# 2007 Technical and Maintenance Conference

# Trends in Tyre Technology

# Speakers

Mr Peter Heatley – Michelin

Mr Allan Sutton – Goodyear Dunlop Tyres

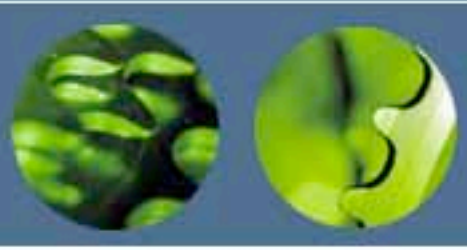
Mr Kevin Buschert – Hedrickson Asia Pacific

Mr Phil Burnett – Bridgestone

Mr Scott Finemore – Advantage Tyres

# 2007 Technical and Maintenance Conference

Peter Heatley - Michelin
Product Marketing Manager - Truck



# Agenda

- Market legislation
- Dimension by market
- Benefits & evolution of new dimensions

# Australia: GENERAL MASS LIMITS

| AXLE | GROUP | LIMIT |
|---|---|---|
| STEER | SINGLE | 6.0 T |
| DRIVE | BOGIE | 16.5 T |
| TRAILER | TRI | 20.0T |

- An increase can be applied to these weights if the vehicle and operator complies with strict standards (HML)

# Australia: NEW MASS LIMITS

| AXLE | GROUP | NEWLIMIT |
|---|---|---|
| STEER | SINGLE | 6.0 T/6.5T |
| DRIVE | BOGIE | 17.5 T |
| TRAILER | TRI | 22.5T |

- Other concessions are single drive group increase from 9.0 to 10.0T
- Road train (with wide base single tyres) from 6.0 to 6.7 T
- A manufacturer must not specify a tyre requiring greater than 825 Kpa (120psi) to meet axle load specification

# Australia: Mass limits – axle groups

| Axles and tyres | Maximum axle group load |
|---|---|
| Single Steer - 2 tyres | 6.0t |
| Twin steer axle group<br>4 tyres | 10.0t for non load sharing suspension<br>11.0t for load sharing suspension Single axle<br>4 tyres9.0t<br>9.0t when fitted to a pig trailer |
| Tandem axle group<br>Single tyres (4) | 14.0t tyre width >450mm<br>13.3t tyre width <450mm but >375mm<br>11.0t tyre width <375mm |
| Tandem axle group<br>Dual tyres (8) | 16.5t<br>16.5t when fitted to a pig trailer |
| Tri-axle group Single tyres (6) | 20.0t tyre width >375mm<br>18.0t when fitted to a pig trailer, tyre width >375mm<br>15.0t tyre width <375mm |
| Tri-axle group<br>Dual tyres (12) | 20.0t<br>18.0t when fitted to a pig trailer |

# Australian market sizes

- Main sizes:

Standard: 11R22.5 - 295/80R22.5

– 275/70R22.5

Wide single: 385/65R22.5

# EU - Trailer Weight /axle or group of axles

- Simple non-driving axle : 10 t.
- 2 Axles Trailer:
  - d < 1.0 m : 11 t
  - 1.0 ≤ d < 1.3 m : 16 t
  - 1.3 ≤ d < 1.8 m : 18 t
  - 1.8 ≤ d : 20 t
- 3 Axles Trailer :
  - d ≤ 1.3 m : 21 t
  - 1.3 < d ≤ 1.4 m : 24 t

# EU - Rigid truck or prime mover axle weight

- Drive axle : 11.5 t

- 2 drive axles on rigid truck or tractor:
  - < 1.0 m : 11.5 t
  - 1.0 ≤ < 1.3 m : 16 t
  - 1.3 ≤ < 1.8 m : 18 t or 19 t when the driving axle is equipped with dual pneumatic tyres and suspensions pneumatic and that the maximum weight of each axle does not exceed 9.5 tonnes.

# EU - Rigid truck weight

- 2 axles rigid truck : 18 t.

- 3 axles rigid truck : 25 t or 26 t when the driving axle is equipped with dual pneumatic tyres and suspensions pneumatic and that the maximum weight of each axle does not exceed 9.5 tonnes.

# EU - Articulated vehicle - Total weight

- 2 axles rigid truck + 3 axles trailer : 40 t.
- 3 axles rigid truck + 2 or 3 axles trailer: 40 t.

- 2 axles prime mover + 2 axles semi-trailer :
  - $1.3 \leq d \leq 1.8$ m : 36 t
  - $1.8 < d$ : 36 t + 2 t
- 2 axles prime mover + 3 axles semi-trailer : 40 t.
- 3 axles prime mover + 2 or 3 axles semi-trailer : 40 t.

# EU market sizes

Main sizes:

Standard: 13R22.5 - 315/80R22.5

– 385/65R22.5

Wide single: 495/45R22.5- 385/55R22.5

– 445/45R19.5

# Summary

1. No restriction regarding tyre pressure
2. No axle load relationship to tyre section width
3. Tyre dimension match to axle load
4. Legislation can very if operating within a local jurisdiction

# US – Weight limits

National Highway System regulations

- Single axle: 9t (20,000 lbs)
- Tandem axle: 15.5t (34,000 lbs)
- Gross vehicle weight: 36t (80,000 lbs)
- Federal bridge formula for load spread over bridges

$W = 500(LN/N-1 + 12N+36)$

# US – Weight limits

States legislate load limits outside of national system
Limits vary from state to state (example below)

| US State Axle Laws | Weight Limit |
|---|---|
| Front Axle | Max. 7,700 kg |
| Single Axle (dual tyres) | Max. 10,000 kg |
| Individual Axle with Single Tires (long combinations and combinations where semi-trailer is built after 2005) by axle's tyre width | |
| Less than 350 mm | Max. 6000 kg |
| 350 < 375 mm | Max. 7000 kg |
| 375 < 400 mm | Max. 7500 kg |
| 400 mm or more | Max. 8000 kg |

# US – Market sizes

Main sizes:

Standard –

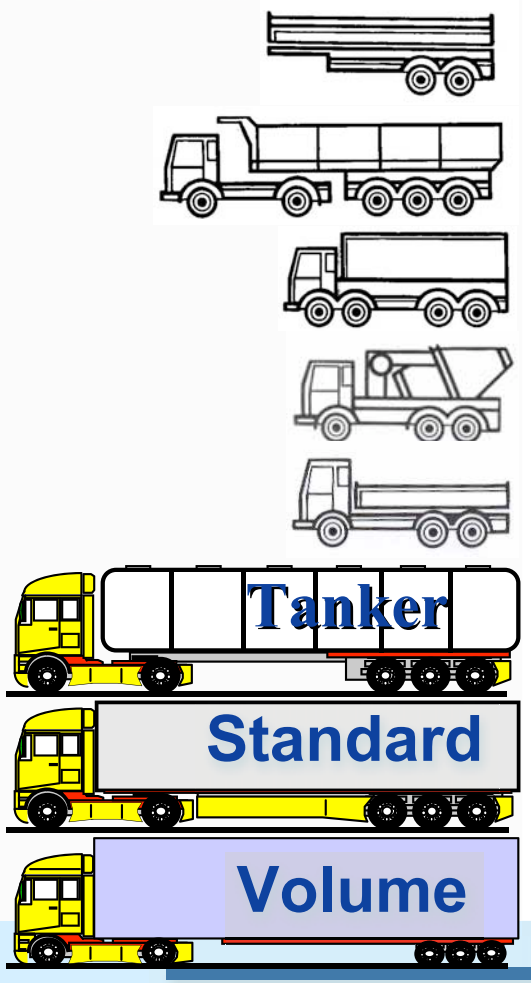
11R22.5 - 275/80R22.5

– 275/80R24.5-11R24.5

Wide single –

425/65R22.5 - 445/50R22.5 - 455/55R22.5

# The trend for the forthcoming years …




315/80
385/65

13R22.5
385/65

Maxi Load +
Ground clearance

315/70
385/55

495/45
385/55

315/60
385/55

Load +
Volume

295/60R22.5
445/45R19.5

Maxi Volume

2004

2007

# Conclusion

Tyre innovations offer:

1. Improved vehicle stability
2. Increased load volume for productivity benefits
3. Low rolling resistance for improved fuel consumption
4. Reduced noise levels

- Current legislation limits the choice of tyres to less innovative dimensions due to pressure regulation & load reduction for wide tyres

# Thank you

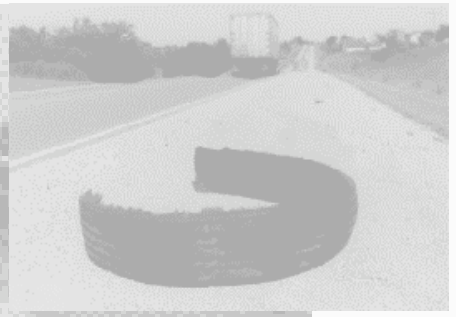
# 2007 Technical and Maintenance Conference

**Alan Sutton**
**National Customer Engineering Manager**
**Goodyear Dunlop Tyres**

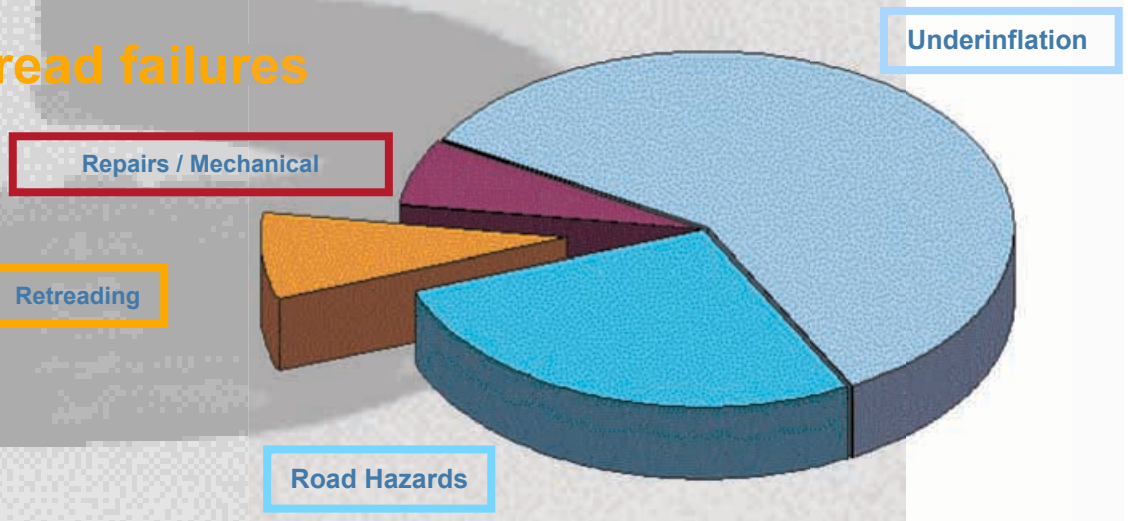
# Overview

- Retreading
  - Myths
  - Benefits
- Puncture Sealing Tyres
  - How they work
- 6.5 Tonne Steer Axle Mass
  - Tyre Suitability
  - Options

# Retreading
## *Roadside tyre pieces*



- Are roadside tyre pieces retreading failures?
  - **Not usually**
- The ATA (USA) investigated failed roadside tyres
  - Nearly 4,000 tyres were inspected
  - Over ¾ of truck tyre fragments were a result of either:
    - Under-inflation or
    - Road hazards
  - **Less than 10% were retread failures**

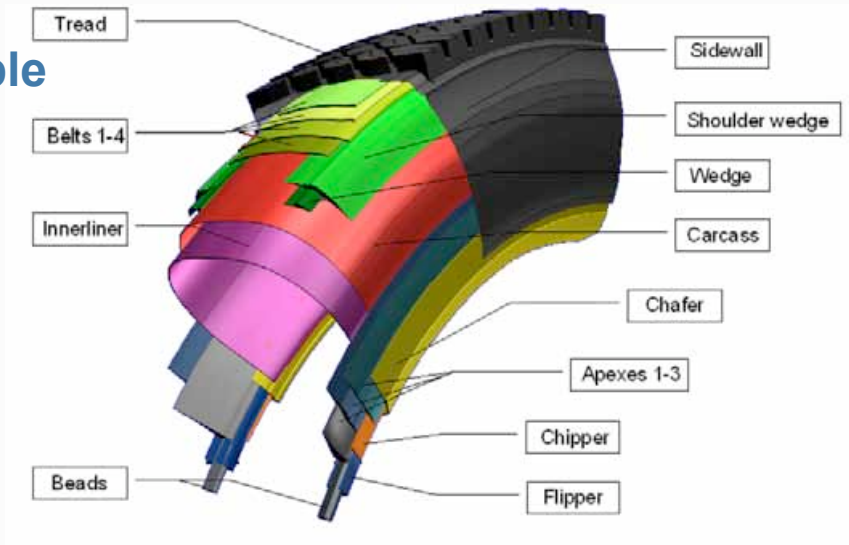


# Retreading
## *Tyre Construction*

- A truck tyre weighs ~ 55kgs, 8kg of which is steel
  - New tyre raw materials consume 85 litres of oil
  - A retread consumes only 23 litres

- After the tread is worn out
  - the tyre casing is **usually still serviceable**
  - *and* has been designed to be retreaded

- **Retreading is very efficient recycling**
  - **Maximises use of these resources**

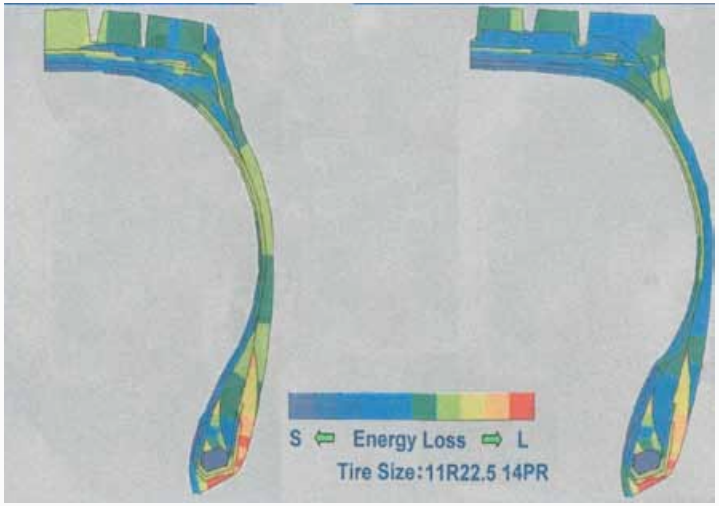


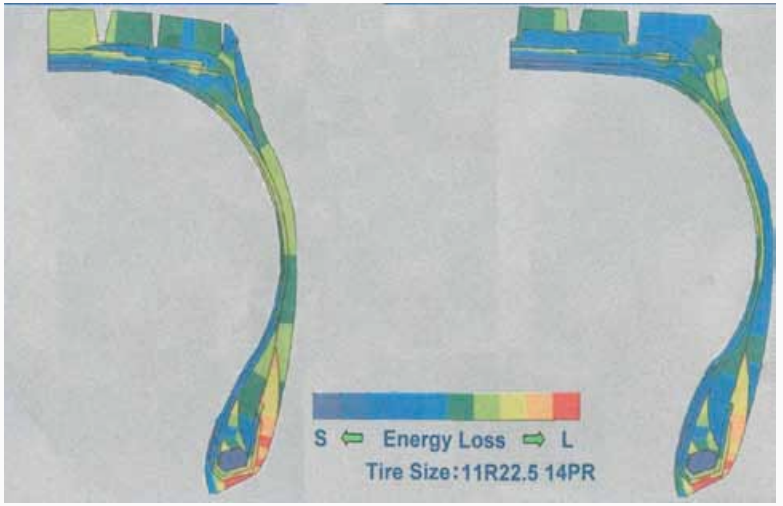
# Retreading
## *New Tyre Technology*

- New tyre technology complements retreading
  - Many new tyre technologies carry over to the retread

**Original design** → **Optimised Design**

- Colder colours show improved RR
- Also reduced casing strain



# Retreading
## *New Tyre Technology*

- Low rolling resistance (RR)
  - Casing design significantly affects RR
    - Tread pattern / compound = over 50%
    - **Remainder is tyre casing design**
  - Optimising a tyre casing to improve RR (using FEA)
    - Often improves casing life and retreadability
    - RR improvements continue to provide gains when retreaded

# Retreading
## *Fleet Benefits*

- If you have purchased a premium tyre
  - You **haven't** only purchased the tread
  - The casing is designed for multiple tread lives
    - **Retreading provides the best cpk**
- Tyre disposal charges / levies
  - Europe has banned tyres (incl. shredded) from landfill
  - Disposal charges are increasing
    - **Consider casing disposal in cpk calculations**
- Raw material costs are increasing
  - Single-use, budget tyres will cost more
    - **Retreads will become more and more cost-effective.**

# Retreading
## *Fleet Considerations*

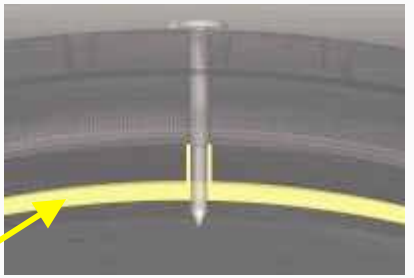
- What tyres are you using now?
- Can you improve cpk?
- Where can retreads be put to best use in your fleet?
- Do you track casings from cradle – grave?
- Do your casings receive necessary maintenance?
  - Regular pressure and tread depth checks
  - Driver care

# New Technology
## *Puncture Sealing Tyres*

Issue: Waste accounts suffering vehicle downtime due to punctures

Solution: Self-sealing tyres

- A sealant is built into the tyre that instantly seals tyre punctures
  - Seals punctures up to 6mm (in tread / crown)
  - No repair usually necessary
  - Can be retreaded (and continues to self-seal)
  - Development complete – on sale

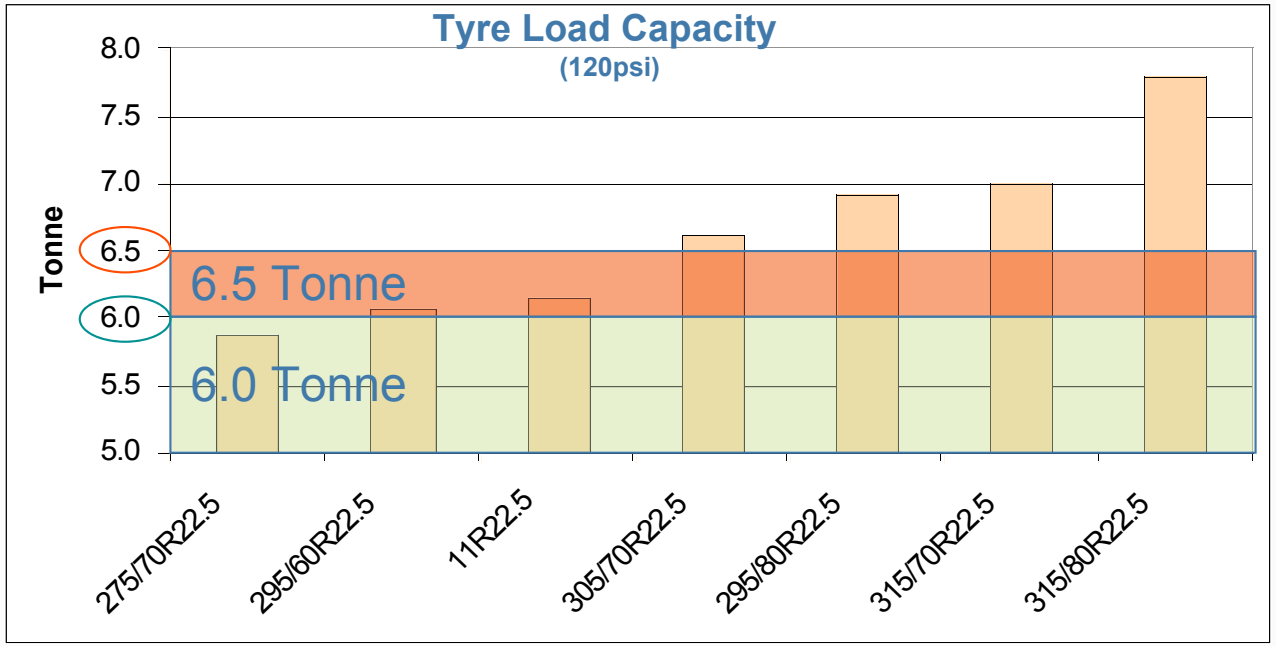


Duraseal layer (Yellow)

# 6.5 Tonne Steer Axle Mass
## *Capacity of common sizes*

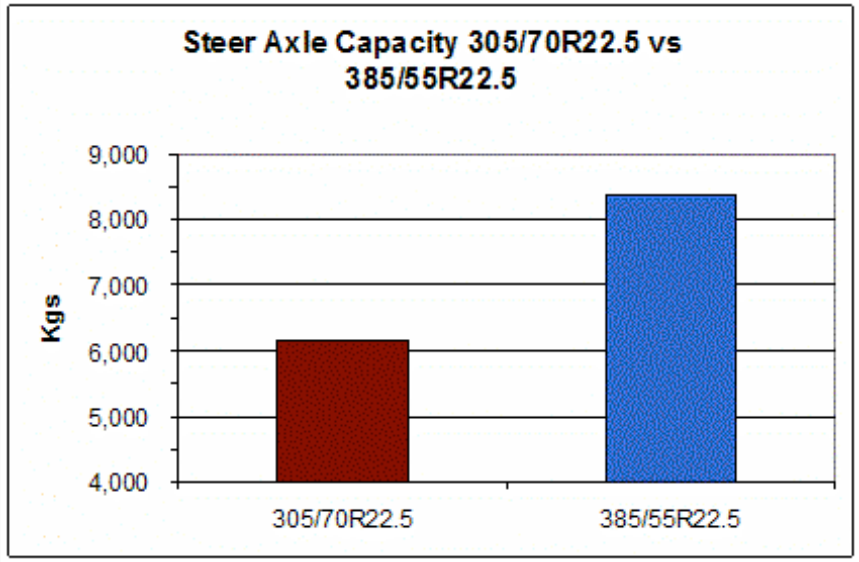
At 6.0 tonne most sizes have some reserve capacity, however
Some sizes, in particular low OD tyres, cannot carry 6.5 tonne

- Those that can, will:
  - Operate with less reserve capacity
  - Require higher inflation pressures



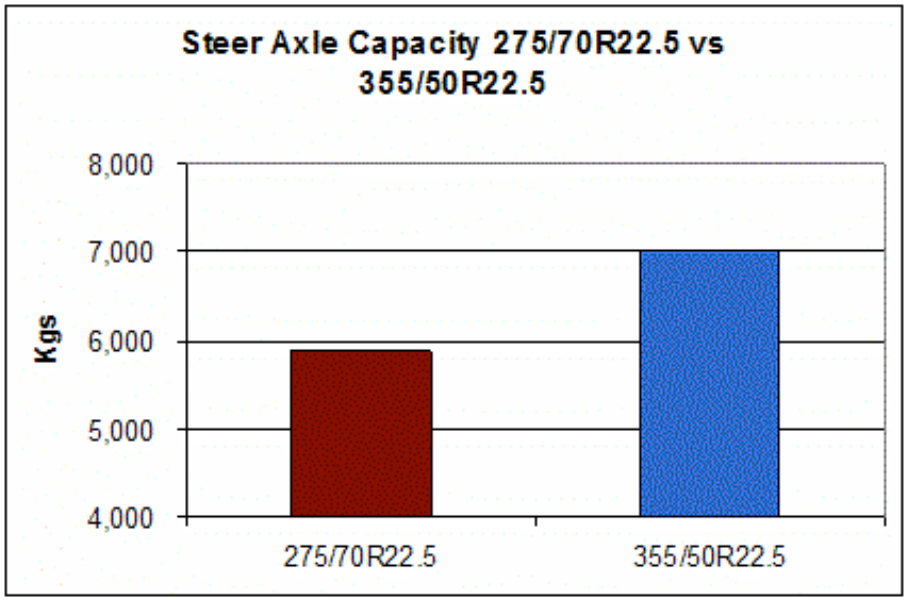
# 6.5 Tonne Steer Axle Mass
## *Alternative Tyre Sizes*

- **New sizes have been developed**:
  - For applications requiring high load capacity and low truck height
  - **385/55R22.5 – Equal height of a 305/70R22.5**
    - **30% more load capacity**




# 6.5 Tonne Steer Axle Mass
## *Alternative Tyre Sizes*

- **New sizes have been developed**:
  - For container transport
  - **355/50R22.5 – Equal height of a 275/70R22.5 or 295/60R22.5**
    - **20% more load capacity**




# 2007 Technical and Maintenance Conference

## Tyre Inflation Systems & Tyre Inflation Monitoring

Kevin Buschert - B. Eng.
Lead Engineer, Trailer –
Hendrickson Asia Pacific

# OVERVIEW

Tyre Inflation Systems

- Purpose
- Applications
- Designs

Cost / Benefit Analysis

North American Experience

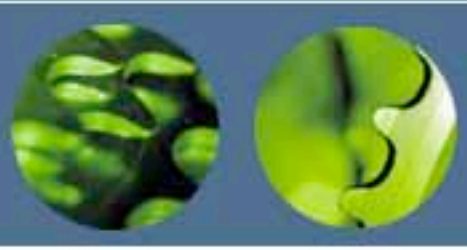
Australian Experience

# Tyre Inflation Systems - Purpose

- Purpose
  - Change Tyre Pressure to suit load
  - Change Tyre Pressure to improve traction in various terrain
  - Maintain Tyre Pressure to reduce tire inspection time
  - Maintain Tyre Pressure to reduce risk of sudden tire failure
  - Maintain Tyre Pressure to reduce fuel consumption
  - Warn operator of significant leaks

# Tyre Inflation Systems - Applications

- Heavy Vehicle Applications
  - Military
  - On Highway
  - Off Highway
  - Prime Mover
  - Heavy Rigid
  - Semi Trailers
  - B Doubles, Dog Trailers, Dolleys, etc.



# Tyre Inflation Systems - Designs

- Design – Plumbing
  - External inflation hose
    - Steer,  drive, lift, pusher, tag, trailer axles
  - In axle inflation hoses
    - Lift, pusher, tag, trailer
  - Pressurized Axle
- Design – Pressure Control
  - Constant Pressure
  - Periodic Pressure checks / adjustment
  - Electronic control unit
  - Mechanical regulator

# Cost / Benefit Analysis

- Cost
  - Varies by design type
- Benefits
  - Reduced risk of sudden tire failure
  - Reduced fuel consumption
  - Reduced tire maintenance costs
  - Increased tire life
  - Increased ‘on road’ time

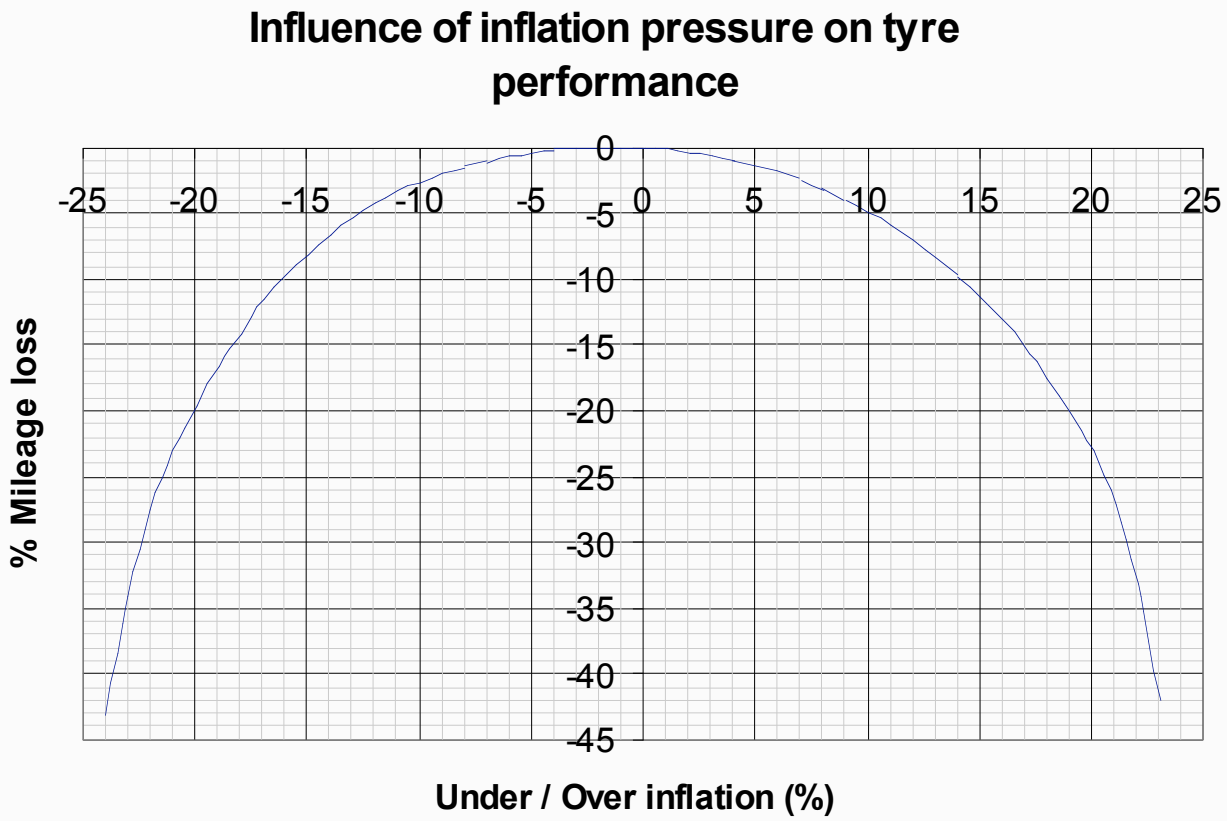
# Cost / Benefit Analysis

- North American Claims:
  - Only 44% of all truck tyres are within 5 psi of their target inflation (FMCSA PSV-04-0002)
  - 20% under-inflation reduces tyre carcas life by 30% (TMC RP235)
  - 15% under-inflation reduces fuel mileage by up to 2.5%
  - 90% of all tyre failures are directly related to under-inflation
  - Only about 8% of drivers check tire pressure before each trip with a gauge

# Cost / Benefit Analysis

- Australian Market Claims
  - More severe road conditions
  - Higher average loads
  - Higher ambient temperatures increase tire sensitivity to incorrect tire pressure
  - Pressure loss ~ 2 psi / month – assuming good tyre / rim seal

# Cost / Benefit Analysis

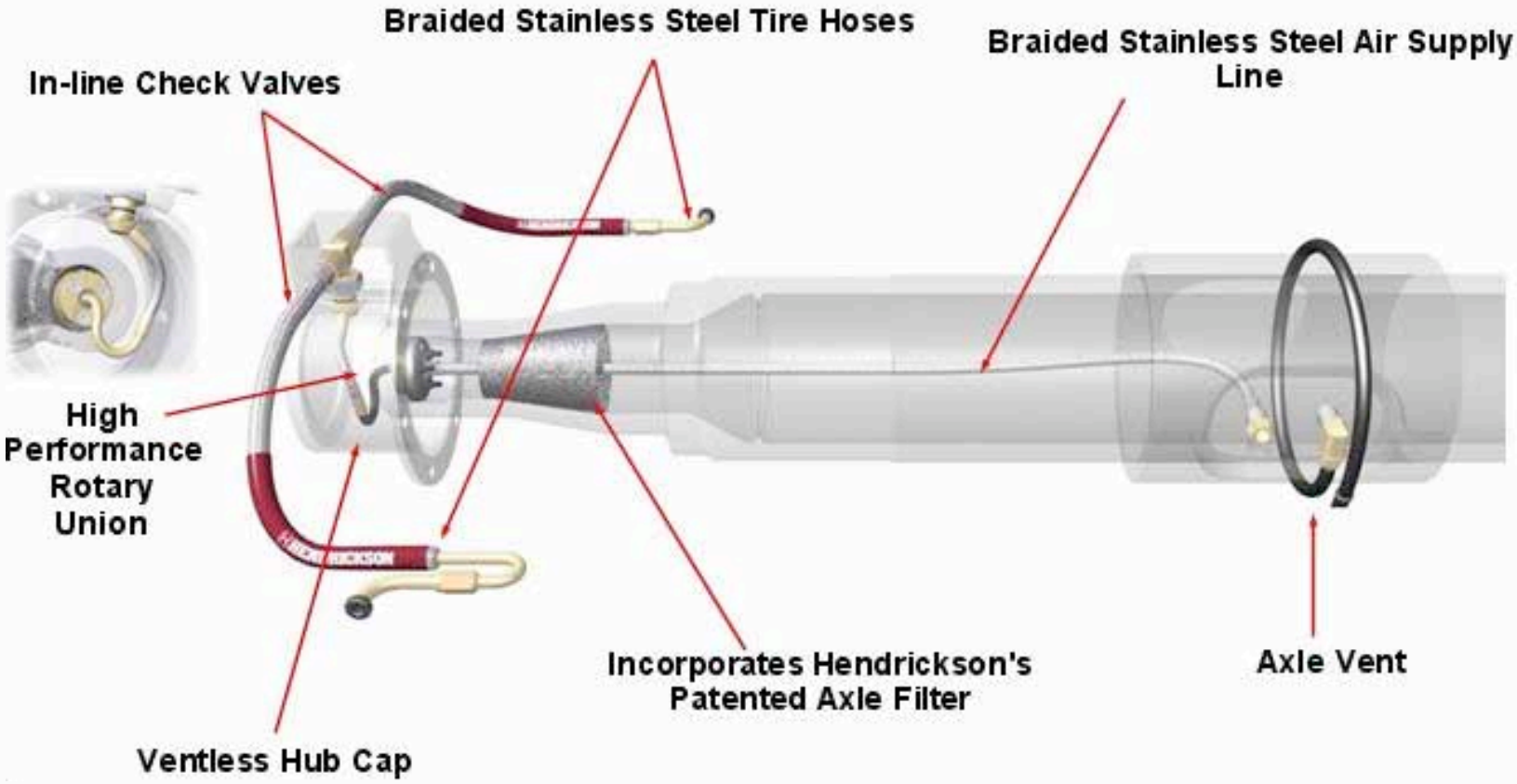


HENDRICKSON

*For The Road Ahead*

# TIREMAAX® Tire Inflation System

# TIREMAAX®

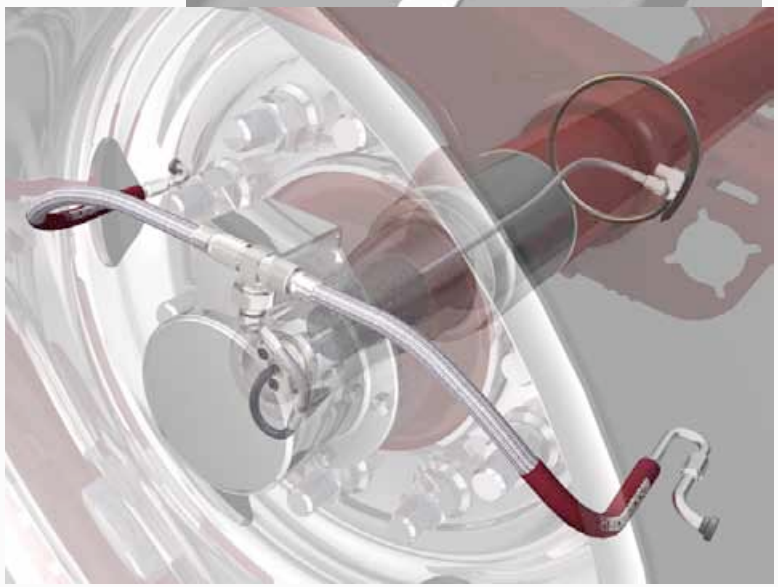

Braided Stainless Steel Tire Hoses
In-line Check Valves
Braided Stainless Steel Air Supply Line
High Performance Rotary Union
Incorporates Hendrickson's Patented Axle Filter
Axle Vent
Ventless Hub Cap

# TIREMAAX® – Features

- Incorporates patented axle-filter
- Axle is not pressurized
  - Helps prevent contaminants from being forced into wheel-end
- Hendrickson axle ventilation system (Patent Pending)
  - Does not vent at wheel-end
  - Helps prevent foreign materials from being ingested into the wheel-end
  - Prevents wheel-end lubrication from exiting through hubcap

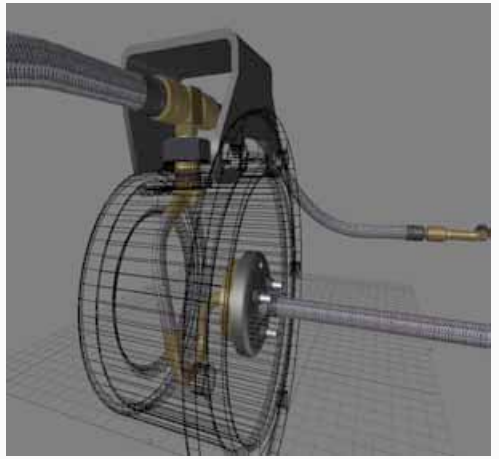
# TIREMAAX® – Features

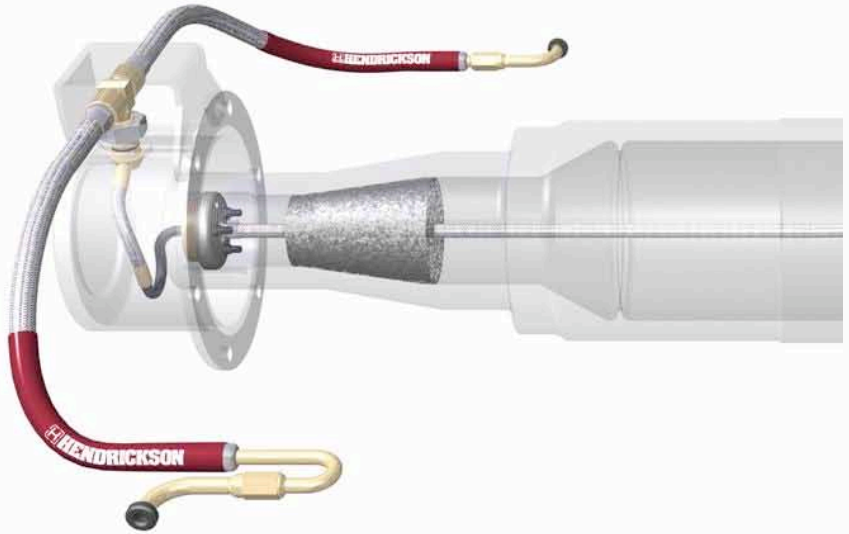
- Rotary union and lines are only pressurized when necessary
  - Internal components last longer
- Lamp illuminates only when attention is required
- Leaks do not result in wheel-end pressurization
- System turns off if tyre blows



# TIREMAAX® - Rotary Union

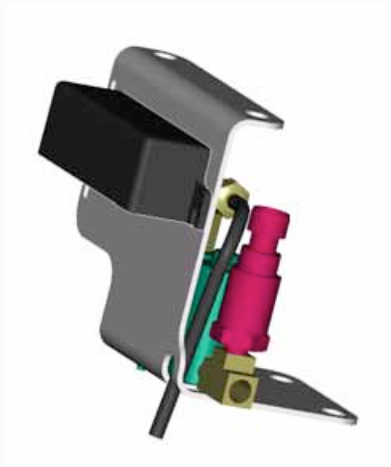
- High-performance ball bearings
  - Packaged design ensures seal concentricity
  - Bearings absorb axial loads instead of seals
- Specially designed seals to handle extreme temperature ranges
- No scheduled rotary connection replacement \
  – 7+ yr. life

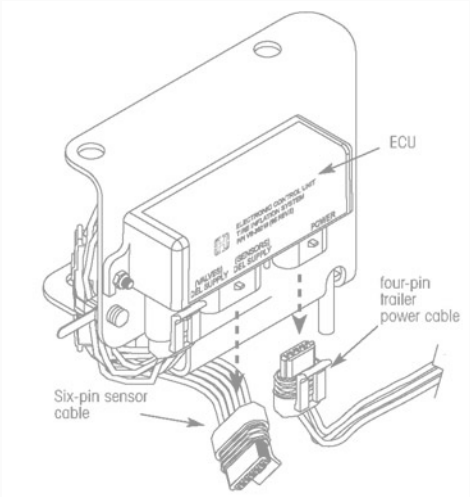




# TIREMAAX® - Electronic Control Unit

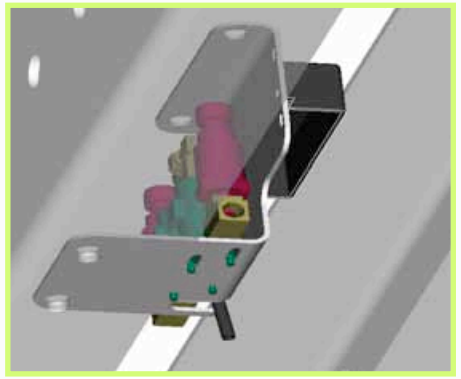
- Electronic system provides significant advantages over a regulator based system
  - Disables the system to conserve air and prevent pressurizing the hub
  - Only pressurizes system while filling
  - Intelligent warning light alerts driver
  - LED on the controller assembly communicates target pressure, status and diagnostic codes



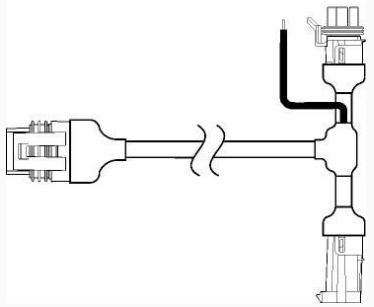



# Installation

- Install controller onto frame rail or cross brace



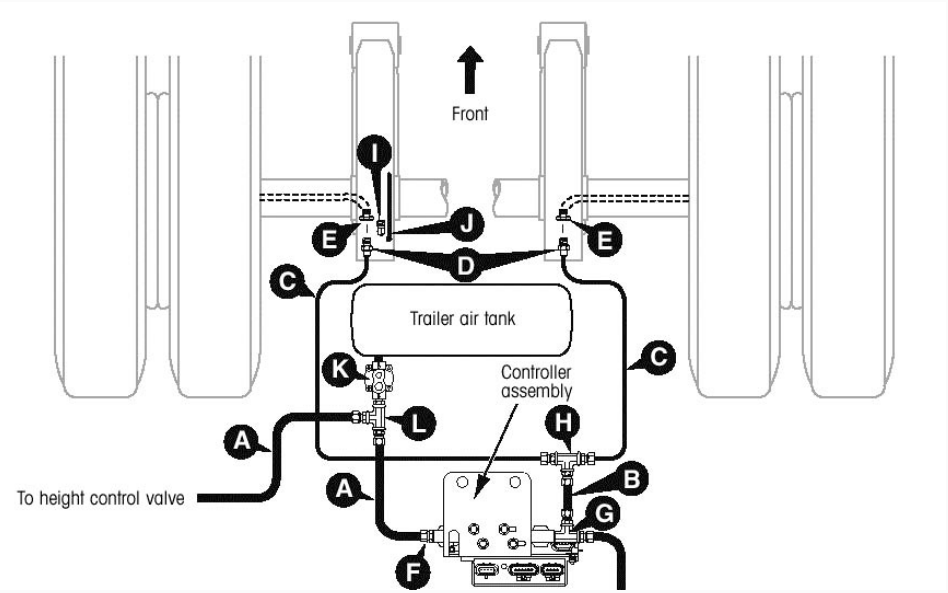
- Plug in wiring harness, spice into trailer power supply.



- Mount the indicator light; run light wire

# Installation

- Plumb air-line from PPV to controller
- Plumb air-lines from controller to axles




- Install tyre hoses and T-guards

# TIREMAAX® Specifications

| | |
|---|---|
| Tire Pressure Setting Range | 70 to 130 psi |
| Pressure Accuracy | +/- 1% |
| Pressure Check Interval | 10 minutes |
| Recommended Operating Voltage | 12 volts |
| Inflation Capacity | 10 psi in appox. two minutes |
| Weight | 2.8 kg (Axle) |

# 2007 Technical and Maintenance Conference

Phil Burnard – Bridgestone
Technical Field Service Mgr - NSW

# Trends in Tyre Technology - Maintenance

**Tyre maintenance, general principles.**

- Aim = Maximise return on cost. By achieving even wear to give highest possible km run, while minimising fuel use.

- What sort of return?
  - **Lowest cost per km** : Quality tyres cost more but deliver higher km run with correct preventative maintenance. The big 3 also invest more in high technology, development and testing = lower rolling resistance = lower fuel use.
  - **Good quality tyres with good alignment and regular maintenance**, Cpk = prime mover and trailer Syd-Melb = 4c. Syd-Bris or Adel = 5c or Syd-Perth = 5.2c Intrastate regional = Local = 5 to 7c (retread on trailer tyres reduce cost by 20%)
  - **Possible fuel reduction with lower rolling resistance tyres**:

    From my presentation last year: Low RR tyres on drive and trailer could save 7% in fuel, but it is hard to quantify in real operation. Some loss of tyre life by using lower tread depth tyres or wide single tyres.

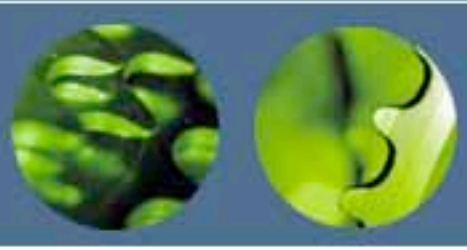
# Trends in Tyre Technology - Maintenance

- What improvements in km return ? Customers doing everything right…

A generation ago (5 to 10 years in tyre terms)

NOW

| Linehaul | Steer | Drive | Trailer | Steer | Drive | Trailer |
|---|---|---|---|---|---|---|
| Syd Melb | 140000 | 250000 | 250000 | 190000 | 300000 | 300000 |
| Syd Bris / Adel | 100000 | 200000 | 200000 | 140000 | 250000 | 250000 |



# Trends in Tyre Technology - Maintenance

**How to achieve best return** = reduce the impact of influences on tyre wear.

1. Pressure ; correct for the load, and maintained
2. Alignment,
3. Route; road camber, road surface, cross winds
4. Truck set up – HP, suspension condition (dampers (shocks) working and correct to stop excessive airbag bounce, lubrication) ,
5. Driver (right foot!) Smooth gear change, gradual take offs. Vastly improve fuel use also.

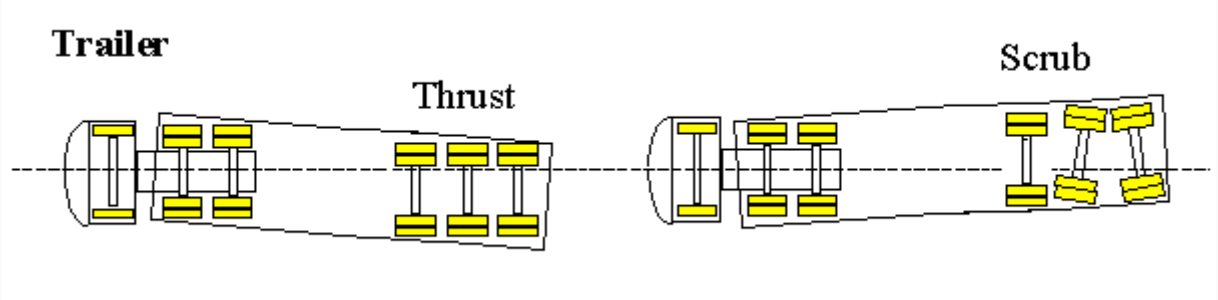
# Trends in Tyre Technology - Maintenance

1. **Pressure checking** – I'll cover shortly together with some new technology

2. **Alignment**: Trucks have improved OE settings dramatically. Many are right from factory, but if they are not it is expensive. So check, or get a printout from OE.

- You need an aligner you can trust and know what they are doing.
- Get them to write down the camber, castor and toe settings
- They do move during service, so it is possible for minor changes, and of course component wear and driving over kerb etc occurs. when you get tyres rotated ask for someone to check for feathering or taper wear.
- Trailers cop a beating– align them! If trailers are off tracking, drivers may see it in mirror

# Trends in Tyre Technology - Maintenance



# Trends in Tyre Technology - Maintenance

**Alignment:**

A general guide – all settings depend on OE specifications, different makes have different steering and suspension systems and thus settings for correct handling.

Beware – there are many opinions on the so called “Black Art” and if you ask me, I’ll give you mine!

Alignment settings must take into account the route and tyre wear you experience. High cambered roads or a lot of city driving require settings at the more extreme end of the range.

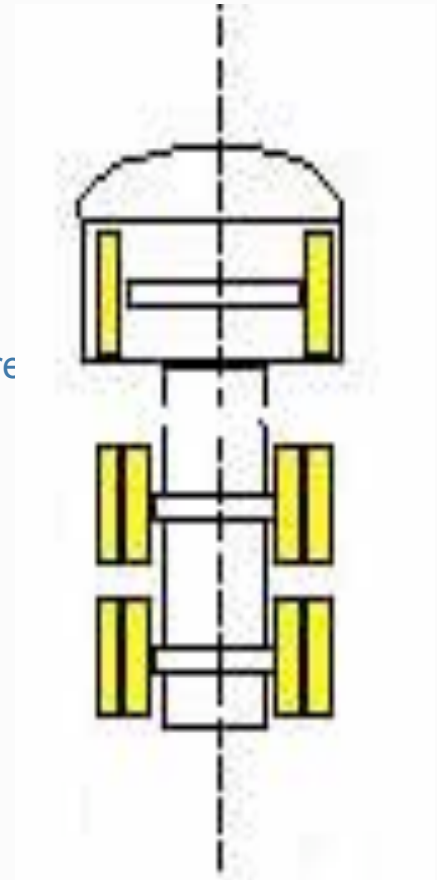
# Trends in Tyre Technology - Maintenance

## Prime Mover

**Camber**
L -0 to- ½, R +1/2 to +1
**Castor**
Usually bet 2 and 4 deg,
L should be ½ -1 deg more
**Toe**
0 to1 mm/m in (check OE)

**Drive tracking**
Front axle straight,
Rear 2mm/m tracking down (left)

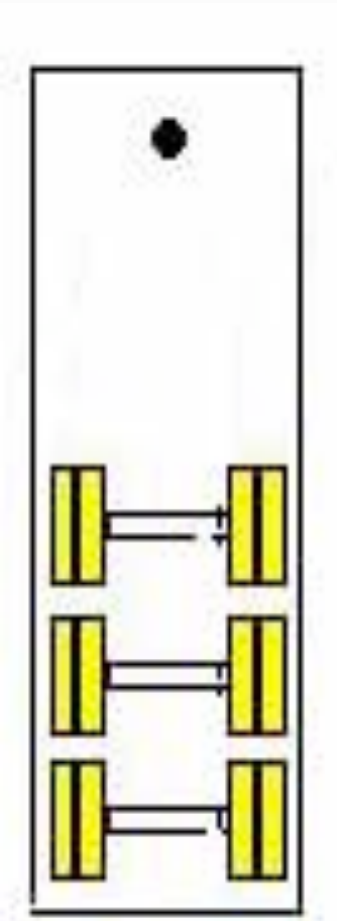
**Toe** in or out should be close to 0 (+/-1mm/m)



## Trailer

Generally all should be tracking at zero, parallel to the centre line

**Toe** in /out
0 (+/- 2 acceptable)



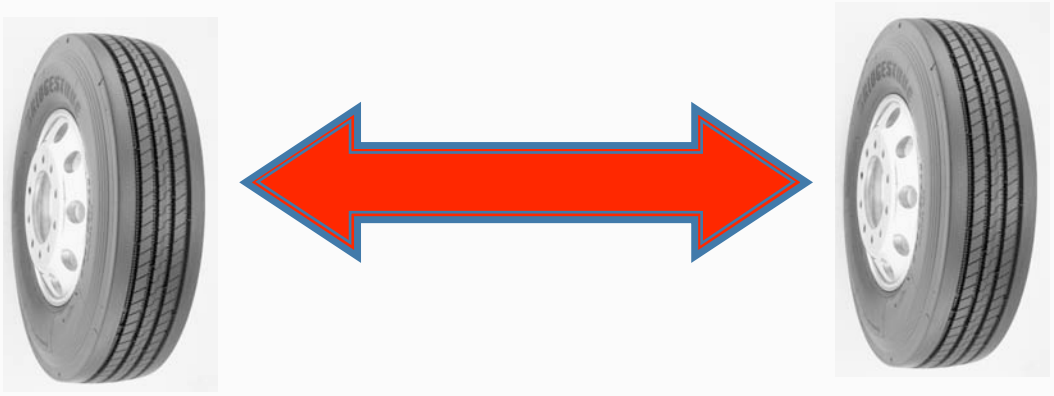
# Trends in Tyre Technology - Maintenance

**Rotation:**

- Has to be done to achieve even wear and thus max km life. due to influences beyond our control
- To some extent, has to work in with your business and maintenance practice, when how often what labour etc.

**Ideally:**

Steer at every 25 % of life side to side no need to turn on the rim unless some abnormal wear/influence dictates it.



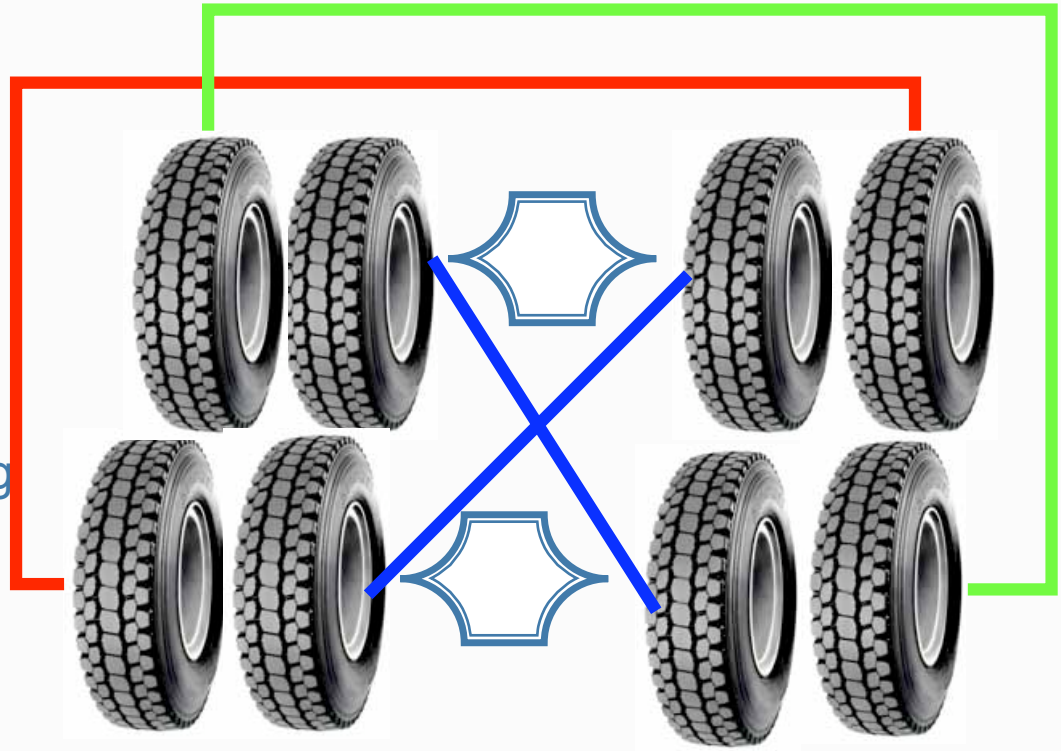
## Steer Axles

# Trends in Tyre Technology - Maintenance

**Rotation:**

- Ideally:
Drive rotated at every 25 % of life

Cross rotated.
(tyre run in opposite direction to smooth out heel/toe reducing Irregular wear & noise



Bogie Drive Assemblies

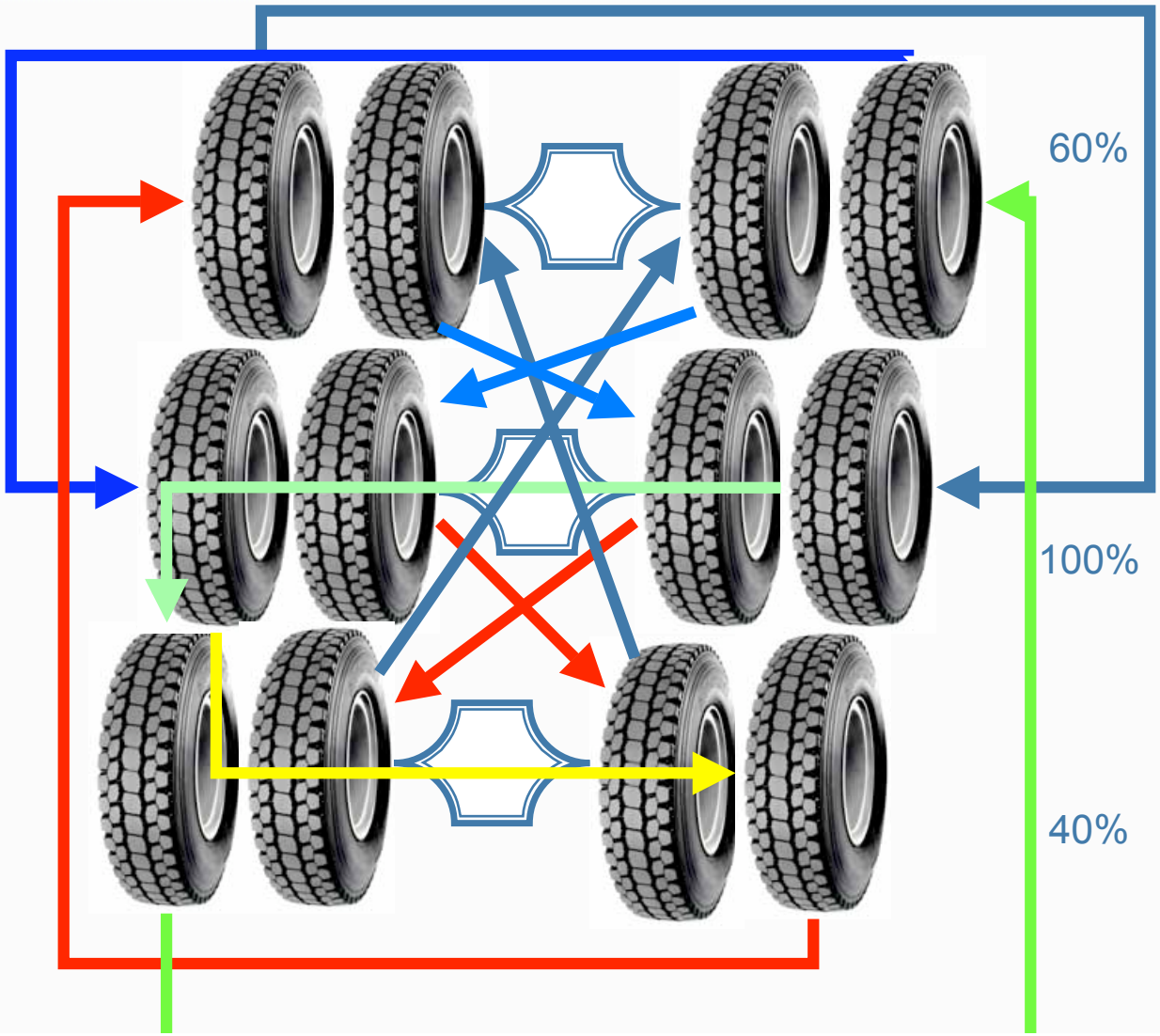
# Trends in Tyre Technology - Maintenance

**Rotation:**

- Trailer – got to be kidding?
- **Wear: Approx:** Middle 100%, rear 40%, front 60%

… why throw your middle axle out at half worn due to diagonal wear – they likely would never have got that way with a couple of rotations. Do them when you do brake checks and other trailer adjustments.

- Diagonally again, front to middle, Middle to rear, Rear to front
- Ideally rotate at 25% of wear again. But hey, one rotation better than none!



# Trends in Tyre Technology - Maintenance

**Maintenance systems / practice / planning**

- A system that can manage intervals for
  - Visual tyre wear check
  - pressure check
  - Rotation
  - alignment (once per yr or when abnormal wear is seen).

- Track costs, tyre purchase, Rotation, damages, repairs
- How:

1/ **By your tyre supplier** – B-fleet type reporting on purchases vs km by vehicle (simple yet effective).
- internet based – easy access, can bring up purchases / service work done by vehicle. Reports can be emailed automatically.

2/ **DIY - set up a spreadsheet** -is not that hard, but getting data and tracking tyre movements accurately in a larger fleet is very hard,

3/ **Purchase a system**. A few mining oriented systems that are quite complex, but can track tyre life from purchase to retread to disposal. Also they can be set to alert when maintenance is due. Some tyre suppliers will have a system on offer. The big global companies have various systems they offer throughout the world, and development is on-going.

Bridgestone have systems that are being designed to go hand in hand with data collection and pressure transmitter devices.

# Trends in Tyre Technology - Maintenance

http://www.bfleet.com.au/

Bridgestone were the first company in Australia able to offer transport operators direct access to their own fleet tyre data live and on-line.

Have a look at the site, there are some forms to help you DIY also.

# Trends in Tyre Technology - Maintenance

Tyre life management

- Many different opinions/options depending on tyre supplier, operation, and size compatibility
  - Run-out to retread, case trade vs. case disposal. what about re-grooving?
  - Consider also environmental responsibility
- cost reduction by use of retreads vs possible increase in damages cost –weigh up.
  - Cost of trailer halves! (saves 25% tyre cost on B-double)
  - Cost of increased damage? Failure rate minimised by good cases and managing repairs. ($4700 save vs $1000?)

# Trends in Tyre Technology - Maintenance

- Pressure monitoring – and New technology.
- A good deal of tyre management is simple pressure checking.
  - **Saves loss of a tyre and potential damage if a puncture is detected**.
  - **Reduces early tyre removal due to irregular wear**.
  - **New Technology**
    - TPMS for Trucks
    - coming out in the market
    - no longer need to unscrew valve caps and use pressure gauges! save 30 seconds tyre in actual labour
    - Calculates COLD pressures - pressure transducers mounted to the rim measure both pressure and temp and give a compensated cold pressure.
  - **Consider hot/cold pressure differences**.
    - Many pressures are measured at the correct setting ( typical 120psi steer, 100psi drive 100 trailer) but are actually running 5 to 10% lower in actual cold pressure, because a summer hot day and trucks sitting in the sun end up reading that much more doe to temperature/pressure increase. Make sure you take this into account in summer!


Standard Tire Sensor


SmartWave Display


Wireless Gateway Receiver


Maintenance Hand-Tool

# Trends in Tyre Technology - Maintenance

**ATA Commercial Vehicle Wheel Security Code of Practice.**

- ATA and fleet managers, tyre suppliers have spent a lot of time drafting this code of practice to give safe work guidelines to fitting of wheels. Since you are all going to be doing a lot more tyre rotations, you should get a copy once it is printed !

- It is a serious matter, because wheels have a possibility of coming loose because they are not torqued correctly and re-checked after fitting.

- Large round black things rolling down the road not attached to trucks, *tend to create some problems!*

# 2007 Technical and Maintenance Conference

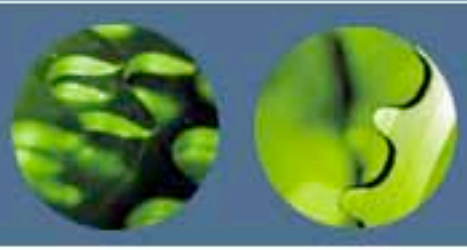
## SCOTT FINEMORE

## ADVANTAGE TYRES LAVERTON – RECAMICVICTORIA

# TRENDS-TYRE TECHNOLOGY

## NEW TYRE DEVELOPMENTS - OPERATOR EXPERIENCE.

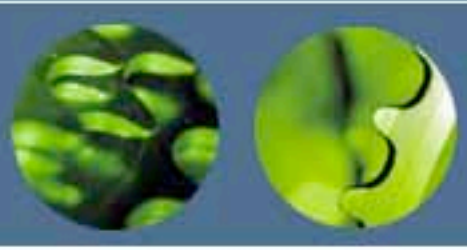
- CHANGE IS THE CHALLENGE.
- INVESTMENT DELIVERS RESULTS.
- MEASUREMENT OF RESULT THEN IMPLEMENTATION / PROMOTION
- MULTIPLYING THAT RESULT IN THE FLEET TO DELIVER PROFIT.



# TRENDS-TYRE TECHNOLOGY

**OPERATORS HAVE UTILISED.**

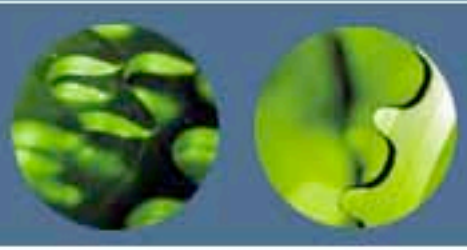
- LOWER CENTRE OF GRAVITY.
- INCREASED LOAD CARRYING CAPACITY.
- IMPROVED ROLLING RESISTANCE.
- FUEL SAVINGS. 5% + 12%
- INCREASED KM’ s .100%



# TRENDS-TYRE TECHNOLOGY

## EQUIPMENT ADVANCES

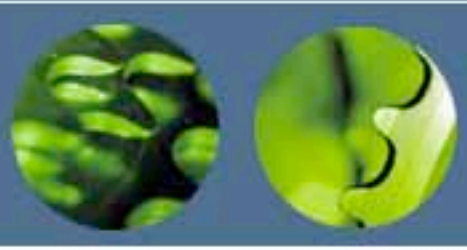
- HEAVIER COMBINATION WEIGHTS
- HIGHER AVERAGE SPEEDS
- HIGHER HORSEPOWER
- LOWER LOAD HEIGHTS
- IMPROVED SAFETY
- IMPROVED POLLUTION MANAGEMENT



# TRENDS-TYRE TECHNOLOGY

## OPERATOR EXPERIENCE

- EVERYONE WILL HEAR ABOUT THE NEW TYRE THAT DID NOT PERFORM TO REQUIRMENTS.
- WHEN A NEW TYRE WORKS OPERATORS TEND TO KEEP IT QUIET AS THAT GIVES THEM THE COMPETITIVE EDGE.

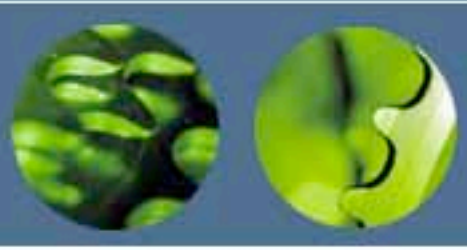


# TRENDS-TYRE TECHNOLOGY

## PROBLEMS AND IMPROVEMENTS

THE BIGGEST PROBLEM IS:

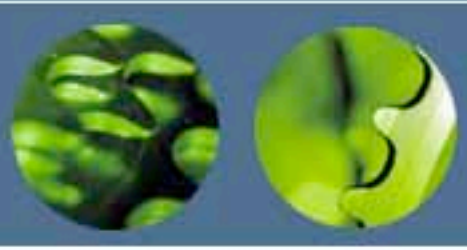
- SALESMAN DON'T QUALIFY THE CUSTOMER FOR THE REQUIREMENT.
- FUEL EFFICIENCY – TYRE LIFE
- TYRES ARE A COMPROMISE.
- DO THE RESEARCH



# TRENDS-TYRE TECHNOLOGY

## NITROGEN INFLATION

- TEMPERATURE IS THE BIGGEST KILLER OF TYRES.
- 15% REDUCTION IN RUNNING TEMPERATURE
- 22% INCREASE IN TYRE LIFE

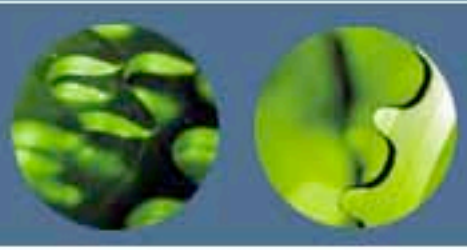


# TRENDS-TYRE TECHNOLOGY

## NITROGEN INFLATION

A REDUCTION IN TEMPERATURE.

- IMPROVES ROLLING RESISTANCE
- INCREASES FUEL EFFICIENCY 3-5%.
- GUARANTEES “AIR” QUALITY

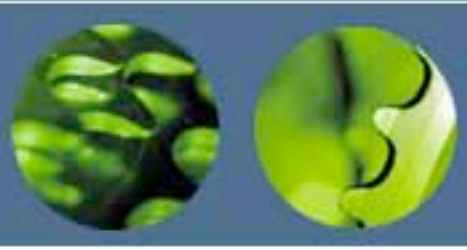


# TRENDS-TYRE TECHNOLOGY

## RETREAD PERFORMANCE

## LAST 25 YEARS

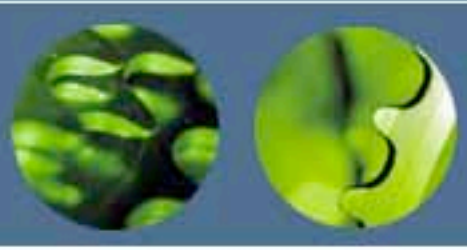
- REDUCED RUNNING TEMPERATURES
- 100% IMPROVEMENT IN KM’ s
- INLINE WITH THE NEW TYRE DEVELOPMENTS- LOW PROFILE
- DEEP TREADS



# TRENDS-TYRE TECHNOLOGY

## RETREAD PERFORMANCE

- FUEL EFFICIENCY 5%+
- APPEARANCE SAME AS NEW
- INCREASED RETREADABILITY

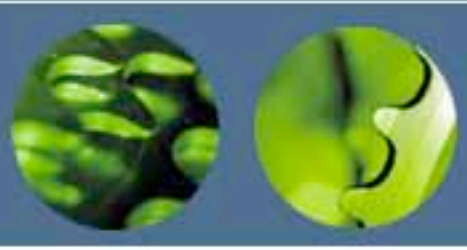


# TRENDS-TYRE TECHNOLOGY

## DEVELOPMENTS .

GLOBALLY

- BRIDGESTONE AMERICA BUYS BANDAG FOR MORE THEN $1 BILLION U.S
- MICHELIN BUYS OLIVER FOR $69 MILLION



# TRENDS-TYRE TECHNOLOGY

## DEVELOPMENTS

- THE 3 BIG PLAYERS MICHELIN , GOODYEAR , BRIDGESTONE.
- ALL IDENTIFIED THE FUTURE IS RECYCLE A PREMIUM CASE AND RETREAD QUALITY IS CRITICAL.
- THEY NEED TO OWN , CONTROL AND INVEST IN THE RETREAD GLOBALLY

# TRENDS-TYRE TECHNOLOGY

## EQUIPMENT DEVELOPMENTS

NON DESTRUCTIVE INSPECTION

# TRENDS-TYRE TECHNOLOGY

## EQUIPMENT DEVELOPMENTS.

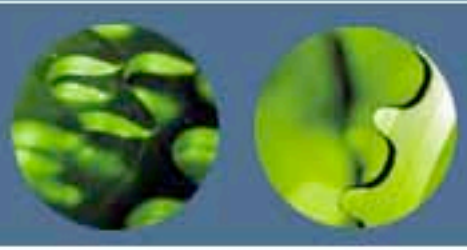
FULLY COMPUTERISED AUTOMATIC LATHES

# TRENDS-TYRE TECHNOLOGY

- COMPUTERISED BUILDERS

# TRENDS-TYRE TECHNOLOGY

## COMPUTERISED AUTOCLAVES- OVENS



# TRENDS-TYRE TECHNOLOGY

## THE FUTURE IS POSITIVE FOR TRUCK TYRE TECHNOLOGY

## OPPORTUNITY: WE NEED OPERATORS CONTINUAL INVESTMENT.

# TRENDS-TYRE TECHNOLOGY