



# Demonstrating opportunities with vehicles

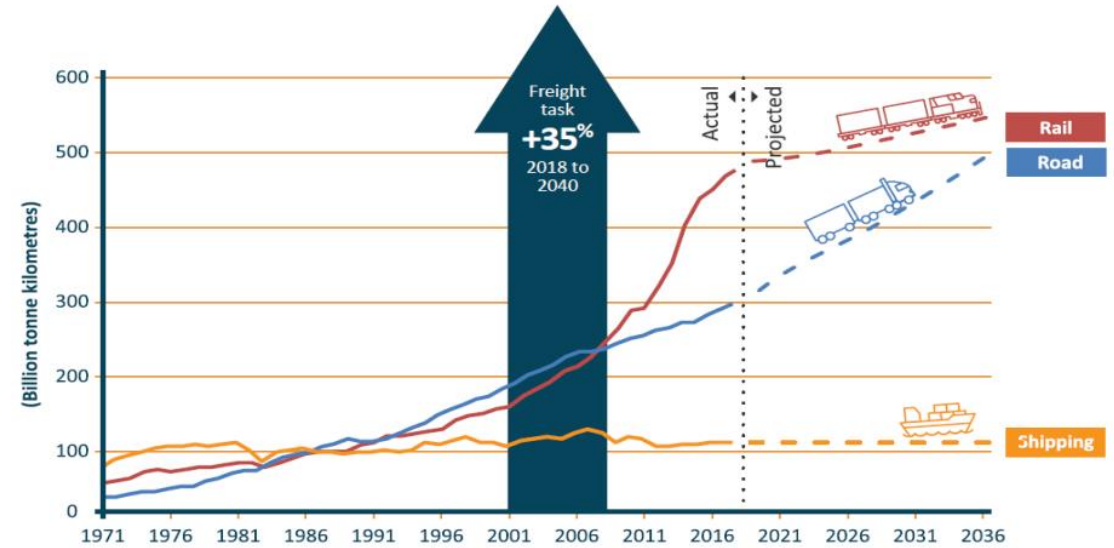
**IRTEENZ 2023**

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Chief Engineer



# Road transport is critical for Australia

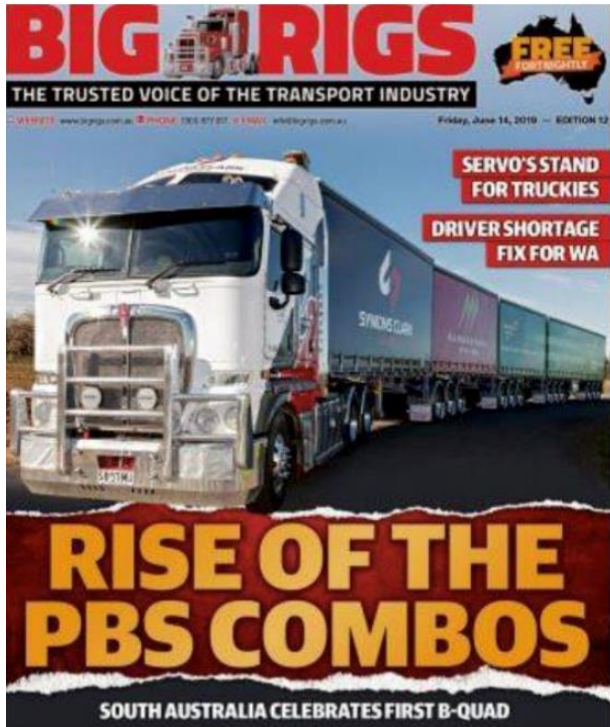
- Improved heavy vehicle productivity is key to Australia's economy.
- Covid-19 pandemic has put pressure on supply chains that brings goods to customers and moves freight around the country.
- Studies have indicated that only 15% of the current road freight is contestable by rail.
- Australian supply chain must become more productive to meet the demand as infrastructure growth will not be able to keep up.
- National driver shortage puts additional pressure on the heavy vehicle industry.



Source: Transport Infrastructure Council 2019



# What is the Performance-Based Standards scheme (PBS)?



- PBS aims to maximise the safe use of higher productivity vehicles by matching vehicles and roads.
- Most progressive heavy vehicle design scheme in the world.
- Alternative regulatory system – PBS requirements are set in National Law – Class 2 Restricted Access Vehicles.
- World first – introduced in Australia.
- Nationally agreed 13 Safety and 4 Infrastructure Standards.
- 4 matched vehicle/access levels (Levels 1-4).
- Commenced in 2007, scheme currently under review (PBS 2.0 project).

# Opportunities with vehicles

- Development of safer, more efficient and environmentally friendly heavy vehicles for the road transport industry under the PBS Scheme.
- Application specific elements of PBS for the development of special purpose combinations – Cranes, concrete mixers, garbage trucks.
- Application of PBS principals for making access decisions – Opening up networks for vehicles based on their performance characteristics.
- Utilisation of new heavy vehicle technologies.



## Access based on performance

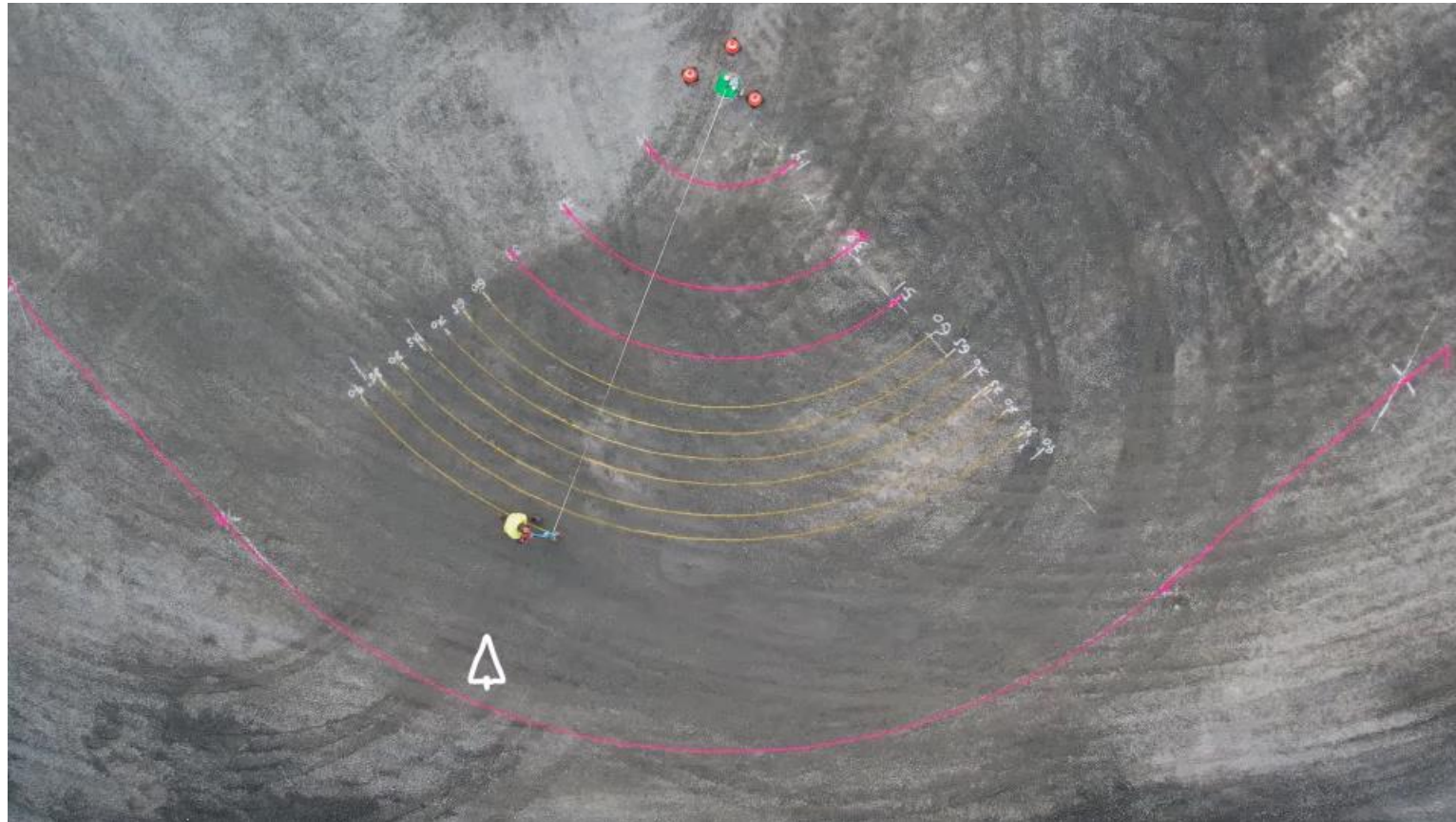


Source: Byford

- **Specify what a vehicle must do** – e.g. a vehicle must be able to fit and operate safely within the available road space.
- **Vehicles can be optimised for specific freight tasks** as PBS vehicles can be exempted from some prescriptive standards – e.g. different dimensions:
  - length
  - width
  - height
  - internal dimensions.



# Spilt Milk Project



Source: NTI

# Swept path

## PBS Level 2

Length: up to 30m

< **8.7m** (PBS limit for all PBS Level 2 combinations)



## Prescriptive B-doubles

Length: up to 26m

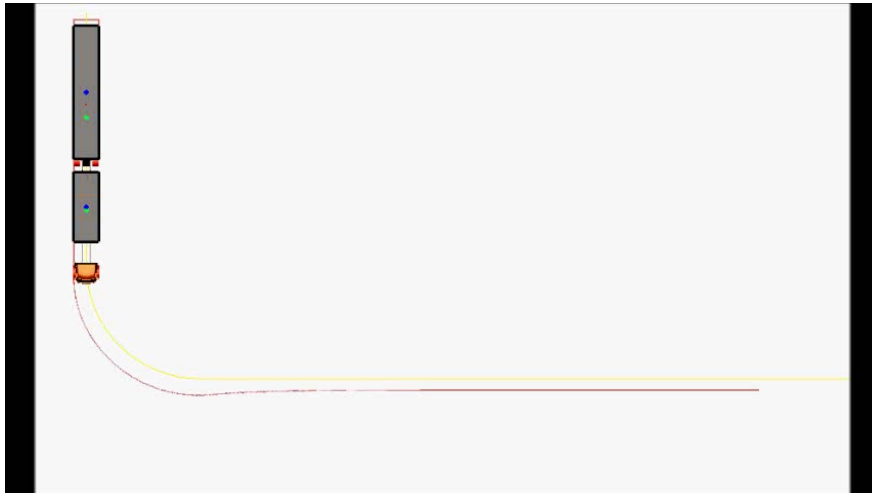
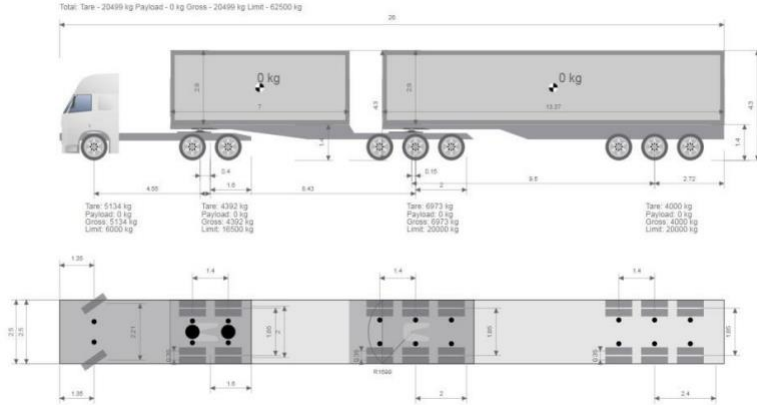
**8.4 – 9.0m**



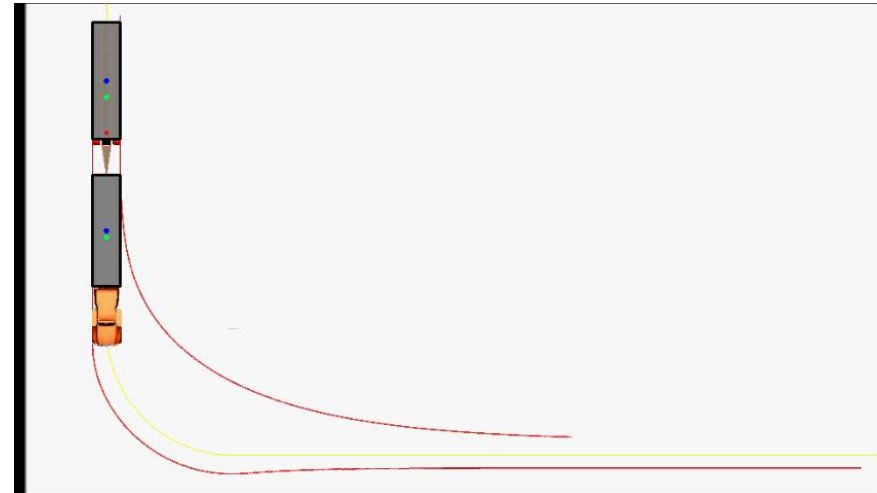
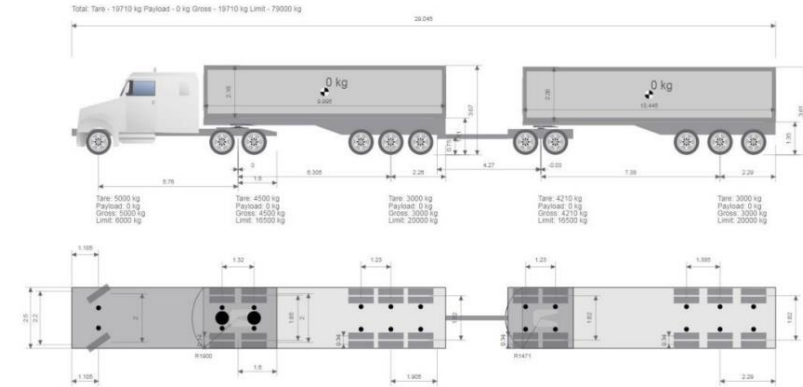
# Low speed swept path (LSSP) – example



## 26m long B-double



## 30m long A-double





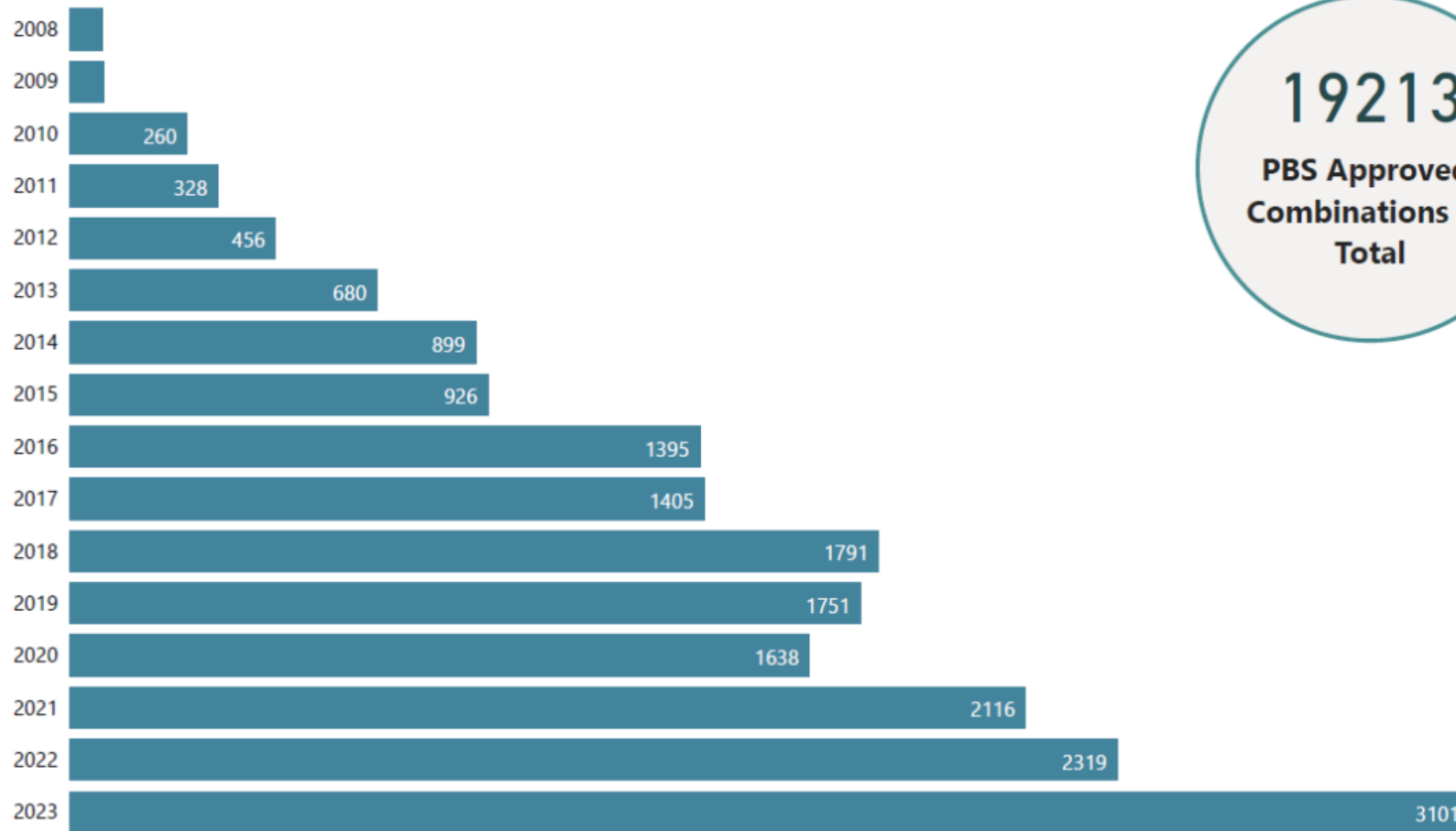
# Four levels of road access



PBS Performance Standards represent 85th percentile performance of comparable prescriptive vehicles.

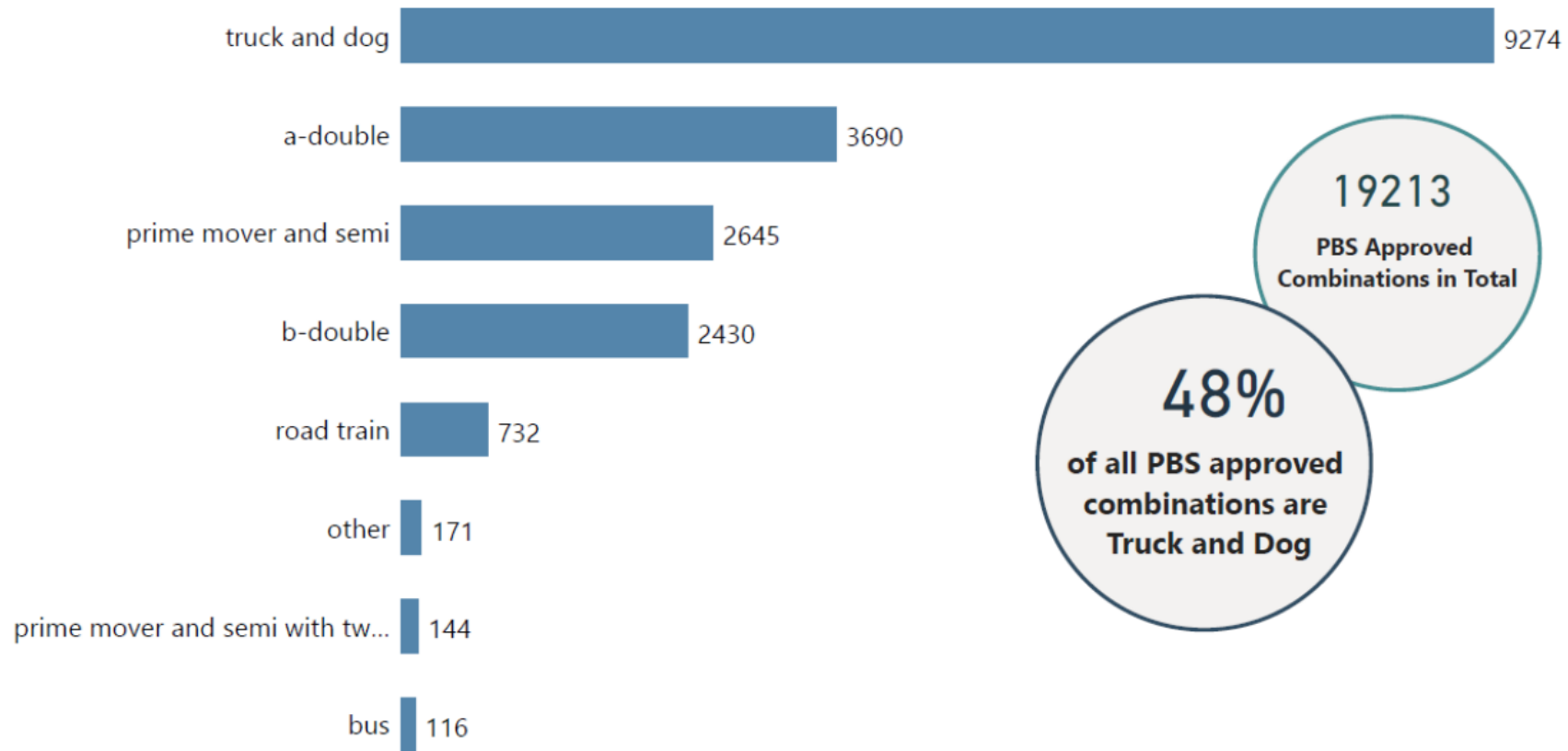
Prescriptive Vehicle		PBS Vehicle		
Vehicle	Length	Assessed Vehicle Performance*	PBS length limits (m)	
			'A'	'B'
Prime mover semi trailer	≤ 19m	Level 1	L ≤ 20 (General Access)	
B-Double	≤ 26m	Level 2	≤ 26	26 < L ≤ 30
Double road train	≤ 36.5m	Level 3	L ≤ 36.5	36.5 < L ≤ 42
Triple road train	≤ 53.5m	Level 4	L ≤ 53.5	53.5 < L ≤ 60

## PBS Combinations Yearly



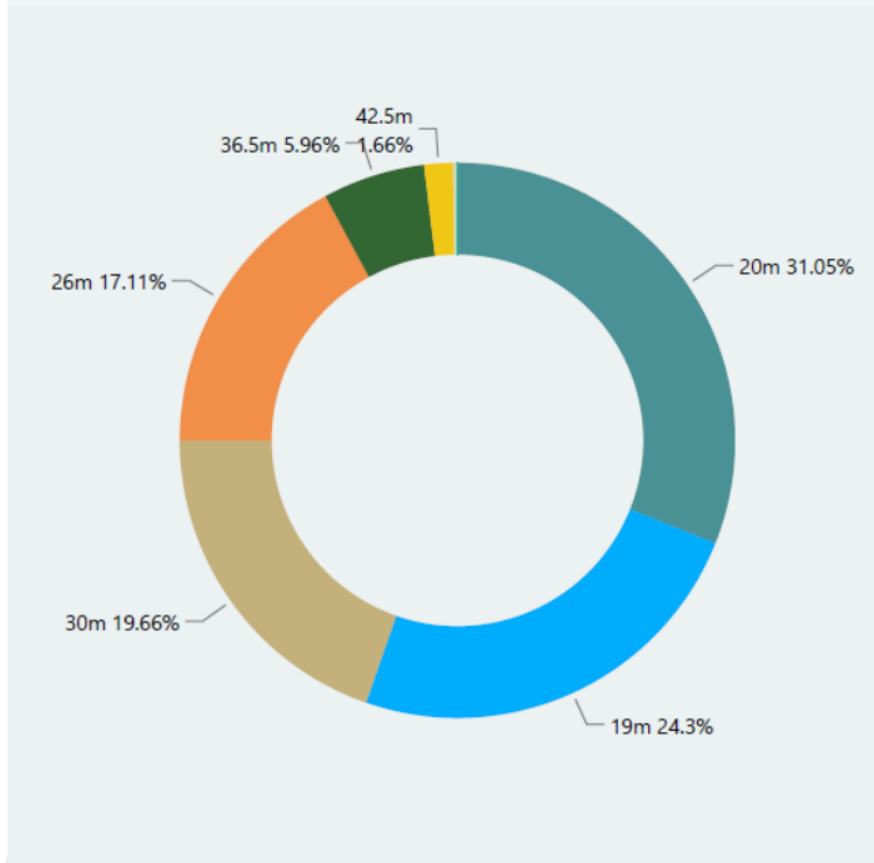
**19213**  
PBS Approved  
Combinations in  
Total

## PBS Fleet by Combination Type

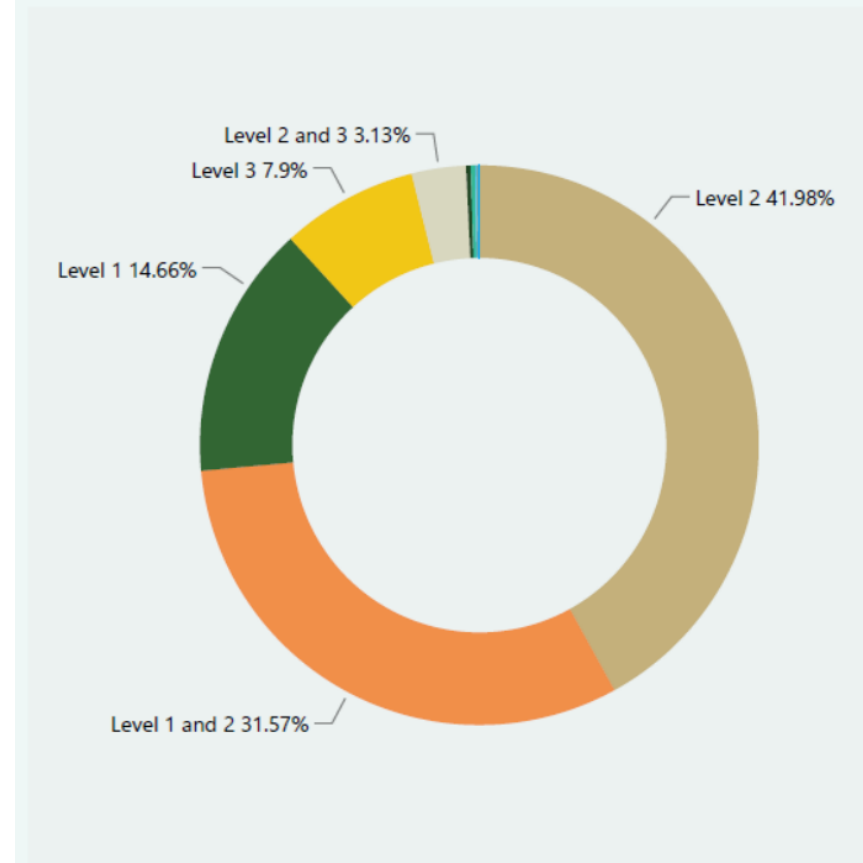




## PBS Fleet by Length



## PBS Fleet by Level



# PBS Examples - truck and dogs



Vehicle provides flexibility and delivers substantial productivity benefits.









**PBS Level 1** - 20m max length, 50.5t GCM.

**PBS Level 2A** - 26m max length, GCM = sum of axle masses (GML, CML, HML).



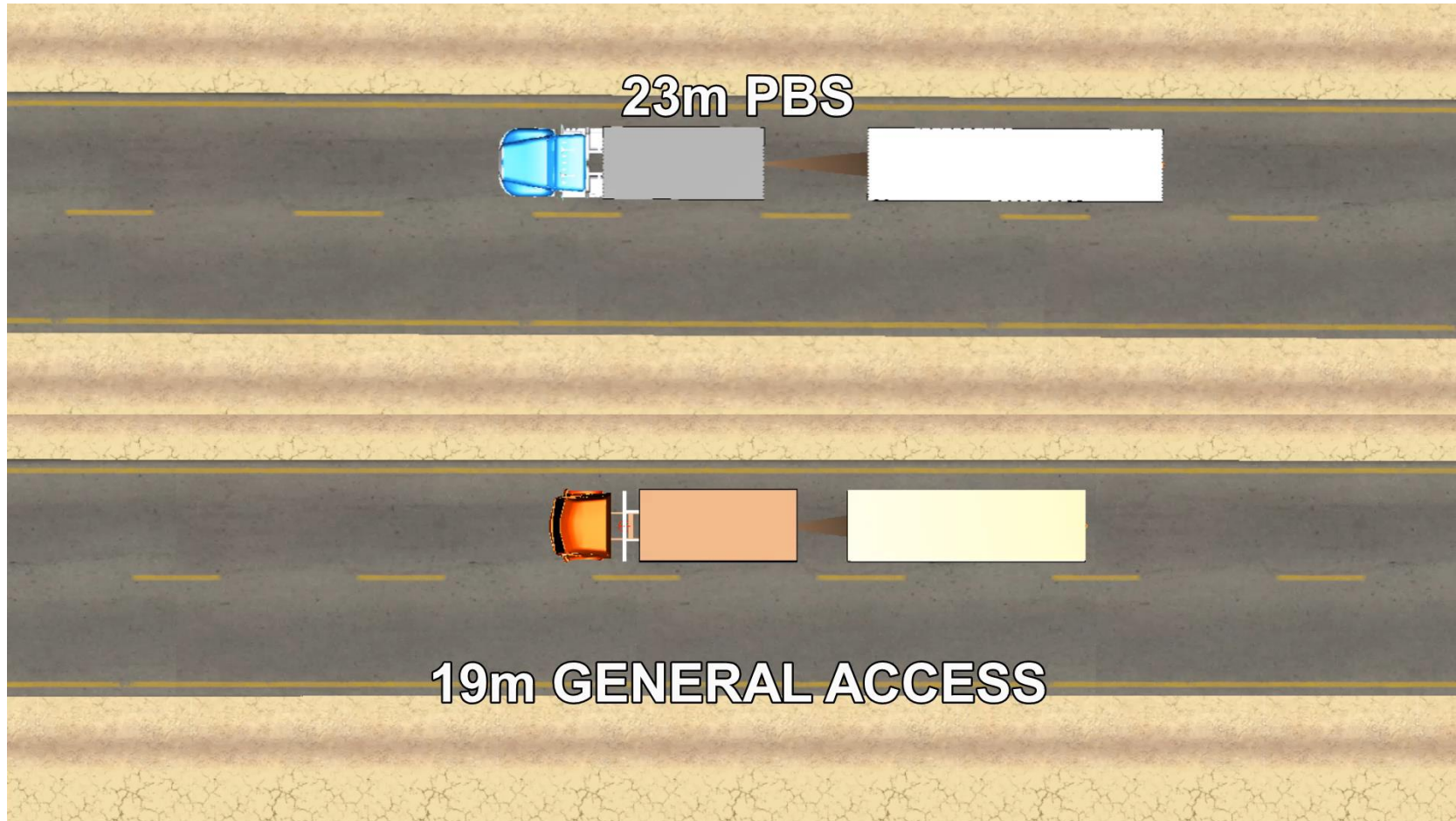
# PBS Truck and dog combinations



Common PBS vehicle configurations	Description	PBS level	Maximum length <sup>†</sup> (m)	Maximum permitted mass			
				GML (t)	CML (t)	HML (t)	
<b>PBS TRUCK AND DOG TRAILERS</b>							
1		3-axle truck and 3-axle dog trailer	1	20.0	48.5	-	-
			2	20.0	48.5	49.5	49.5
2		3-axle truck and 4-axle dog trailer	1	20.0	50.5	-	-
			2	20.0	56.0	57.5	57.5
3		3-axle truck and 5-axle dog trailer	2	26.0	59.5	61.5	63.0
4		3-axle truck and 6-axle dog trailer	2	26.0	63.0	65.0	68.5
5		4-axle truck and 3-axle dog trailer	1	20.0	50.0	-	-
			2	20.0	53.0	54.0	54.0
6		4-axle truck and 4-axle dog trailer	1	20.0	50.0	-	-
			2	20.0	60.5	62.0	62.0
7		4-axle truck and 5-axle dog trailer	2	26.0	64.0	66.0	67.5
8		4-axle truck and 6-axle dog trailer	2	26.0	67.5	69.5	73.0



# High Speed Transient Offtracking (HSTO) simulation



# PBS Truck and dog combinations





# PBS Prime mover and semitrailers

## General access

Articulated  
Length: 19 m  
Gross mass: 43 tonnes  
Loading: 20 pallets



## PBS Level 1 Specified PBS vehicle General access





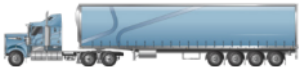
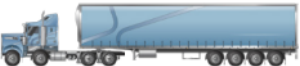


Articulated  
Length: 20 m  
Gross mass: 43 tonnes  
Loading: 26 pallets (30% more)





# PBS Prime mover and semitrailer combinations



Common PBS vehicle configurations	Description	PBS level	Maximum length <sup>†</sup> (m)	Maximum permitted mass		
				GML (t)	CML (t)	HML (t)
<b>PBS PRIME MOVER AND SEMITRAILERS</b>						
9	 2-axle prime mover and 2-axle semitrailer	1	20.0	32.0	32.5	32.5
10	 3-axle prime mover and 2-axle semitrailer	1	20.0	39.5	40.5	40.5
11	 3-axle prime mover and 3-axle semitrailer	1	20.0	43.0	44.0	46.0
12	 4-axle prime mover and 3-axle semitrailer	1	20.0	47.5	48.5	50.0
13	 3-axle prime mover and quad-axle semitrailer	1	20.0	43.0	44.0*	50.5*
14	 4-axle prime mover and quad-axle semitrailer	1 2	20.0 21.0	47.5 47.5	48.5* 48.5*	50.0** 55.0**
15	 Prime mover and semitrailer with 2 axle groups (2-1) <sup>Δ</sup>	1	20.0	48.0	49.0	49.0
16	 Prime mover and semitrailer with 2 axle groups (1-3) <sup>Δ</sup>	1	20.0	49.7	50.7	53.5°

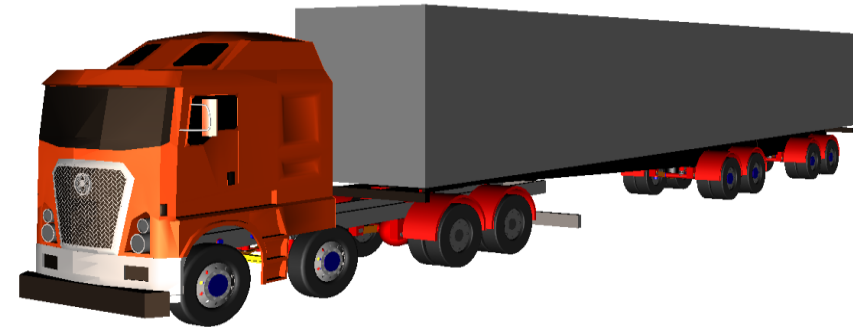
† Vehicles may exceed the upper length in their level. Road manager approval and/or an individual route assessment will be required. \* Quad-axle mass limit (QML). The MDL Regulation allows quad-axle groups up to 27 tonnes provided a combination is PBS approved. ◇ Operation of PBS vehicles on the PBS road network will require Road manager consent. Δ Vehicle Standards exemptions are required before a PBS vehicle approval is issued.

# Innovative vehicle design

19.5m (64 foot) long semi



20.25m (66 foot) long semi



# B-double

68.5t of Gross Combination Mass (GCM), complies with PBS Level 2 standards





# PBS vehicle example – 30m long B-double

77.5t of Gross Combination Mass (GCM), complies with PBS Level 2 standards



# PBS Superstar – PBS A-double

## PBS L2B Tier 3

Length: 30 m  
Gross mass: 85.5 tonnes





# PBS A-double – salmon fish tanker



## PBS L2A Tier 3

Length: 26 m  
Gross mass: 79 tonnes  
Huge environmental benefits  
Using a new type of ice and they don't need salt



# PBS A-double



## PBS L2A Tier 3

Payload: Milk  
Length: 26 m  
Gross mass: 79.5 tonnes





# PBS '40-40' A-double



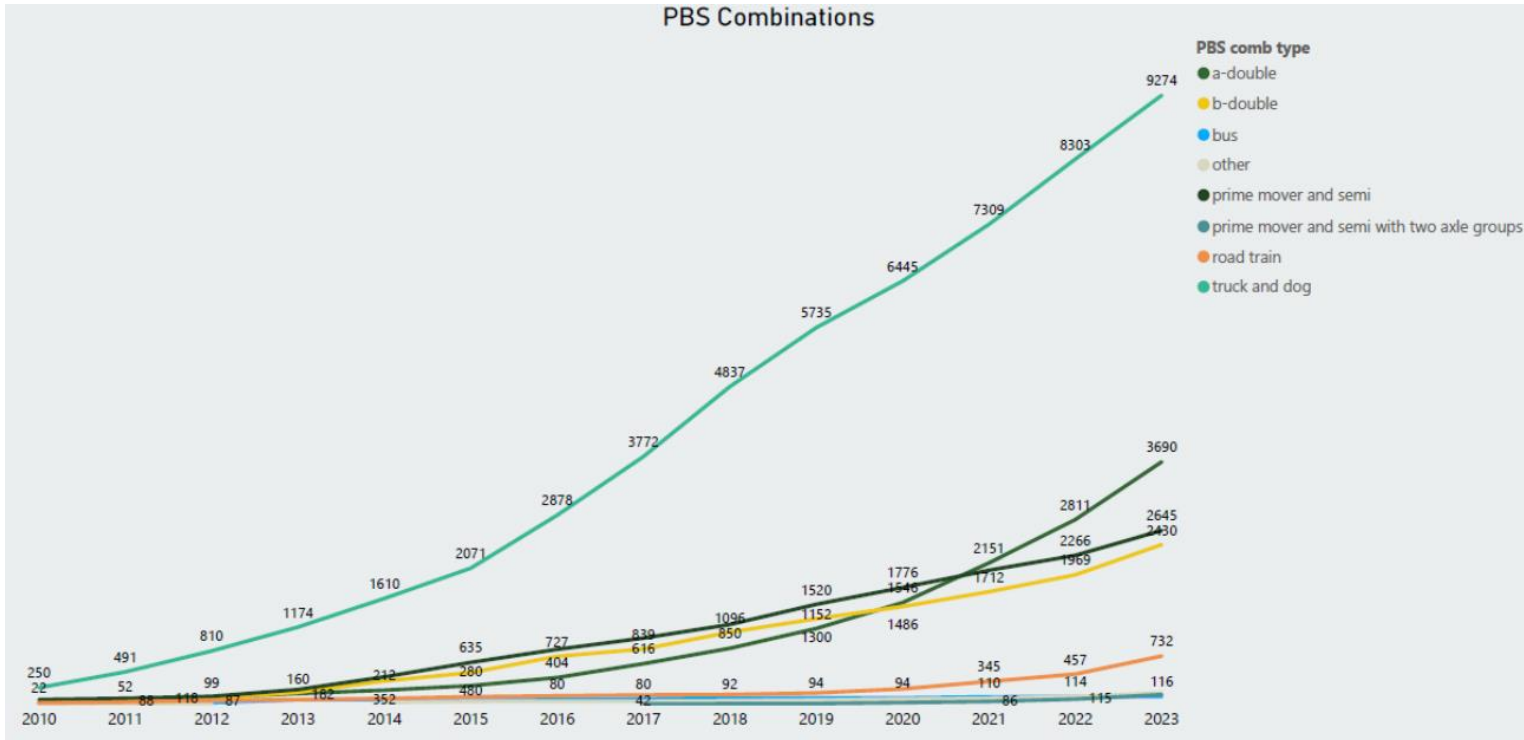
**PBS L2B  
Tier 3**

**PBS L3  
Tier 1**

**Payload: Containers  
Length: 30 m  
Gross mass: 79.5 tonnes**



# PBS A-doubles – a success story



# 20m long AB-double

## PBS L1/L2 Tier 3

Length: 20 m  
Gross mass: 59.5t (L1), 66.0 t (L2)





# Logging combination





# More PBS examples



# Heavy vehicle combinations with split axle groups





# Benefits of split axle groups

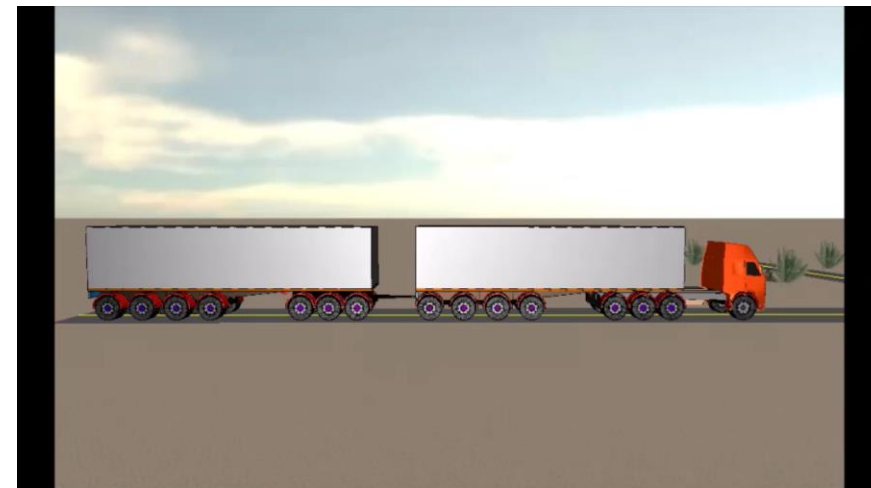


Clenton's Transport Pty Ltd is thrilled to introduce our latest game-changer in the transportation industry: the revolutionary Quad Axel Sideloader! 🚛👉  
...see more



# PBS productivity improvements – Milk tanker

- PBS A-double
- Payload: 75,000 litres of milk
- Operated in WA
- Based on PBS principals





# More PBS productivity examples – “superquad”



# A PBS combination for the Sydney Hydro Project

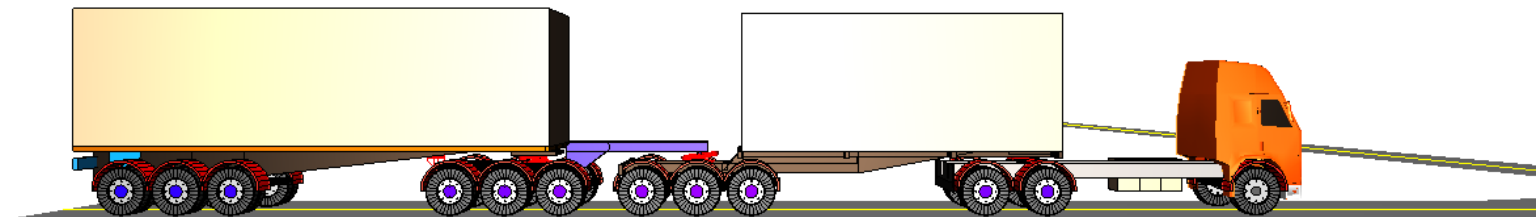
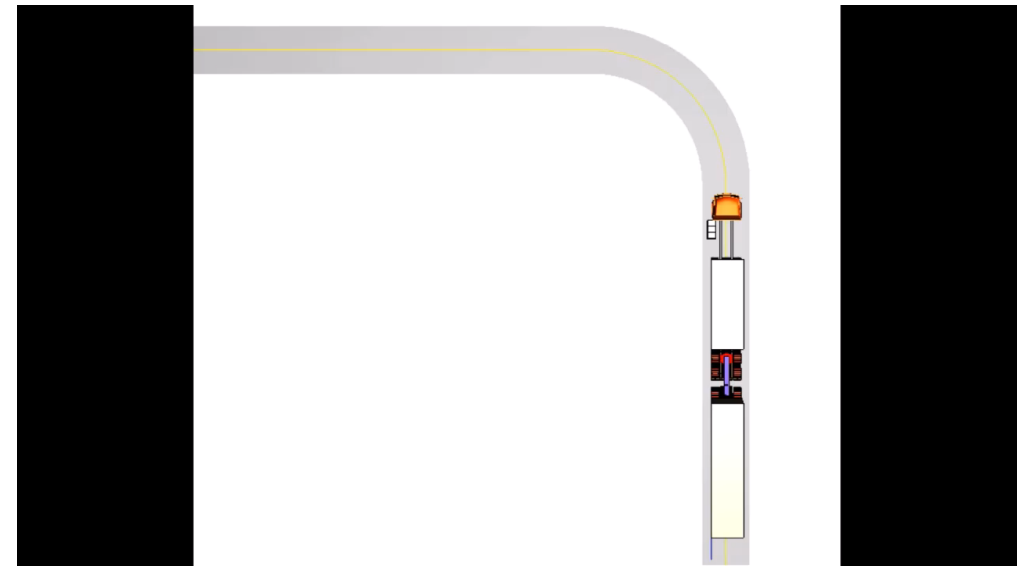


- 26.5m long
- Gross Combination Mass (GCM) of 91 tonnes
- PBS B-triple combination
- Can carry 9 precast concrete tunnel segments
- Huge reduction in trip numbers from 43,500 to 14,500 (the freight task is more than 130,000 segments)
- 6x6 Scania prime mover
- Challenging road environment



# Productivity is the name of the game

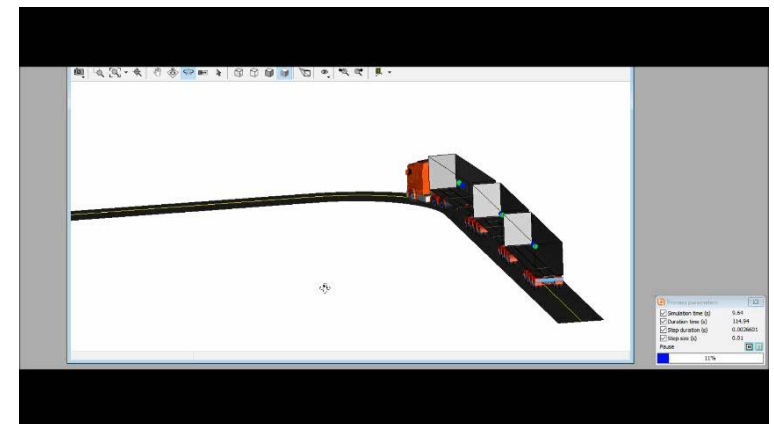
- PBS “A-double?”
- 30.56m long
- Level 1 CML: @65.3t meets all PBS L1 requirements
- Level 2 HML: @85.5t meets all PBS L1 requirements except Gradeability (L2)
- Compliance with PBS Level 1 LSSP (7.38m)
- It has been developed payload height limitations to meet the SRT standards (SRT 0.35g)





# B-triple combination for Port of Brisbane

- 40m - 42m long
- Currently only for empties only
- Three 40 foot or six 20 foot containers

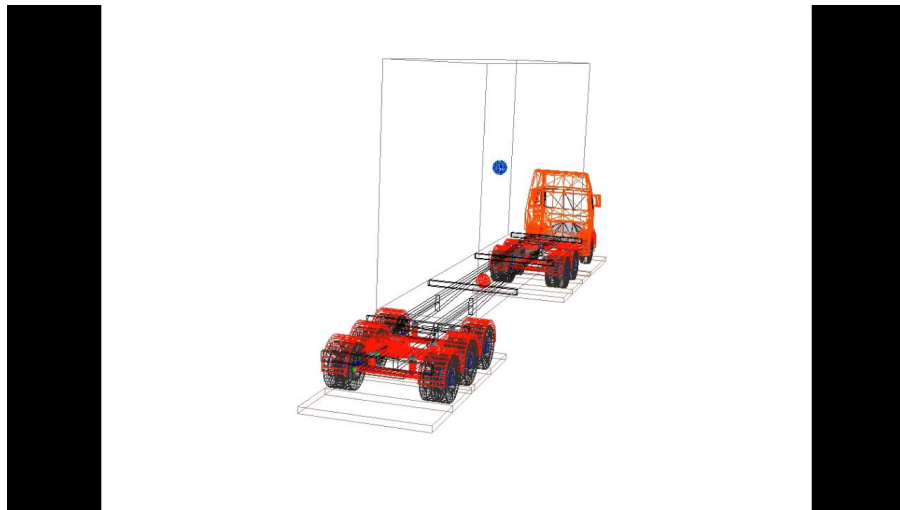
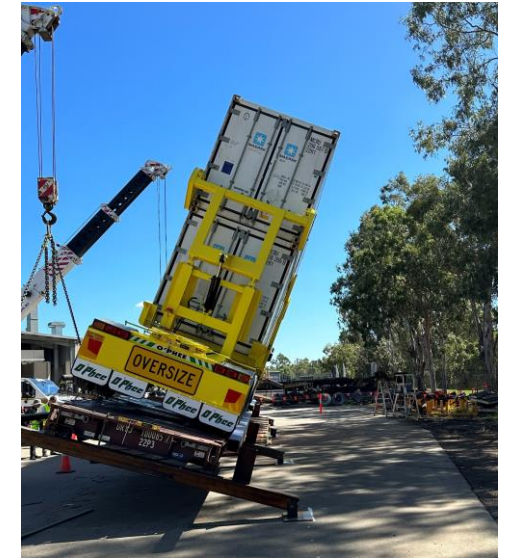




# Project “London” for Port of Brisbane



- Double stacked container carrying vehicle.
- Developed under PBS principals.
- 31m long, 2.75m wide, 7.4m high.
- B-double and B-triple options.
- Computer simulation (even wind loading).
- Validation testing.
- On-road testing, road safety audit.



# Project “London” for Port of Brisbane



- Currently only for empties only
- Four 40 foot or 8 20 foot containers
- PBS toolset was used for the safety assessment of the combination
- Specific operating conditions





# Project “London” for Port of Brisbane

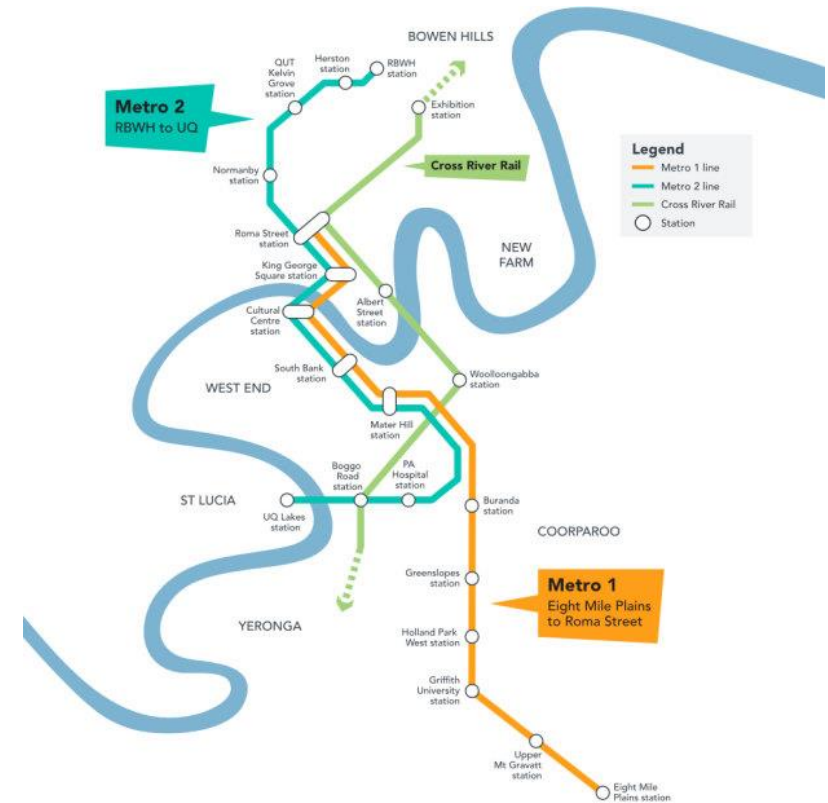




# Passenger transport vehicles – Brisbane Metro



- First of its kind in Australia, but this is also world leading project as these 24.5m long and 2.6m wide vehicles carrying 150-170 passengers
- The buses will be operated in a high-speed environment on dedicated busways
- PBS toolset has been used for assessing the performance of these buses
- Prototype in Australia
- Performance testing has started



# Addressing future demands

- Decarbonization of the transport industry.
- Electric trucks, zero emission trucks.
- Increased axle loads.
- Super singles and higher inflation pressures.
- Different tyre sizes.
- Driven (advanced) trailer axles.
- Low rolling resistance tyres.
- Crash avoidance, harm minimisation.

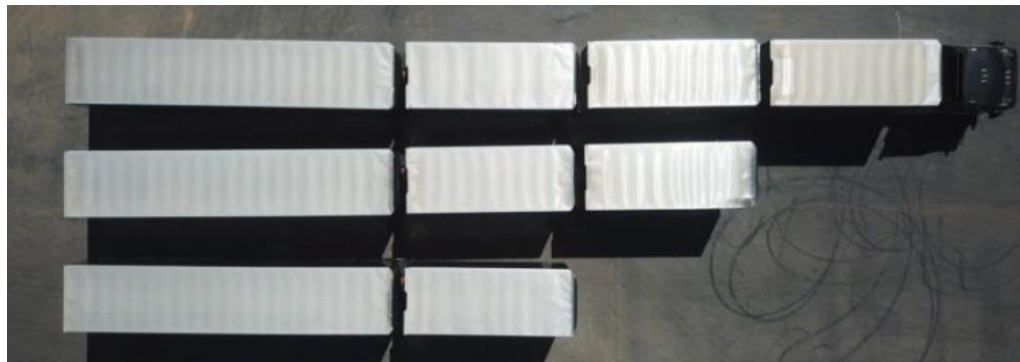




# PBS Level 3 B-Quad – Productivity Benefits (mass)



	PM Semi	B-Double	B-Triple	B-Quad
Performance	19m prime mover and semi-trailer	Prescriptive B-Double	PBS Level 2	PBS Level 3
Length (m)	≤ 19	≤ 26	≤ 30	≤ 36.5
GCM (t)	50.5	68.5	85	105
Nominal Payload (t)	32.7	43.5	52.8	65.6
Payload Equivalency	1	1.33	1.61	2
Trips per 1000t of payload	31	23 (26%)	19 (39%)	16 (49%)





# PBS Level 3 B-Quad – Productivity Benefits (volume)



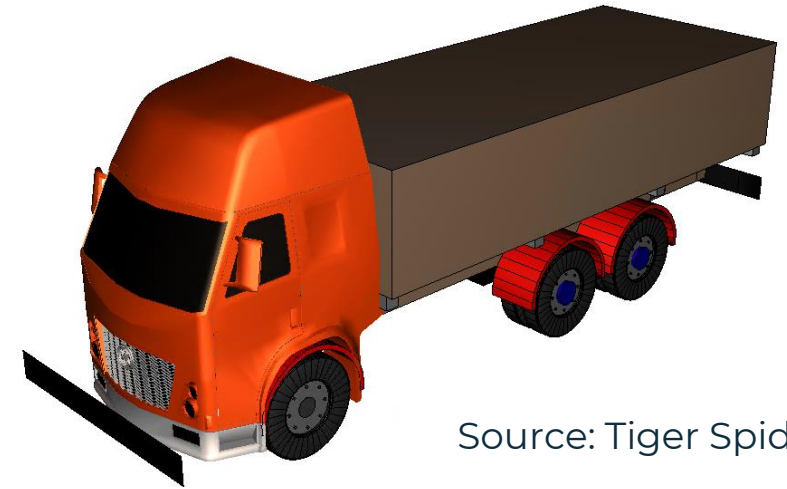
	PM semi	B-double	PBS B-double	PBS B-double	B-quad	B-triple
Length (m)	≤ 19	≤ 26	≤ 26	≤ 30	≤ 36.5	≤ 42
Number of pallets	22 (24)	32	36	42	50	60
Payload equivalency	1	1.45	1.63	1.90	2.27	2.72
Trips per 1000 pallets	46	32 (30%)	28 (40%)	24 (48%)	20 (57%)	17 (64%)



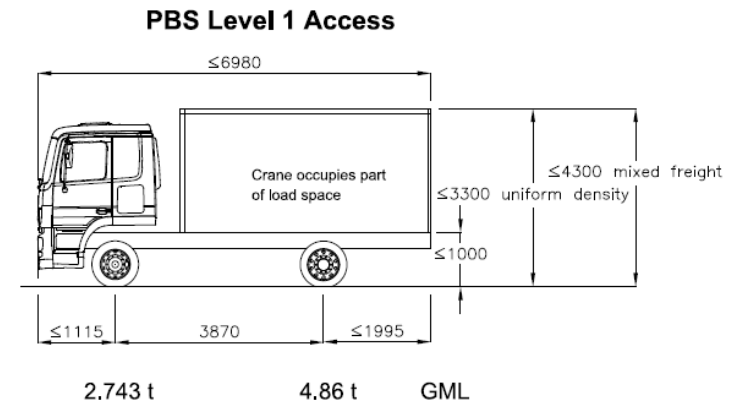
# PBS trends and observations



- Around 90 different PBS combination types
- Increased number of A-doubles, B-triples
- Large number of new combinations
- Application of PBS for smaller vehicles (garbage trucks, spreader)
- Approval of PBS A-doubles exceeding 30m (Victoria, Tas)
- Combinations with split axle groups
- Application of super single tyres above current prescriptive axle load limits
- Application of new technologies (steering axles, iCorner, iTurn)



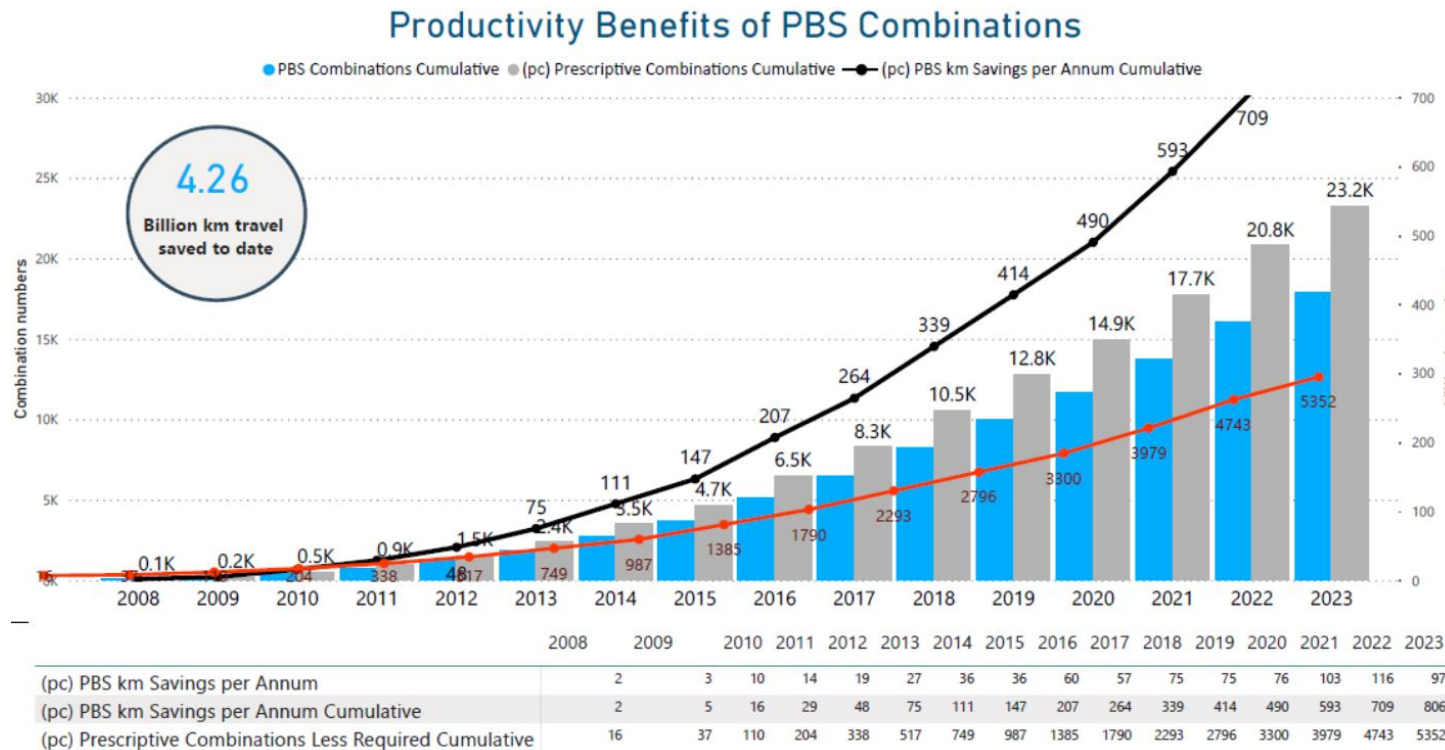
Source: Tiger Spider



# PBS benefits



- More than 5200 transport operators running a PBS combination.
- Fewer heavy vehicles doing less kilometres to deliver the same freight.
- Less trips, less exposure, reduced impact on the environment.
- In 2019: 10.3 fatal crashes per billion heavy truck vehicle kilometres travelled. (VKT – BITRE)







# Thank you

For more information:  
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