

# **The Aluminum Advantage**

## ***Commercial Vehicle Applications***

**Todd Summe**

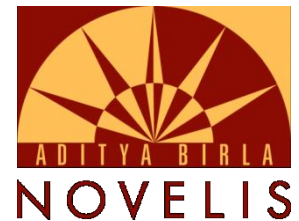
Technical Committee, The Aluminum Association's  
Aluminum Transportation Group

Division Manager, Product Design & Development – Alcoa

[www.autoaluminum.org](http://www.autoaluminum.org)



# Defining Who We Are

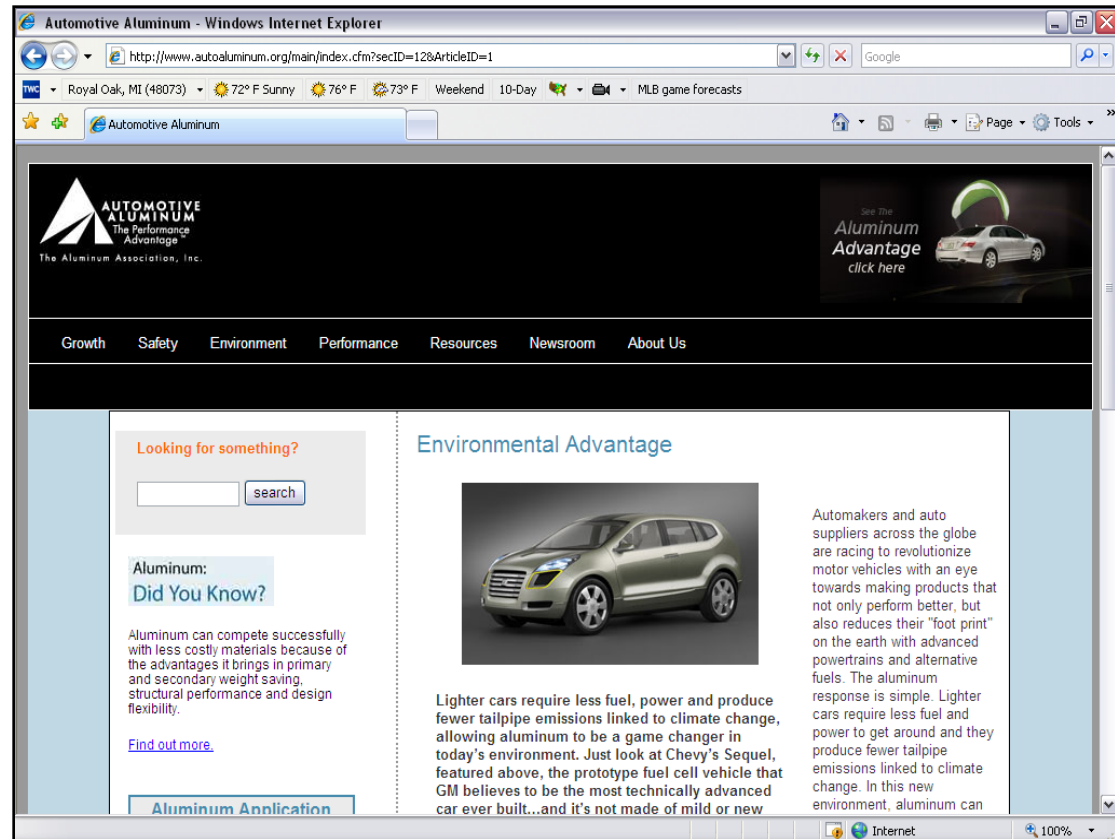


The Aluminum Association, Inc.



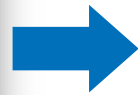
# Our Mission

- 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



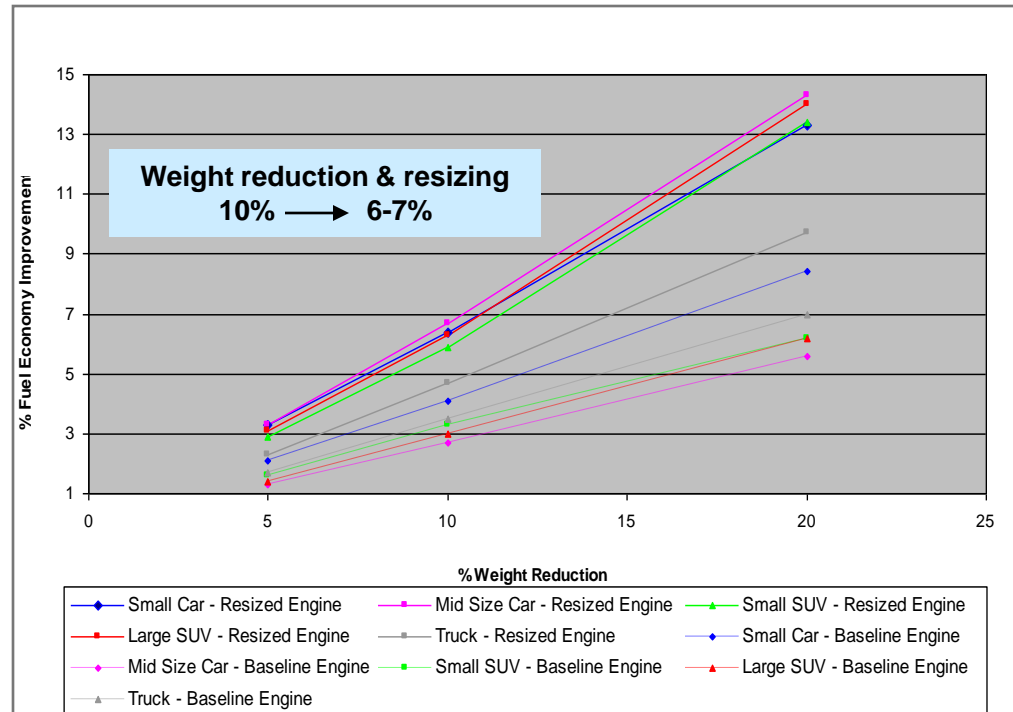
Infinitely Recyclable



# Research Validates Benefits of Lightweighting

## ASSOCIATION SPONSORED RESEARCH

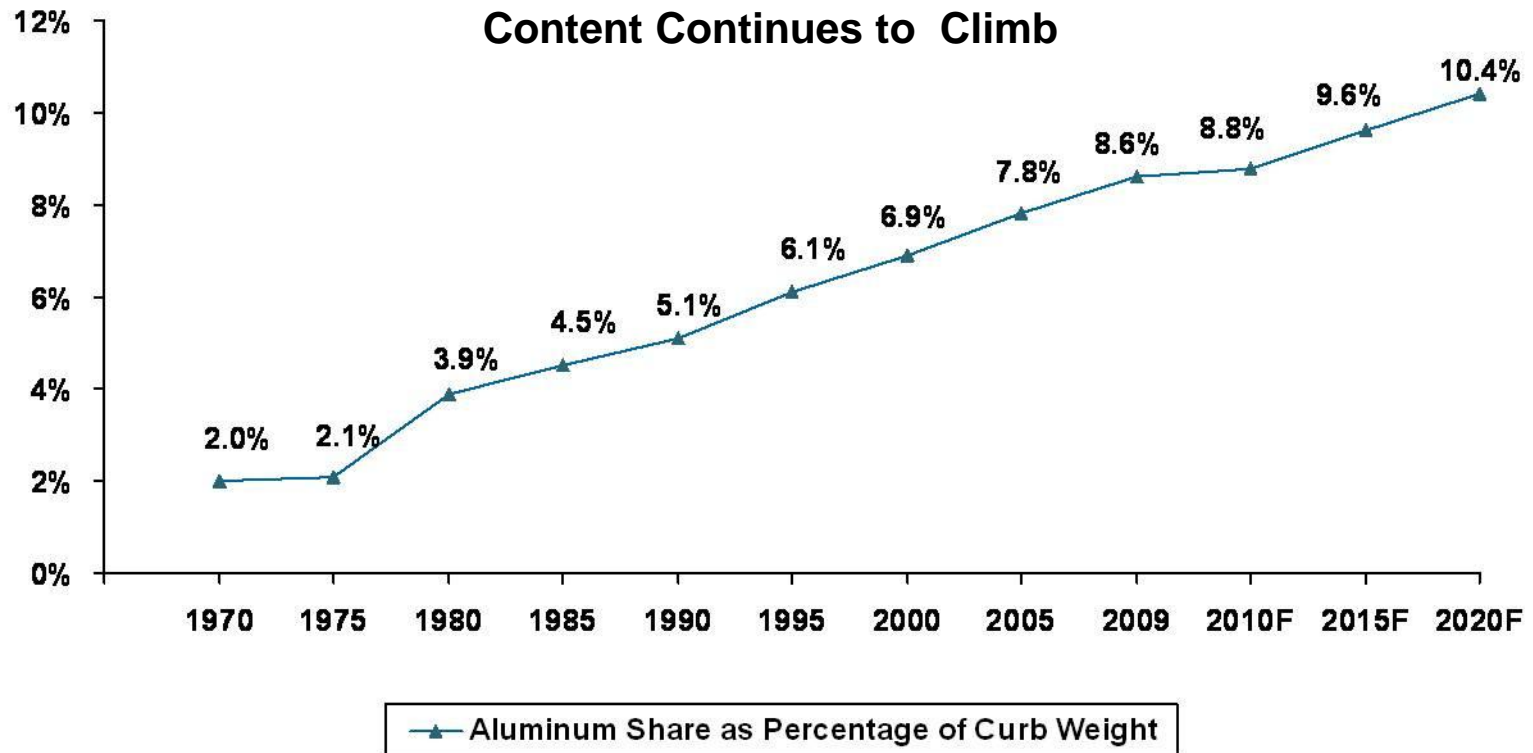
- Safety: Size vs. Weight (DRI 2004)
- Vehicle Structure: Manufacturing and Lifecycle Cost Analysis (IBIS 2005)
- Improving Sustainability in the Transport Sector Through Weight Reduction and the Application of Aluminum (IAI 2006)
- Benefit Analysis: Use of Aluminum Structures in Conjunction with Alternative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

# Validation Leads to Continuous Growth

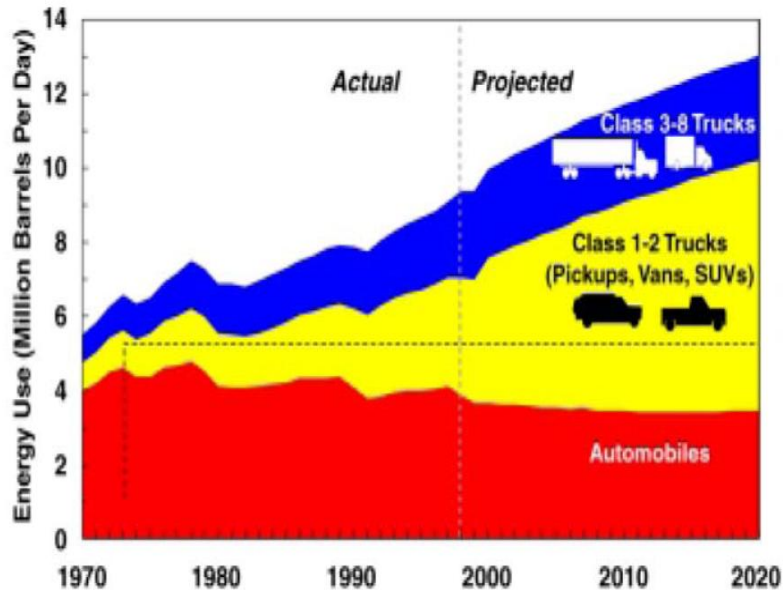
## North American Light Vehicle Aluminum Content Continues to Climb



# Why We Are Here Today

- Apply our auto industry model to the commercial vehicle industry
- Lightweighting with aluminum can help you tackle the challenges
  - Auto companies and other third-parties acknowledge aluminum's value proposition will help them meet 2016 CAFE standards
- Overview
  - Industry challenges
  - Value proposition
  - Weight saving benefits
  - Research and data

# Challenges Facing Industry



*Of the 83 million barrels of crude oil used per day, trucks account for more than half of the oil used in transportation and its share is projected to increase*

- Rising energy costs
- Growing concern over greenhouse gas emissions
- Federal mandates continue to add weight to heavy-duty vehicles
- Weak economy

*Source: International Energy Outlook 2005; U.S. EIA*

# 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



*According to the U.S. EPA, a 10% drop in truck weight reduces fuel use between 5-10%*

# 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%

Source: Alcoa 2008, Q4 research

# Aluminum Already on the Road

- Cab structure
- Trailer side walls and structure
- Flatbeds/tippers/dump bodies
- Forged aluminum wheels
- Frame cross members
- Coal trucks
- Fifth wheel
- Fuel tanks
- HVAC components
- Landing gear
- Tank bodies
- Bellhousing

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



# How Much Weight is Being Saved?



*Aluminum wheels on a tractor can save 30 lbs. each for a total savings of 300 lbs.*

## Tractor

- Axle hubs = 120 lbs.
- Centrifuse brake drums = 100 lbs.
- Clutch housing = 50 lbs.
- Front axle leaf springs = 70 lbs.

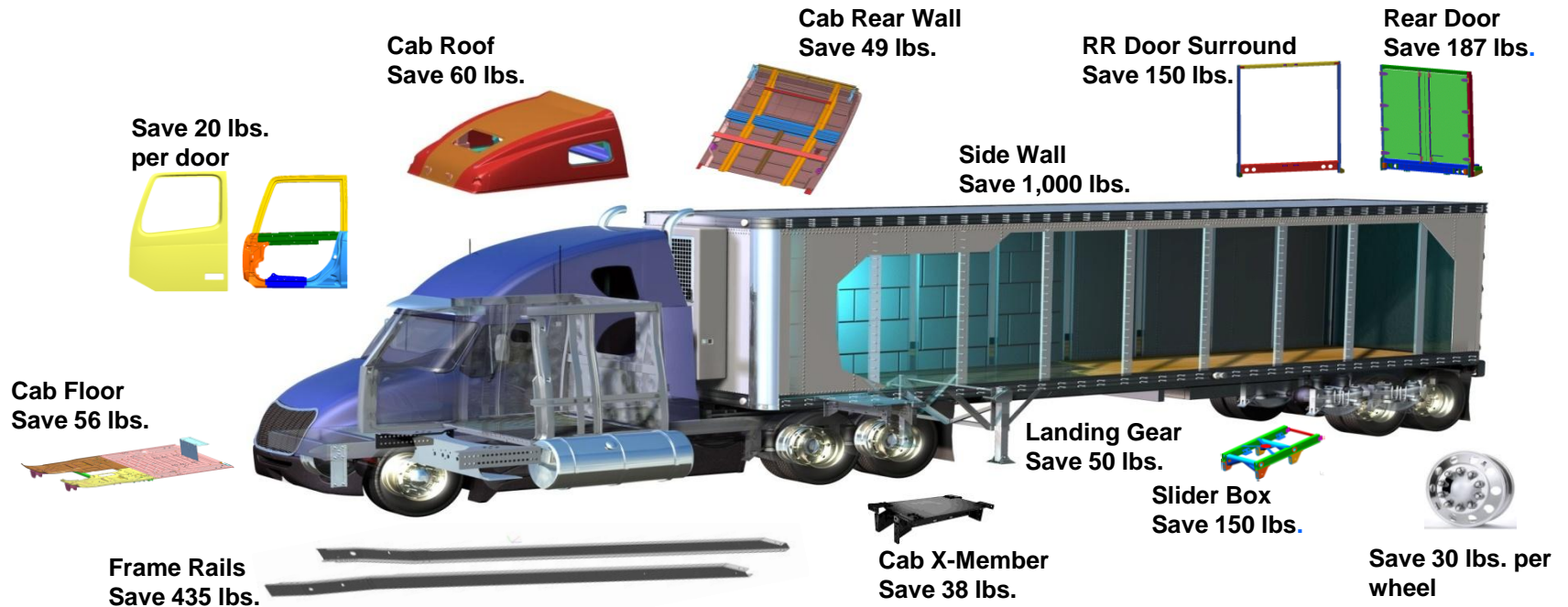
## Trailer

- Roof posts = 75 lbs.
- Floor joists = 300 lbs.
- Upright posts = 600 lbs.
- Hubs and wheels = 900 lbs.

*Source: U.S. EPA Weight Reduction Fact Sheet 2004*

# Emerging Technologies Save More Weight

3,500 lbs. weight savings potential



# Research Supporting Our Value Proposition

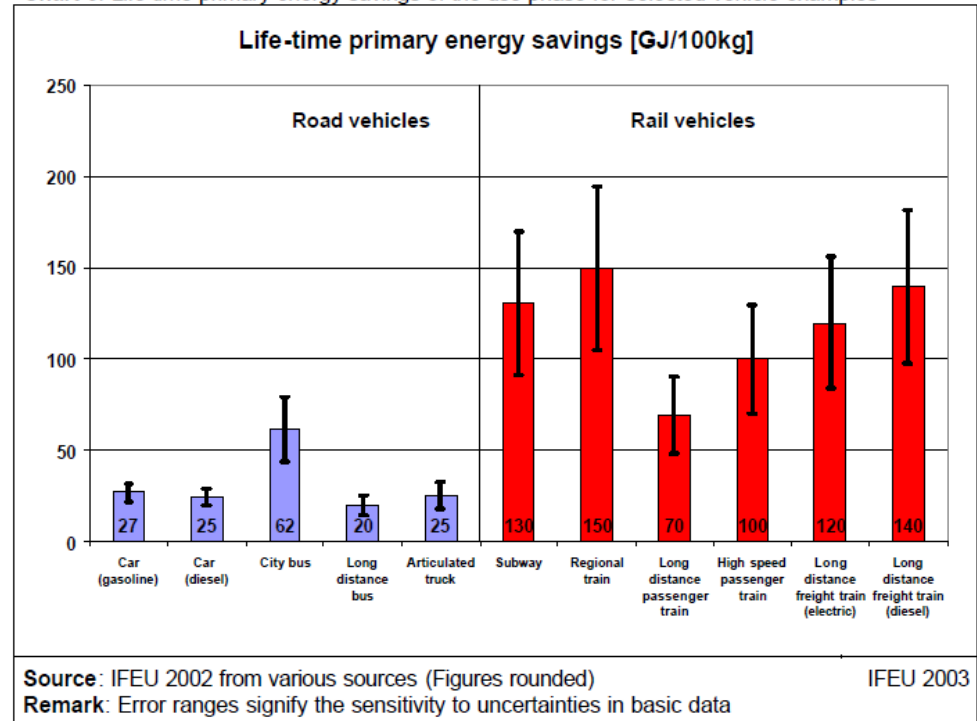
- Potential Savings as a Result of Weight Reduction (IFEU Heidelberg 2003)
- Improving Sustainability in the Transport Sector via Weight Reduction and Application of Aluminum (IAI 2006)
- Case Study: China Bus Project (Alcoa 2008)
- Impact of Weight on Rolling Resistance and Fuel Economy (Smithers 2009)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



# IFEU Heidelberg Research Findings

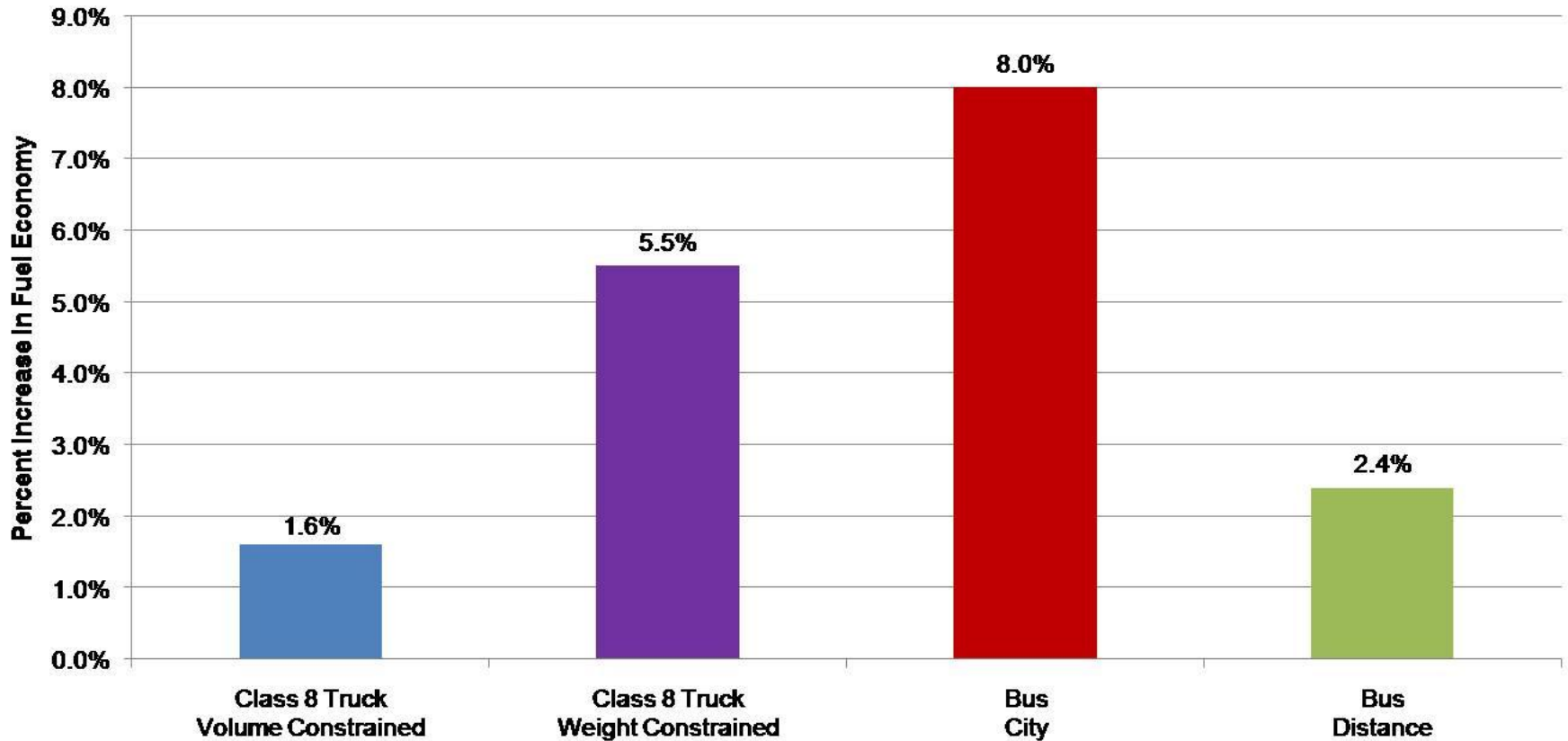
- Results based on real-world experience of truck OEMs
- Weight is a factor in truck and bus fuel economy
- Trucks and buses represent a large potential fuel savings
- Duty cycle dependant

Chart 3: Life time primary energy savings of the use phase for selected vehicle examples



Source: IFEU, SGKV 2002

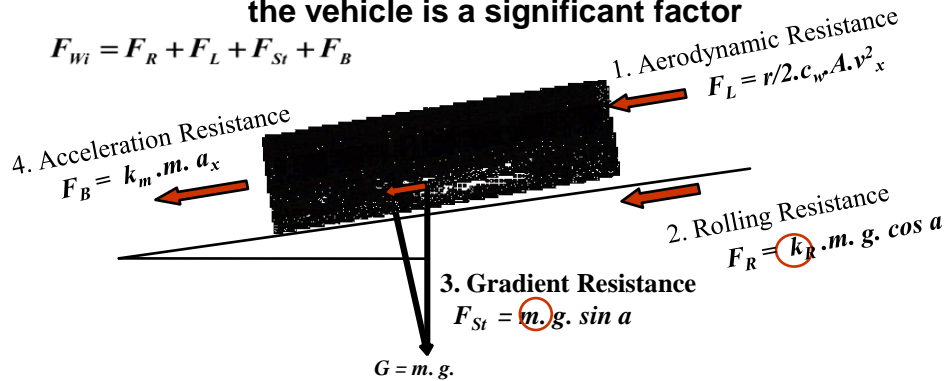
# Estimated Fuel Economy Benefit from 10% Weight Reduction



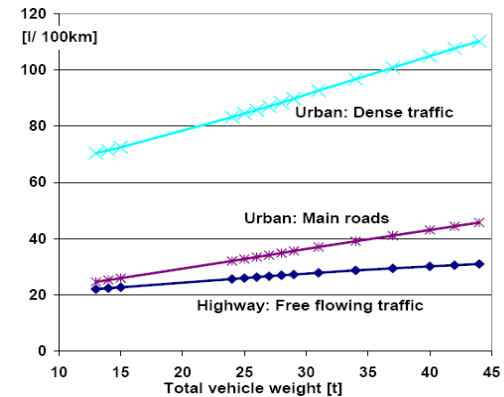
Source: IFEU, SGKV 2002

# Impact More Pronounced in Urban Setting: Bus Example

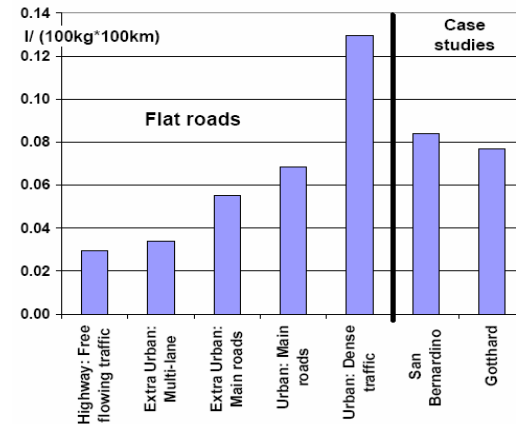
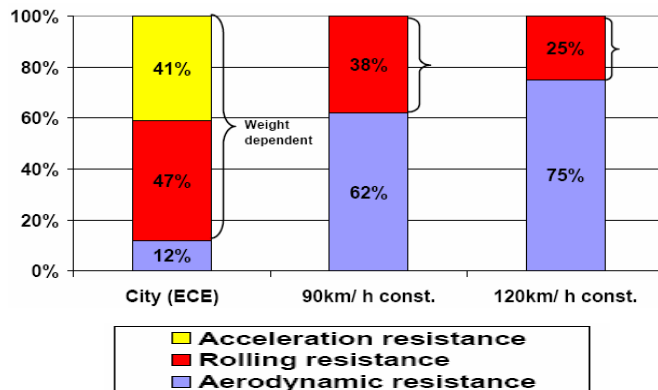
Physical resistances have an impact on vehicle fuel efficiency and mass of the vehicle is a significant factor



Duty cycle is important factor

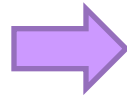


Impact is more pronounced in urban setting

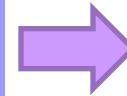


# China Bus Project: Real World Success

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



**>6% Fuel  
Economy  
Improvement**



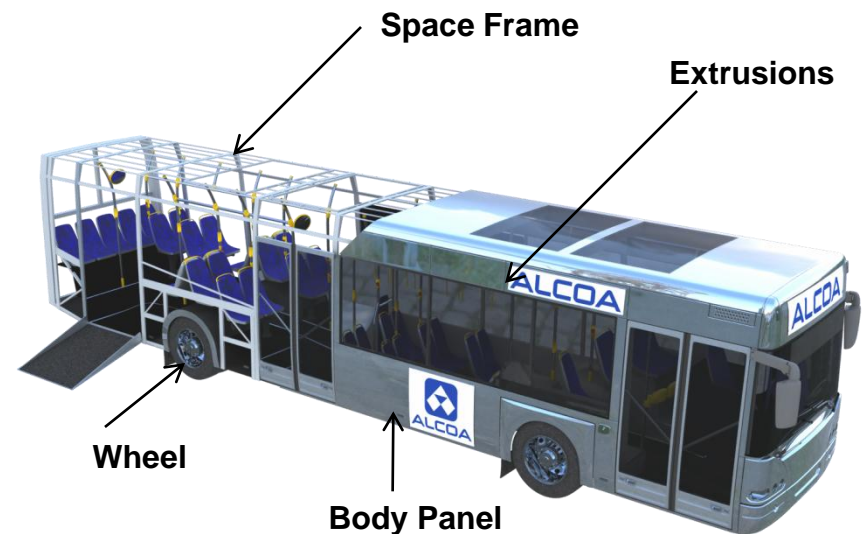
**50 Tons of  
CO<sub>2</sub> Lifetime**

## Value – Ecological

- Reduction in CO<sub>2</sub> emissions
- Reduced road surface wear and tear

## Value – Financial

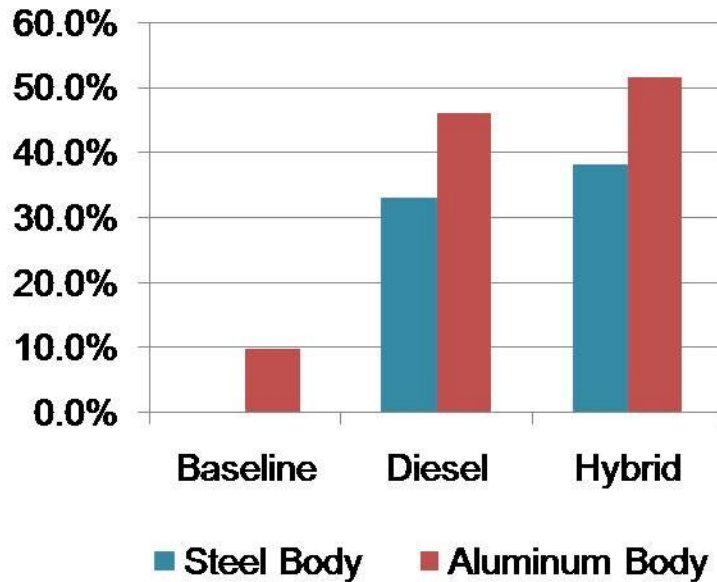
- Less fuel
- Maintenance savings (tires, brakes, suspension)
- Improved corrosion resistance
- Payback of 2-3 years



# Relevant Auto Study: Aluminum Adds Value to Alternative Powertrains

## Larger Fuel Savings

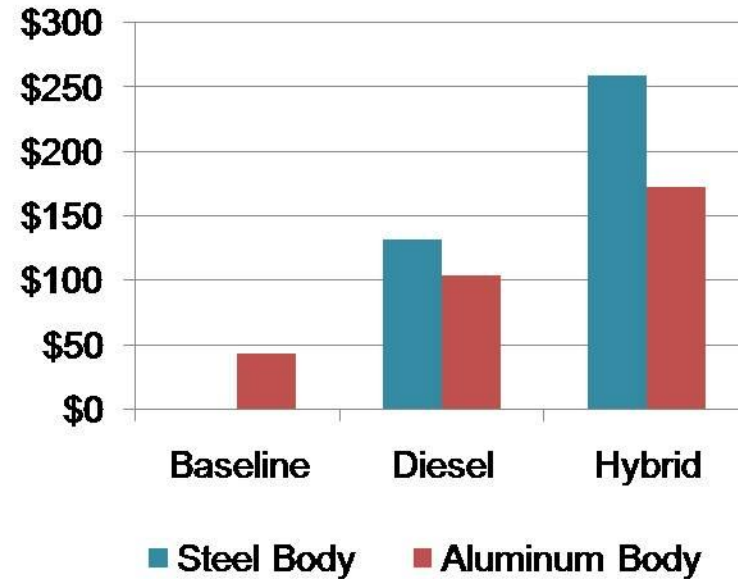
Percent Increase in MPG



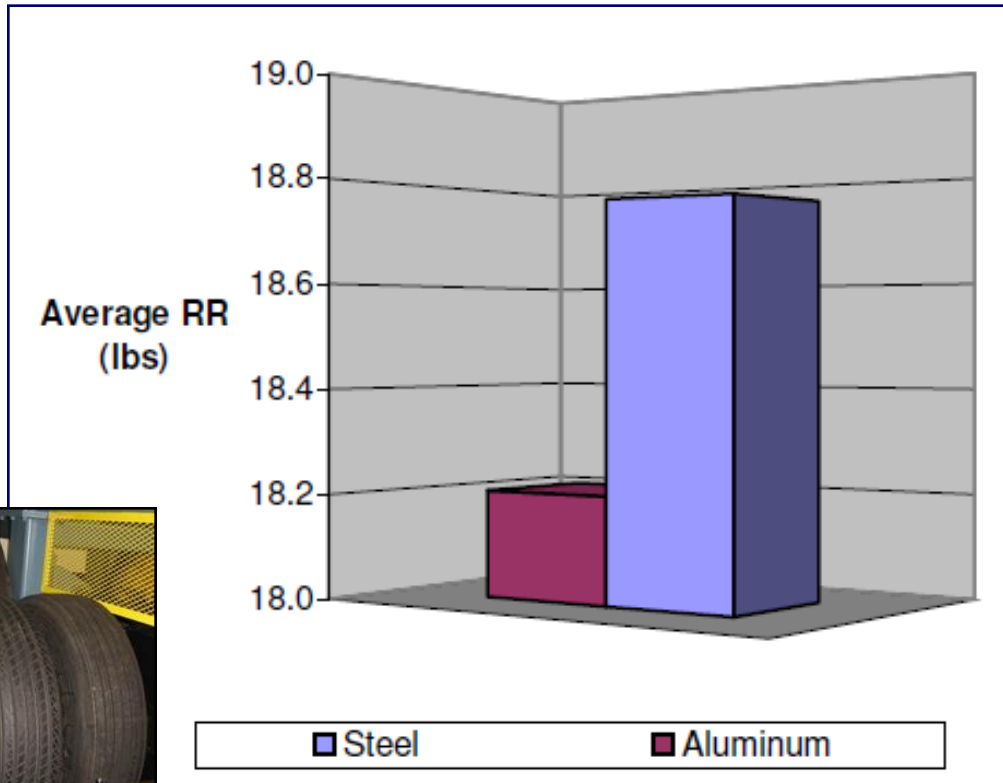
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## Lower Vehicle Cost

Cost per 1 MPG Increase



# Aluminum Wheels Pay Fuel Economy Dividends



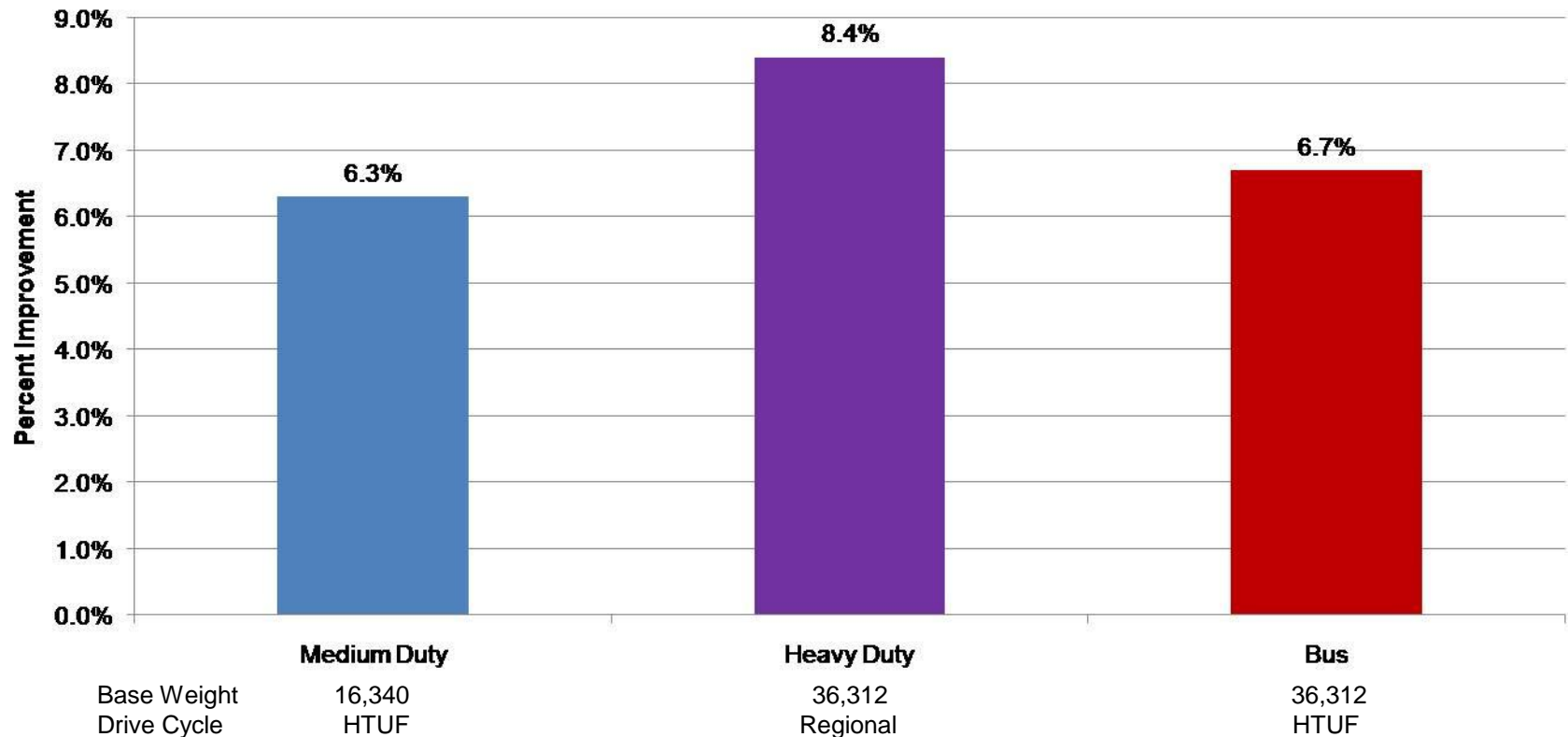
An aluminum wheel can improve tire rolling resistance by up to 3% over a comparable size steel wheel

3% less rolling resistance  
=1% fuel savings

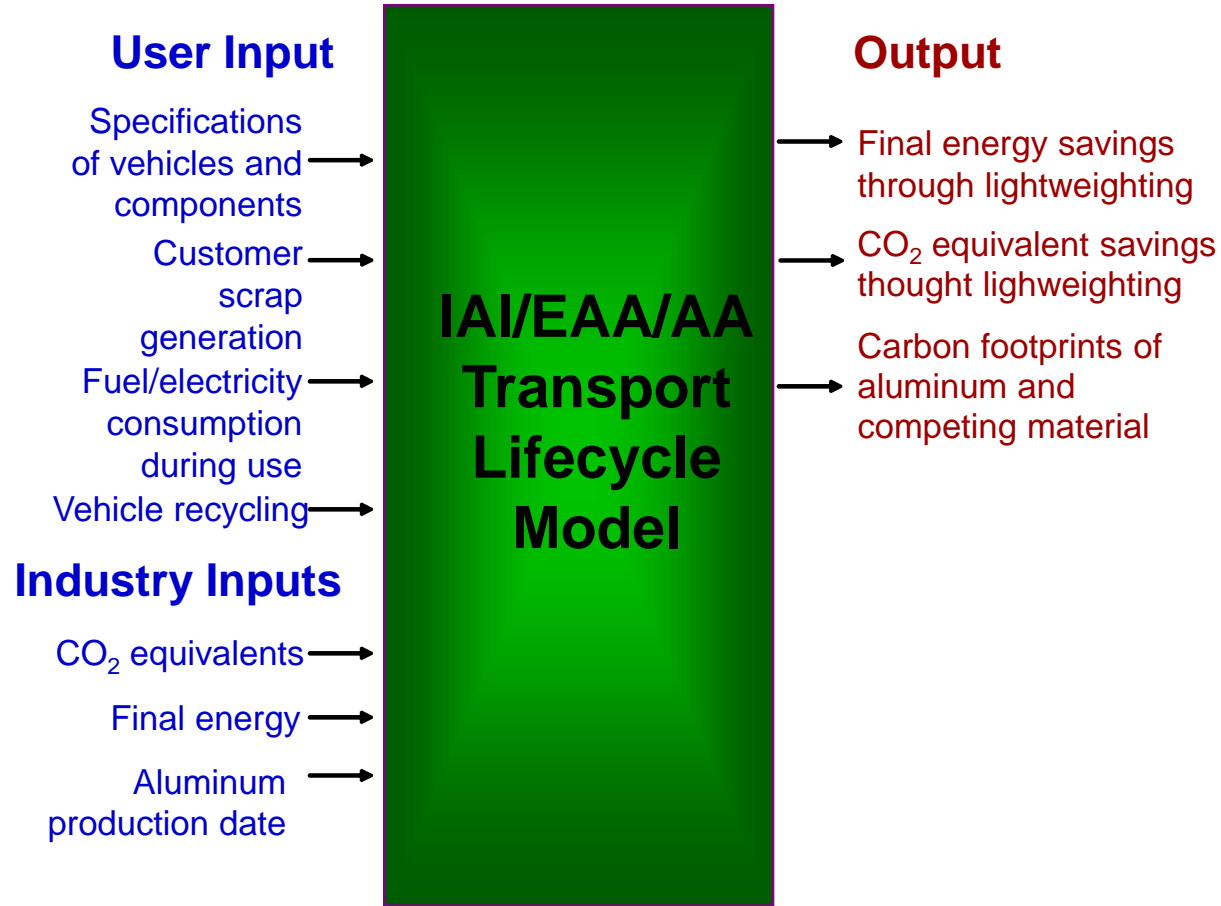
Source: Smithers Scientific Services

# Major Tire Manufacturer Simulator Data

## Fuel Economy Improvement Per 10% Weight Save



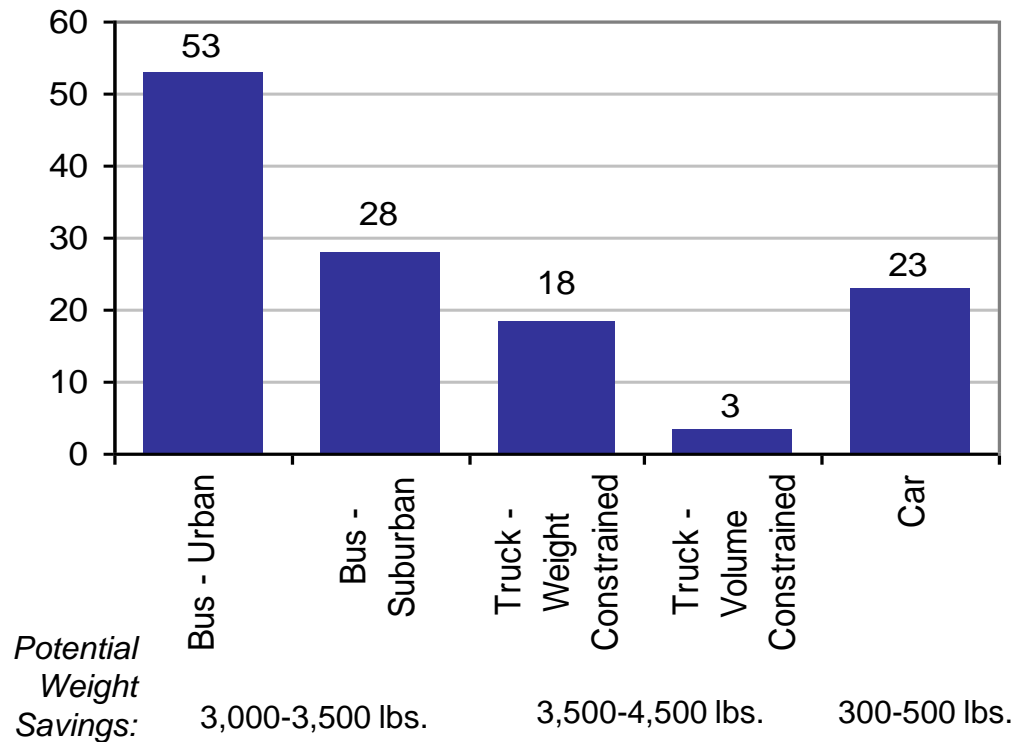
# IAI Transport Model Illustrates Potential CO<sub>2</sub> Savings from Lightweighting



# IAI: Aluminum Helps Reduce CO<sub>2</sub>

- Auto aluminum already saving 300 million metric tons of CO<sub>2</sub> annually
- Including CO<sub>2</sub> impact of aluminum production
- Use-phase savings far outweigh production CO<sub>2</sub> generation
- Recycled aluminum uses 95% less energy

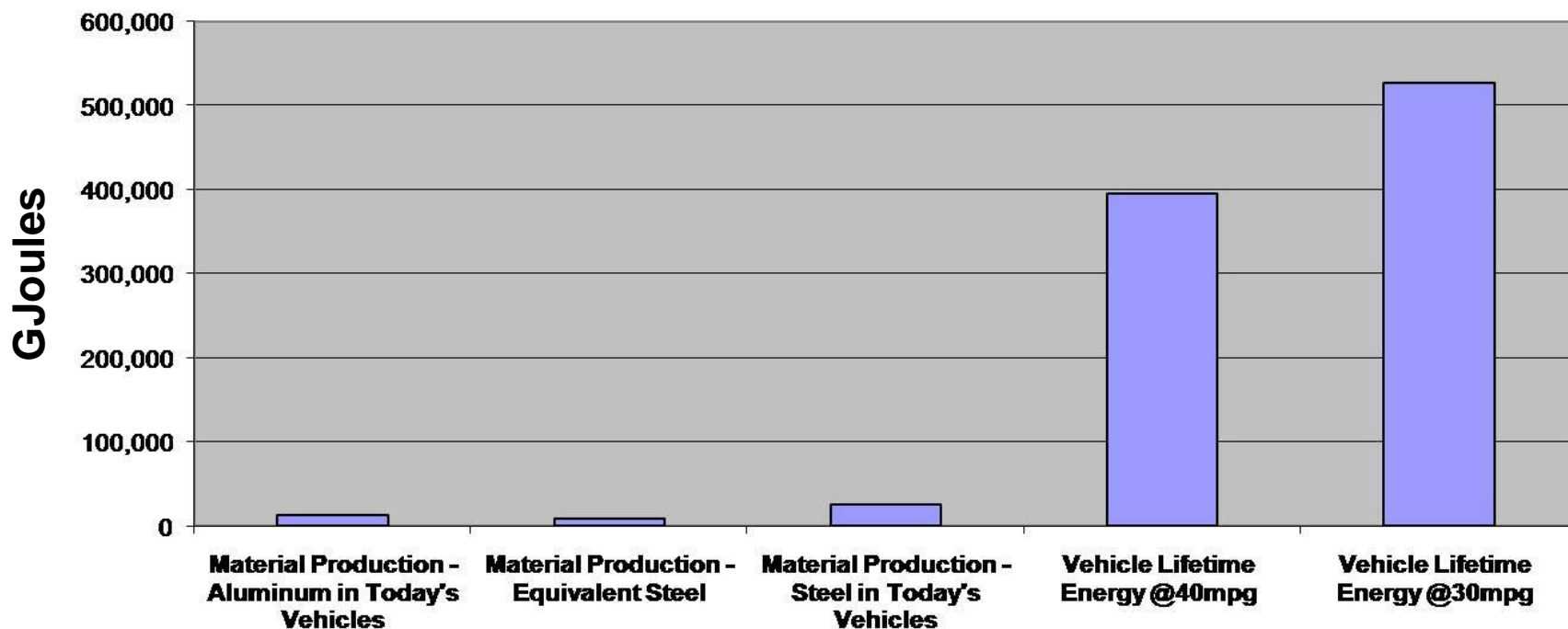
Specific Savings  
(Tons of CO<sub>2</sub> per ton of weight save)



Source: IFEU, 2003

# Use-phase Savings Outweigh Production Energy Generation

## Lifetime Energy Consumption



Source: Alcoa – Automotive Example

# Aluminum is a Part of the Solution

## *More Payload AND Lower Costs*

- One ton of weight reduction = up to 588 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 CO<sub>2</sub> Emissions*

- Save 18 tons of CO<sub>2</sub> for every ton of aluminum you add to your fleet

## *Reduced dependence on imported oil*

## *Infinitely recyclable*



# Help US so that we can help YOU

Research topics  
Data gaps to fill



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