



The impact of Tyre Regulations on Heavy Duty Vehicle Fuel Efficiency

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- **Classification of regulations for tyres**
- **What is Rolling Resistance and How does it affect Fuel Economy**
- **Benchmark and Benefit: Status of Tyre RR regulations in other countries**
 - **Implications for India**
- **Benchmark: Heavy Duty Vehicle Regulations in Other Countries and Link to Tyre RR**
- **Conclusion and Recommendations**

Expectations from tyres



Function and
Safety



Performance



What regulators are doing worldwide?

Examples

Function and Safety



R30/R54/R64/R75



FMVSS 49 CFR Part 571



GB 9743/GB9744

Performance



R117: Rolling Resistance,
Wet Grip, Noise



TFE CIP: Rolling
Resistance, Wet Grip, Wear



GB/T29042-2012: Rolling
Resistance

What regulators are doing in India?

Function and Safety



R30/R54/R64/R75



FMVSS 49 CFR Part 571



GB 9743/GB9744



IS15633/IS15636/IS15627

Performance



R117: Rolling Resistance,
Wet Grip, Noise



TFE CIP: Rolling
Resistance, Wet Grip, Wear



GB/T29042-2012



NO REGULATIONS

What are performance parameters and Are these important in Indian context?



Importance for India

- Fuel Saving of 865 million liters per year
- Green house gas (GHG) reduction (2.3 million tons of CO₂ every year)

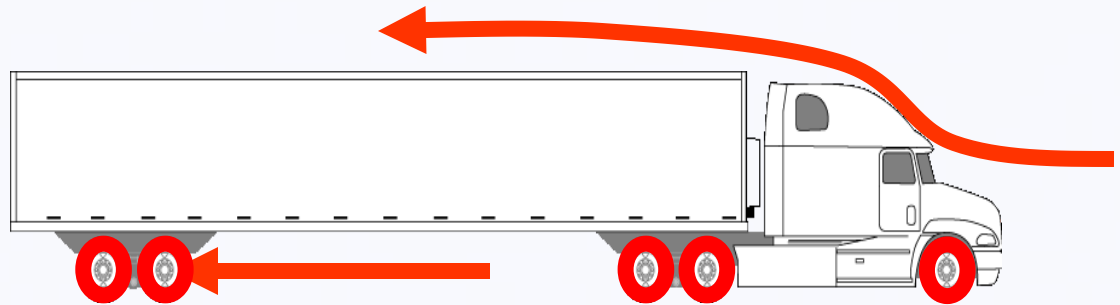
Tyre Contribution to Fuel Consumption

source: USA Dept of Energy

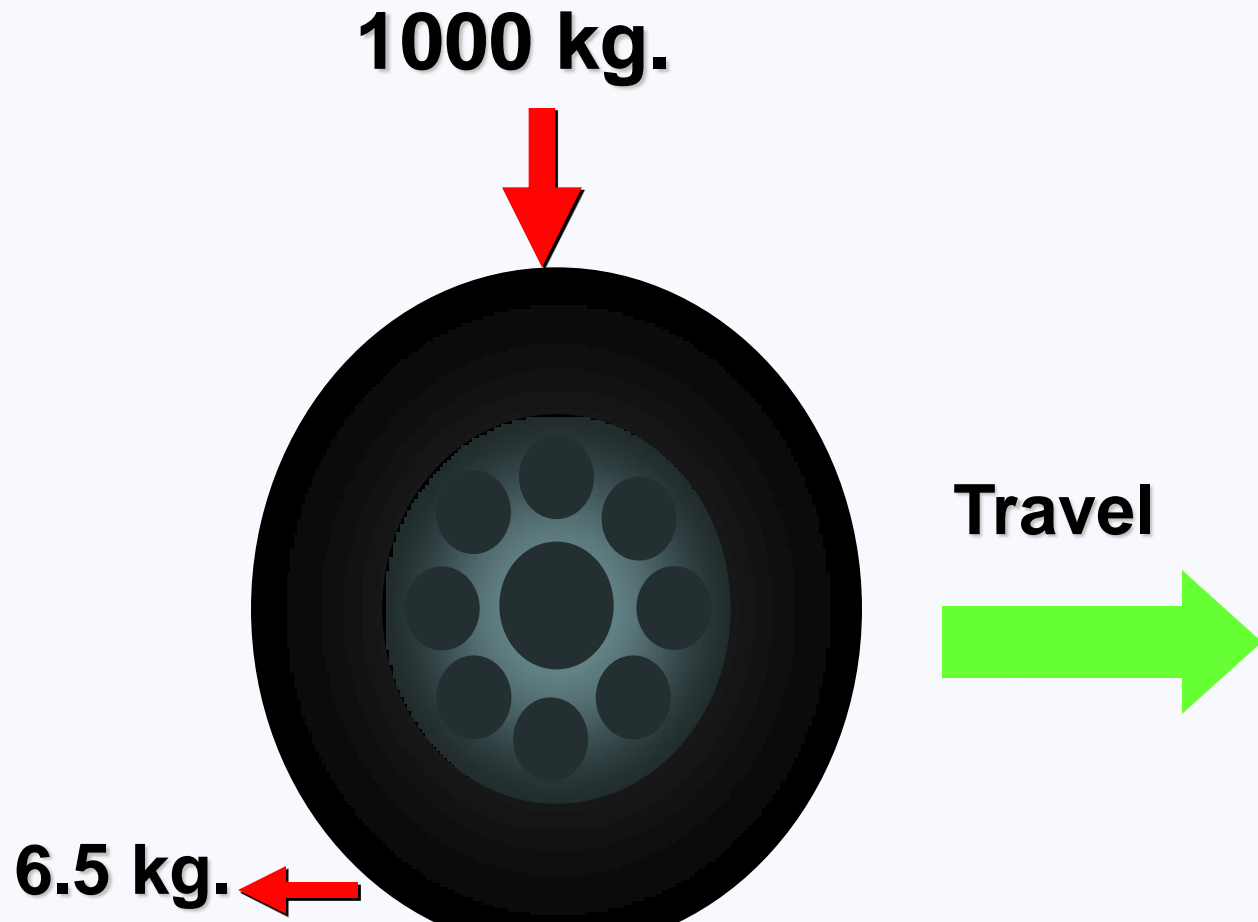
Aerodynamic drag
40%

Mechanical losses
25%

Rolling resistance
35%



Rolling Resistance: Truck Tyre Example

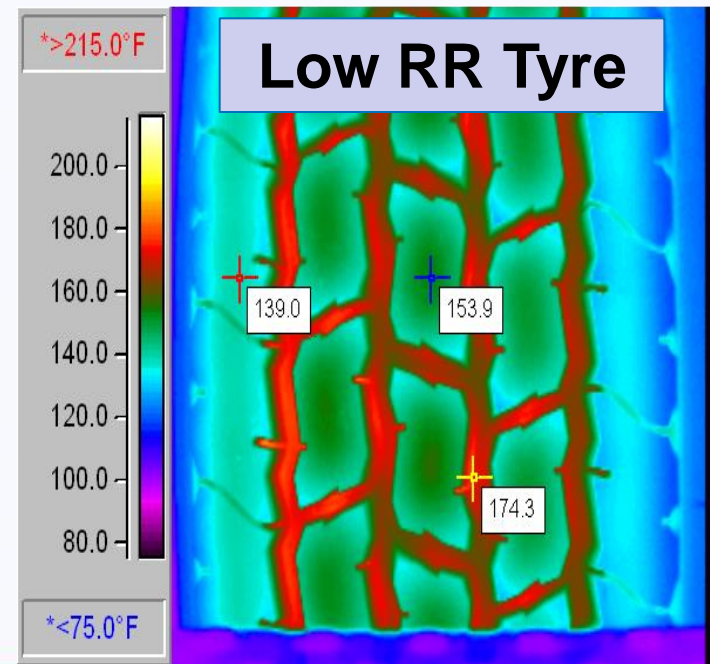
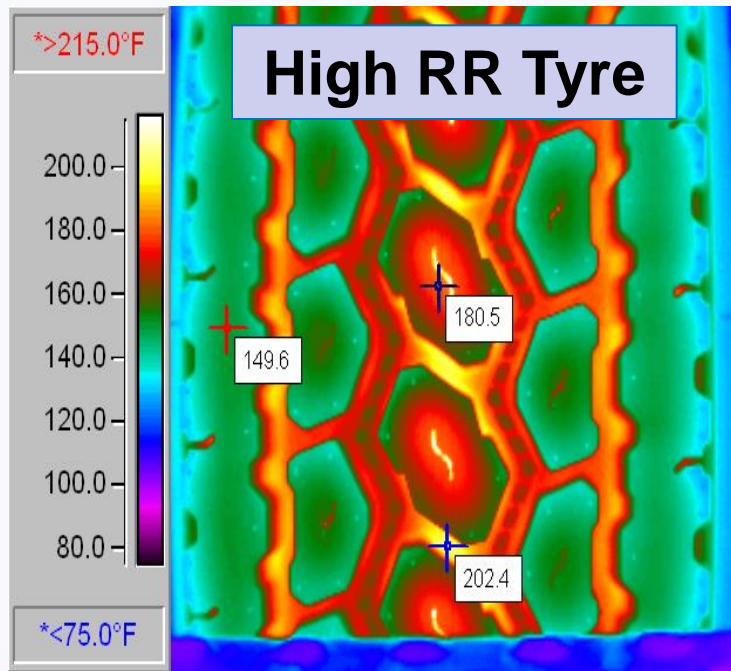


For every 1000kg of GVW, rolling resistance drag is 6.5kg

For e.g. 16 ton truck, rolling resistance drag is $6.5 \times 16 = 105\text{kg}$

Tyre Rolling Resistance

Rolling Resistance is caused by the energy consumed in heating the tyre. Thus, the hotter a tyre the higher the Rolling Resistance. These are infrared images of two different truck tyres rolling under identical conditions.





RR impact on HDV Fuel Economy

- For every **10% change in tyre rolling resistance**, one can achieve between **3 and 4% fuel savings** for heavy duty vehicles.
- Truck tyres in the India market can vary in rolling resistance by over 30%, so the potential is large.

Note: India heavy truck tyre market is 70% bias tyres, which have inherently higher RR than radials.

- Tyre RR can be regulated in two ways:
 - Max cap on tyre RR: such regulation has been announced in European Union, China, Russia, Korea, Brazil, Saudi Arabia
 - Grading of tyre RR: such regulation has been announced in European Union, United States, Korea, Brazil, Saudi Arabia
- BIS is in discussion to create a maximum cap on tyre RR for India, starting with passenger car tyres but nothing certain for Truck Tyres
- What could be the theoretical effect of capping Heavy Truck Tyre RR for India?

Theoretical Impact of Truck RR Thresholds Basis 2013 Fuel Consumption data


Environment

- 7 tires per truck
- Truck run 30,000 km/year
- Current fuel efficiency → 40 l/100km
- Total trucks → 3 million
- 2.67 kg of CO₂ per Liter of diesel
- Contribution of tires → 1/3 of fuel (conservative)..[\Papers\EPA RR Fuel truck Bachman-Erb-Johnson.pdf](#)
- Weighted Average RR based on graphs
 - WO = 8.06 kg/t
 - W = 7.48 kg/t
- Difference in average RR = 7.2%
- Impact on fuel economy = 2.4%
- Total fuel consumed (billion liters)
 - WO = 36.0
 - W = 35.1
- **Savings → 864 million liters per year**
- **Savings → 2.3 million tons of CO₂ per year**



Vehicle Regulations: Heavy Duty Vehicles

- **Challenge:** In many Countries, HDV are not packaged in “models” in the same manner as passenger cars: How to look at vehicle fuel economy?
- **One Benchmark Solution:** Both USA and Europe use computer modeling
- **Manufacturers must measure engines but must model the entire truck assembly**
- ***Tyre Rolling Resistance is key to success for such regulations***



Tyre RR and how incorporated into HDV CO₂ / Fuel Regulations

Country/Region	Parameter Controlled	When? (Model Year)	Name of Computer Model	How Tyre RR Integrated into Model?
USA	gCO ₂ /t*mile gal/1,000t*mile	Phase 1 MY 2014-2017 Phase 2 MY 2018-?	GEM	Exact RR for each tyre provided by tyre manufacturer or measured by OEM
Europe	gCO ₂ /t*km gCO ₂ /m ³ *km gCO ₂ /pass*km	> MY 2019	VECTO	RR Grade median or actual RR value (likely)
China	Liter/100km	MY 2015		Actual RR or a Default RR value
Japan	km/l	MY 2015		Default RR value

- **Countries around the world now regulate truck tyre rolling resistance**
 - This is a real opportunity for India to set a maximum cap on tyre RR to improve fuel economy of the legacy truck fleet
- **If CO₂ / Fuel Economy regulations are implemented for HDV in India, it would be wise to include actual RR in the calculations to promote wise selection of tyres**



Thank you for your attention.