Road Traffic Management Corporation

transport — Department: Transport, REPUBLIC OF SOUTH AFRICA

CSIR our future through science

NRCS national regulator for compulsory specifications

Vehicle Standards & Systems Summit towards Safe Roads in South Africa 2016

Introduction to PBS: PBS history

Dr Paul Nordengen – CSIR/Les Bruzsa – NHVR, Australia

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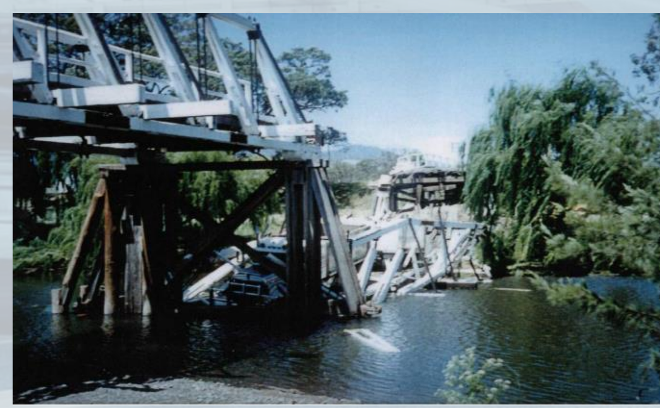
What is a heavy vehicle?

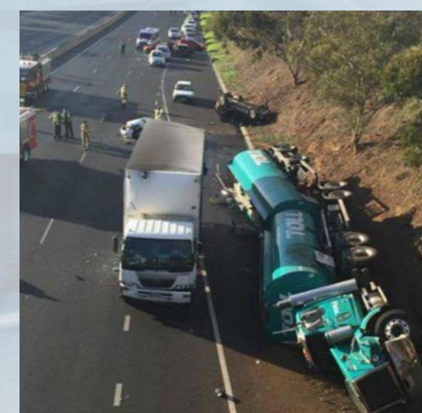
- **In the Australian context:** A combination or vehicle that has a Gross Vehicle Mass (GVM) or ATM of more than 4.5 t [HVNL s6]

NHVR

Why do we need size and weight regulations?

- Promoting safety and
- Protecting the infrastructure



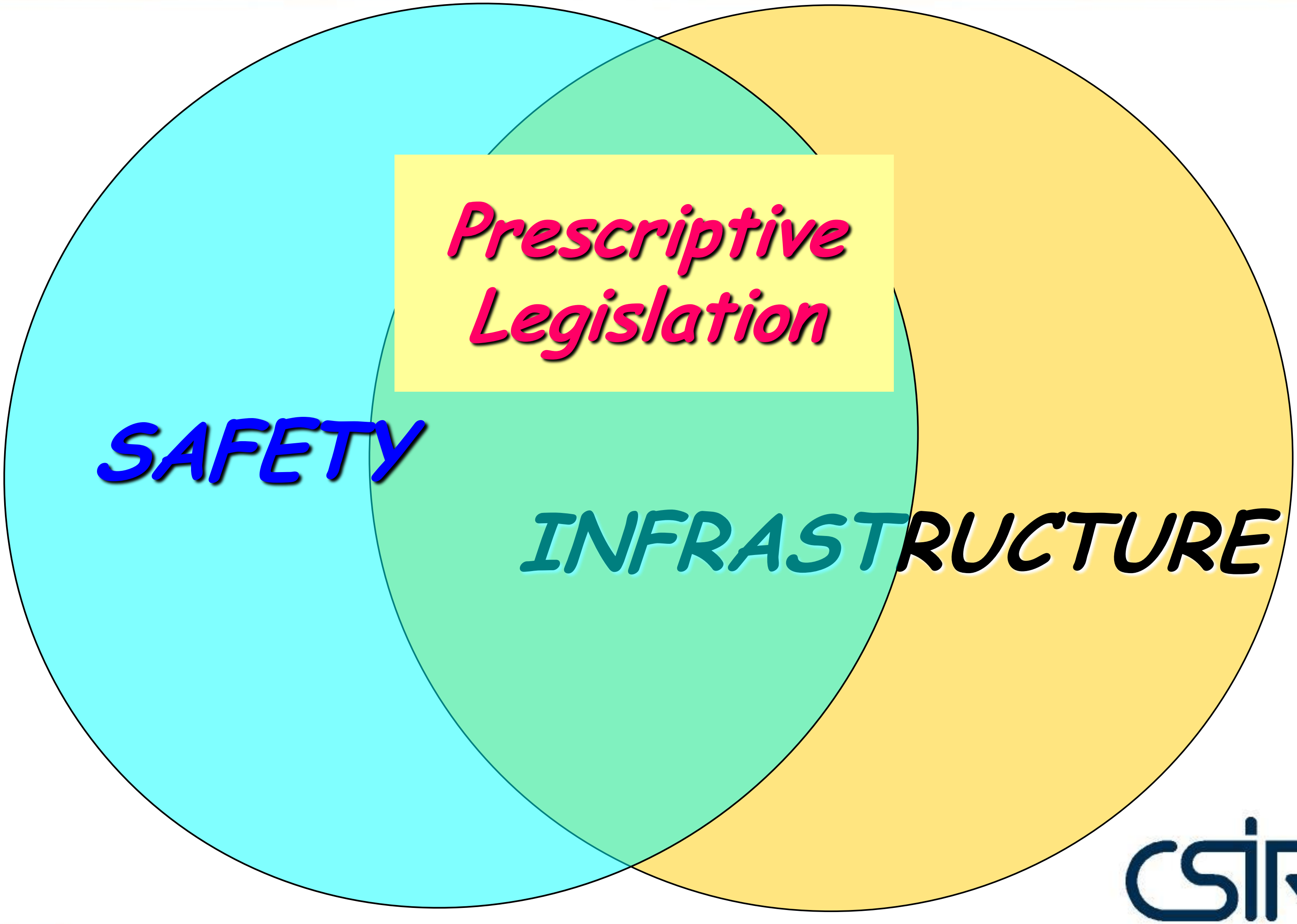


Early regulations

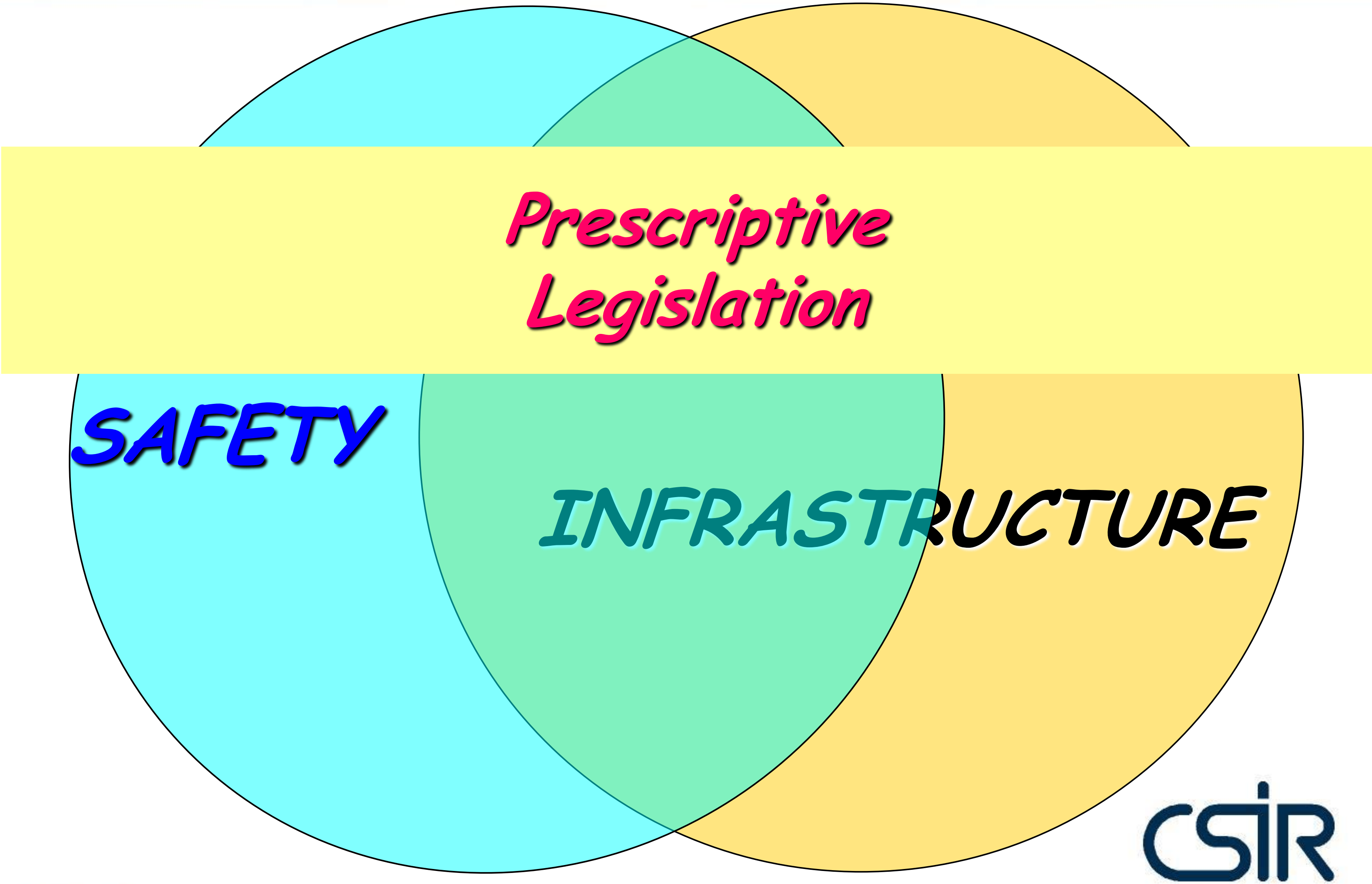
- 450 BC Roman Legal Code specifies lane width
  - 1.2 m wide (single carriage), 2.45 m (two-lane) where straight and
  - 4.90 m where curved
- 50 BC Romans introduce wheel load limits (cca 250kg)
- 438 AD Theodosian code introduced weight limits
  - 750 kg on ox-drawn wagons,
  - 500 kg on horsed-drawn wagon and
  - 100 kg on a cart
  - also limited the number of animals that could be used to haul a vehicle

- 1622 England prohibits loads greater than 1t carried on any vehicle during winter

Ensuring safety and infrastructure protection

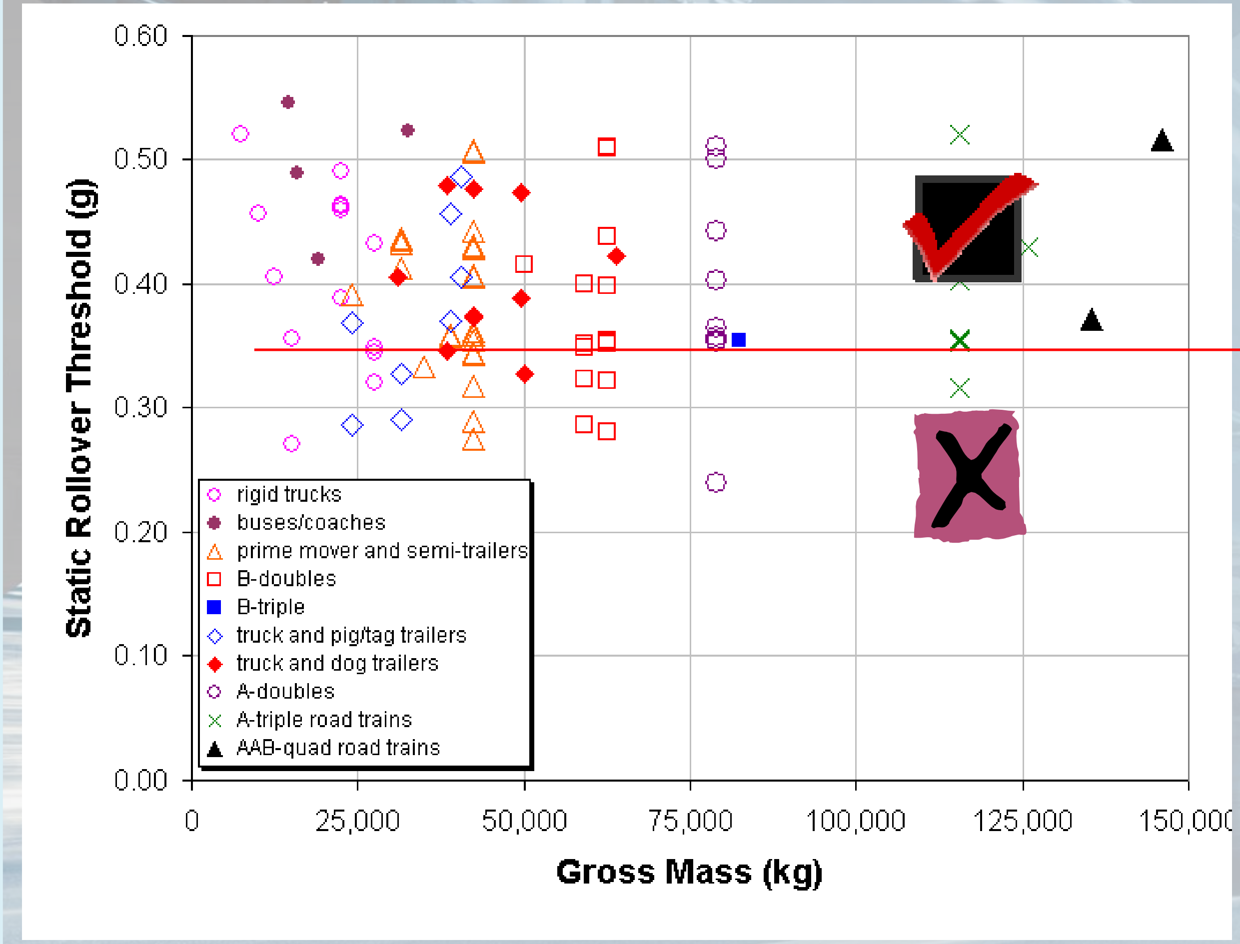


Ensuring safety and infrastructure protection



Prescription can be a poor proxy for safety

Source: NTC



Performance-Based Standards

Performance-Based Standards

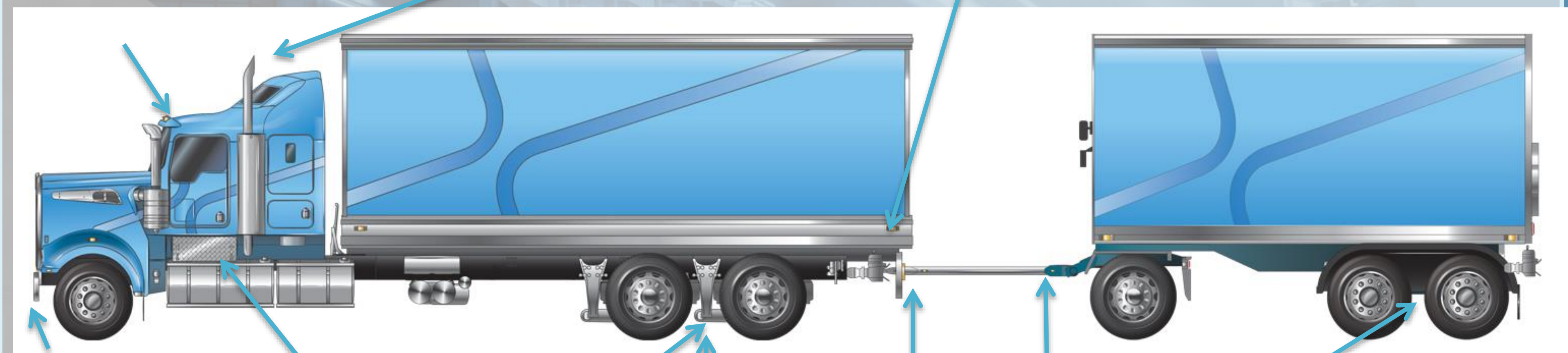

MB-34-93
LHD

Current Australian Design Rules (ADRs)

ADR3 *Seats and Seat anchorages*
ADR4 *Seatbelts*
ADR5 *Seatbelt anchorages*
ADR8 *Glazing*
ADR14 *Rear vision mirrors and devices*
ADR18 *Instrumentation*
ADR59 Roll over strength (buses)
ADR65 *Speed limiting*

ADR30 *Emission control*
ADR42 *Exhaust location*

ADRs 6, 13, 45, 46, 47, 48, 49, 50, 51, 52, 74, 75, 76, 77, 78 *Lamps*



ADR84 *Front underrun*

ADR35 Truck brakes

ADR38 *Trailer brakes and suspension*

ADR1 *Reversing lamps*

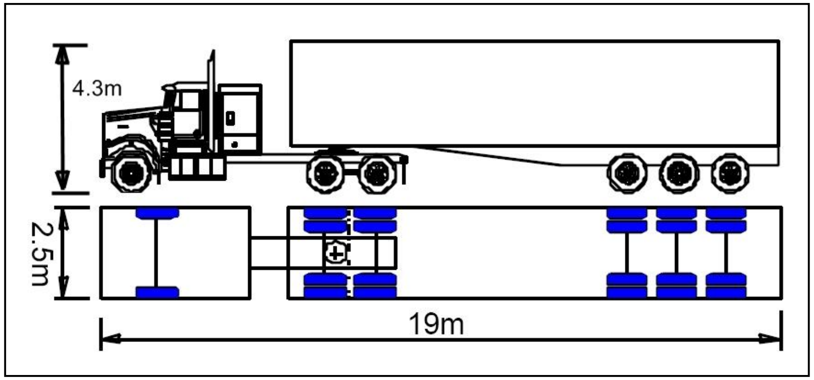
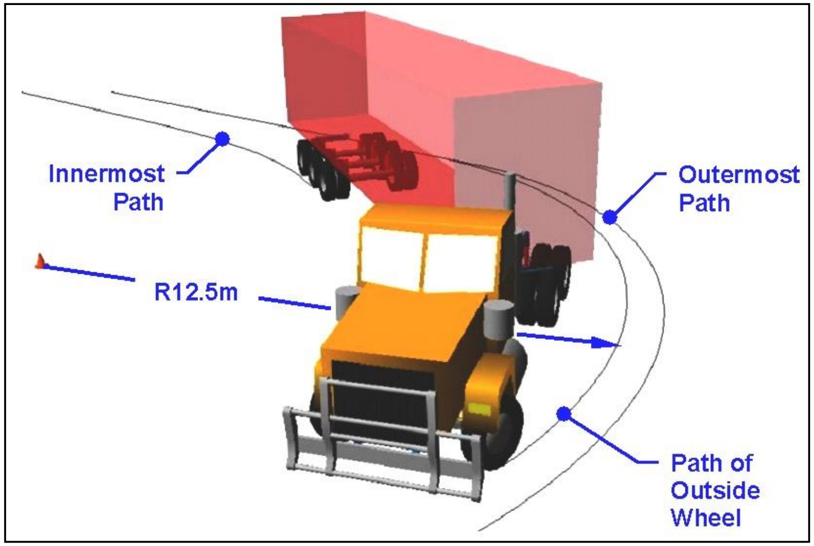
ADR62 *Couplings*

ADR42 *Bonnet latches, diesel engines, field of view, protrusions in the cabin, sleeper cabins, warning devices, windscreen wipers and washers, ventilation, visual display screens.*

ADR42 *Retractable axles and wheel guards*

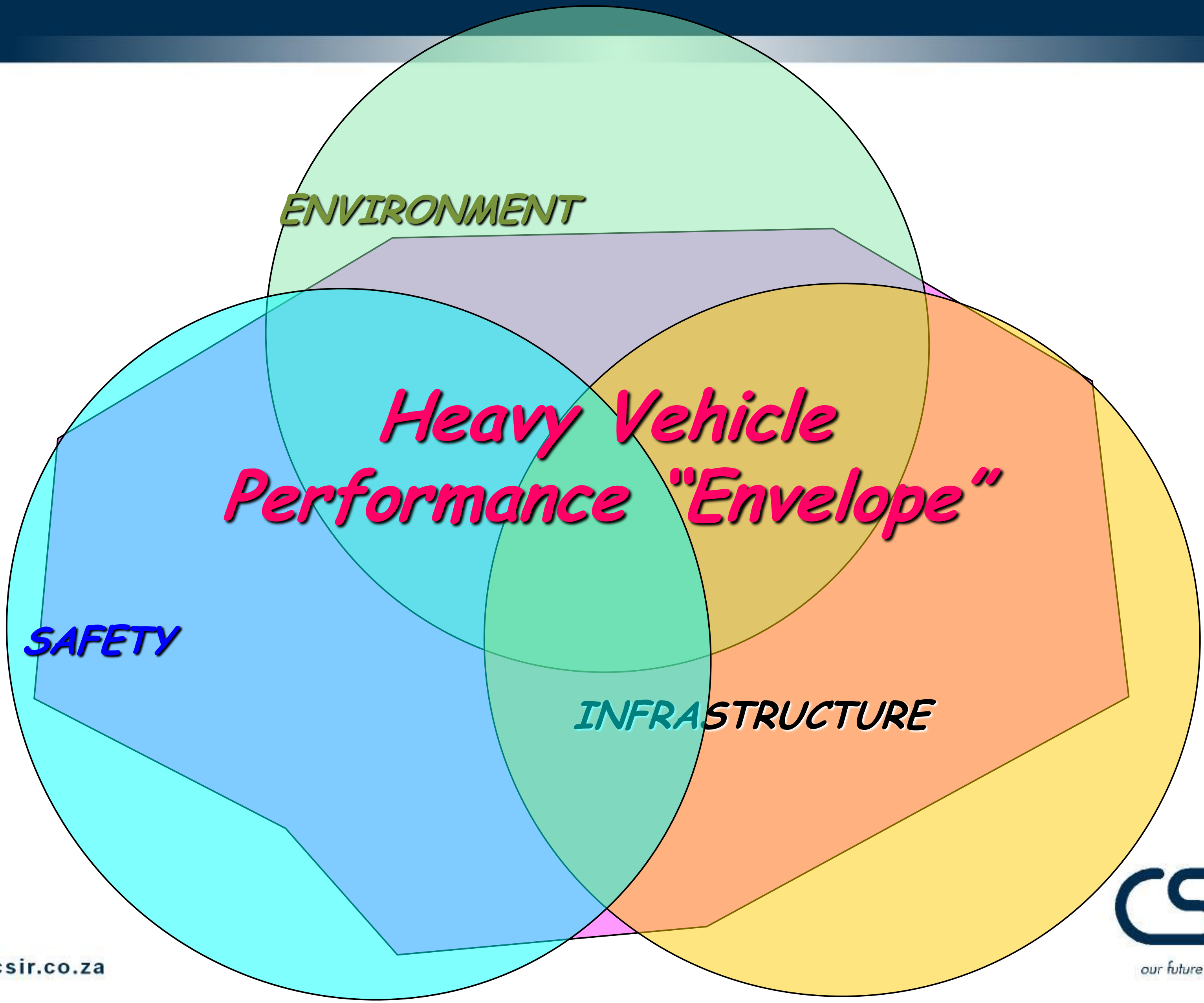
Generally:
ADR43 Dimensions
ADR44 Specific purpose requirements
ADR58 Specific requirements for buses
ADR61 Marking
ADR63 Multi-combination trailers
ADR64 Multi-combination motor vehicles

Performance-Based Standards

Prescriptive Standards	Performance-Based Standards
	
What the vehicle looks like	**What the vehicle can do**
Governs **mass and dimensions**	Governs actual **on-road performance**
Constrains productivity	Allows **heavier and/or larger** vehicles
Constrains innovation	Promotes **innovation**

Images courtesy of the Australian National Transport Commission

Performance Based Standards

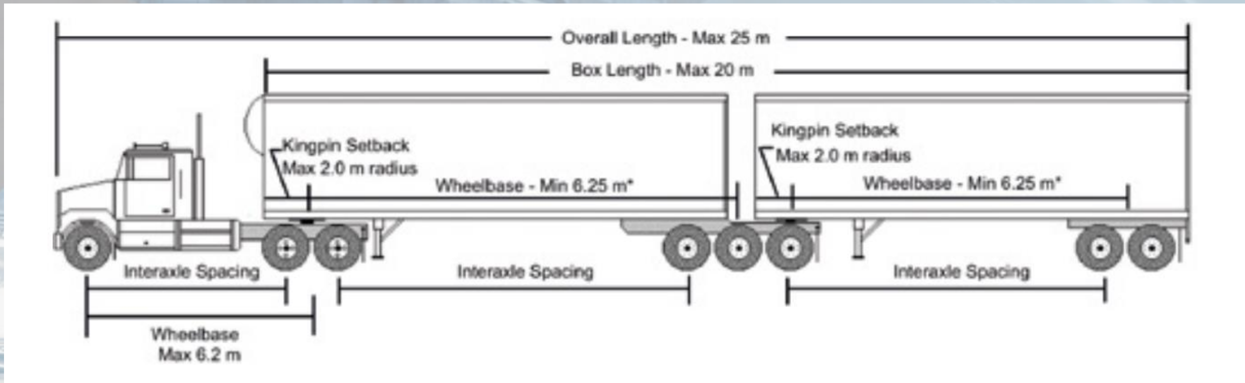


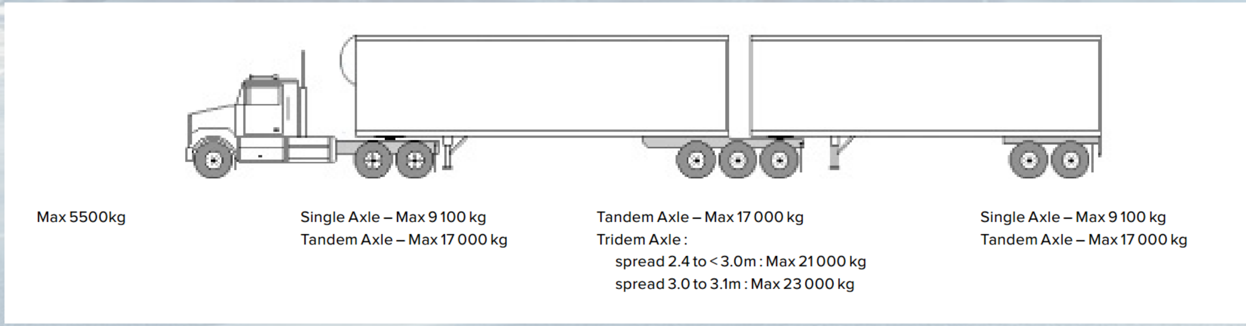
History - Canada

- In 1980s, University of Michigan Transport Research Institute (UMTRI) researched and developed a range of new performance measures
- Applied in the Roads Transport Association of Canada (RTAC) study in Canada
  - used performance standards to derive regulatory principles (e.g. triaxles better than tandems)
  - liberalisation of some limits provided fundamental safety and road compatibility conditions are maintained
  - Used performance standards to encourage certain vehicle configurations ("B-trains")
  - PBS would need to be very broad and watertight
- Development of prescriptive vehicle "envelopes" based on performance
- Special policies and permits in some provinces

History - Canada

- Economic analysis and contribution
- Special operating conditions including type of license, training, driving experience, physical fitness even criminal records
- Demonstrated safety and operational benefits





History – New Zealand

- Performance standards used for permitting vehicles outside prescriptive limits in the 90's
- Mainly A-doubles, longer logging vehicles
- Some performance standards included in regulations in 2002
  - Stability measure introduced : Static Rollover Threshold (SRT)
  - Vehicles must have an SRT of 0.35g or better
  - Compliance system was also introduced (SRT Compliance Certificate)
- High-productivity Motor Vehicles (HPMVs) introduced in 2010.
- Permits based on performance
- Prescriptive dimensional envelopes were developed with no assessment required

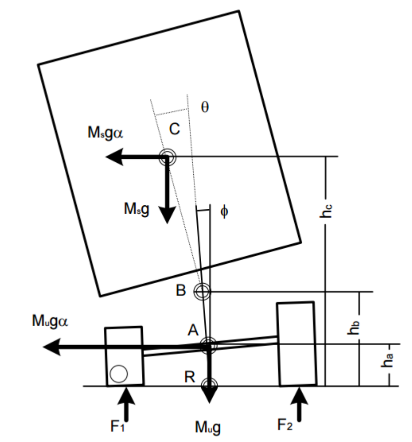
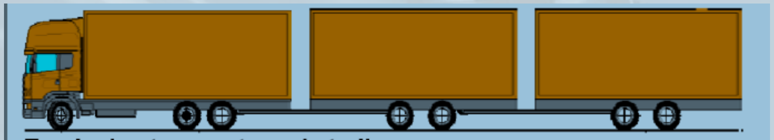


Figure 1 Vehicle Roll Notation

History – Europe

- Development of the European Modular System (EMS) – Directive 96/53/EC
- Based on vehicle modules not on performance outcomes
- Harmonisation is the difficult issue (cross border operation could only be approved under bilateral agreements)
- Sweden is developing a PBS scheme
- Longer vehicles are operated in several European countries
- Current OECD HCV project using PBS approach


Truck plus two centre-axle trailers

Semitrailer + center axle trailer

History - Australia

- Introduction of B-doubles from the late 80’s
- Development of innovative combination in the early 90’s in Australia
  - 1992 Dec - First PBS type submission submitted to National Road Transport Commission (NRTC) for the operation of dangerous goods vehicles with increased mass limits
  - Mid 90’s to 2004-2008 development of innovative heavy vehicle combinations
  - Assessment of performance
    - Increased used of computer simulation
    - Vehicle testing

Innovative vehicle combinations

B-Doubles

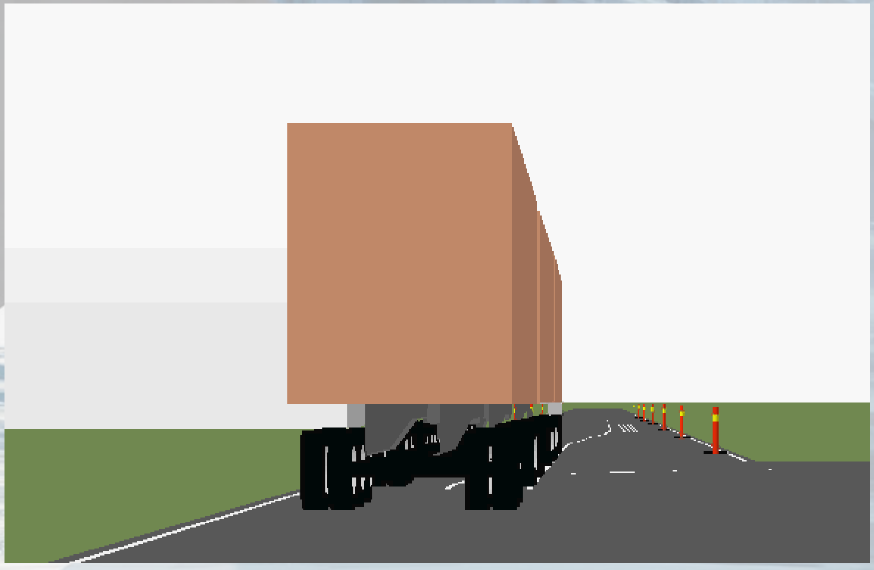
B-triples

AB-triples

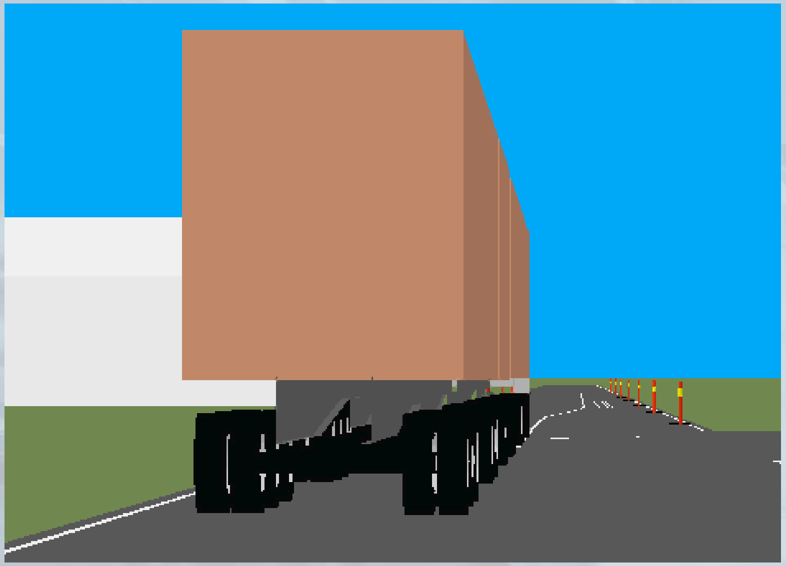
Initial approach for the approval of innovative combinations

- **Benchmarking**

Triple road train



BAB-Quad



Sim: RUR

Australian history contd.

- 1999 NTC commenced the PBS development project
  - Making road transport more innovative, efficient and safe
  - Greater national uniformity and consistency
  - Reducing environmental impacts
  - Reducing administrative costs
- 2001 Australian Transport Council (ATC) endorsed policy framework for development of PBS approach
- 2003 ATC approved interim PBS framework that included interim PBS standards and measures – Safer Management of Australian Road Transport (SMART)
  - The project identified 100 field performance measures that describe the on-road performance of a heavy vehicle
  - 20 measures were selected
  - The performance of 139 heavy vehicle combinations was assessed against the interim standards

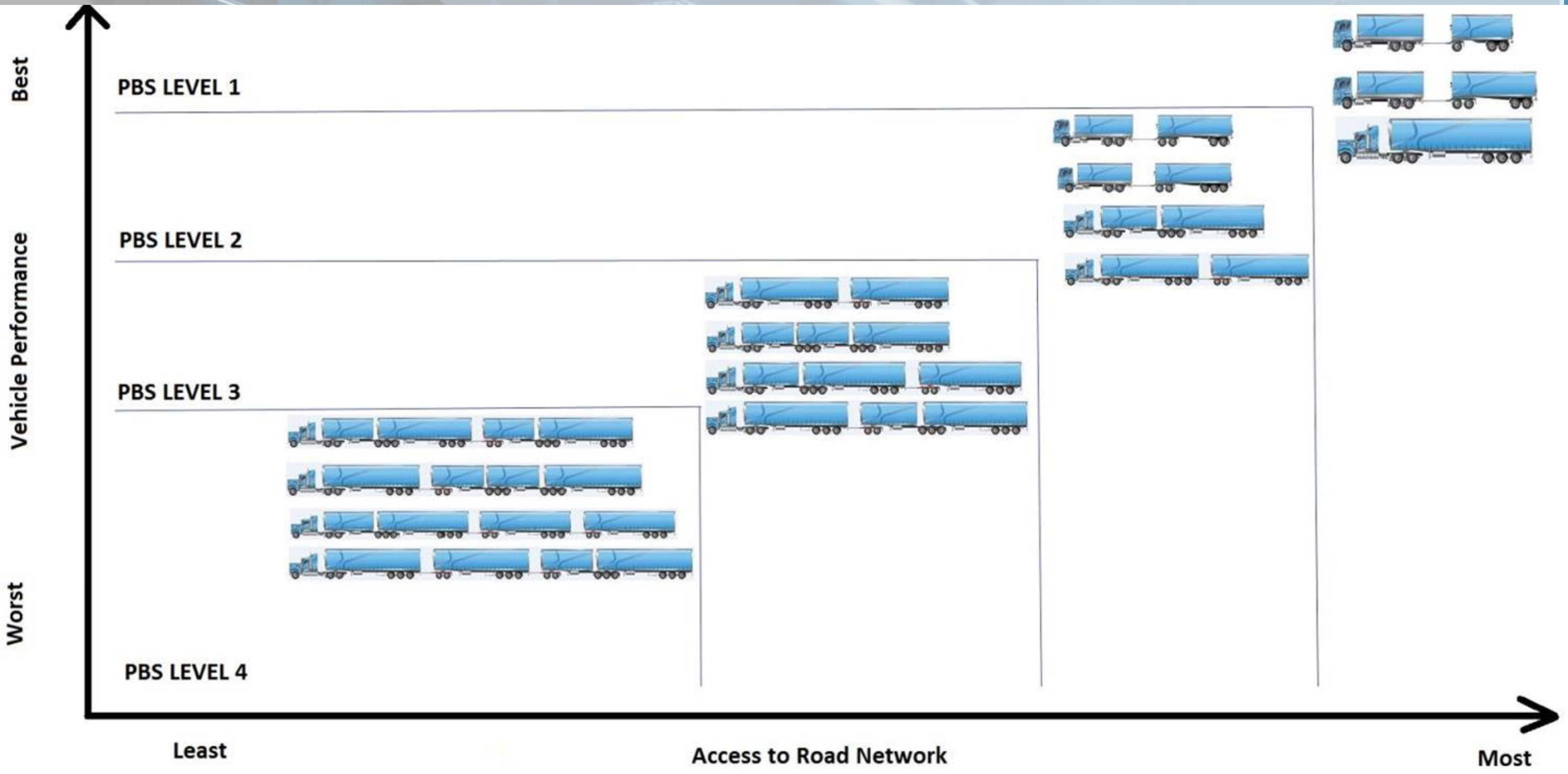
Australian history cont.

- 2005 Interim Regulation Panel (IRP) applied the interim PBS measures
- 2006 Council of Australian Governments (COAG) recognised the potential of PBS and identified PBS as a "major transport productivity reform in Australia"
- 2007 PBS package approved by Transport Ministers
  - Establishment of a National Framework, administered by the National Transport Commission (NTC)
  - Establishment PBS Performance Review Panel (PRP)
  - Vehicle assessment guidelines (20 standards to be discussed later);
  - Vehicles certification guidelines;
  - Route classification guidelines;
  - Accreditation of PBS Assessors; and
  - Accreditation of PBS Certifiers

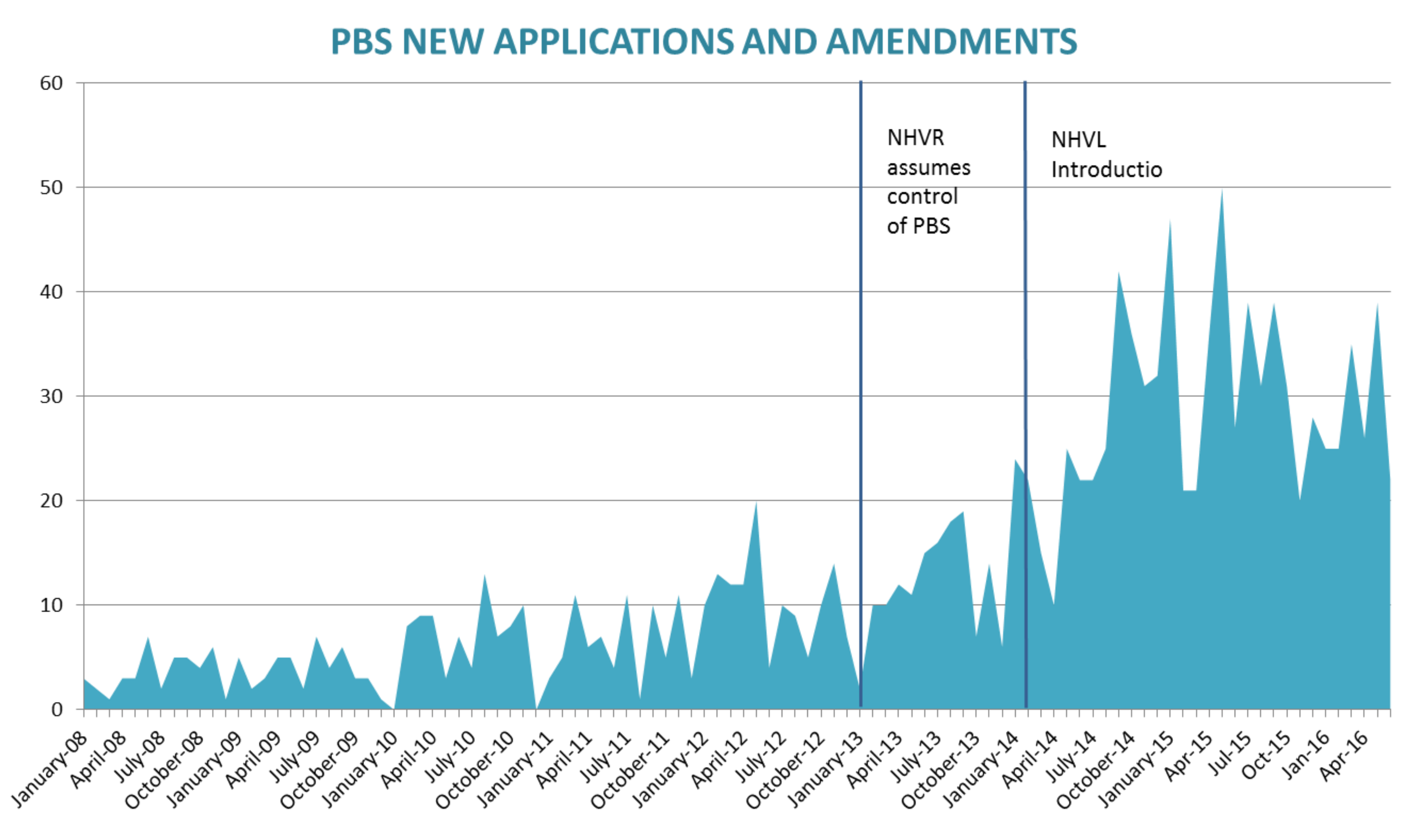
Australian history cont.

- 2011 PBS Regulatory Impact Statement (RIS) is released
- 2013 Jan NHVR takes over PBS administration under existing administrative arrangements
- 2014 Feb PBS incorporated into Heavy Vehicle National Law (HVNL)
- Improved access arrangements, access permits are also issued by NHVR
- 2016 April 41st PBS PRP meeting
- 2016 May First PBS Notice is released for truck and dog combinations

Access based on performance level

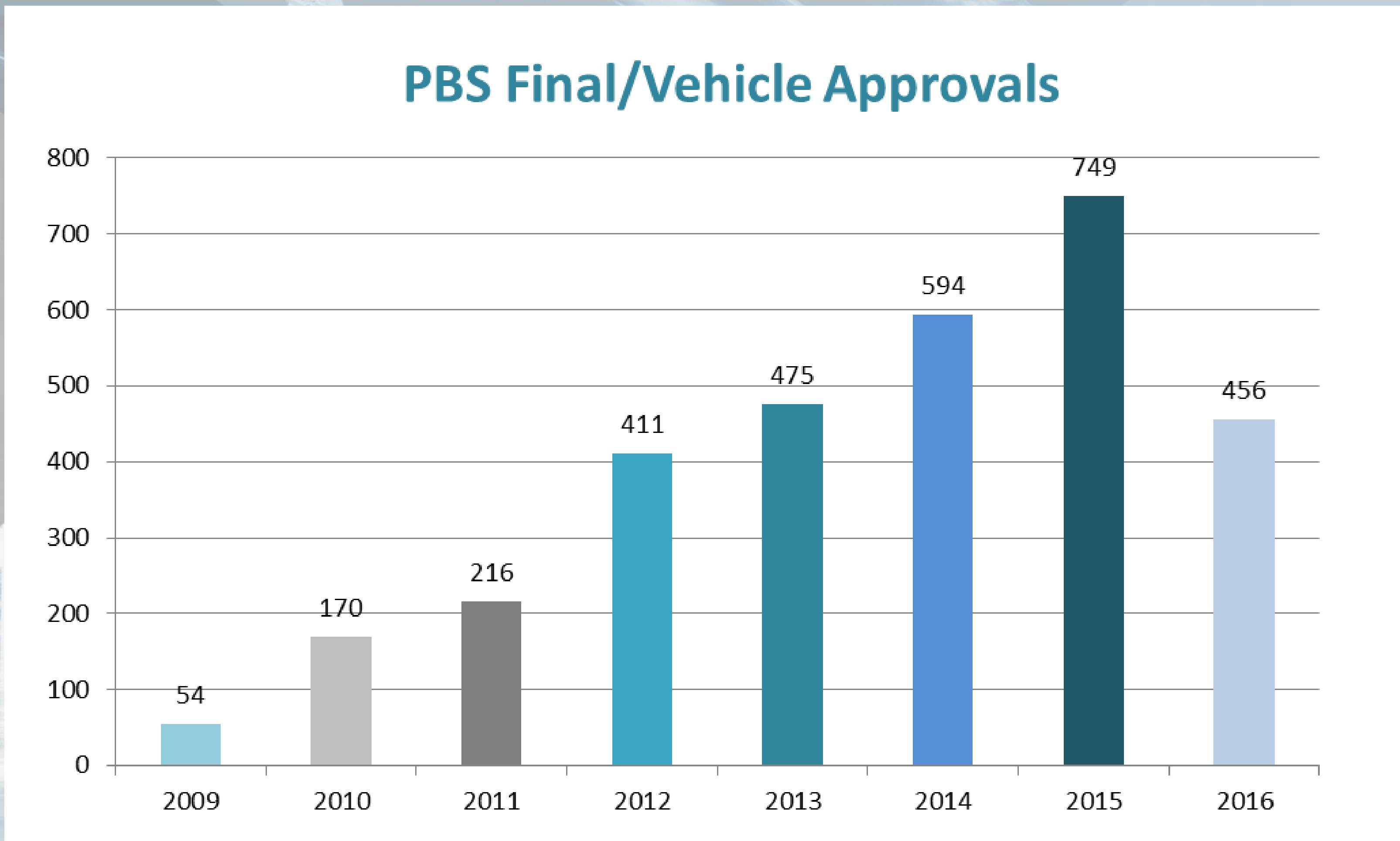


Exponential growth



NHVR

PBS final/vehicle approvals



PBS Summary

- PBS aims to maximise the safe use of higher productivity vehicles by matching the right vehicles to the right roads
- Most progressive heavy vehicle design scheme around the world
- Alternative regulatory system – the comprehensive PBS requirements are set in Heavy Vehicle National Law
- World's first – only introduced into Australia
- Selected and nationally agreed Infrastructure and Safety Standards
- The only truly national scheme in Australia at the moment

Vehicle Standards & Systems Summit towards Safe Roads in South Africa 2016

The Smart Truck/PBS pilot project in South Africa

Dr Paul Nordengen – CSIR

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PBS Pilot Project Objectives

Investigate the Performance-Based Standards approach to heavy vehicles design and operations as researched and implemented specifically in Australia, Canada and New Zealand with a view to improving heavy vehicles operations in South Africa through:

- Reduced road wear (per tonne.km)
- Reduced vehicle trips i.e.
  - Reduced congestion
  - Reduced safety exposure risk
- Improved safety performance
- Improved transport productivity
- Reduced emissions (per tonne.km)

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PBS in Africa ??? ....

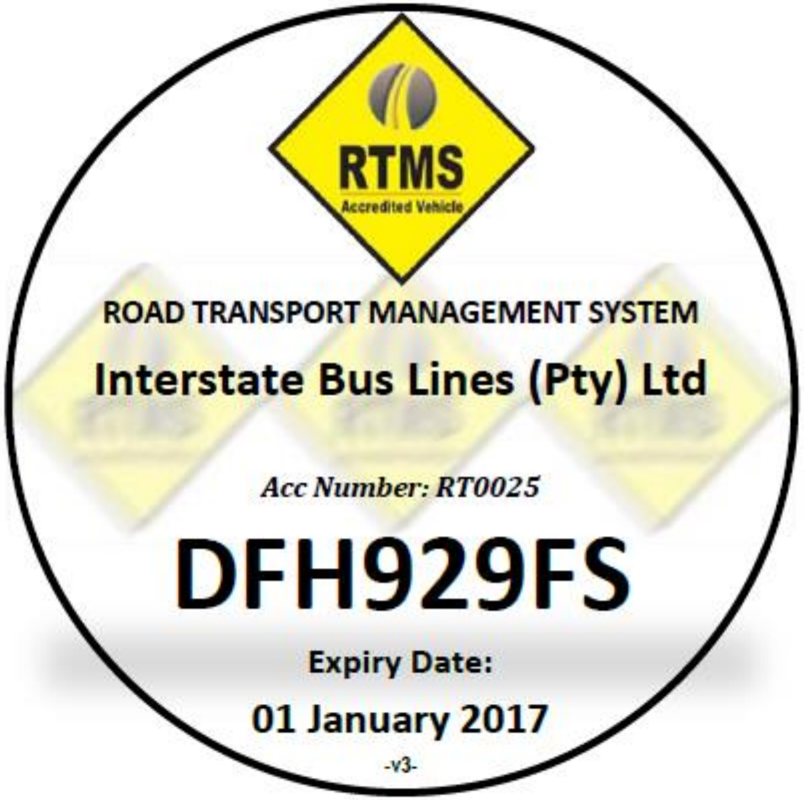
RTMS – Road Transport Management System

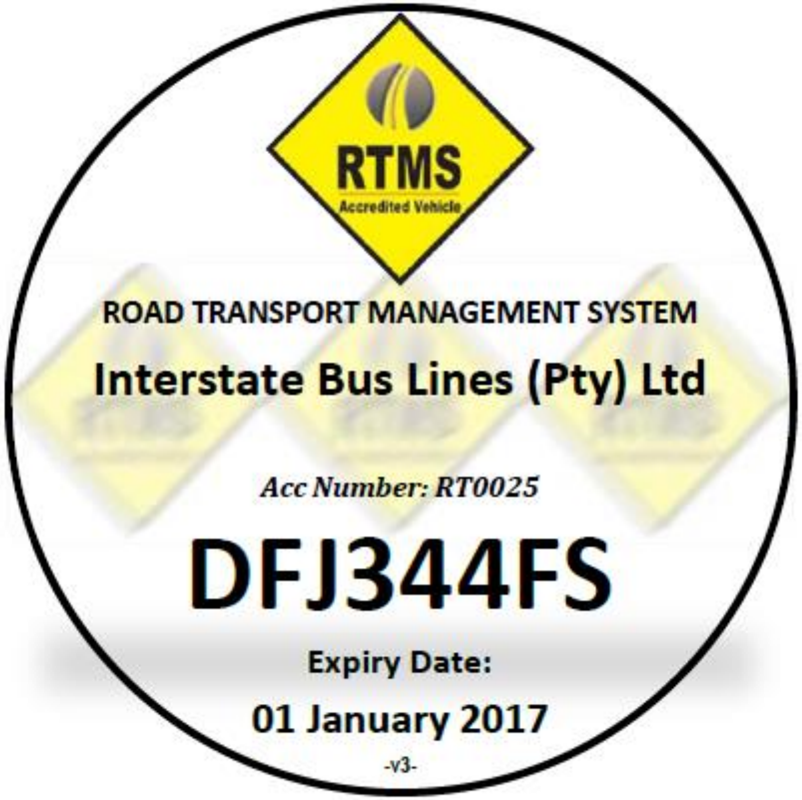
- RTMS is a self-regulation initiative which aims to address issues such as:
  - Road infrastructure protection
  - Heavy vehicle safety
  - Logistics efficiency
- It achieves this by prescribing minimum standards for:
  - Load management (over-loading/under-loading)
  - Vehicle maintenance
  - Driver training, health, hours
  - *etc.*
- SABS standard: SANS 1395
- Ensures a level of professionalism of transport operators
  - If certification is lost, normal prescribed mass and length limits will apply.

www.rtms-sa.org

RTMS board

RTMS discs





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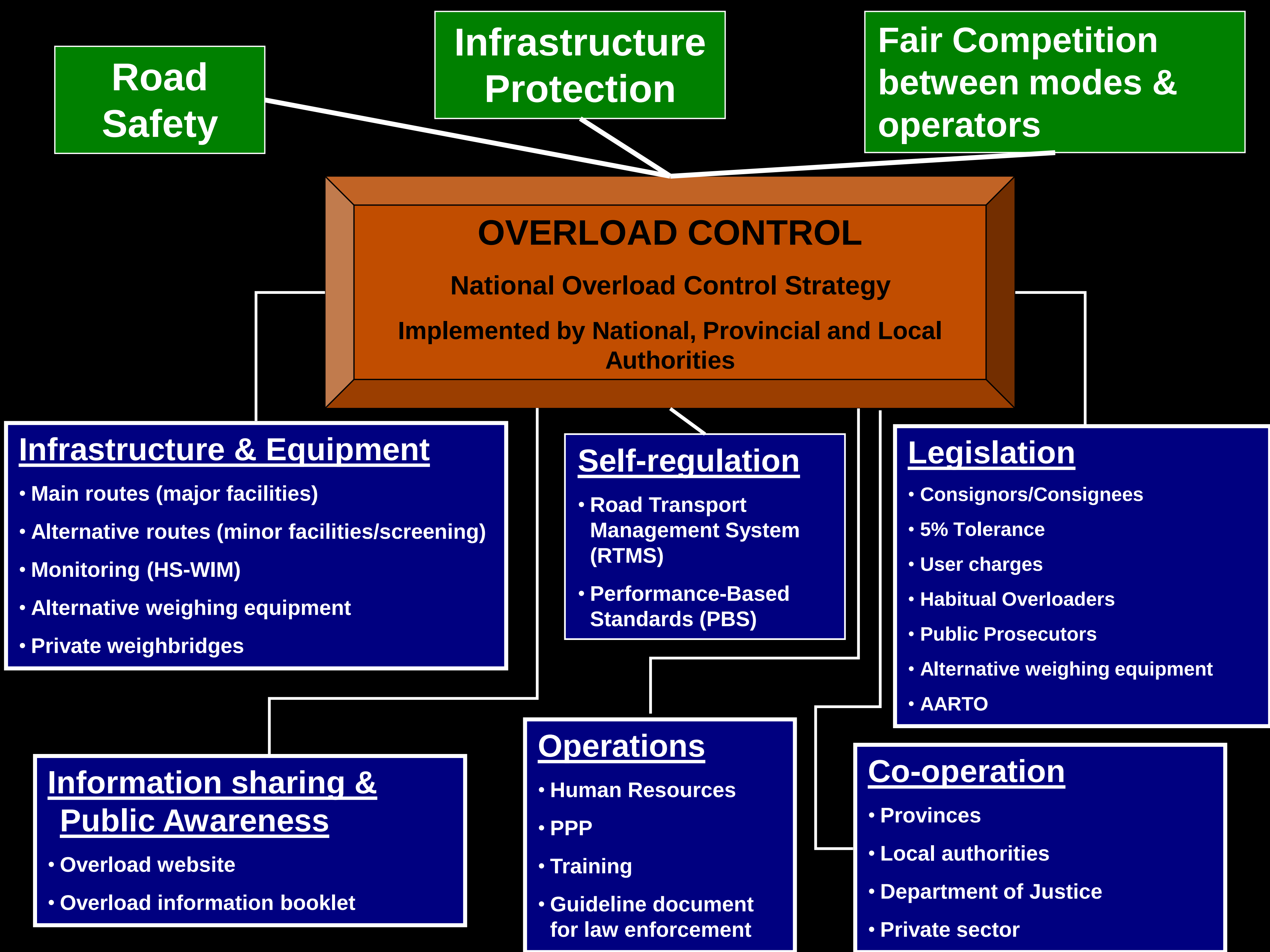
our future through science

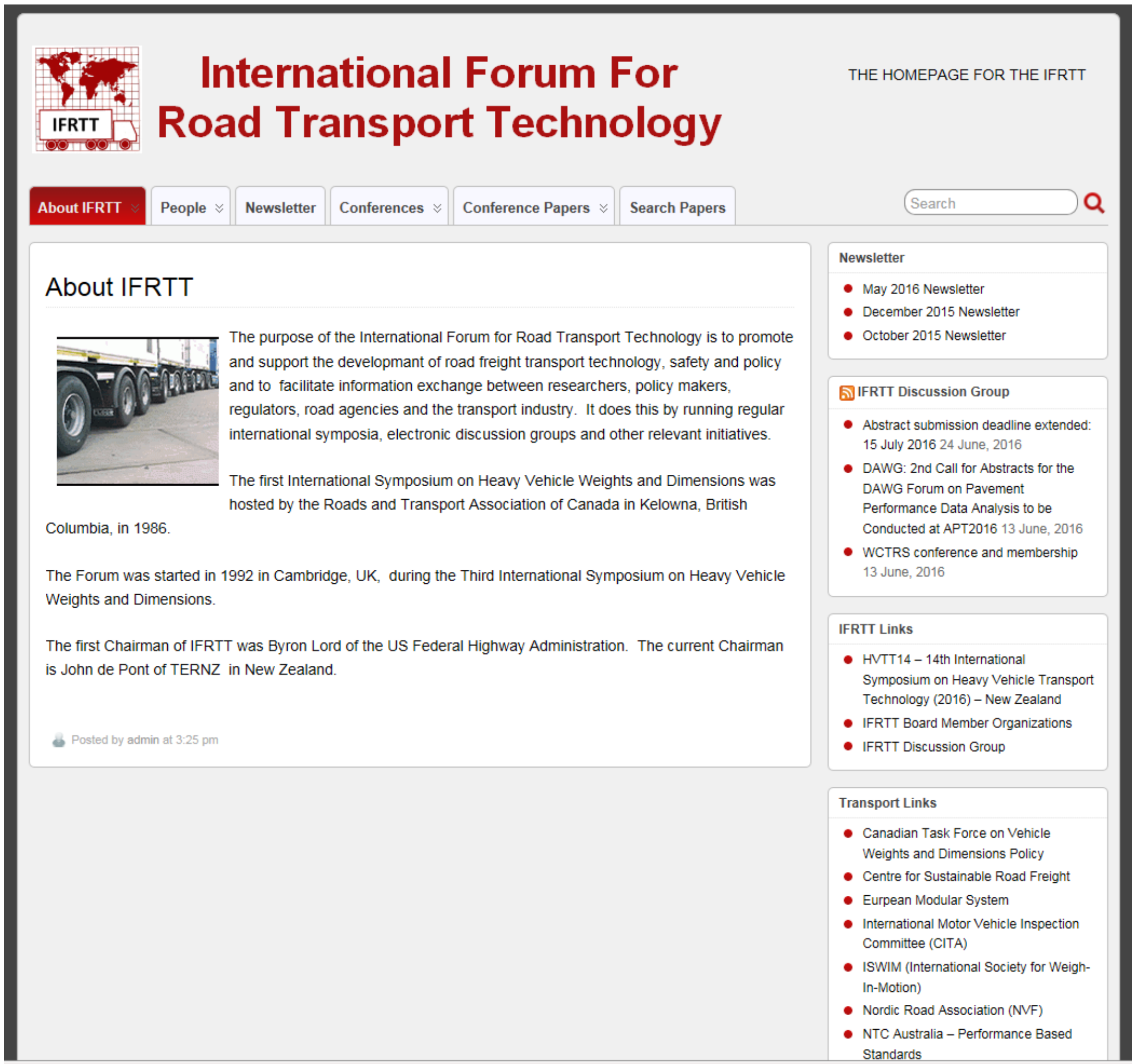
PBS Pilot Project in South Africa

- ISHVWD in 1998, 2000 & 2002
- PBS seminar in Melbourne in 2003
- Committee established in 2004
- First 2 PBS vehicles (timber) commissioned in Nov 2007
- Involvement in OECD project “Moving Freight with Better Trucks (2010)
- OECD project on High Capacity Vehicles (HCVs) – current project


Road Safety
Infrastructure Protection
Fair Competition between modes & operators
OVERLOAD CONTROL
National Overload Control Strategy
Implemented by National, Provincial and Local Authorities
Infrastructure & Equipment
• Main routes (major facilities)
• Alternative routes (minor facilities/screening)
• Monitoring (HS-WIM)
• Alternative weighing equipment
• Private weighbridges
Self-regulation
• Road Transport Management System (RTMS)
• Performance-Based Standards (PBS)
Legislation
• Consignors/Consignees
• 5% Tolerance
• User charges
• Habitual Overloaders
• Public Prosecutors
• Alternative weighing equipment
• AARTO
Information sharing & Public Awareness
• Overload website
• Overload information booklet
Operations
• Human Resources
• PPP
• Training
• Guideline document for law enforcement
Co-operation
• Provinces
• Local authorities
• Department of Justice
• Private sector

International Forum for Road Transport Technology (IFRTT)

- www.road-transport-technology.org



Heavy Vehicle Transport Technology (HVTT) conferences

International Forum For Road Transport Technology

THE HOMEPAGE FOR THE IFRTT

About IFRTT | People | Newsletter | Conferences | Conference Papers | Search Papers

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Conferences » Past conferences

Past conferences

- HVWD1 – 1986 Kelowna, BC, Canada
- HVWD2 – 1989 Kelowna, BC, Canada
- HVWD3 – 1992 Cambridge, UK
- HVWD4 – 1995 Ann Arbor, Michigan, USA
- HVWD5 – 1998 Maroochydore, Queensland, Australia
- HVWD6 – 2000 Saskatoon, Saskatchewan, Canada
- HVWD7 – 2002 Delft, The Netherlands
- HVWD8 – 2004 Misty Hills, Johannesburg, South Africa
- HVWD9 – 2006 Penn State University, USA
- HVTT10 – 2008 LCPC/ENPC, Paris Marne-la-Vallee, France. Held in conjunction with the ICWIM 5
- HVTT11 – 2010 Melbourne, Australia
- HVTT12 – 2012 Stockholm, Sweden
- HVTT13 – 2014 San Luis, Argentina

View/Search Proceedings




Posted by admin at 5:51 pm

Newsletter

- May 2016 Newsletter
- December 2015 Newsletter
- October 2015 Newsletter

IFRTT Discussion Group

- Abstract submission deadline extended: 15 July 2016 24 June, 2016
- DAWG: 2nd Call for Abstracts for the DAWG Forum on Pavement Performance Data Analysis to be Conducted at APT2016 13 June, 2016
- WCTRS conference and membership 13 June, 2016

IFRTT Links

- HVTT14 – 14th International Symposium on Heavy Vehicle Transport Technology (2016) – New Zealand
- IFRTT Board Member Organizations
- IFRTT Discussion Group

Transport Links

- Canadian Task Force on Vehicle Weights and Dimensions Policy
- Centre for Sustainable Road Freight
- Eurpean Modular System
- International Motor Vehicle Inspection Committee (CITA)
- ISWIM (International Society for Weigh-In-Motion)
- Nordic Road Association (NVF)
- NTC Australia – Performance Based Standards

14th Heavy Vehicle Transport Technology conference, 15 – 18 Nov 2016, Rotorua, New Zealand

www.hvttconference.com

HVTT14
FUTURE PATHWAYS

15 -18 NOVEMBER 2016
ROTORUA

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Home

Welcome to HVTT14!

The International Forum for Road Transport Technology (IFRTT) is proud to present the 14th International Symposium on Heavy Vehicle Transport Technology (HVTT14). This conference will provide a unique forum for legislators, road administrators, academics, consultants, vehicle manufacturers and suppliers, transport organizations and transport operators to discuss and exchange ideas on ways to improve the safety, efficiency, productivity and sustainability of the road transport industry.

In 2016, for the first time in its history the conference will be held in New Zealand under the auspices of the Institute of Road Transport Engineers of New Zealand (IRTENZ). The location of the conference is Rotorua which, as well as being an internationally renowned tourist centre, is a major hub of both forestry and road transport.

We look forward to welcoming you all here in November.

News

There are two new pages on the web-site. Paper submissions gives formatting details and instructuions for submitting your full paper. Rotorua gives information on accommodation, travel and sightseeing in Rotorua.

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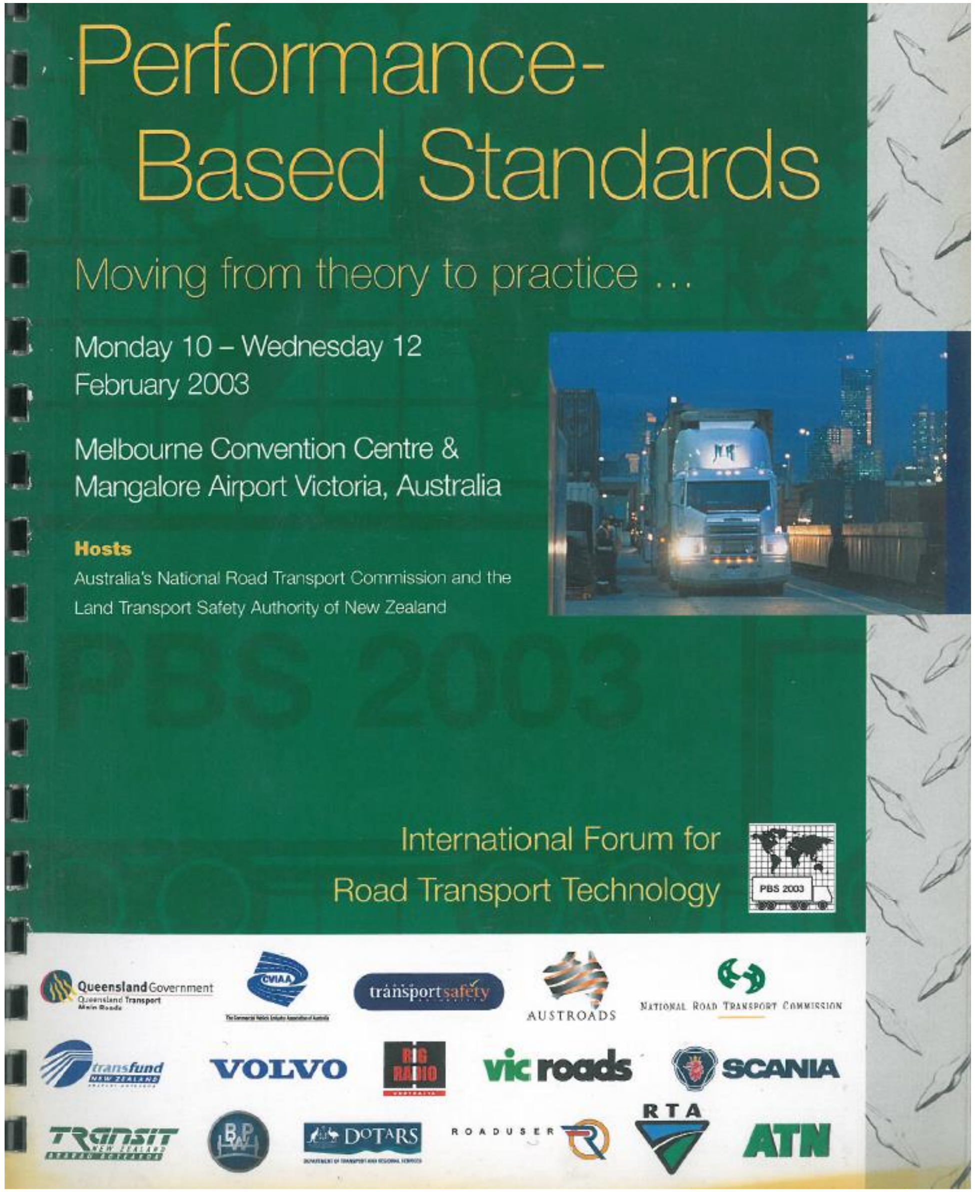
PBS seminar, Melbourne, 10 – 12 February, 2003



PBS seminar, Melbourne, February, 2003

PERFORMANCE ASSESSMENT OF INNOVATIVE VEHICLE COMBINATIONS

Les Bruzsa
Principal Engineer (Strategic Policy Team)
Queensland Department of Transport

The regulation of heavy vehicle movements in Australia has traditionally been governed by the use of inflexible, highly prescriptive statutory and administrative instruments. This tendency to a 'one rule fits all' approach to network access has outlived its usefulness.

Road transport is moving into an area of standards that are performance-based in association with systems which provide assurance to network owners and regulators that operating conditions are being complied with. Queensland Transport strongly supports the development of these road transport policy options that are based on scientific information and assessment and progress initiatives for the most effective use of the road system. This process will lead to the development of more diverse heavy vehicles that are designed for freight task specific jobs and fewer, more flexible and nationally uniform vehicle regulations.

Various sections of Queensland Transport and Department of Main Roads have undertaken extensive research and development in the assessment of innovative combinations. They have encouraged the development of new vehicle concepts that improve the productivity of road transport while maintaining or improving road safety. The presentation illustrates the existing performance-based approach for the assessment and approval of innovative vehicle combinations.

This new approach involves detailed examination of the dynamic performance of the proposed heavy vehicle combinations including computer simulation of the dynamic performance of heavy vehicle configurations, instrumented field trials using integrated video and instrumentation systems and investigations into stability, braking, safety, design and road effects of heavy vehicle combinations.

Australian Performance Standards for heavy vehicles

PERFORMANCE BASED
STANDARDS SCHEME

THE STANDARDS AND VEHICLE
ASSESSMENT RULES

as at 10 November 2008 (incorporating
all amendments consented to by the ATC
up to that date)

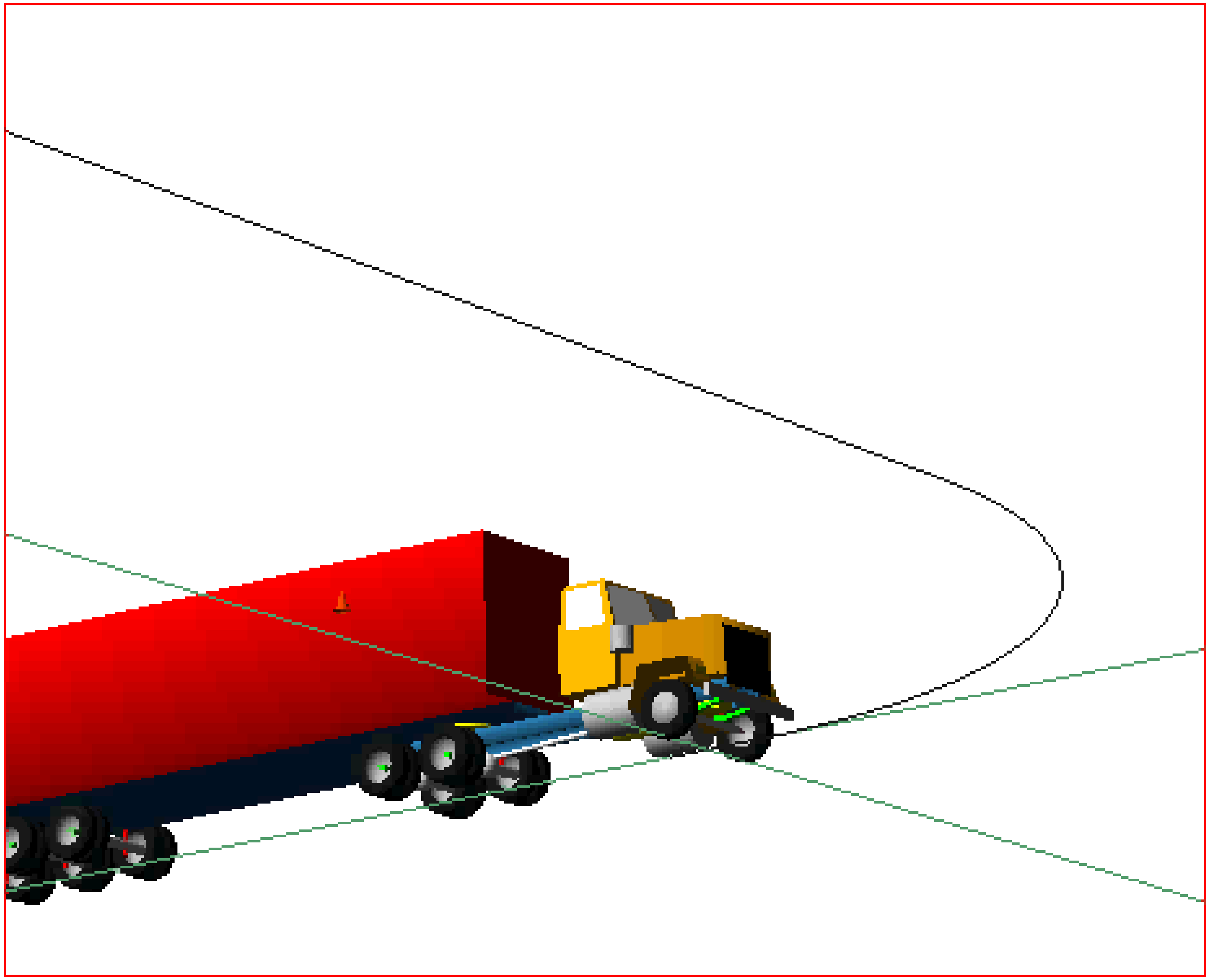
NTC
AUSTRALIA
National Transport Commission

Prepared by
National Transport Commission

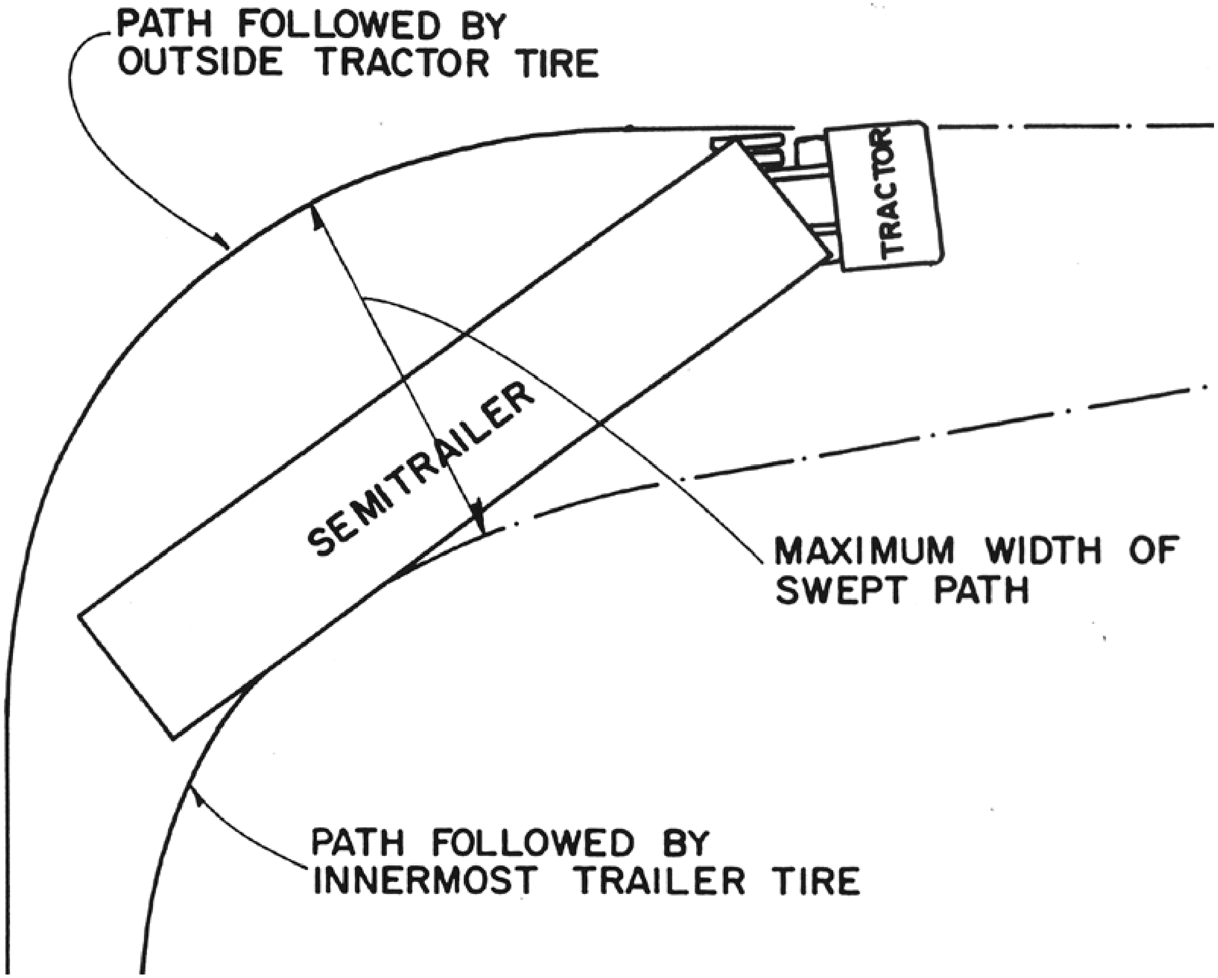
Performance-Based Standards: Safety

Manoeuvre/Test	Performance Standard
Low-speed 90° turn (5 km/h)	Low-speed swept path Tail swing Frontal swing Steer-tyre friction demand
High-speed lane-change (80 km/h)	Rearward amplification High-speed transient offtracking
Rollover	Static rollover threshold
High-speed pulse steer (80 km/h)	Yaw damping coefficient
High-speed on uneven road (90 km/h)	Tracking ability on a straight path
Various (driveability standards)	Startability Gradeability A Gradeability B Acceleration Capability

Low-Speed Offtracking



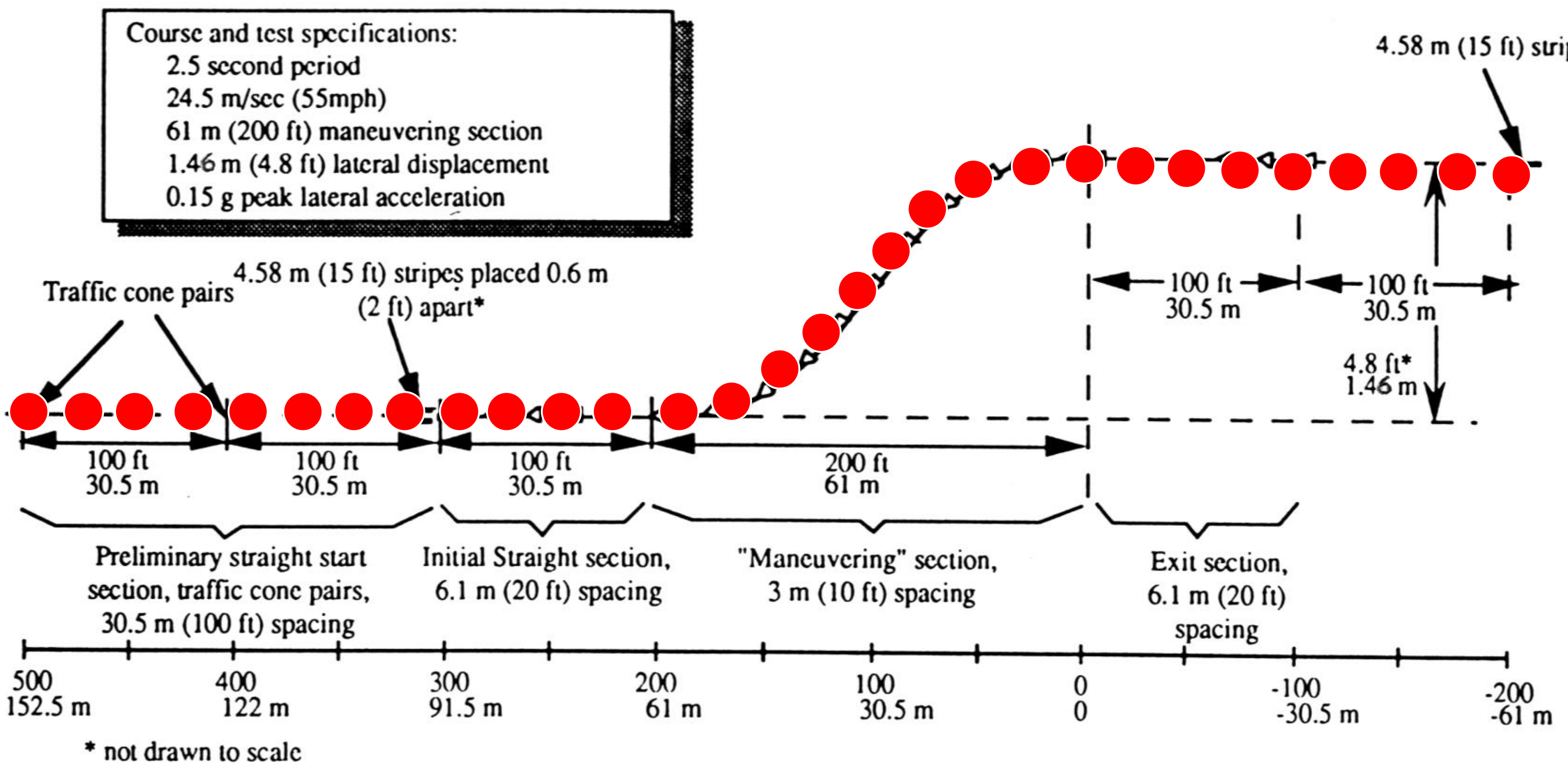
Low-Speed Offtracking



Low-Speed Offtracking

High Speed Transient Offtracking

PBS Lane Change Manoeuvre (SAE J2179)



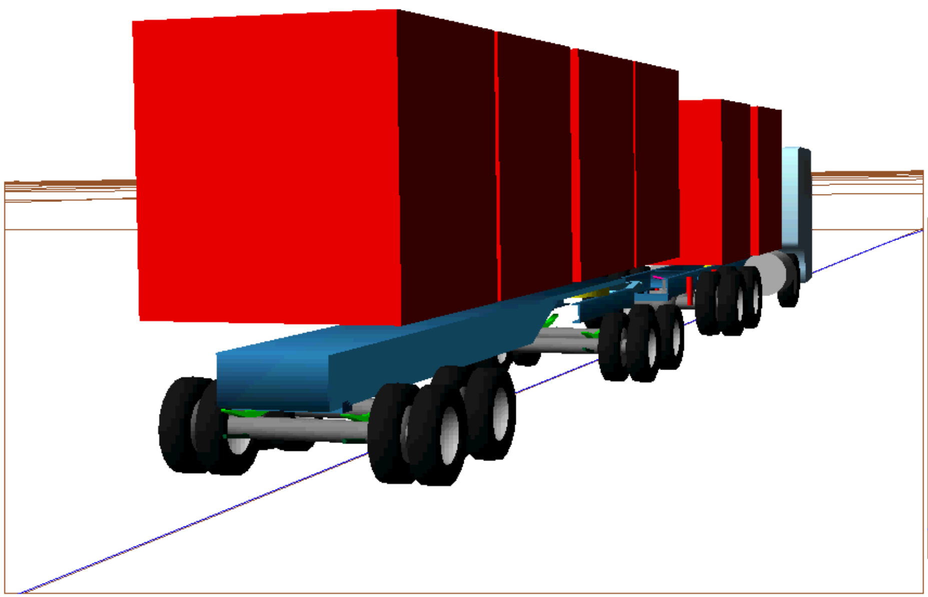
High Speed Transient Offtracking

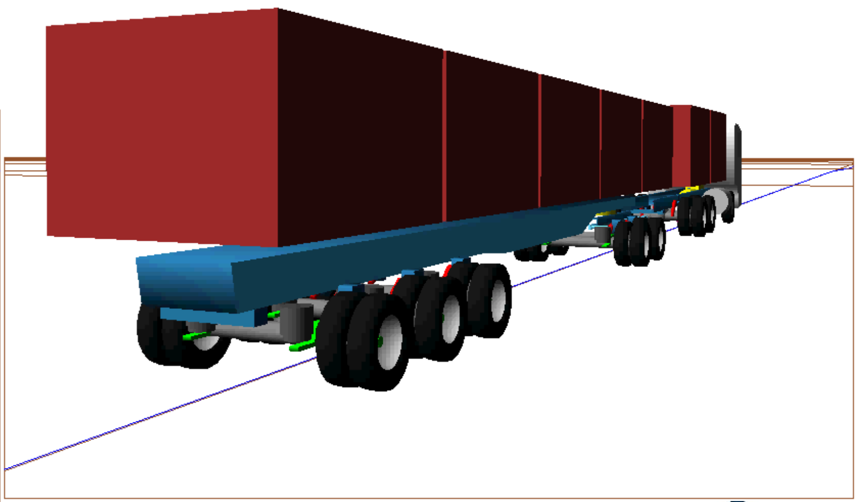
baseline

Last_Run Time= 2.4000 Frame=50

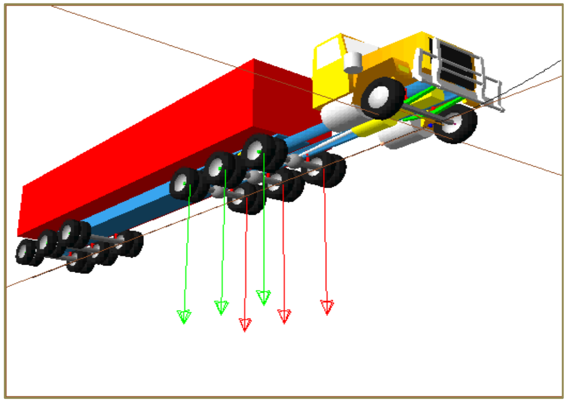
PBS

Last_Run Time= 2.4000 Frame=50





Performance-Based Standards: Infrastructure



Infrastructure

Pavements

Bridges

Pavement Vertical Loading
Pavement Horizontal Loading
Tyre Contact Pressure Distribution

Bridge Loading

Smart Truck pilot project rules

transport

Department:
Transport
REPUBLIC OF SOUTH AFRICA

SMART TRUCK PROGRAMME

RULES FOR THE DEVELOPMENT AND OPERATION OF SMART TRUCKS AS PART OF THE PERFORMANCE-BASED STANDARDS RESEARCH PROGRAMME IN SOUTH AFRICA

April 2016

Compiled by: **Smart Truck Committee and CSIR Built Environment**

CSIR
our future through science

Smart Truck project requirements

- RTMS certification (Operator/RTMS auditor)
- Concept design, proposed route(s) (various e.g. consignor, operator)
- PBS application for concept approval (transport operator/consignor/ee)
  - Application letter
  - Valid RTMS certificate
  - GA drawing of proposed combination
  - Proposed route(s)
  - Bridge and road wear (preliminary) assessment
- PBS concept approval (relevant A/L permit offices)
- PBS principle approval (if required) (national DoT)
- Detail design (trailer manufacturer/OEM)
- PBS assessment (accredited PBS assessor - CSIR/Wits/Australia)
- PBS design approval (Smart Truck Review Panel)
- Manufacture (trailer manufacturer)
- NaTIS registration (SABS/NRCS/DoT)
- Commissioning (certifier - road authority/CSIR)
- Operation and monitoring (A/L Permit Office(s), auditor, CSIR)

Smart Truck board - proposals

PBS Pilot Project in South Africa

Target kms: 100 million Kms travelled to date: 69 million (end-April 2016)

No. of Smart Trucks per Province: April 2016										
Commodity/ Industry	E. Cape	W. Cape	N. Cape	Mpum.	Gauteng	Limpopo	KZN	Free State	N. West	Total
Timber	0	0	0	30	0	0	53	0	0	**83**
Mining	0	5	2	12*	0	36*	11	0	0	**54**
Processed Sugar	0	0	0	0	0	0	9	0	0	**9**
Fuel	0	0	0	0	0	0	5	0	0	**5**
Beef cattle	0	0	2*	0	0	0	0	0	2*	**2**
Beer	0	0	0	0	0	0	2	0	0	**2**
Buses	0	0	0	12	0	0	0	0	0	**12**
Total	**0**	**5**	**4**	**54**	**0**	**36**	**80**	**0**	**2**	**167**

*Note: 12 mining PBS vehicles operating in both Mpumalanga and Limpopo;
2 beef cattle PBS vehicles operating in Northern Cape and North West

Current projects: Containers, tomatoes, paper reels, coal, general freight

Smart Trucks: Potential Gains

- Reduced vehicle trips i.e.
  - Reduced congestion
  - Reduced safety exposure risk
- Improved safety performance
- Improved transport productivity
- Reduced road wear (per ton.km)
- Reduced emissions (per ton.km)
- Improved performance of the SA heavy vehicle fleet


Thank you

Vehicle Standards & Systems Summit towards Safe Roads in South Africa 2016

PBS Safety Standards

Robert Berman – CSIR

Rberman@csir.co.za

The Performance Standards

15 PBS Standards

- **Longitudinal performance** (4 Standards)
- **Low-speed directional performance** (6 Standards)
- **High-speed stability performance** (5 Standards)

The Longitudinal Standards

1. **Startability (St)**

   Maximum upgrade on which the vehicle can pull away from rest

2. **Gradeability A (GraA)**

   Maximum upgrade on which the vehicle can maintain forward motion

3. **Gradeability B (GraB)**

   Maximum speed the vehicle can maintain on a 1% upgrade

4. **Acceleration Capability (Acc Cap)**

   Time taken for the vehicle to cover 100 m from rest on a 0% grade

The Low-speed Standards

1. Low-speed Swept Path (LSSP)
2. Frontal Swing (FS)
3. Difference of Maxima (DoM)
4. Maxima of Difference (MoD)
5. Tail Swing (TS)

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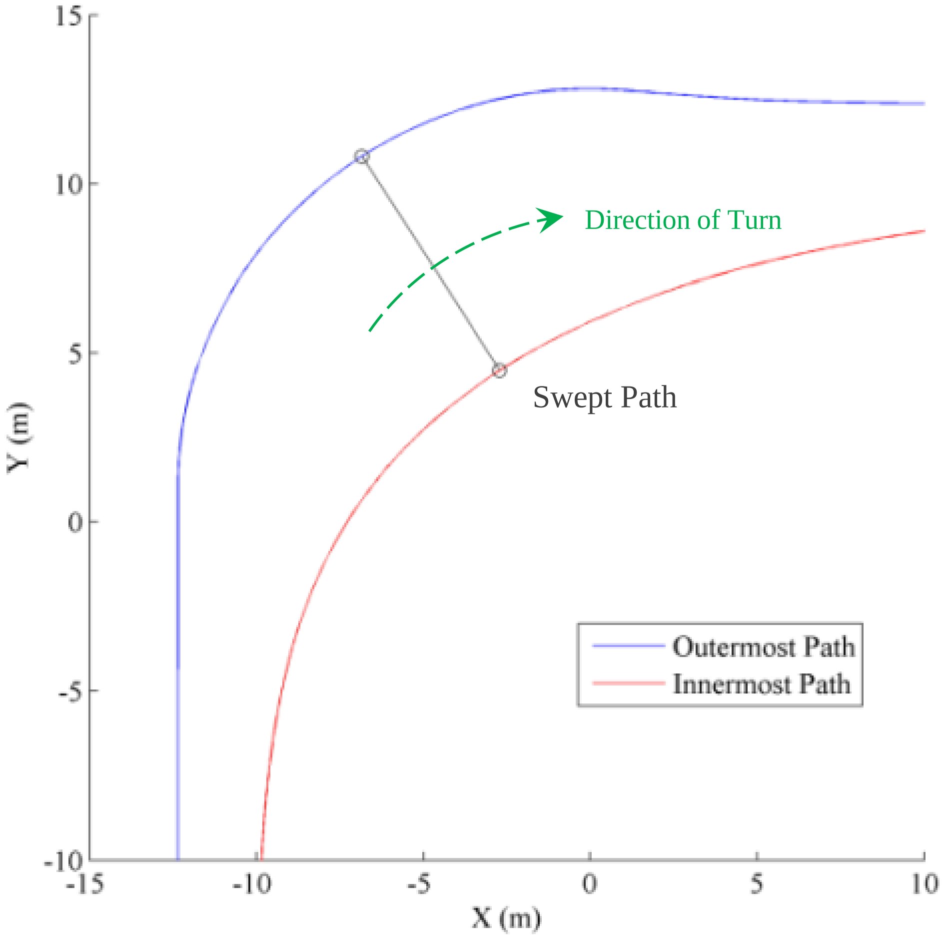
Low-speed Swept Path

Maximum width of road required when executing the prescribed 90 degree turn



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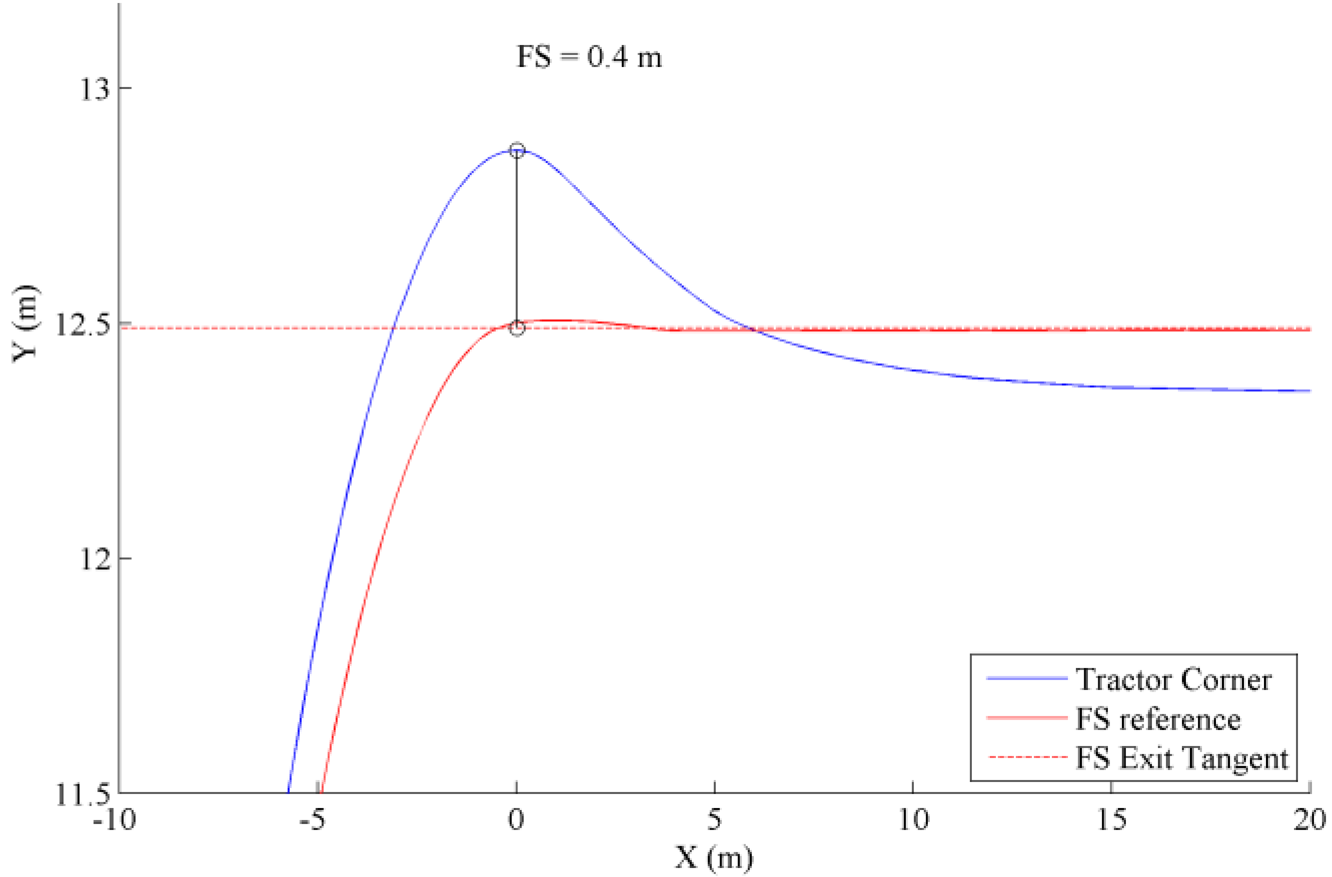
Frontal Swing

Amount the front outside corner of the tractor swings outside the maximum width of the tractor in the exit of the turn



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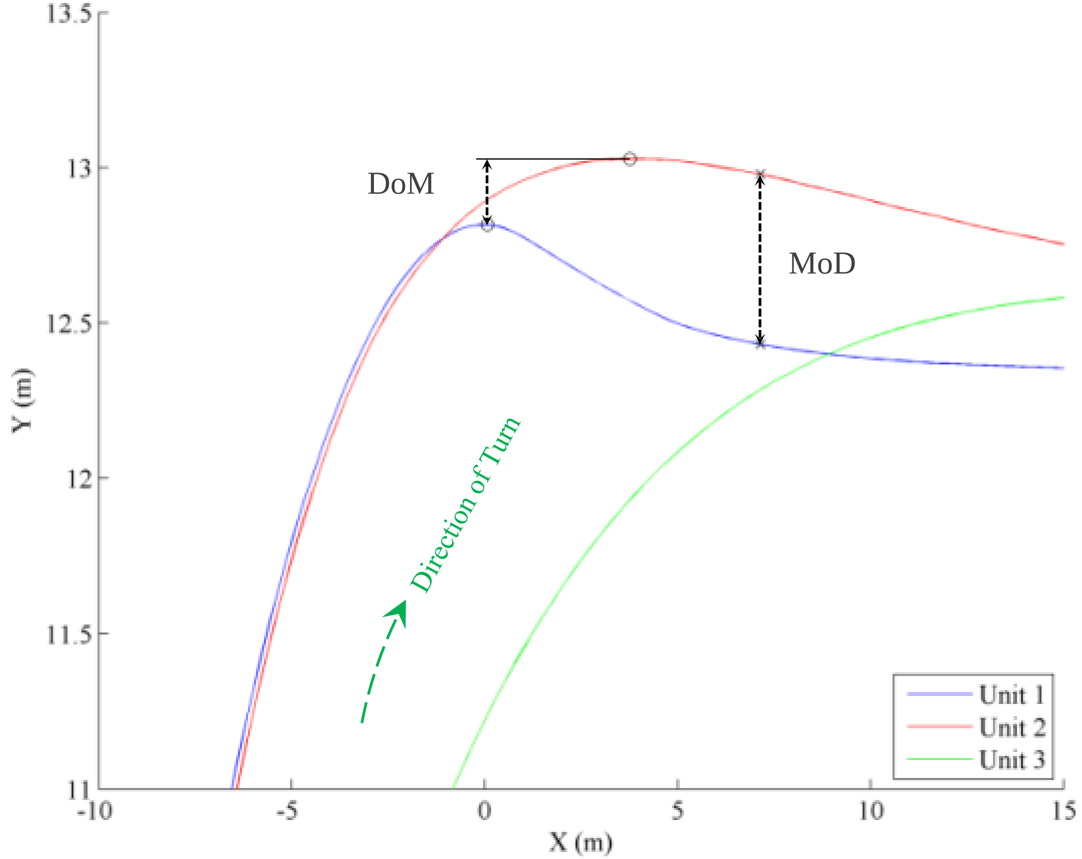
Difference of Maxima

For Semitrailers, DoM is the amount that the path of the outside corner of a following unit extends beyond that of the preceding unit



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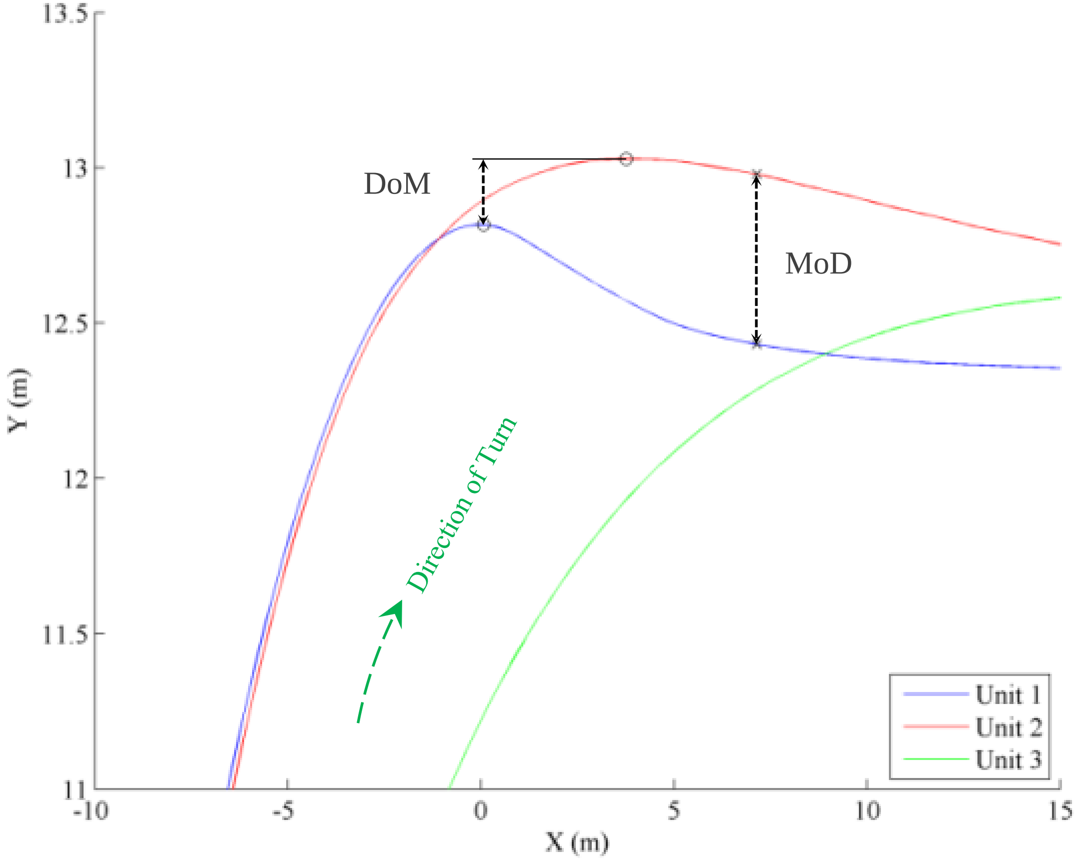
Maximum of Difference

For Semitrailers, MoD is the maximum width between the outer corner paths of two successive vehicle units



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The High-speed Standards

1. Static Rollover Threshold (SRT)
2. High-speed Transient Offtracking (HSTO)
3. Rearward Amplification (RA)
4. Tracking Ability on a Straight Path (TASP)
5. Yaw Damping (YD)

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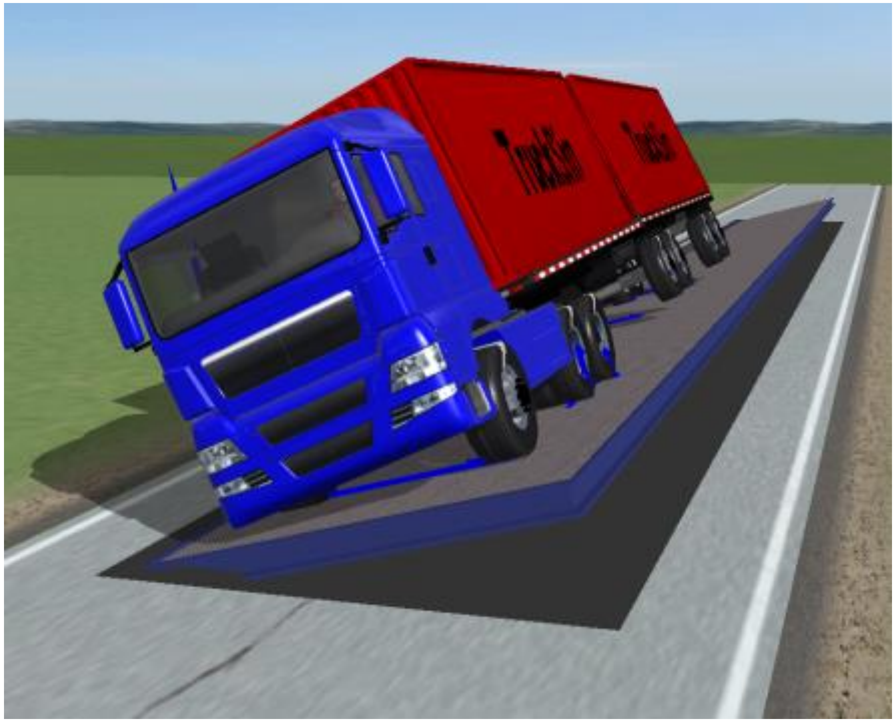
Static Rollover Threshold

Maximum steady state lateral acceleration the vehicle can sustain in a constant-radius high-speed turn, or alternatively is measured using a tilt-table test



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High-Speed Transient Offtracking

Excess lateral displacement, or overshoot, of the rearmost axle beyond that of the steering axle path in the prescribed lane-change manoeuvre

Rearward Amplification

Measure of the degree to which the lateral acceleration of the lead unit is amplified in the trailing units in the prescribed lane change manoeuvre and is important in determining the likelihood of rearmost trailer rollover

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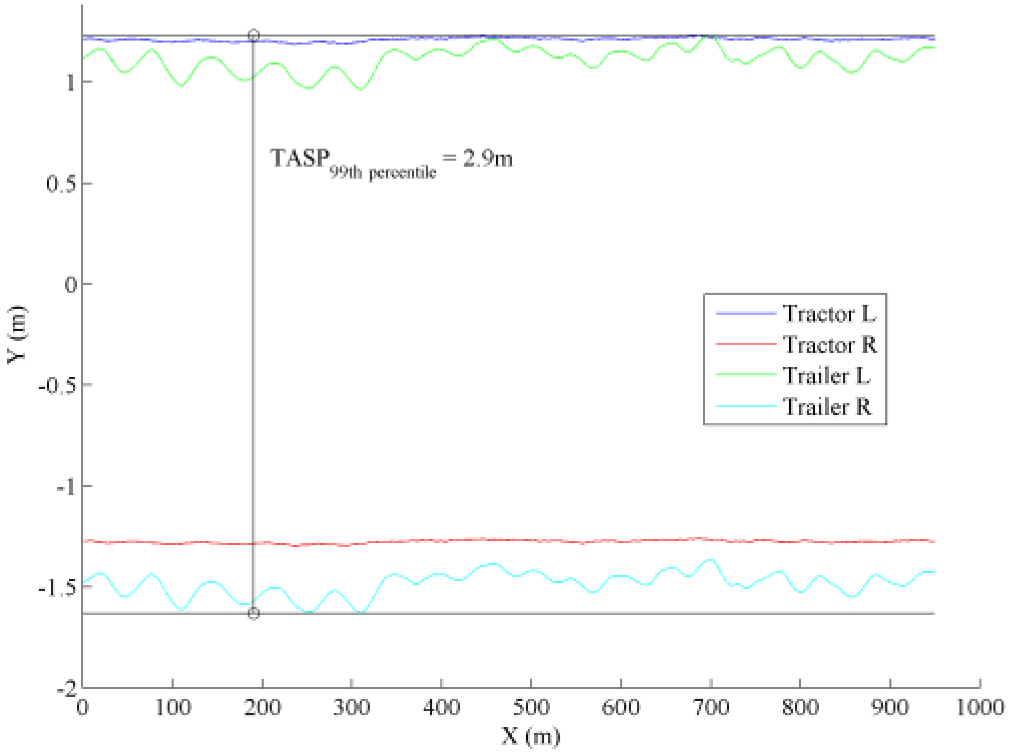
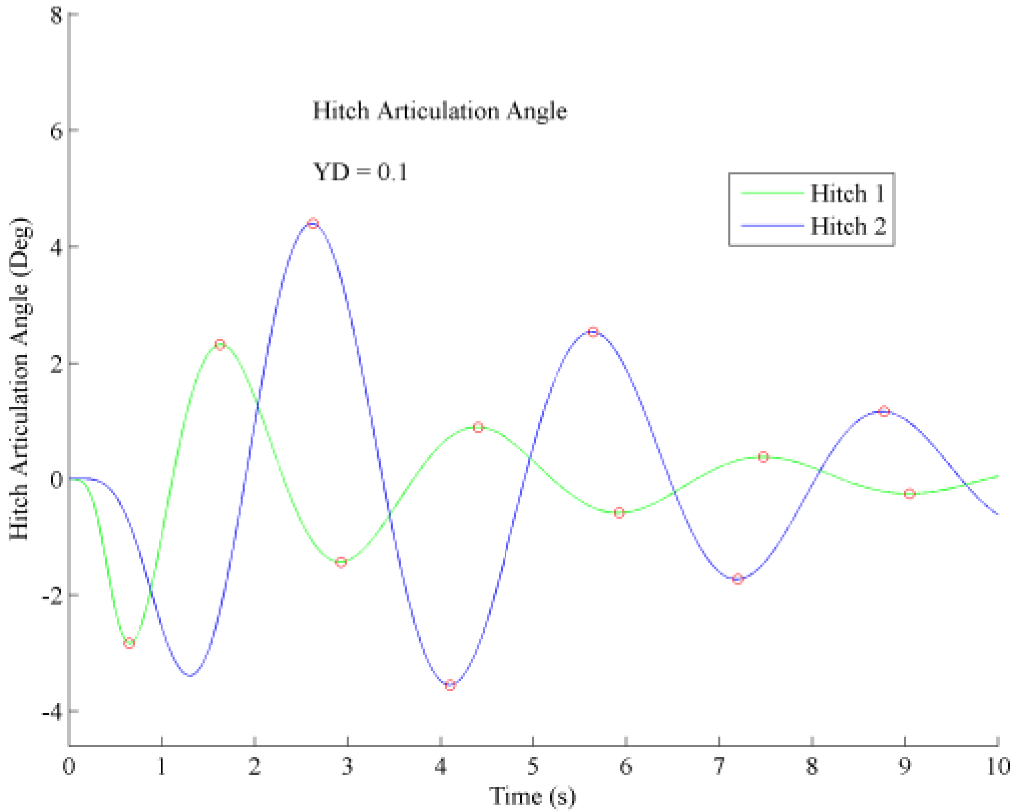
Tracking Ability on a Straight Path

Total width of road used by a vehicle when travelling at high-speed along a straight road with an uneven and cross-sloping surface



Yaw Damping

Rate at which yaw oscillations or "snaking" decay after a severe steering input at high speed



PBS Levels

	Required performance			
Load condition:	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Startability (%)	≥ 15%	≥ 12%	≥ 10%	≥ 5%
Gradeability A (Maintain motion) (%)	≥ 20%	≥ 15%	≥ 12%	≥ 8%
Gradeability B (Maintain speed) (km/h)	≥ 80 km/h	≥ 70 km/h	≥ 70 km/h	≥ 60 km/h
Acceleration Capability (s)	≤ 20.0 s	≤ 23.0 s	≤ 26.0 s	≤ 29.0 s
Tracking Ability on a Straight Path (m)	≤ 2.9 m	≤ 3.0 m	≤ 3.1 m	≤ 3.3 m
Low Speed Swept Path (m)	≤ 7.4 m	≤ 8.7 m	≤ 10.6 m	≤ 13.7 m
Frontal Swing (m)	≤ 0.7 m			
Difference of Maxima (m)	≤ 0.20 m			
Maximum of Difference (m)	≤ 0.40 m			
Tail Swing (m)	≤ 0.30 m	≤ 0.35 m	≤ 0.35 m	≤ 0.50 m
Steer-Tyre Friction Demand (%)	≤ 80%			
Static Rollover Threshold (g)	≥ 0.35·g			
Rearward Amplification	≤ 5.7·SRT_rrcu*			
High-Speed Transient Offtracking (m)	≤ 0.6 m	≤ 0.8 m	≤ 1.0 m	≤ 1.2 m
Yaw Damping Coefficient @ 100 km/h	≥ 0.15			

The South African Breweries Limited

Distribution Services

Vehicle Standards & Systems Summit towards Safe Roads in South Africa

SAB PBS Project

Author/s: Rob Noble

Date / version:

Introduction to the SAB PBS Project

The operation of a PBS fleet yields significant financial, road safety, roads wear and environmental benefits when compared to the current legislated heavy truck and trailer combination

Self Regulation processes enabled by the Road Traffic Management Systems (RTMS)

Safer Truck and Trailer Designs

Fewer vehicle combinations required to transport equivalent amount of product

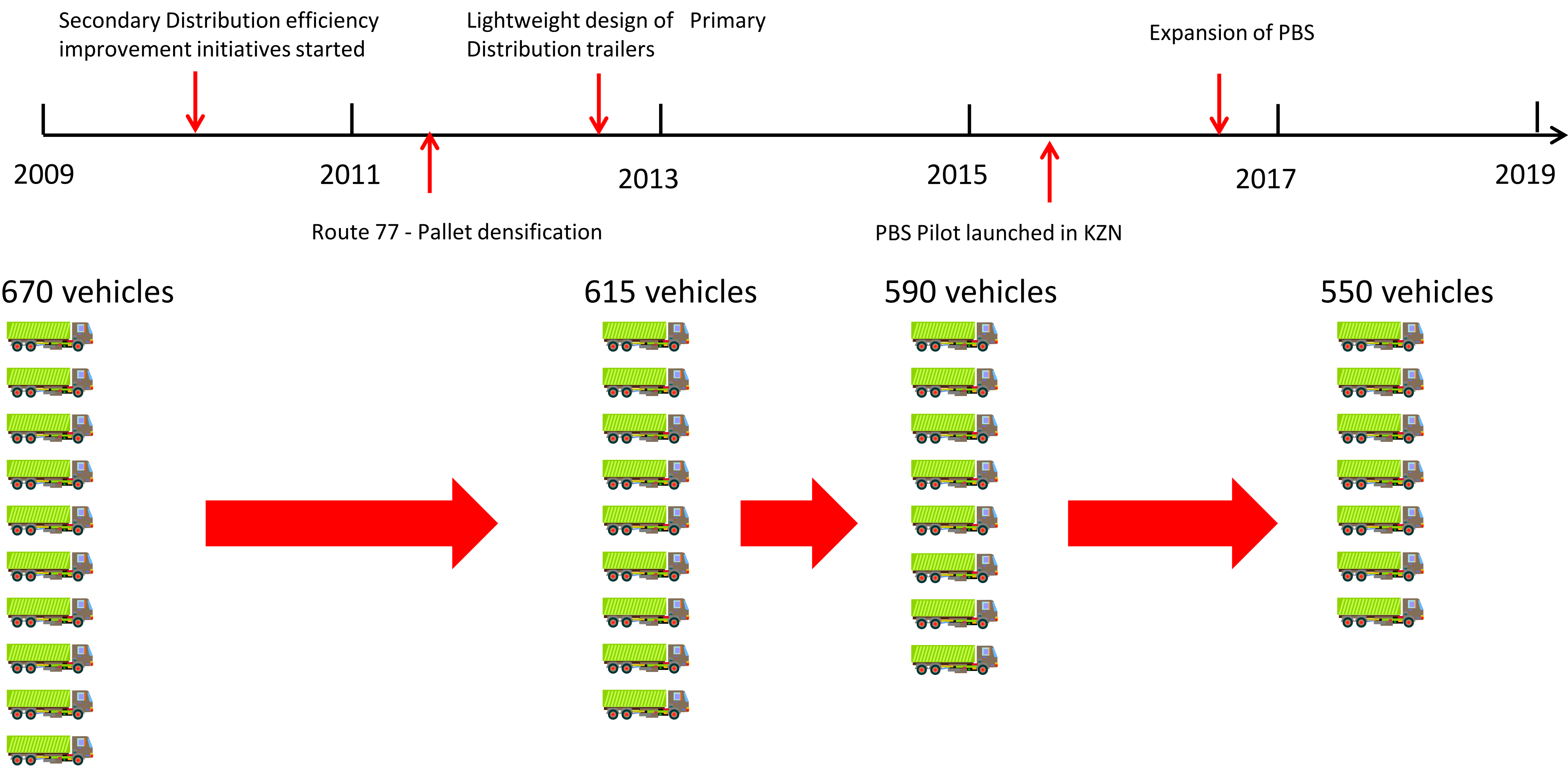
A reduction in road wear and road damage

Reduction in total CO_2 emissions

Supports the UNDA

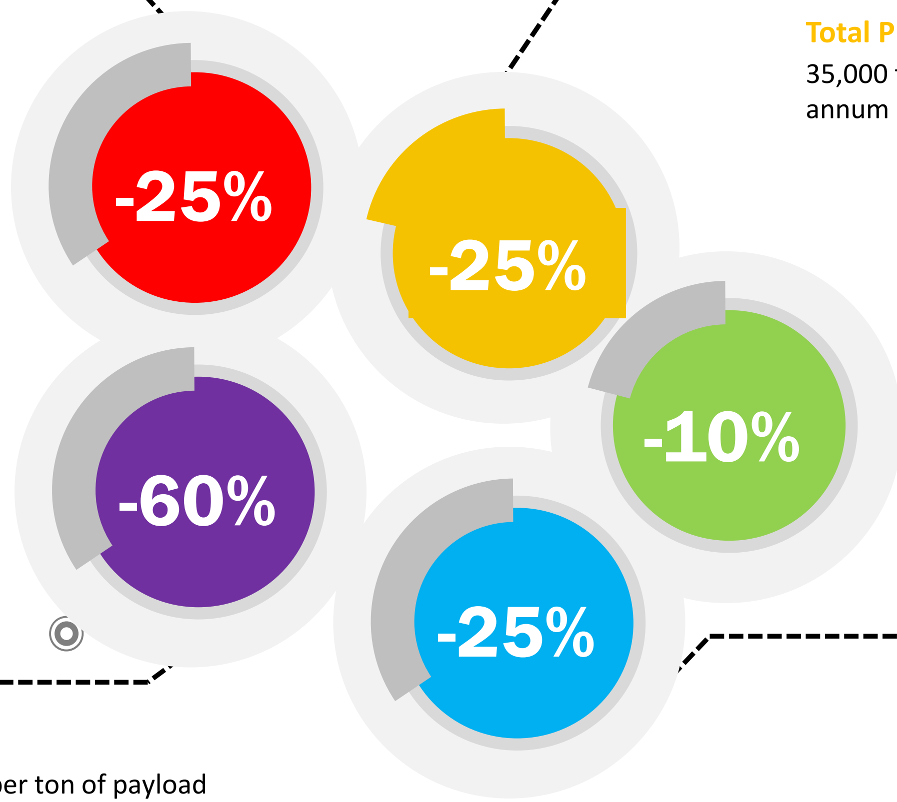
By incorporating RTMS, a safer truck and more advanced heavy vehicle and reducing the number of vehicles on the roads, PBS directly supports the UNDA of reducing road fatalities

SAB has implemented multiple initiatives to reduce the number of heavy vehicles operating on South African Roads. PBS is the next step that will allow further reduction in SAB vehicles operating on South African roads



Over the past 6 years, SAB has removed 80 heavy vehicles from operation on South African roads. The PBS Project will allow for another 40 vehicles to be removed

Moving from the current baseline fleet to the 40 pallet PBS fleet will result in a significant reduction in transport activity, which has a direct impact on reducing road congestion, improving road safety as well as reducing environmental impact



Number of PD trucks

40 fewer vehicles on the road

Total PD shipments

35,000 fewer shipments transported per annum

CO_2 emissions

A reduction in CO_2 emissions of 5,000 tons/annum

Road Wear Impact

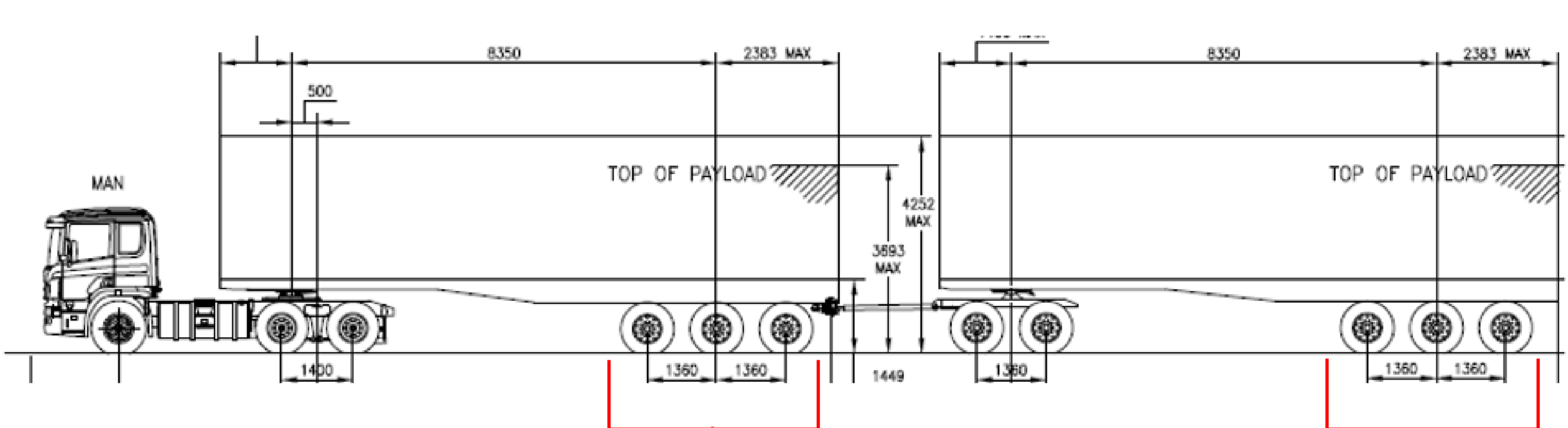
60% less road wear impact per ton of payload

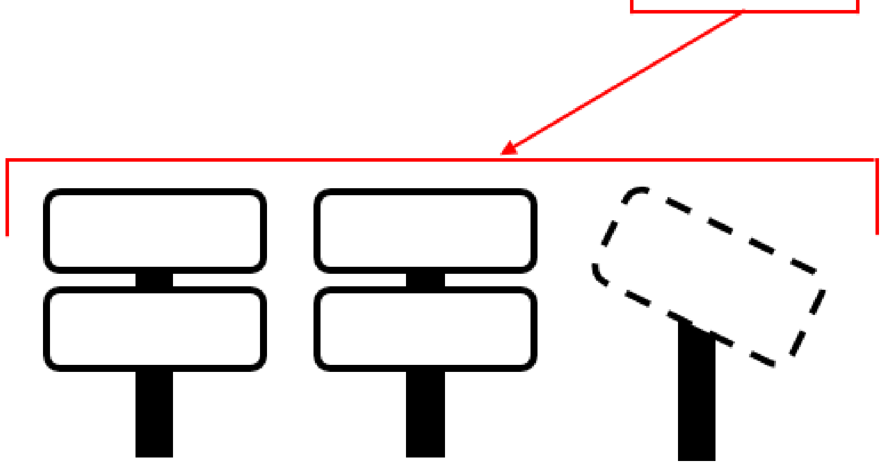
KM Travelled

12,3million fewer KM/annum

Engagement with companies currently involved in PBS operations shows the real world extraction of safety and environmental benefits are substantial

The SAB PBS trailer is fitted with steering axles which allows for improved low speed turning performance





Self steering axle with single tyre

- A reactive steering system – no forced input is required
- The self steering axle follows the curve radius of the truck path and has a turning angle of 12°
- Minimum required ratio of fixed axles to steering axles is 1:1

The PBS combination has a low speed swept path that is equal to that of the current 22m baseline combination

Preparation for on-road PBS operations

PBS Training Overview

Step	Description	Content
1.	**Driver Selection process prior to attending formal training**	• Drivers must have at least 5 years experience driving heavy motor vehicles • Drivers must have a clear criminal record • Foreign drivers must be in compliance with the relevant South African legislation • Drivers must have a fit for work medical assessment status which includes the below tests *i) Vital Indicators (blood pressure, pulse, body temperature)* *ii) Vision* *iii) Test for Diabetes (blood Gluclose)* *iv) Audiometery* *v) Lung function* *vi) Cholesterol* *vii) Drug test including Cannabis*
2.	**Driver Formal Training program**	• Drivers selected to drive PBS will attend the formal YONKE driver training program • 3 day theoretical classroom sessions which covers: *i) Road Safety and defensive driving skills* *ii) PBS specifics regarding the actual vehicle combination as well as the legal requirements* *iii) Depot process changes regarding additional SAB licensing changes* *iv) Post classroom session assessment to gauge competency* • 5 day Practical sessions which covers: *i) In the yard training* *ii) Post yard training assessment to gauge competency* *iii) On the Road training operating a PBS vehicle* *iv) Final on the road assessment to gauge competency*
3.	**Driver qualification**	• Post the driver training program, successful drivers will be eleigible to operate a PBS vehicle • Drivers will receive a certificate of competency from YONKE • Drivers will also be issued a PBS drivers license card which will be required to be presented at the SAB sites to validate that a PBS vehicle is being operated by an accredited driver

Components of Training Program

This SAB PBS Driver Training Program is **CETA** Accredited

3 Days Classroom Theoretical session

- **Workbooks printed and issued**
- **Discussion forums**
- **Group assignments**
- **PBS specifics detailed**

TRAINING PROGRAMME

- Road Traffic Legislation (Introduction – basis of all road behaviour)
- Introduction to PBS (PBS commandments)
- SAB Site refresher
- Vehicles – PBS Vehicle specific trucks and models
- Vehicle Maintenance and Inspections – including PBS vehicle specific requirements
- Definitions of defensive driving
- Identification of road accident factors
- Road Accidents and Human Errors
- Driver Attitudes and Behaviors
- Speed – Accepted limits
- PBS – speed requirements
- Adapting to different driving conditions
- Review of PBS routes and identified risks
- Review of PBS sites and identified risks
- Factors affecting concentration
- Hazard Identification
- Observation skills
- Collision Prevention
- Prevention of vehicle roll over
- Safe Following Distance
- PBS minimum following distances
- Escape Routes
- Hijack prevention
- Importance of seatbelts
- Effective eye lead time
- Fatigue Management
- PBS Driving hours – single and double drivers
- Economic Driving patterns
- Cargo Securement

Theoretical Assessments

- **PBS Specific questionnaire**
- **Generic tests on Defensive driving, traffic act, safety & fatigue…**

Components of Training Program

5 Days Practical Training

In the Yard Session

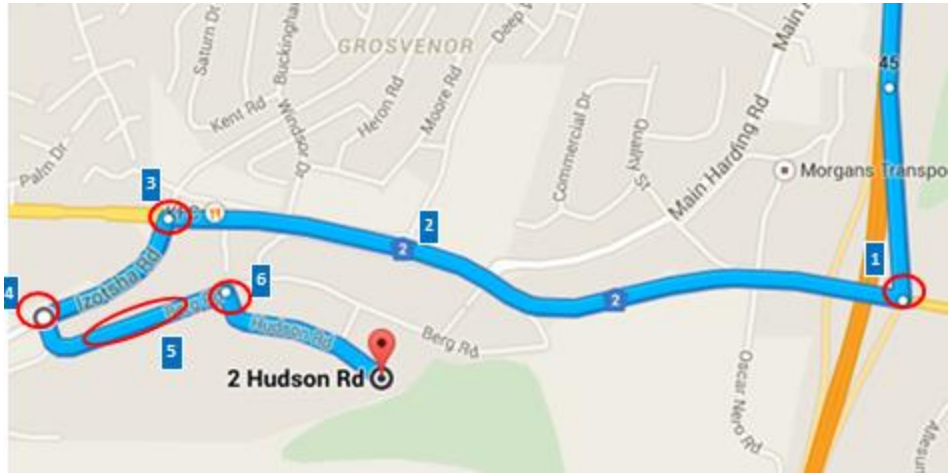
- 1.5 days
- Physical engagement with PBS vehicle
- Breakdown of "new" components
- Pre-trip inspections
- Driving course designed
  - 90 degree turning
  - Straightening
  - U-Turns
  - Reversing
- Yard Assessment conducted

On the Road Session

- 3.5 days
- Formative and Summative assessments
- Full beer loads

Driver Awarded SAB PBS License

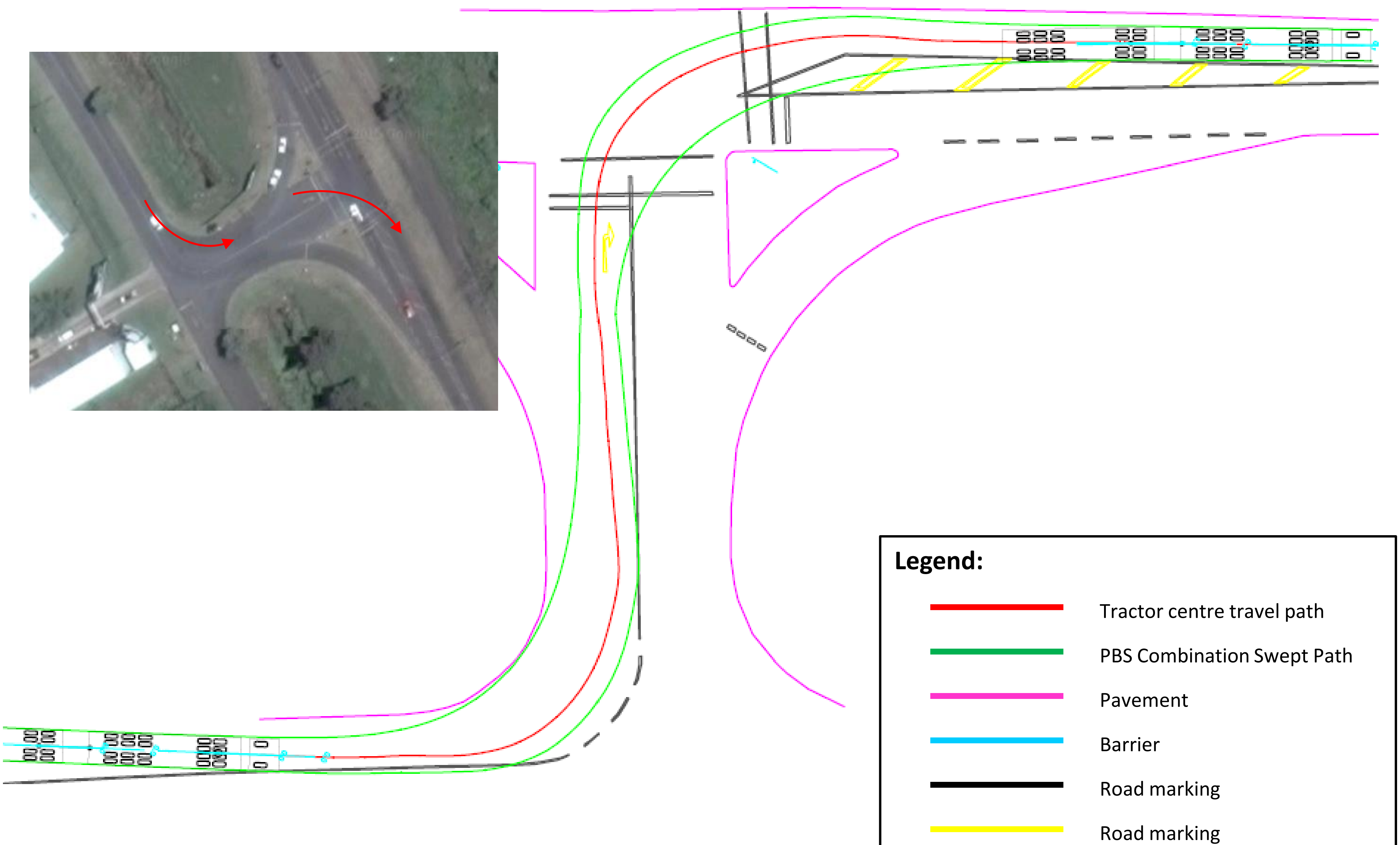
Comprehensive route risk assessments are conducted for all proposed PBS routes to ensure all potential hazards have been identified and that any necessary mitigation measures are developed



All intersections on proposed PBS routes are scanned to generated 3D images used to simulate the PBS combination's turning performance.

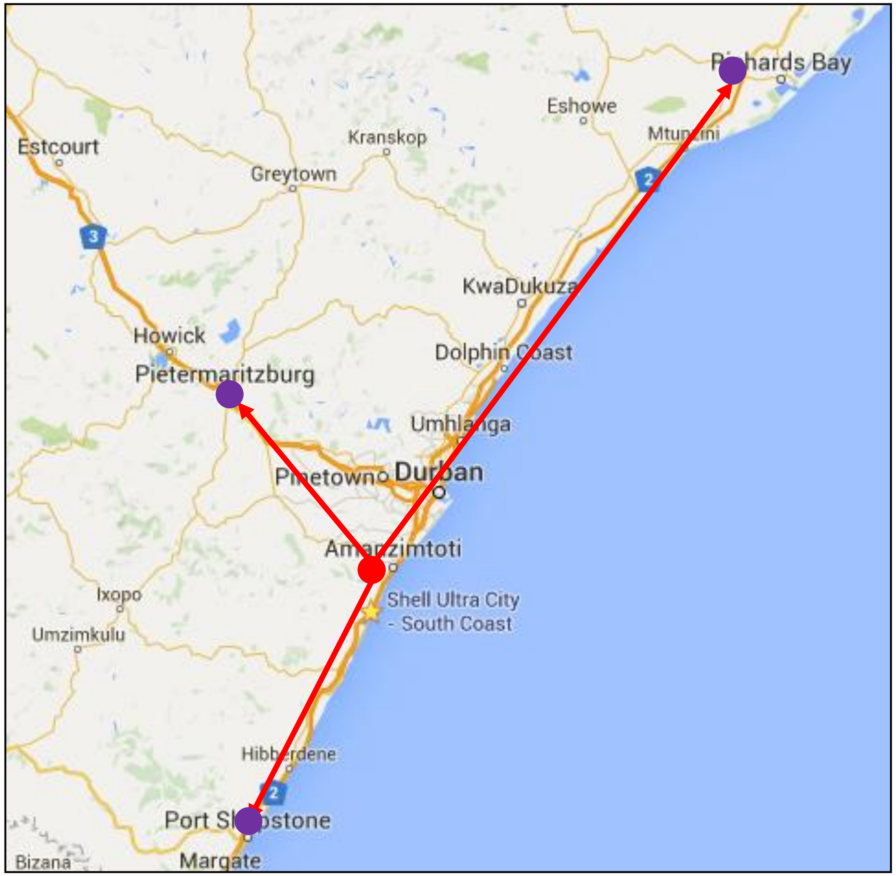
Vehicle Swept Path Simulation conducted for SAB 40 pallet PBS combination

SAB Prospecton Depot to SAB Pietermaritzburg Depot:
Brayford Road into Camps Drift Road



SAB PBS Pilot

The SAB PBS combination has been operating in KZN since March 2016 on routes from Prospecton to Empangeni, Port Shepstone and Pietermaritzburg



Lessons learnt so far

Pre-work is key to a successful roll out

- Route assessments
- Driver training

Partnering with the Provincial DoT on route selection is key

- Trial runs to ensure best routes are selected and give Provincial DoT piece of mind

A truck with greater HP does not necessarily yield better travel time

- PBS combinations are delivering the same travel times as baseline with 480HP truck-tractors, even on routes with steep gradients

Vehicle Standards & Systems Summit towards Safe Roads in South Africa 2016

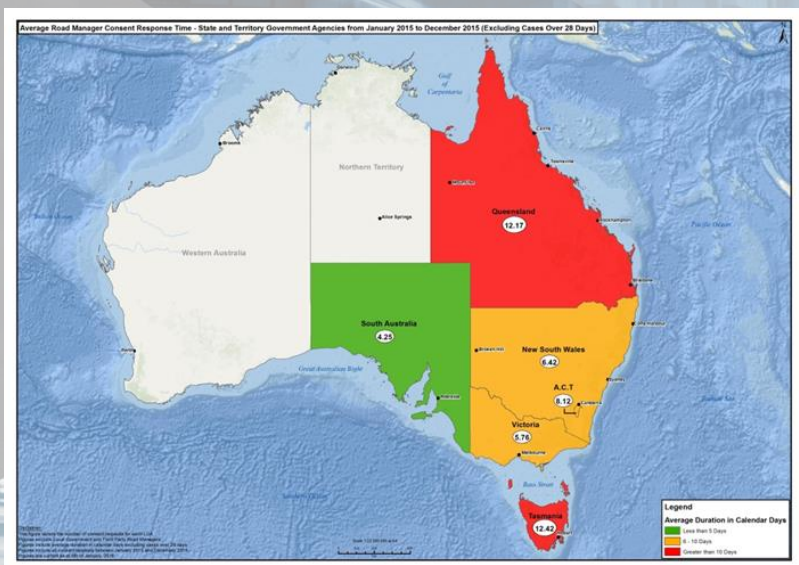
PBS legislation in Australia

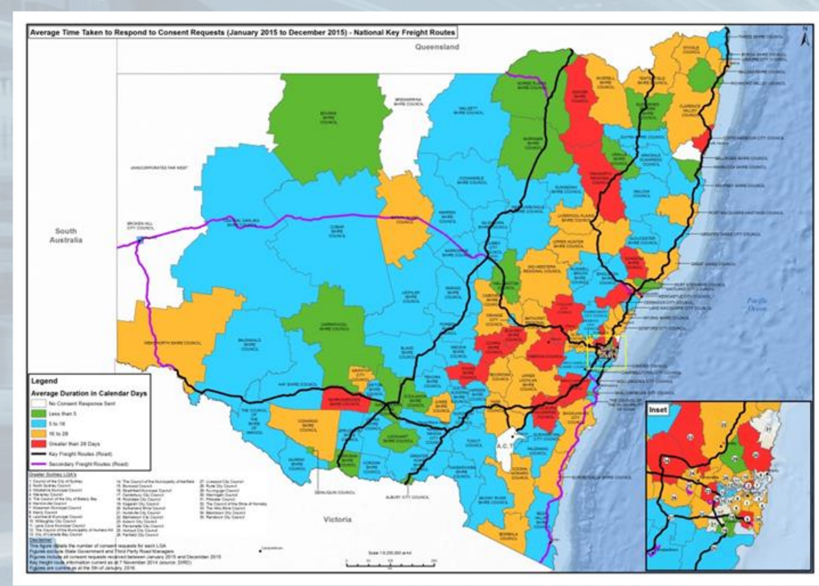
Dr Paul Nordengen – CSIR/Les Bruzsa – NHVR, Australia

pnordengen@csir.co.za

3 levels of Governments

- **Very complex regulatory and legal frameworks cover the design and operation of heavy vehicles in Australia**
- **Federal, state and local governments have different roles and responsibilities**





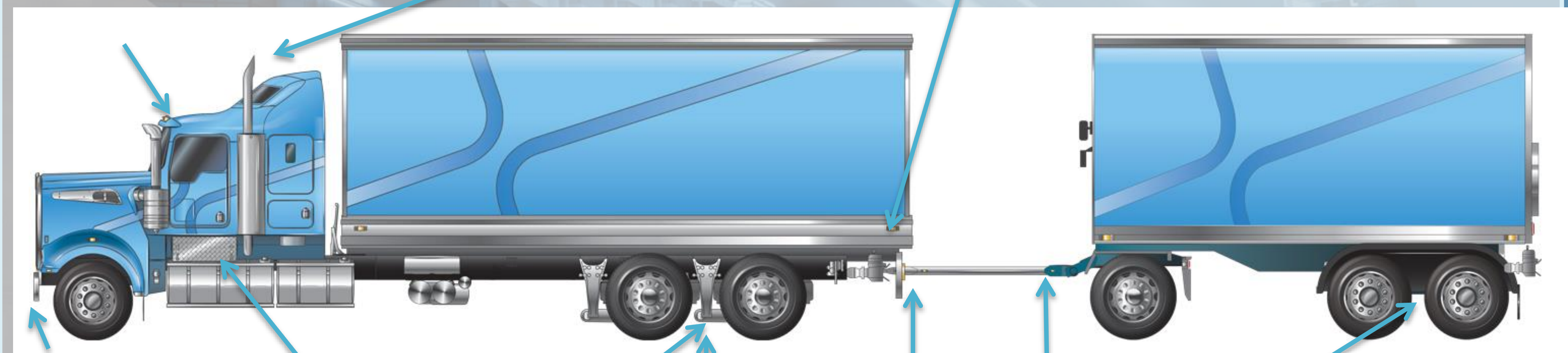
NHVR

Current Australian Design Rules (ADR)s

ADR3 *Seats and Seat anchorages*
ADR4 *Seatbelts*
ADR5 *Seatbelt anchorages*
ADR8 *Glazing*
ADR14 *Rear vision mirrors and devices*
ADR18 *Instrumentation*
ADR59 Roll over strength (buses)
ADR65 *Speed limiting*

ADR30 *Emission control*
ADR42 *Exhaust location*

ADRs 6, 13, 45, 46, 47, 48, 49, 50, 51, 52, 74, 75, 76, 77, 78 *Lamps*



ADR84 *Front underrun*

ADR35 Truck brakes

ADR38 *Trailer brakes and suspension*

ADR1 *Reversing lamps*

ADR62 *Couplings*

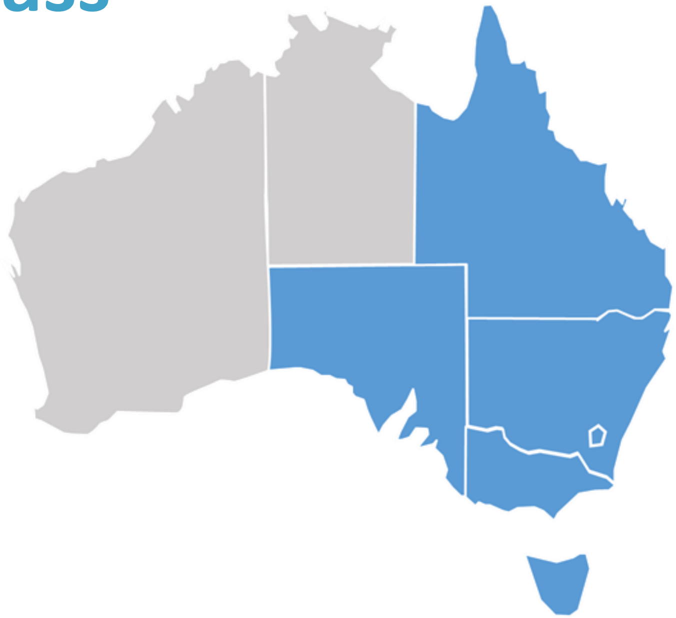
ADR42 *Bonnet latches, diesel engines, field of view, protrusions in the cabin, sleeper cabins, warning devices, windscreen wipers and washers, ventilation, visual display screens.*

ADR42 *Retractable axles and wheel guards*

Generally:
ADR43 Dimensions
ADR44 Specific purpose requirements
ADR58 Specific requirements for buses
ADR61 Marking
ADR63 Multi-combination trailers
ADR64 Multi-combination motor vehicles

About the NHVR

Australia's dedicated regulator for all vehicles over 4.5 tonnes gross vehicle mass



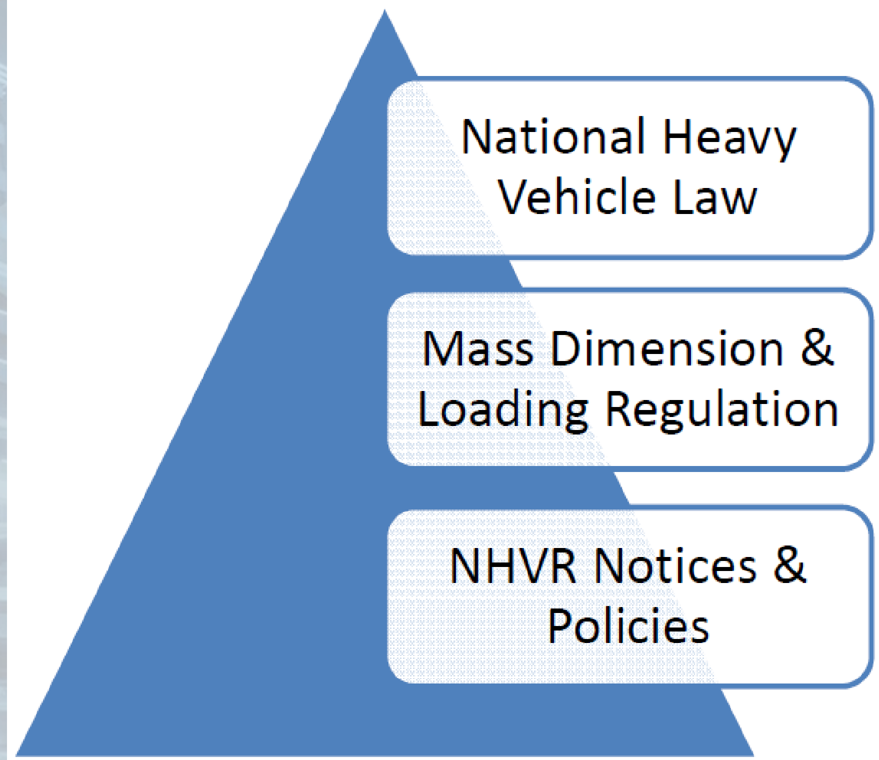
- Administer the National Heavy Vehicle Law (NHVL)
- Promote & improve public and heavy vehicle safety
- Manage impacts of heavy vehicles on environment, road infrastructure & public amenity
- Promote industry productivity & efficiency
- Encourage & promote productive, efficient, innovative & safe business practices
- Harmonise laws and policies

NHVR

Legislative instruments

AUDAX · AT · FIDELIS

Queensland



General freight and the law

Class 2	• Definition as per Sect 136 of the NHVL. • Power for NHVR to issue a permit under Sect 143 NHVL.
Class 3	• Definition as per Sect 116 of the NHVL. • Power for NHVL to issue a permit under Sect 122 of the NHVL.
Road Managers & Third Party Approvals	• Sect 155 of the NHVL requires NHVR to obtain the consent of the Road Managers. • Sect 157 of the NHVL details how NHVL must advise an applicant if third party approval is required.

Restricted access vehicles

- There are 3 classes of restricted access vehicles
  - Class 1 restricted access vehicles
    - Special Purpose Vehicles – cranes, concrete pumps
    - Oversize/Overmass (OSOM) load carrying vehicles (indivisible loads)
    - Agricultural vehicles and implements
  - Class 2 restricted access vehicles
    - B-doubles, B-triples, road trains,
    - PBS vehicles
  - Class 3 restricted access vehicles
    - Freight schemes, 50t truck and dog, spreader boxes etc.

NHVR

PBS and the legislation

- **Heavy Vehicle (General) National Regulation – sets the standards that all heavy vehicles must comply with and also prescribes what PBS vehicles must be met.**
- **Part 2 defines the process for determining an application for PBS Design Approvals or PBS Vehicle Approvals**

AUDAX · AT · FIDELIS

Queensland

Heavy Vehicle National Law Act 2012 (HVNL)

Chapter 1, Part 1.4 [Section 22] → PBS Design Approvals

Chapter 1, Part 1.4 [Section 23] → PBS Vehicle Approvals

Exemptions for PBS vehicles permitted under National Regulations

ADR 43

- clause 6.1 (Length)
- clause 6.2 (Rear overhang)
- clause 6.3 (Height)
- clause 6.5 (Width)
- clause 9.4 (Retractable axles)
- clause 9.5 (Retractable axles)

ADR 62/63

Tow coupling overhang and location

MDL Regulations

Length

- section 3 of Schedule 6 (general)
- section 4 of Schedule 6 (trailers)
- section 5 of Schedule 6 (rear overhang)
- section 6 of Schedule 6 (Trailer drawbars)

- section 7 of Schedule 6 (Width)
- section 8 of Schedule 6 (Height);

VS Regulations

Section 29(b&c) and Section 31 of Sch 3 - Coupling attachment and overhang

PBS process

Application	•Application submitted to the Regulator by an accredited PBS Assessor •Regulator checks application for completeness and validity
Sec Rec	•Regulator processes application, prepares a Sec Rec and submits it to the Panel
Review Panel	•Panel reviews the application and provides advice on the application to the Regulator
Design Approval	•Regulator issues a Design Approval or rejects the application
Certify	•Vehicle inspected against the Design Approval •Certificate issued and application submitted to the Regulator for Vehicle Approval
Vehicle Approval	•Regulator reviews the certification and issues Vehicle Approval
Access Permit	•Operator applies to the Regulator for Access permit •Regulator issues Access permit

PBS related responsibilities of the NHVR

- **Managing the PBS framework**
- **Assessment and approval of PBS applications**
- **Approval of PBS vehicle certifications and combinations**
- **Authorisation of PBS Assessors and PBS Certifiers**
- **One stop shop for PBS vehicle and access applications**
- **Facilitating access for PBS vehicles**
  - **PBS access decisions remain with the Road Managers**
- **Maintenance of PBS approvals**
- **Monitoring PBS operations**
  - **Compliance with PBS conditions**
  - **Demand for access**

NHVR

PBS and the Jurisdictions

- **Jurisdictions**
  - **Provide members to the PBS Performance Review Panel (PRP) to advise on PBS applications for design approvals**
  - **Advise what level of access a PBS heavy vehicle has on the road network, including any appropriate operating conditions**
  - **After PBS Vehicle has been built and certified, jurisdictions are responsible for registering the vehicle**

Role of local governments

- Local governments are formally recognised as road managers under the HVNL
- A road manager determines if restricted access vehicles can access their road network and the conditions under which they may operate.
- A road manager must give consideration to potential road infrastructure, public amenity and public safety impacts.
- A road manager must give reasons for decisions and must give consideration to guidelines for granting access.
- Road manager decisions are internally reviewable.

Questions?

Vehicle Standards & Systems Summit towards Safe Roads in South Africa 2016

PBS Infrastructure standards: Bridge and Road Wear Analyses

Dr Paul Nordengen – CSIR
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Introduction: Bridge analysis

- Prescriptive approach: Reg. 241, the "bridge formula" – very conservative in order to mitigate risks, in particular overloading
- TRH11: Table 3.1 (abnormal load bridge formula – less conservative, but has limitations
- Performance-based approach originally developed for All-terrain mobile cranes in 2010
- Same approach for PBS vehicles

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Structures Performance Standard

- Check PBS concept designs against the A/L bridge formula – minimum required factor of safety, FoS = 35%
- Compare maximum bending moments and shear forces generated the by the proposed PBS vehicle with those of a reference bridge design load (NA + NB30) from the SA Bridge Design Code

transport

Department:
Transport
REPUBLIC OF SOUTH AFRICA

TRH 11

DIMENSIONAL AND MASS LIMITATIONS AND OTHER REQUIREMENTS FOR ABNORMAL LOAD VEHICLES

8th Edition

March 2010
Revision 1

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Shortcomings of Table 3.1, TRH11

Table 3.1: Limitations on the Maximum Allowable Mass (in kg) of Multi Axle Groups imposed by Bridges and Culverts

Distance between extreme axles (m)	Effective width (m)													Tracking required
	3,5	3,6	3,7	3,8	3,9	4,0	4,1	4,2	4,3	4,4	4,5	4,6	4,7	
1,2	30070	30920	31780	32640	33500	34360	35220	36080	36940	37800	38660	39510	40370	30950
1,5	31590	32490	33390	34300	35200	36100	37000	37910	38810	39710	40610	41520	42420	33700
1,8	33110	34060	35000	35950	36890	37840	38790	39730	40680	41620	42570	43520	44460	36300
2,1	34630	35620	36610	37600	38590	39580	40570	41560	42550	43540	44530	45520	46510	38750
2,4	36160	37190	38220	39250	40290	41320	42350	43390	44420	45450	46490	47520	48550	41300
2,7	37680	38750	39830	40910	41980	43060	44140	45210	46290	47370	48440	49520	50600	43100
3,0	39200	40320	41440	42560	43680	44800	45920	47040	48160	49280	50400	51520	52640	45100
3,3	40720	41890	43050	44210	45380	46540	47700	48870	50030	51190	52360	53520	54680	46900
3,6	42250	43450	44660	45870	47070	48280	49490	50690	51900	53110	54320	55520	56730	48550
3,9	43770	45020	46270	47520	48770	50020	51270	52520	53770	55020	56270	57520	58770	50050
4,2	45290	46580	47880	49170	50470	51760	53050	54350	55640	56940	58230	59520	60820	51800
4,5	46810	48150	49490	50830	52160	53500	54840	56180	57510	58850	60190	61530	62860	52600
4,8	48340	49720	51100	52480	53860	55240	56620	58000	59380	60760	62150	63530	64910	53600
5,1	49860	51280	52710	54130	55560	56980	58400	59830	61250	62680	64100	65530	66950	54500
5,4	51380	52850	54320	55780	57250	58720	60190	61660	63120	64590	66060	67530	69000	55200
5,7	52900	54410	55930	57440	58950	60460	61970	63480	64990	66510	68020	69530	71040	55800
6,0	54430	55980	57540	59090	60650	62200	63760	65310	66870	68420	69980	71530	73090	56200

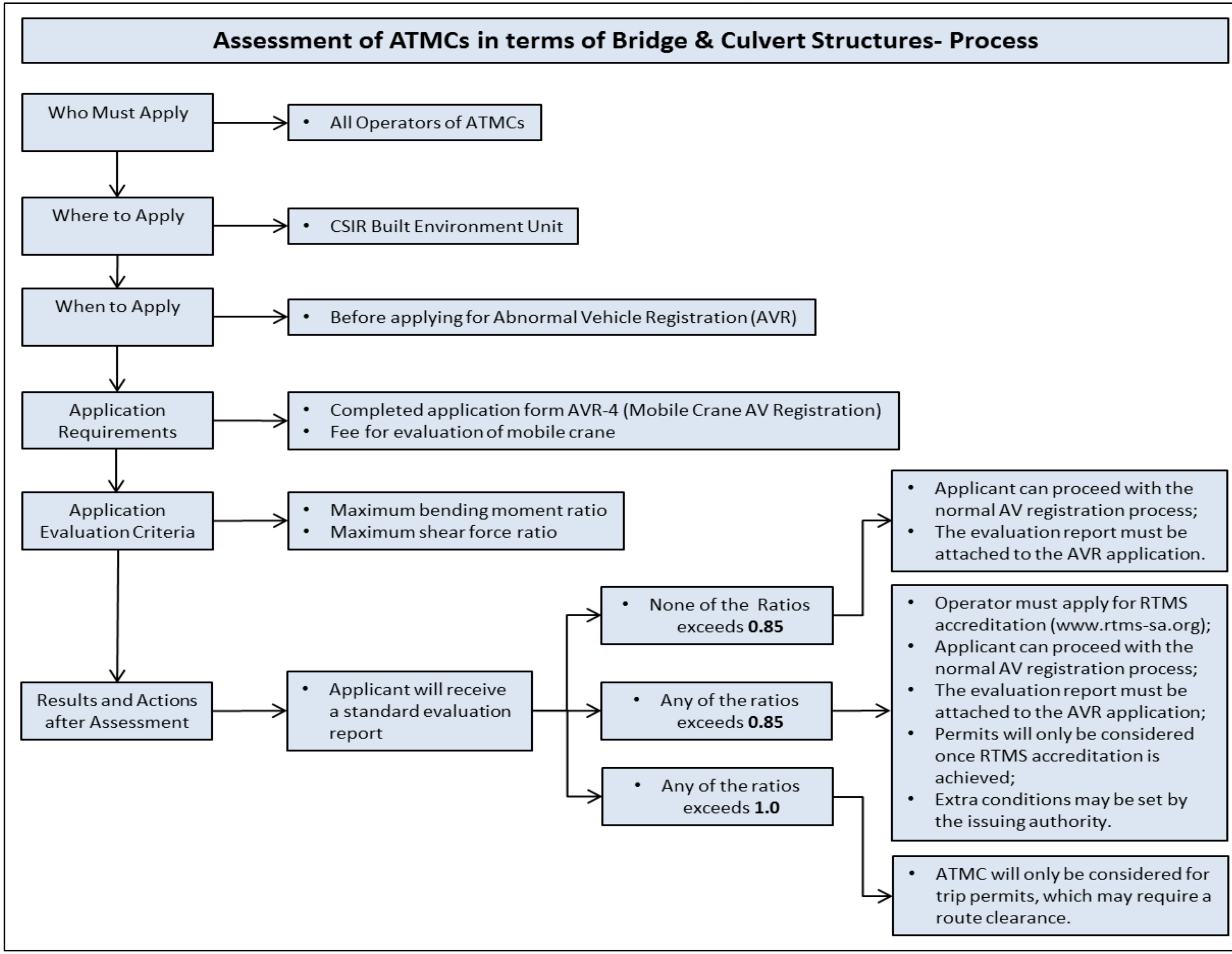
i) Values are based on the formula: **Allowable Mass (kg) = EW x (6,850 + 0,00145 x distance between extreme axles)** where EW, the effective width, and the distance between extreme axles are in mm (values are rounded to the nearest 10 kg).

ii) Interpolation is permitted but not extrapolation.

iii) Where loads exceed the maximum unrestricted values given in the last column, vehicles will be subject to special tracking requirements and structures will be temporarily closed to other road users. This applies to all values to the right of the heavy stepped line in the table.

Methodology for Mobile Crane registrations

Approved Assessment Process



Methodology for Mobile Crane registrations

Mobile Crane Classification

- None of the Ratios exceeds **0.85**

- Applicant can proceed with the normal AV registration process;
- The evaluation report must be attached to the AVR application.

Safe

- Any of the ratios exceeds **0.85**

- Operator must apply for RTMS accreditation (www.rtms-sa.org);
- Applicant can proceed with the normal AV registration process;
- The evaluation report must be attached to the AVR application;
- Permits will only be considered once RTMS accreditation is achieved;
- Extra conditions may be set by the issuing authority.

Warning

- Any of the ratios exceeds **1.0**

- ATMC will only be considered for trip permits, which may require a route clearance.

Critical

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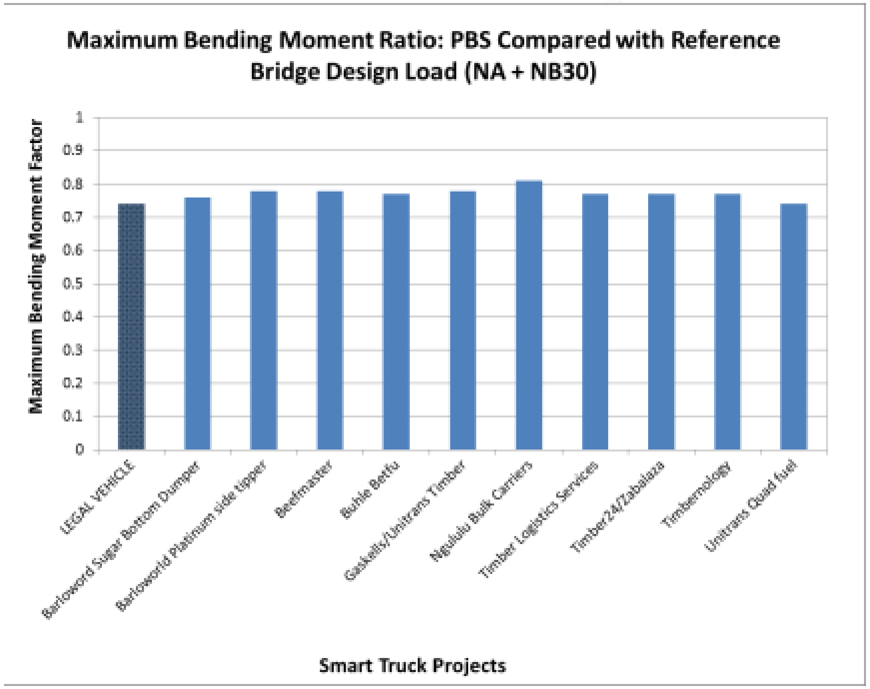
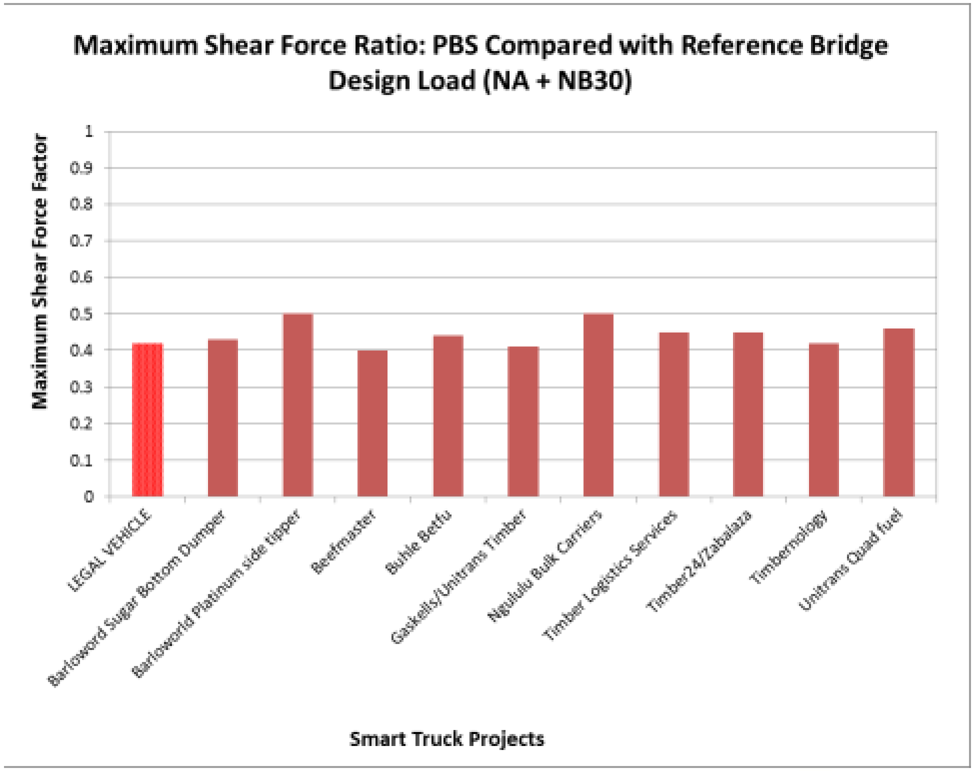
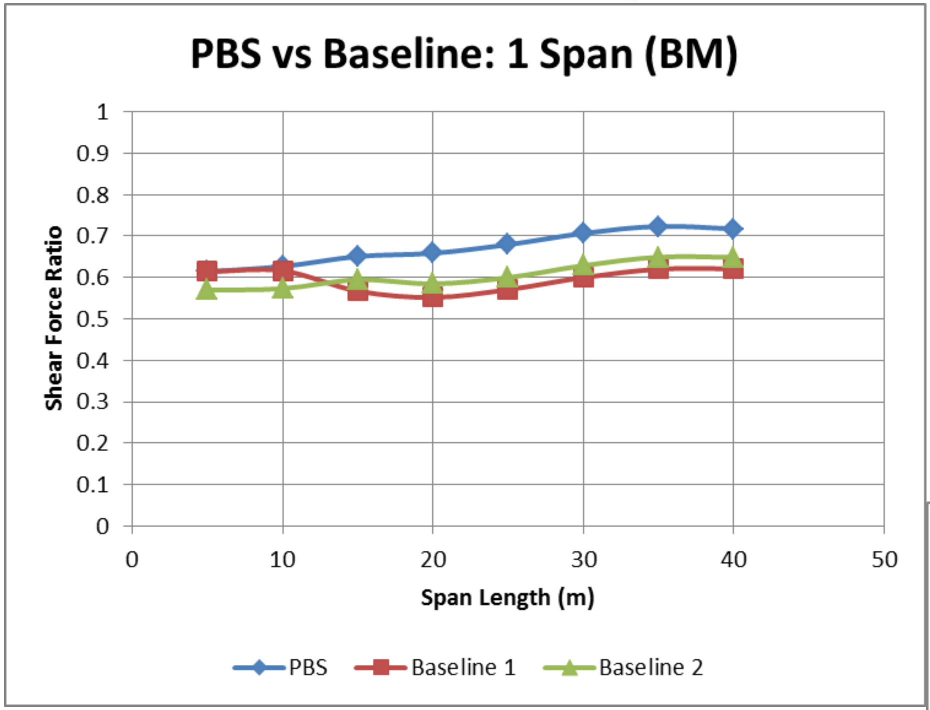
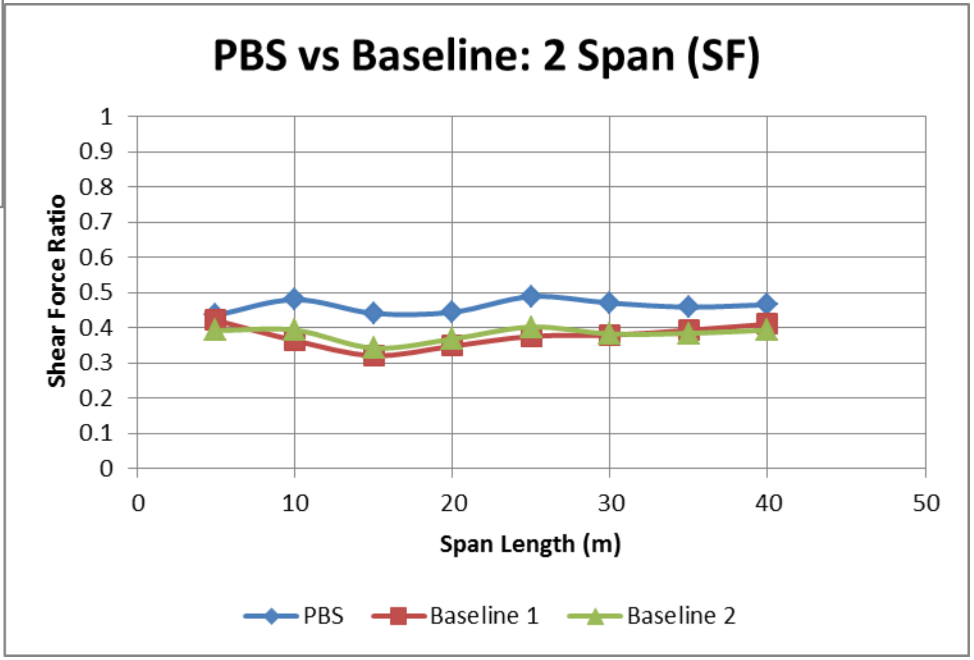
Structures Performance Standard



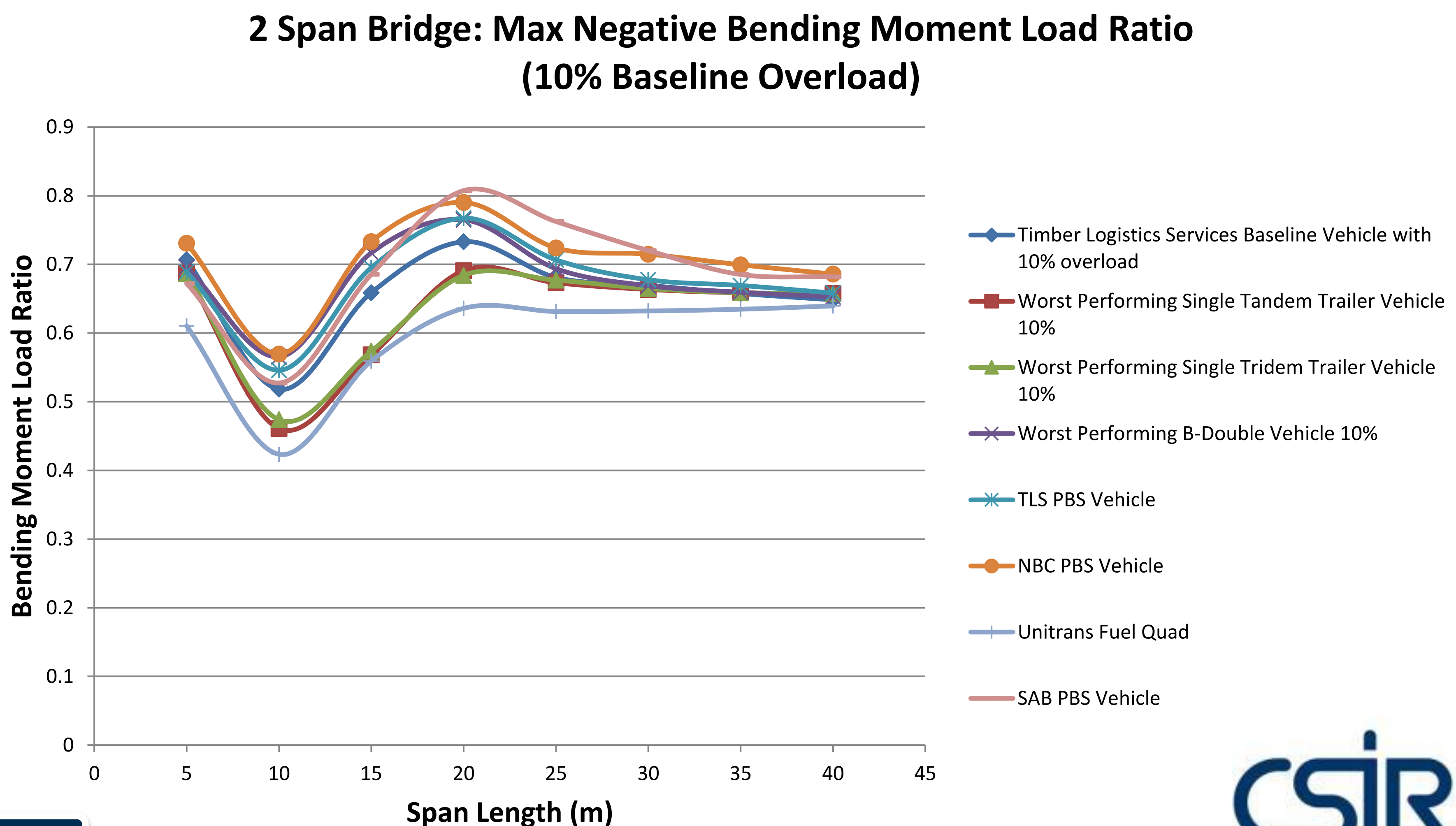


Structures Performance Standard





Structures Performance Standard



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Road Wear Analysis

- Assessment based on the SA Mechanistic Empirical Pavement Design Method (TRH14)
- Based on determining a Load Equivalency Factor (LEF) for the vehicle
- LEF expresses road wear as a factor of standard axles to impart the same damage
- Eight common SA pavements analysed

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The Eight Pavements

Pavement A: ES100

Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II	Phase III
50 AG*	0.44	2000	2000	1500
150 G1*	0.35	450	450	350
150 C3*	0.35	2000	2000	500
150 C3	0.35	1500	550	250
SUBGRADE	0.35	180	180	180

Pavement B: ES100

Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II	Phase III
50 AG*	0.44	2000	1800	1500
150 G 1*	0.35	250	250	240
150 C3*	0.35	2000	1700	160
150 C3	0.35	1500	120	110
SUBGRADE	0.35	90	90	90

Pavement C: ES0.1

Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II
S*	0.44	1000	1000
100 G4*	0.35	300	225
125 C4*	0.35	1000	200
SUBGRADE	0.35	140	140
	-	-	-

Pavement D: ES0.1

Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II
S*	0.44	1000	1000
100 G4*	0.35	200	180
125 C4*	0.35	1000	120
SUBGRADE	0.35	70	70
	-	-	-

Pavement E: ES30/ES50

Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II	Phase III
40 AG*	0.44	2500	2500	1600
120 BC*	0.44	3500	3500	1500
450 C3*	0.35	2200	1000	300
200 G7*	0.35	300	300	200
SUBGRADE	0.35	150	150	140

Pavement F: ES1.0

Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II
S*	0.44	2000	1600
80 BC*	0.44	2000	1600
150 C4*	0.35	1000	300
SUBGRADE	0.35	140	140
	-	-	-

Pavement G: ES10

Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II	Phase III
30 AG*	0.44	2400	2000	1600
150 C3*	0.35	2000	1800	250
300 C4*	0.35	1000	300	100
SUBGRADE	0.35	180	140	100
	-	-	-	-

Pavement H: ES0.3

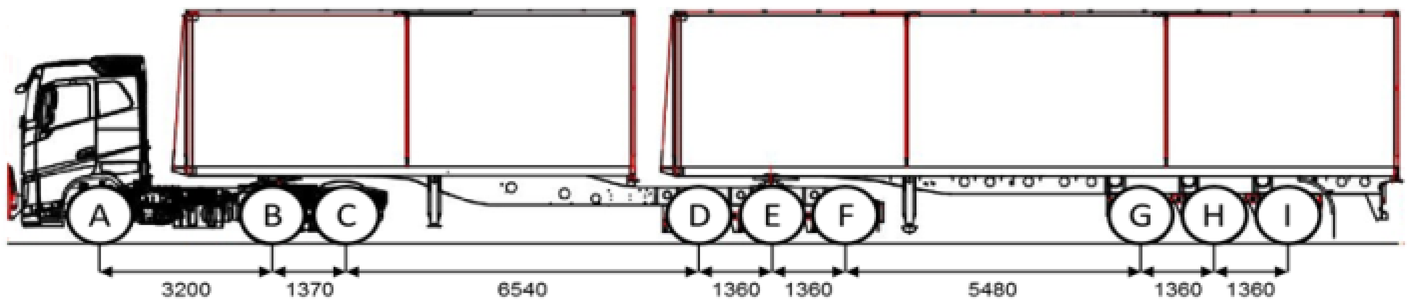
Layer	Poisson's Ratio	Elastic Moduli (MPa) Phase I	Phase II	Phase III
S1*	0.44	2000	1000	200
100 C4*	0.35	2000	1500	100
100 C4*	0.35	1000	300	100
SUBGRADE	0.35	140	140	100
	-	-	-	-

* Classification according to TRH 14 (CSRA, 1985)

8 Pavement structures-1.ppt

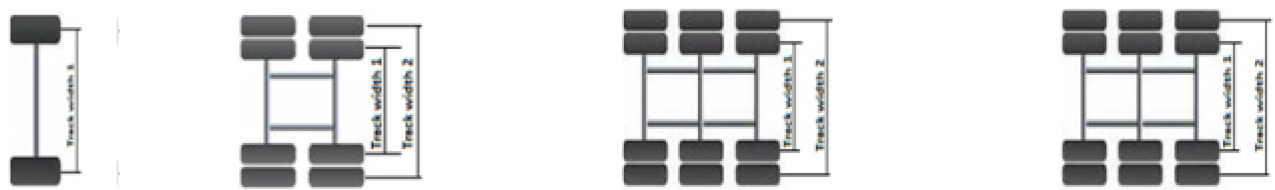
Vehicle Input Data – PBS Combination

Combination
Tare mass (kg) 19 572
Payload (all axle groups) (kg) 52 710
Rated Payload (kg) 49 500
Total Mass (kg) 72 282



Tare mass (kg)		5 662		3 920		4990		5000
Payload (kg)		1 928		13 056		18901		18825
Total mass (kg)		7 590		16 976		23891		23825

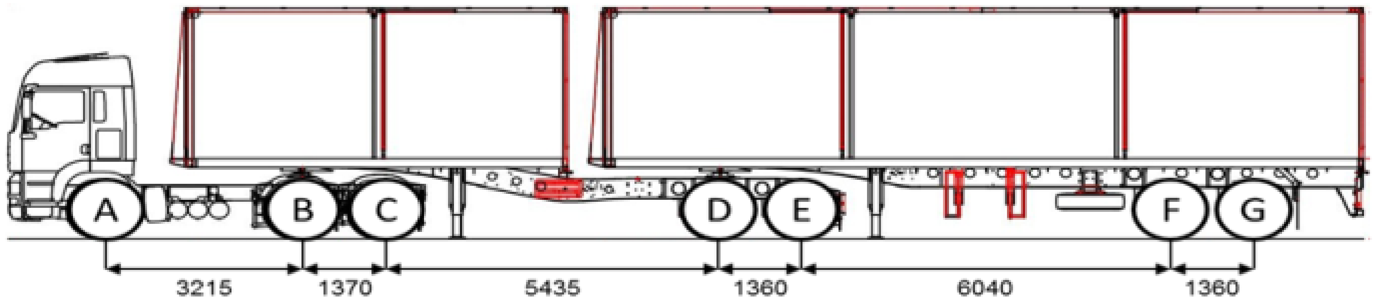
Tyre size		385/65R22.5		315/80R22.5		315/80R22.5		315/80R22.5
Single/Dual		Single		Dual		Dual		Dual



Track width 1 (mm)		2 035		1 494		1568		1568
Track width 2 (mm)				2 174		2272		2272

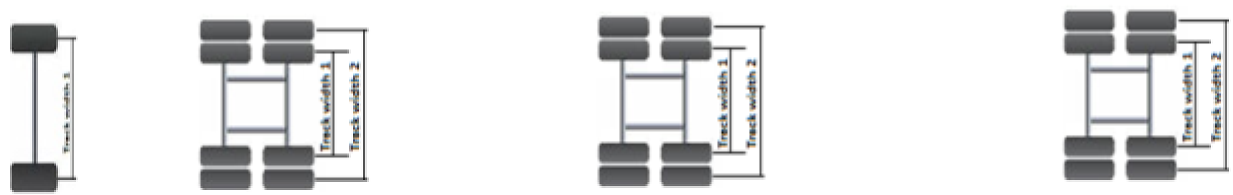
Vehicle Input Data - Baseline

Combination
Tare mass (kg)
16 690
Payload (all axle groups) (kg)
39 310
Rated Payload (kg)
36 200
Total Mass (kg)
56 000



Tare mass (kg)		5 500		4 000		3260		3930
Payload (kg)		1 350		11 850		13440		12670
Total mass (kg)		6 850		15 850		16700		16600

Tyre size		385/65R22.5		315/80R22.5		12R22.5		12R22.5
Single/Dual		Single		Dual		Dual		Dual



Track width 1 (mm)		2 041		1 454		1586		1586
Track width 2 (mm)				2 154		2254		2254

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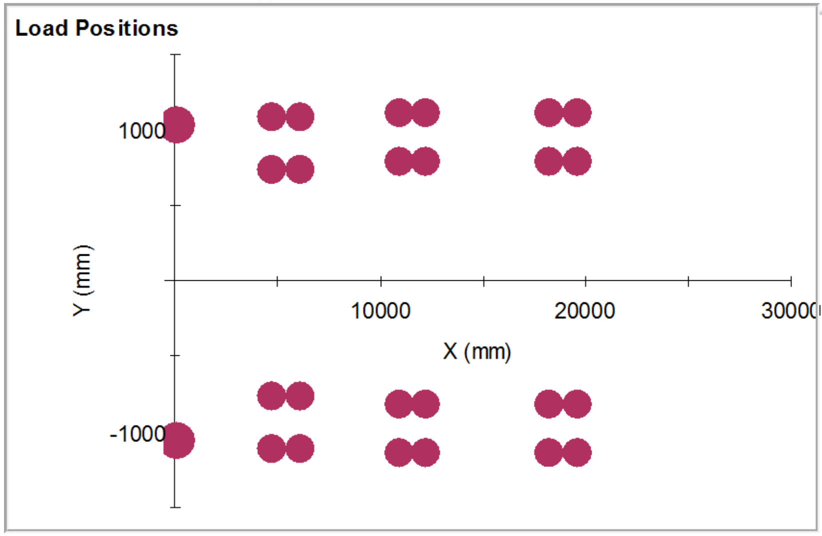
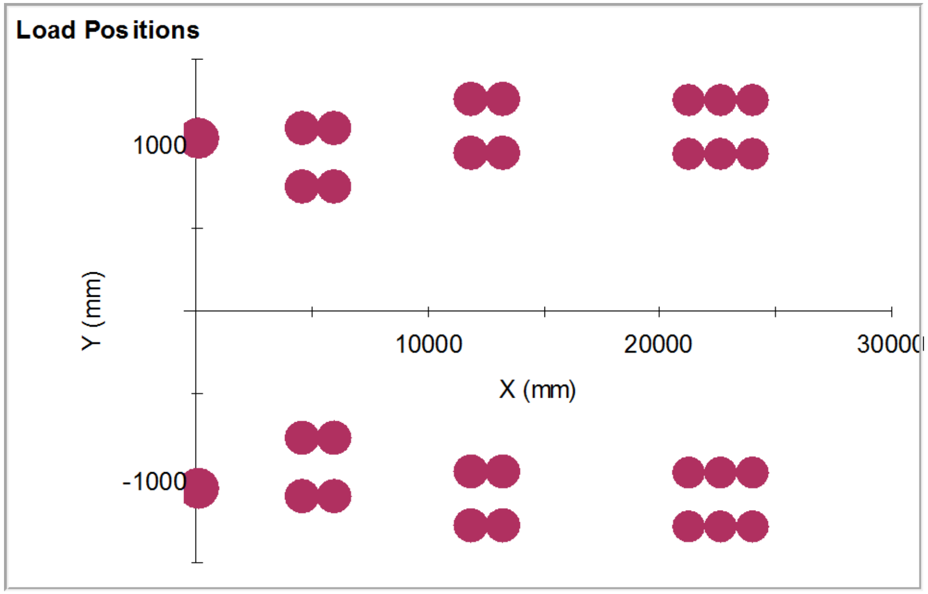
Vehicle Input Data





Outputs of mePADS

Payload

Baseline combination: 36 200 kg

PBS combination: 49 500 kg

Pavement	LEF/1 000kg payload		Difference:
	Baseline	PBS	Baseline vs PBS
Pavement A ES100	0.13	0.11	-15.6%
Pavement B ES100	0.12	0.10	-14.6%
Pavement C ES0.1	0.16	0.14	-11.0%
Pavement D ES0.1	0.27	0.28	2.7%
Pavement E ES30	0.18	0.17	-7.5%
Pavement F ES1.0	0.14	0.12	-12.0%
Pavement G ES10	0.19	0.18	-9.3%
Pavement H ES0.3	0.20	0.18	-10.0%
Average for all pavements	**0.17**	**0.16**	**-7.5%**

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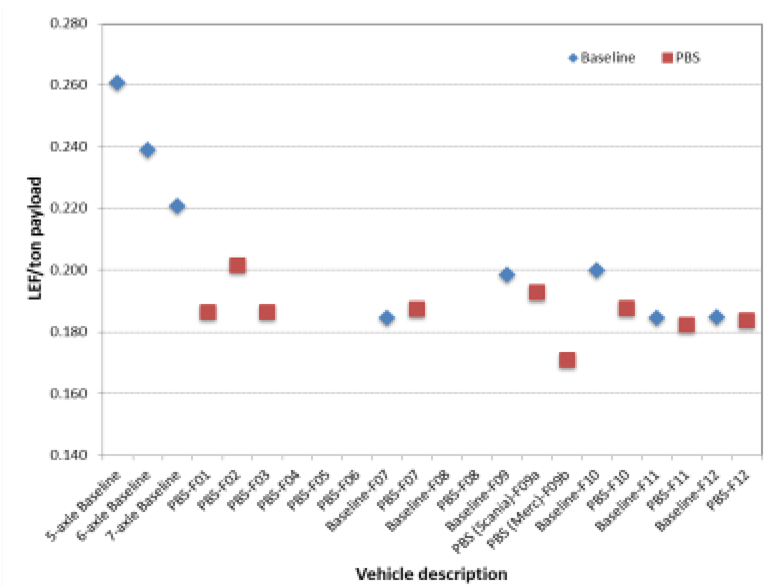
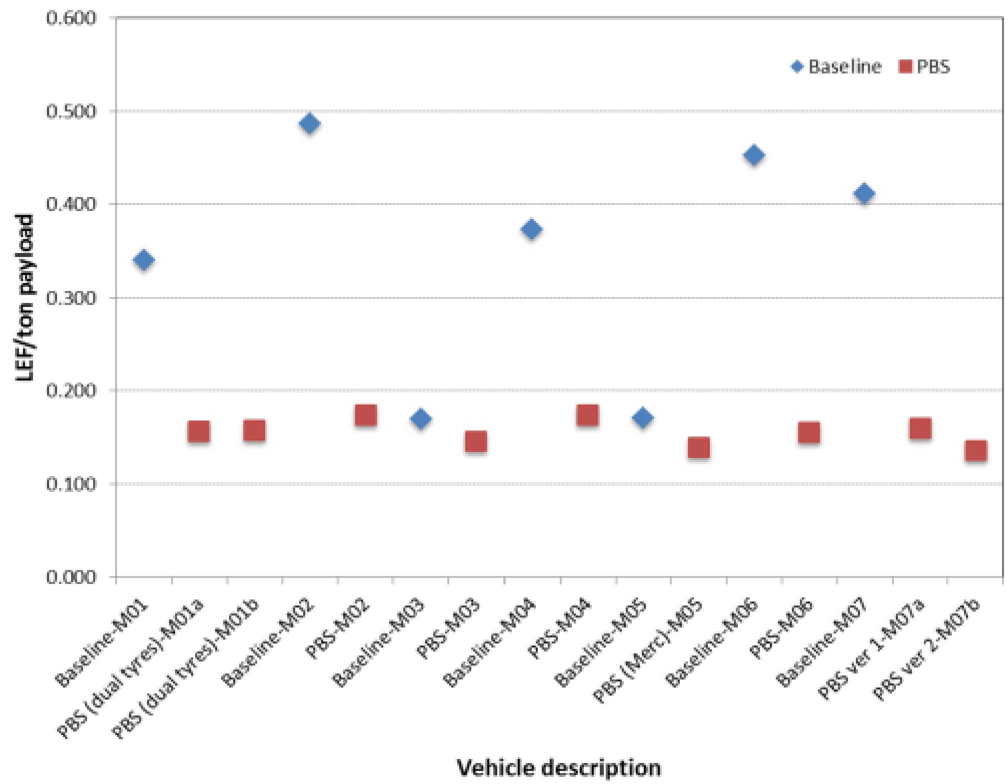
Road Wear Assessment results





Conclusions

- Infrastructure standards are to ensure the same, or preferably *less*, road wear per tonne of payload transported
- RTMS and Smart Truck initiatives will promote a reduction in heavy vehicle overloading in South Africa, thereby also reducing road wear
- Ensure that the safety of road structures is maintained as well as their lifespan (in terms of fatigue)

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ABNORMAL


BB160

Vehicle Standards & Systems Summit towards Safe Roads in South Africa 2016

Smart Truck/PBS vehicles in South Africa

Dr Paul Nordengen – CSIR
pnordengen@csir.co.za

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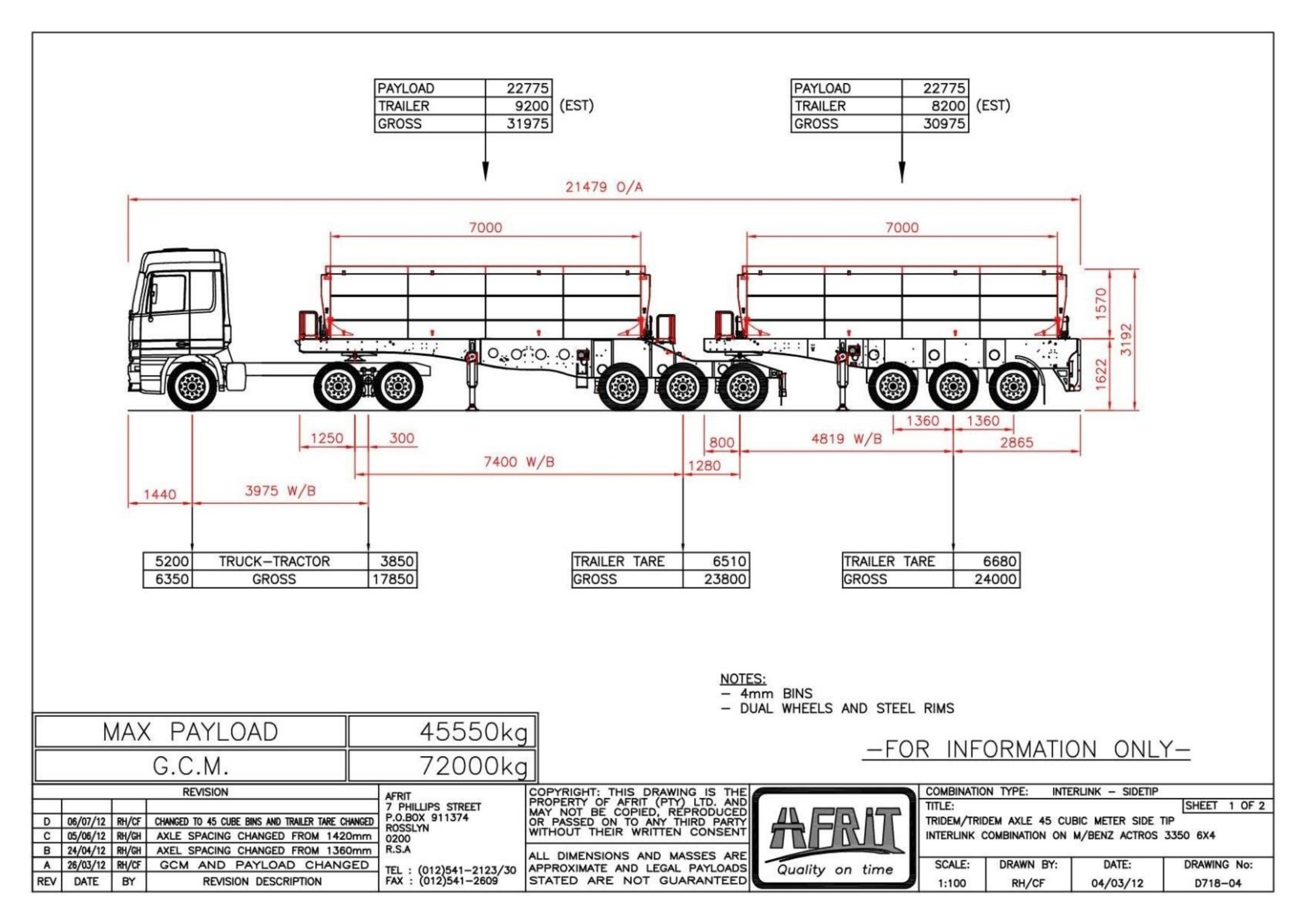
Mining Side-tipper



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Buhle Betfu Carriers
BB199
ABNORMAL LOAD VRAG
MAN
Buhle Betfu
Carriers
Buhle Betfu Carriers
BB205
ABNORMAL LOAD VRAG
MAN
Buhle Betfu
Carriers
AFRIT


Buhle Betfu Carriers
BB205
Buhle Betfu
Carriers
ABNORMAL LOAD VRAG
MAN
BB214


Buhle Betfu Carriers
ABNORMAL LOAD VRAG
MAN
Buhle Betfu
Carriers
BB214
AFRIT


SMART TRUCK
TIMBERNOLOGY
SCANIA
S02
TRUCK OF THE YEAR
R500
ABNORMAL
NRB 61311
SMART TRUCK
TIMBERNOLOGY
SCANIA
TRUCK OF THE YEAR
R500
ABNORMAL


ABNORMAL LOAD


Timber Logistics Services
ABNORMAL LOAD
MAN
RTMS
157
TGS 33.480
Timber Logistics Services
(039)973 2736

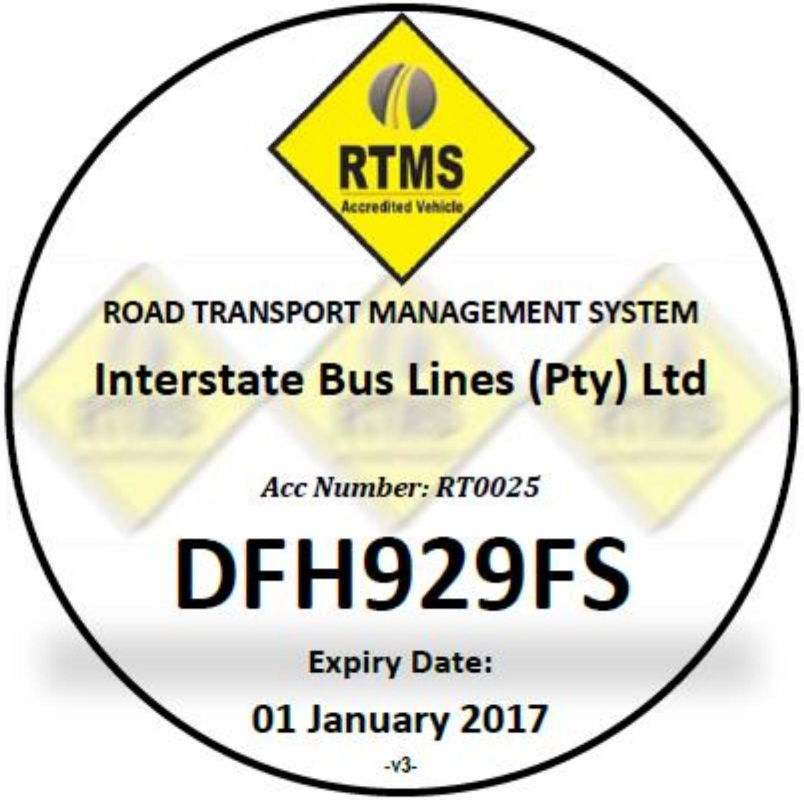

157
ABNORMAL LENGTH
VEHICLE - 27.6m
AFRIT

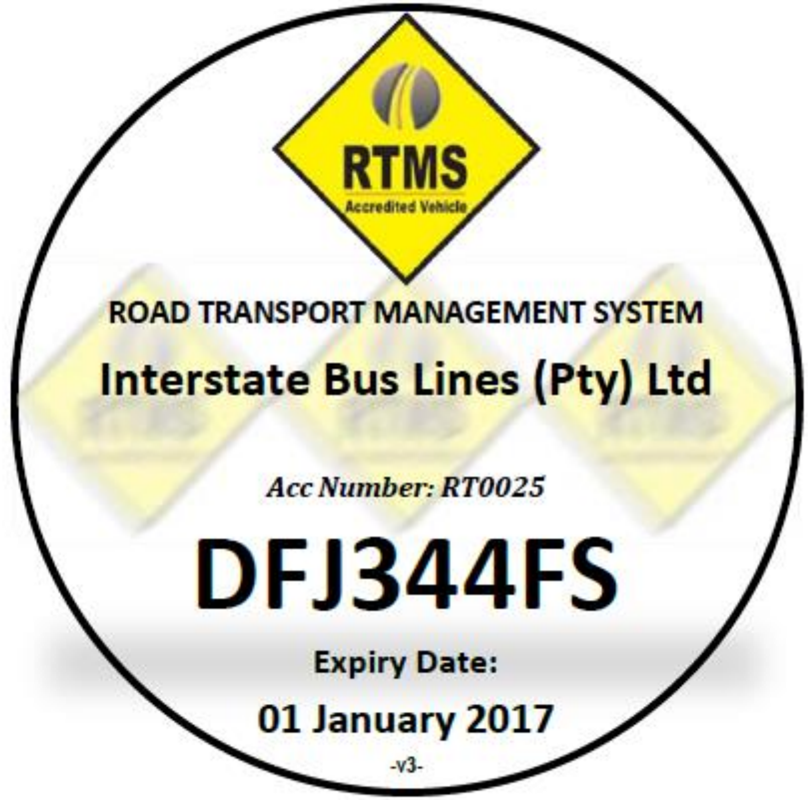
SA Breweries PBS combination


Timber Logistics Services
PD-TL155
ABNORMAL LOAD
155
MAN
RTMS
Certified Company
F8599
MAN
NX 37432

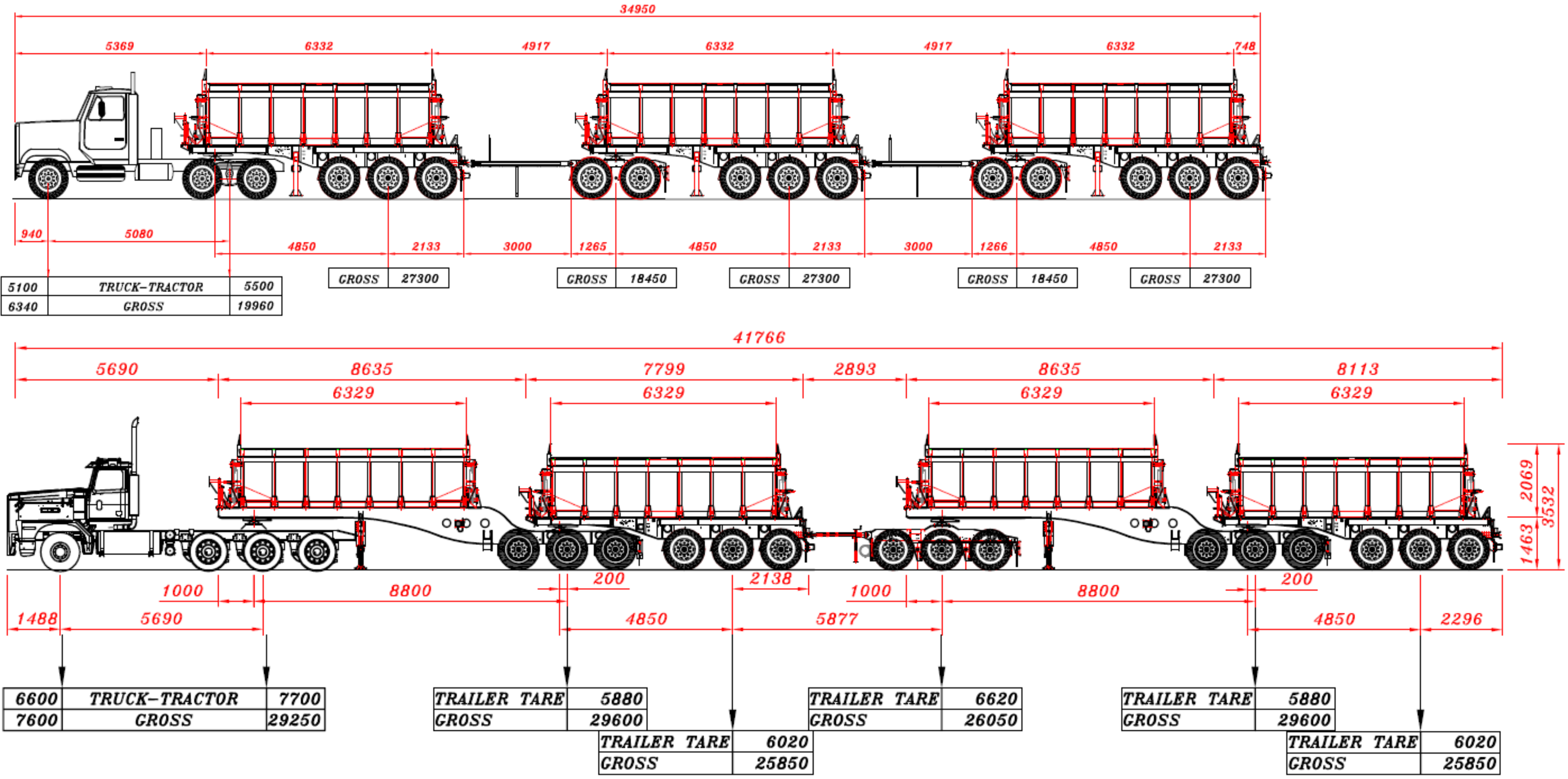

THIS VEHICLE NEEDS
2 LANES TO TURN
ABNORMAL LENGTH
VEHICLE 30M
ND 388-036
80
GRW
155


RTMS
SAB
The South African
Breweries


RTMS
Accredited Vehicle
ROAD TRANSPORT MANAGEMENT SYSTEM
Interstate Bus Lines (Pty) Ltd
Acc Number: RT0025
DFH929FS
Expiry Date:
01 January 2017
-v3-


RTMS
Accredited Vehicle
ROAD TRANSPORT MANAGEMENT SYSTEM
Interstate Bus Lines (Pty) Ltd
Acc Number: RT0025
DFJ344FS
Expiry Date:
01 January 2017
-v3-

Unitrans B-Triple vs BAB Quad



Unitrans BAB Quad

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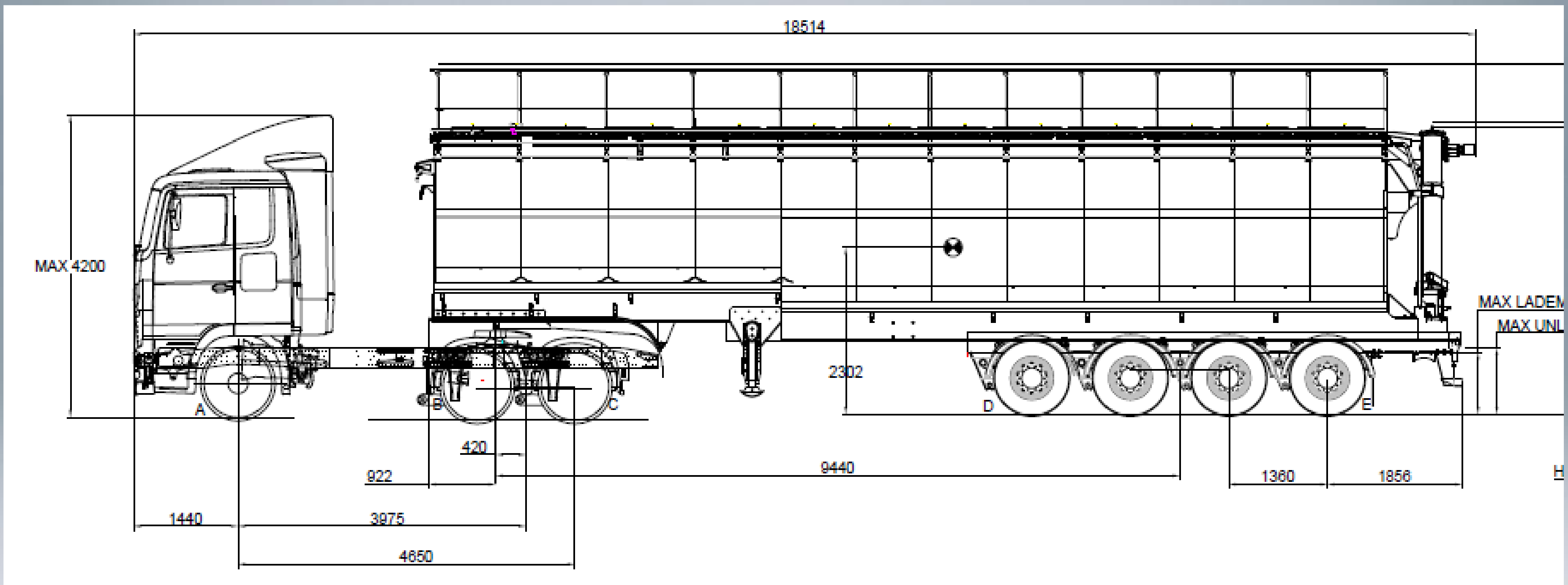
Mining Road Train: Rearward Amplification

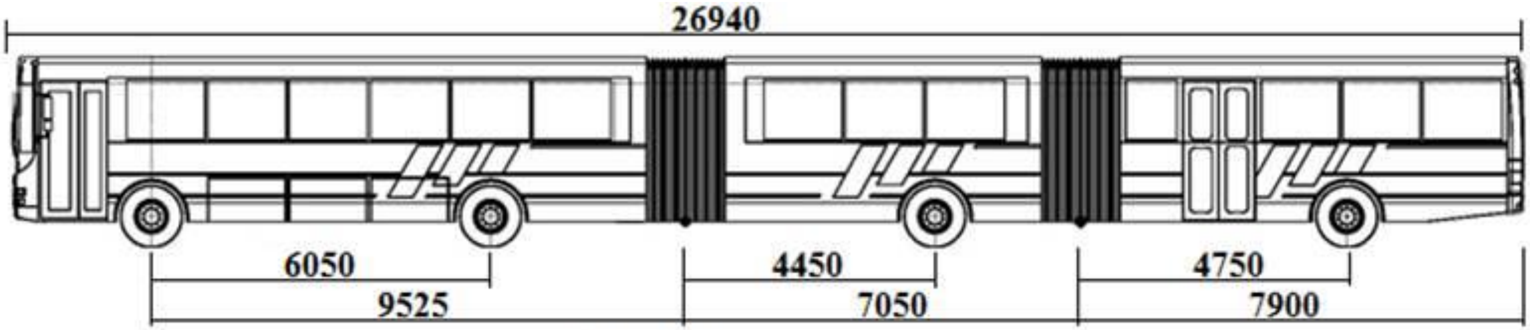
Unitrans Fuel Quad

Unitrans Auger Bulker

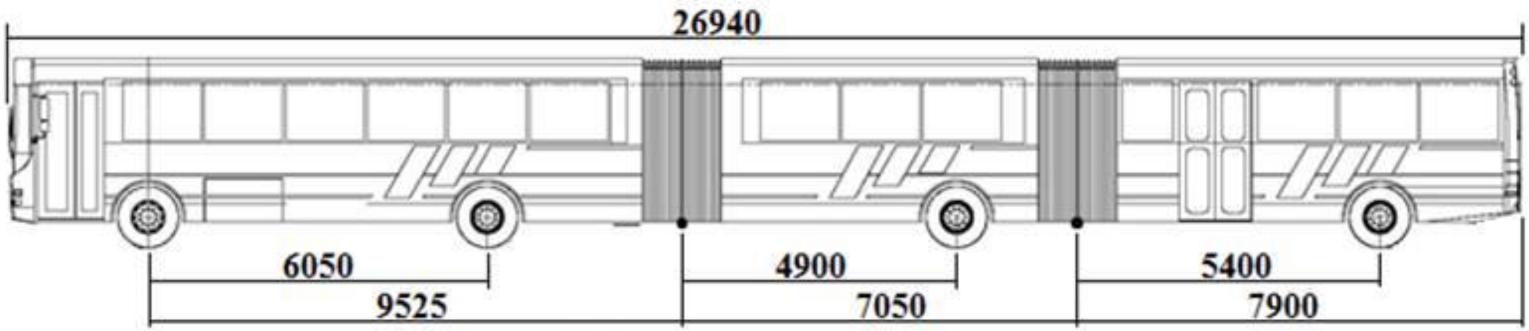


PBS Bi-articulated Bus

PBS Bi-articulated Bus



Original Vehicle



Modified Vehicle


100
ZZ2
100
RTMS
ZZ2
ZZ2
ZZ2

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072

Car Carriers

RTMS
Accredited Vehicle

Car Carriers

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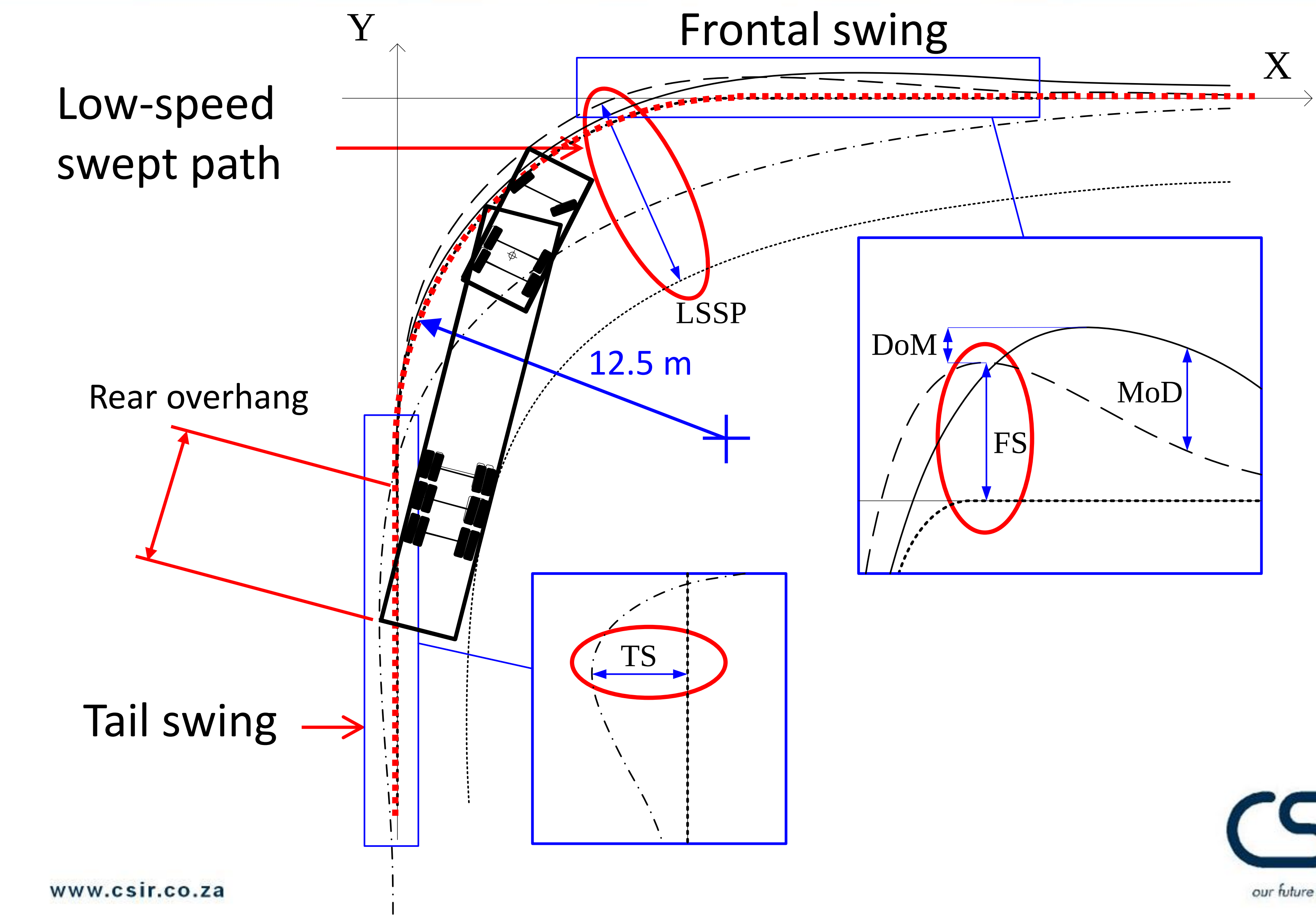
Tail swing



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Tail swing

- Existing car-carriers were shown to exhibit poor tail swing performance due to excessive rear overhangs.
- Tail swing of up to 710 mm was calculated (limit = 300 mm).
- This was shown to be a result of lenient rear overhang legislation.

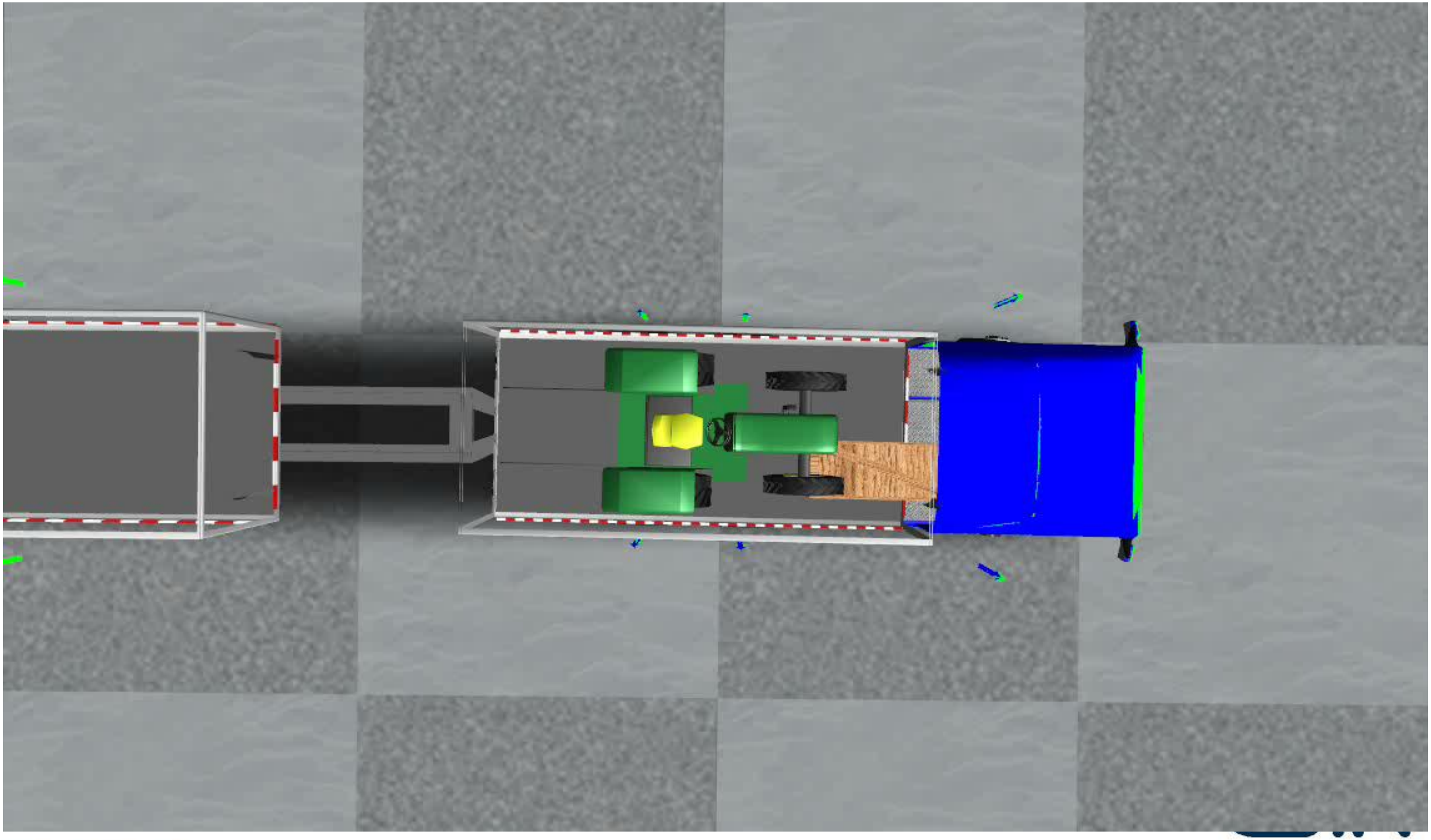
Vehicle type	Rear Overhang		Tail Swing	
				
Rigid truck	3.7 m	**5.01 m**	0.30 m	**0.60 m**
Semitrailer	3.7 m	**6.32 m**	0.30 m	**0.87 m**
Tag-trailer	3.7 m	**7.00 m**	0.30 m	**1.25 m**

De Saxe, C.C., Kienhöfer, F. & Nordengen, P.A., 2012. Tail swing performance of the South African car-carrier fleet. In 12th International Symposium on Heavy Vehicle Transport Technology. Stockholm.

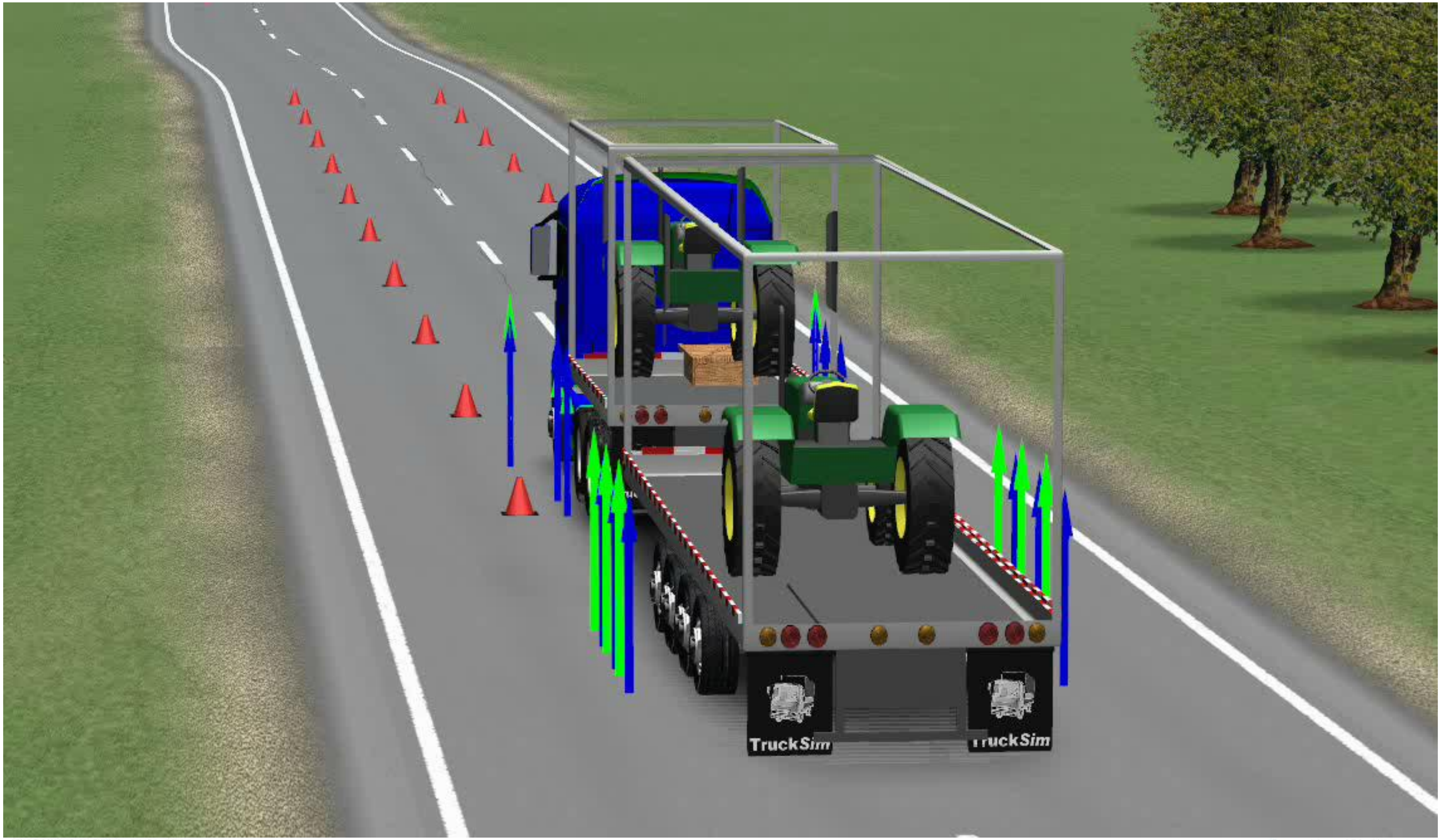
Car Carrier: Assessment Results

Standard	Units	L1 Limit	9m WB	10m WB
LSSP	m	≤ 7.4 m	6.7 m	7.2 m
Frontal Swing	m	≤ 0.7 m	0.7 m	0.7 m
Tail Swing	m	≤ 0.3 m	**0.66 m**	0.30 m
STFD	%	≤ 80 %	31 %	32 %
SRT	g	≥ 0.35 g	0.35 g	0.38 g
RA		$\leq 5.7*SRT_{rrcu}$	1.27	1.17
HSTO	m	≤ 0.6 m	**0.7 m**	0.6 m
TASP	m	≤ 2.9 m	**3.0 m**	2.9 m
Yaw Damping		≥ 0.15	0.20	0.39

Tail swing



Rearward amplification



Road Map for Car Carriers

ROADMAP OF CAR CARRIERS IN SOUTH AFRICA

Category	Permit Conditions
1. Car carrier combinations registered and licenced on NaTIS prior to 1 April 2010	• Operator is RTMS-certified • Must have a previous permit issued to them. • Maximum unladen combination length = 18.5/22.0m • Maximum combination length of laden vehicle with load projections = 19.0/22.5m • Maximum height = 4.6m • All permits will expire on 1 April 2023 or when the trailer age reaches 20 years, whichever comes first.
2. Car carrier combinations registered and licenced on NaTIS after 1 April 2010 and prior to 1 April 2013.	• Operator is RTMS-certified • If combination is PBS compliant (Level 1): – Maximum unladen combination length = 18.5/22.0m – Maximum combination length of laden vehicle with load projections = 19.5/23.0m – Maximum height = 4.6m • If combination is not PBS compliant: – Maximum unladen combination length = 18.5/22.0m – Maximum combination length of laden vehicle with load projections = 19.0/22.5m – Maximum height = 4.6m – Permits will expire on 1 April 2023 or when the trailer age reaches 20 years, whichever comes first
3. Car carrier combinations registered and licenced on NaTIS after 1 April 2013	• Operator is RTMS-certified • Combination must be PBS compliant (Level 1) • Maximum unladen combination length = 18.5/22.0m • Maximum combination length of laden vehicle with load projections = 19.5/23.0m • Maximum height = 4.6m

RTMS
Accredited Vehicle

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List of PBS-approved Car Carriers

Trailer Manufacturer	Truck Make and Model	Trailer Model	Report ID	Combination mass (CM) [kg]	Original Submission Assessment Date
Afrit	Volvo FM62TR3HL	Short-Long Car Carrier D105-468	PBS-SA-4	38482	01 June 2015
Lohr	Volvo FM 400 FM62RB3HJ	MHR 3.10 EHR 2.01	PBS-SA-5	42 348	13 November 2014
Lohr	Volvo FM 400 FM62TR3HL	MHR 3.10 EHR 2.01	PBS-SA-1009	42 348	13 November 2014
Lohr	Volvo FM 400 FM62TR3HA	MHR 3.10 EHR 2.01- PF XS	PBS-SA-2013	43 056	12 October 2015
Lohr	Volvo FM 400 FM62TT3HA	EHR 3.21 - PF WXS Car-Carrier	PBS-SA-2016	41 190	04 November 2015
Lohr	Merc Actros 2541/54 6x2	MHR 3.30 AS D1 EHR 2.03 XS	PBS-SA-7	43 333	01 August 2013
Lohr	Scania P410 LB 6x2 MNA	MHR 3.10 EHR 2.01	PBS-SA-1011	42 563	25 June 2014
Lohr	Volvo FM440HP 6x4	Maxilohr MXR 3.10 EHR 2.21 ZA (Truck on truck)	PBS-SA-6	47 680	05 February 2015
Lohr	Volvo FM 330	SHR ZA semi-trailer - 525 mm hitch offset	PBS-SA-1012	32 095	21 July 2015
Lohr	Volvo FM 330	SHR ZA semi-trailer- 625mm hitch offset	PBS-SA-2014	32 095	07 October 2015
Rolfo	Volvo FM 330	SA Blizzard	PBS-SA-2017	33 698	09 December 2015
Unipower	Mercedez Benz Actros 2541/54	Macroporter	PBS-SA-1	41 000	01 October 2014
Unipower	Mercedez Benz Atego 1528LS/36	Flexiporter MK2	PBS-SA-2012	29 657	12 October 2015
Unipower	Renault Premium Lander 380.26 6x2	Macorporter MK3	PBS-SA-1013	40 640	01 August 2015
Unipower	Volvo FM 330	Flexiporter MK2	PBS-SA-9	32 465	10 June 2015
Unipower	Volvo FM400 FM62TB3HJ	Maxiporter Mk3	PBS-SA-2018	45 000	15 February 2016
Unipower	Volvo FM400 FM62TR3HL	Maxiporter Mk3	PBS-SA-3	45 026	20 May 2015
Unipower	Volvo FM400 FM62TT	Macroporter	PBS-SA-2	41 600	01 June 2015

Vehicle Standards & Systems Summit towards Safe Roads in South Africa 2016

Monitoring of Smart Truck/PBS vehicles in South Africa

Dr Paul Nordengen – CSIR

pnordengen@csir.co.za

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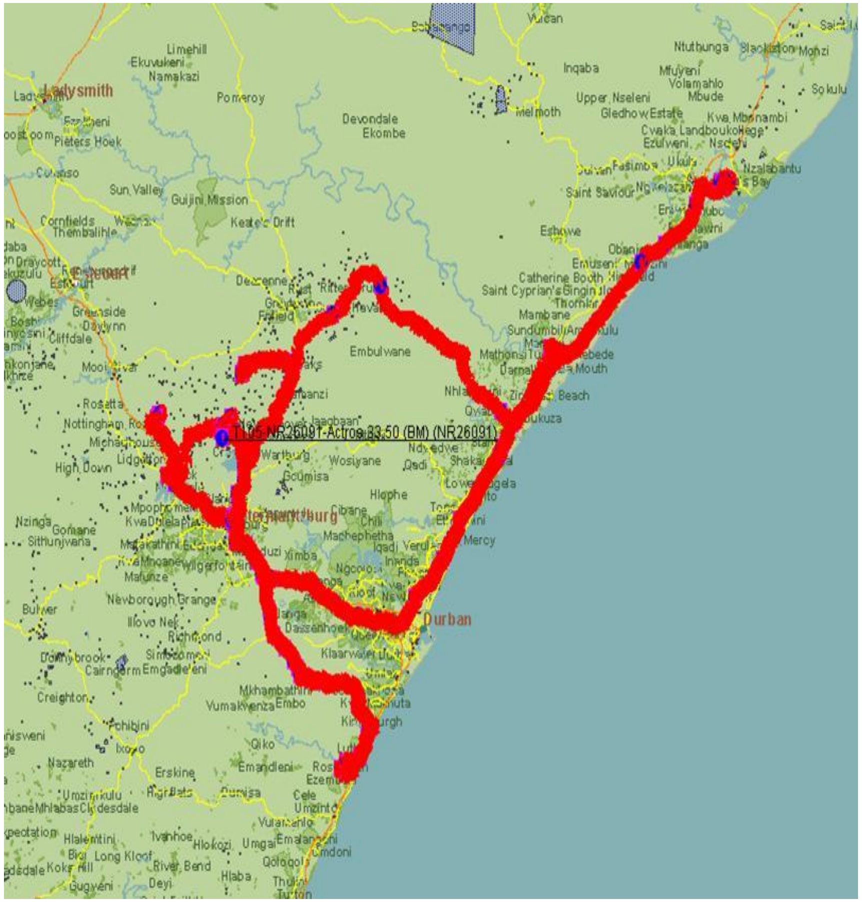
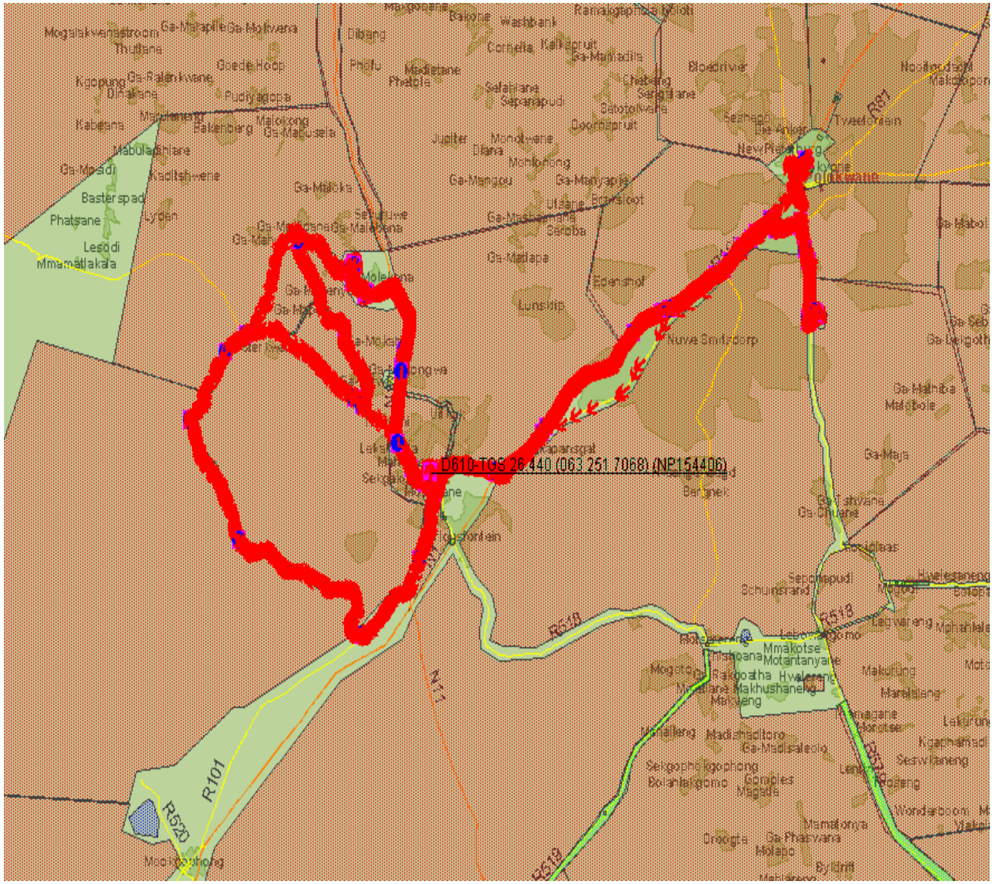
Monitoring of Smart Trucks

- Operational compliance
  - Approved route(s)
  - Speed
  - Combination mass
- Trips and trips savings
- Fuel efficiency
- Emissions
- Crash rates

Access: Route compliance





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Access: Speed compliance

Mail From: "AVANI" <avani@mobiltrack.com>

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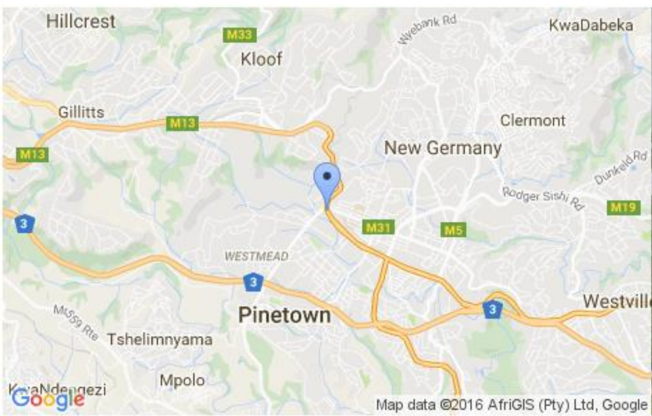
"AVANI" <avani@mobiltrack.com> 02/08/2016 01:04 PM

SPEEDING ALERT 1_3833 VOLVO_S05 (VOLVO_S05) (TEKWANI) (82Km/h)_02/08/2016 13:03:25_

to: FrancoisO@tekwani.co.za; osvaldo@avaniafrica.com; Paul Nordengen

Location: M13, eThekwini Ward 18, Pinetown, eThekwini Metropolitan Municipality, KwaZulu-Natal, 3610, South Africa



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PBS Pilot Project in South Africa

Target kms: 100 million Kms travelled to date: 69 million (end-April 2016)

No. of Smart Trucks per Province: April 2016										
Commodity/ Industry	**E. Cape**	**W. Cape**	**N. Cape**	**Mpum.**	**Gauteng**	**Limpopo**	**KZN**	**Free State**	**N. West**	**Total**
Timber	0	0	0	30	0	0	53	0	0	**83**
Mining	0	5	2	12*	0	36*	11	0	0	**54**
Processed Sugar	0	0	0	0	0	0	9	0	0	**9**
Fuel	0	0	0	0	0	0	5	0	0	**5**
Beef cattle	0	0	2*	0	0	0	0	0	2*	**2**
Beer	0	0	0	0	0	0	2	0	0	**2**
Buses	0	0	0	12	0	0	0	0	0	**12**
Total	**0**	**5**	**4**	**54**	**0**	**36**	**80**	**0**	**2**	**167**

*Note: 12 mining PBS vehicles operating in both Mpumalanga and Limpopo;
2 beef cattle PBS vehicles operating in Northern Cape and North West

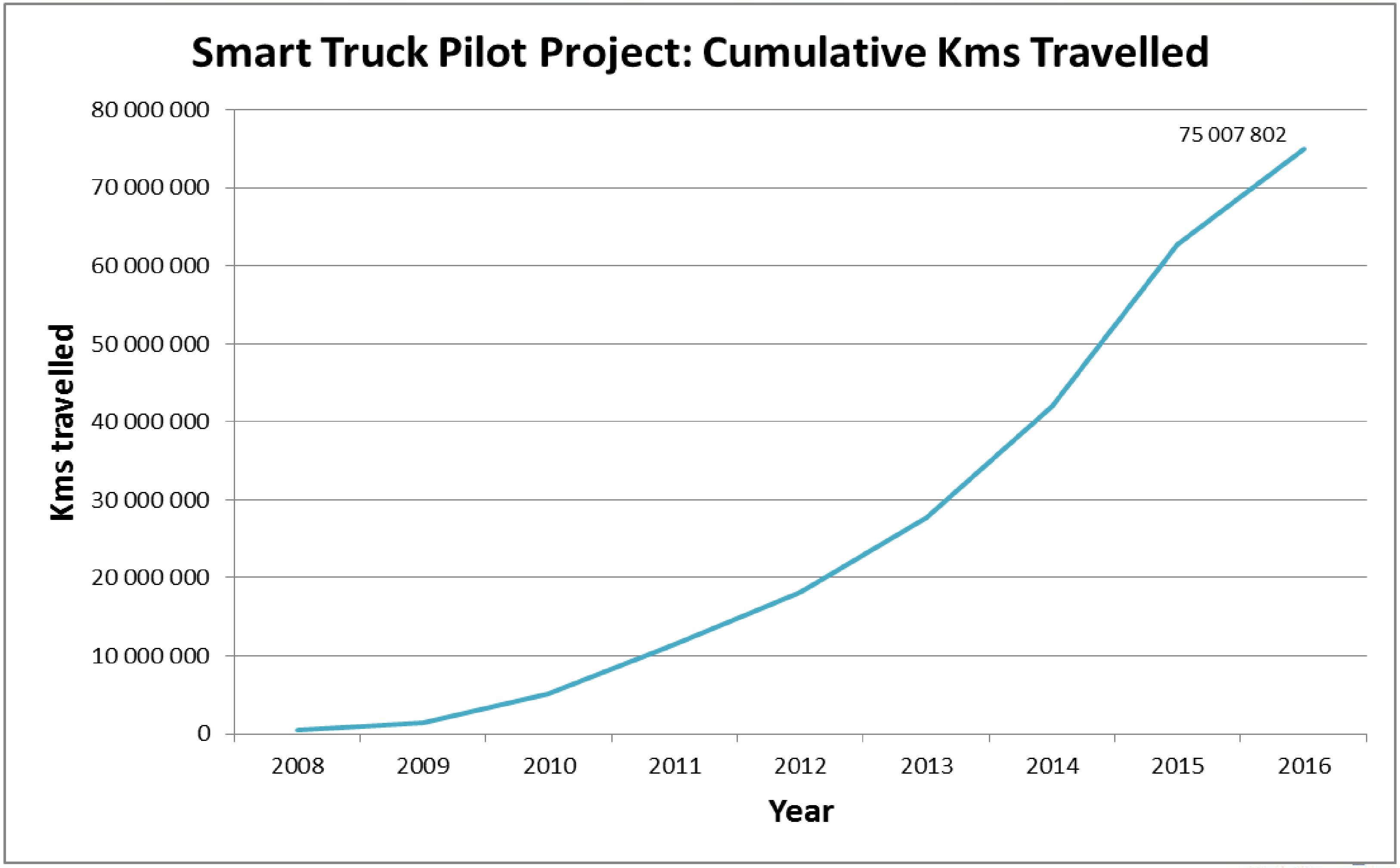
Current projects: Containers, tomatoes, paper reels, coal, general freight

Smart Truck monitoring: Kms travelled

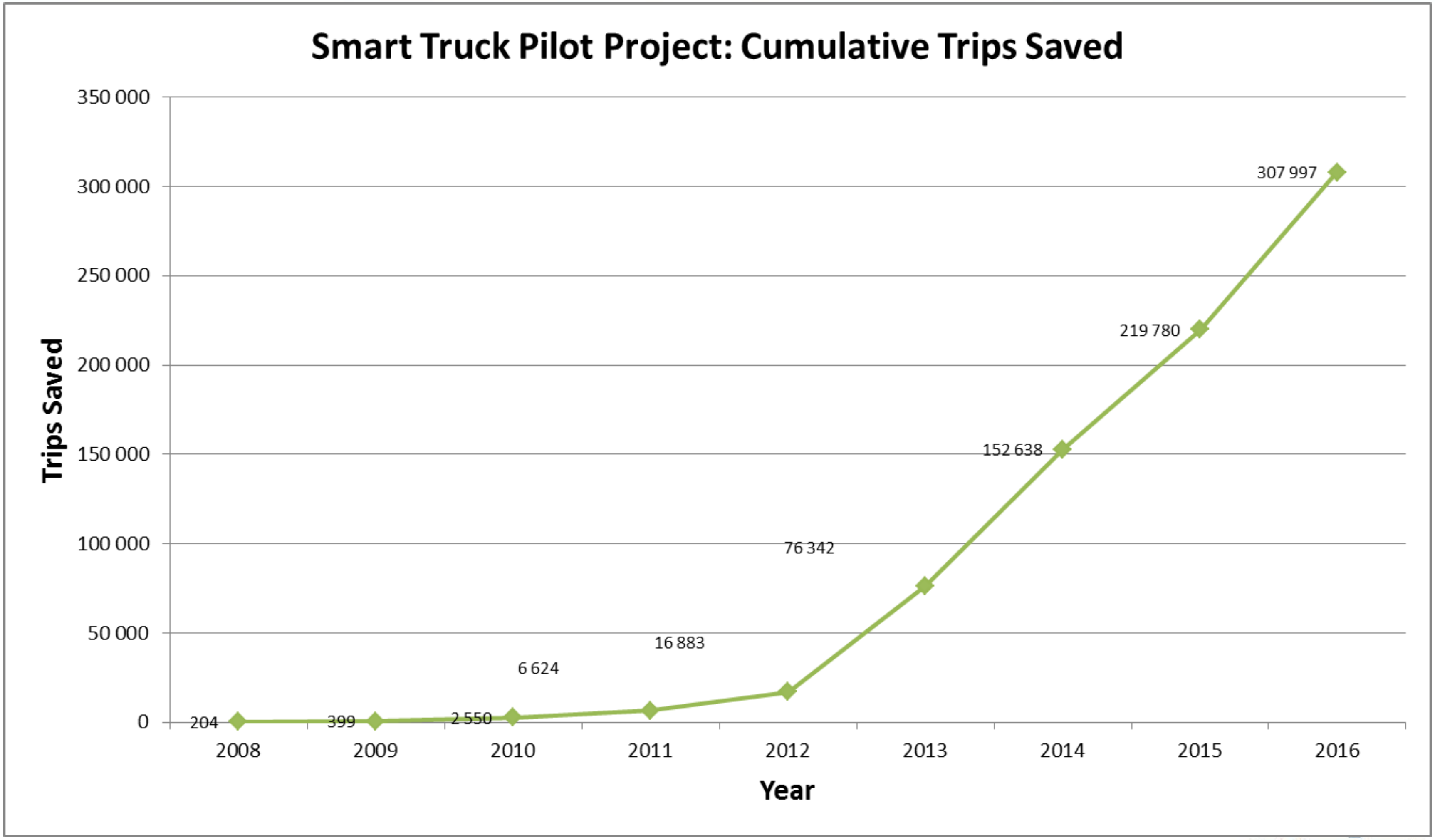
Table 2-1: Summary of the total Kilometres Travelled by Operational Smart Trucks per Commodity during April 2016

Kilometres Travelled by Smart Trucks per Commodity April 2016										
Commodity/Industry	**E.Cape**	**W.Cape**	**N.Cape**	**Mpum.**	**Gauteng**	**Limpopo**	**KZN**	**FreeState**	**N.West**	**Total**
Timber	-	-	-	394 460	-	-	631 607	-	-	**1 026 067**
Sugar Cane	-	-	-	-	-	-	9 074	-	-	**9 074**
Processed Sugar	-	-	-	-	-	-	119 543	-	-	**119 543**
Fuel	-	-	-	-	-	-	59 151	-	-	**59 151**
Cattle	-	-	5 665	-	-	-	-	-	2 666	**8 331**
Mining	-	79 739	10 513	67 629	-	205 641	75 808	-	-	**439 330**
Beer	-	-	-	-	-	-	28 878	-	-	**28 878**
Buses	-	-	-	80 732	-	-	-	-	-	**80 732**
Total	-	**79 739**	**16 178**	**542 821**	-	**205 641**	**924 061**	-	**2 666**	**1 771 106**

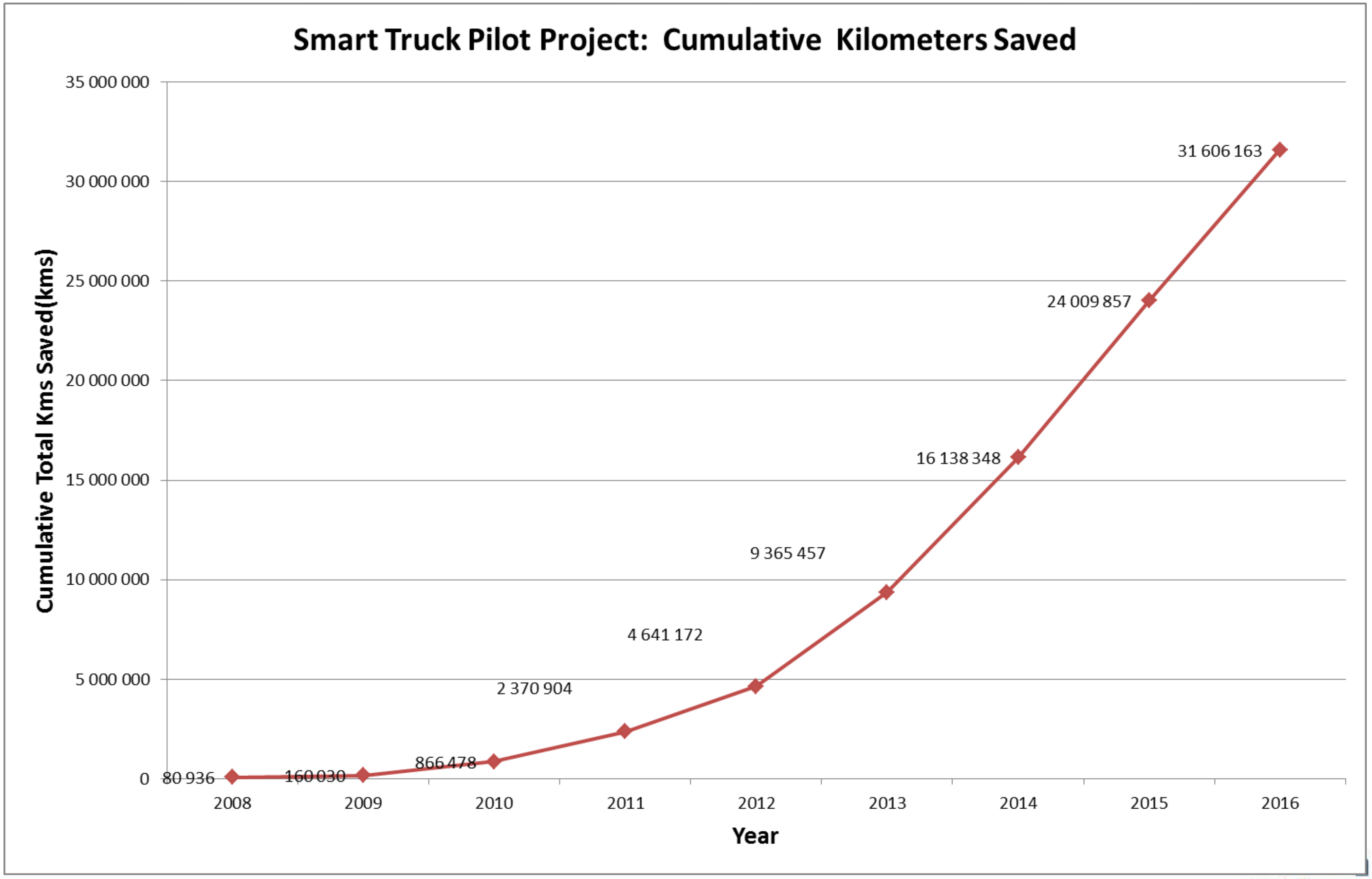
Smart Truck monitoring: Kms travelled



Smart Truck monitoring: Trips saved



Smart Truck monitoring: Kms saved



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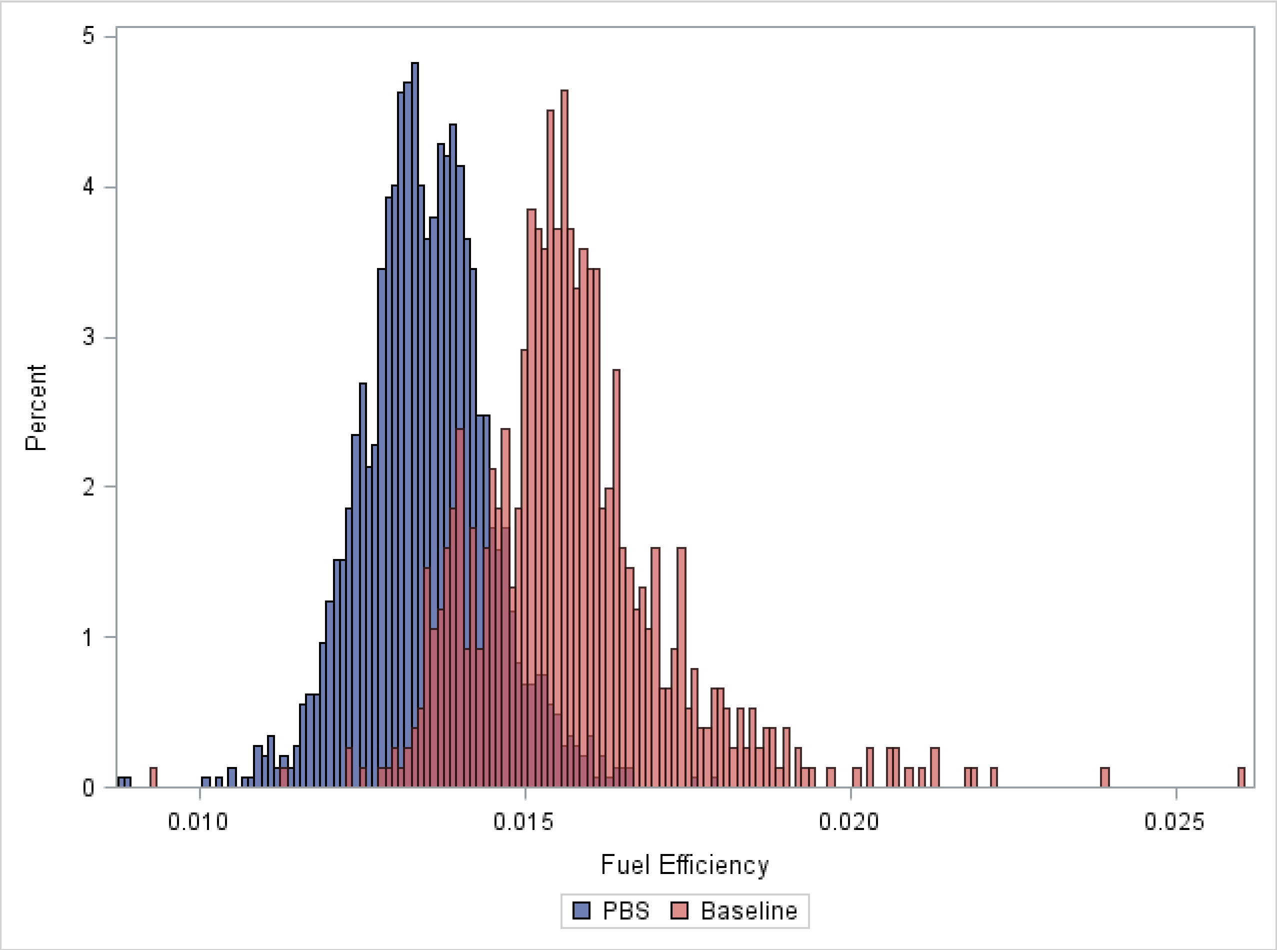
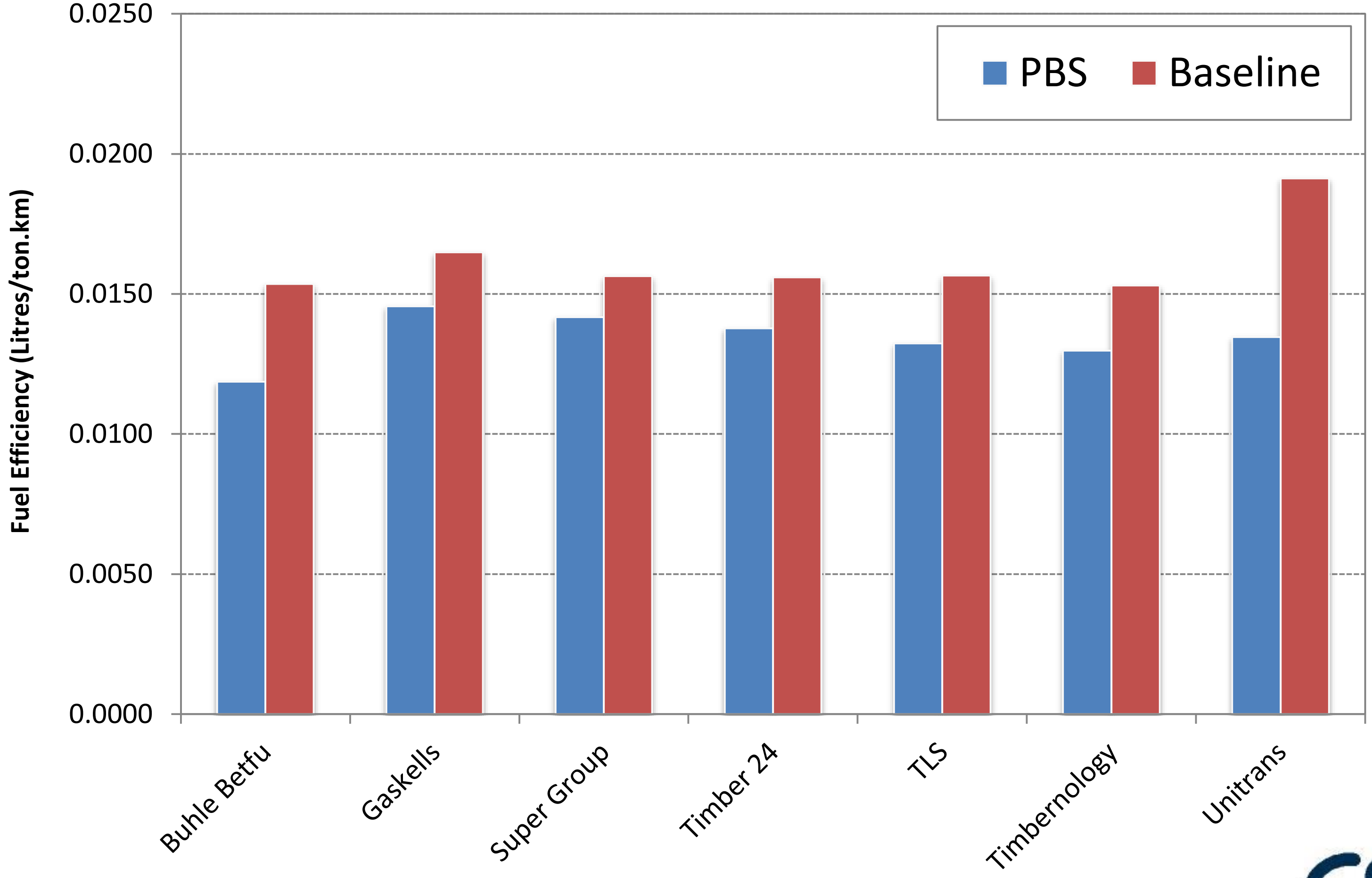
Fuel efficiency improvements

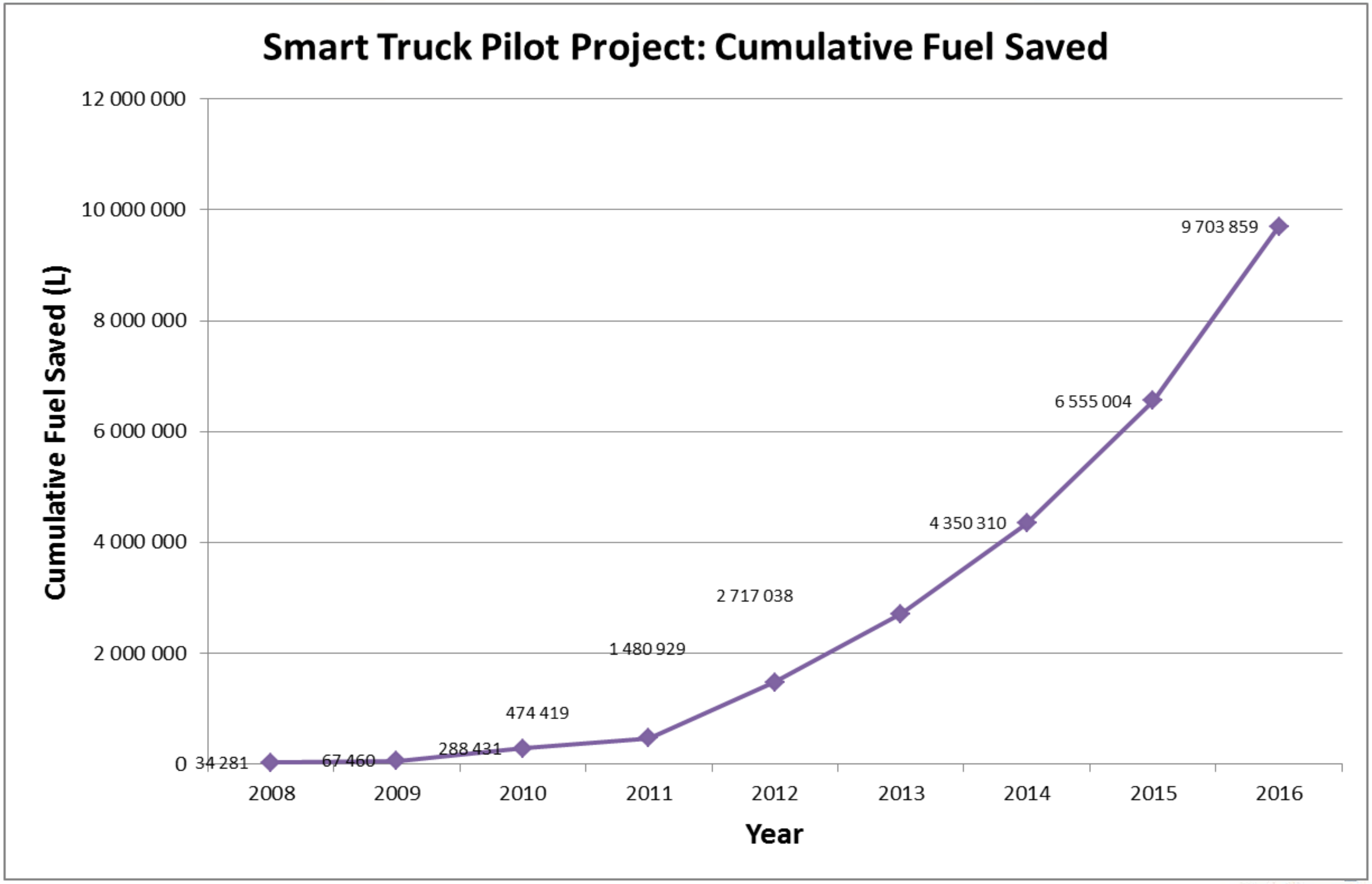


Histograms of fuel efficiency for baseline and PBS vehicles, January 2008 to September 2013

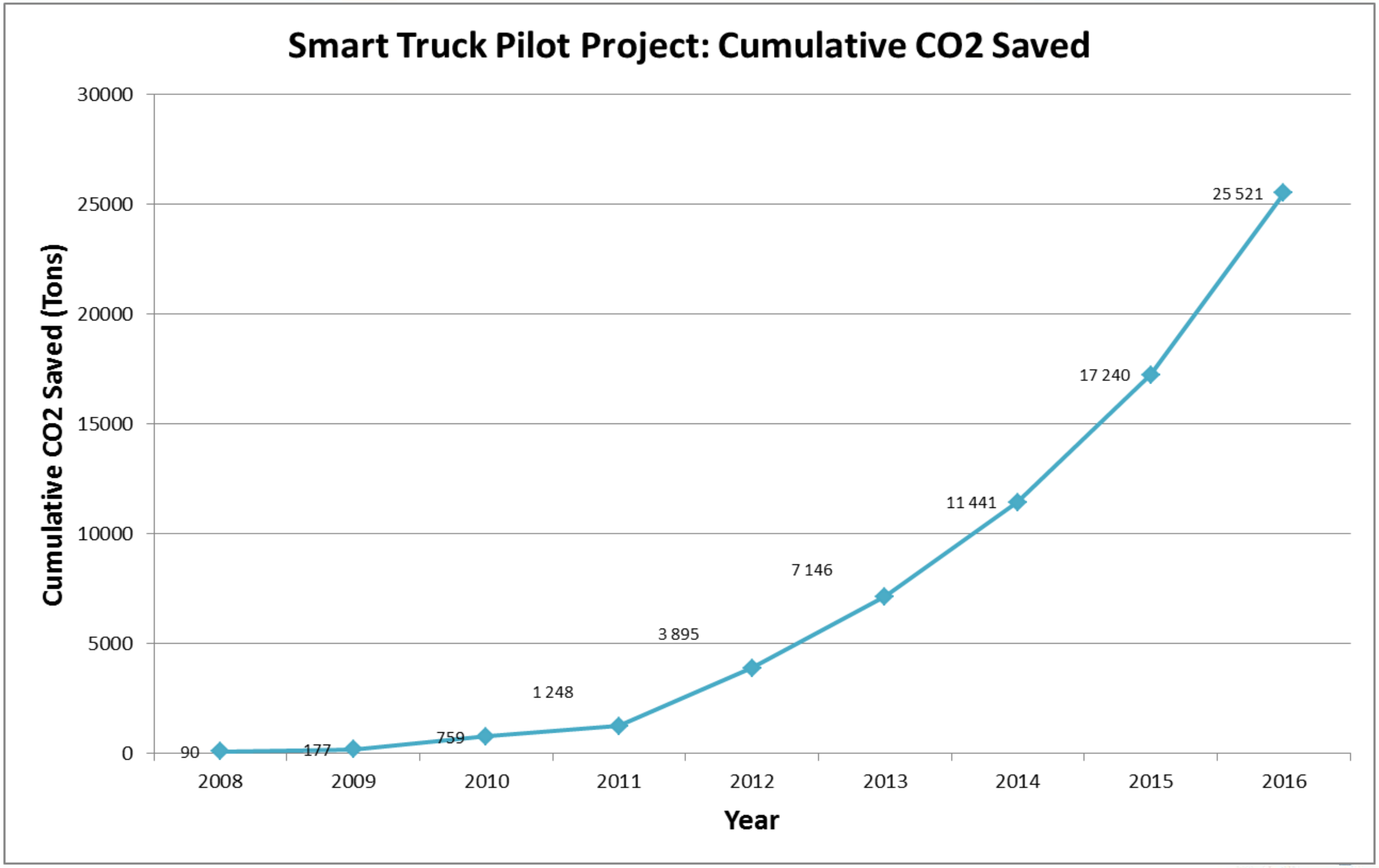
Fuel efficiency improvements in forestry



Smart Truck monitoring: Fuel efficiency

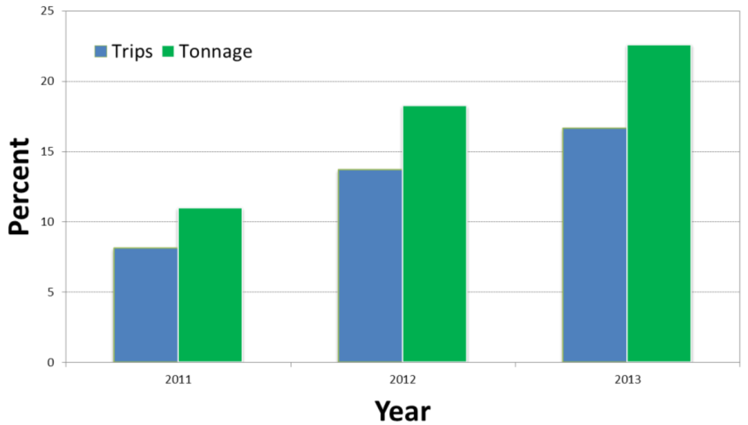


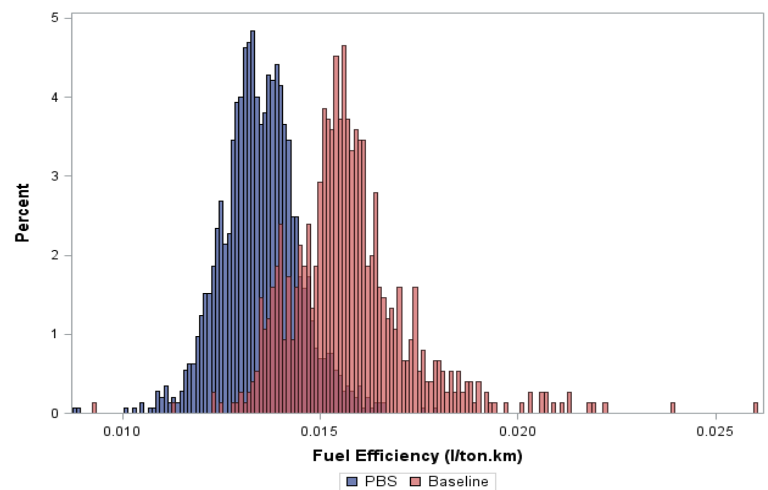
Smart Truck monitoring: Environmental Impacts



Smart Truck (PBS) project

- 106 demonstration projects operational during 2014
- 130 car carriers plus 100 others in design phase
- 75 700 trips saved, 1.23 million litres of fuel, 3 390 tons of CO_2
- Approx. 22% of pulp timber transported by Smart Trucks in 2013
- On average 14% fuel savings in forestry industry





2013

- Fuel savings: 1.24 million litres
- Emissions: 3 250 tons CO_2
- Road freight in SA (2012): 303 billion ton.km Assuming 10% are PBS vehicles would result in a reduction of 188 million tons CO_2 p.a.

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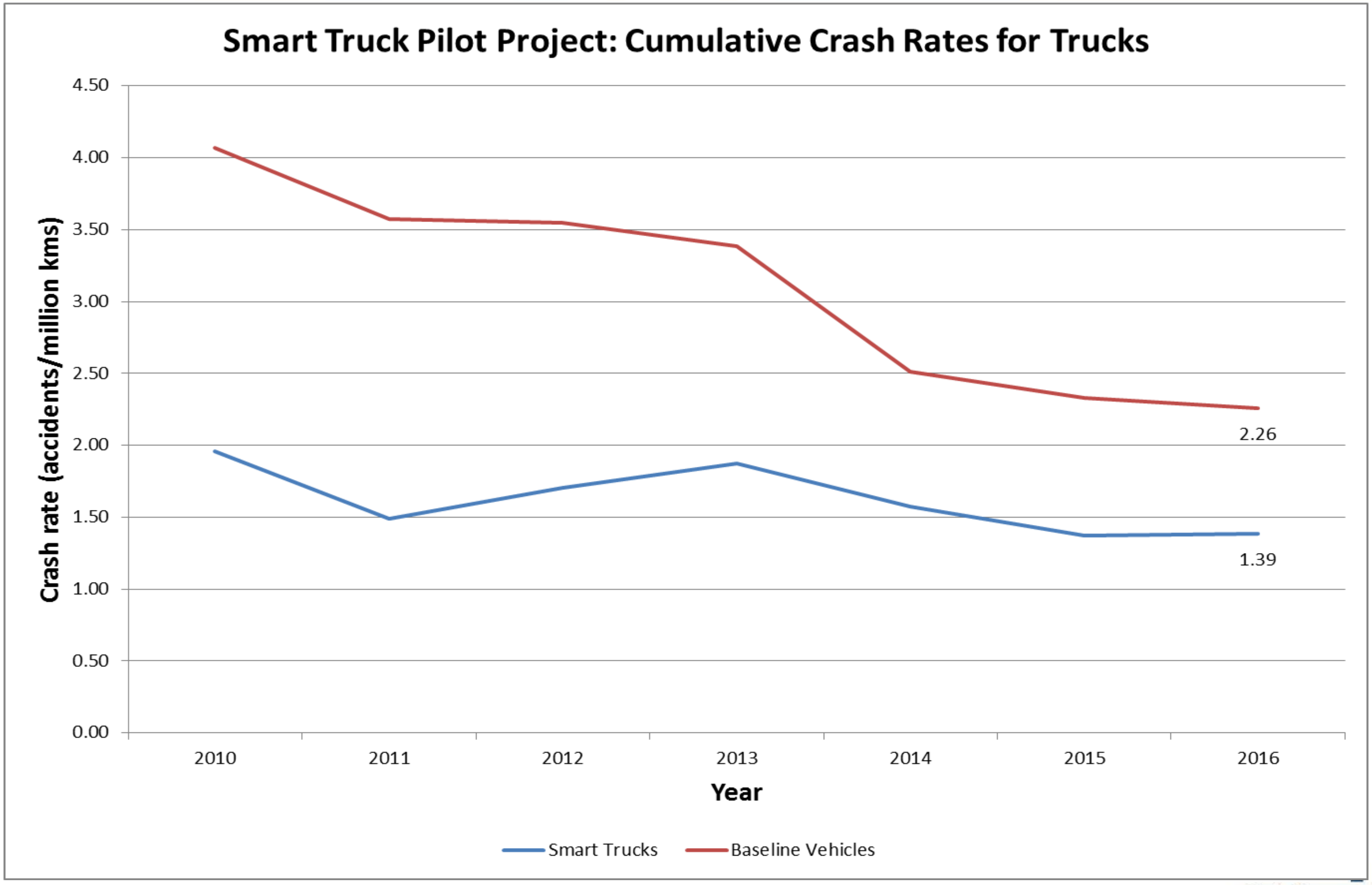
Smart Truck Safety Performance Results: Jan 2008 – July 2016

		Timber Logistics Services	Unitrans Timber	Buhle Betfu	Timber24	Total
No of Crashes	Smart Trucks	30	8	9	3	104
	Baseline	101	2	27	52	543
	Total	131	10	36	55	647
Total Kilometres	Smart Trucks	16 554 920	4 698 908	5 019 000	3 378 162	75 008 000
	Baseline	23 490 641	1 183 134	9 212 970	21 981 042	240 265 000
	Total	39 409 884	5 882 042	14 231 970	24 654 106	315 273 000
Crashes per million kms	Smart Trucks	1.80	1.70	1.80	0.90	1.39
	Baseline	4.30	1.70	2.90	2.40	2.26
	Total	3.30	1.70	2.50	2.20	2.13
Caused by Third Parties and Pedestrians (included in figures above)						
No of Crashes	Smart Trucks	11	3	0	0	50
	Baseline	44	13	0	0	264
	Total	55	16	0	0	315
% of Total	Smart Trucks	91.7%	33.3%	0.0%	0.0%	58.1%
	Baseline	51.2%	650.0%	0.0%	0.0%	53.4%
	Total	56.1%	145.5%	0.0%	0.0%	54.3%

Crash rate ratio:

Smart Truck : Baseline 1:1.63

Smart Truck monitoring: Crash rates



Smart Truck monitoring: Cost of crashes

	Km (million)	Crash Rate (per million km)	Cost/crash	Total Cost
Smart Trucks	75.01	1.39	R 300 000	R 31 279 170
Legal Trucks	106.60	2.26	R 300 000	R 72 274 800
Cost savings				R 40 995 630


Thank you