

The Aluminum Advantage

Exploring Commercial Vehicle Applications

Randall Scheps

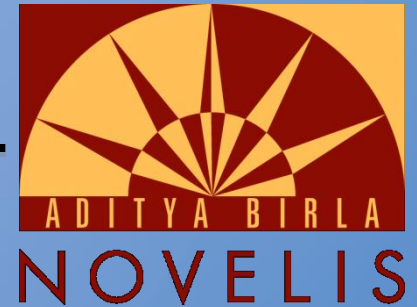
Chairman, The Aluminum Association's

Auto & Light Truck Group

Marketing Director, Alcoa Ground Transportation

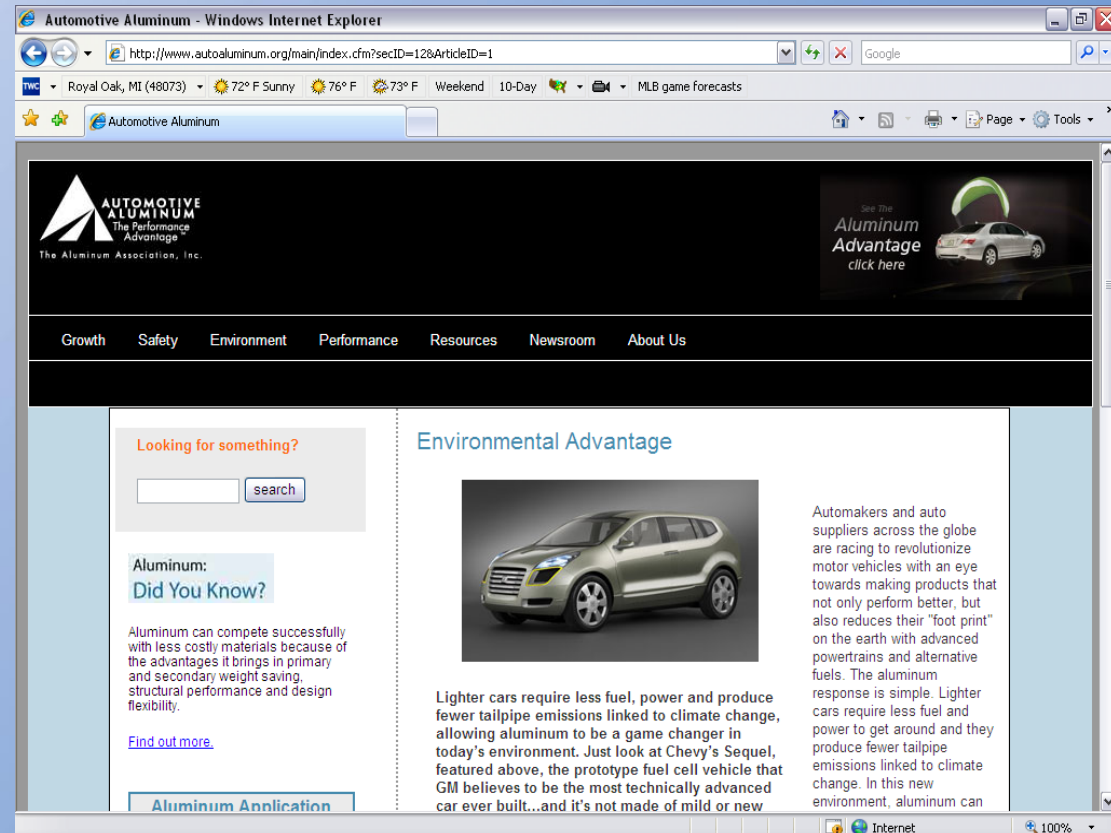
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Defining Who We Are



Our Mission

- Central resource for the automotive industry on aluminum
- Promote research and programs highlighting advantages
- Expanding mission to include commercial vehicles



Aluminum Builds a Better Vehicle

Mass Reduction



Better Fuel Economy



Reduced Emissions



Improved Safety



Enhanced Performance



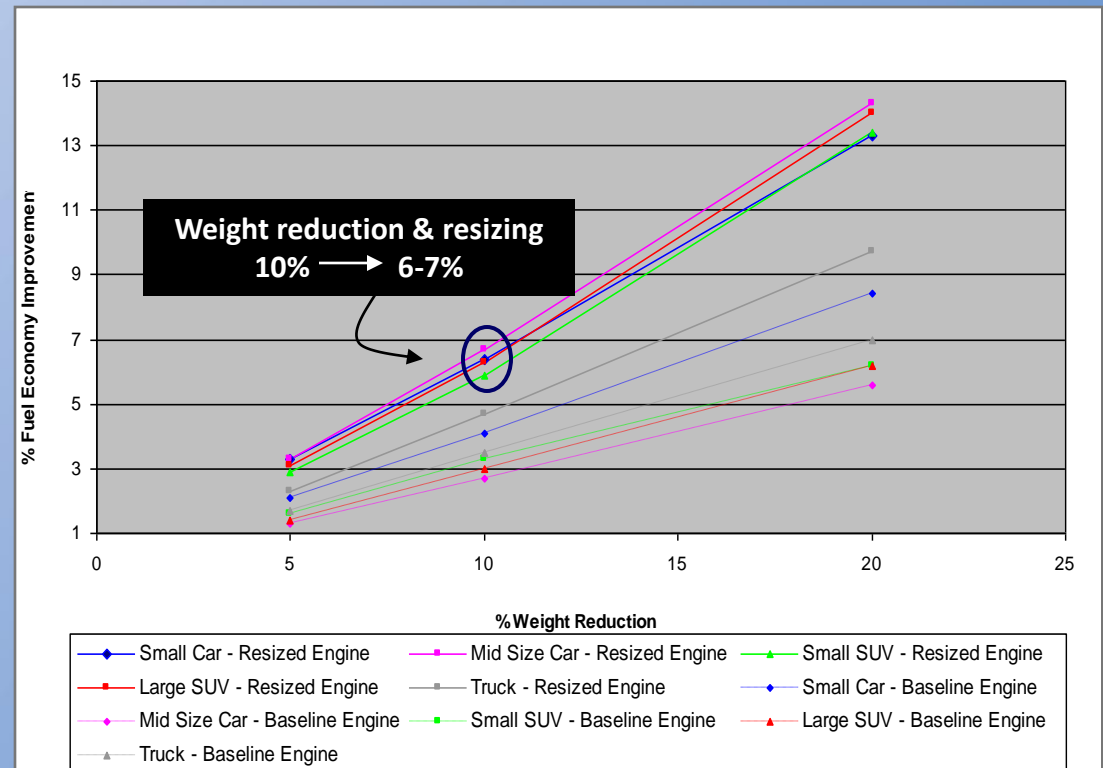
Infinitely Recyclable



Association Sponsored Automotive Research

- Safety: Size vs. Weight (DRI 2004)
- Vehicle Structure - Manufacturing and Lifecycle Cost Analysis (IBIS 2005)
- Improving Sustainability in the Transport Sector Through Weight Reduction and the Application of Aluminum (IAI 2006)
- Benefit Analysis: Use of Aluminum Structures in Conjunction with Alternative Powertrain Technologies in Automobiles (IBIS 2008)
- Aluminum Growth Study (Ducker 2009 & 2006)

Impact of Vehicle Weight Reduction on Fuel Economy for Various Vehicle Architectures (Ricardo 2007)



Why We Are Here Today

- Lightweighting with aluminum can help you achieve your goals
 - Auto companies and other third-parties acknowledge aluminum's value proposition will help them meet 2016 CAFE standards
 - Success experienced in auto industry and same model can apply to the commercial vehicle industry
- Overview
 - Value proposition
 - Weight saving benefits
 - Research and data

Why Aluminum for Commercial Vehicles?

THE VALUE PROPOSITION

- Increased payload
- Lower maintenance costs
- Reduced fuel consumption
- Reduced greenhouse gas emissions
- Improved durability
- Higher resale value
- Infinitely recyclable



Truck Owners See Value in Lightweighting

Benefits of Reducing Truck Weight
(Heavy-Duty Truck Owners Only - Multiple Mentions)

	Heavy-Duty Trucks Total	Over the Road	Vocational	Pickup & Delivery
Payload capacity	50%	50%	50%	50%
Fuel economy	39%	41%	29%	52%
Don't know	21%	22%	24%	12%
Wear and Tear	4%	4%	4%	5%
Maintenance costs	3%	2%	4%	2%
Lighter components (general)	2%	2%	1%	2%
More power/higher performance	2%	4%	0%	2%
Emissions	1%	1%	2%	0%
Life of vehicle	1%	0%	1%	2%
Operating costs	1%	0%	3%	0%
Safety	1%	0%	1%	5%
Vehicle design	0%	0%	1%	0%
Other	0%	0%	1%	0%

Aluminum Already on the Road

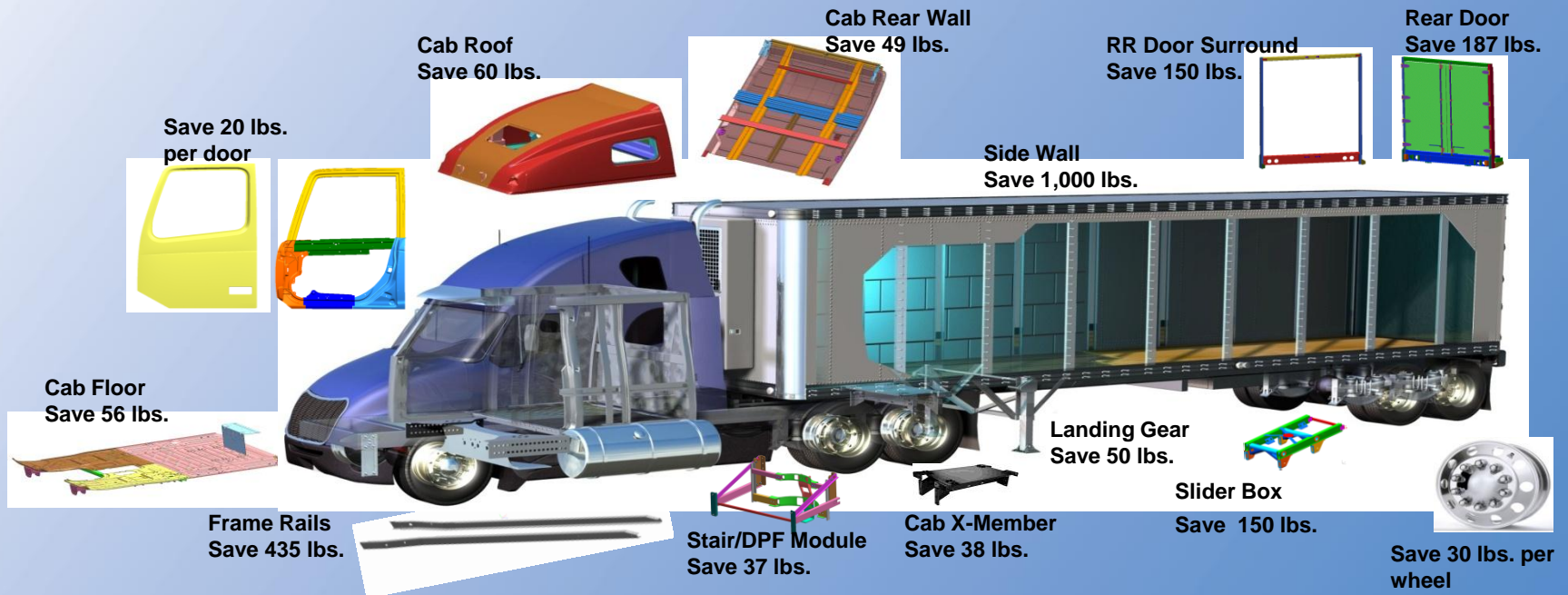
- Cab structure
- Forged aluminum wheels
- Fuel tanks
- HVAC components
- Bellhousing
- 5th wheel
- Landing gear
- Trailer side walls and structure
- Tank bodies

**The average Class 8 Tractor today contains
1,000 lbs. of aluminum**



Potential Future Applications

- Emerging technologies help save more weight
 - Save **3,500 lbs.** versus today's truck and trailer with aggressive weight reduction



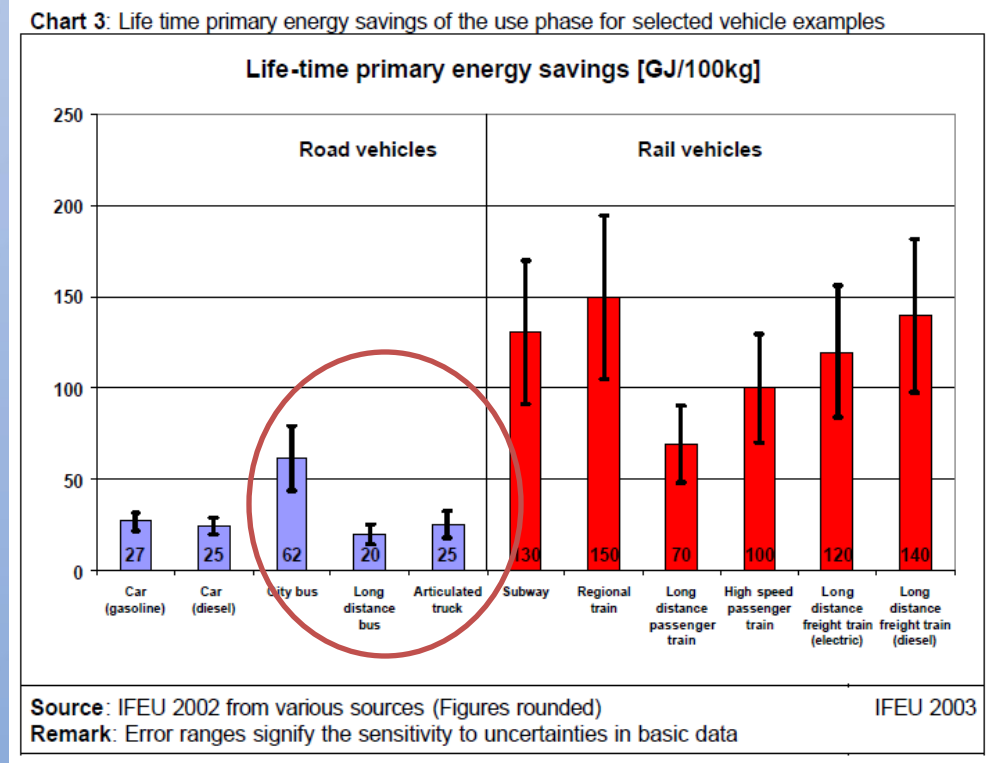
Research Supporting Our Value Proposition

- Potential Savings as a Result of Weight Reduction (IFEU Heidelberg 2003)
- Improving Sustainability in the Transport Sector Through Weight Reduction and the Application of Aluminum (IAI 2006)
- Simulator Data (Major Tire Manufacturer 2007)
- Case Study: China Bus Project (Alcoa 2008)
- Impact of Weight on Rolling Resistance and Fuel Economy (Smithers 2009)

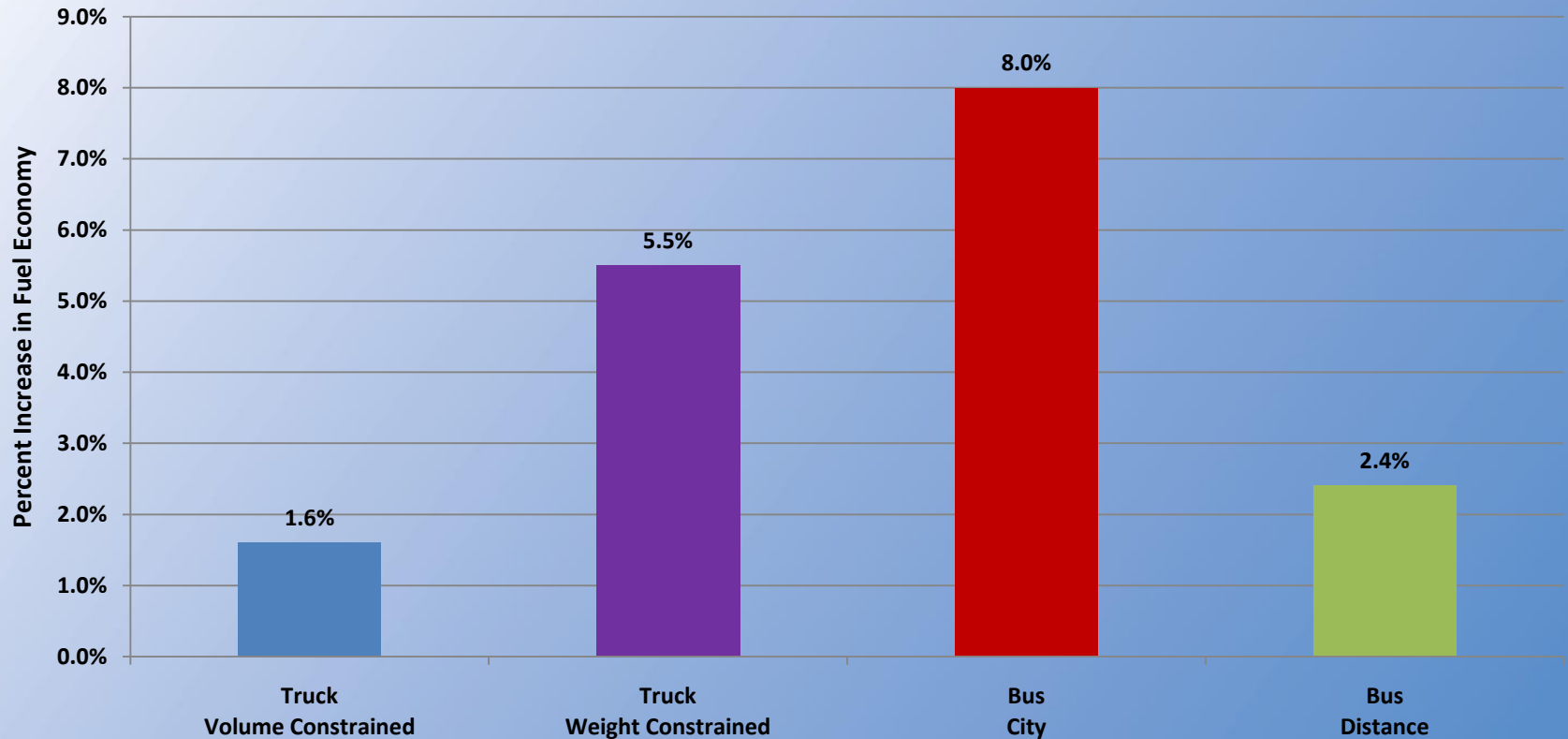


IFEU Heidelberg Research Findings

- Weight is a factor in truck and bus fuel economy
- Trucks and buses represent a large potential fuel savings
- CO₂ reductions also
- Duty cycle dependant
- Results based on real-world experience of truck OEMs



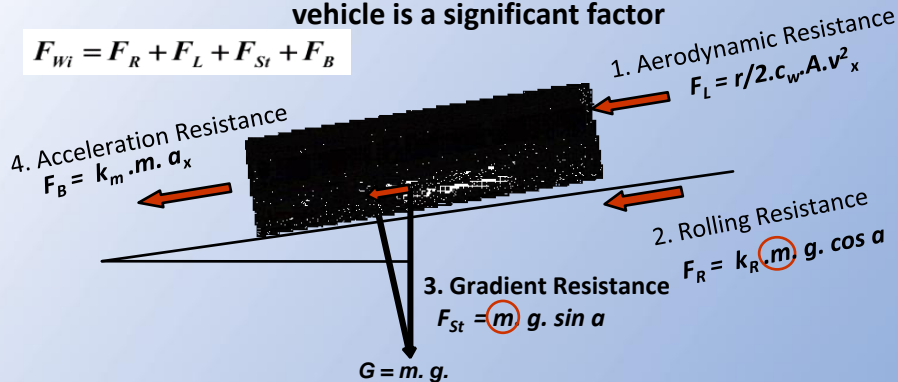
Estimated Fuel Economy Benefit from 10% Weight Reduction



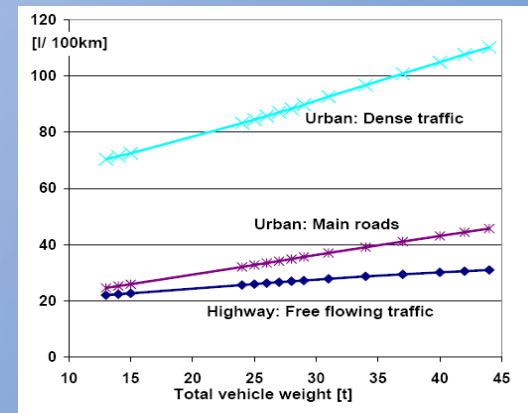
Impact More Pronounced in Urban Setting

Bus Example

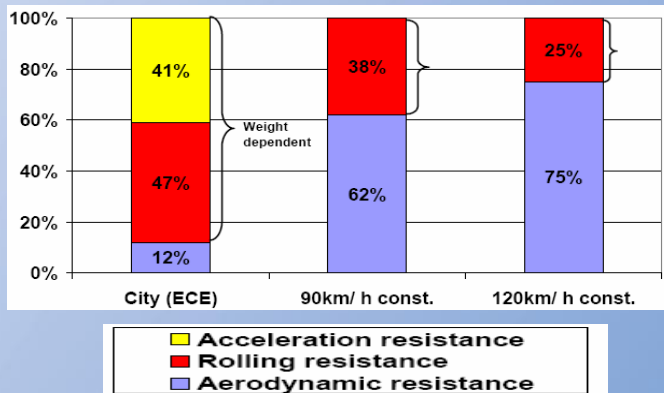
Physical resistances have an impact on vehicle fuel efficiency and mass of the vehicle is a significant factor



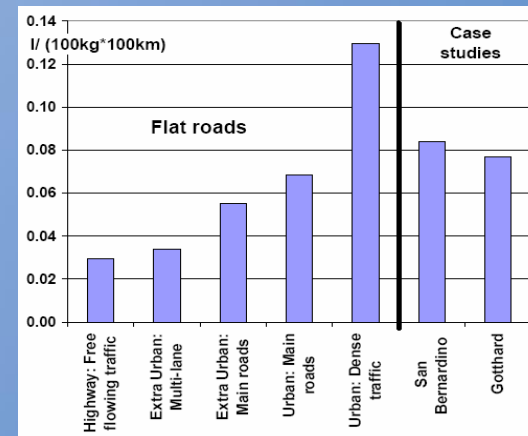
Heavier buses consume more fuel in urban areas



Impact is more pronounced in urban setting



Lightweighting will enhance fuel consumption

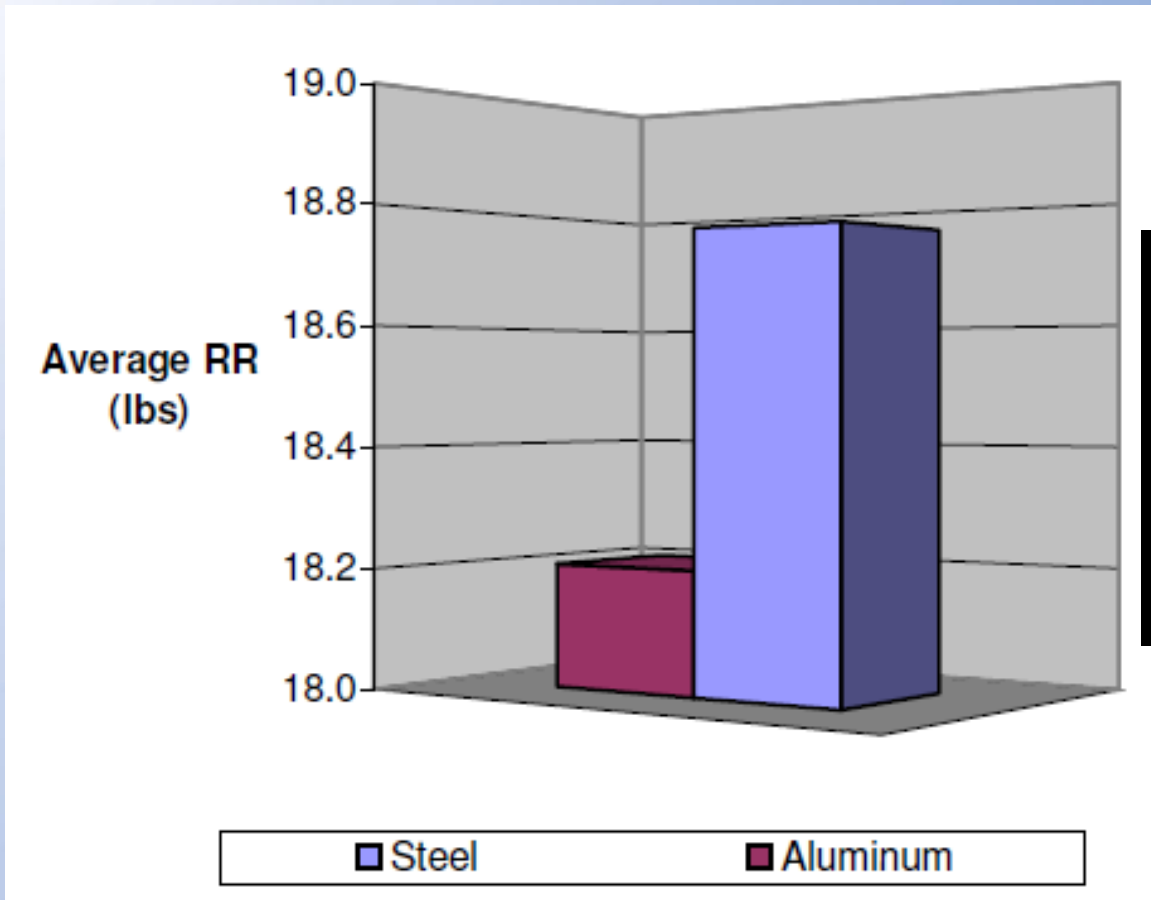


Rolling Resistance Lab Test

- Research conducted by third-party firm (Smithers)
- Tested to SAE spec and followed U.S. EPA Smartway protocol
- Five test runs completed at varying loads and tire pressures

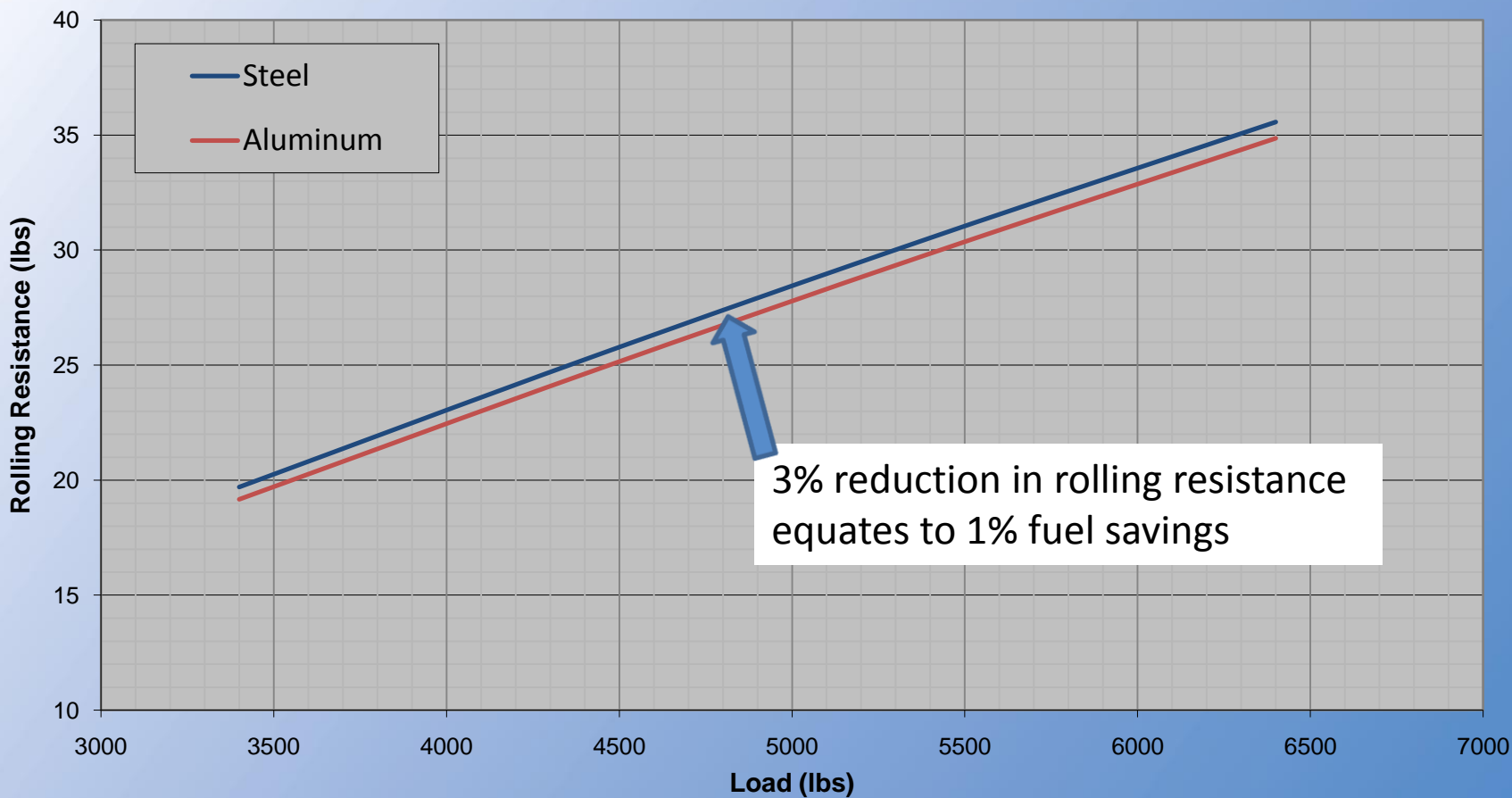


Light Weight Pays Fuel Economy Dividends



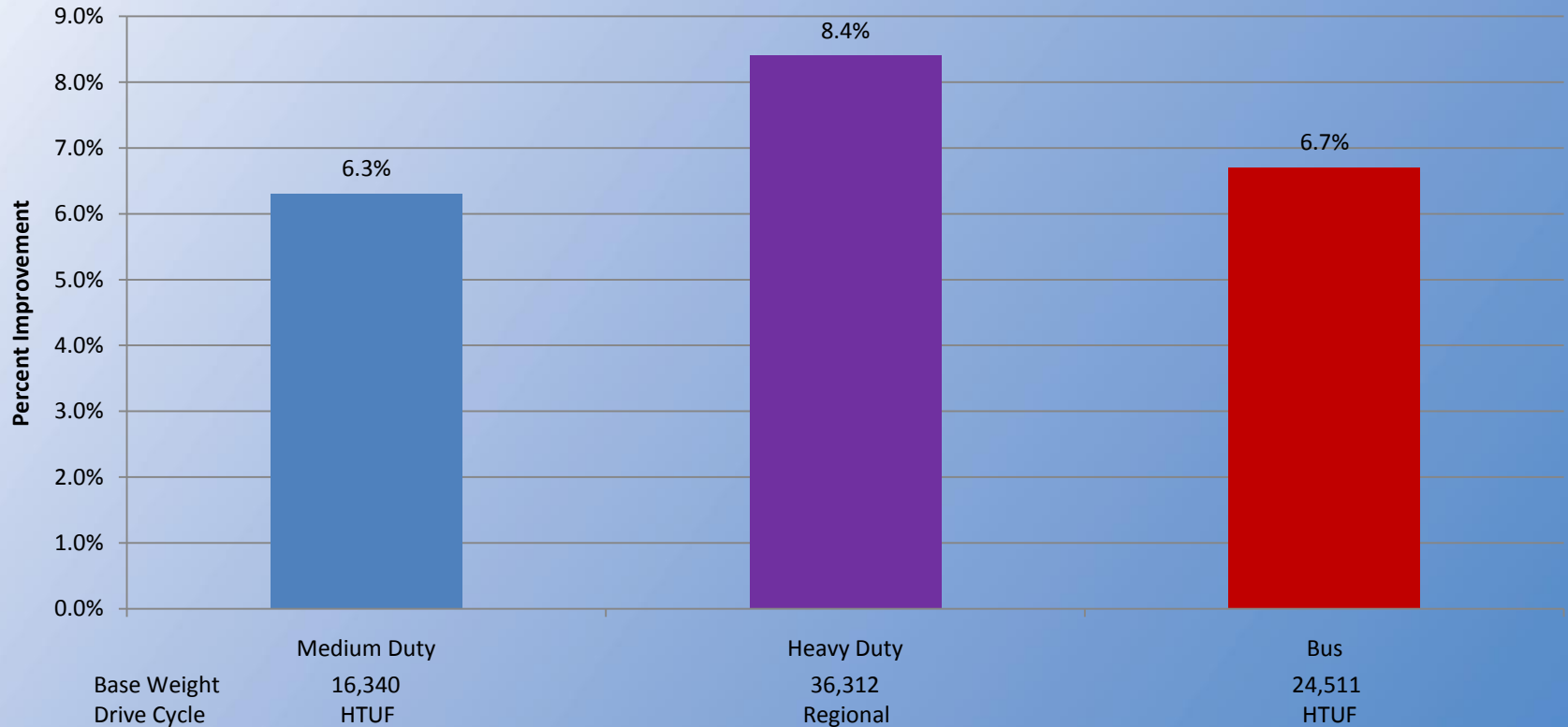
An aluminum wheel can improve tire rolling resistance by up to 3% over a comparable size steel wheel

Light Weight Pays Fuel Economy Dividends



Major Tire Manufacturer Simulator Data

Fuel Economy Improvement Per 10% Weight Save



China Bus Project: Real World Success

**Weight
Reduction of
1,400 kg (12%)**



**6% Fuel
Economy
Improvement**



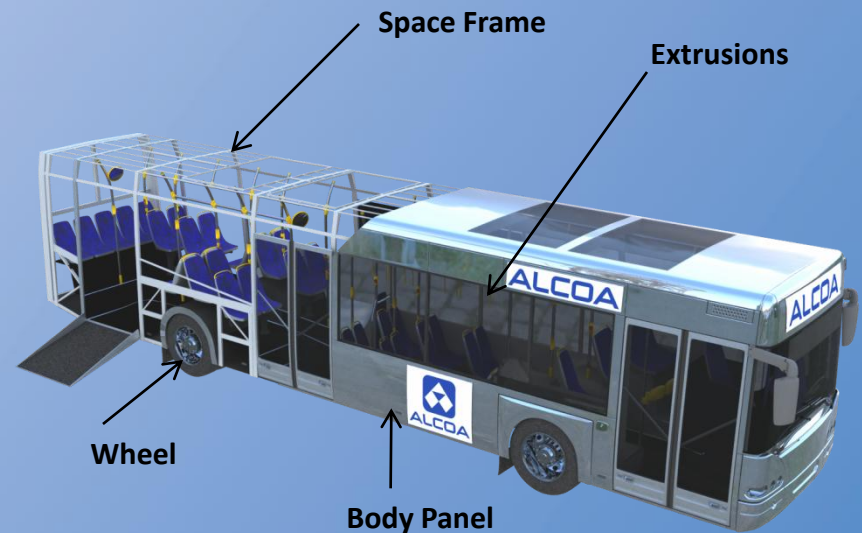
**50 tons of CO₂
Lifetime**

Value – Ecological

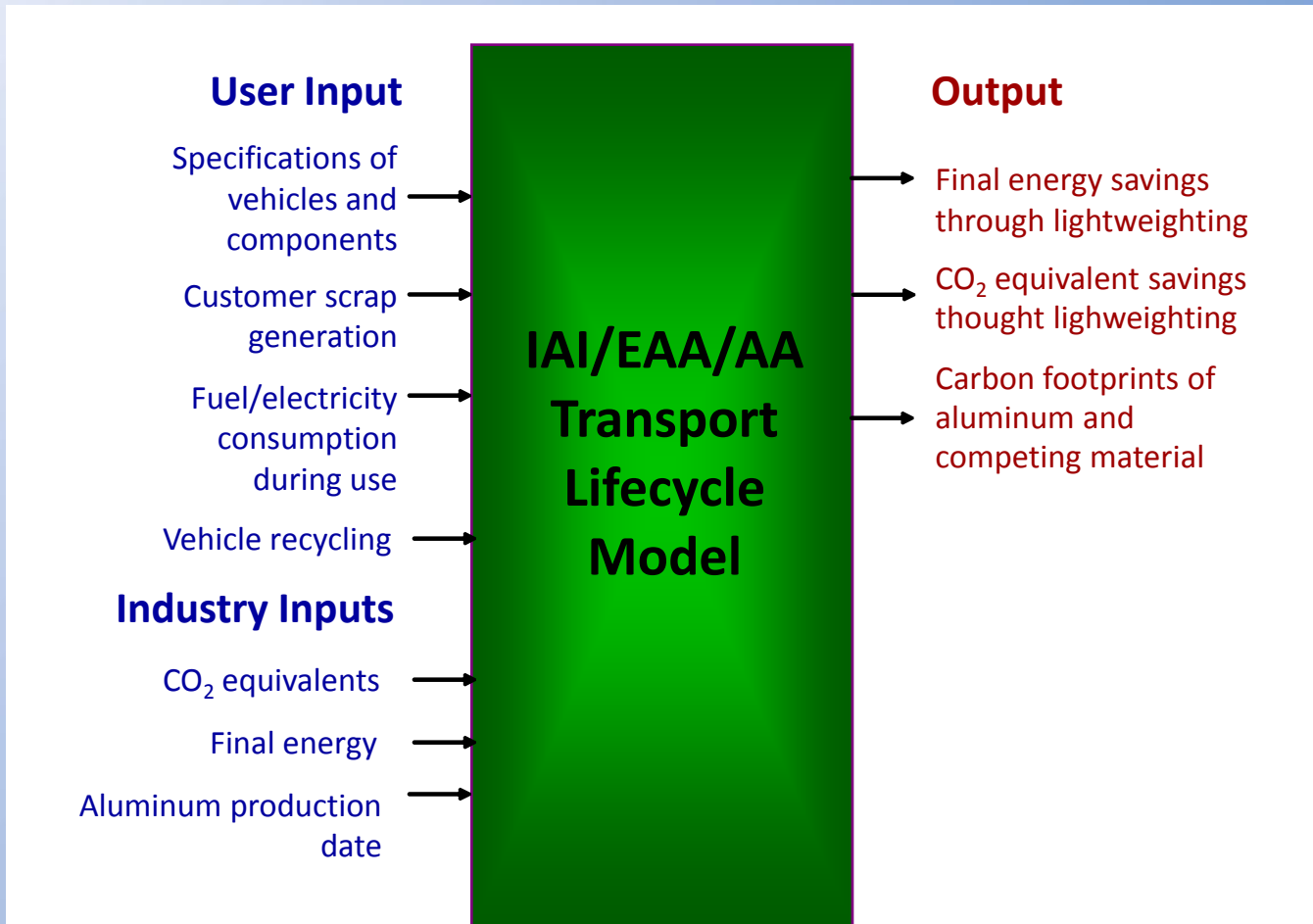
- Reduction in CO₂ emissions
- Reduced road surface wear and tear

Value – Financial

- 6% less fuel
- Maintenance savings (tires, brakes, suspension)
- Improved corrosion resistance
- Payback of 2-3 years

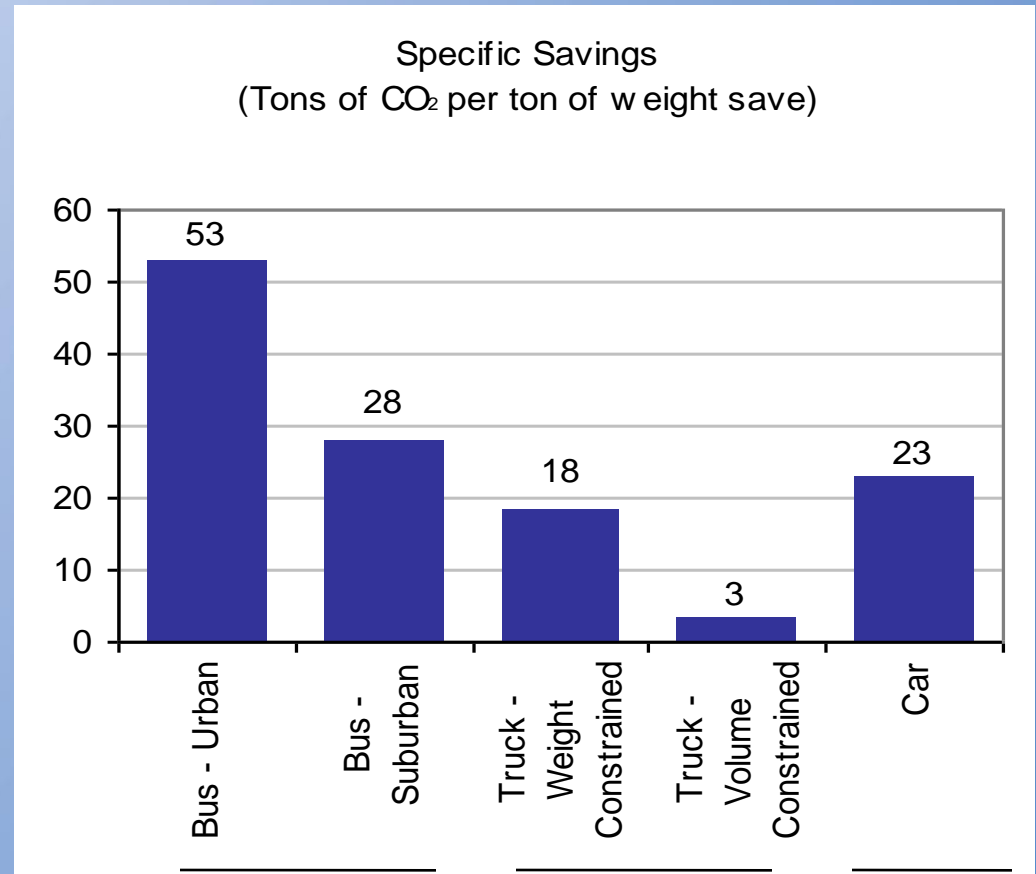


IAI Transport Model Illustrates Potential CO₂ Savings from Lightweighting



IAI: Aluminum Helps Reduce CO₂

- Auto aluminum already saving 300 million metric tons of CO₂ annually
- Including CO₂ impact of aluminum production
- Use-phase savings far outweigh production CO₂ generation
- Recycled aluminum uses 95% less energy



Potential Weight Savings:

3,000-3,500 lbs.

3,500-4,500 lbs

300-500 lbs

Aluminum is a Part of the Solution

More Payload AND Lower Costs

- One ton of weight reduction = up to 2,000 gallons of diesel per year
- Lower maintenance costs
- Lower tire and brake costs

Higher residual value and durability

- Corrosion resistant parts last longer

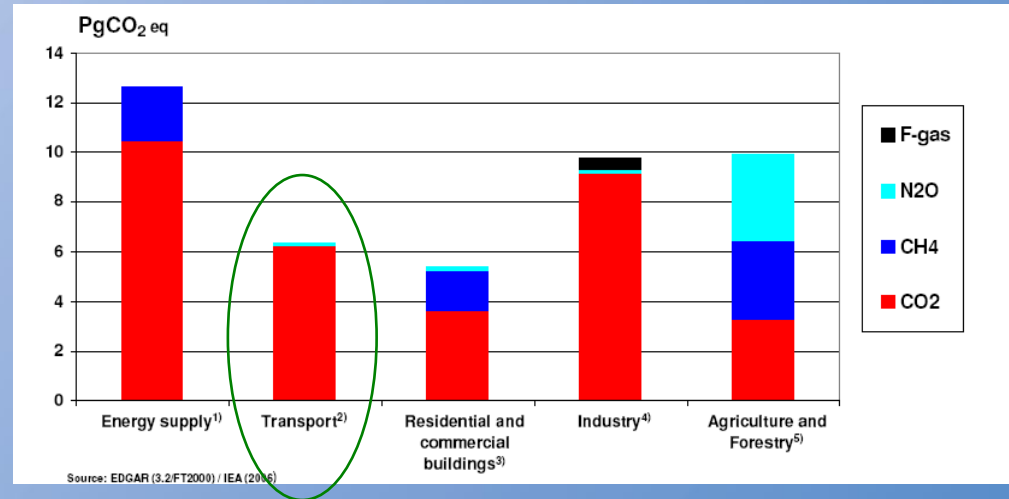
Reduced Lifetime CO₂ Emissions

- Save 18 tons of CO₂ for every ton of aluminum you add to your fleet

Reduced dependence on imported oil

Infinitely recyclable

Global CO₂ Sources



Questions?

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