

The Changing Make Up of Automobiles

Survey Results: Aluminum Usage by North American Automakers

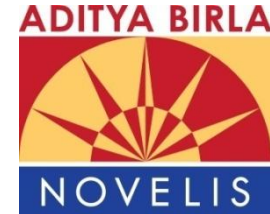


**An Aluminum Association Webinar
September 23, 2011**

www.aluminumintransportation.org

Defining Who We Are

The Aluminum Association's Aluminum Transportation Group (ATG)



Introductions



Randall Scheps

ATG Chairman
Marketing Director
Alcoa, Inc.



Doug Richman

ATG Executive and
Technical Committees
Vice President
Engineering & Technology
Kaiser Aluminum

Why We are Here Today

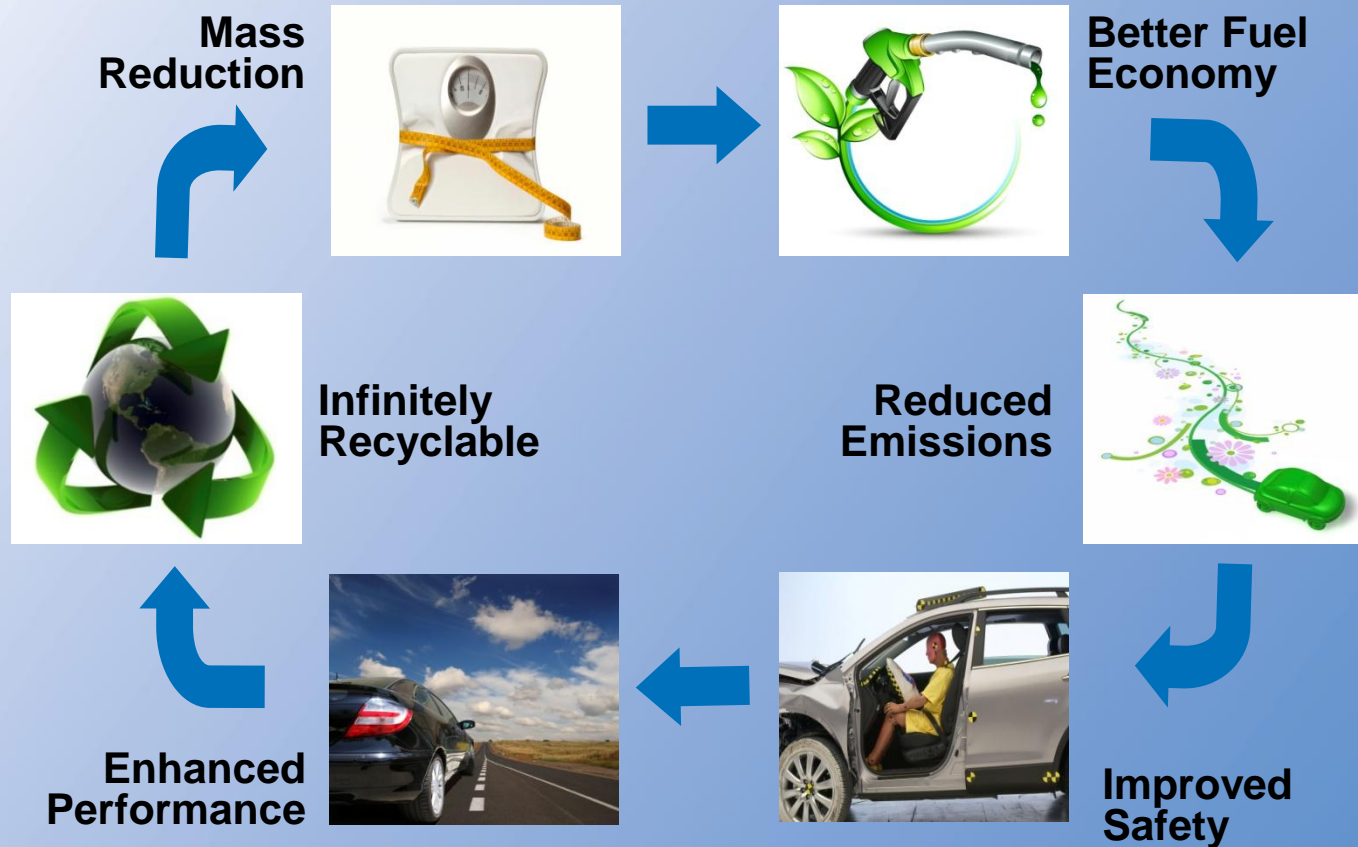
- Promote a holistic, multi-material approach combining strong lightweight materials like aluminum with smart design and advanced powertrains
- Agenda
 - Benefits of Lightweighting with Aluminum
 - Results of 2011 Ducker Survey of Automakers on Aluminum Content in Passenger Vehicles
 - Q & A

Vehicle Make-Up Is Changing

- Two main factors leading automakers to rethink vehicle design
 - Consumer demand and desire for increased fuel efficiency coupled with a need to continuously improve safety, function and comfort
 - New, stringent fuel economy standards



Aluminum Builds a Better Vehicle



Automakers Confirm Plans to Downweight

- **Audi:** To migrate aspects of the ASF® technology currently in the A8 to higher volume vehicles like the A6
- **BMW:** To use more aluminum to cut weight
- **Ford:** To trim 250-750 lbs. out of each model year
- **GM:** To trim 500 lbs by 2016 and 1,000 lbs. by 2020
- **Jaguar Land Rover:** To construct all future vehicles with aluminum bodies
- **Nissan:** To reduce 15% of vehicle weight



Aluminum-Intensive Vehicles Today: Maintained Size, Decreased Weight



2011 Audi TT
*Roadster ASF 58%
aluminum and Coupe
ASF 69% aluminum*
Source: Audi



2011 Jaguar XJ
*All aluminum
body structure
saves 150kg
compared to its
competitors*
Source: Jaguar



2011 Audi A8
*ASF all aluminum
except the B-pillars*
Source: Audi

- Better fuel economy
- No downsizing
- Improved handling
- Lower lifetime CO₂
- Improved safety
- Enables cost savings

Aluminum in 2012 North American Light Vehicles

Survey of North American
Automakers by Ducker Worldwide

Survey Objectives

- Primary Objective
 - Accurate estimate of 2012 North American light vehicle aluminum content
- Secondary Objective
 - Estimate “most likely” material mix through 2025

Methodology

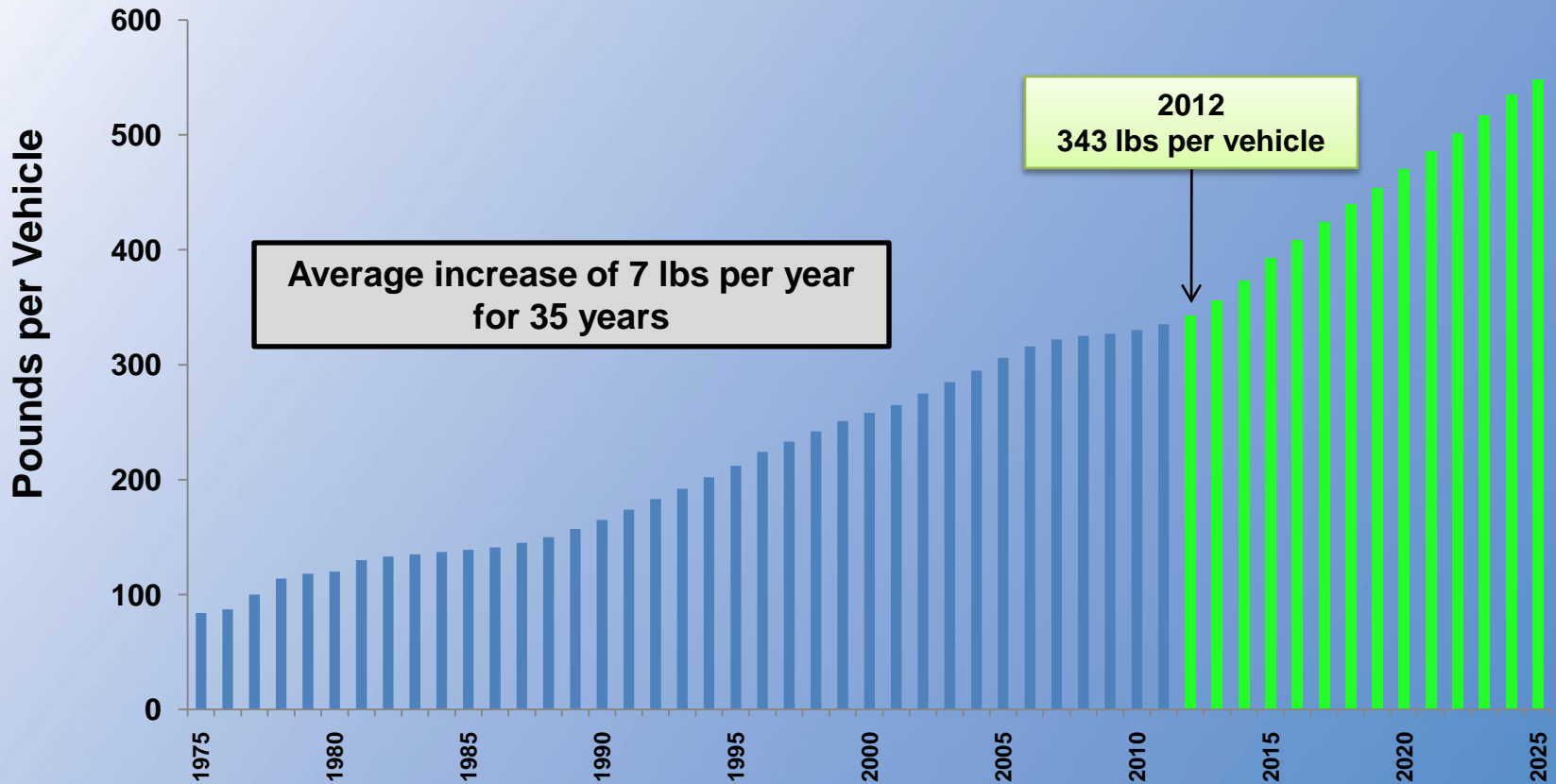
- Detailed analysis of aluminum content
 - Segment
 - Original Equipment Manufacturers (OEMs)
 - More than 90 components
 - Iron, steel, aluminum and magnesium
 - All product forms – cast, rolled and extruded
- Interviews conducted with automotive engineers
 - Major OEMs
 - Tier One suppliers
 - Material producers



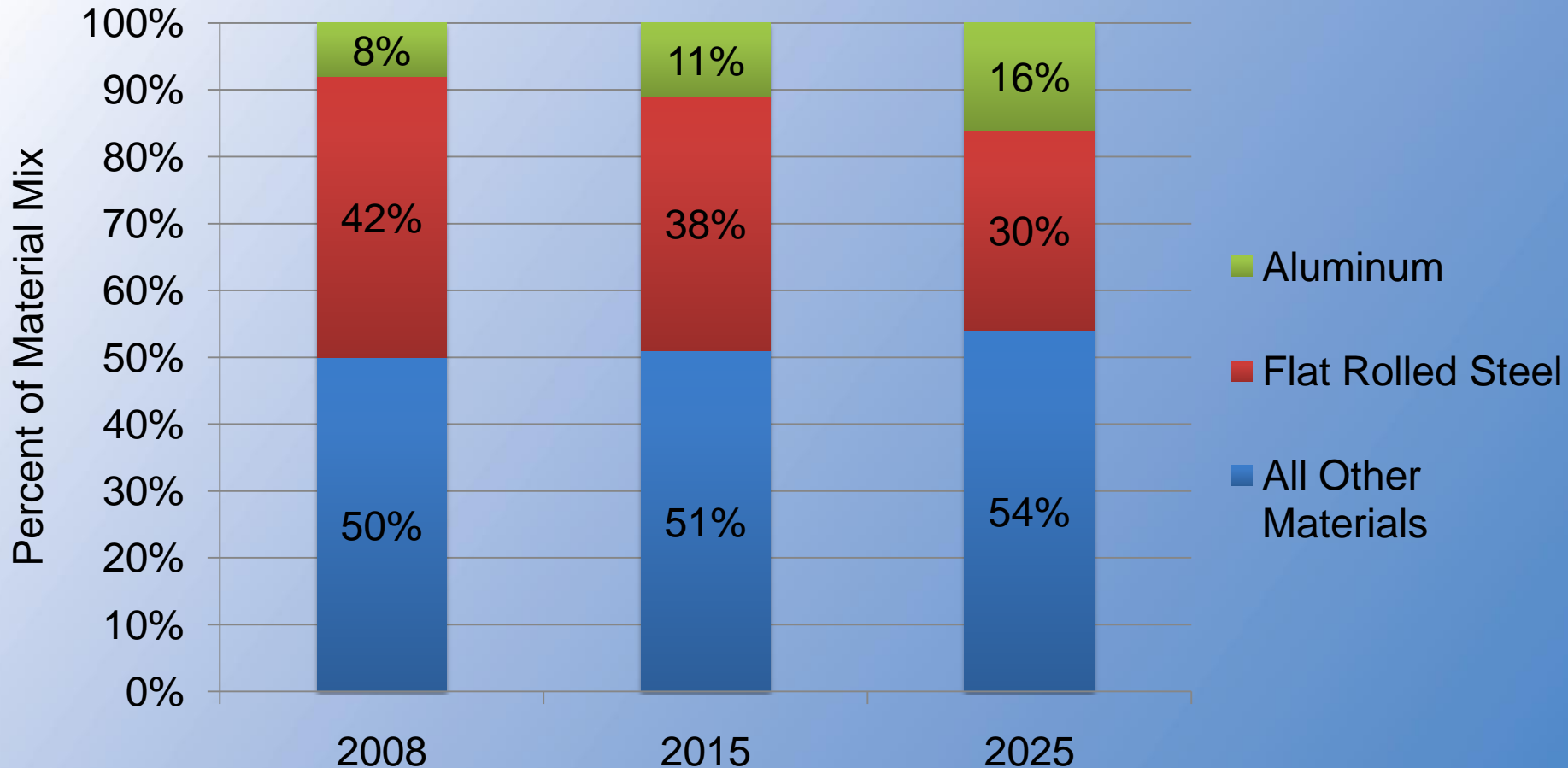
Core Findings

40 Years of Uninterrupted Growth

Aluminum Content – Pounds Per Vehicle

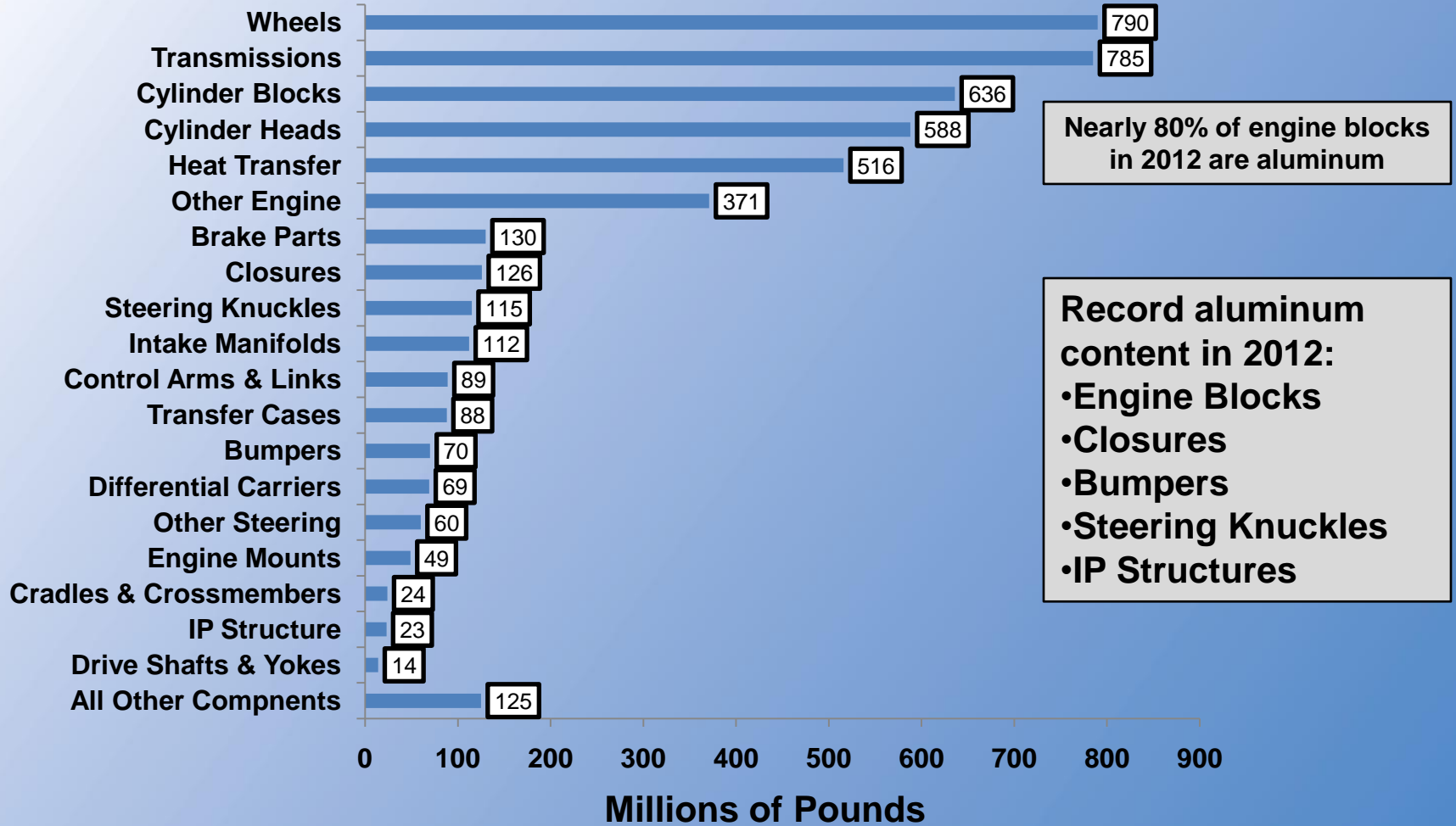


Aluminum Share Expected to Double

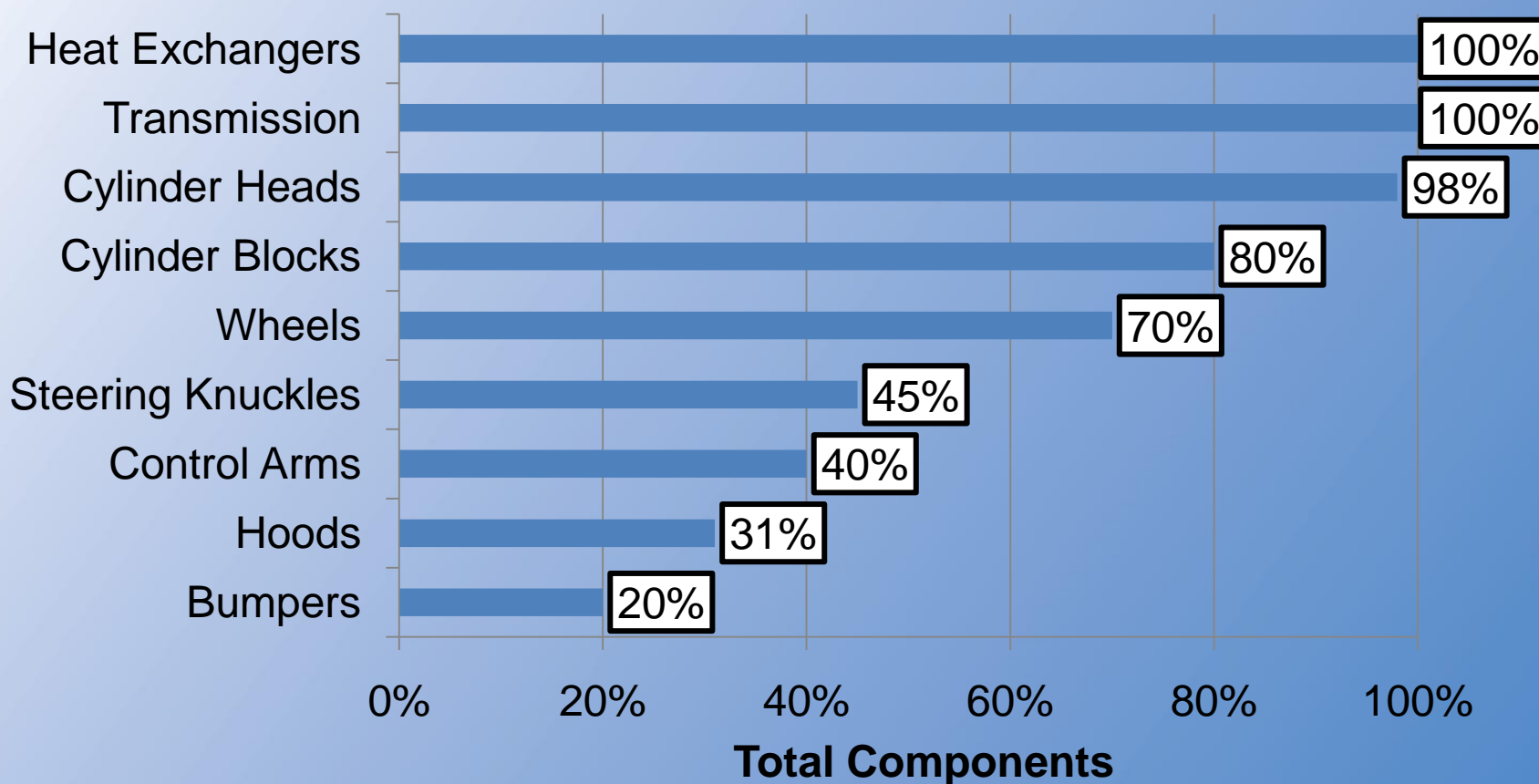


Component Analysis

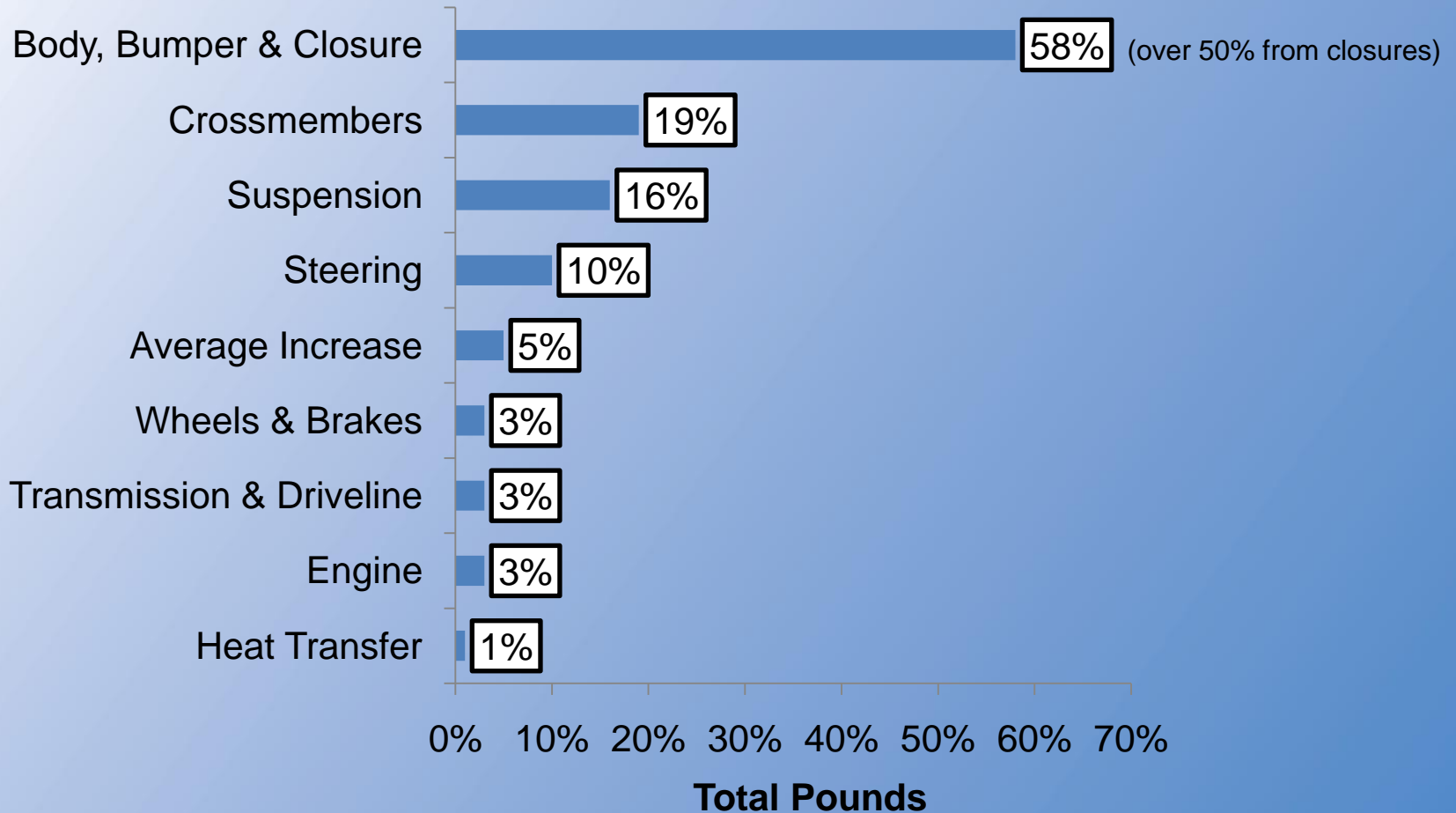
Aluminum Content in 2012



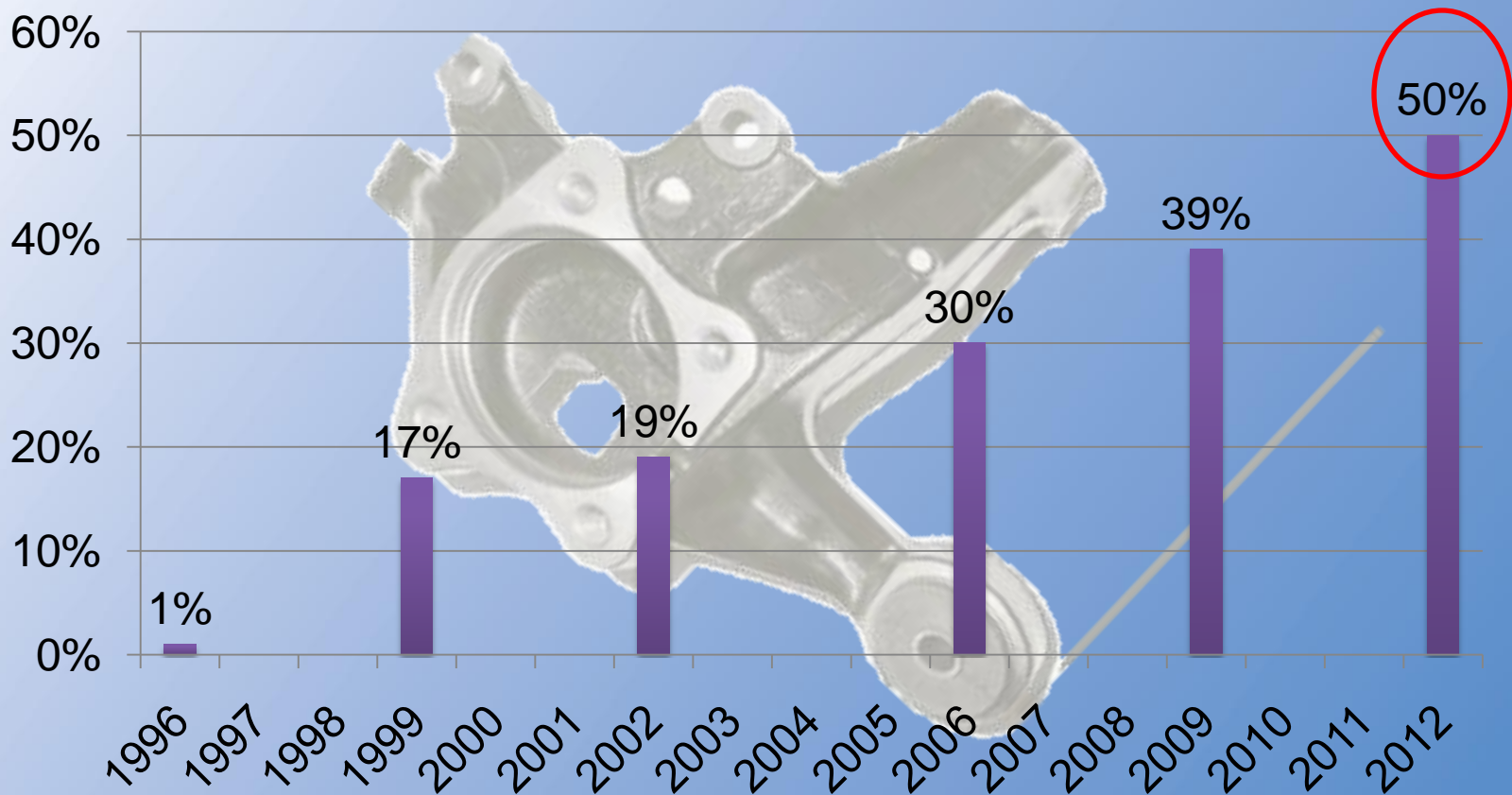
Aluminum Penetration for Key Components in 2012



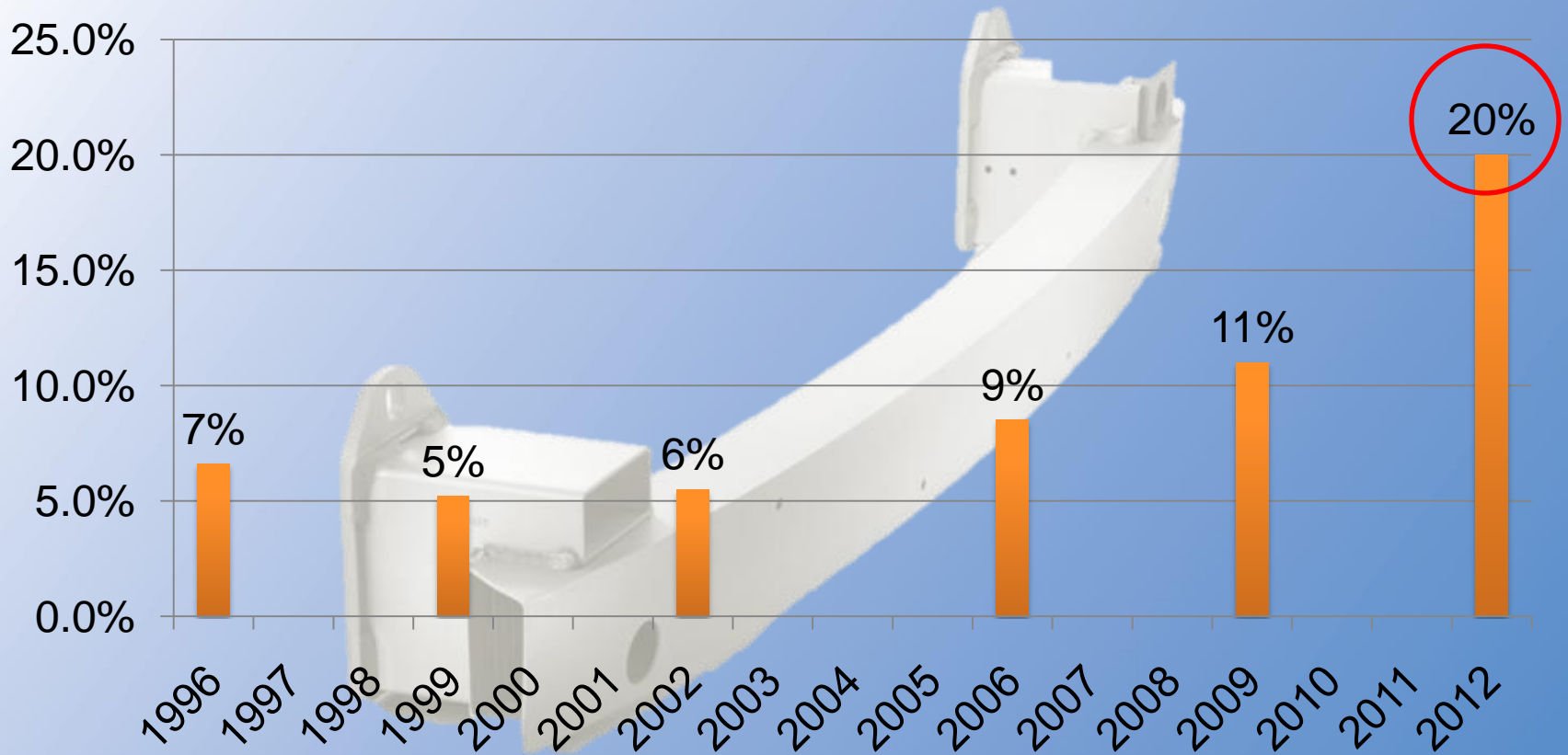
2009-2012 Aluminum Content Growth



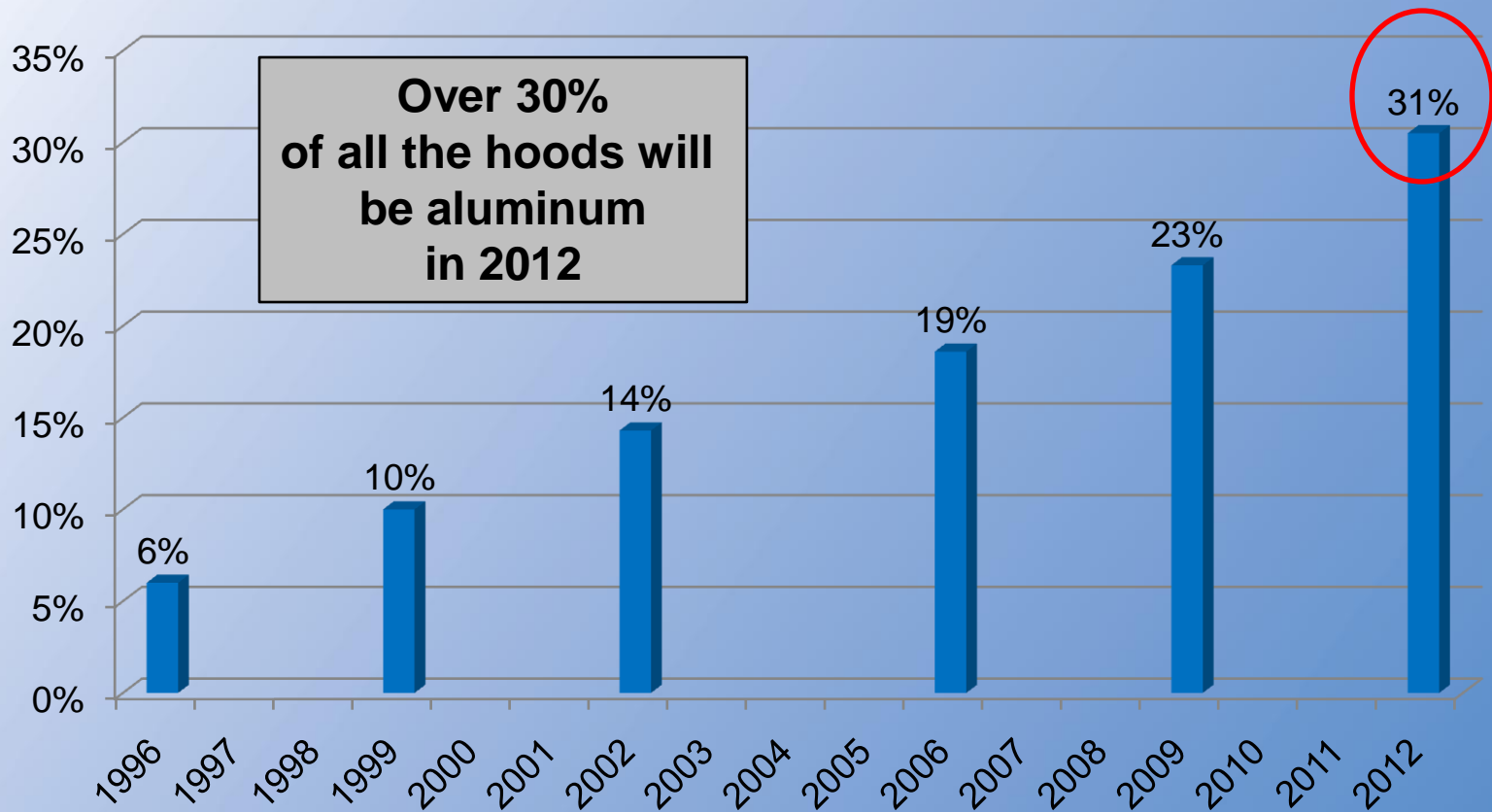
50% Percent of Knuckles Aluminum in 2012



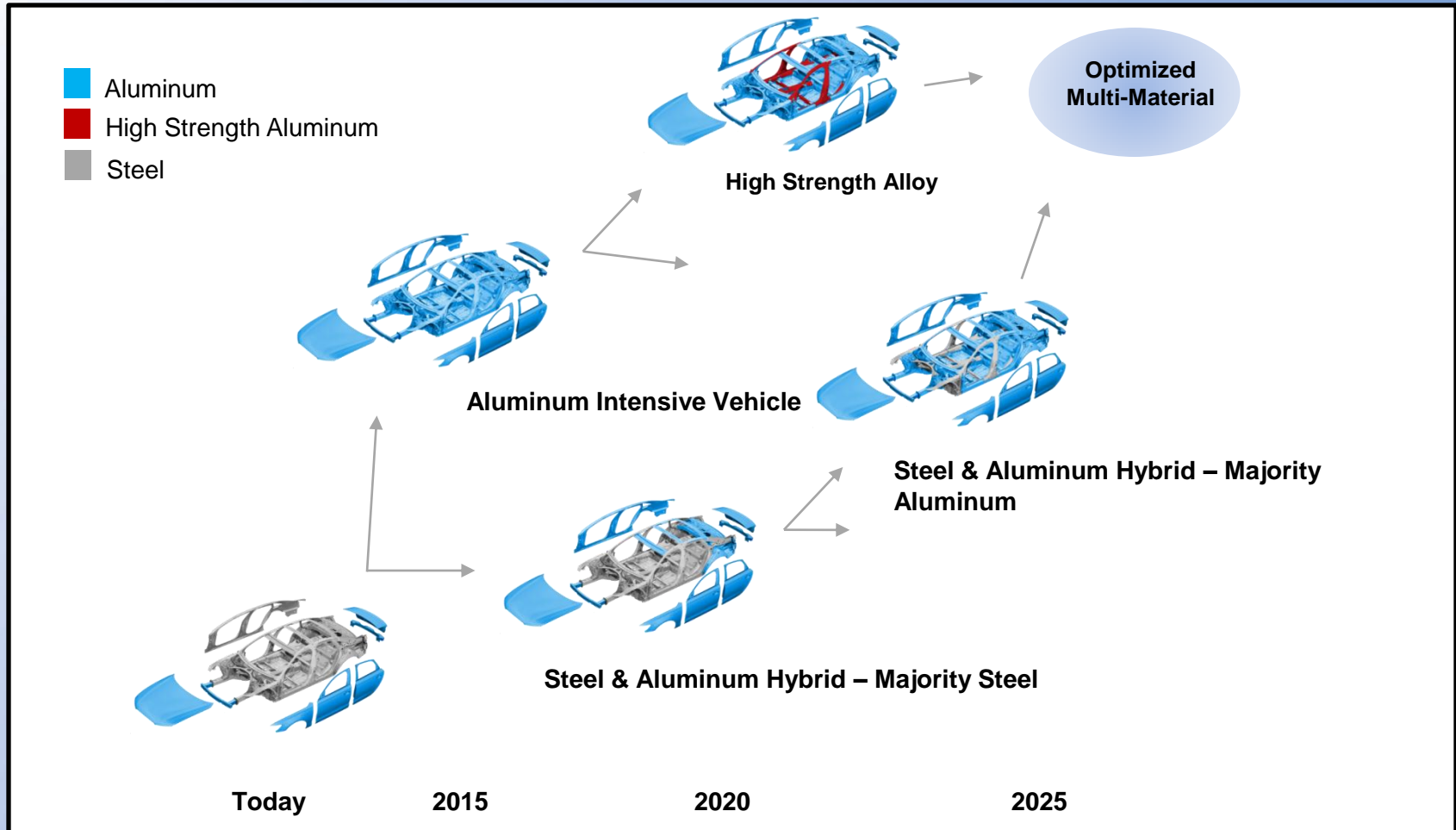
20% of All Bumpers Aluminum in 2012



Aluminum Hood Growth



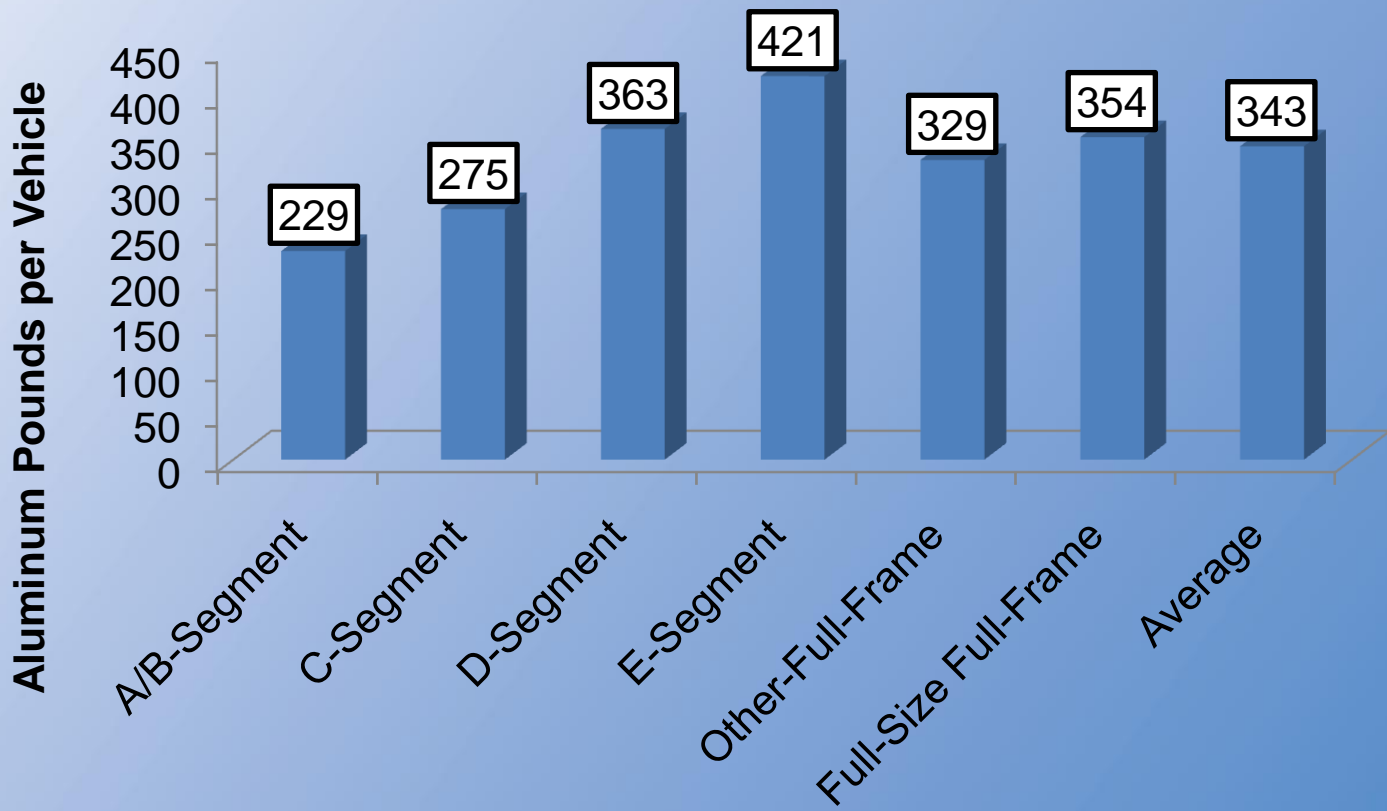
Evolution of Body-in-White Construction



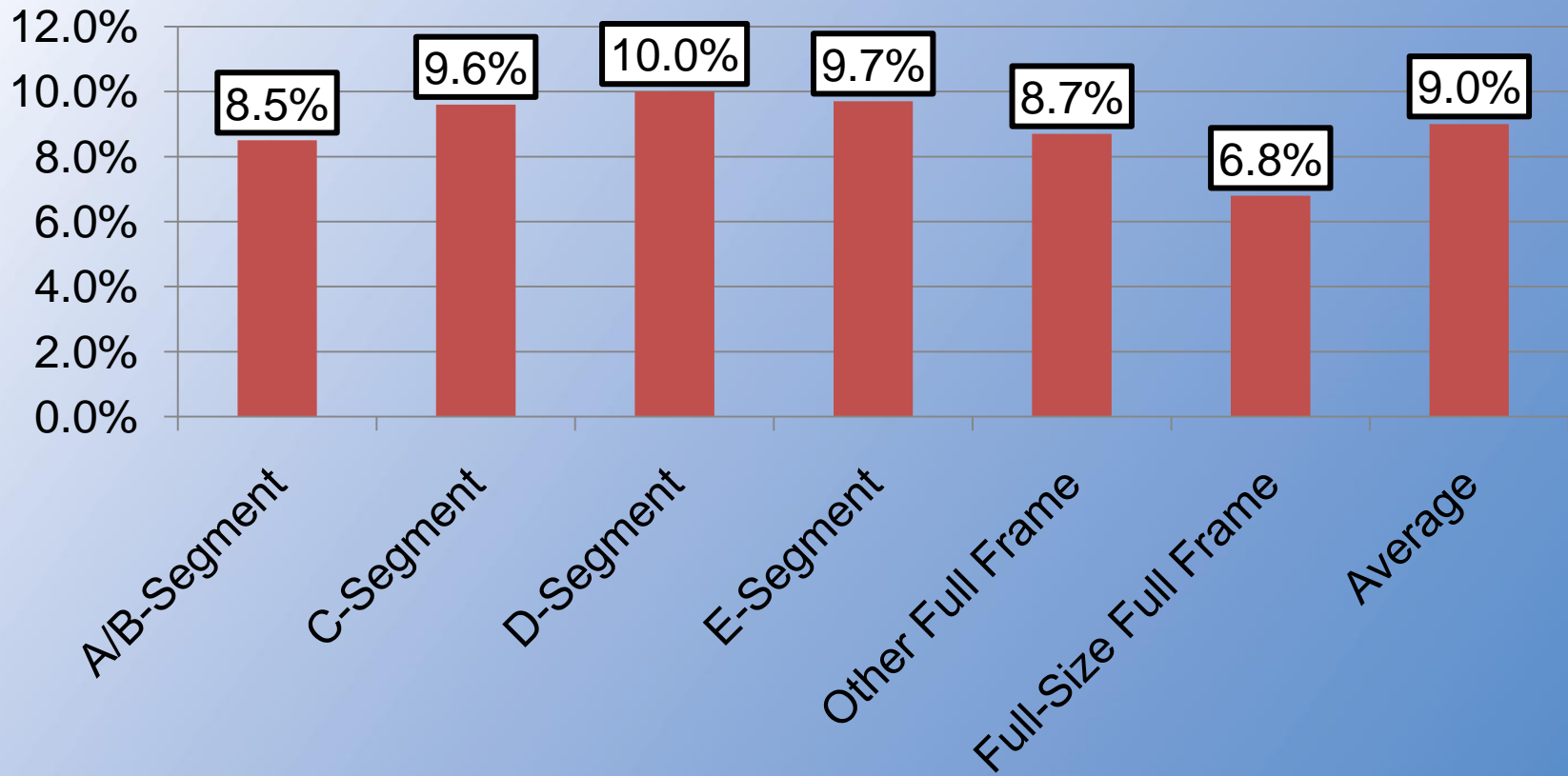
Segment Analysis

E Segment Vehicles Leader in Total Aluminum Pounds Per Segment

2012 Aluminum Pounds per Segment



Aluminum Percent of Curb Weight by Segment



North American Aluminum Content Leaders

GM content leader at 366 lbs per vehicle



2012 Chevrolet Malibu
Aluminum Content 385 Lbs

Source: General Motors Media Site

Honda content leader as percent of
curb weight at 10.7% per vehicle



2012 Honda CRV
Aluminum Content 10.9%

Source: Honda Media Site

Top Aluminum Content Vehicles

- Newer vehicles have average aluminum content 10.4% of vehicle curb weight (vs. 9%)

- Cadillac ATS
- Cadillac XTS
- Chevrolet Malibu
- Chrysler 300
- Chrysler/Fiat C Sedan
- Fiat 500
- Ford Explorer
- Ford Escape
- Ford Fusion
- Honda Accord
- Honda Civic
- Honda CR-V
- Lincoln MKZ
- Mercedes-Benz ML-Class
- Nissan Altima
- Toyota Avalon



2012 Ford Escape
Aluminum content 10.9%
Source: Ford Media Site



2012 Chrysler 300
Aluminum content 10.6%
Source: Chrysler Media Site

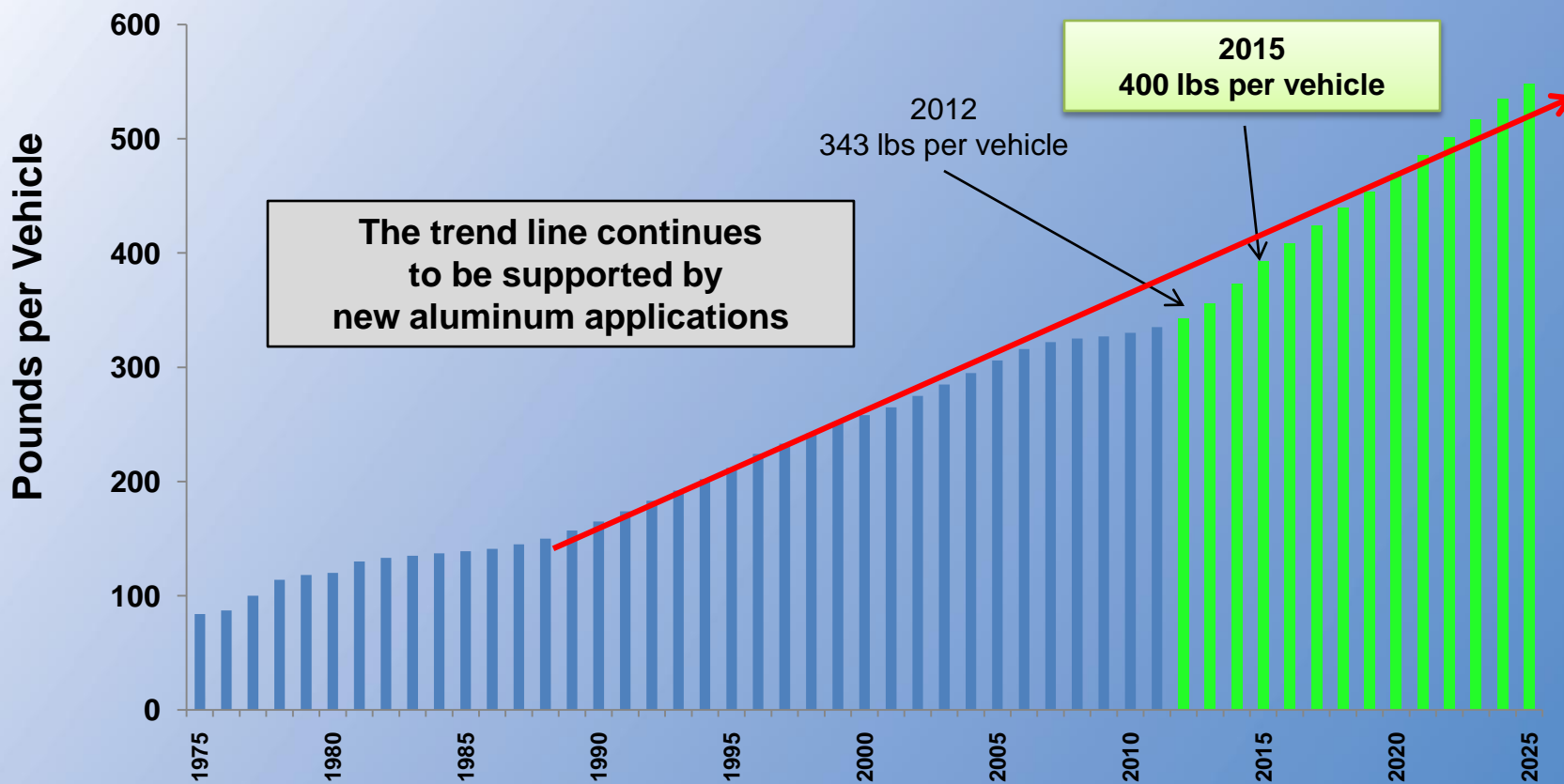


2012 Nissan Altima
Aluminum content 11.1%
Source: Nissan Media Site

Ducker Worldwide Aluminum Forecast

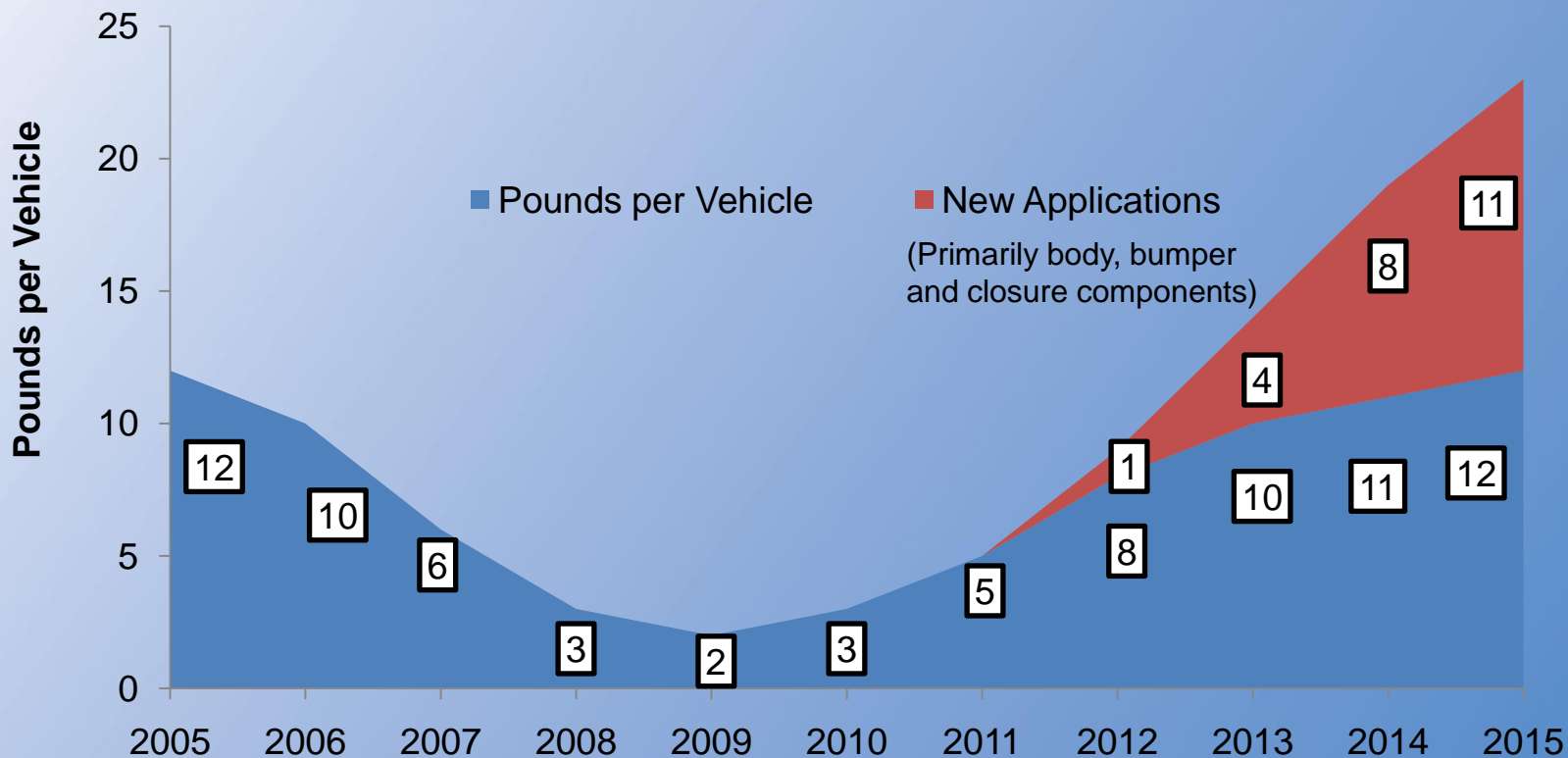
Aluminum Growth Projected to Reach 400 Pounds Per Vehicle by 2015/2016

Aluminum Content – Pounds Per Vehicle



New Applications Required to Achieve 2015/2016 Growth Scenario

North American Light Vehicle Aluminum Content Increases



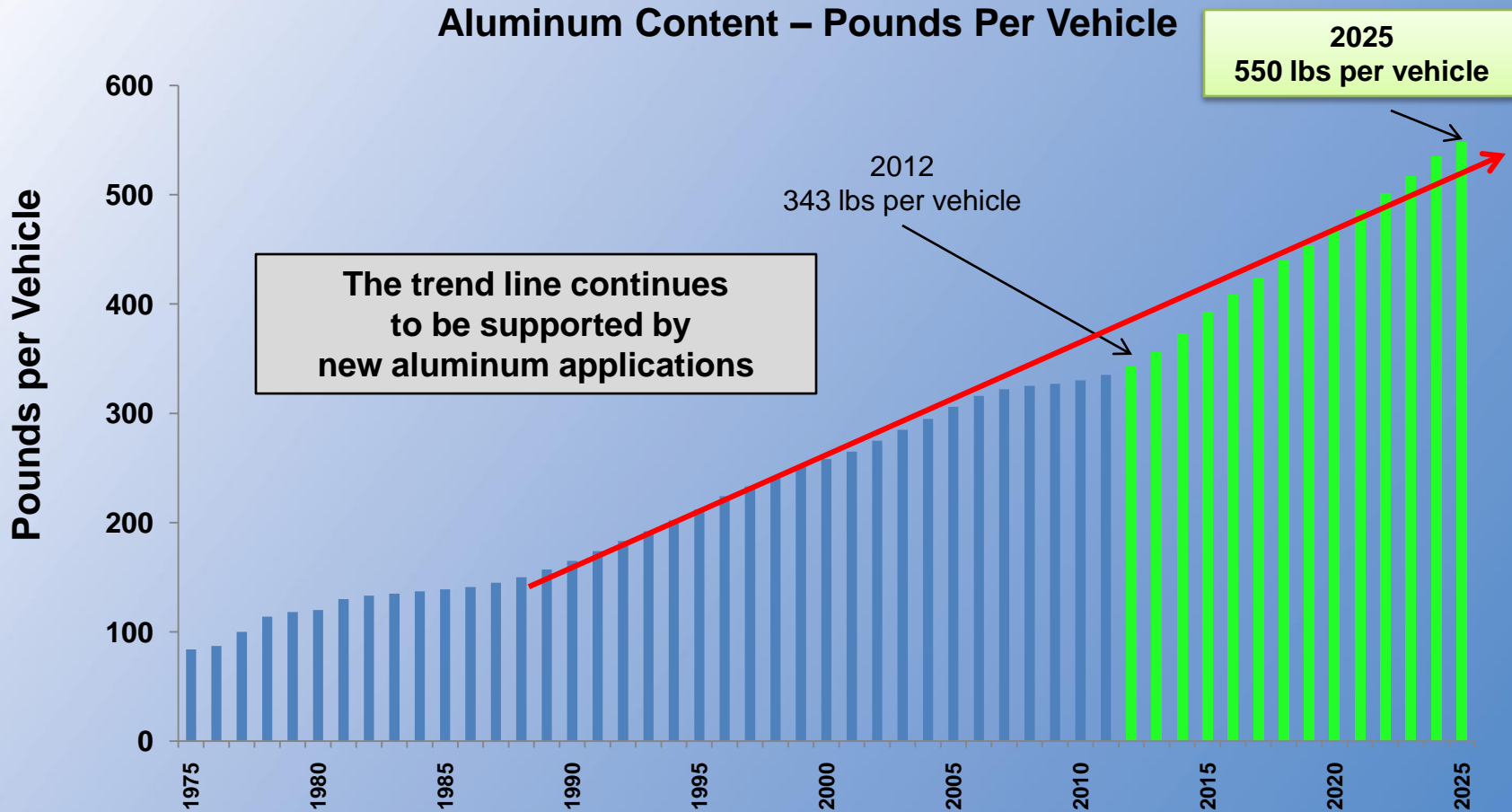
Ducker Long Term Forecast Assumptions

- 51 MPG 2025* fuel economy target
- 10% average weight reduction
- 44% HEVs
- 1 sq. ft. (2% from 2008 EPA base year) footprint reduction

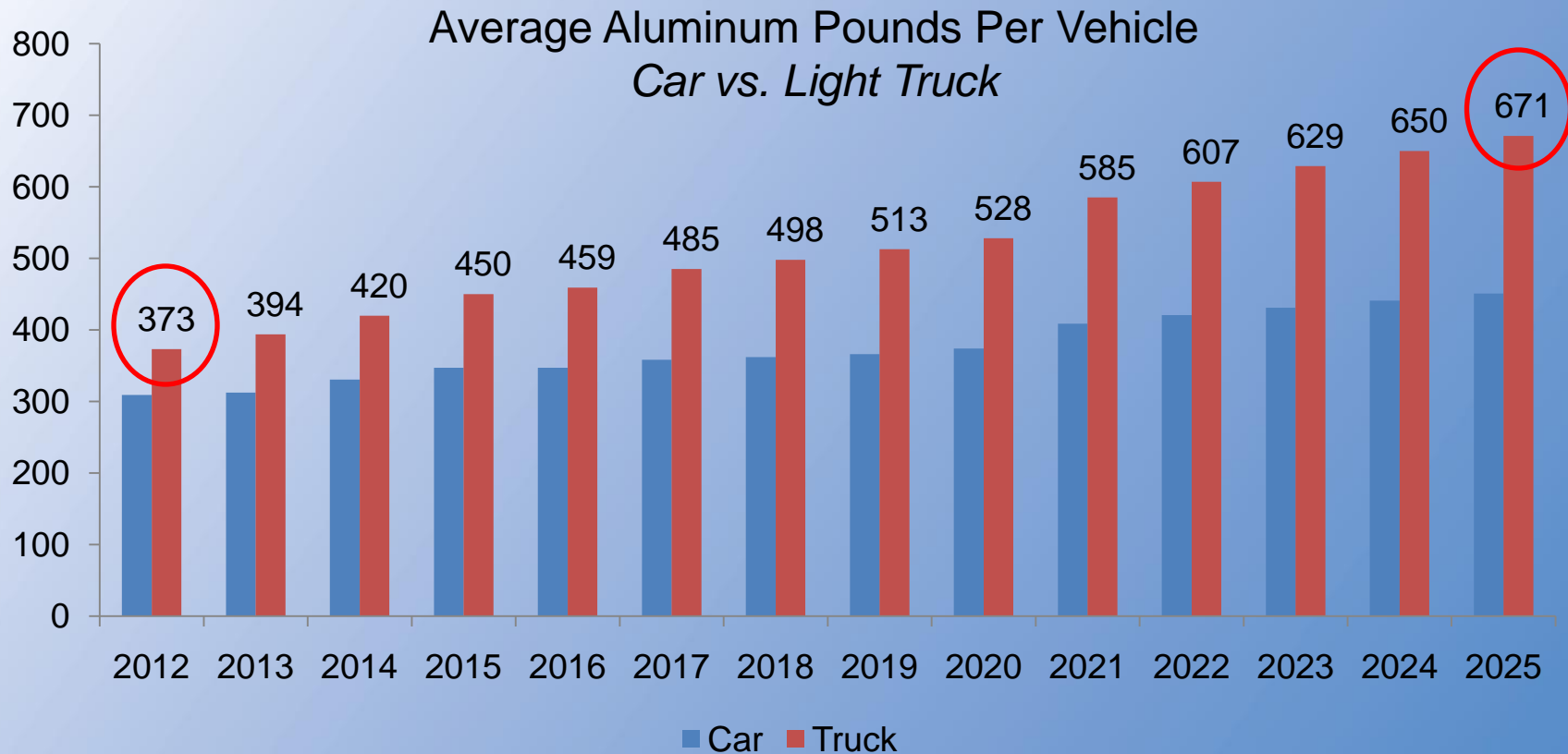
** Average based on 54.5 MPG for cars and at least 46.5 MPG for light trucks*

Significant Growth For Aluminum Predicted by 2025

Aluminum Content – Pounds Per Vehicle

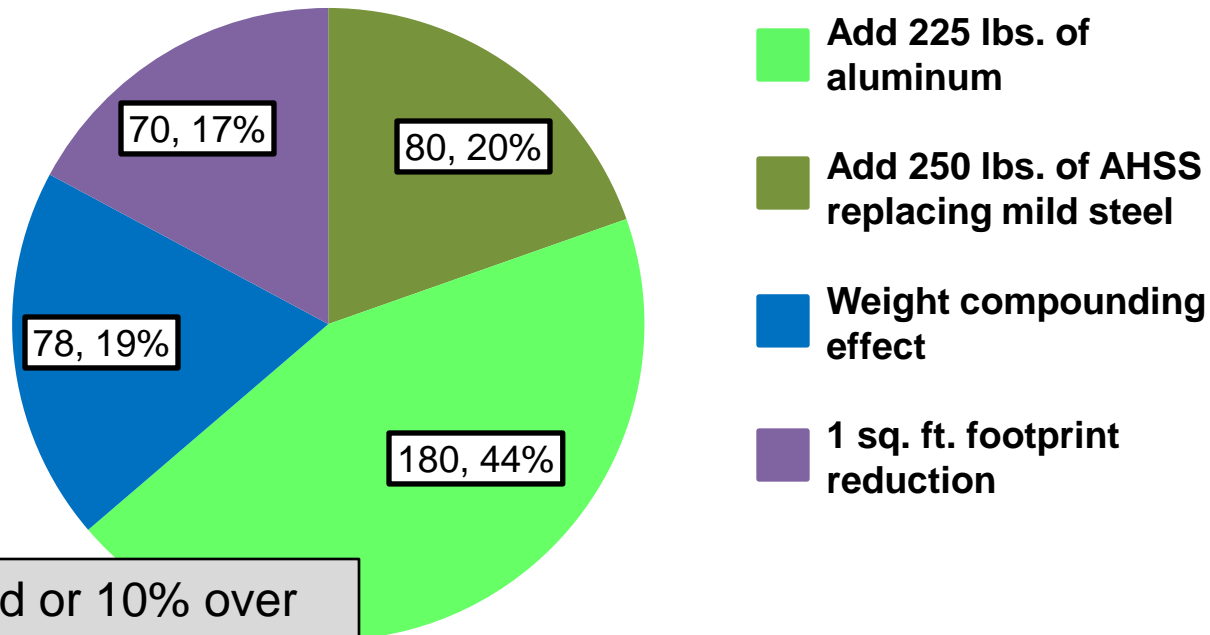


Aluminum Pounds Per Truck Predicted to Increase Dramatically



Average Vehicle Must Lose Over 400 Lbs of Curb Weight by 2025

Sources of Weight Savings
for 4% CAGR for MPG



408 lbs. saved or 10% over 2008 (NHTSA/EPA base year)

Average Net Cost of Direct and Indirect Weight Reduction

- Increased use of aluminum necessary and cost effective in achieving 400 lb weight reduction by 2025

Average Cost of Direct Weight Savings

Cost	Dollar/Pound Saved
Primary	\$2.00
Secondary	(\$1.82)
Net Cost	\$0.18

Ducker Study Conclusions

- Consumer demand and fuel economy regulations are driving a dramatic increase in aluminum usage
 - Weight savings from aluminum and AHSS for body parts
- Automakers working hard to improve fuel economy and maintain or improve size, function, safety and comfort
- Weight reduction with aluminum is a cost effective part of the solution

Ducker Study Conclusions

- By 2025, the average vehicle will get lighter by 400 lbs.
 - Aluminum and AHSS
 - Aluminum
 - Sheet , extrusions
 - Closures, body-in-white, bumper, and suspension components
- Aluminum will grow to 16% of curb weight
 - 343 pounds in 2012
 - 550 pounds in 2025
 - Increase of 207 lbs. in 13 years
 - Industry added 200 lbs. per vehicle from 1990 to 2010
- This is a conservative forecast

Question & Answer

Please submit questions through the box that appears on your screen

For additional aluminum research in the areas of safety, cost, alternative powertrains, growth and sustainability, to sign-up for the ATG's monthly newsletter and/or download this presentation, please visit us online at www.aluminumtransportation.org or e-mail atginfo@aluminum.org

Thank You