Technology in the service of road safety

TIRE MONITORING AND MANAGING

Eyal Ram

VP Projects, Neomatix

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Neomatix

- Start up company
- Vision based technology
- BI – Alerts for fleet management
- Tire health
- Asset tracking

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Over View

- Tire wear out and safety
- Tire inflation
  - Fuel consumption (CO_2 emissions)
  - Life time
- Monitoring and managing systems

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Tire wear out and safety

NHTSA (2012) :

“Tire-Related Factors in the Pre-Crash Phase” Eun-Ha choi, Ph.D

- The data was collected from 2005 until 2007 (3 years)
- 5,470 crashes analyses – represent 2,189,000 crashes

Tire wear out and safety

- Vehicles that experienced one or more: Tire/wheel deficiency, blowout/flat tire ,other degradation in the Pre-crash phase

- Main result: ~9% of the total crashes “tire related crashes”

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Tire wear out and safety

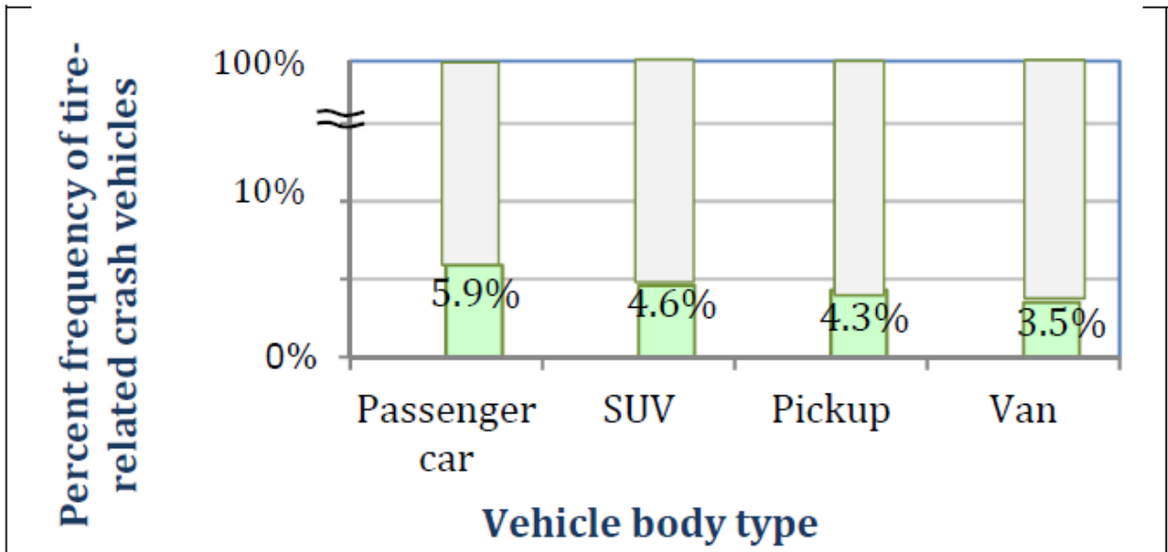

Figure 2(a). Percentage of tire-related crash vehicles in each vehicle body type

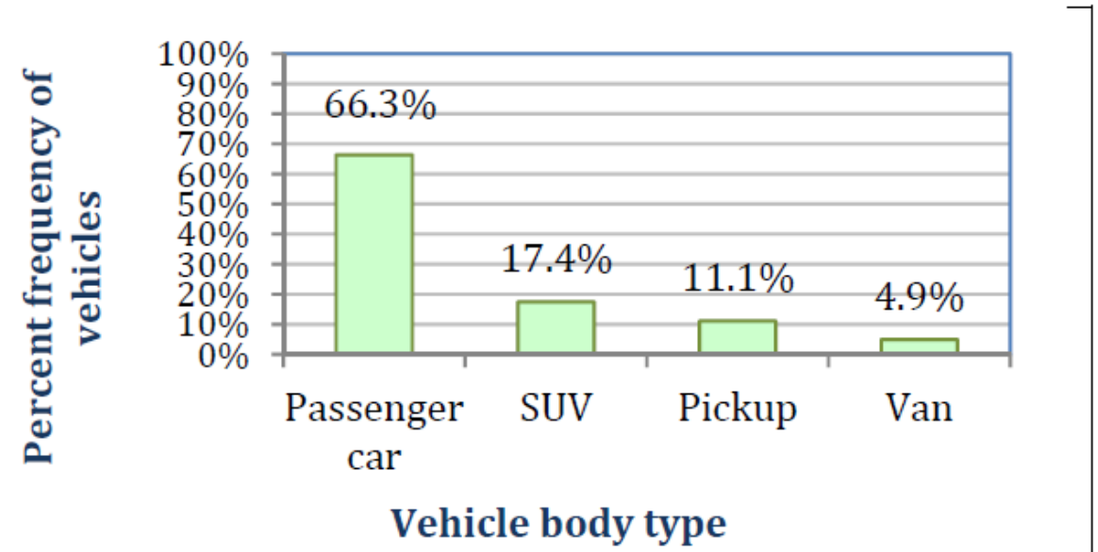

Figure 2(b). Percentage distribution of tire-related crash vehicles over vehicle body type

Figure 2. Tire-related crash vehicles and vehicle body type
(Data Source: NMVCCS 2005-2007)

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Tire wear out and safety

- Tire damage

- Tire tread

- Tire inflation

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Tire wear out and safety

- Tire damage

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Tire wear out and safety

- Tire damage:

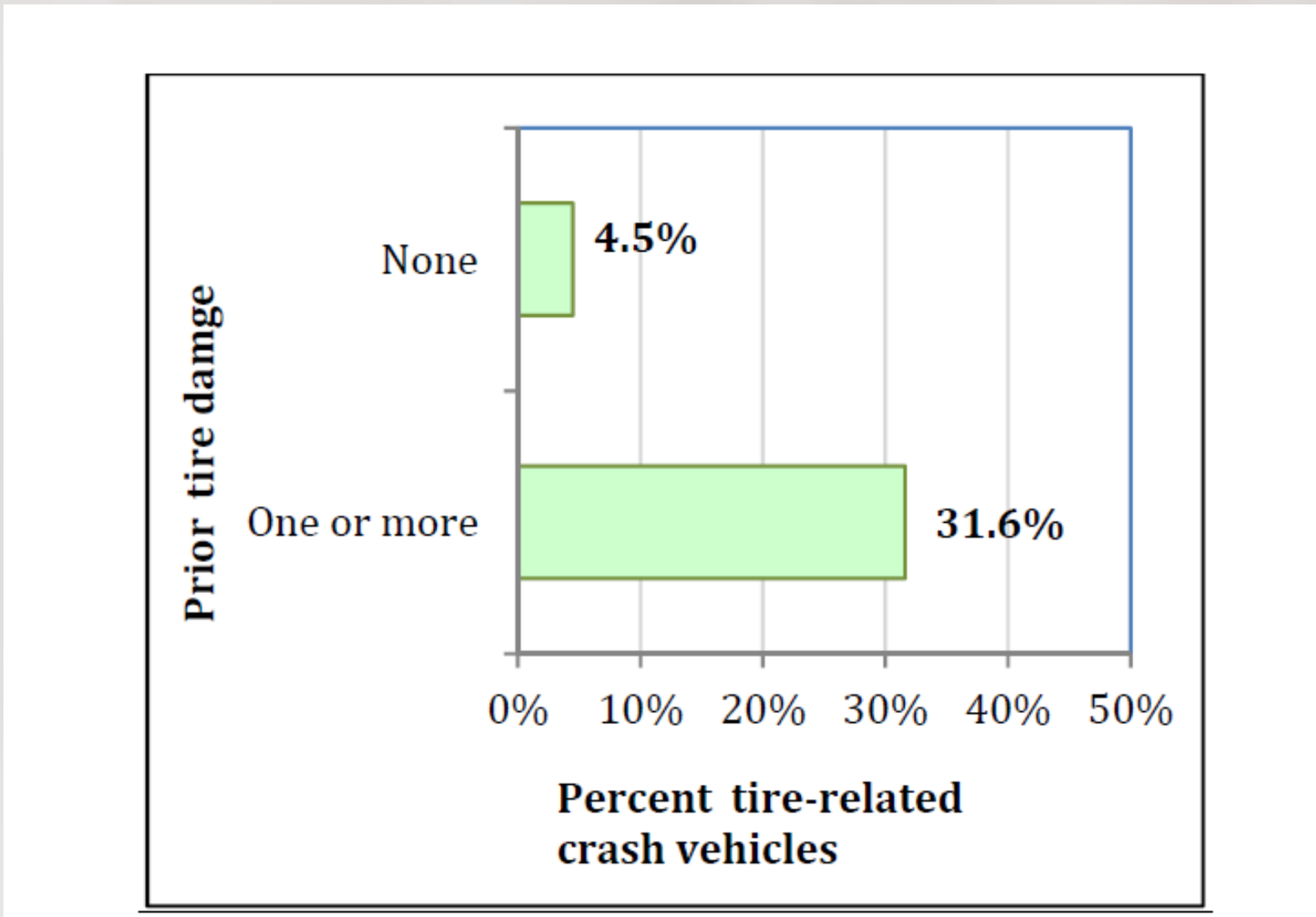

Figure 3. Percentage of tire-related crash vehicles by presence of prior tire damage (Data Source: NMVCCS 2005-2007)

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Tire wear out and safety

30% of passenger cars & 20% of commercial vehicles have at least one tire that shows signs of ageing or other irregularities that increases the risk of tire failure.

Table 2.4: Deficiency rates – Roadside inspections of commercial vehicles during 2007-2008.

	Wheels/ tyres defects	
Austria	2164	13.6%
Belgium	866	14.6%
Bulgaria	335	29.9%
Cyprus	214	16.8%
Czech Republic	12224	20.6%
Germany	29511	16.6%
Denmark	13	5.7%
Estonia	356	21.3%
Finland	368	6.4%
France		
Greece	2291	45.4%
Hungary	990	5.1%
Ireland	545	15.9%
Italy		
Lithuania	1353	17.5%
Luxembourg	193	17.6%
Latvia		
Malta	778	17.2%
Netherlands	188	11.3%
Poland	15464	28.2%
Portugal	154	20.7%
Romania	5503	42.9%
Sweden	4595	13.9%
Slovenia		
Slovakia	404	23.3%
United Kingdom	19325	20%

“Study on some safety-related aspects of tire use” (European commission Directorate-general for Mobility and Transport, Dec 2014)

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Tire wear out and safety

- Tire damage

- Tire tread

- Tire inflation

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Tire wear out and safety

- Tire tread

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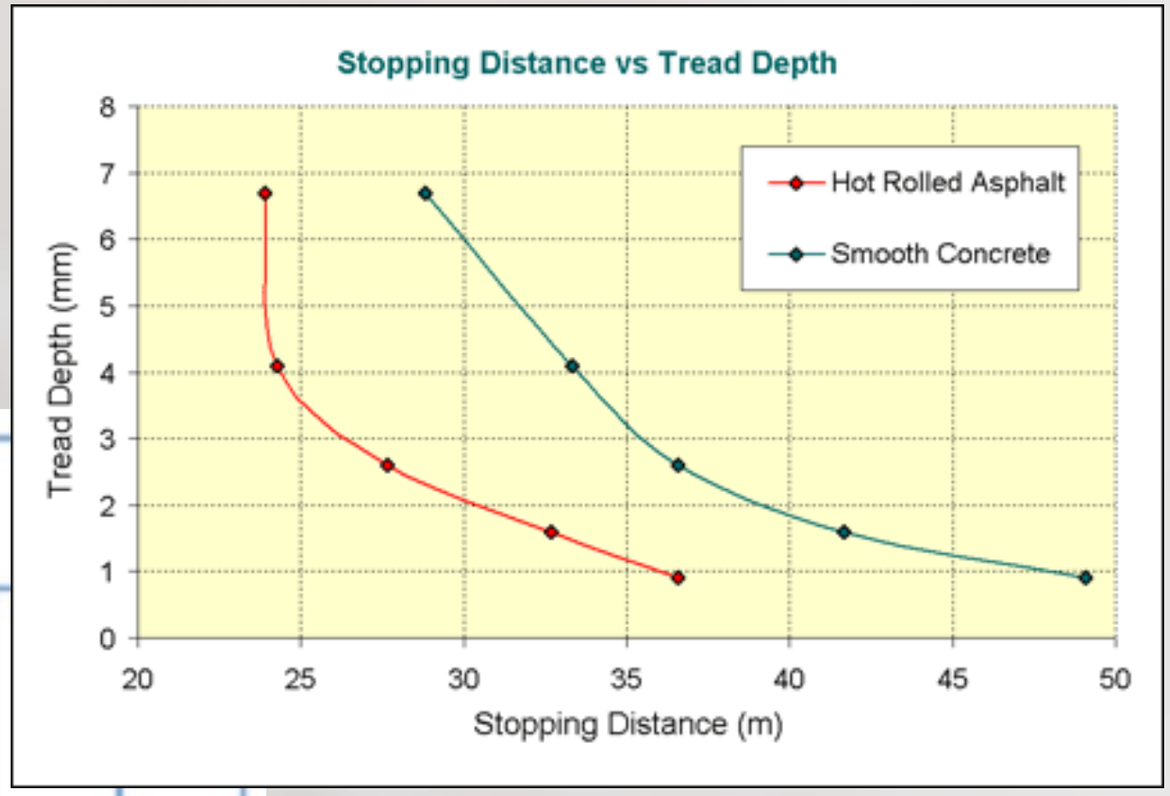
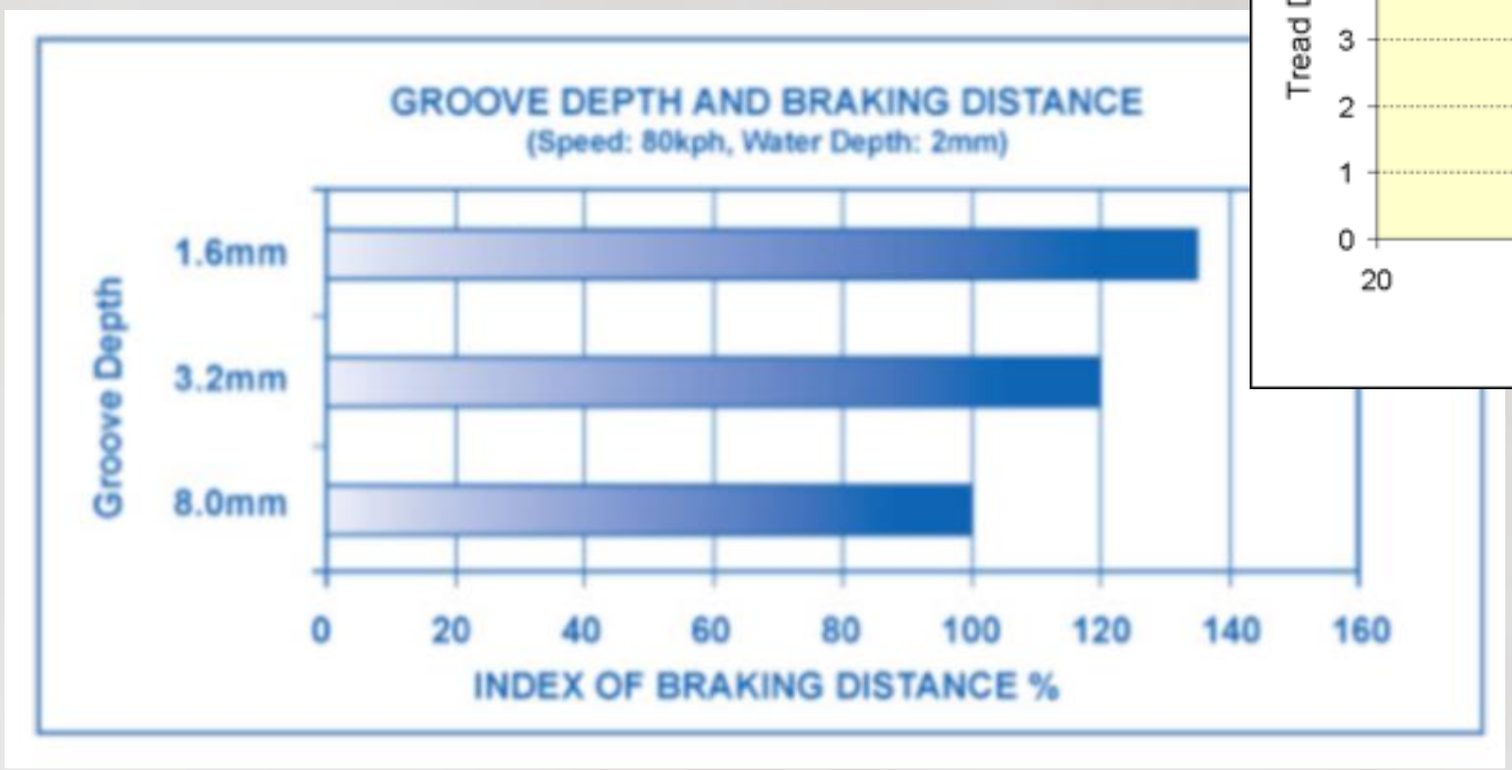
Tire wear out and safety

- Tire tread depth:





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Tire wear out and safety

- Tire tread depth:

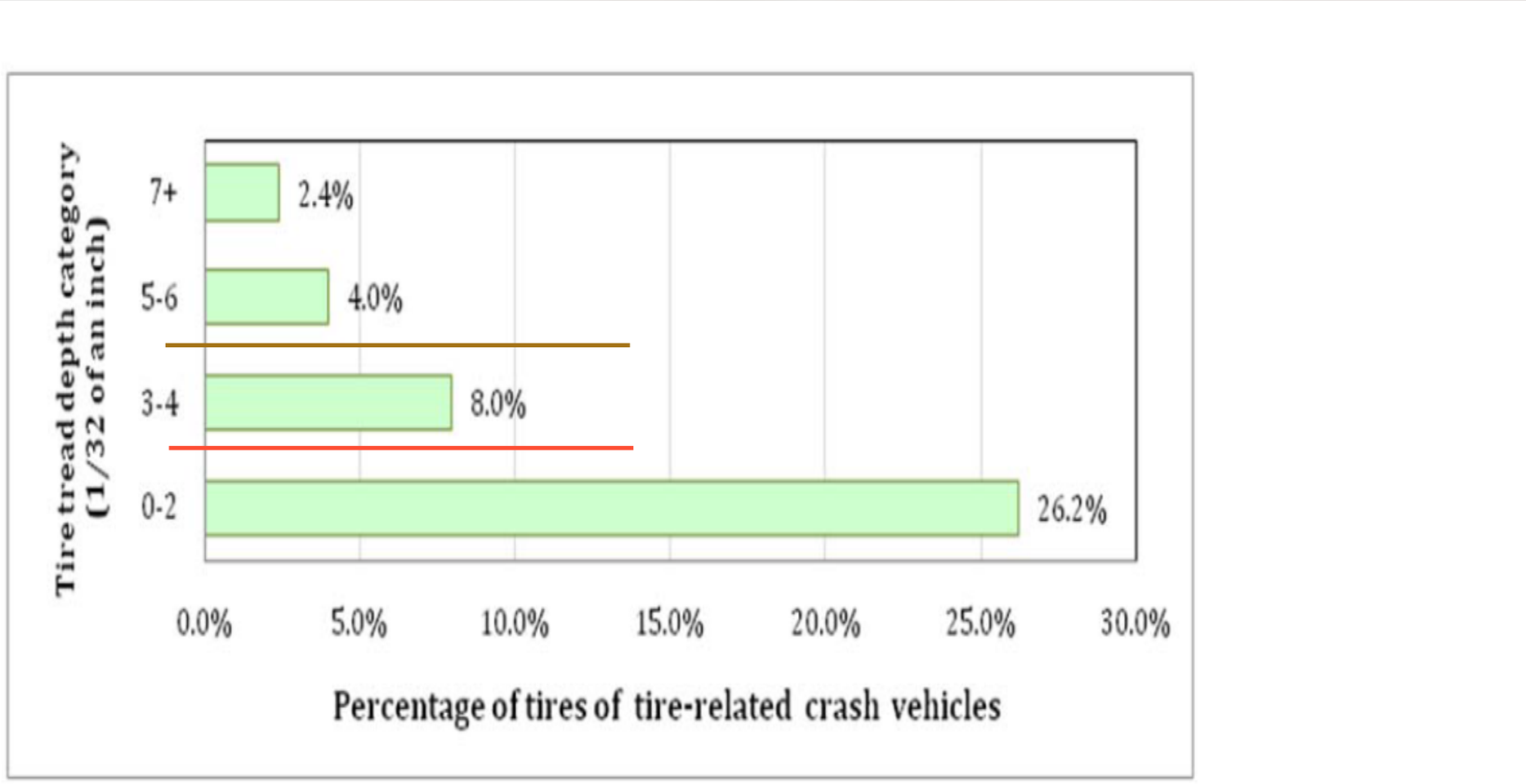

Figure 5. Percentage of tires of tire-related crash vehicles in each category of tire tread depth (Data Source: NMVCCS 2005-2007)

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Tire wear out and safety

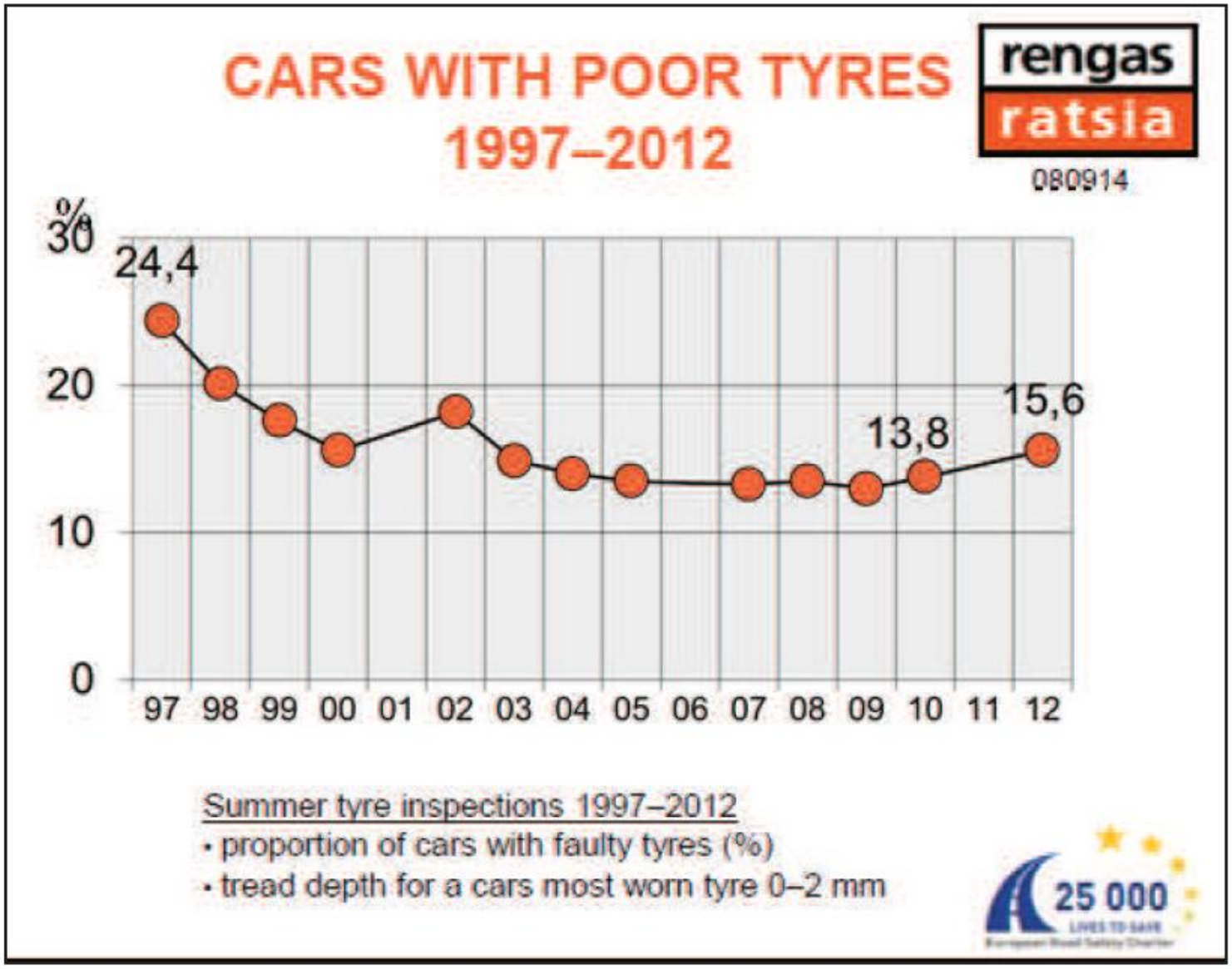

Figure 2.2: Summer tyre inspections in Finland 1997 – 2012 - Share of vehicles with very reduced tread depth (<2 mm).

“Study on some safety-related aspects of tire use” (European commission Directorate-general for Mobility and Transport, Dec 2014)

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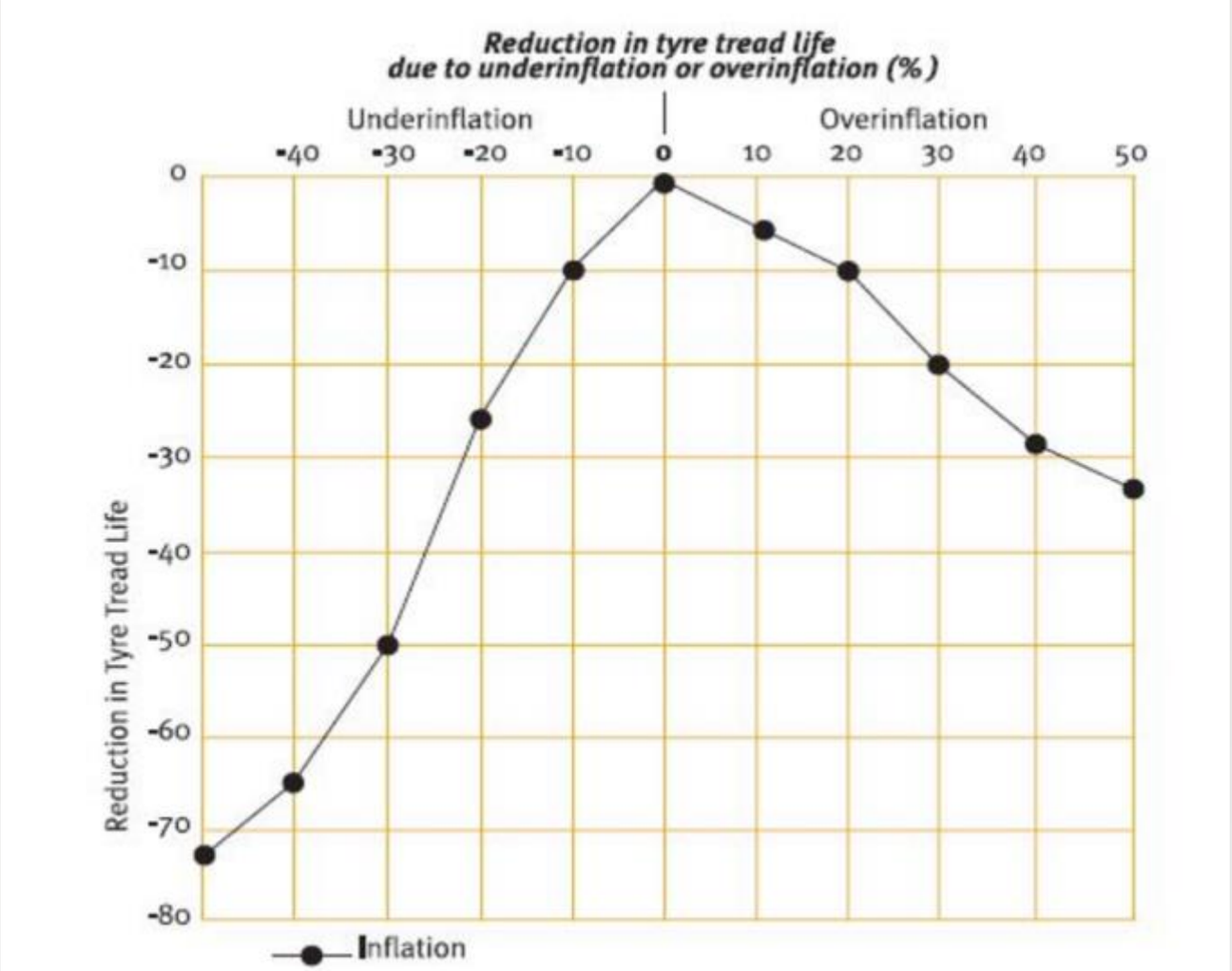
Tire wear out and safety

The curve gives a general indication of the link between inflation pressure and tread life: it should be implied that it applies equally to all types and sizes of earthmover tyres. It clearly shows the consequences of inappropriate pressure on tyre performance



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Tire wear out and safety

- Tire damage

- Tire tread

- Tire inflation

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Tire wear out and safety

- Tire inflation

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Tire wear out and safety

- Tires lose pressure daily. In cool weather, a tire will typically lose one or two pounds of air per month. In warm weather, tires lose even more air.

Tire wear out and safety

- Tire pressure:

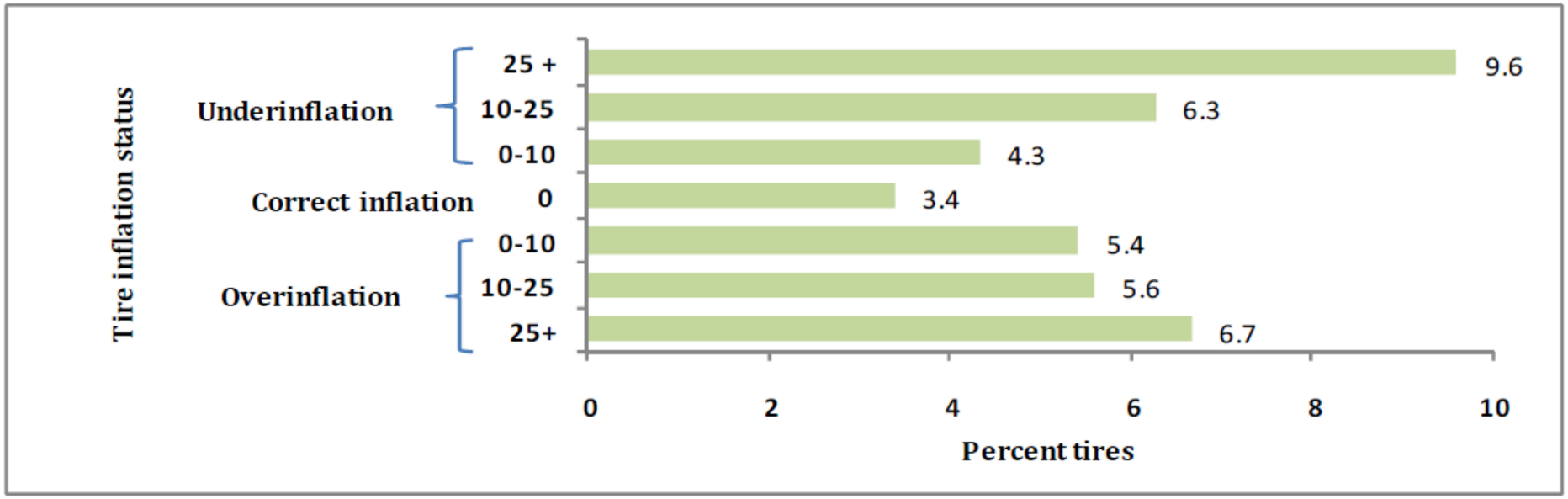

Figure 4. Percentage of tires of the tire-related crash vehicles in each category of tire inflation status (underinflated, correctly inflated, and overinflated)
(Data Source: NMVCCS 2005-2007)

When tires are underinflated by 25% or more, tires are 3 times as likely to be cited as critical events in the pre-crash phase

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Tire wear out and safety

“Study on some safety-related aspects of tire use” (European commission Directorate-general for Mobility and Transport, Dec 2014)

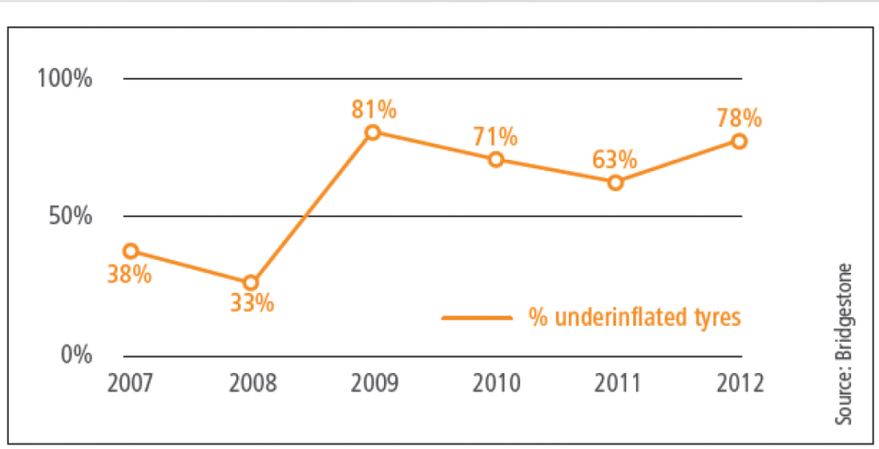

Figure 2.3: Share of tyres with underinflation assessed from roadside inspections in multiple EU member states in 2007-2012.

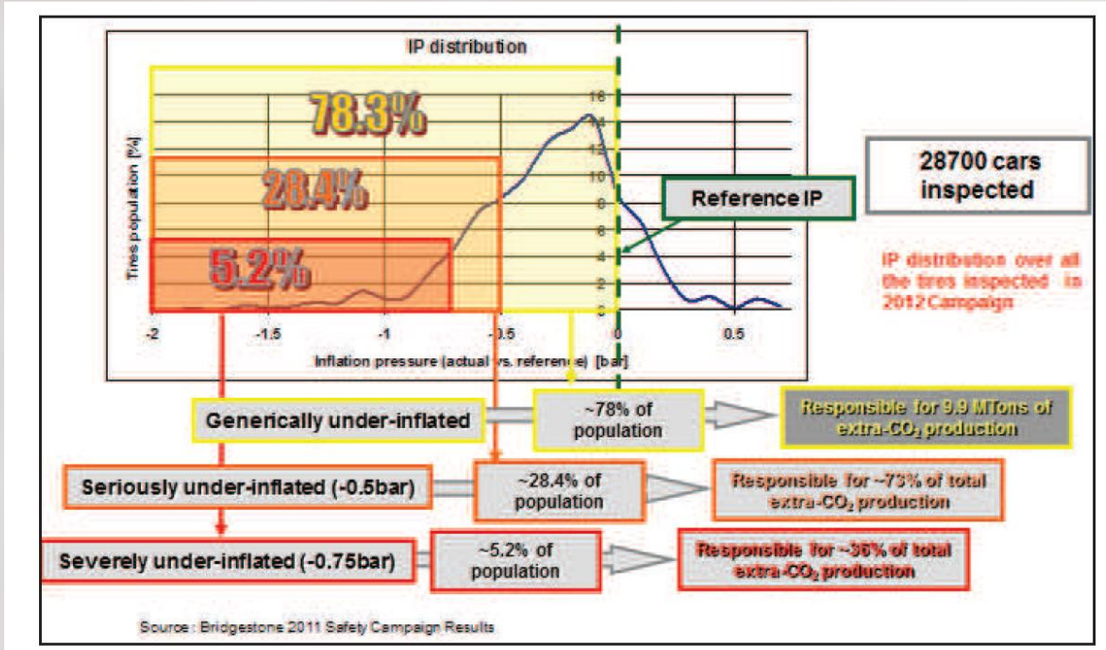

Figure 2.4: Results for inflation pressure (IP) of the 2011 Pan-European Bridgestone tyre safety awareness campaign.

20% of passenger cars have one or more tire with a reduced inflation pressure that is considered dangerous

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Tire wear out and safety

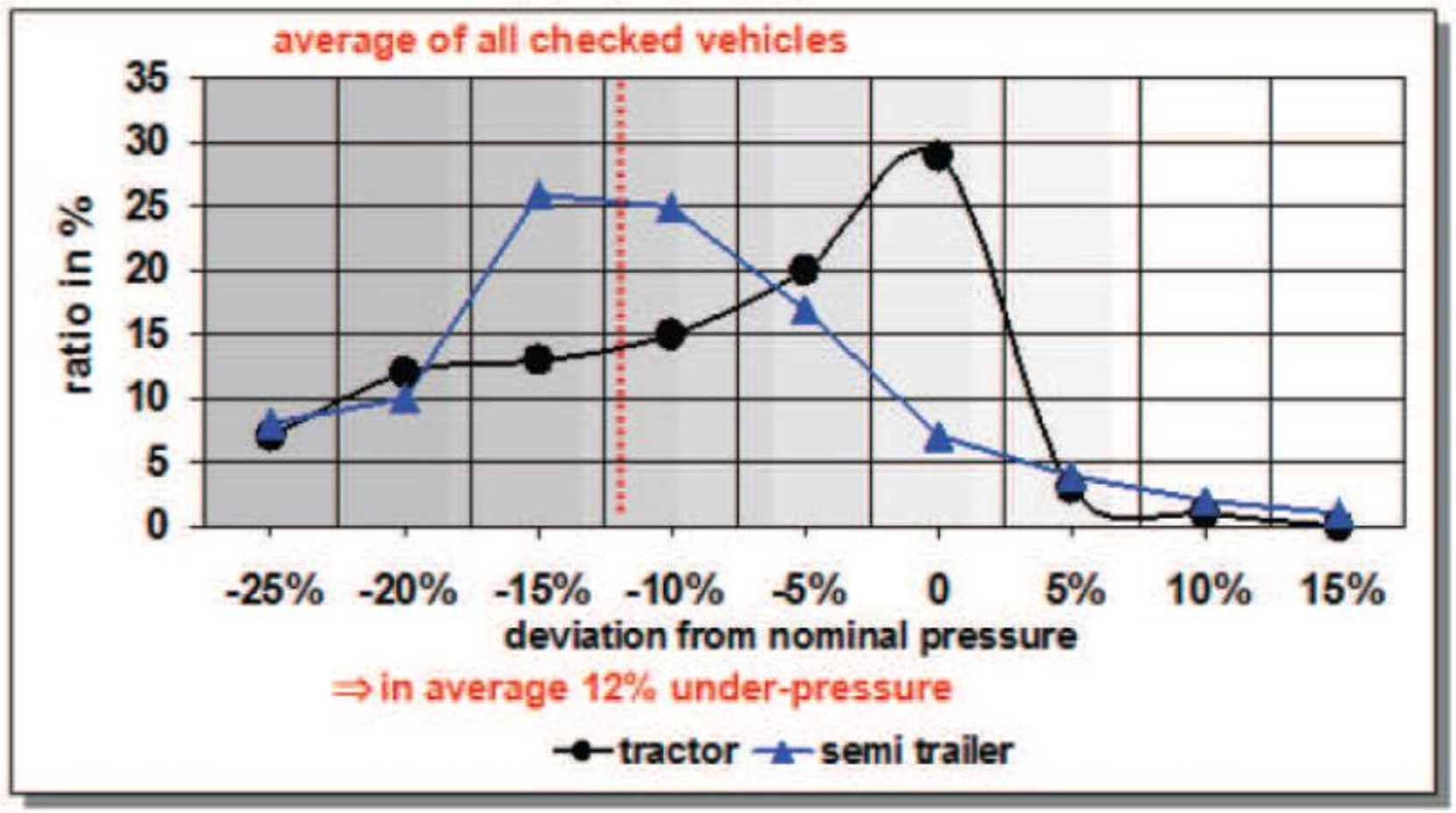

Figure 2.6: Inflation pressure distribution for tractors and semi-trailers assessed from roadside inspections by Continental on 600 vehicles.

"Study on some safety-related aspects of tire use" (European commission Directorate-general for Mobility and Transport, Dec 2014)

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Tire wear out and safety

Most tire blowouts are caused by under inflation.

When a tire is underinflated, the side of the tire flexes more and generates heat that leads to tire failure

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Tire wear out and safety

Front or Rear Blowout?

- If a front tire blows out - a catastrophic failure – the vehicle will tend to pull toward the left or right, depending on which side has the bad tire
- If a rear tire blows out (particularly on a rear-wheel-drive car or truck), the vehicle's tail will want to slide around, or "fishtail" - a very dangerous situation that can lead to a spinout and complete loss of directional control

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Tire wear out and safety

- Car rollover
  - Blowout, Loss of tire tread, Tire belt peel off, Tread separation, Tire bead unseating

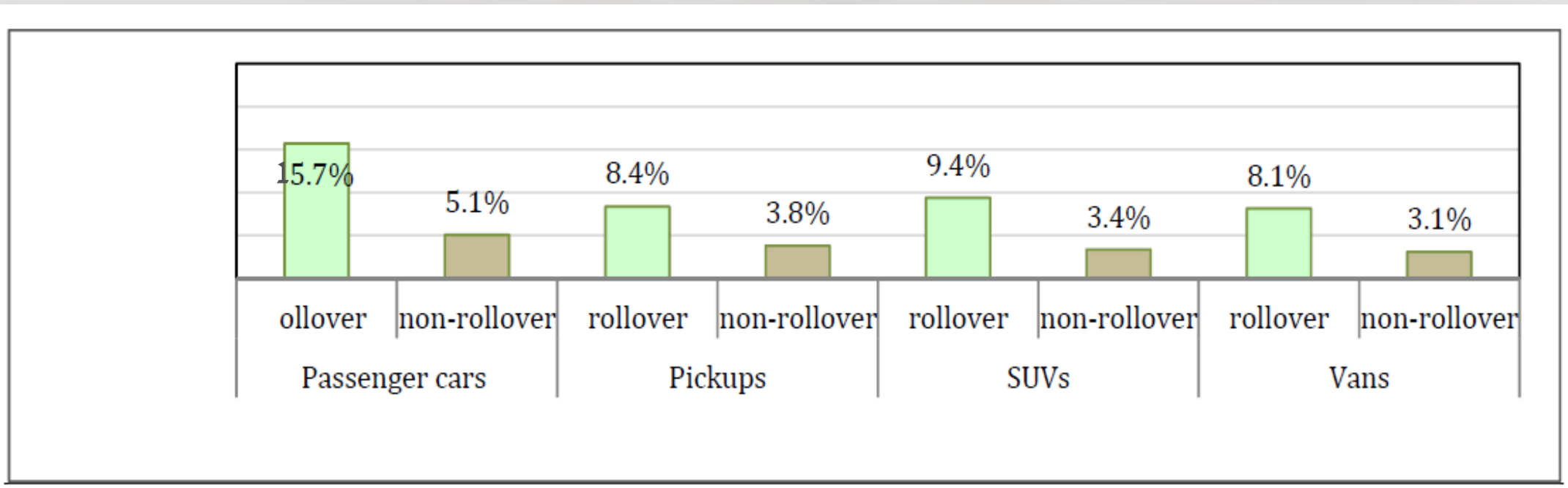

Figure 6. Percentages of tire-related crash vehicles for each vehicle body type and rollover status
(Data Source: NMVCCS 2005-2007)

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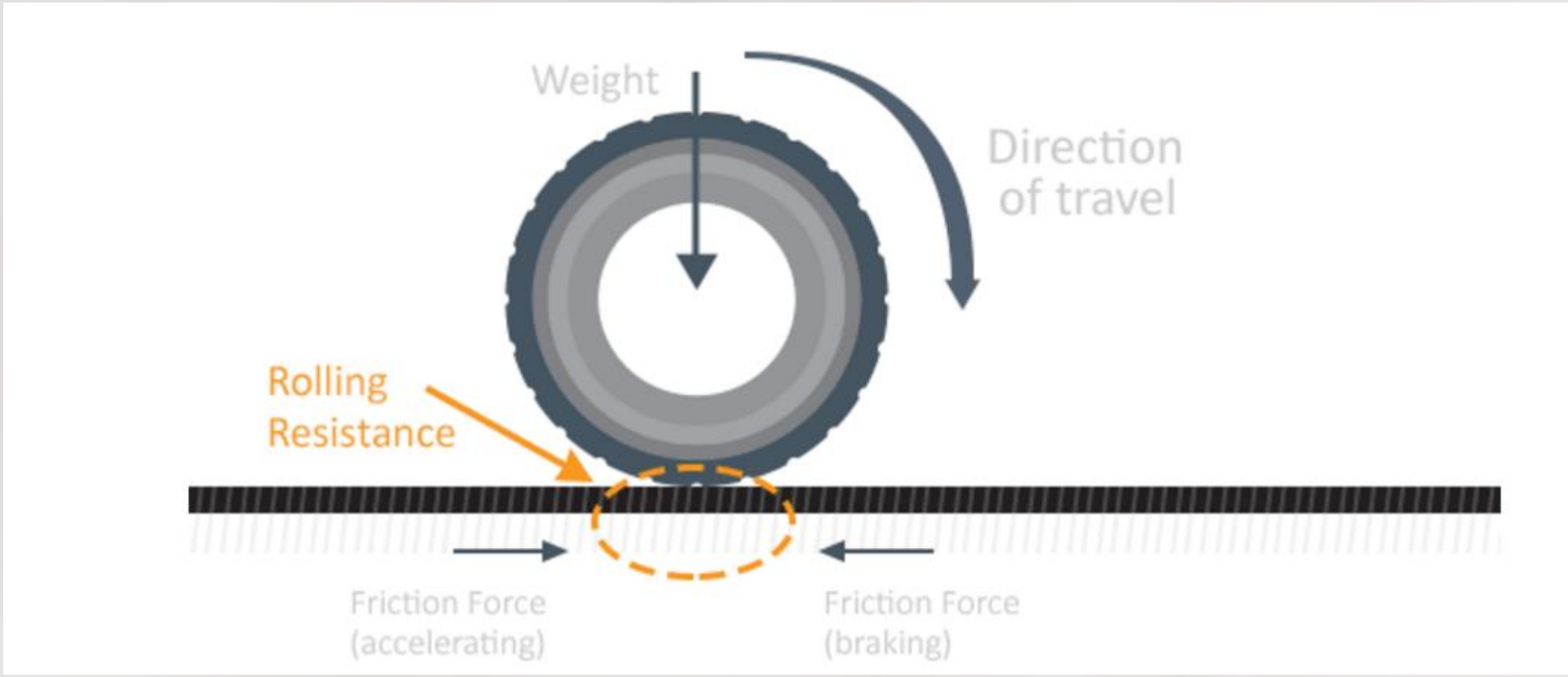
FUEL CONSUMPTION

- Rolling Resistance



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FUEL CONSUMPTION

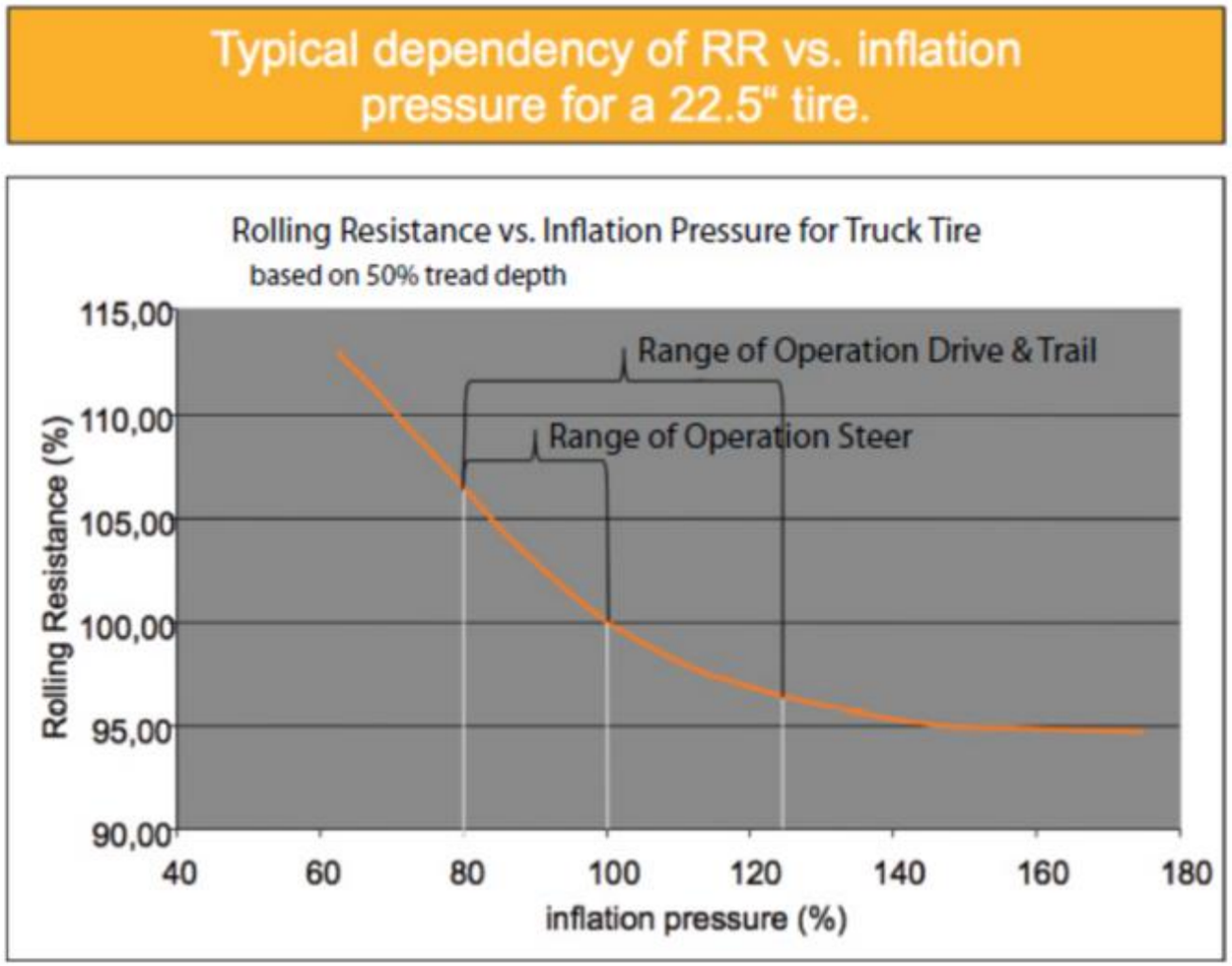
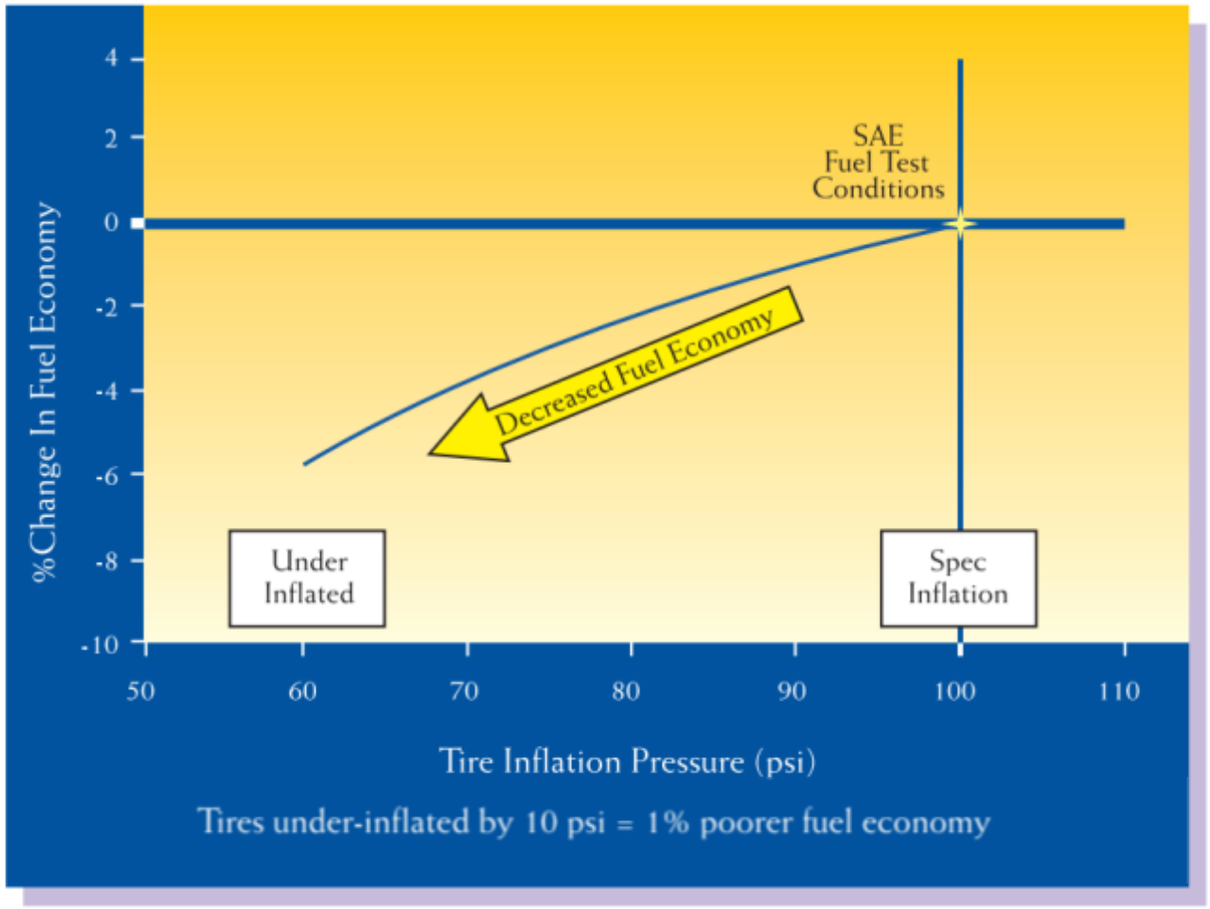


FIGURE 5-3 Typical dependency of rolling resistance on inflation pressure for a 22.5 in. tire. SOURCE: J. Kleffmann, Continental, “Effect of Tire Inflation on Rolling Resistance,” Presentation to NRC Committee on Assessment of Technologies and Approaches for Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles, Phase 2, November 21, 2013.

FUEL CONSUMPTION



Source: Goodyear Computer Fuel Economy Model

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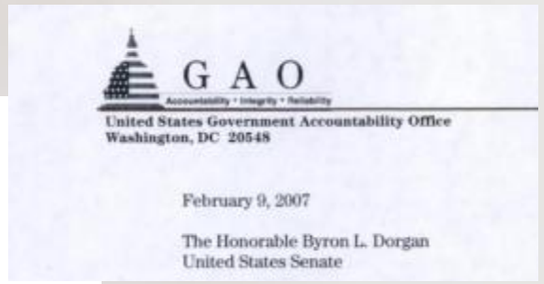
FUEL CONSUMPTION



GAO
Accountability * Integrity * Reliability

United States Government Accountability Office
Washington, DC 20548

February 9, 2007

The Honorable Byron L. Dorgan
United States Senate

Underinflated tires can have a slight impact on fuel economy.[7] According to a 2006 congressionally mandated TRB study on fuel efficiency, passenger car and light trucks use an estimated 130 billion gallons of fuel per year.[8] In addition, DOE's designated economist on this issue estimates that vehicles with underinflated tires waste approximately 1.2 billion gallons of fuel per year due to the increased resistance of the tires.

Government Is Taking Steps to Address Tire Underinflation

The federal government has enacted legislation and is using public information and educational programs to inform the public about tire underinflation. Congress enacted the TREAD Act in 2000 in response to reports that tire failures caused by tread separation from certain Firestone tires installed on Ford SUVs and trucks

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[5]Innerliners are the coating laminated to the inside of tubeless tires that provide a barrier between the substance used to inflate the tire (e.g., compressed air) and the tire.
[6]Single-wide tires are designed to replace dual-mounted tires on trucks—one single-wide tire is mounted on each side of an axle.
[7]Other factors that affect fuel efficiency include driving habits such speeding, as well as a vehicle's load.
[8]TRB *Special Report 286*.

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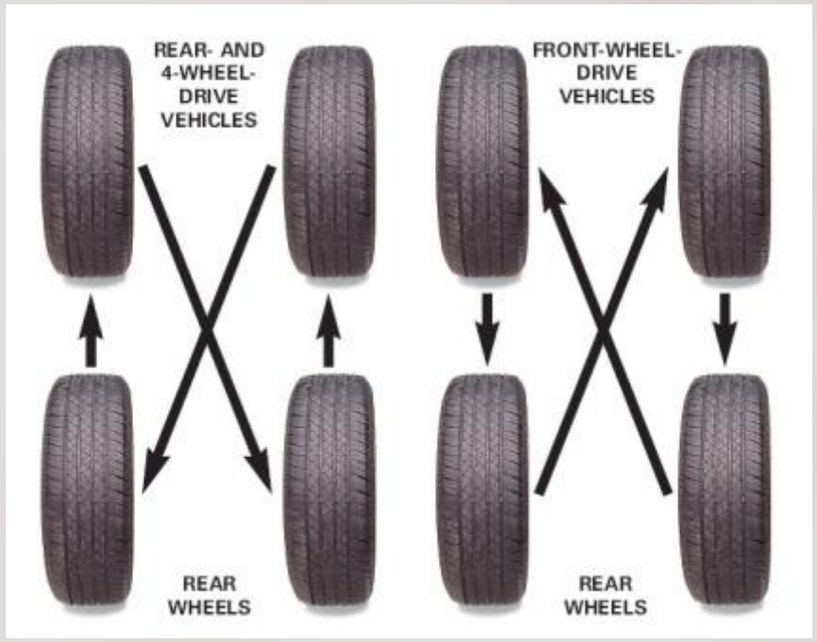
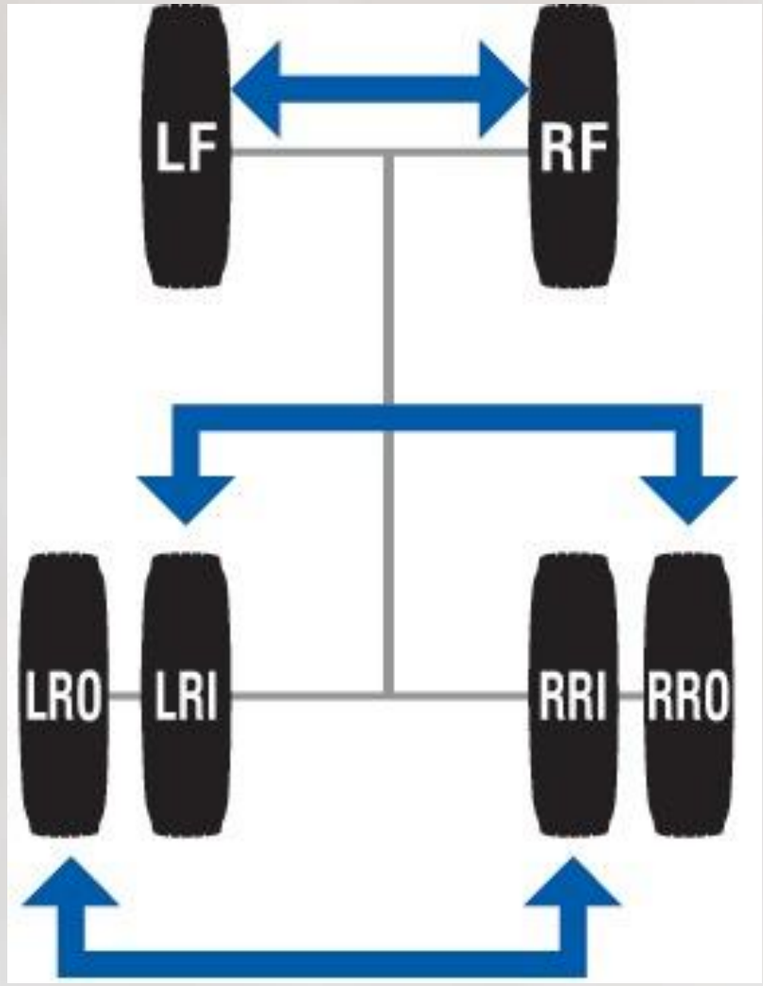
TIRE LIFE-TIME





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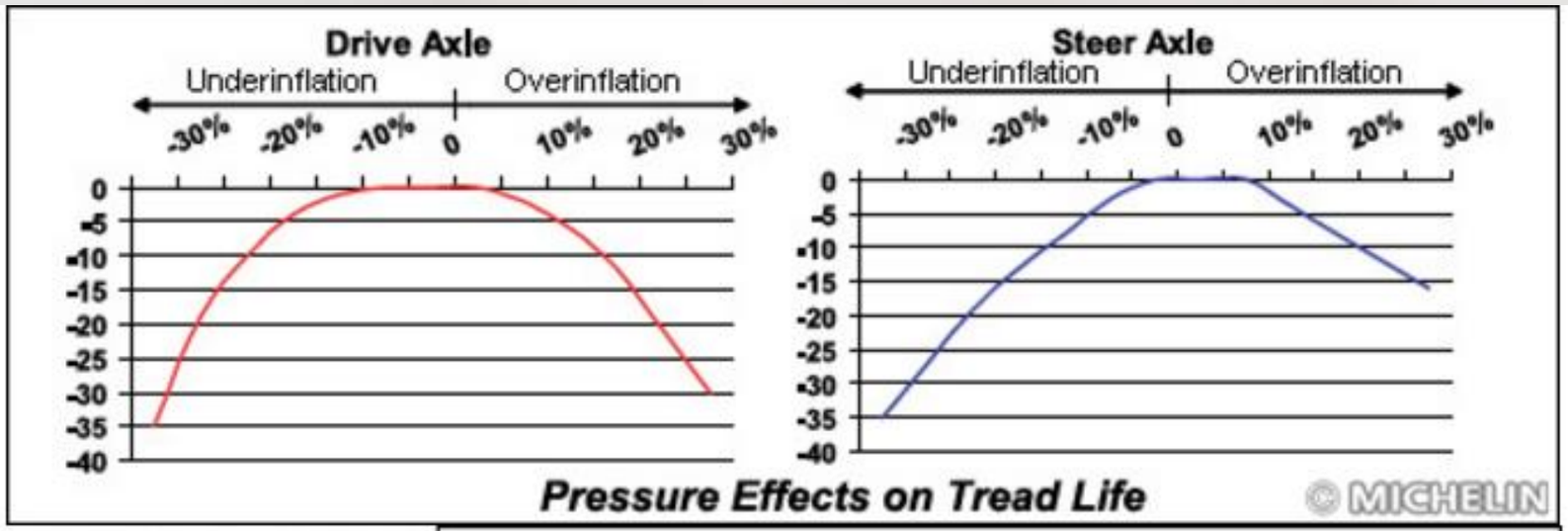
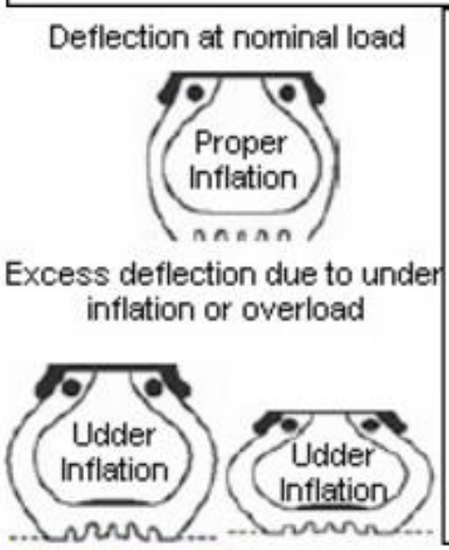
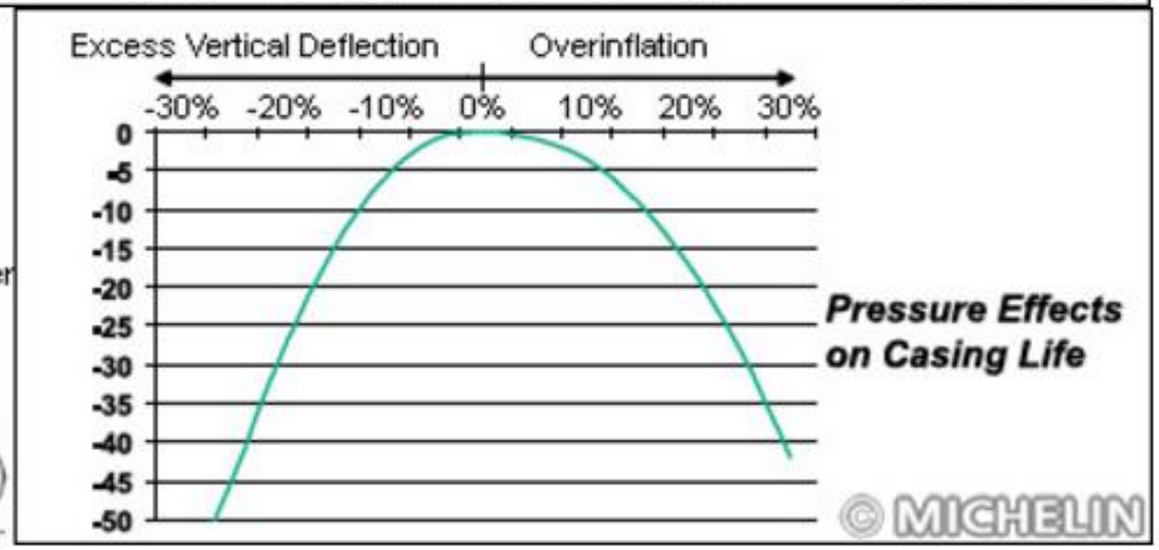
TIRE LIFE-TIME







Influence on cost

Correct pressure	20% underinflation (steer)	20% overload © MICHELIN
Price : 100%	Price : 100%	Price : 100%
Mileage : 100%	Mileage : 85%	Cosing Life : 73%
Ratio of Cost / Kilometre		
Invested Capital = 100% / Mileage = 100% = 1	Invested Capital = 100% / Mileage = 85% = 1.17	Invested Capital = 100% / Cosing Life = 73% = 1.37
Correct = 100%	**Extra Cost = 17%**	**Extra Cost = 37%**

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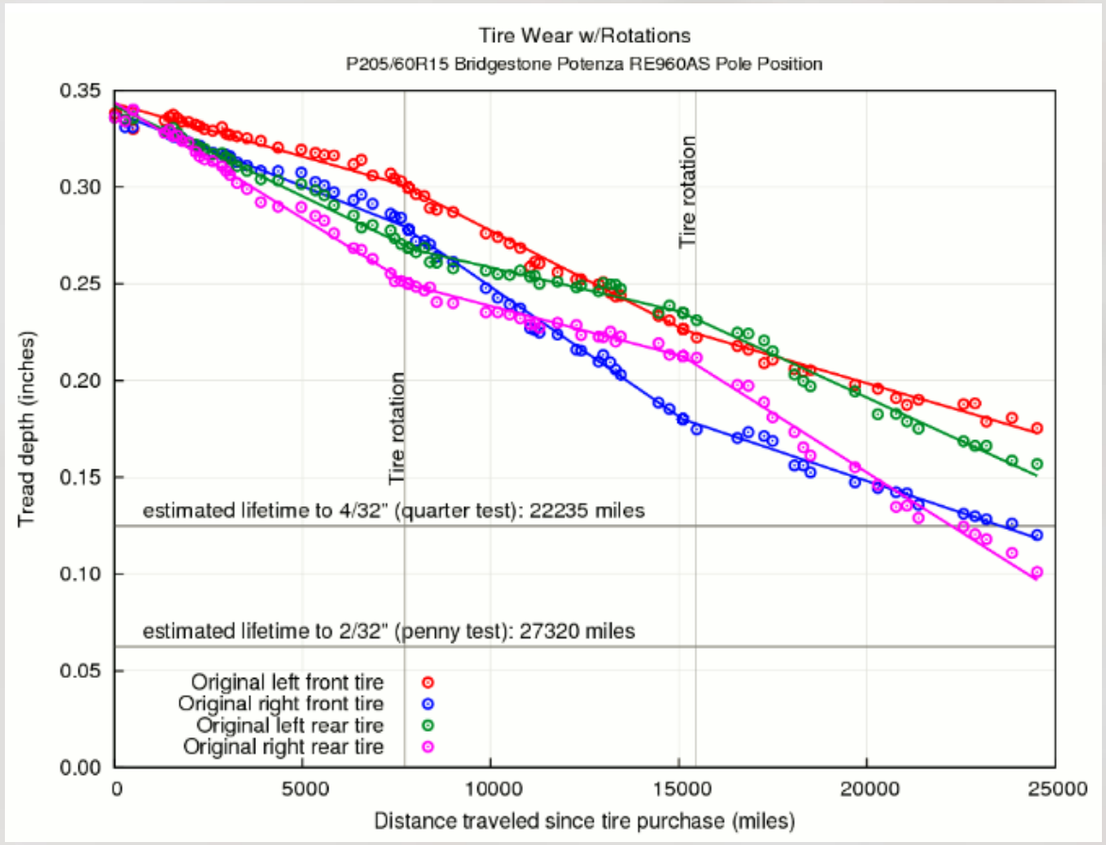
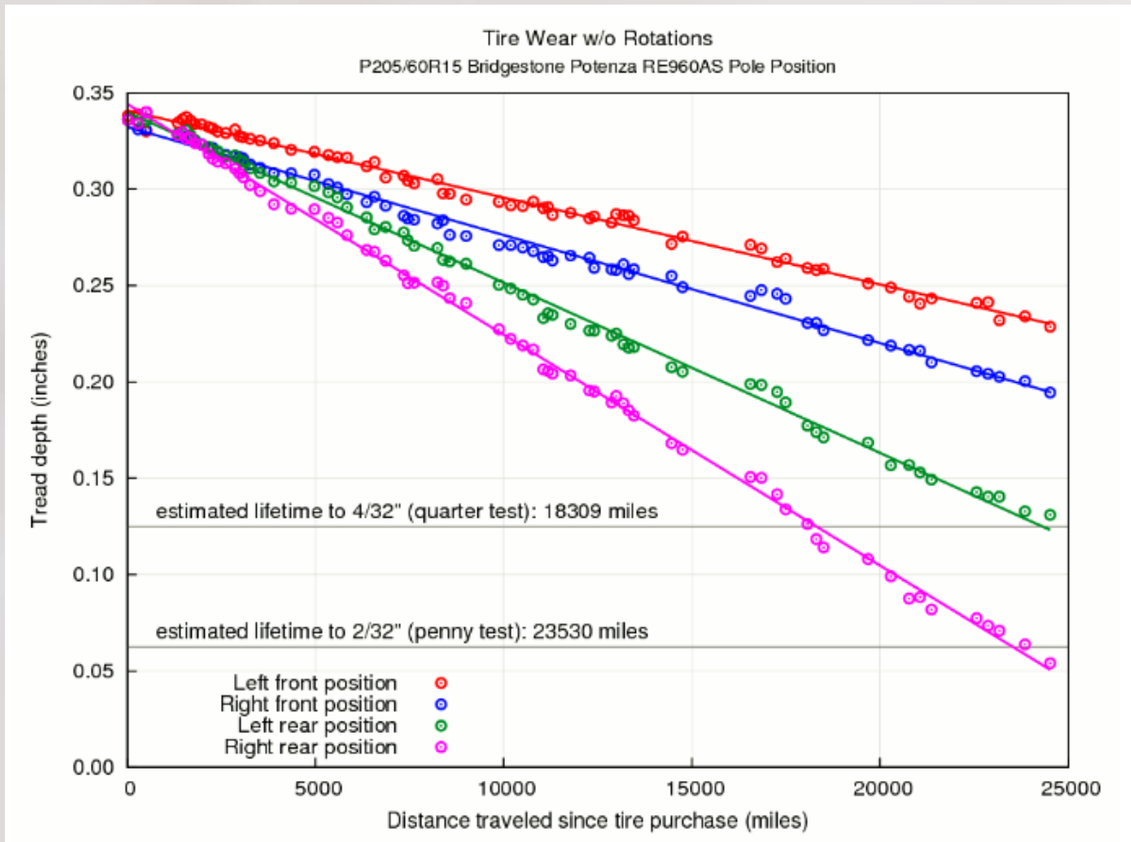
TIRE LIFE-TIME





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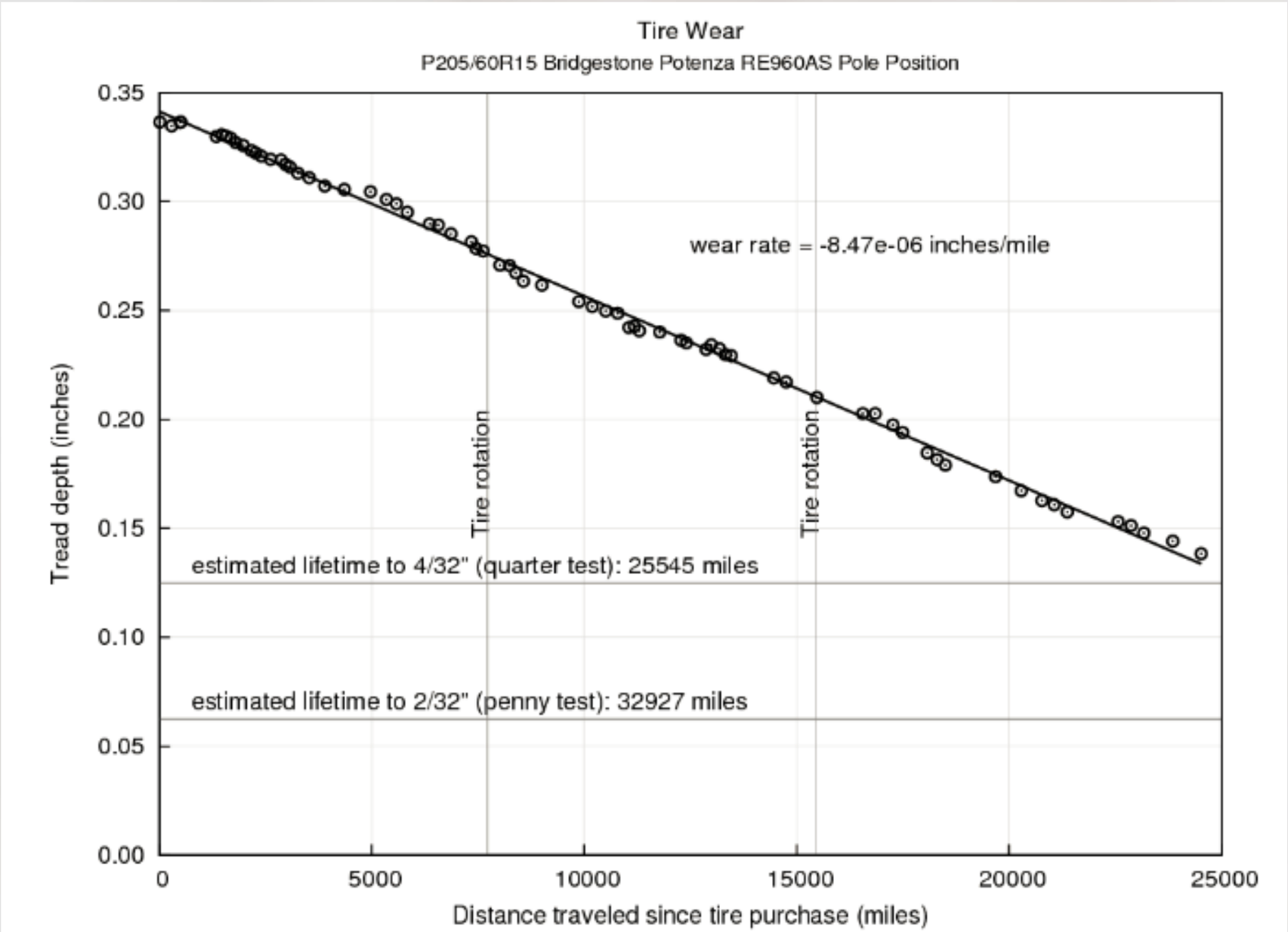
TIRE LIFE-TIME



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TECHNOLOGIES

Pressure detection

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TECHNOLOGIES

TPMS

Firestone recall: Over 100 deaths and 3,000 serious injuries

Congress (Tread Act): TPMS technology in all light motor vehicles (under 10,000 pounds), to help alert drivers of under-inflation

This act affects all light motor vehicles sold after Sep. 2007 (US) and Nov. 2012 (EU)

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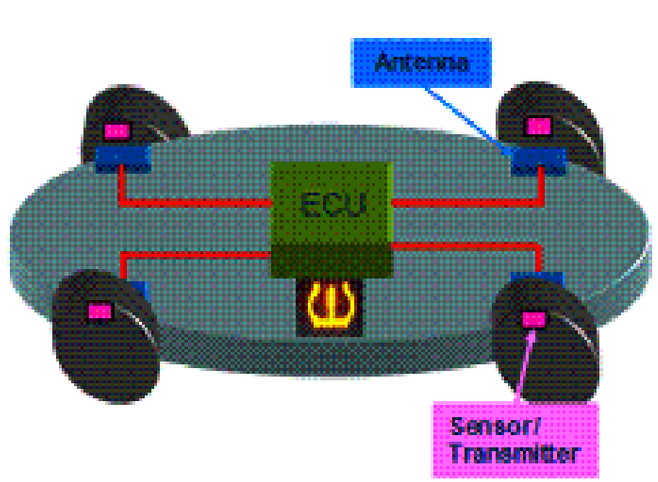
TPMS

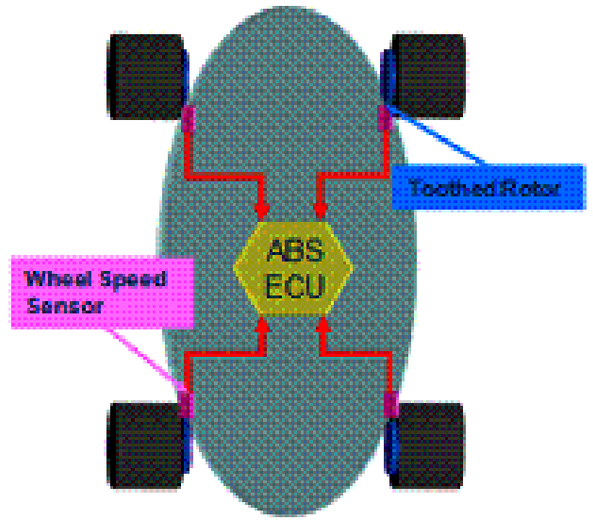
The Two Tire Pressure Monitoring Technologies (North America), 2007

Direct TPMS



A direct system measures the actual tire pressure via in-tire sensors.

Indirect TPMS



An Indirect system calculates the tire pressure by comparison of wheel rotational speeds via ABS.

Source: Frost & Sullivan

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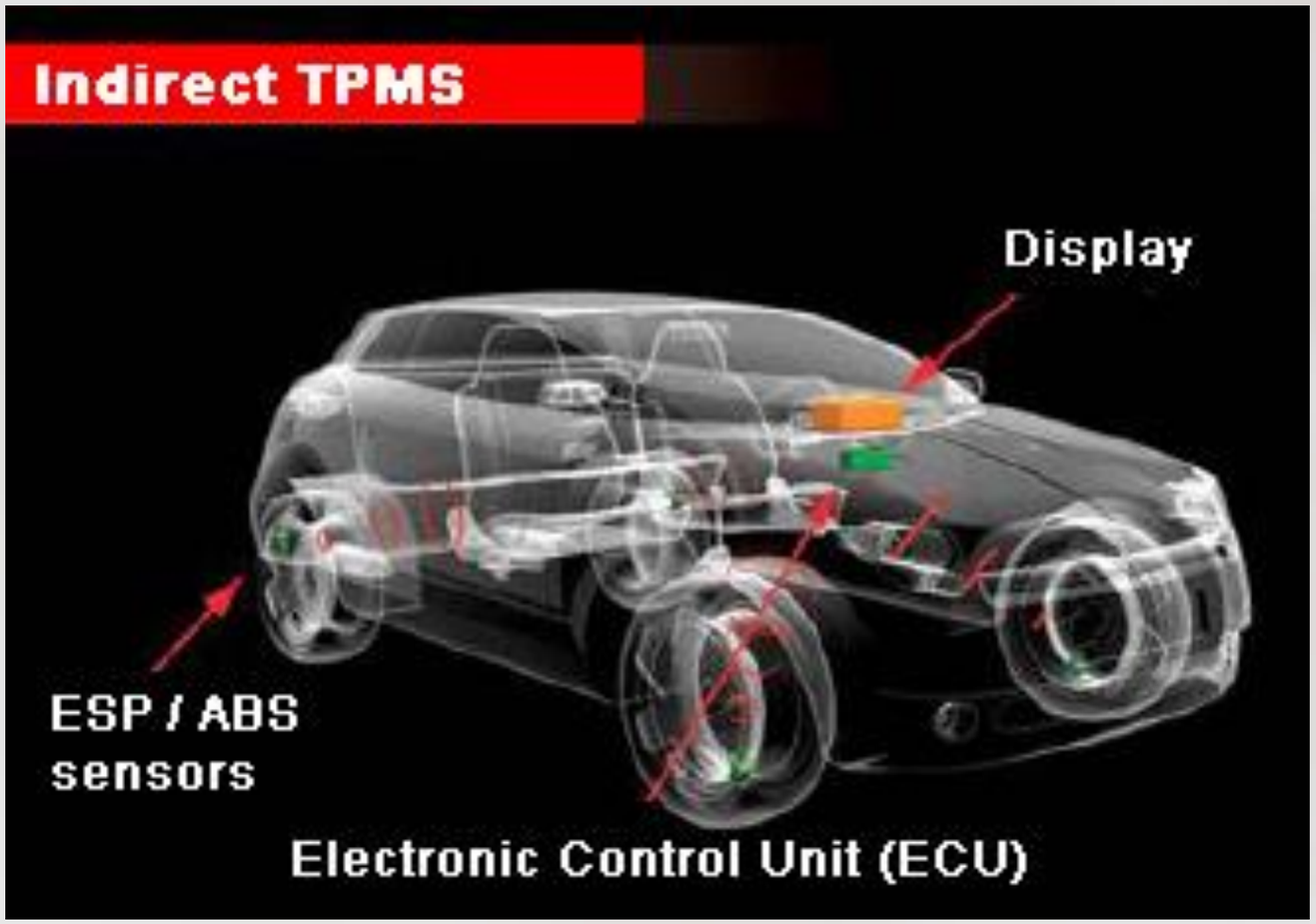
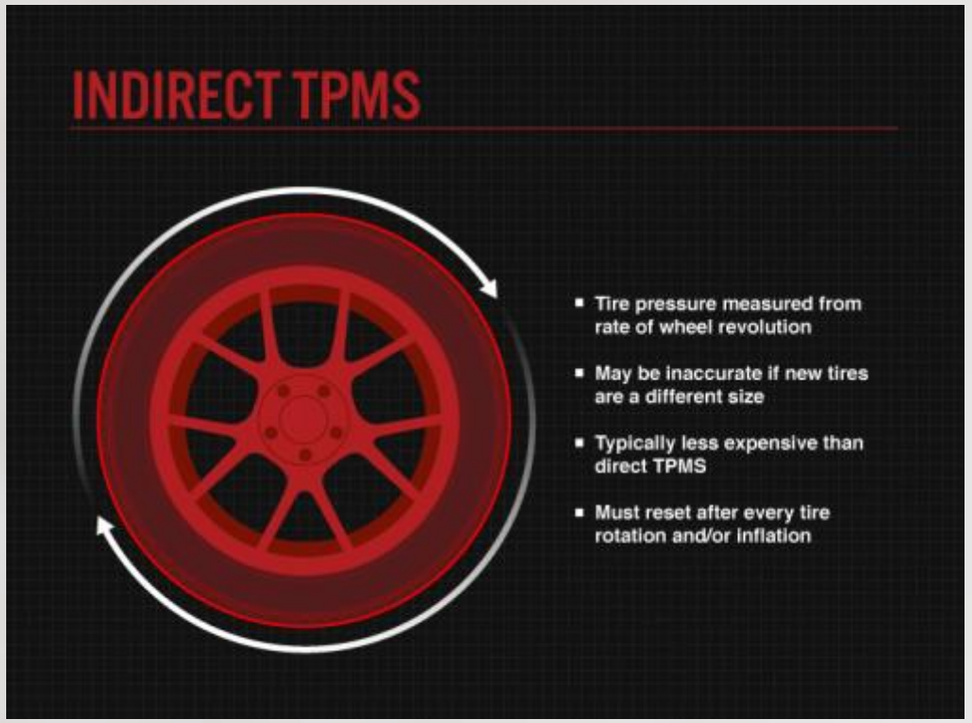
TPMS - indirect





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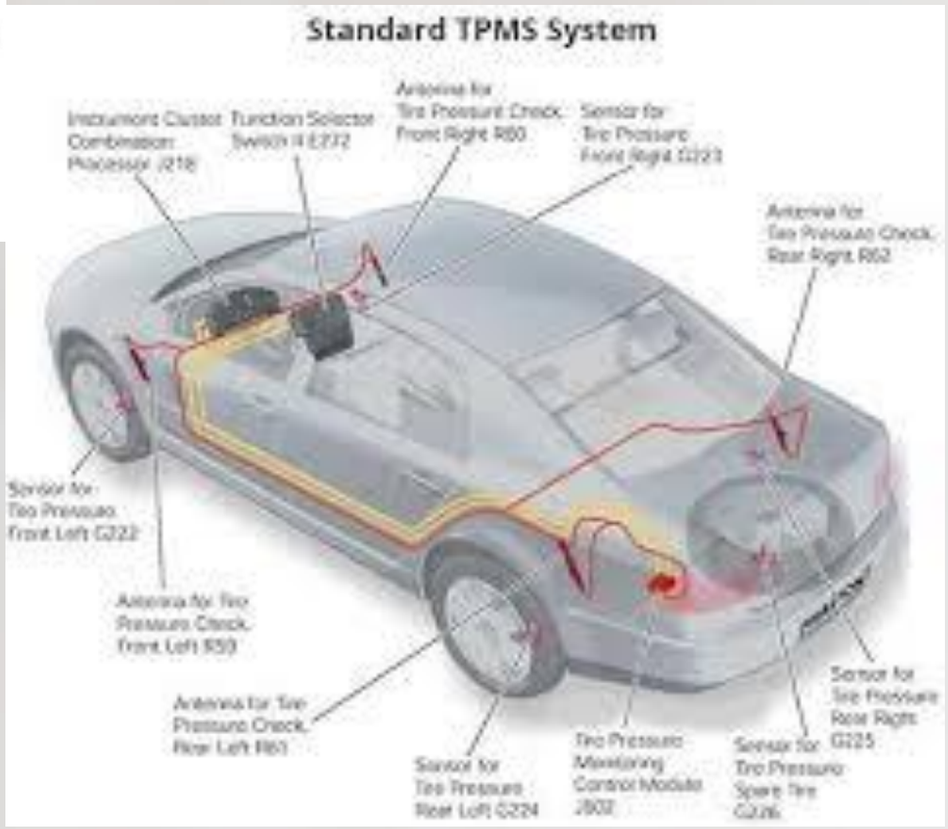
TPMS - direct



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TPMS

Freescale Semiconductor’s tire pressure monitoring package measures just 7 mm x 7 mm. It includes pressure and temperature sensors, two accelerometers, a microcontroller, RF transmitter, and low-frequency receiver.
(Source: Freescale Semiconductor)

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TECHNOLOGIES

TPMS

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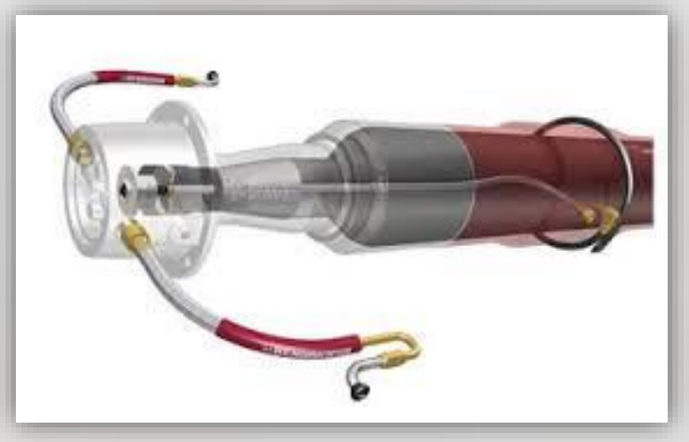
CTIS



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Pressure detection – sensor plates

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Pressure detection – image analysis

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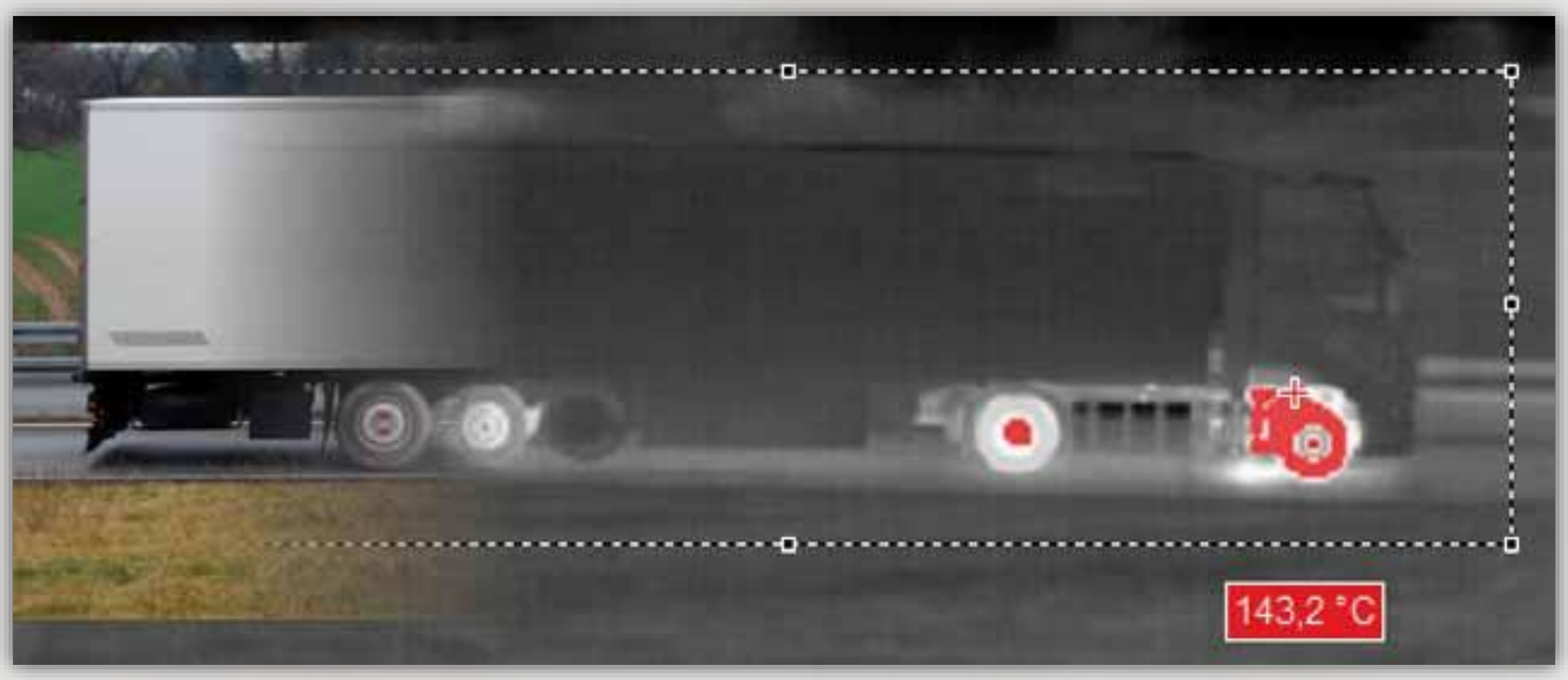
Temperature



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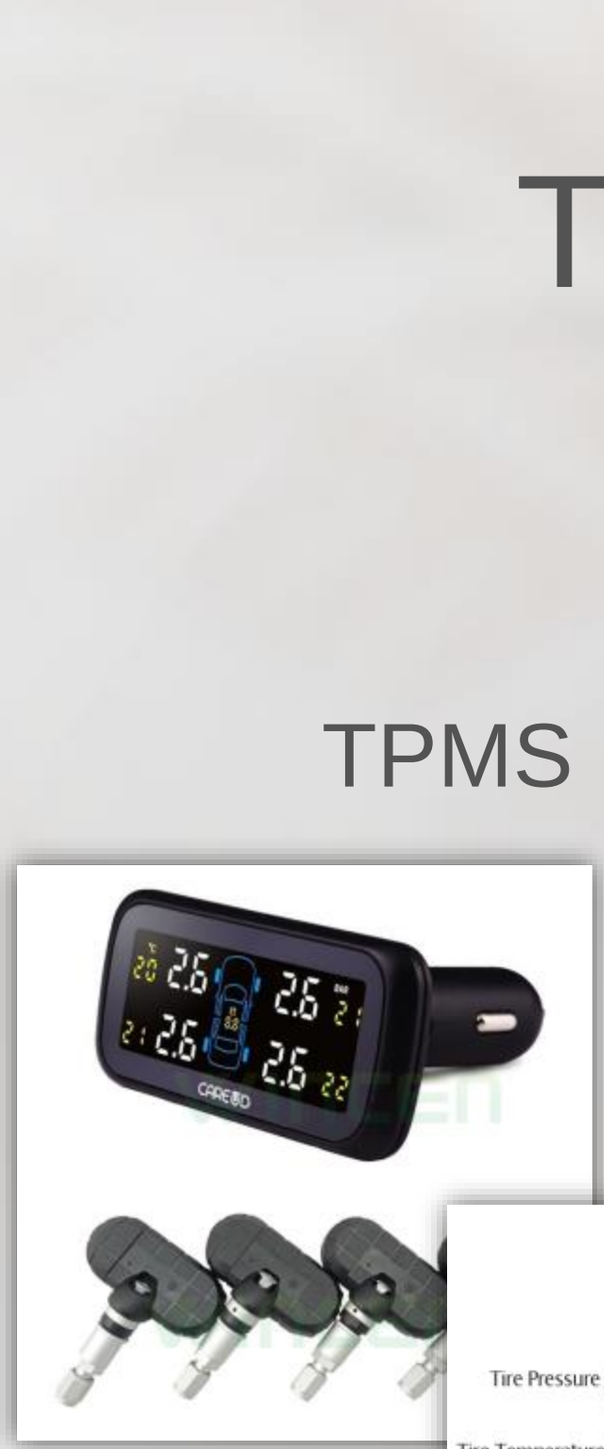
Temperature

TPMS



IR sensor

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TECHNOLOGIES

Tread wear

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Tread wear – Laser detection

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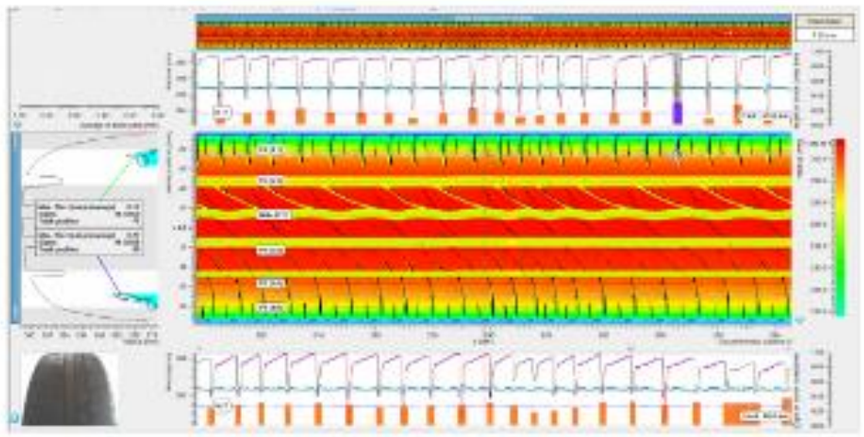
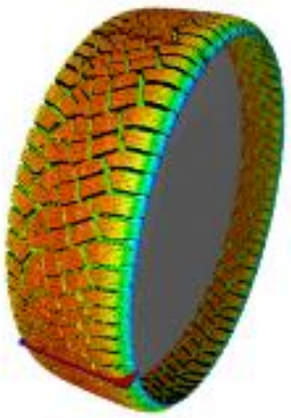
Tread wear – Laser detection





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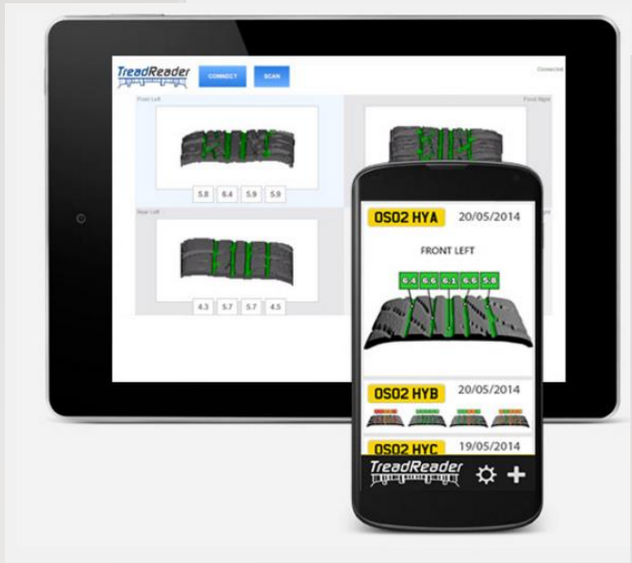
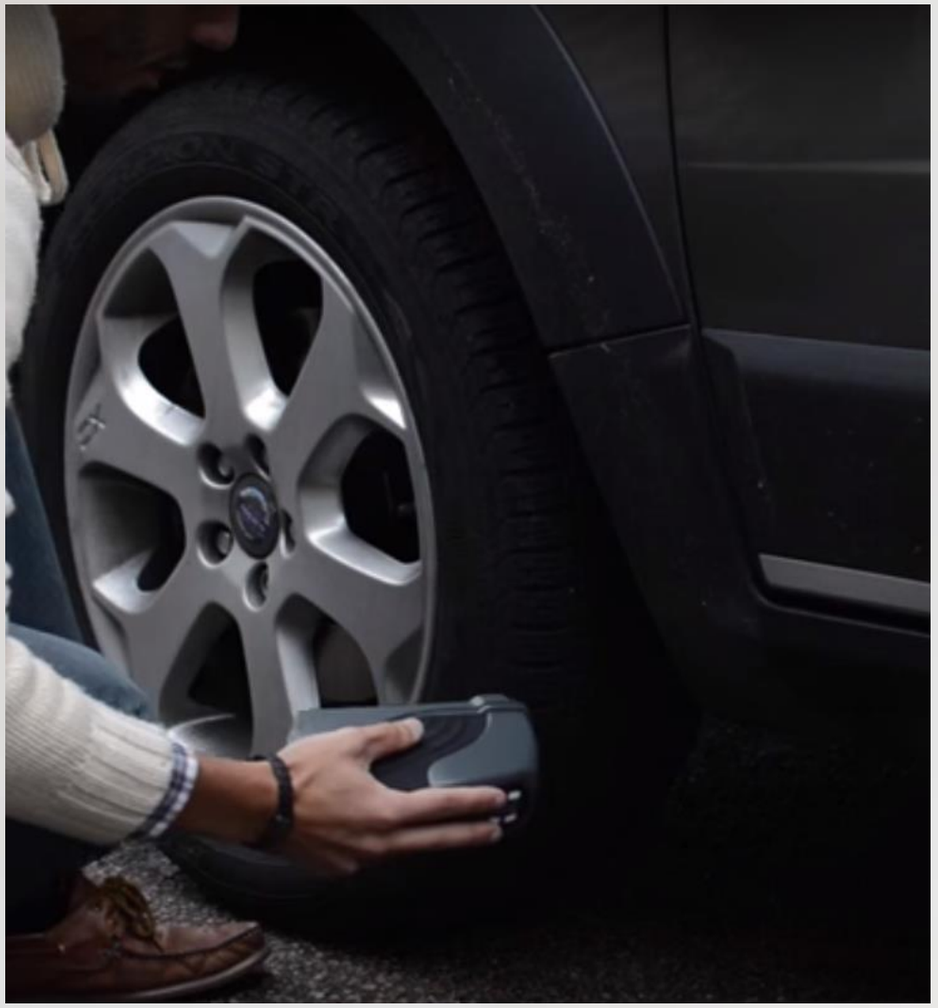
Tread wear – Laser detection





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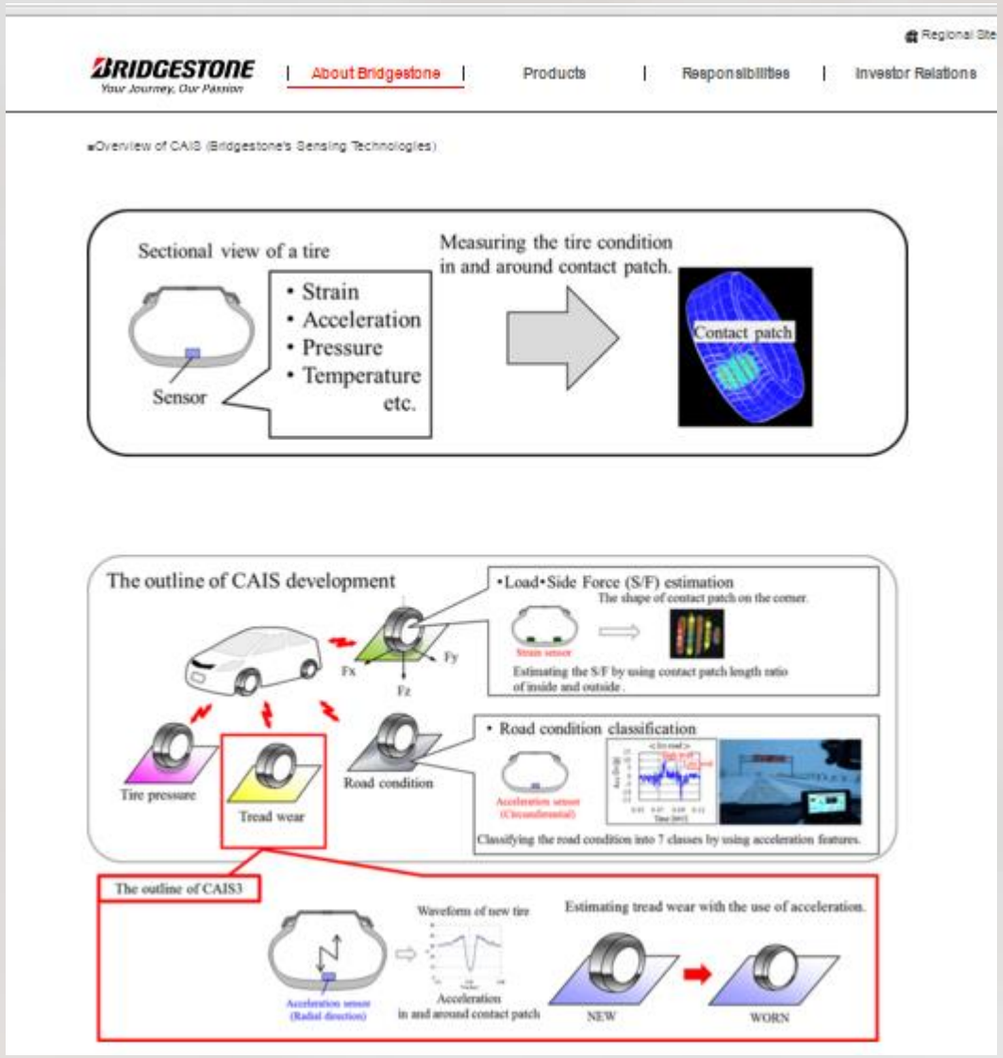
Tread wear – Internal sensor



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TECHNOLOGIES

Tread wear – Optic detection

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TECHNOLOGIES

Side wall damage – Optic detection

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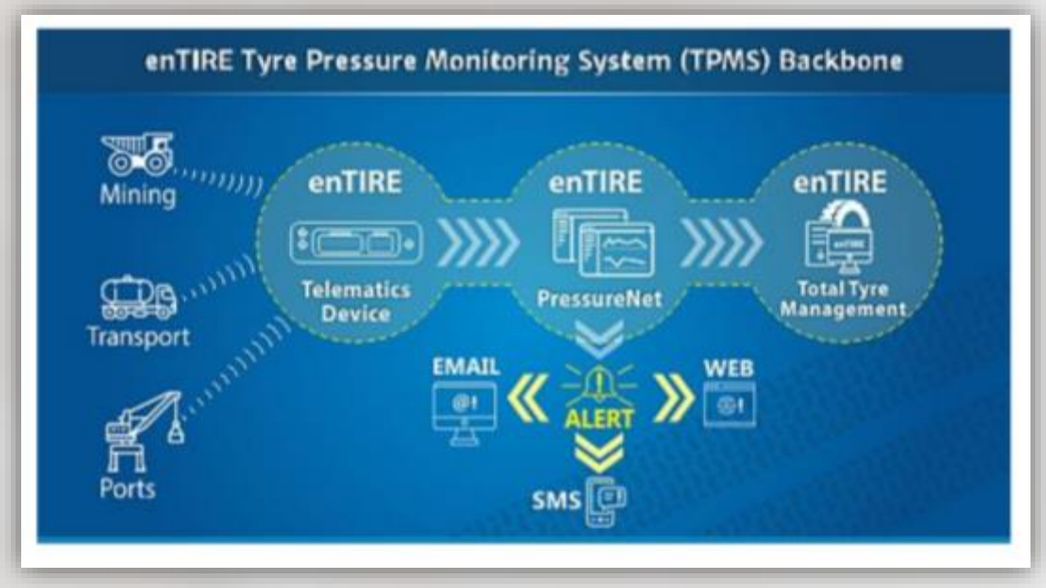
PRODUCTS : SENSORS AND FLEET MANAGEMENT

VMC enTIRE™ PressureNet

The system is a tire analysis system that supports TPMS sensors on each wheel and data management.



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PRODUCTS : SENSORS AND FLEET MANAGEMENT

Bridgestone Total Tire Care

Bridgestone uses several technologies to gather TPMS information to support fleet operations. This service requires a TPMS to be installed on each wheel in the vehicle

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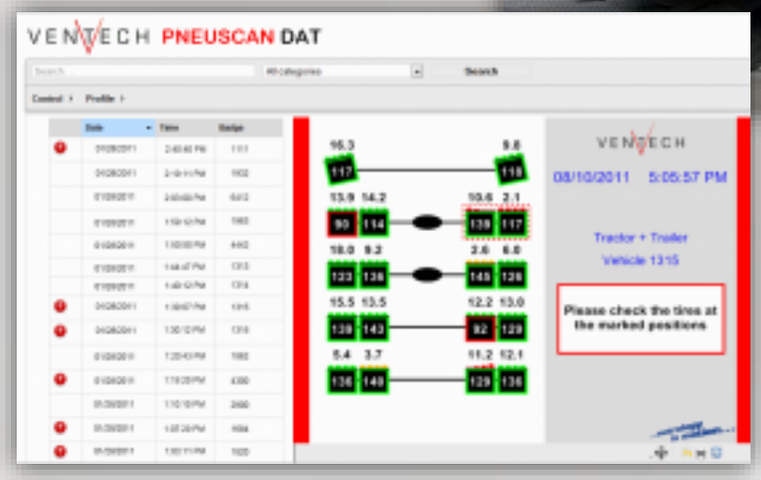
PRODUCTS : SENSORS AND FLEET MANAGEMENT

Ventech Pneuscan

Ventech’s system is a tire analysis system that includes tire pressure, tread depth, vehicle identification and data management.



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PRODUCTS : SENSORS AND FLEET MANAGEMENT

Neomatix

Vision based technology
scan process and automated procedure.
The Neomatix Tire Resource Automation Expert (T.R.A.X.) implements a fully automated process and requires no installation on the vehicles or wheels

The system includes tire pressure & temperature , tread depth, sidewall damage and more, vehicle identification and data management.

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CONCLUSIONS

- Tire health is critical
- “Healthy” tire saves life
- “Healthy” tire saves money
- Verity of technologies

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THANK YOU FOR LISTENING

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