

Tyre Technology

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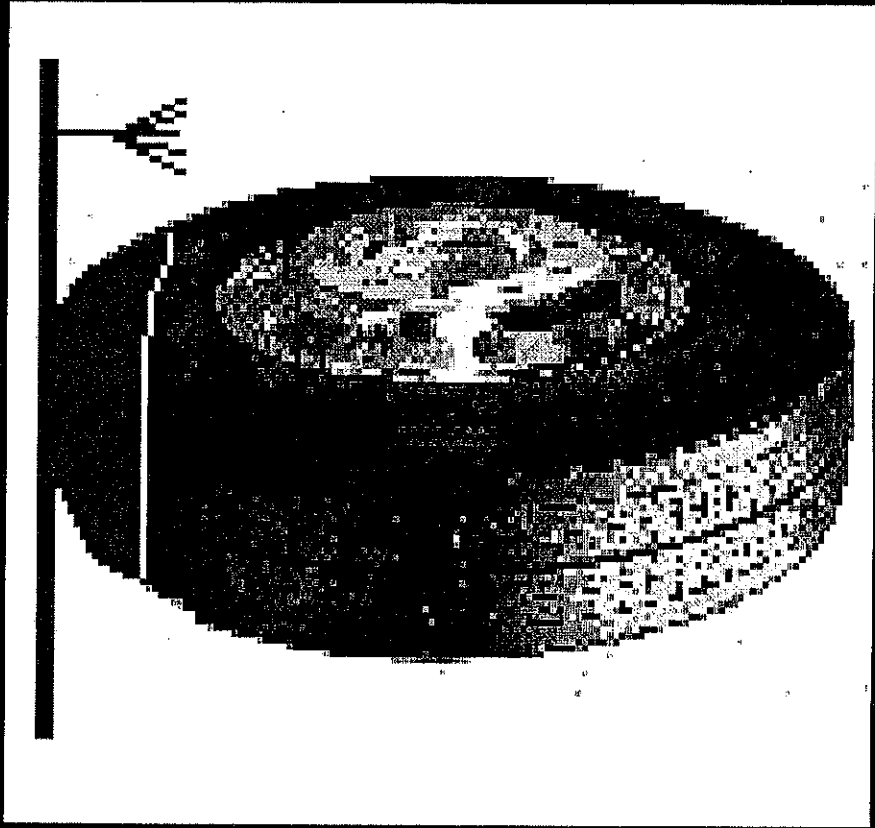


Tyre Technology
Today and Tomorrow



GOODYEAR

Smart Tyres



A white starburst graphic with multiple points, located to the left of the section header.

'Smart' Trucks

- Electronics integrated into the design of the truck:
- Electronic Engine Controls
- Diagnostic Links
- Trip Recorder
- A/C Controls
- Semi-Automatic Transmission
- Anti-Lock Braking System
- Future
 - Collision Warning System
 - Traction Control

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Tyre Identification Options

- **Branding**
- **Bar Coding**
- **Rf Technology**

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Smart Tyre Requirements

- Identification
- Pressure Sensing
- Temperature

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Smart Tyre System Requirements

- **Survive tyre build, cure, retread processes**
- **In service performance**
 - **Durability**
 - **Repeatability/Stability**
 - **Accuracy**
- **No impact on tyre integrity**
- **NDT machine survivability**
- **Acceptable transponder/system cost**

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What is a Smart Tyre?



- Inclusion of 'Chips' in tyres
- Chips provide reliable and accurate information on tyre ID, pressure and temperature
- Wireless data transfer to display or PC for data processing
- Must be durable and retread process resistant
- Methodology to improve chip durability and resistance to NDT inspection evolving rapidly

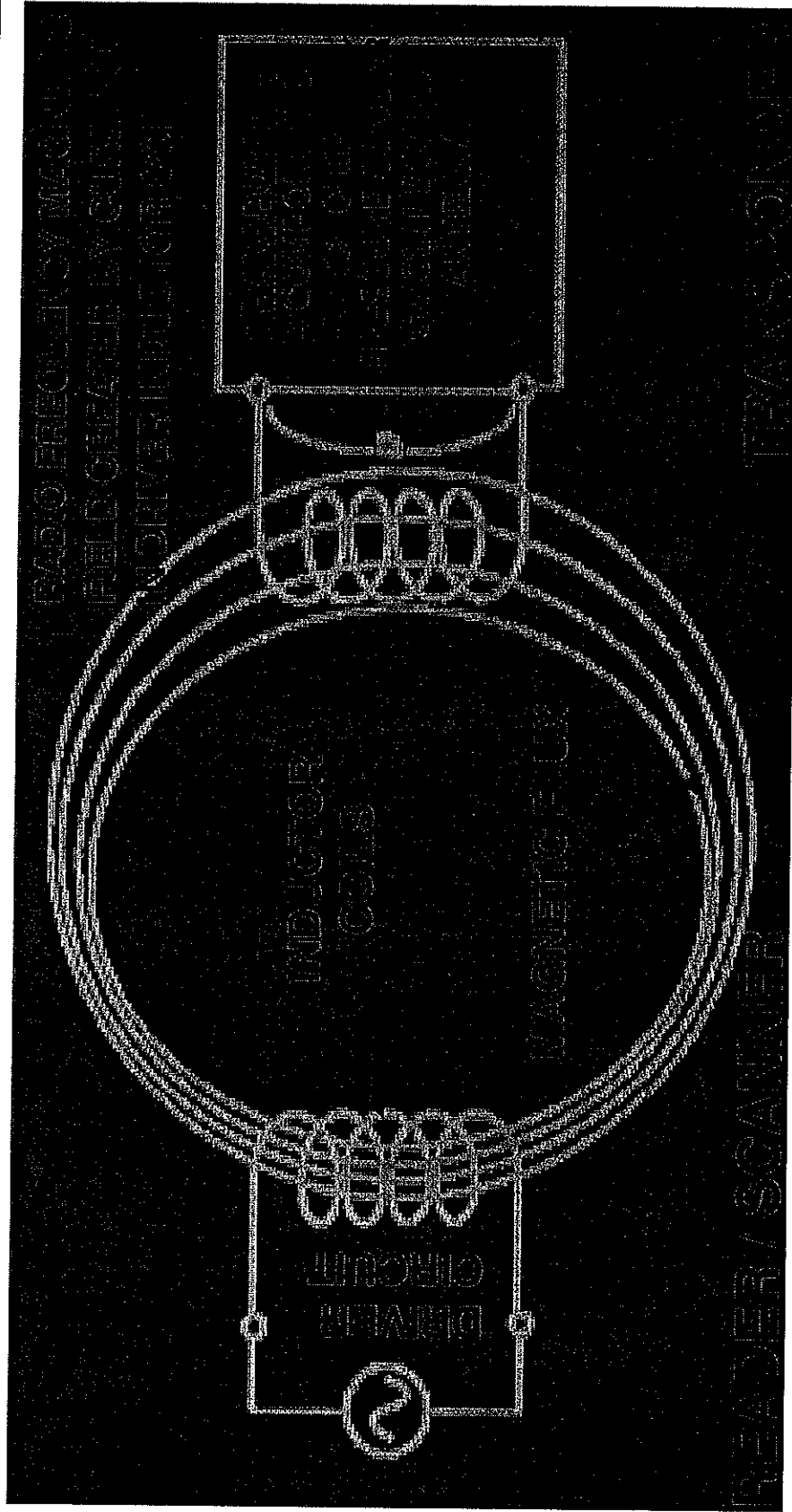
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RF Specification

- **Device Which Operates for 10 Years**
- **Easily Read / Can Identify a Specific Tyre**
- **Capable of Becoming Industry Standard**

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Smart Tyre Transponder Operation



RF Technology

➤ PASSIVE SYSTEM

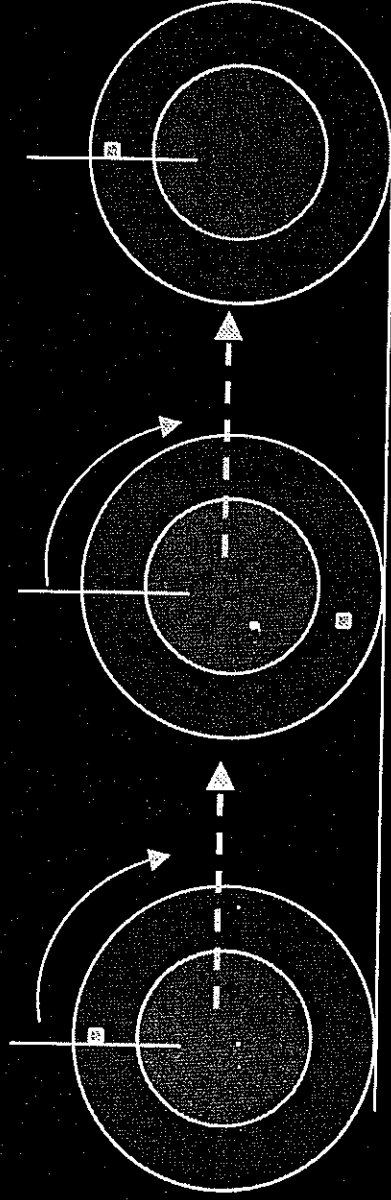
- No Battery
- Short Read Range
- Simple Built into Tyre
- Compact/Lt Weight
- Survives Retread
- State-of-Science Technology
- Low Cost ID/Press/Temp

➤ ACTIVE SYSTEM

- Needs Battery
- Long Read Range
- Complex Added On
- Weighs more
- Cannot Survive
- Utilizes Existing Technology
- Higher Cost ID/Press/Temp

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'Smart' Truck Tires Future



Where: $\text{Mileage} = \frac{\text{Number of Revolutions}}{\text{(Tire Revolutions per Km)}}$

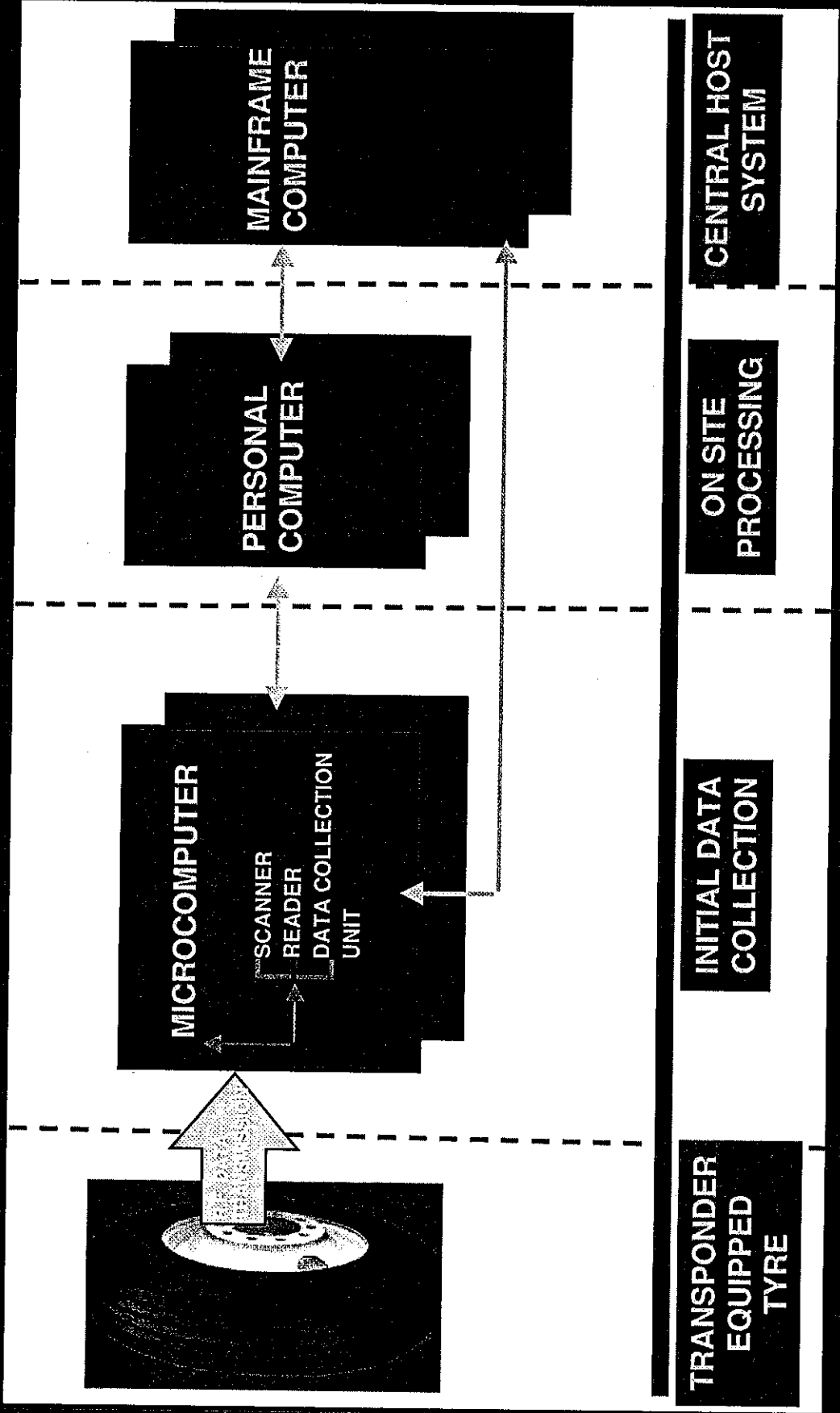
A starburst graphic consisting of a central point with multiple lines radiating outwards, creating a star-like effect.

'Smart' Trucks (cont.)

- **Micro-computer chip with tyre Revolution Counter**
- **To provide accurate tyre mileage information**
- **Eliminates the need to record truck mileage at tyre application and removal**

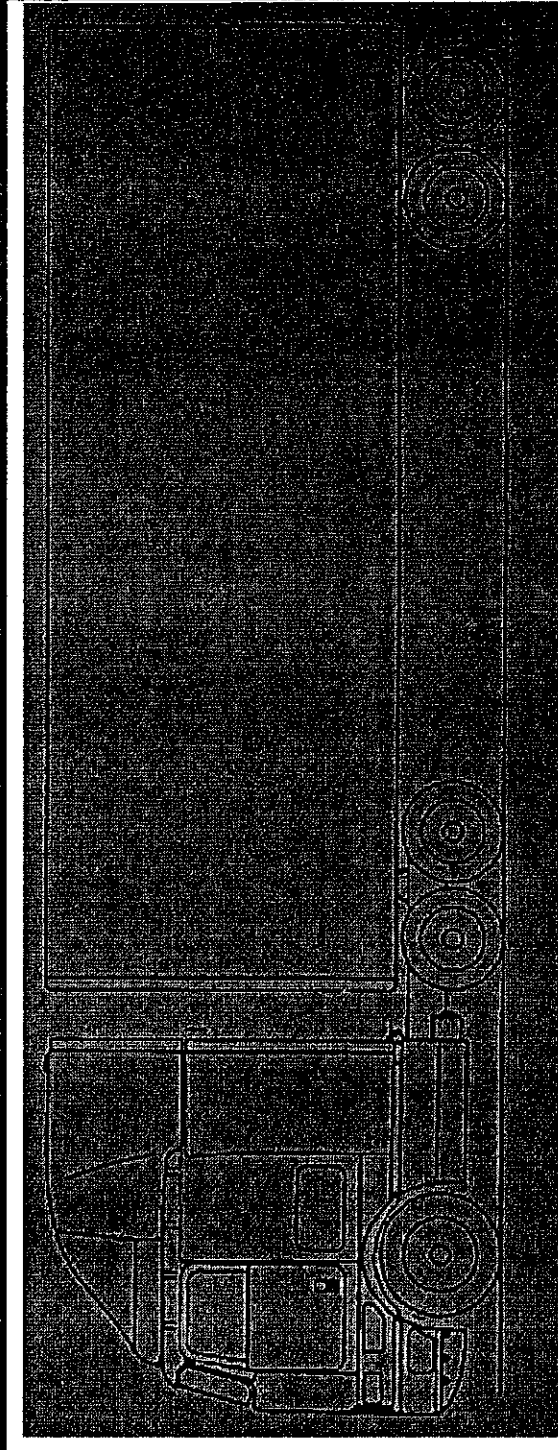
GOOD YEAR

'Smart' Truck Tyres



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Fuel Economy



User Trends

**Electronic Engines
New Transmissions
Optimized Tyre Systems**

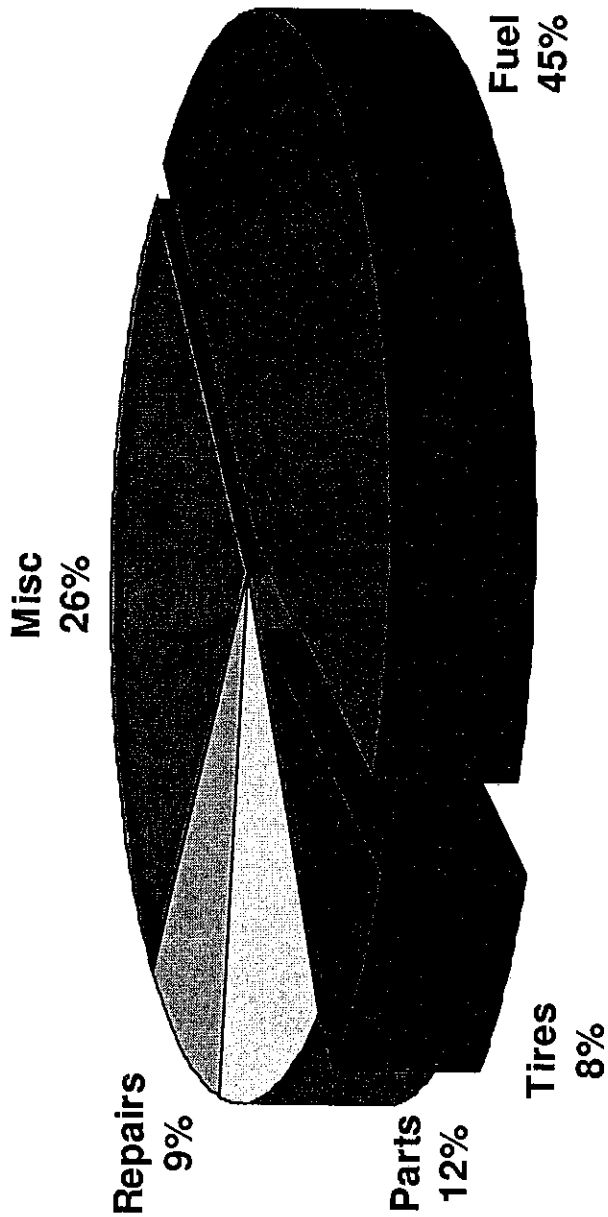
Tyres

**New Materials
Reduced Temperatures
New Designs**

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Importance of Fuel Economy

Top 100 Fleets-1994



Fuel is the Largest Variable Operating Cost



Fuel Economy

Operations Factors Impacting Fuel Consumption



Fuel Economy is not just a tyre issue

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**Fuel Economy
Environmental Factors**



Temperature



Topography



Road Surface

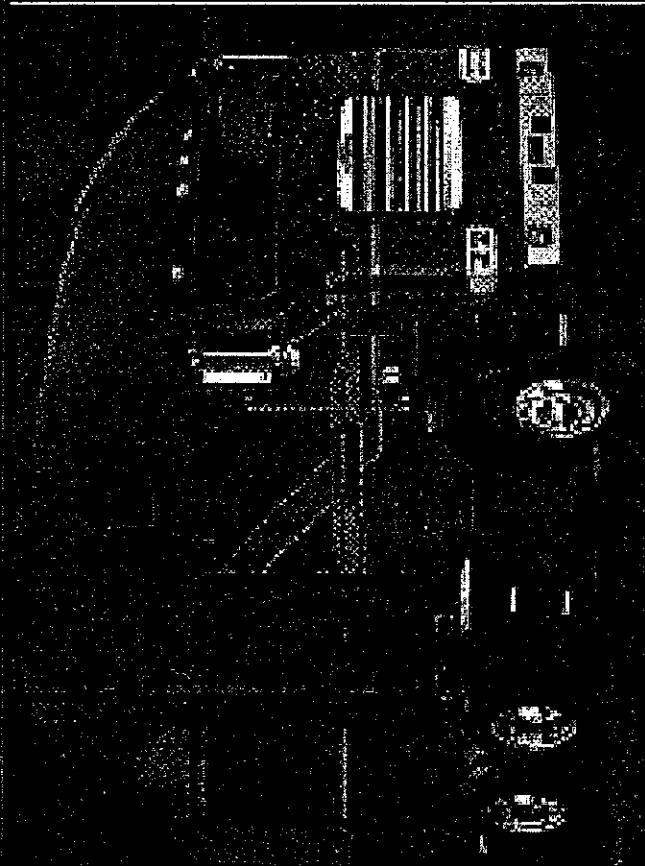


Weather

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Fuel Economy Tyre Rolling Resistance

LOAD

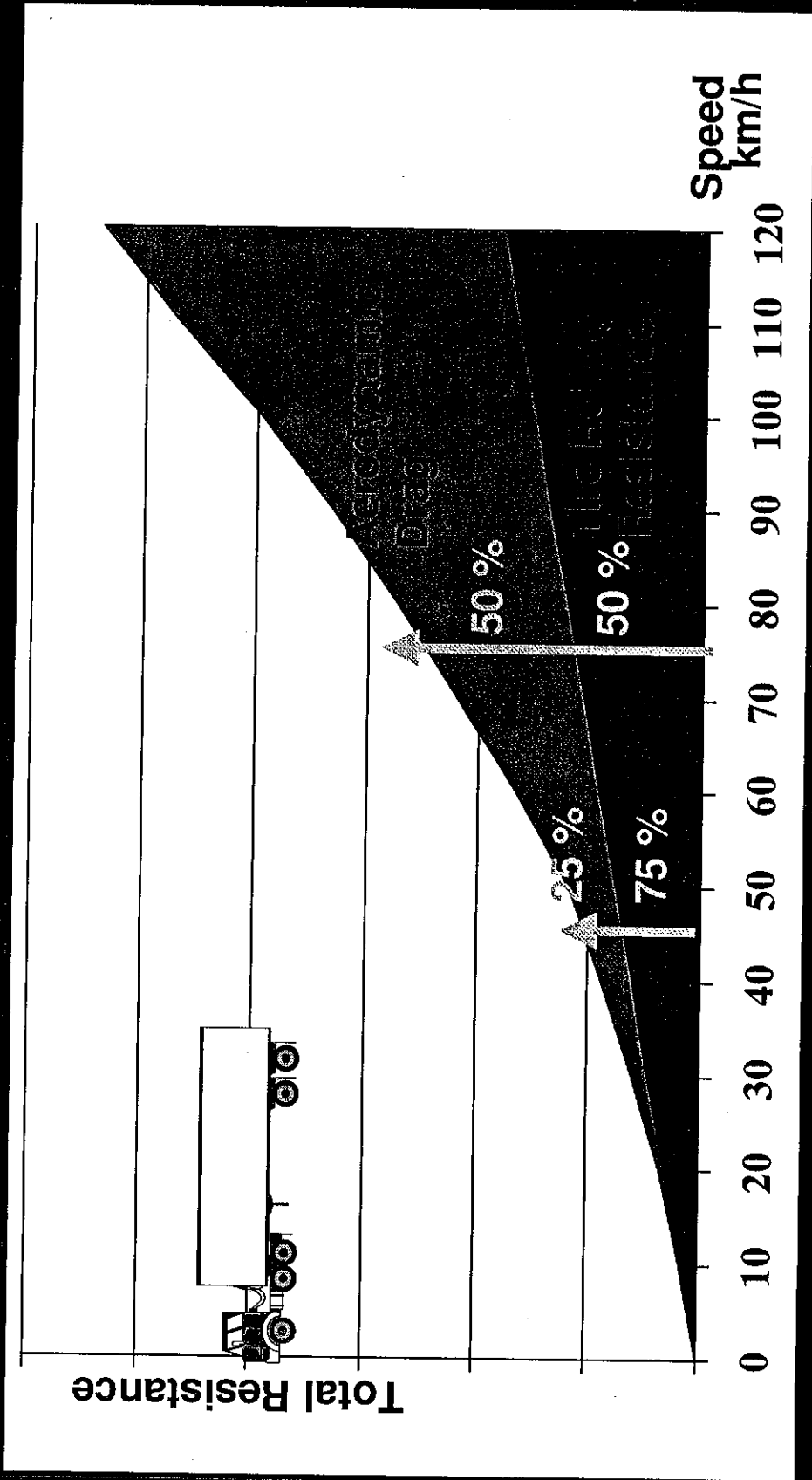


**TYRE ROLLING
RESISTANCE
(TIRE DRAG)**

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Rolling Resistance

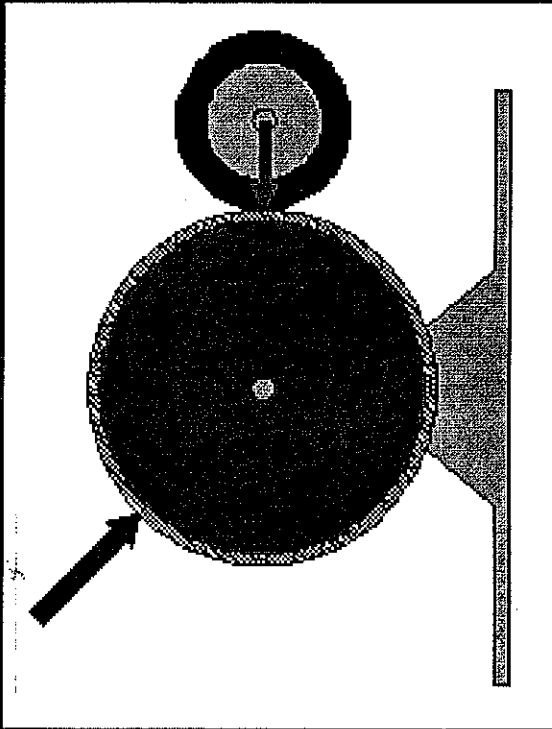
Rolling Resistance and Aerodynamic Drag



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Fuel Economy Tyre Rolling Resistance

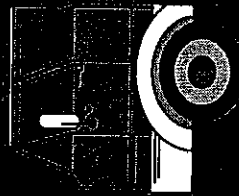
TEXTURED FLYWHEEL
SURFACE



- > ENVIRONMENTAL / OPERATIONAL PARAMETERS CONTROLLED
- > VARIED LOAD / INFLATION TEST PROCEDURE

Fuel Economy

Fuel Economy and Rolling Resistance



	Steer	Drive	Trailer	Total
Contribution	15 %	30 %	55 %	100 %
Tyre Rolling Resistance	- 10 %	- 10 %	- 10 %	- 10 %
Truck Fuel Economy	- 0.5 %	- 0.9 %	- 1.6 %	- 3 %

10 % Rolling Resistance Reduction = 3 % Fuel Economy

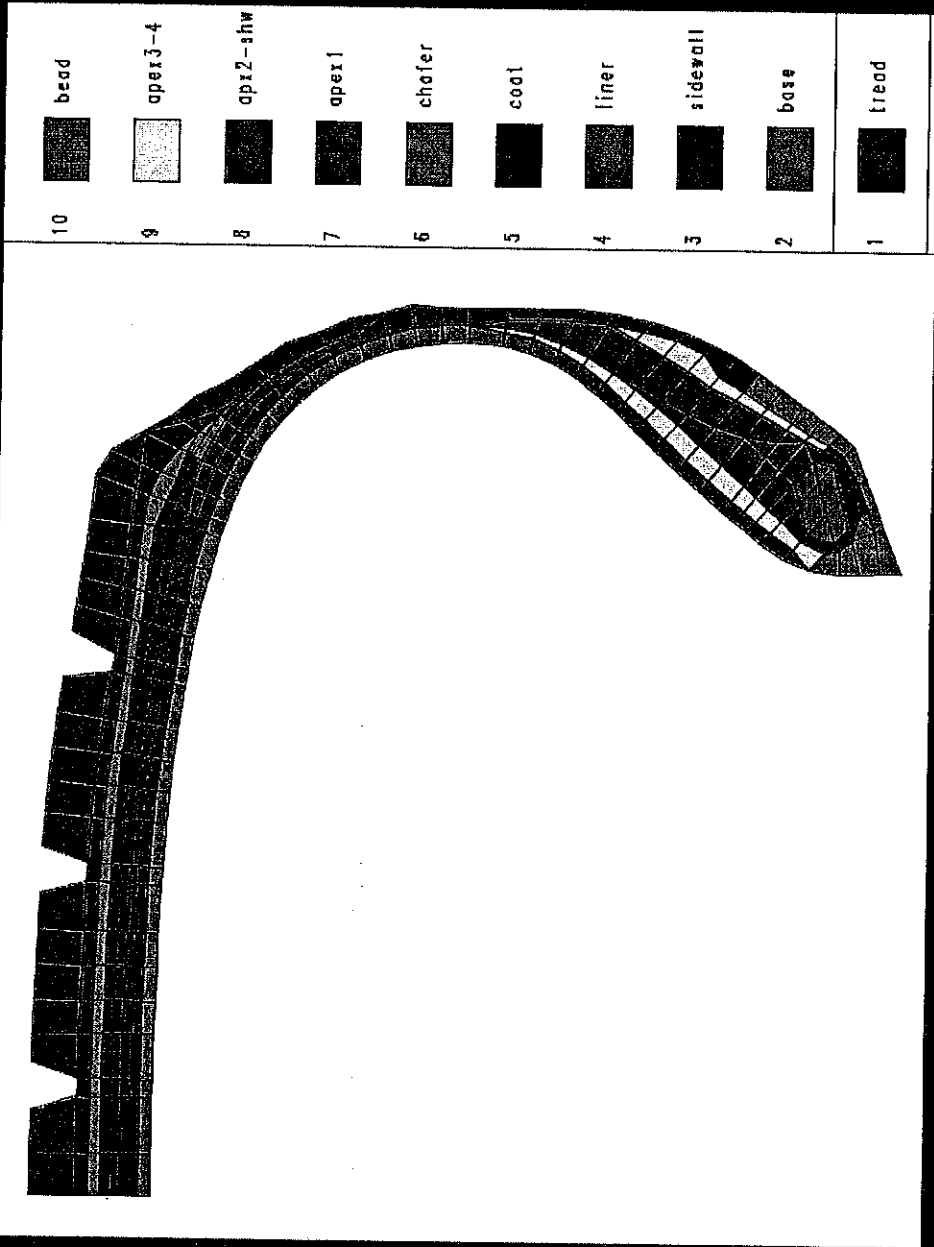
Rolling Resistance

Factors influencing Rolling Resistance

- **Compound Hysteresis**
- **Rubber Volume**
 - **Nonskid: 1mm NSK decrease => 2% RR decrease**
- **Strain Level**
 - **stiffer construction : strain level decrease => RR decrease**
 - **net to gross ratio : 1% NTG increase => 0.6 % RR decrease**

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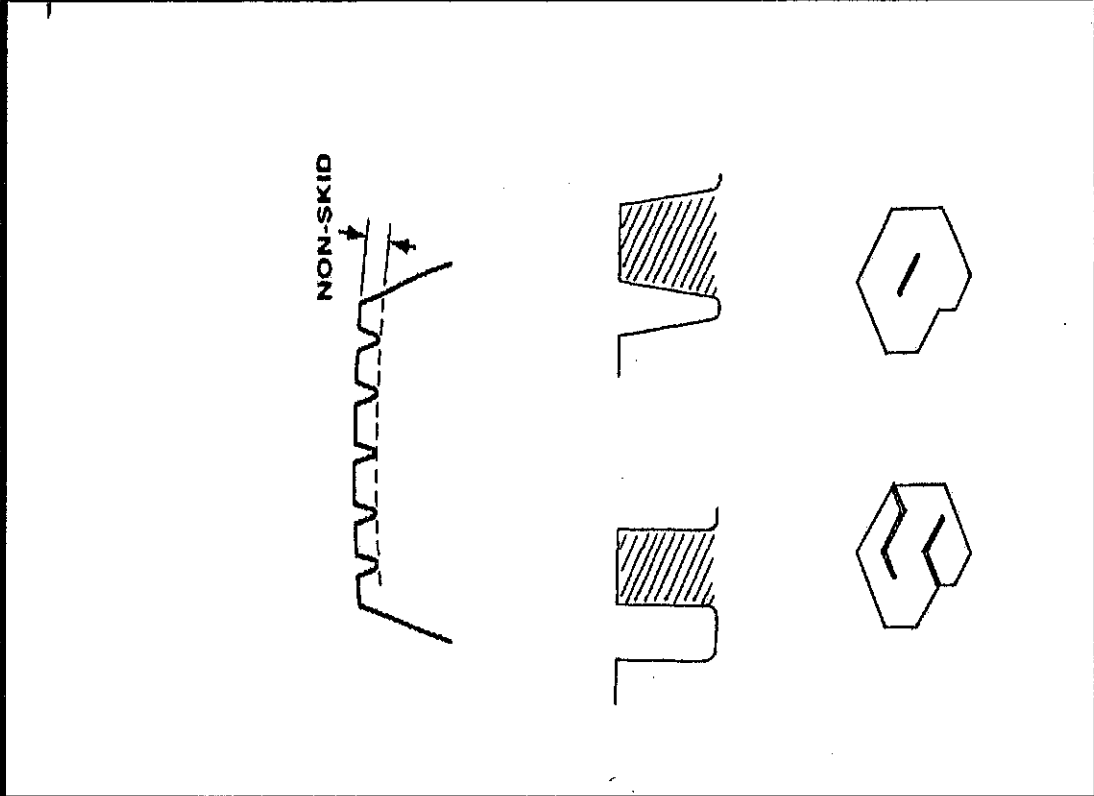
Rolling Resistance Component Contribution



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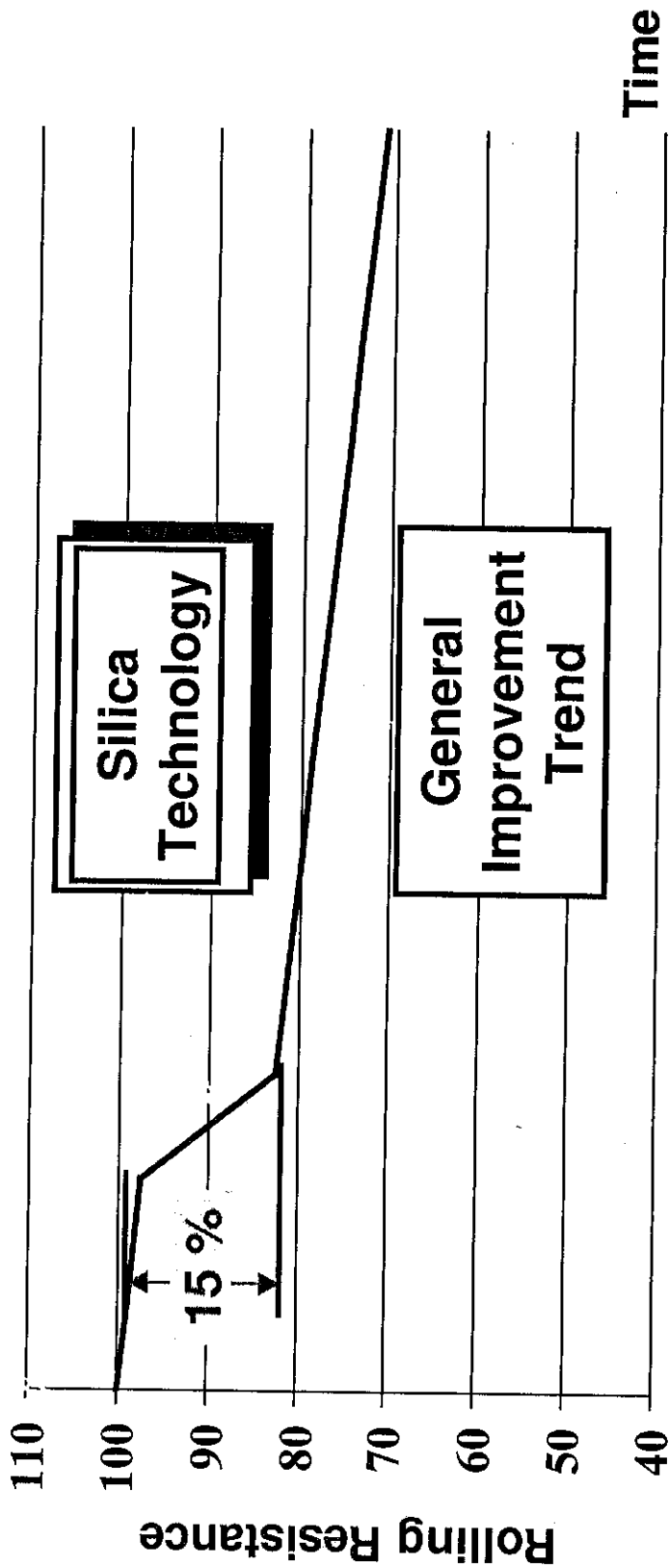
Fuel Efficient Tyre Design Features

- Increased % Net/Gross
- Shallower Non-Skid Depth
- Stiffer Tread Elements
- Minimal Tread Siping



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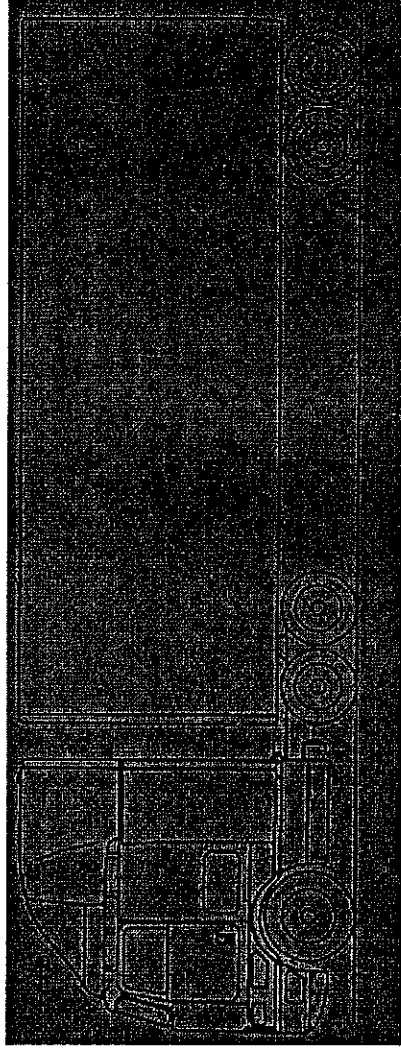
Rolling Resistance Silica Technology



**Silica Technology: Rolling Resistance Improvement
without compromise on Traction or Wear**

GOODYEAR

Reduced Diameter Tyres



The logo features the words "GOOD YEAR" in a bold, sans-serif font. The word "GOOD" is positioned above "YEAR". A stylized winged figure, resembling a winged wheel or a similar symbol, is placed between the two words, partially overlapping them. The entire logo is set against a dark, textured rectangular background.A white, multi-pointed starburst graphic is located in the upper left corner of the page, partially overlapping the dark background.

Reduced Diameter Tyres

- > **Advances in brake system technology**
 - > **New/improved materials**
 - > **Reduced diameter brake/wheel/tyre systems**
- > **Advantages of new systems**
 - > **Weight savings**
 - > **Increased cargo capacity**
 - > **Vehicle aerodynamic benefits anticipated**

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*Reduced Diameter Tyre Applications

Class 7/8

11R22.5

11R24.5

295/75R22.5

285/75R24.5



285/70R19.5

265/70R19.5

255/70R22.5

255/60R22.5

Class 6

9R22.5

10R22.5



245/70R19.5

225/70R19.5

INCREASE CARGO VOLUME UP TO 7.0%

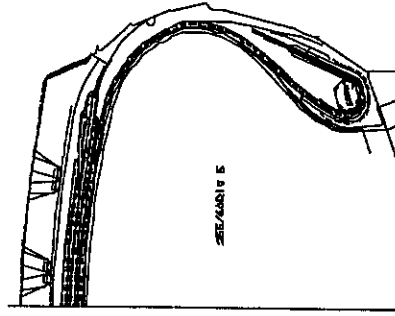
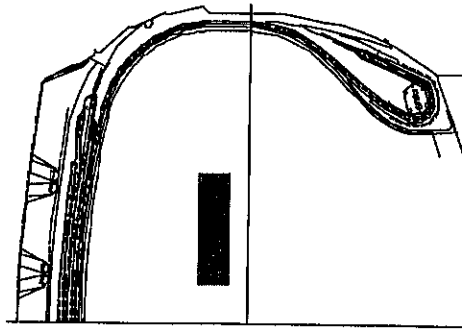
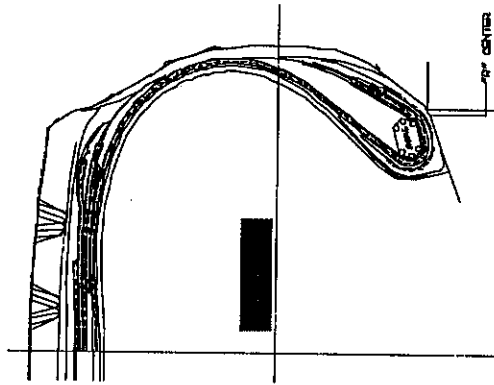
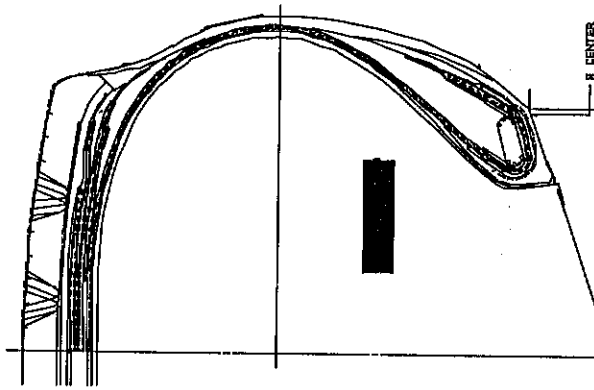


295/75R22.5
LRG

255/70R22.5
LRH

265/70R19.5
LRG

255/60R22.5
LRH



OD 39.92
SH 8.70
S-LD/INF 6175/110
D-LD/INF 5675/100
VOLUME 100%

36.61
7.05
5510/115
5070/115
66%

34.13
7.32
5070/110
4805/110
65%

34.57
6.02
5070/120
4675/120
55%

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Truck Tyre Dimensions Size Evolution

<u>Size</u>	<u>10.00R20</u>	<u>11R22.5</u>	<u>275/80</u>	<u>275/70</u>	<u>295/60</u>
Initial Load (kg)	4600	6000	6000	5000	6000
Initial Infl. (bar)	5.75	8.00	8.00	7.25	9.00
Current Load (kg)	6000	6300	6300	6300	6300
Current Infl. (bar)	8.00	8.50	8.25	9.00	9.00

Tyre volume constantly decreasing:
Tyre load and inflation constantly increasing



Truck Tyre Features

Aspect Ratio Influence on Tyre Performance

<u>Features</u>	<u>AR</u>	<u>88</u>	<u>60</u>
Carcass Durability		+	
Treadwear/Mileage		(+)	
Speed Capability			+
Fuel Economy		+	
Comfort/Ride		+	
Stability			+
Lower Tire Weight			+
Loading/Step-in Height			+
Ground Clearance		+	
Cargo Volume			+
Traction		+	

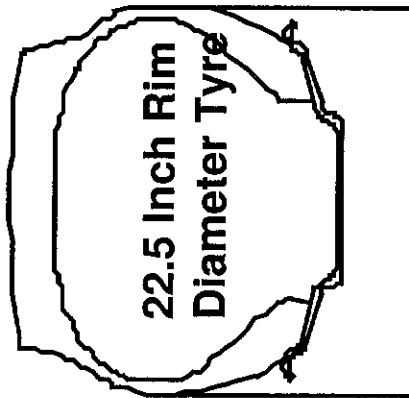
Aspect Ratio often derived from economical reasons



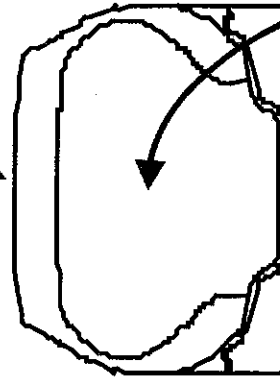
★ Tyre Performance Issues 19.5" Rim Diameter Tyres

Smaller Tyre Diameter =
Higher Revolutions per Km

Shorter Sidewalls More
Prone to Damage



22.5 Inch Rim
Diameter Tyre



19.5 Inch
Rim Diameter
Tyre

Load Carrying Capability:

Smaller Inside Tyre Volume
Requires Higher Inflation

Technology Concerns

- Performance Tradeoffs
- Brake Heat
- Curb Damage
- Component Compatibility
- Dock Heights
- Vehicle Resale

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Tyre Performance Issues

- **Treadwear**
- **Durability/Retreadability**
- **Pavement Damage**
- **Ride/Stability**
- **Sidewal Damage**
- **Brake Heat**