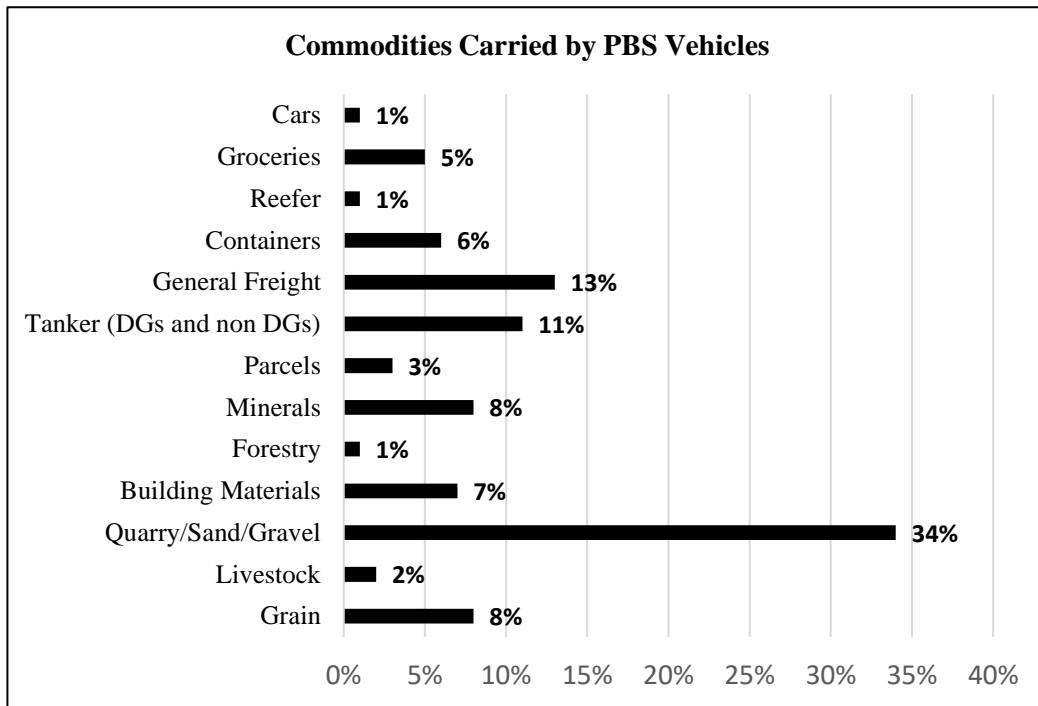
Derived from NTC 2017 Gtkm Generator

Table 3 again presents the benefits that the vehicle savings, and thus the laden kilometre savings have on the overall gtkm task. As an example in 2022 the gtkm savings due to PBS uptake would have saved 21.5% of gtkms if that task had been performed by a conventional fleet. As a rule every 1000 PBS vehicles saves 4.54% of the gtkms that would have been performed by a conventional fleet.

### 5. What are PBS Vehicles carrying?

The most recent snapshot of commodities carried by PBS fleets show quarry/sand/gravel dominates the commodity classes. The rigid truck and trailer configurations underpin this task as well as a proportion of the minerals and grains groups.

**Figure 4: PBS vehicles - what do they haul?**



Source: NTC 2017

It should be noted that since this survey was undertaken there have been observable heightened activity in the forestry, livestock, parcels, and general freight areas especially with A-doubles. However, the population of truck and dog trailer combinations have also grown since this time.

**Figure 5: Truck and four axle dog trailer**



## 6. Fuel Savings

Based on a current assumption that diesel fuel, or bio-diesel, will be used by heavy PBS trucks over the next decade there will be a net fuel saving, through the use of PBS vehicles. Using the 2016 base, (NRTC, 2017), the population of PBS vehicles will have a direct relationship to these calculated fuel savings. This assumption remains true as long as the profile of the PBS population remains the same through to 2034. In all probability the

calculation of fuel savings in Table 4 will be an underestimate as an increase in the larger articulated combinations will see greater fleet fuel consumption savings.

**Table 4: Forecast Fuel savings 2016 – 2034 (million litres)**

Year	PBS forecasts	Saving/year Mill litres	Cumulative Mill litres
2034	46406	857	8259
2033	43370	801	7402
2032	40157	741	6601
2031	37183	686	5860
2030	34428	636	5174
2029	31878	588	4538
2028	29381	542	3950
2027	27079	500	3407
2026	24958	461	2907
2025	22689	419	2447
2024	20440	377	2028
2023	18169	335	1651
2022	16075	297	1315
2021	13745	254	1018
2020	11630	215	765
2019	9949	184	550
2018	8253	152	366
2017	6497	120	214
2016	5092	94	94

*Estimated from a 2016 base from NTC 2017 and*

In 2034 there will be a calculable fuel saving of 857 million litres of diesel and a cumulative saving, off a 2016 base, of 8.2 billion litres of diesel. PBS comes with major environmental benefits.

## 7. Safety 1: Comparative Major Crash Metrics 2009-2019

The major crash metrics were averaged from the findings of the three previous safety reports: Austroads 2014, NTC 2017 and NHVR 2021. The two major crash metrics are ‘crashes per 100 million kilometres’ and crashes ‘per 10,000 vehicles’. The definition of a major crash is based on an insurance definition involving damage greater than \$50,000 Australian dollars per incident.

**Table 5: Major Crash metrics by conventional and PBS configurations**

Configuration	Registration Class	Major Crash Rates	
		Per 100 m kms	Per 10K Vehicles
Light Rigid	Conventional	8.0	24.0
Medium Rigid	Conventional	14.8	24.4
Heavy Rigid	Conventional	14.7	33.1

Heavy Rigid (Trailer)	Conventional	16.7	119.7
Heavy Rigid (Trailer) PBS	PBS	8.8	98.7
Semi-Trailer	Conventional	19.3	148.9
Semi-Trailer (PBS) 20m Trailer Quad axle	PBS	2.8	98.6
B-Double	Conventional	9.6	151.5
Super B-Double (PBS)	PBS	8.5	122.4
Enhanced B-Double (PBS)	PBS	3.7	76.4
B-Triple	PBS/Permit	3.7	59.4
A-Double	PBS	11.4	149.1
Type I (Double Road Train)	Conventional	23.03	286.8
Type II (Triple Road Train)	Conventional	23.86	296.4
Road Train (Quad Trailer) <sup>1</sup>	Conventional	61.98	787.8
Road Train (AAB, BAB Quad (trailer))	PBS	5.4	119.4
Road Train (Quin Trailer)	Permit	na	na

Source: Austroads 2014, NTC 2017, NHVR 2021, and Pers Comms, 1. WA/Qld/NT 2022/2023 Quad Road train survey, 2022/23

The average crash rates were supplemented in 2022/23 with a specific survey of the heavy tow operators in Western Australia servicing the double, triple, and quad road train sector. This survey did reveal a significant problem with the conventional quad road train operations in this area. The PBS equivalent quad road train operations are performing at a much higher level of safety, possibly due to performing on better infrastructure and driven by more experienced drivers.

## 8. Safety 2: Forecast fatalities savings through PBS use

Of great interest besides the savings in major crashes is what fatalities may be saved by having less trucks on the road doing less kilometres. Table 6 presents the forecast for the billions of kilometres saved to 2033, through the use of PBS vehicles. The heavy vehicle fatality rate per billion heavy vehicle kilometres travelled, is published by the Bureau of Transport and Infrastructure Economics (BITRE) on an annual basis. As at 2019 this rate was 9 fatalities per a billion kilometres of heavy vehicle travelled and for the fatal savings in Table 6 this rate is calculated to reduce to 7.5 per billion kilometres travelled to the period 2033. The fatality savings will be greater if this fatality rate stays above the 7.5 rate.

**Table 6: Fatal saving by using PBS configurations**

Year	Fatals Saved	Bill Kms saved
2033	14.86	1.981
2032	13.86	1.848
2031	12.86	1.714
2030	11.79	1.573
2029	10.78	1.437
2028	10.08	1.343
2027	9.34	1.246



2026	8.70	1.145
2025	7.90	1.039
2024	7.11	0.936
2023	6.35	0.836
2022	5.62	0.740
2021	4.78	0.629
2020	4.05	0.533
2019	4.10	0.456
2018	2.78	0.376
2017	2.76	0.296
2016	1.95	0.217
2015	1.60	0.167
2014	1.16	0.118
2013	0.61	0.068
<b>Total</b>	<b>143.05</b>	<b>18.70</b>

*Estimates based on billion kilometres saved times the fatality rates per billion kms*

The savings in fatalities is calculated by multiplying the heavy truck fatality rate by the billions of kilometres saved by using PBS trucks. Since 2013, 143 fatalities are forecast to be saved through the use of PBS trucks..

## 6. Is PBS just for big trucks doing long distance work?

Since the inception and implementation of the PBS scheme there has often been an international and a partial domestic perception that Australia’s HPVs are anything but a useful tool for the urban freight task.

**Table 7: Percentage Urban Operations by PBS Vehicles**

Truck Type	Per Cent Urban Operation
Rigid Truck 3ATD Trailer	95%
Rigid Truck 4ATD Trailer	90%
Rigid Truck 5ATD Trailer	88%
Rigid Truck 6ATD Trailer	85%
20 m quad axle Semi Trailer	16%
Super and Enhanced B Doubles	19%
A-Doubles	13%
Triples	3%
Quad Road Trains	0%
<b>TOTAL</b>	<b>51%</b>

From surveys undertaken with PBS operators since the 2014 Austroads report, through to the NHVR’s 2021 study, with supplementary data from the NHVR itself, based on new HPV applications, half of the current HPV population is involved in urban freight operations. International perception, usually gained from conferences, often considers HPVs are too big

for urban operations. This view is misplaced. Our rigid truck and trailer operations do dominate urban operations but urban located container ports benefit significantly from specific HPV articulated configurations. As well, the 20 metre extended quad axle semi-trailers are proving highly popular with supermarket operations in both urban and near capital city regional deliveries. So are PBS vehicles useful in the urban areas, well, certainly for some the appropriate configurations the answer is, absolutely!

## **7. Conclusion**

The accelerated implementation and uptake of the Performance Based Standards scheme has seen many benefits since its inception and since the facilitation of the scheme's rollout through the NHVR's oversight of the program. The benefits are many: kilometre and fuel savings, large productivity benefits, gross tonne kilometre savings that have pavement infrastructure benefits, savings in major truck crashes and significant savings in truck crash fatalities. The scheme spans urban, regional and remote freight operations and the growth of the program has defied all forecasts since 2014. This initiative should be considered by many more countries than just those who have trialed one or two configurations. If popularity equals a good freight policy has the PBS scheme been a good policy, again absolutely!!

## **8. Acknowledgements**

Considerable thanks go to the NHVR's chief engineer Les Bruza for continuous access to PBS population and configuration data. As well, the majority of crash incidents data were supplied from insurance data sourced from NTI's NTARC desk for the three major PBS safety studies. Both Owen Driscoll initially, and currently Adam Gibson are owed thanks in this regard. These major crash incidents data spanned both the conventional and the PBS fleets. Supplementary data was obtained with direct surveys which were undertaken by CILTA principals as were the calculation of the major PBS comparative crash metrics. This co-operative, tri-party arrangement, has been in place since the first major PBS safety and productivity report that was published through Austroads in 2014.

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## **Glossary**

ABS	Australian Bureau of Statistics ( <a href="http://www.abs.gov.au">www.abs.gov.au</a> )
BITRE	The Bureau of Transport and Infrastructure Economics
CILTA	Chartered Institute of Logistics and Transport Australia
CML	Concessional Mass Limits
GCM	Gross Combination Mass
GTKM	Gross Tonne Kilometre
GVM	Gross Vehicle Mass
HML	Higher Mass Limits
HPVs	High Productivity Vehicles
NHVR	National Heavy Vehicle Regulator ( <a href="http://www.nhvr.gov.au">www.nhvr.gov.au</a> )
N(R)TC	National (Road) Transport Commission ( <a href="http://www.ntc.gov.au">www.ntc.gov.au</a> )
NTARC	National Truck Accident Research Centre
NTI	National Transport Insurance
PBS	Performance Based Standards
SMVU	Survey of Motor Vehicle Use, Cat
UoM	University of Melbourne