
TMC
TECHNICAL & MAINTENANCE
CONFERENCE
PACCAR & DEALER
2017

ROLLER BRAKE TESTING

Chair

Chris Loose – ATA

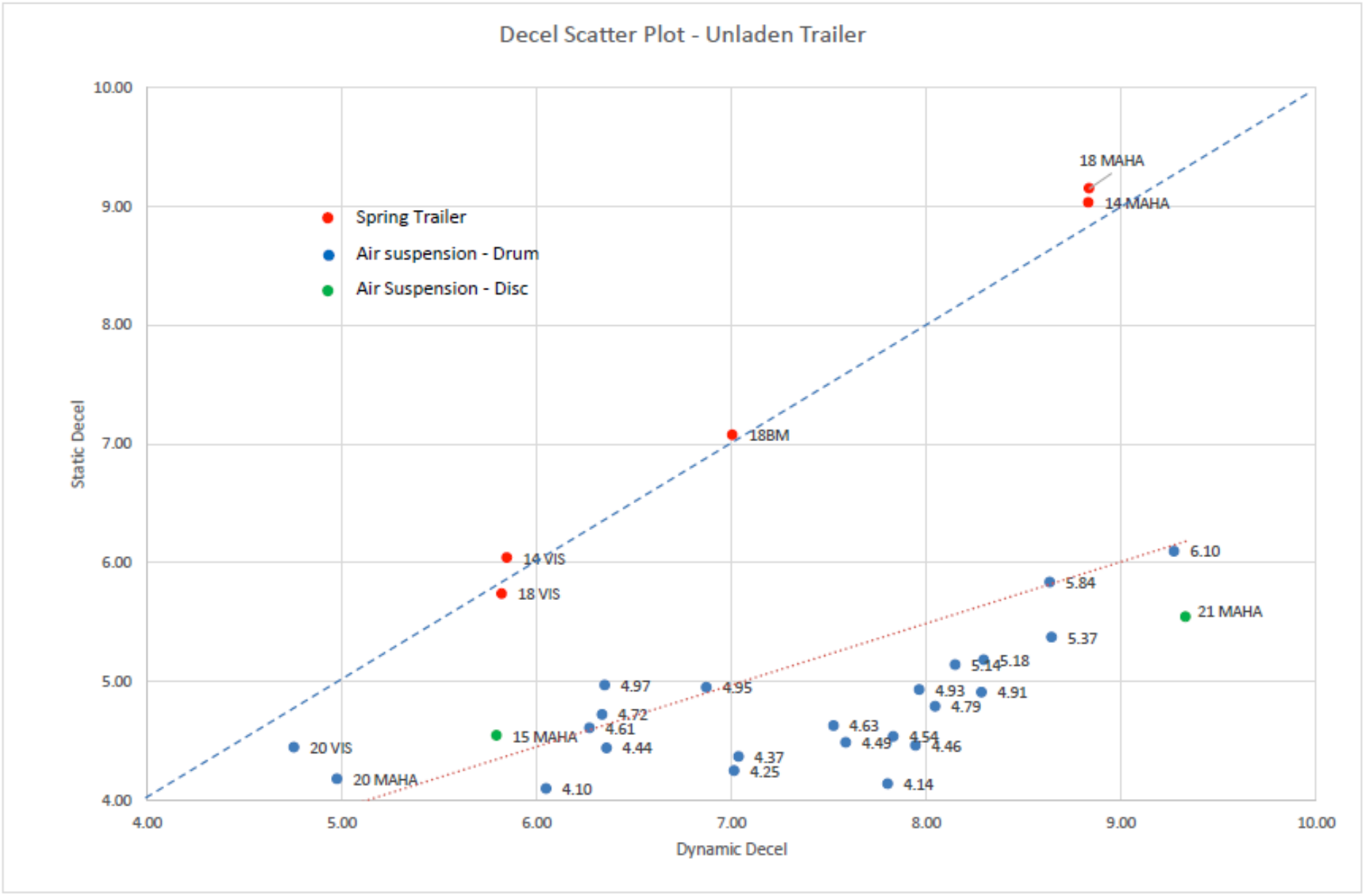
Panel members

Brett Patterson - RMS

Dan Cleary - VIS Nepean Transport Equipment

Joe Bourke - Levanta

Les Bruzsa - NHVR


Decel Scatter Plot - Unladen Trailer
Static Decel
Dynamic Decel
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Spring Trailer
Air suspension - Drum
Air Suspension - Disc
18 MAHA
14 MAHA
18BM
14 VIS
18 VIS
6.10
5.84
21 MAHA
5.37
5.14
5.18
4.97
4.95
4.93
4.91
4.79
4.72
4.61
15 MAHA
4.63
4.54
4.49
4.46
20 VIS
4.44
4.37
4.25
20 MAHA
4.10
4.14

CHRIS LOOSE – ATA
ADR PERFORMANCE STANDARDS

ADR 35 Brakes

- Service brakes (Laden / Unladen)
  - Truck – 3.78 m/s^2
  - Car/bus – 4.19 m/s^2

  From 100 km/h with max. control force 685 N
- Park brake
  - 18% gradient

  In each direction, for not less than 5 minutes

NB

All at optimised test conditions

Trailers are design to be compatible (“tram lines”).

HVNL PERFORMANCE STANDARDS

The Law (HVNL) - HV (VS) National Regulation

HVNL in–service brake performance requirements for a heavy motor vehicle or heavy combination	Service brakes	Emergency brakes
Peak deceleration from any speed (assumed to be from less than 10 km/h)	4.4 m/s^2	1.5 m/s^2
Average deceleration from any speed (assumed to be stop from at least 35 km/h)	2.8 m/s^2	1.1 m/s^2
Stopping distance, defined as from 35 km/h to a stop within	16.5 m	40.5 m
Parking brake must be able to keep the heavy vehicle or any combination stationary on a	12% gradient	

Table 1: HVNL requirements for minimum for brake efficiency

Vehicles must comply to all requirements.

Equipment limitation.

Applies to vehicle or vehicle combination *

INDUSTRY ACTION

National Heavy Vehicle Inspection Manual (NHVIM)

Brakes / RBT only

Nov 14	Ver 1	First adopted QLD/ACT
Nov 15	Ver 2.0	Average/peak PS for non RBT tests
Feb 16	Ver 2.1	Issued. Nothing on braking
Jun 16	Ver 2.1	Becomes effective
		NHVIM fact sheet – brake testing *
Jul 17	Ver 2.2	- Std from 3.0 / 4.5 kN/tonne to 2.8 / 4.4 m/s^2 - average/peak, “Brake" drag remove
		VSG 14 – RBT *

TIMELINE

14	May 15	NHVR attend ITC and supported the RBT tap
	July 16	NHVIM comes into force most areas
1	June 16	Meeting with NHVR – no progress
-	Dec 16	TAP – draft 1st edition
-	Mar 17	TAP – draft 2nd edition
25	May 17	ITC meeting – vigorous debate with NHVR
22	June 17	ITC met with NHVR - consider dynamic
14	Aug 17	Marulan JIET RBT program
29	Sept 17	4th transition period extension to 31 Jan 18

Roads & Maritime

Brett Patterson, Senior Manager- Compliance Operations

Brake testing in NSW

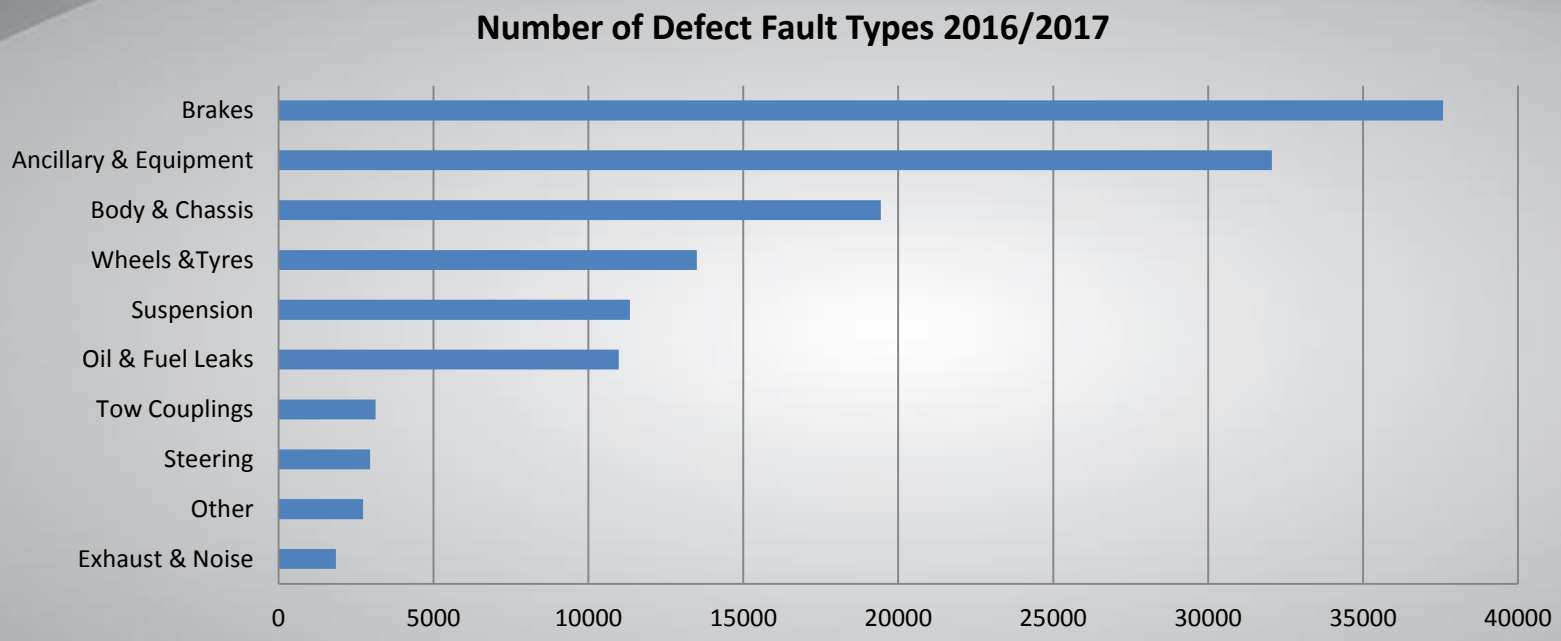
Roads and Maritime undertakes the majority of heavy vehicle inspections (that includes RBT) undertaken nationally.

There are approximately

- 170 HVAIS in NSW that have Roller Brake test machines.
- Roads and Maritime operates 38 Roller Brake Test machines from fixed heavy vehicle inspection sites and 24 mobile units.

- Due to the volume of heavy vehicles tested, RBT performance standards changes on industry has predominantly been identified in NSW.

Defect fault types 2016/17



The top three defects identified were:

- Brakes (37,591 faults)
- Ancillary Equipment (32,062 faults)
- Body/Chassis (19,436)

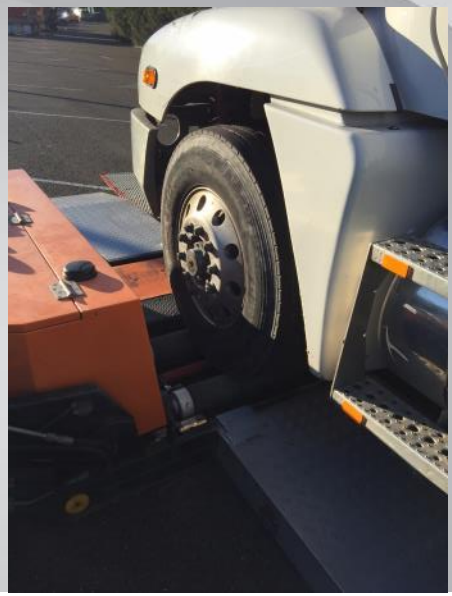
Brake fault analysis (Q1 -2017)

- Brake fault -codes

Brake Fault Code items:

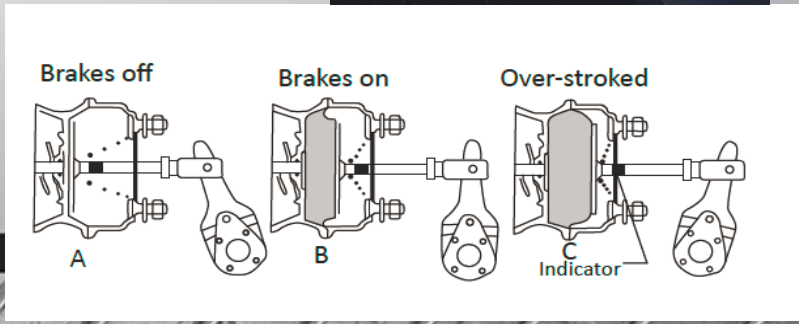
<u>On road Inspections- 6,448 brake fault code items:</u>

- 967 x Service brake/s have excessive travel,
- 894 x More the 30% brake imbalance between wheels,
- 505 x Service brake/s not properly adjusted,
- 402 x Service brake indicator indicates adjustment required,
- 348 x Service brakes inoperative.

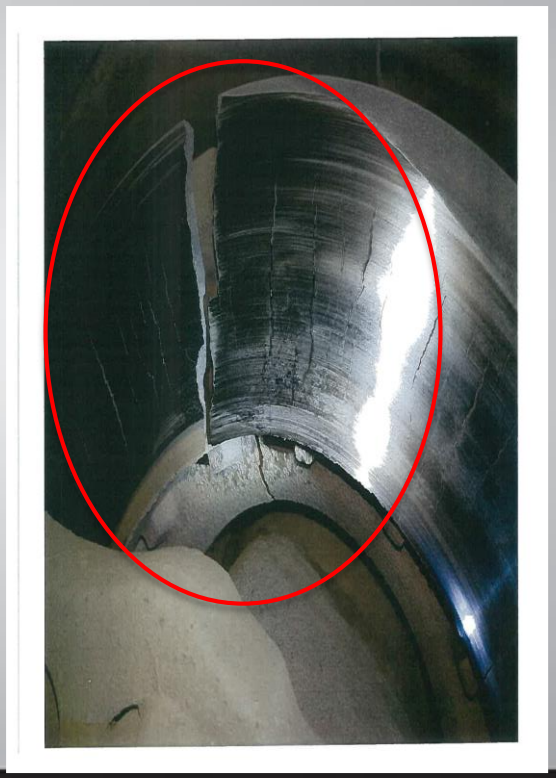


<u>HVIS (Registration inspections- 9,235 brake fault code items:</u>

- 1,308 x More the 30% brake imbalance between wheels,
- 734 x Service brake/s have excessive travel,
- 441 x Service brake/s not properly adjusted,
- 414 x Brake system air leaks,
- 303 x ADR 35 System to operator correctly.



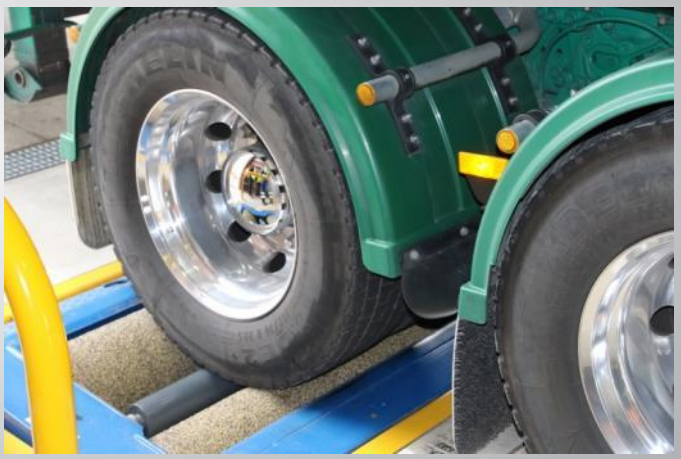
Brake faults detected



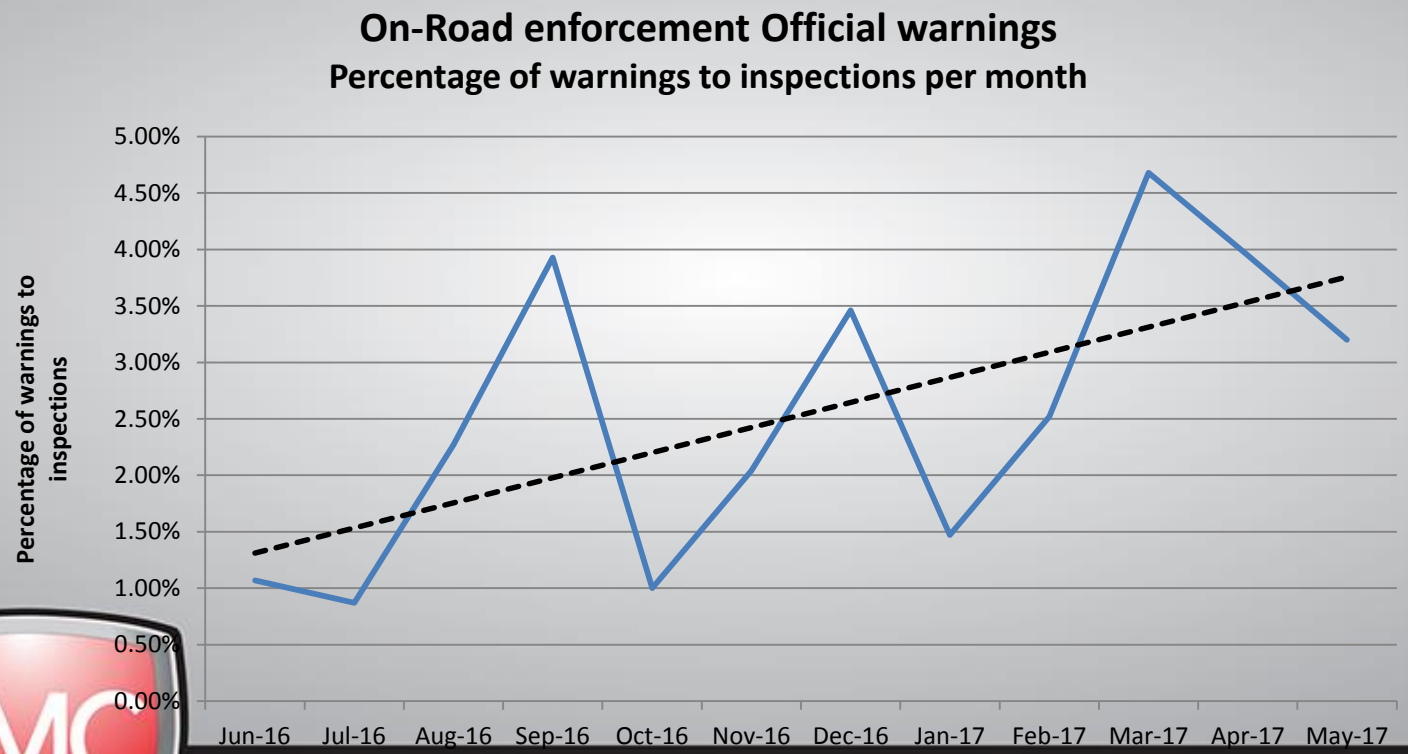
Brake Testing in NSW

In 1998, the previous Roads and Traffic Authority undertook physical heavy vehicle testing to establish the kN/tonne roller brake testing performance required for a heavy vehicle to comply with the applicable Road Transport law.

- This resulted in the performance standard of 3kN/tonne requirement in NSW.
- With the introduction of the NHVIM in NSW (June 2016) a RBT performance standard of 4.4kN/tonne was required.
- A NSW transition period was implemented with warnings issued for vehicles detected between 3kN/t and 4.4kN/t



Transition period monitoring



Official Warning analysis

Vehicle analysis

•More than 50% of the official warnings were issued to 2 truck manufactures and 3 trailer manufactures.

•78% of the warnings were issued to TRAILERS (Trailers, Other Trailer and Domestic Trailer) and 13% to PRIME MOVERS.

•No particular trend in year of manufacture.

- •90% of the notices were issued to vehicles manufactured between 1998 and 2017.

Roller brake testing

- Static mass vs dynamic mass

The following example shows the difference between static vs dynamic testing – with the static mass (18.53t) and dynamic mass (13.65t) shown on the lower part of the document.

Example below; 2005 Krueger 3 Axle (airbag) trailer

Note: if the Static mass is used it provides a brake force of 5.2kN /tonne.

However if the Dynamic mass is used a brake force of 7.12kN / tonne is achieved

BRAKE TEST

	Roller res.[kN] Left	Roller res.[kN] Right	Brake force [kN] Left	Brake force [kN] Right	Brake force [kN] Axle	Diff.:[%]	Ovality [%] Left	Ovality [%] Right	Deceleration:[%] sta	Deceleration:[%] dyn	weight [t] sta	weight [t] dyn	Pedal [N]	Pressure [bar] Pm	Pressure [bar] Px
1 SB	0.65	0.44	15.22	16.59	31.80	8	---	---	53	67	6.06	4.81	---	--- ---	--- ---
2 SB	0.68	0.52	15.25	15.33	30.58	1	---	---	50	65	6.20	4.76	---	--- ---	--- ---
3 SB	0.52	0.84	15.41	19.40	34.81	21	---	---	57	87	6.27	4.08	---	--- ---	--- ---

final evaluation

	Max. brake force [kN]	Imbalance [%]	Decel. static [%]	Decel. Dynamic [%]
Service brake system (SB)	97.19	21	53	73
Parking brake system (PB)	--- ---	---	---	---

Static weight 18.53 t 5.2 kN Dynamic weight 13.65 t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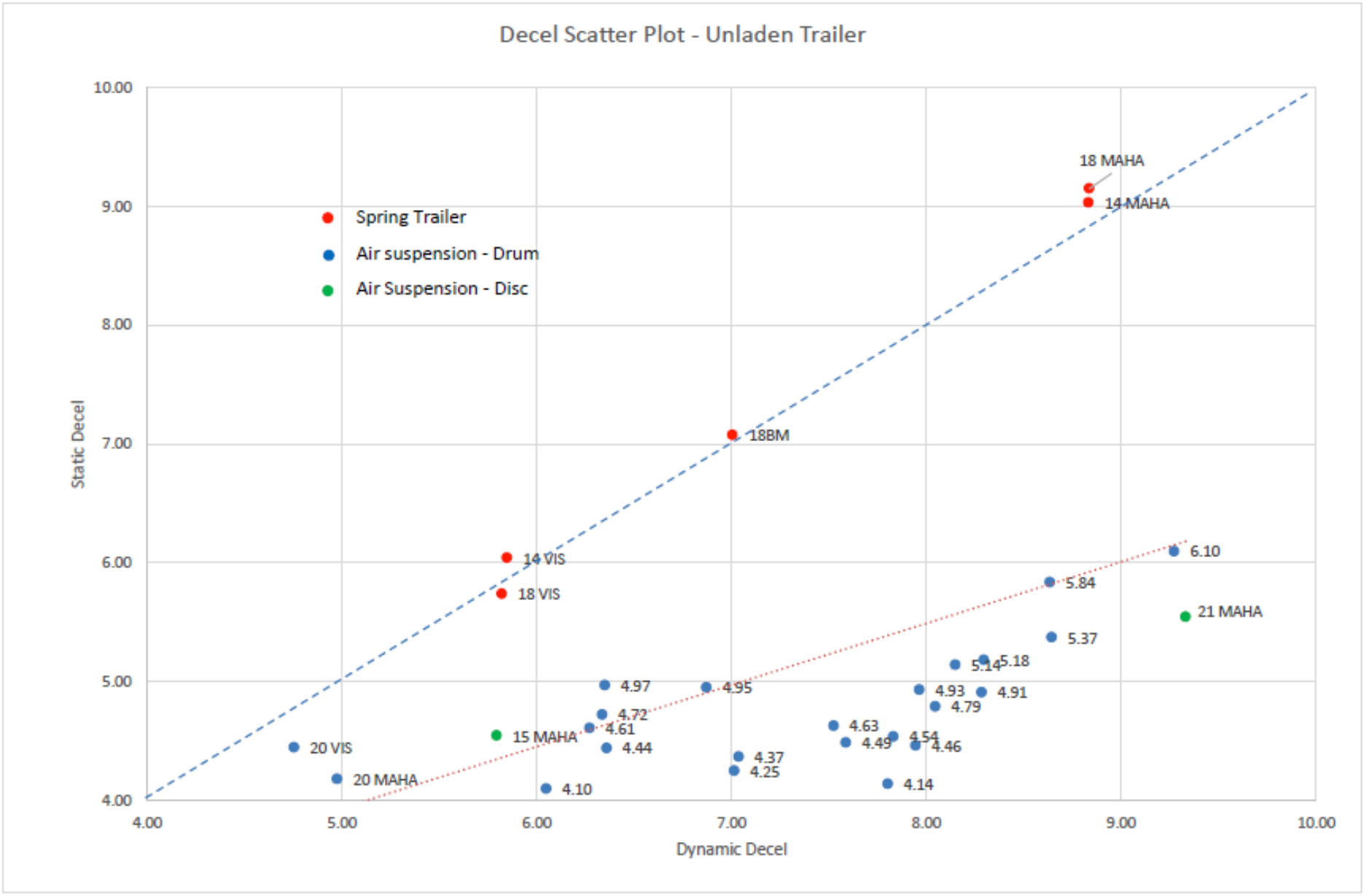
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Joint Industry –Brake test day

Marulan Safety Station – 14/15 August 2017

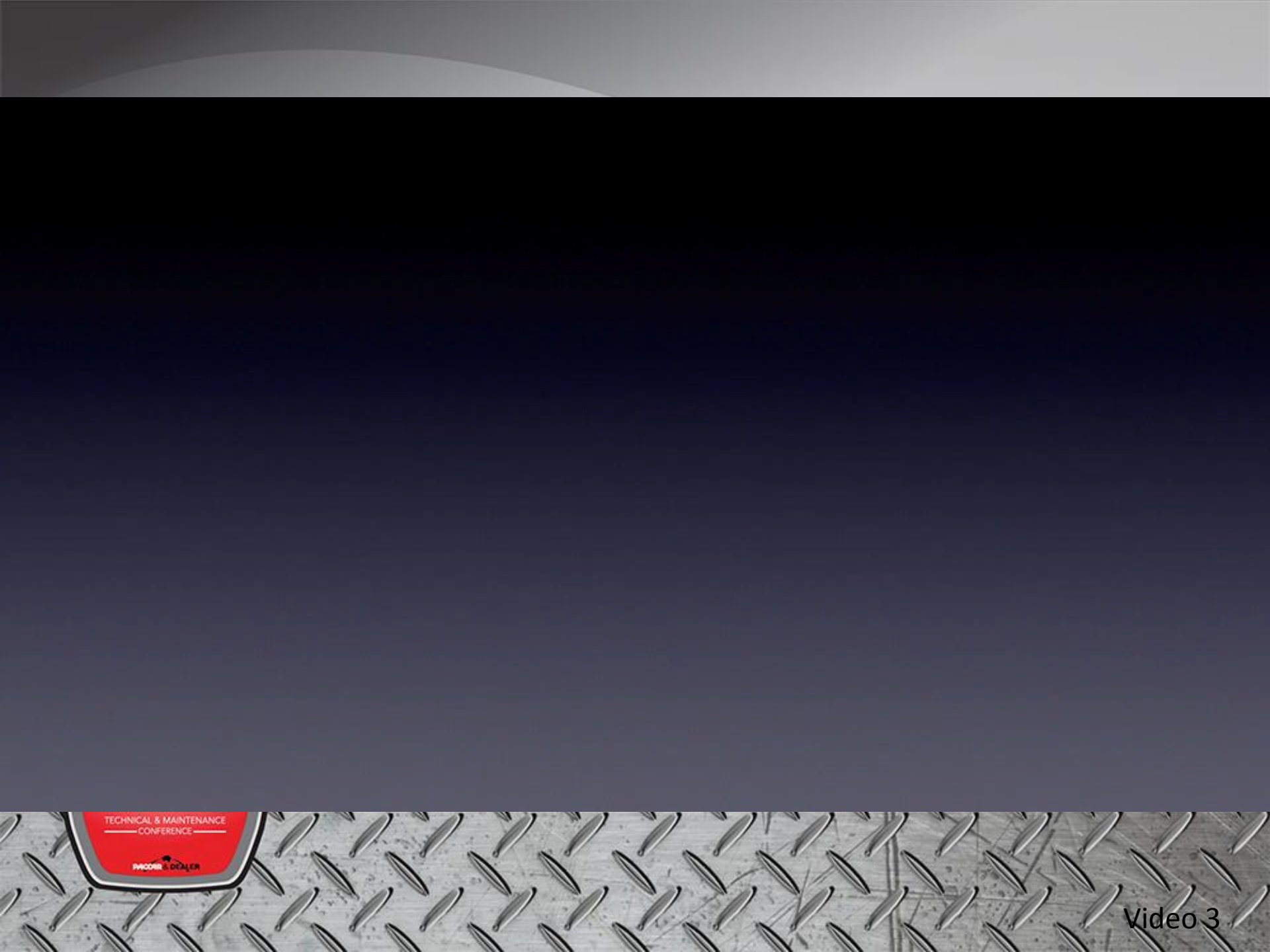
Focus-

- Collaboration and data collection on Roller Brake Testing (RBT) performance standards and procedures

Stakeholders-

- National Heavy Vehicle Regulator
- Australian Trucking Association
- Heavy Vehicle Industry Association
- RBT equipment suppliers
- State Road Agencies (RMS, ACT and VicRoads)
- Heavy Vehicle Operators (and drivers)

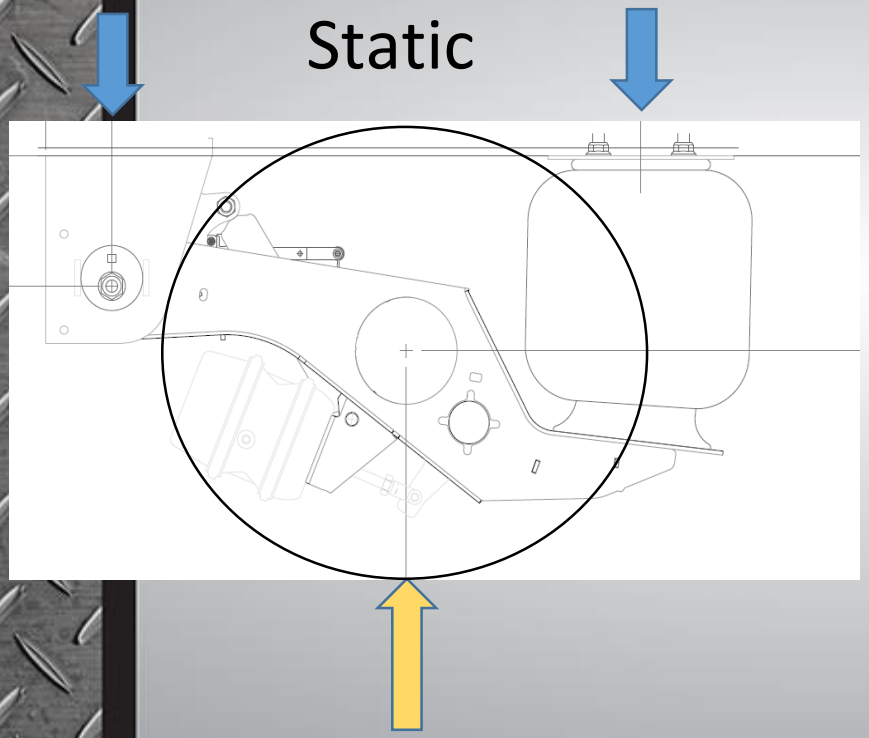
Video 2



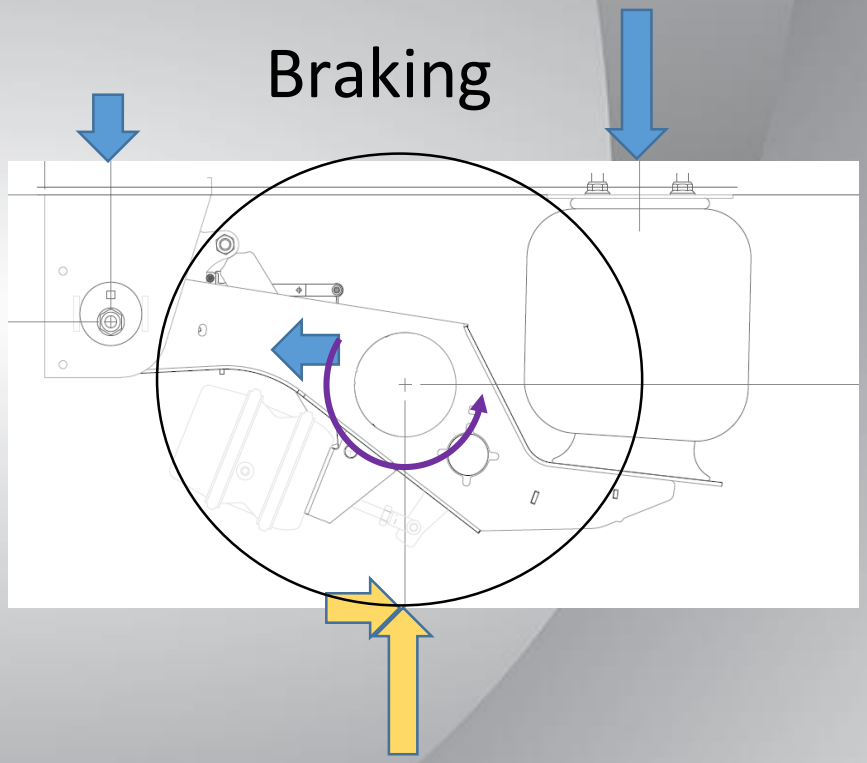
Video 3

DAN CLEARY – VIS NEPEAN
STATIC VS DYNAMIC

Static



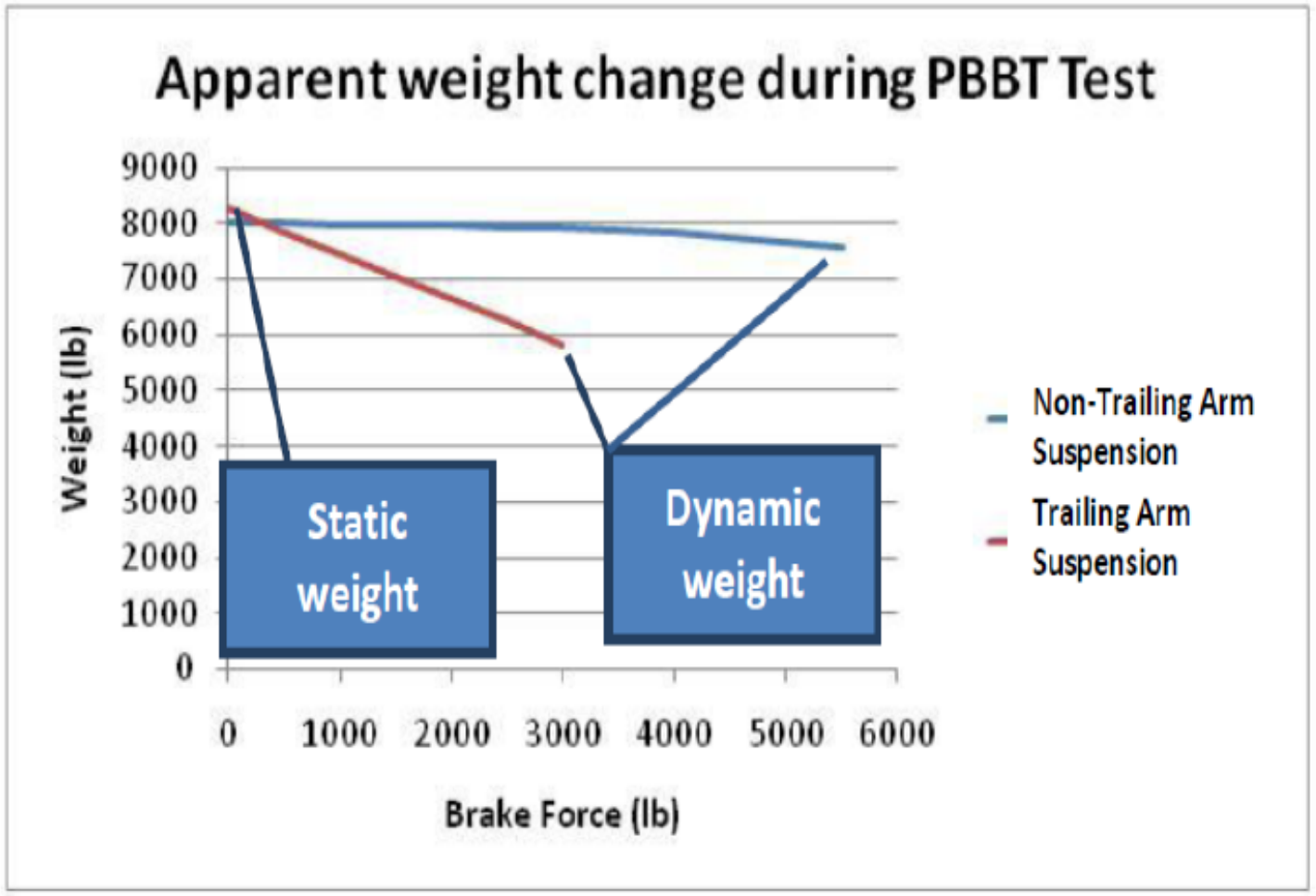
Braking



- Suspension Input
- Reaction Forces into Chassis

STATIC VS DYNAMIC

- Static has been used traditionally by the early adopters of roller brake testers throughout Europe.
- The more recent adopters of roller brake testers for enforcement & vehicle inspection use dynamic – such as NZ and Nth America.
- The Static Method ignores that weight changes through the test and hence overstates accuracy.
- 2011 Hendrickson in the US did extensive testing to confirm that trailing arm suspensions were the main contributing suspension type causing this issue.
- The two variable inputs cannot be ignored scientifically. New methods need to be implemented to deal with the issue.



Suspension Style vs. Brake Force (Axle Weight Off-loading)

Figure 3

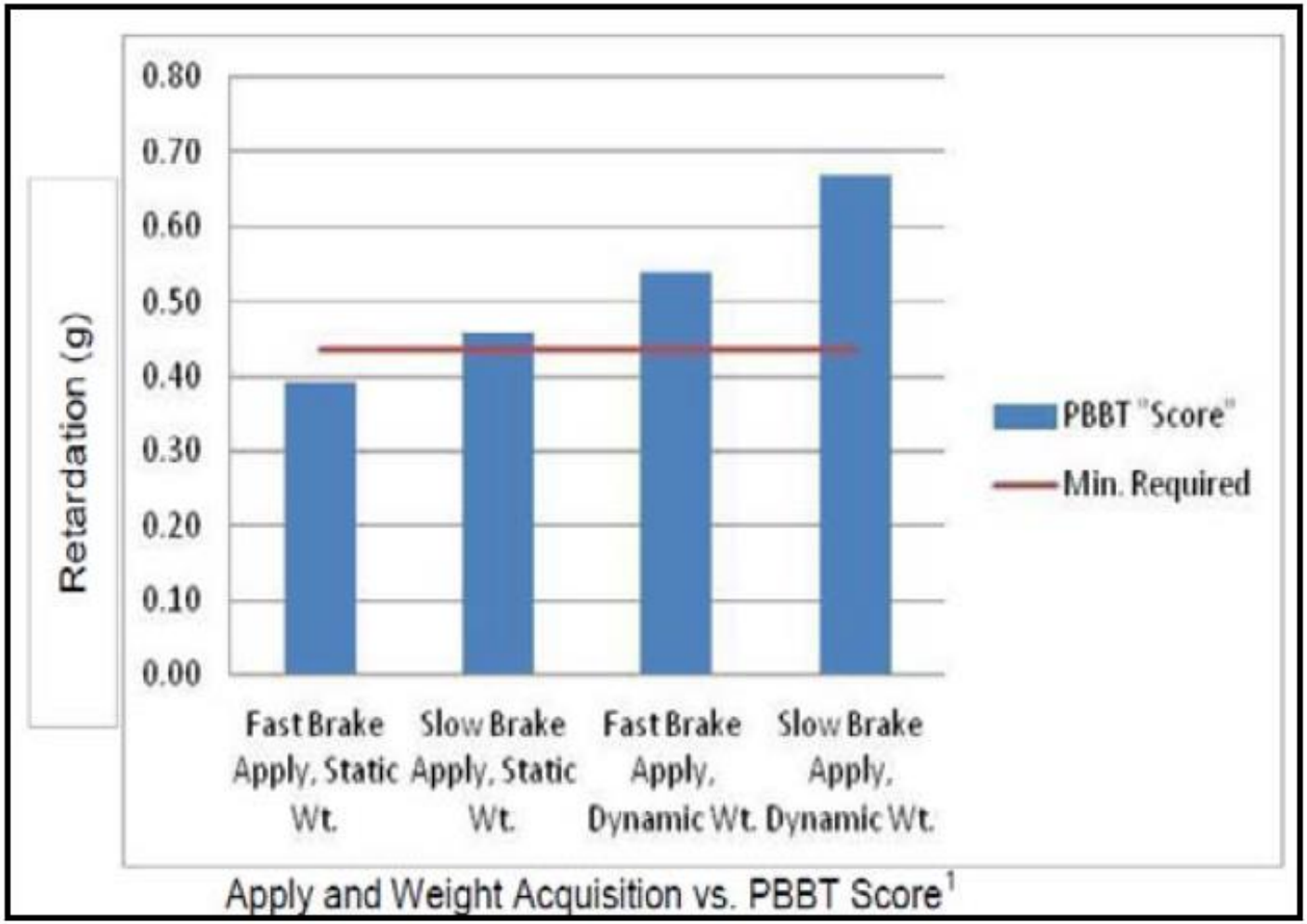
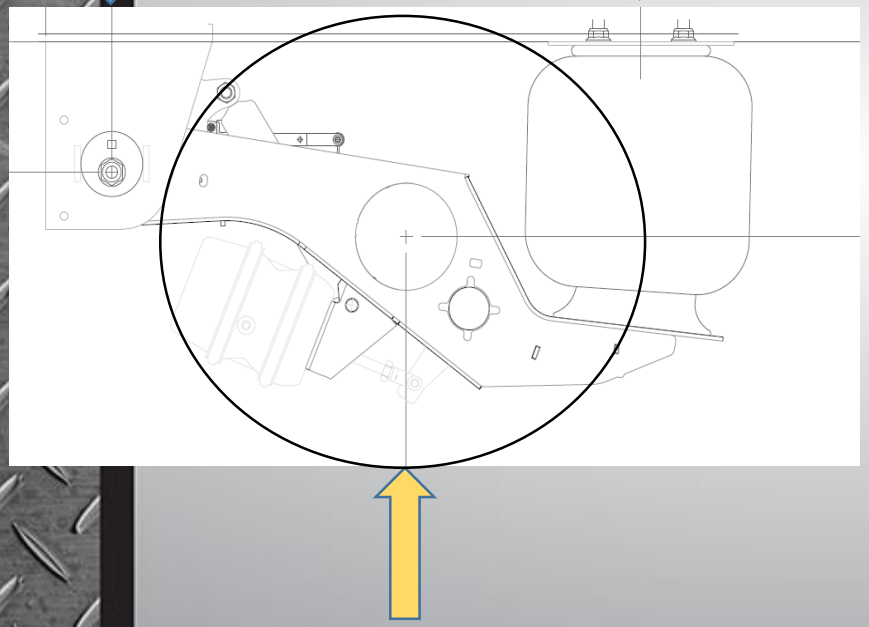

0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Retardation (g)
Fast Brake Apply, Static Wt.
Slow Brake Apply, Static Wt.
Fast Brake Apply, Dynamic Wt.
Slow Brake Apply, Dynamic Wt.
PBBT "Score"
Min. Required
Apply and Weight Acquisition vs. PBBT Score[1]

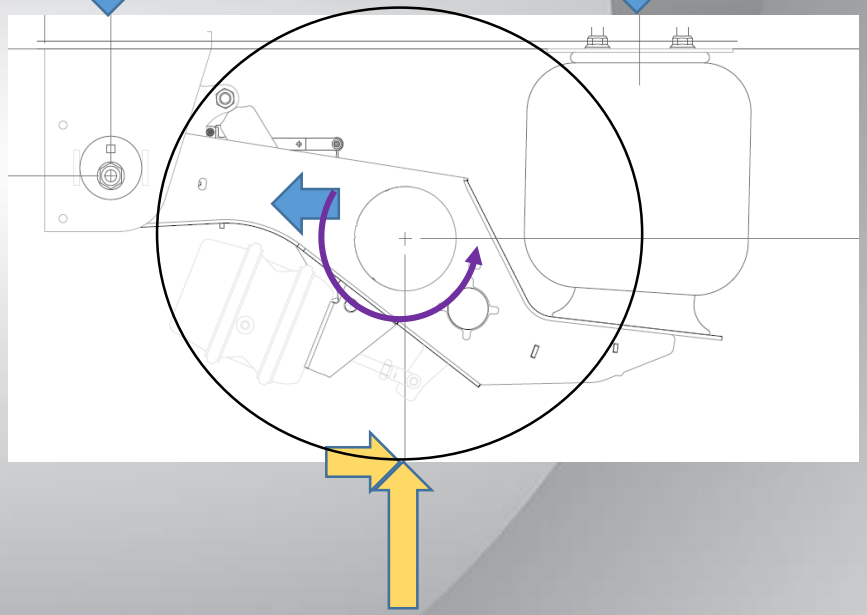
Figure 4

DAN CLEARY – VIS NEPEAN
STATIC VS DYNAMIC

Static



Braking

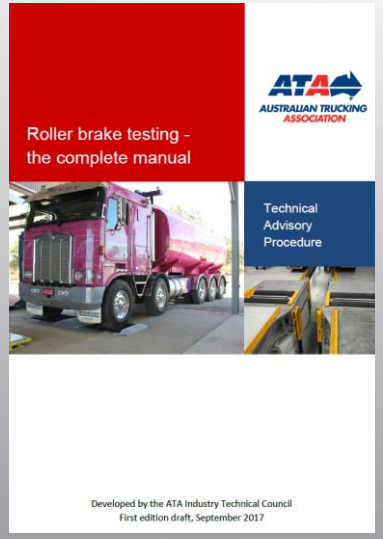


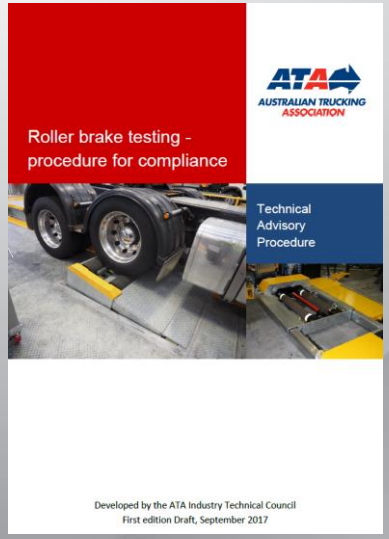
- Suspension Input
- Reaction Forces into Chassis

STATIC VS DYNAMIC – WHAT WE KNOW SO FAR

- Static clearly produces false negatives
- Dynamic can sometimes produce false positives if excessive weight unloads through the test
- Option to reduce the occurrence of false positives
  - Limit range of inputs
  - Identify unrealistic/theoretically incorrect results
  - Terminate test earlier
  - Improve accuracy of data collected.

JOE BOURKE – LEVANTA
THE TEST PROCEDURE





Why Test Brakes?


Queensland Government
Department of Transport and Main Ro
NHVR
National Heavy Vehicle Regulator
Tasmanian Government
Transport
Government of South Australia
Department of Planning, Transport and Infrastructure
NORTHERN TERRITORY GOVERNMENT
Department of
vicroads
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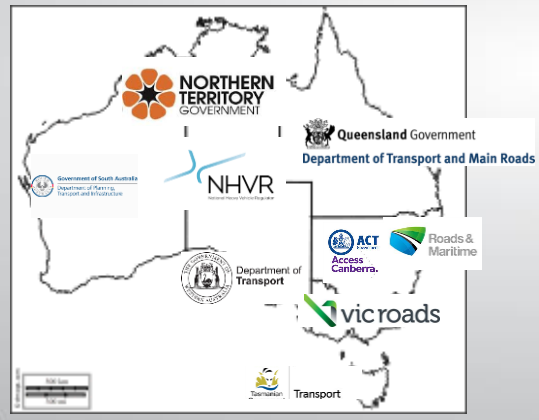
Why test brakes on an RBT?

Reduced maintenance cost
Faster diagnosis of problems
Detect problems that may not otherwise be obvious
Reduced running costs
Reduced driver fatigue
Improved corporate image



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TESTING AREA SET UP AS PER SITE REQUIREMENTS & AS2958.1-1995 Yes ☑

SERVICE BRAKE TEST *- Site specific requirements =*

Performance % = 66 Pass ☑ Fail ☐

Inspection of machine components & skid marks: Pass ☑ Fail ☐

SECONDARY BRAKE TEST *- Site specific requirements =*

Performance % = 33 Pass ☑ Fail ☐

Inspection of machine components & skid marks: Pass ☑ Fail ☐

PARK BRAKE TEST *- Site specific requirements =*

Stationary Test - Reverse: Pass ☑ Fail ☐

Stationary Test - Forward: Pass ☑ Fail ☐

TESTING AREA RESTORED AS PER SITE REQUIREMENTS & AS2958.1-1995 Yes ☑

RELEVANT DOCUMENTATION COMPLETED AS PER SITE REQUIREMENTS Yes ☑

COMMENTS:

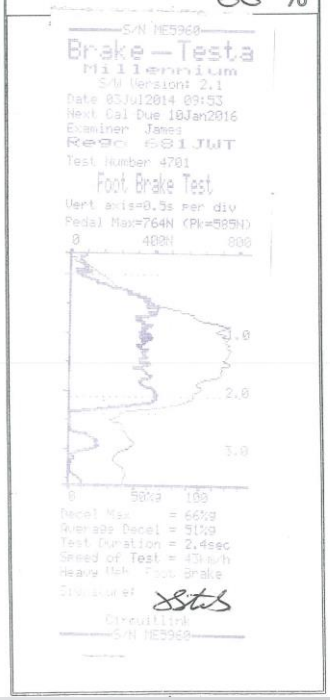
.....

.....

.....

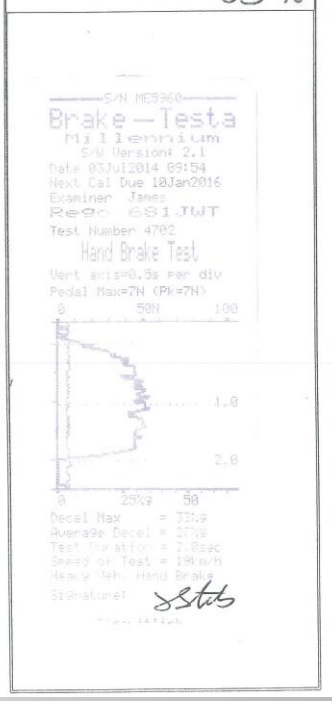
SERVICE BRAKE TEST

66 %



HANDBRAKE TEST

33 %



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1 Service	Left	Dif	Right	Total	Notes
Test Weight	3400 kg		3400 kg	6800 kg	
Rolling Resistance	0.68 kN		0.96 kN	1.64 kN	
Ovality	1.46 kN		1.22 kN		
Wheel Lock	Lock				
Brakeforce	23.50 kN	1 %	23.80 kN	47.30 kN	* Peak Values
Deceleration				71 %	

2 Service	Left	Dif	Right	Total	Notes
Test Weight	3300 kg		3300 kg	6600 kg	
Rolling Resistance	0.82 kN		0.96 kN	1.78 kN	
Ovality	1.46 kN		1.38 kN		
Wheel Lock	Lock				
Brakeforce	24.68 kN	1 %	24.30 kN	48.98 kN	* Peak Values
Deceleration				76 %	

2 Parking	Left	Dif	Right	Total	Notes
Test Weight	3320 kg	%	3320 kg	6640 kg	
Brakeforce	16.14 kN	19 %	20.10 kN	36.24 kN	
Deceleration	50 %		62 %	56 %	
Wheel Lock			Lock		

3 Service	Left	Dif	Right	Total	Notes
Test Weight	3420 kg		3420 kg	6840 kg	
Rolling Resistance	1.18 kN		0.92 kN	2.10 kN	
Ovality	--- kN		--- kN		
Wheel Lock					
Brakeforce	1.16 kN	--- %	0.76 kN	1.92 kN	* Peak Values
Deceleration				3 %	

3 Parking	Left	Dif	Right	Total	Notes
Test Weight	3380 kg	%	3380 kg	6760 kg	
Brakeforce	1.22 kN	--- %	21.50 kN	22.72 kN	
Deceleration	4 %		65 %	34 %	
Wheel Lock			Lock		

4 Service	Left	Dif	Right	Total	Notes
Test Weight	2980 kg		2980 kg	5960 kg	
Rolling Resistance	0.90 kN		0.88 kN	1.78 kN	
Ovality	1.10 kN		--- kN		
Wheel Lock					
Brakeforce	1.08 kN	--- %	0.86 kN	1.94 kN	* Peak Values
Deceleration				3 %	

Total	Left	Dif	Right	Total	Notes
Test Weight	13100 kg		13100 kg	26200 kg	
Brakeforce	50.42 kN		49.72 kN	100.14 kN	
Deceleration	39 %		39 %	39 %	
Parking: Brakeforce	17.36 kN		41.60 kN	58.96 kN	
Parking: Brake Efficiency	14 %		32 %	23 %	

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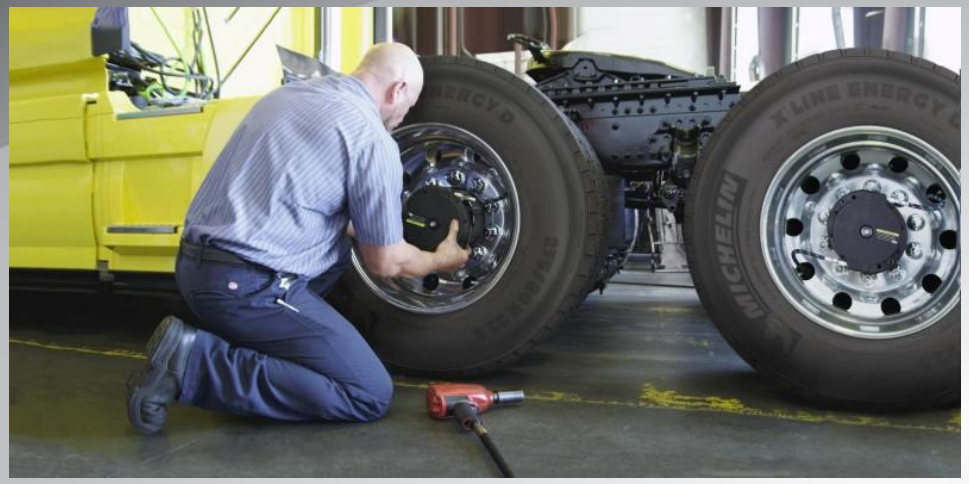
Testing Procedure

Tyre Pressures correct



All tyres are inflated to the OEM recommended pressures as under inflation will give erroneous results.

The air system can be held at 650 kPa (90 psi) or above. Lower air pressure may cause otherwise sound brakes to fail the test. In addition, maintenance is required to the air system when the system cannot achieve the required pressure.

Air pressure 650 kPa or 90 PSI

During testing the driver is responsible for maintaining the test air pressure or vacuum reserve and communicating this to the inspector so that the test can be performed correctly. Vacuum systems can be monitored by the brake fail light or vacuum light. However, air systems are the primary systems of concern to the trucking industry.

On level surface, in an appropriate safe location with the air system pressure above 650kpa (90psi), release the park brakes and driver should then apply the brake pedal to the floor slowly several times for vehicles fitted with automatic slack adjusters on foundation drum brakes to ensure correct adjustment is obtained prior to testing beginning.

The area for testing must be flat, level and take into account the length of the vehicle to be tested.

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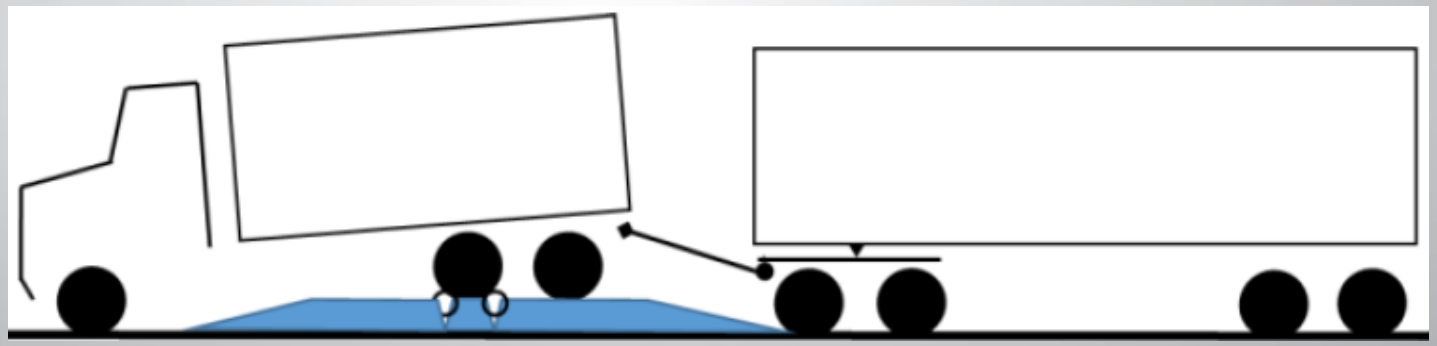
The vehicle must be located squarely to the RBT and be centred on the RBT unit. The inspector should be able to observe this visually. If the vehicle is not square to the RBT unit then it should be removed and repositioned correctly.

A mobile or above-ground RBT unit will typically raise an axle group by 150 mm. This could create an issue with the axle group's load sharing capability. All axles in an axle group must be at the same level as an axle under test within that group. There must be a sufficiently wide platform on the RBT unit to allow for this. Ideally, no part of the axle group under test may be off the level test bed (e.g. on the ramp). Where the vehicle under test is not parallel to the test surface the inspector should ensure the suspension travel of the test axle has not bottomed out. Air suspension should be dropped and raised back to ride height while in the test position if possible.

The use of platforms to level the vehicle element under testing minimises these problems



During the Test:

The driver should listen to the instructions from the tester
When the roller start, let the wheels find the path of least resistance (within reason)
Apply the brake slowly and smoothly, just like stopping at a red light.
Apply the brake to full pedal and hold until the rollers stop (either by slip or manual stop)
When testing the park brake apply it as smoothly as possible in one action.

LES BRUZSA - NHVR
THE NHVR TEST PROCEDURE/TIMELINE

- Early December 2017, lock test procedure
- 1 February 2018, transition period ends
- NHVR enforcement test produced
- NHVIM update

ROLLER BRAKE TESTING

PANEL Q & A

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