DUCKER WORLDWIDE

ALUMINUM ASSOCIATION
AUTO AND LIGHT TRUCK GROUP
2009 UPDATE
ON ALUMINUM CONTENT
IN NORTH AMERICAN, EUROPEAN AND JAPANESE VEHICLES
EXECUTIVE SUMMARY

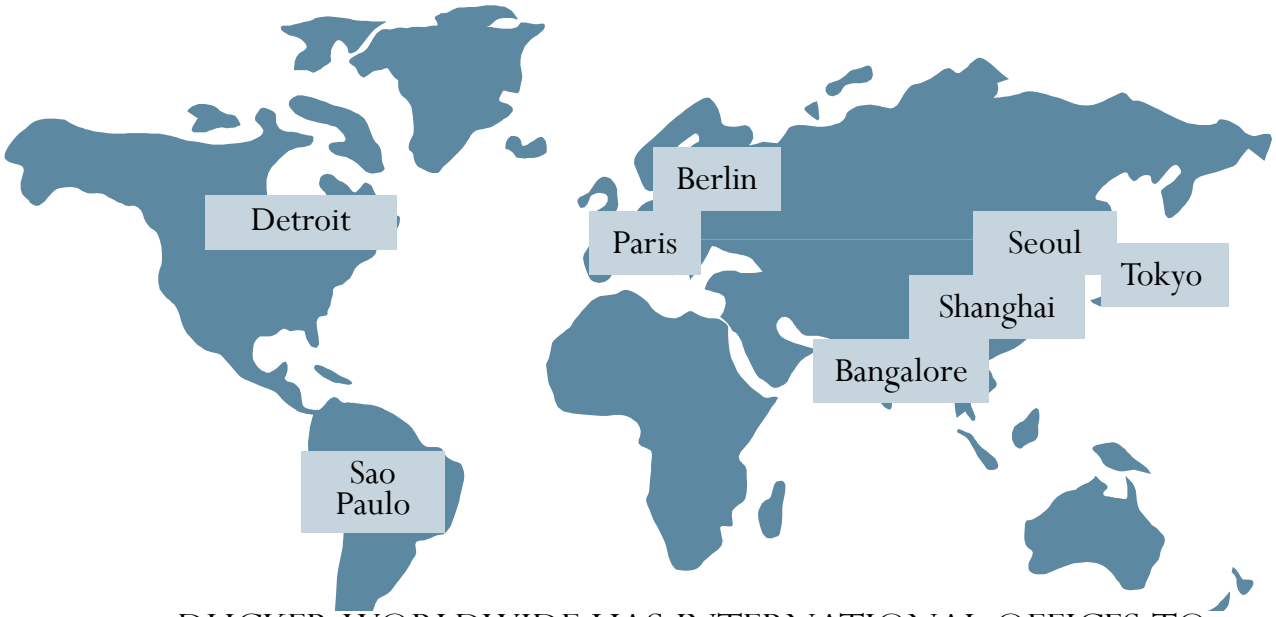
DECEMBER 2, 2008

INTRODUCTION AND METHODOLOGY

Introduction and Methodology

Background

- Ducker Worldwide has collected data on the growth and development of aluminum content in automotive light vehicle applications on an annual basis since 1991.
- Ducker started its systematic efforts in North America in 1991, expanded into Europe and Japan in 2000 and the remainder of the world in 2007.
- Data are collected on a “bottom-up” basis, meaning the market has been tracked on an OEM, platform-by-platform and product-by-product basis. With metallurgists, engineers and component specialists on staff, Ducker has become a leading subject-matter-expert for the global automotive industry on aluminum content and aluminum applications across all vehicle systems.



DUCKER WORLDWIDE HAS INTERNATIONAL OFFICES TO PROVIDE CLIENTS WITH GLOBAL PERSPECTIVE

Introduction and Methodology

Study Methodology

- Ducker conducts direct interviews with the purchasing and engineering personnel at the OEMs, tier suppliers and aluminum companies that are directly involved in making decisions to utilize aluminum for each component. Over the past 18 years, Ducker has developed an extensive industry network and is well positioned to gather any data point related to aluminum and automotive.
- Ducker uses primary research to gather data on the topic. Ducker always begins with material supplier interviews. The next step is component supplier interviews, and the final step is OEM interviews to confirm our findings. Secondary research from published sources only plays a minor role in our work.
- The nearly 100 light vehicle aluminum components for which Ducker collects data are shown in the Appendix of the full report. The aluminum penetration for every component can be different for every vehicle in every region. The principle objective of our studies is to determine the average pounds of aluminum for each of the components and systems shown in the Appendix, and to use these system average weights to determine the average aluminum content for the vehicles forecast for production in each region of the world. Finally, the average aluminum content in each region is separated into the various aluminum product forms (i.e. high pressure die castings, low pressure permanent mold and other castings, rolled products, extruded products and forgings and impacts).

Introduction and Methodology

Study Methodology

- The two most important data points for project success are the penetration of aluminum by component by region and the average aluminum weight for these components. We believe we have been successful in obtaining these data points for all the critical components under study, and we believe the results of this effort provide the most reliable and accurate estimates of auto aluminum use that have ever been developed.
- **In order to finish the project on schedule, Ducker fixed vehicle production at 12.94 million vehicles for the year 2009. Production forecasts for 2009 have declined for seven straight months in 2008 and as of October 31 the latest CSM forecast is 11.8 million units for 2009. The lower estimate does not have a significant effect on any of the key observations or conclusions of the report.**
- In **Phase I** published in October 2008, we presented aluminum data on the past, present and the expected future production of light vehicles in **North America**. In **Phase II**, published in December 2008, we present data comparing aluminum to the expected content in North America in 2009 with light vehicle aluminum content in **Europe, Japan and the remainder of the world** for 2009.
- **Please note** that prior to 2008/2009, Ducker excluded A Segment vehicles from the Japan data. A Segment vehicles in Japan are primarily “mini trucks.” We have put the A Segment into the Japan worldwide data analysis, but we have excluded it from the direct comparisons with North America and the EEU for the sake of historical consistency.

EXECUTIVE SUMMARY – PHASE I

Executive Summary

- The North American auto industry is in the midst of the greatest turmoil and need for change in recent history. The 25% decline in production from 2001 to 2009, although not unprecedented, has put the industry under extreme financial pressure. For the Big 3 in particular, these are desperate times. This sad state of affairs is additionally compounded by the shift in market share from the Big 3 to the foreign domestics, the shift in mix away from high-profit, full-frame vehicles and finally the government mandate to improve fuel economy by 40% in the face of extremely volatile oil prices. We will attempt in this report to address the effect all these factors may have on aluminum use for light vehicles between now and 2020.
- Most of the comparisons in this report will be between the recently **revised data** we collected on this topic **for 2006** North American vehicles with our **best estimates** of what will we and other experts believe will happen in **2009 and 2020.**
- The next 21 pages provide a summary of our findings and a forecast for 2009 and 2020. The remainder of the document provides details by component, details by OEM and details about the most likely uses of aluminum in future light vehicles that were compiled through OEM interviews.
- Some key observations on 2008 and 2009 are shown on the next page.

Executive Summary

- The Big 3 have lost nearly 10 market share points to the foreign domestics over three years.
- Production at GM, Ford, Chrysler and Nissan will decline by 2.75 million vehicles from 2006 to 2009 while Honda, Toyota and others are expected to grow production by 400,000 units from 2006 to 2009.
- In 2008, fuel economy will be the highest in recorded history at 26.8 MPG according to the EPA.
- The decline in curb weight from calendar year 2004 to 2009 will be the largest decline in nearly 30 years and contribute an improvement to fuel economy of at least one MPG.
- The shift away from full-frame large trucks and SUVs was the largest contributing factor to the decline in curb weight and the resulting fuel economy improvement in 2008.
- The shift to more vehicles in the B, C and D unibody vehicle segments will be beneficial to aluminum in the long term, but the size of the shift in 2008 caused a decline in curb weight which negatively affected not only aluminum weight per vehicle, but steel and iron weight as well.
- As a result, aluminum will suffer the first decline in pounds (2 lbs.) per vehicle in 35 years in 2008, but 2009 should put aluminum back on a new but slightly slower growth curve.
- Even though 2009 vehicle production will be much lower than 2006 production, there will be a need for more aluminum engine blocks, more knuckles, more suspension arms and links, more brake calipers, more hoods and more bumpers than in 2006
- On a pounds per vehicle basis, most 2009 light vehicle systems will increase aluminum content over 2006 with the big exception being subframes, cradles and crossmembers. This segment has declined by 80% over the last three years and will cost aluminum 40 to 50 million pounds of content in 2009. These losses can be attributed to the move to advanced high strength steels for these parts at Chrysler, Nissan and Ford.

Executive Summary

- Some of the **highlights** for 2009 are as follows:
  - Over 22% of the vehicles in 2009 will have an aluminum hood, an all time record.
  - Nearly 70% of all engine blocks will be aluminum in 2009.
  - Nearly one third of all 2009 models will have at least one pair of aluminum control arms or suspension links.
  - Nearly one half of all 2009 models will have at least one pair of aluminum knuckles.
  - Aluminum ABS housings will be on 85% of the 2009 vehicles.
  - Honda and BMW have become the aluminum content leaders over the last three years replacing GM and Nissan.
  - Honda has programmed rear aluminum knuckles for all new vehicles.
  - The BMW X6 will have an average aluminum content of 443 pounds, and with the V8 engine option and an aluminum full size spare, some X6 models will contain over 500 pounds of aluminum or 10% of the curb weight.
  - Vacuum die cast (High Q) aluminum front strut towers on the BMW X6, first aluminum strut towers in North America.
  - Aluminum IP beams for the Honda Pilot and Acura MDX plus aluminum knuckles, hoods and control arms make the aluminum content 423 pounds or 10% of curb weight.
  - The MDX/Pilot and BMW X6 are bell weather unibody vehicles which optimize both aluminum and advanced high strength steel use.

Executive Summary

- Other highlights that won't go into effect until after 2009 are:
  - Some versions of the very high volume GM Global Epsilon program will have forged aluminum Ball Joint Yokes weighing approximately six pounds each along with aluminum control arms and knuckles with a launch in 2009 in Europe, 2010 in North America and China in 2012.
  - GM may merge with Chrysler, and because GM has a more consistent approach to aluminum than Chrysler use, this should be beneficial to North American aluminum content going forward. A Chrysler/ Nissan merger would be detrimental to aluminum use, in our opinion they are both inconsistent .
  - The Prius will be manufactured in Mississippi with an aluminum hood and deck lid in 2010.
  - Chevy Volt will have an aluminum hood and possibly an aluminum front structure in 2011 or late 2010.
- As a percent of average curb weight, aluminum will be at an all time high of 8.6% in 2009, and is likely to be greater than 10.0% of curb weight by 2020.
- If the full frame share of total production in 2020 falls to 10% from the predicted 20%, aluminum's share of overall curb weight could be as high as 12% in 2020.
- The best long-term scenario for aluminum in order to optimize aluminum as a percent of curb weight is 100% unibody vehicles with low torque gasoline engines or hybrid engines which insures 100% aluminum block use and the optimum use of aluminum structural parts and aluminum closures. Low torque means under 500 Newton meters.

Executive Summary

The results of our interviews of 32 automotive material thought leaders are as follows:

- There is a **less than a 15% probability** that there will be a significant number **of mass-produced full aluminum bodies** by 2020.
- There is a **60% probability** that a significant number of vehicles with **partial aluminum body structures** will be in production by 2020.
- There is a **75% probability** that aluminum content will grow to **more than 350 to 360 pounds per vehicle** over the next twelve years and there is only a 25% probability of any decline in aluminum content during this period.
- There is a **75% probability** that aluminum content growth will remain in the **four to six pounds per vehicle per year** range through 2020 in addition to what growth there is for aluminum partial and complete body structures. We believe that the 2008 decline in aluminum content is an aberration caused by mix shift and the one time loss of most subframes and cradles to steel.
- There is a **very low probability**, less than 10%, that **aluminum will lose any significant share** to steel, iron or magnesium over the next twelve years.
- Based on the above, we have concluded that the most likely aluminum content by 2020 is 376 pounds per vehicle with a 20% chance of reaching 395 pounds per vehicle and a 30% chance of aluminum content being as low as 355 pounds per vehicle.
- These same experts also said that both aluminum and high strength steel will be **very significant** in their efforts to improve fuel economy by 40% by 2020.

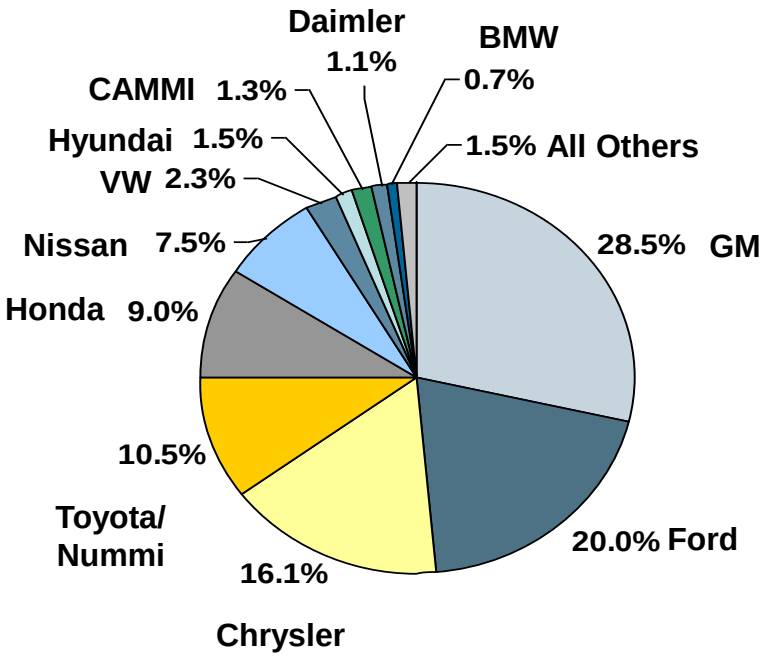
Executive Summary

North American Light Vehicle Production

- Segmented by OEM -

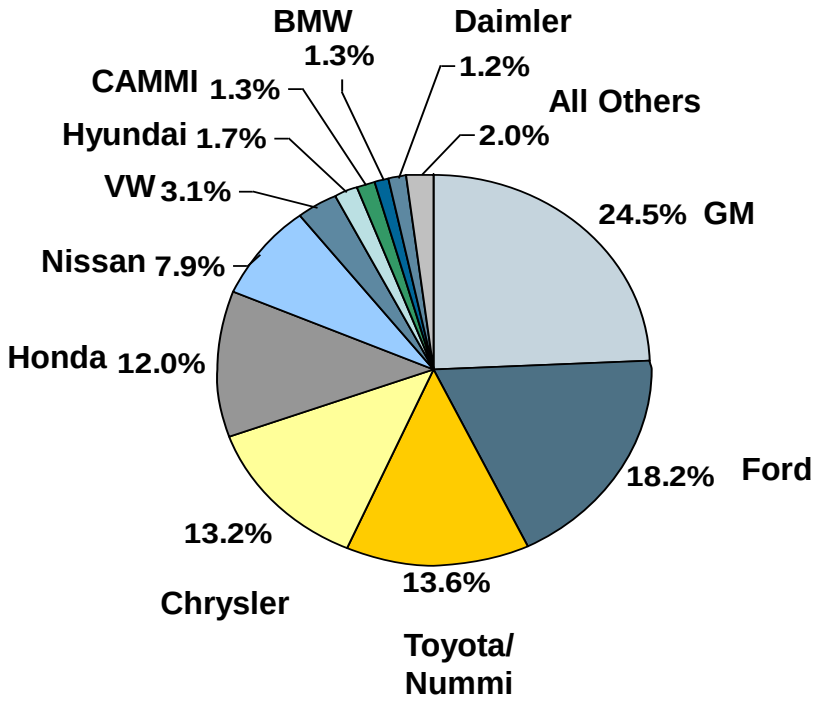
The Big 3 have lost nearly 10 production share points over three years

2006



15.3 Million Vehicles

2009



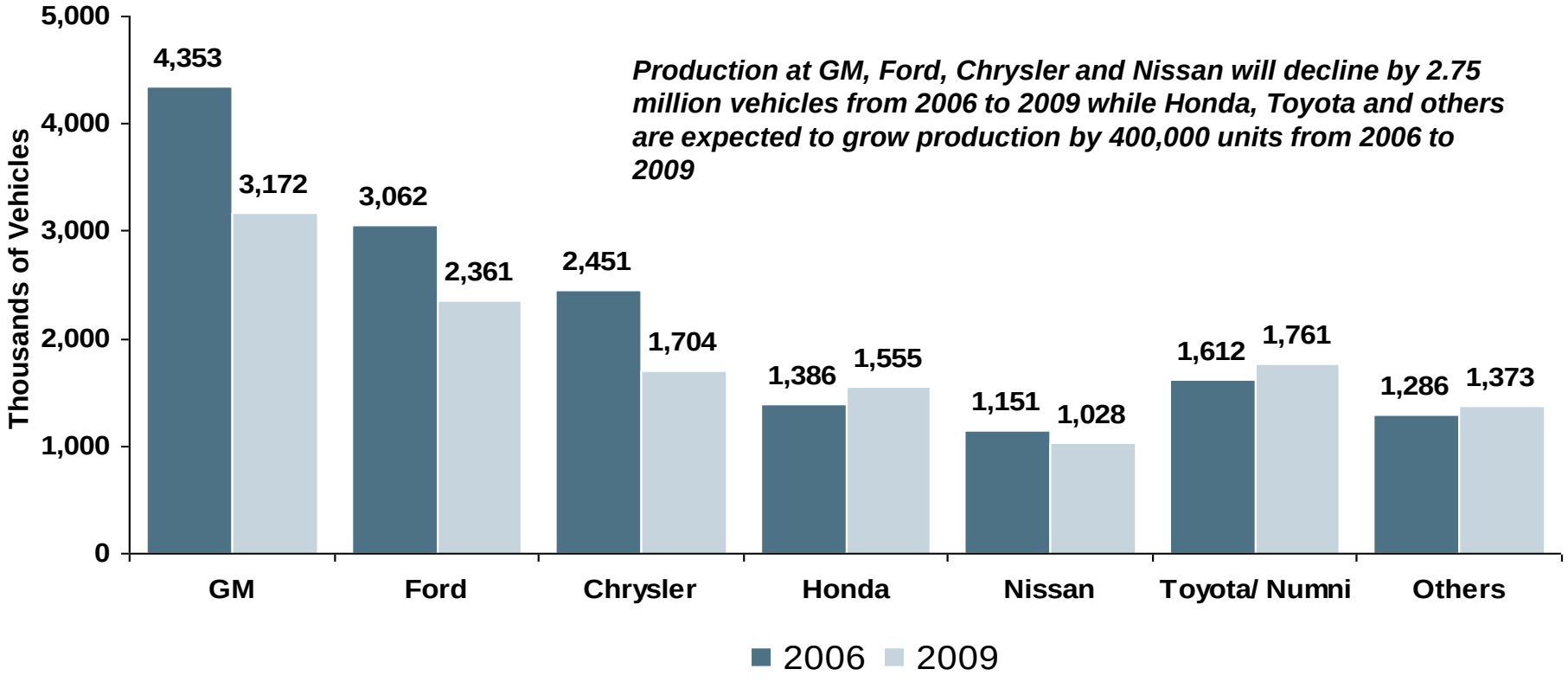
12.954 Million Vehicles
(could be as low as 11.8 Million)

Source : CSM

Executive Summary

North American Light Vehicle Production

- Segmented by OEM -
2006 Versus 2009



Production at GM, Ford, Chrysler and Nissan will decline by 2.75 million vehicles from 2006 to 2009 while Honda, Toyota and others are expected to grow production by 400,000 units from 2006 to 2009

Source: CSM

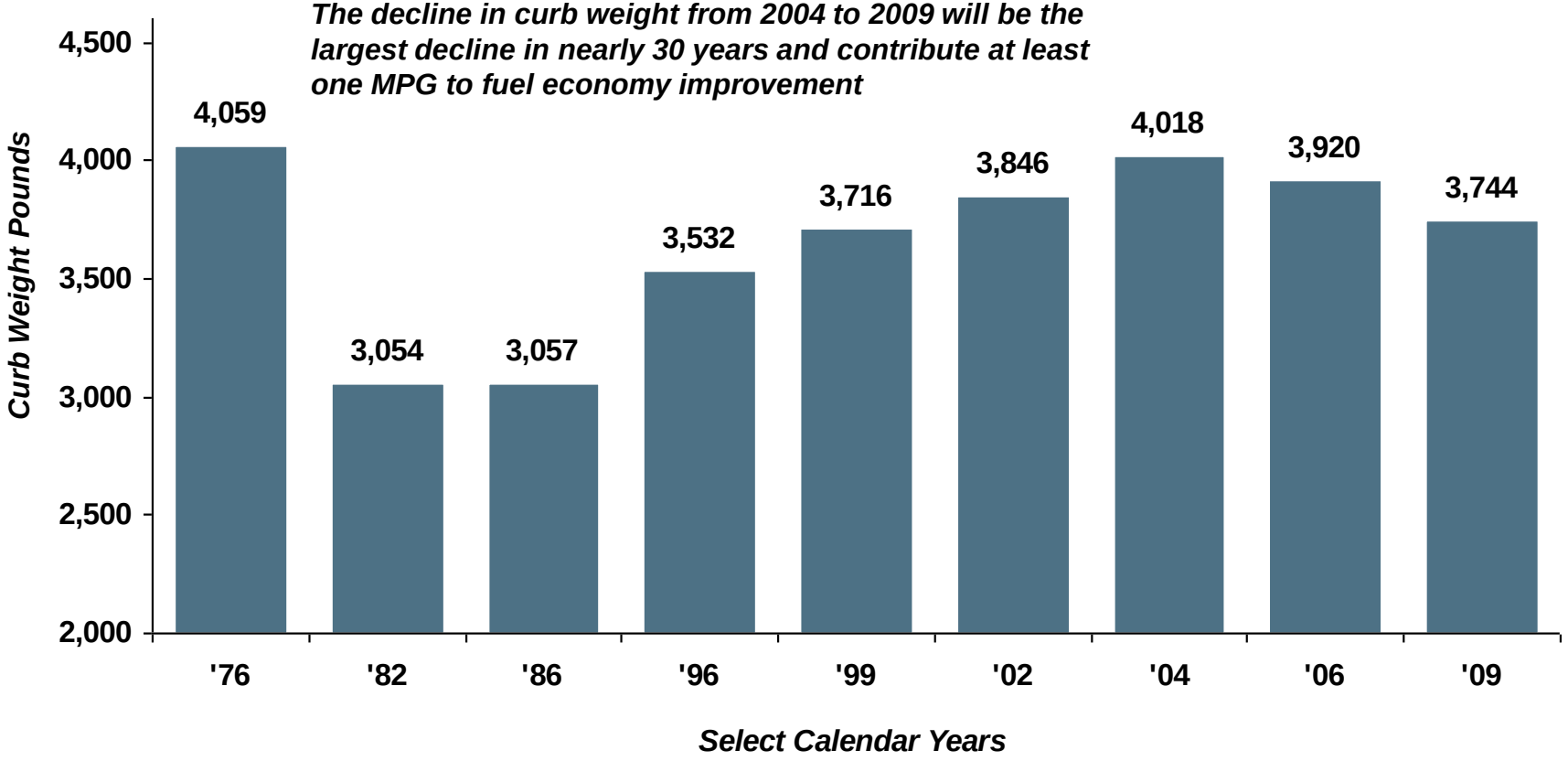
Executive Summary

North American Light Vehicle Curb Weight

- History and Forecast -

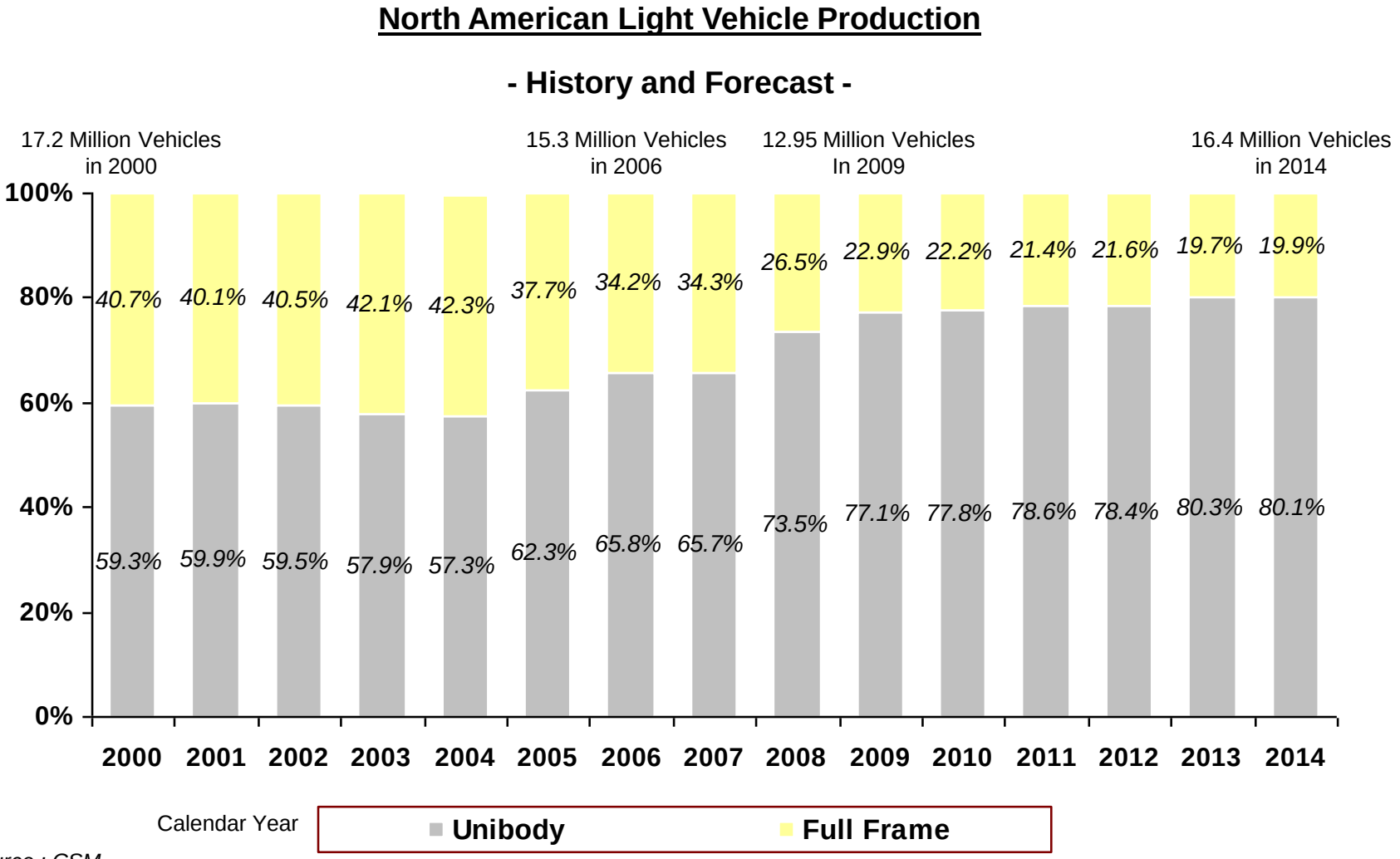
*Unibody vehicles are expected to average **3,469 pounds** and full frame vehicles will average **4,668 pounds** in 2009*

The decline in curb weight from 2004 to 2009 will be the largest decline in nearly 30 years and contribute at least one MPG to fuel economy improvement



Executive Summary

- The shift away from full-frame large trucks and SUVs was the largest contributing factor to the decline in curb weight and the improvement in fuel economy in 2008.



Source : CSM

Executive Summary

North American Light Vehicle Production

- Millions of Aluminum Units or Pounds/Vehicle -

These systems and components represent over 95% of all the aluminum weight in the vehicle

	Calendar Year				
	1996	1999	2002	2006	2009
Vehicles (Millions)	15.10	17.00	16.40	15.30	12.95
Engine Blocks	2.72	3.91	5.74	7.99	8.95
Cylinder Heads	14.20	18.42	21.63	24.06	20.08
Intake Manifolds	12.38	9.86	8.96	8.86	7.53
Oil Pans	7.25	8.84	9.02	9.74	8.64
Other Engine **Pounds**	20.0	20.5	20.5	21.6	21.8
Automatic Transmissions	13.44	15.13	14.92	13.86	11.48
Manual Transmissions	1.66	1.87	1.48	1.44	1.52
Transfer Cases	2.3	3.0	2.45	3.0	2.18
Differential Carriers	1.7	2.0	2.1	3.3	2.3
Wheels	27.2	39.4	40.7	41.0	35.9
ABS Housings	10.57	12.41	12.30	11.93	11.05
Drive Shafts	0.7	1.5	2.0	3.0	2.0
Brake Calipers	0.5	1.8	3.9	12.0	12.1

	Calendar Year				
	1996	1999	2002	2006	2009
Hoods	0.9	1.7	2.4	2.85	2.89
Other Closures	0.1	0.5	1.4	0.94	0.14
Bumper Beams	2.0	1.7	1.7	2.6	2.85
Heat Shield Pounds	2.1	3.1	3.82	4.05	4.2
Control Arms/Links	0.5	4.3	6.7	9.0/1.6	10.8/2.1
Knuckles	0.6	9.6	10.4	15.0	16.8
Subframes/Cradles & Crossmembers	1.0	1.3	1.5	2.0	0.568
Driveline Yokes	1.4	3.0	4.0	6.0	4.0
Front Structures	--	0.5	0.9	0.6	0.4
Complete Structures Including IP	--	--	0.01	0.01	0.21
Heat Exchangers	32lbs.	32lbs.	32lbs.	31.5lb.	31.5lbs
Curb Weight Pounds	3,532	3,716	3,846	3,920	3,744
Aluminum % of CW	6.3%	6.8%	7.2%	8.1%	8.6%

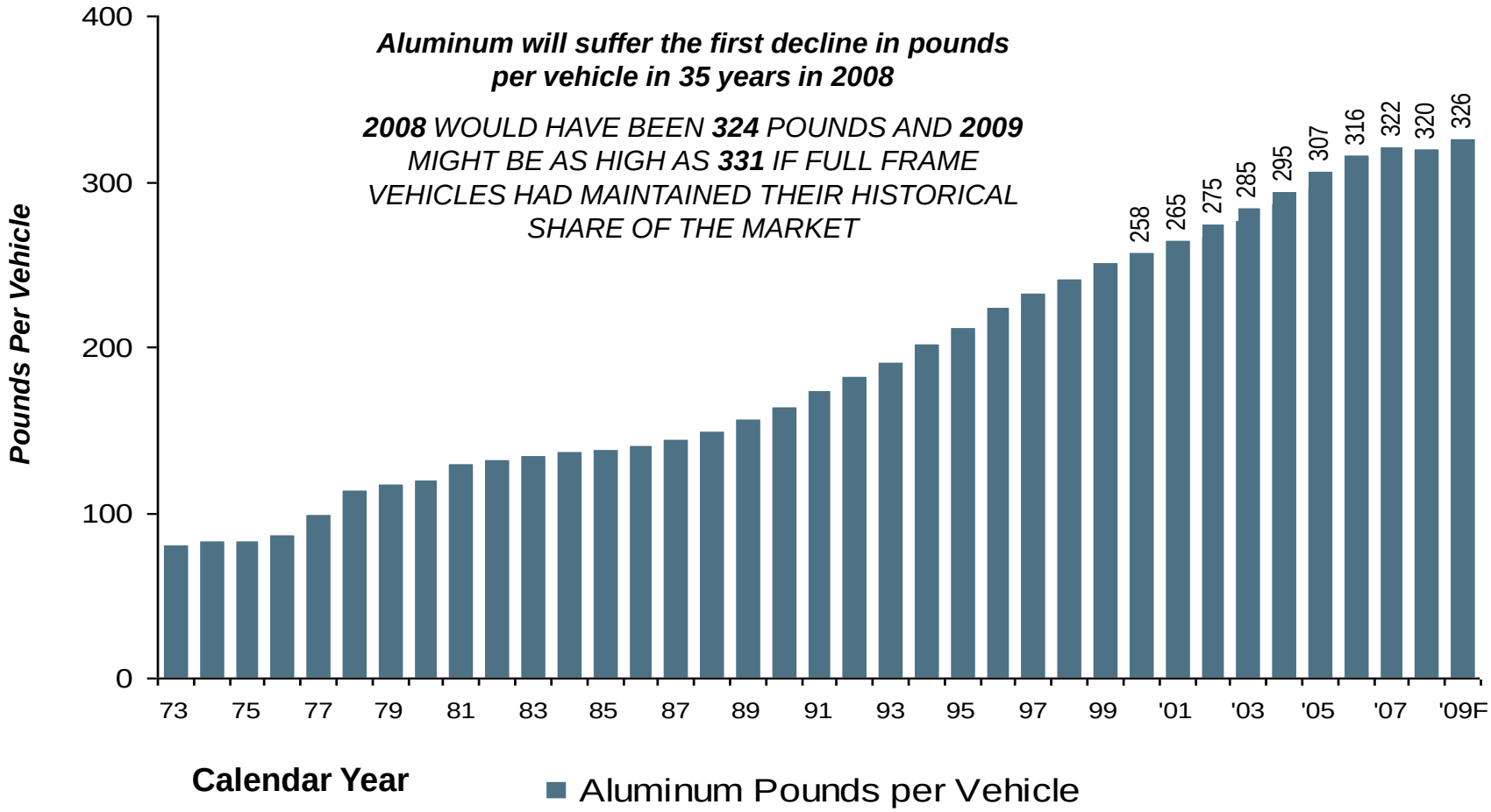
Executive Summary

North American Light Vehicle Aluminum Content

- History and Forecast -

Aluminum will suffer the first decline in pounds per vehicle in 35 years in 2008

2008 *WOULD HAVE BEEN* ***324*** *POUNDS AND* ***2009*** *MIGHT BE AS HIGH AS* ***331*** *IF FULL FRAME VEHICLES HAD MAINTAINED THEIR HISTORICAL SHARE OF THE MARKET*



Executive Summary

North American Light Vehicle Aluminum Content

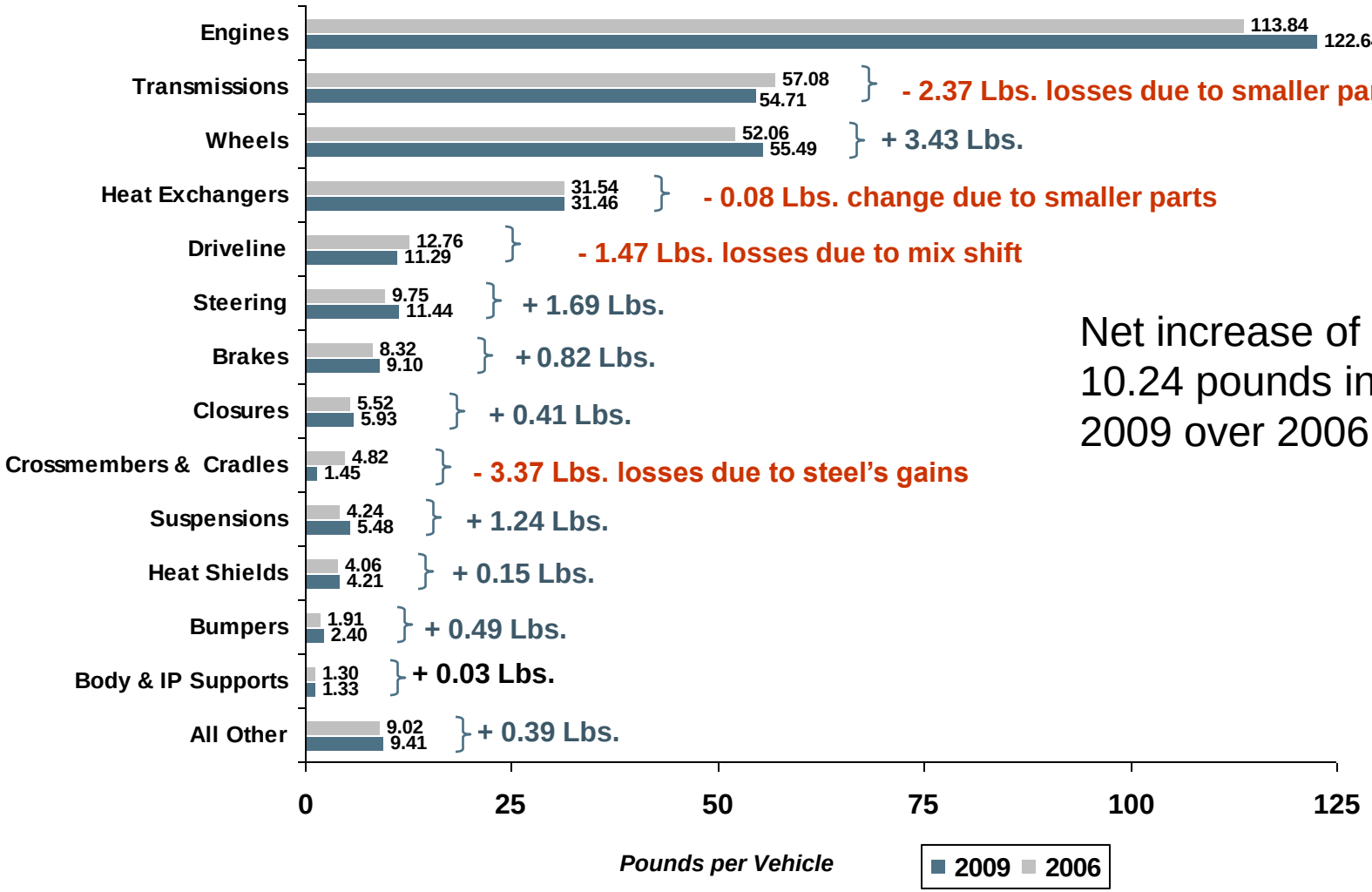
- Pounds per Vehicle -

System/Component	Actual 1996	Actual 1999	Actual 2002	Actual 2006	Estimate 2009
Engines	76.85	81.04	92.66	113.84	122.64
Transmissions	55.17	56.63	56.69	57.08	54.71
Driveline Components	4.00	4.86	5.35	12.76	11.29
Wheels	33.00	42.92	49.32	52.06	55.49
Heat Exchangers	32.00	32.00	32.00	31.56	31.46
Suspensions	0.25	1.40	2.18	4.15	5.48
Steering Components	3.00	8.00	8.17	9.75	11.44
Cradles and Subframes	2.00	2.30	3.41	4.83	1.45
Brakes	3.25	3.83	5.48	8.32	9.10
Closures	1.65	2.60	4.32	5.52	5.93
Heat Shields	2.10	3.10	3.82	4.06	4.21
Bumpers and Bumper Beams	1.00	1.25	1.35	1.91	2.40
Body and IP Structures	--	1.77	1.26	1.30	1.33
All Other Components	9.23	9.30	9.03	9.02	9.41
Total	**223.5**	**251.00**	**274.94**	**316.16**	**326.34**

Executive Summary

North American Light Vehicle Aluminum Content

2009 Compared to 2006

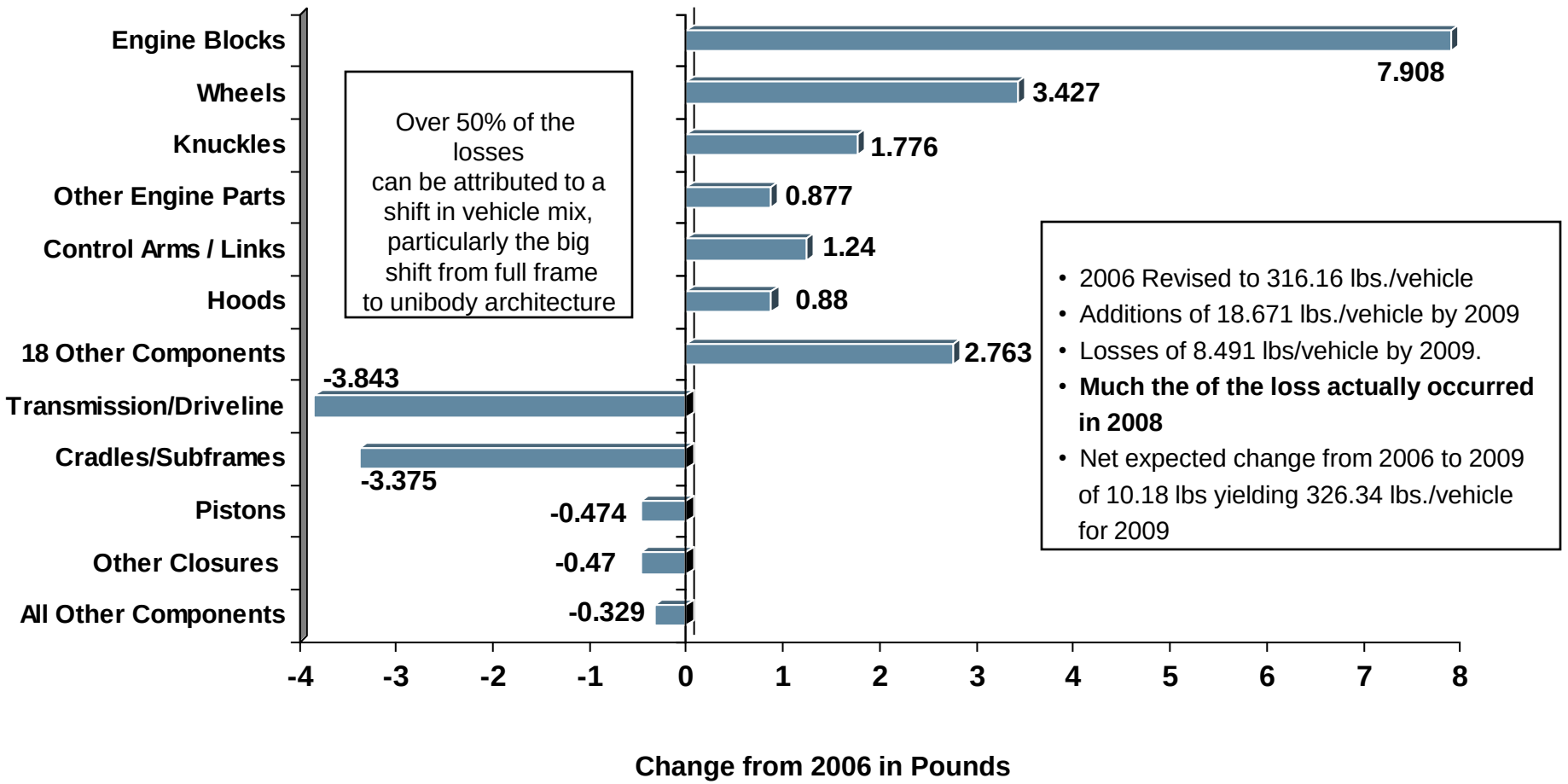


Net increase of 10.24 pounds in 2009 over 2006

Executive Summary

North American Light Vehicle Aluminum Content

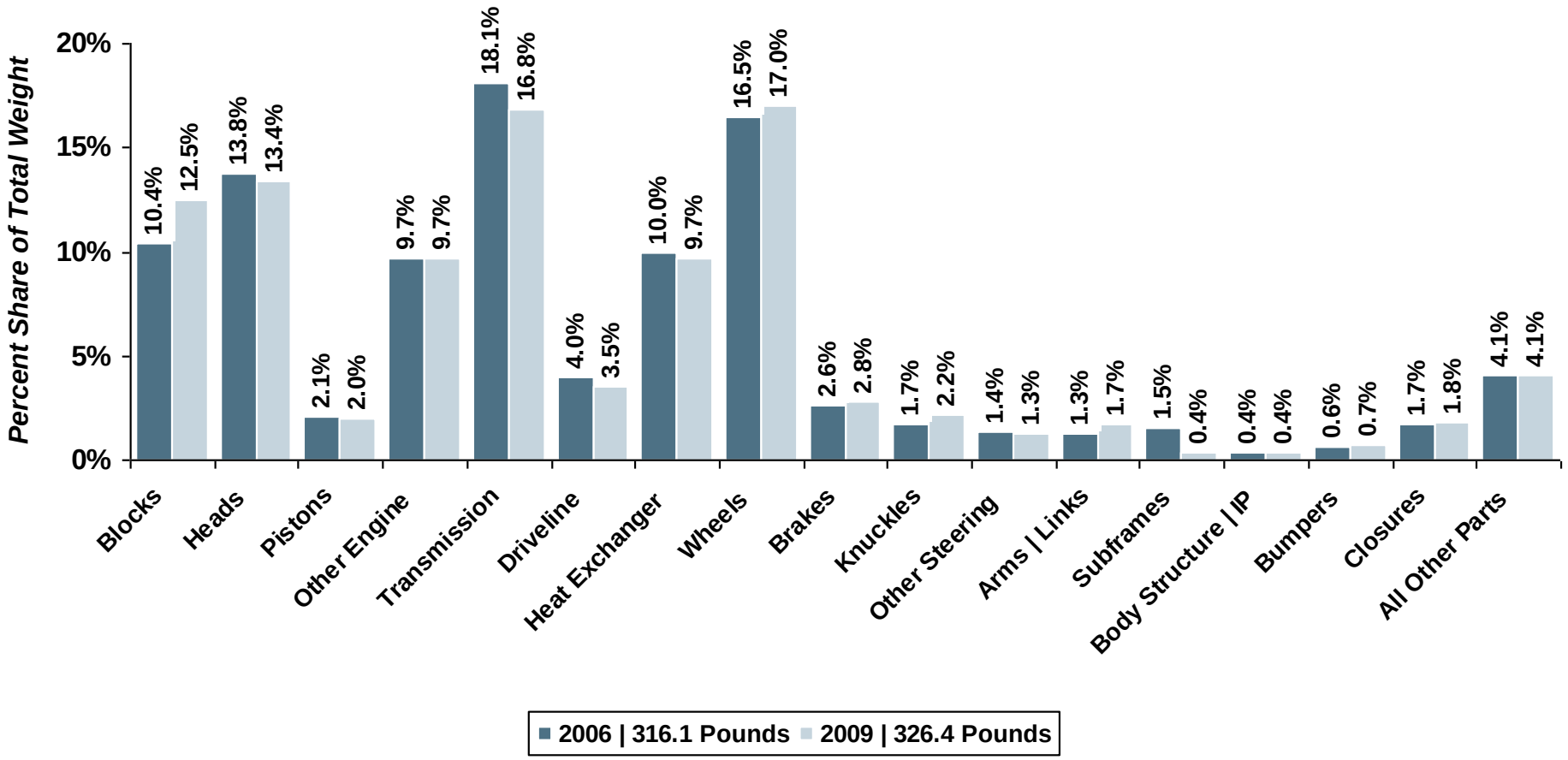
- 2009 Versus Revised 2006 -



Executive Summary

2009 North American Light Vehicle Aluminum Content

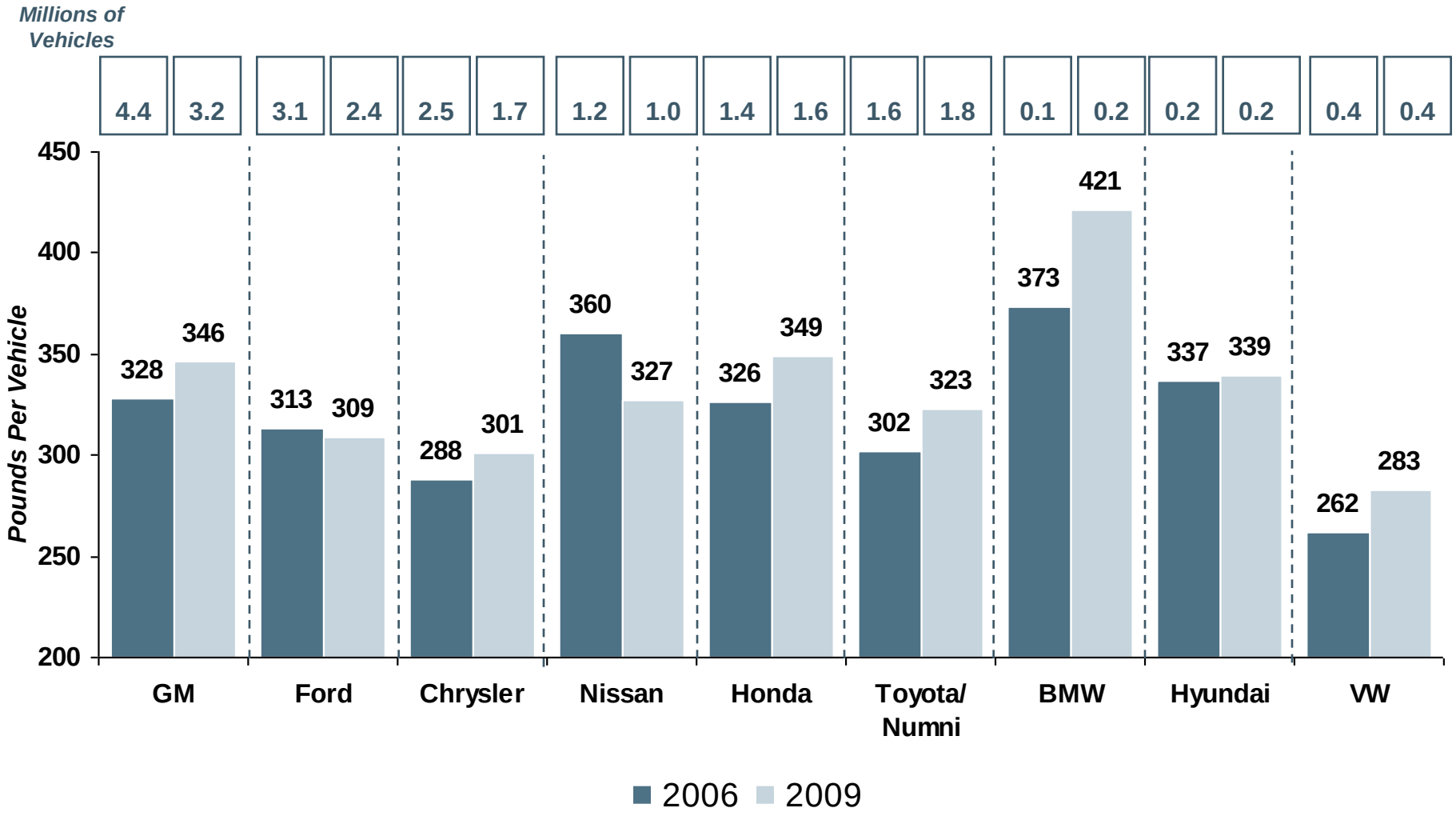
- Segmented by System or Component -



Executive Summary

North American Light Vehicle Aluminum Content

- Segmented by OEM -
2006 Versus 2009

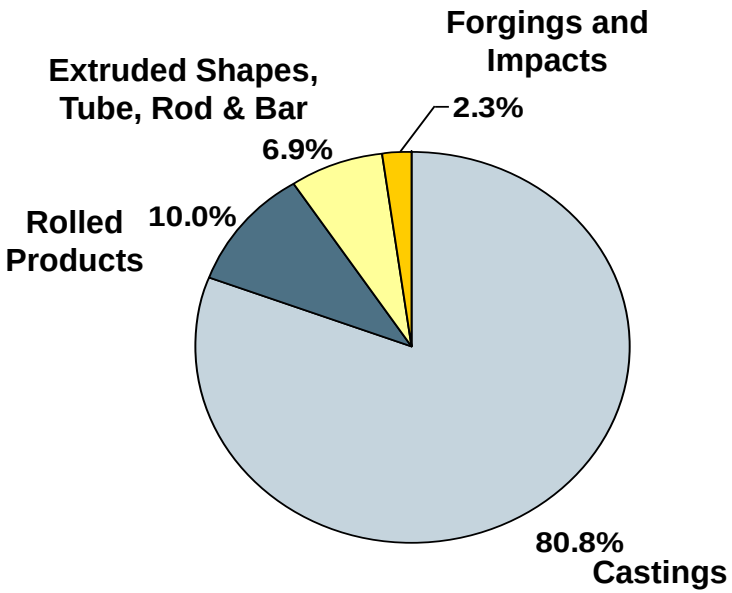


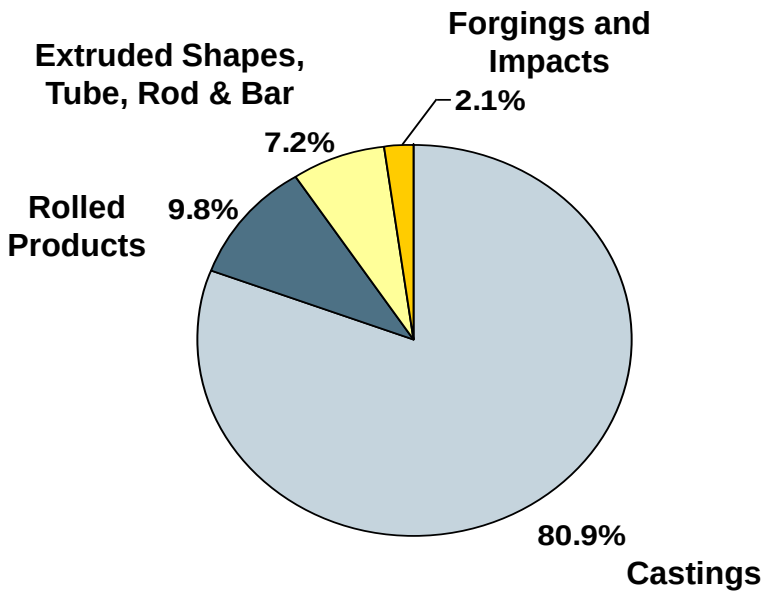
Executive Summary

North American Light Vehicle Aluminum Content

2006 **2009**

Broad product mix changes from 2006 to 2009 will be minimal





4.837 Billion Pounds

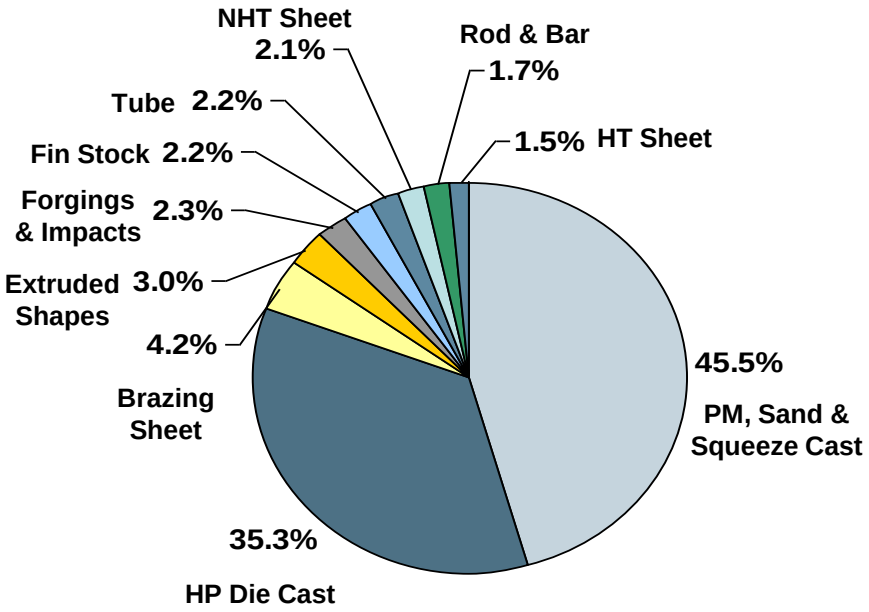
4.225 Billion Pounds
Based on 12.95 Million Vehicles

Executive Summary

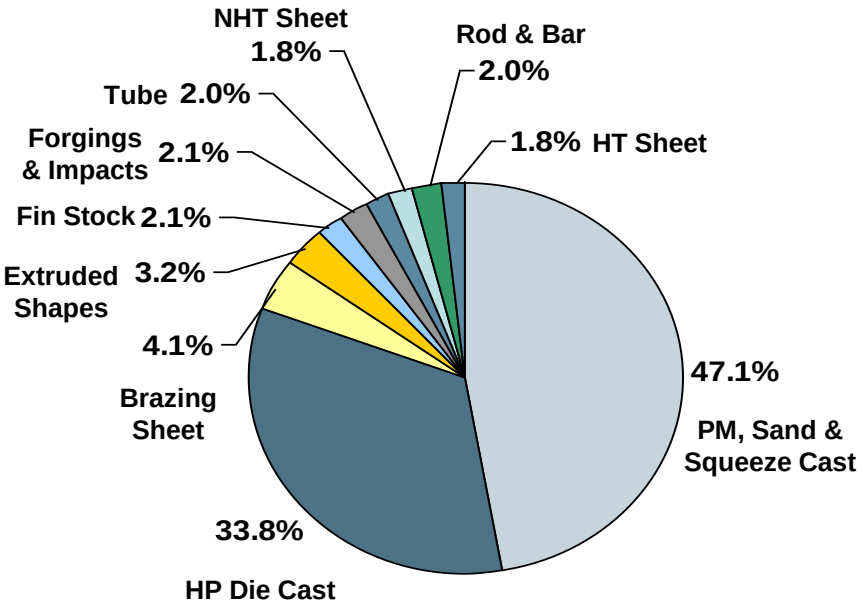
North American Light Vehicle Aluminum Content

PM castings, squeeze castings heat treated sheet, extruded shapes and rod and bar will all increase share in 2009

2006



2009



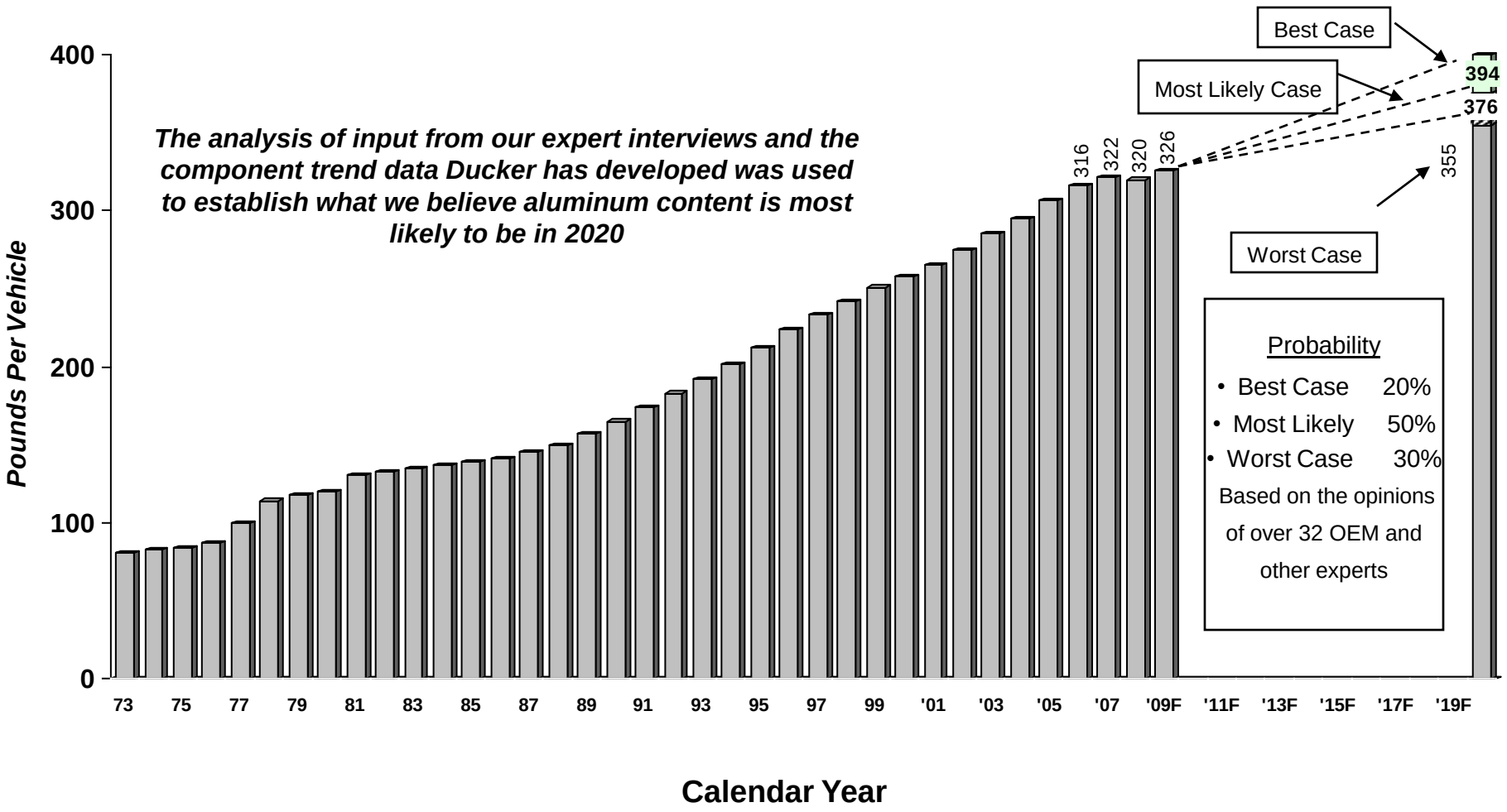
4.837 Billion Pounds

4.225 Billion Pounds
Based on 12.95 Million Vehicles

Executive Summary

North American Light Vehicle Aluminum Content

- History and Forecast -



Executive Summary

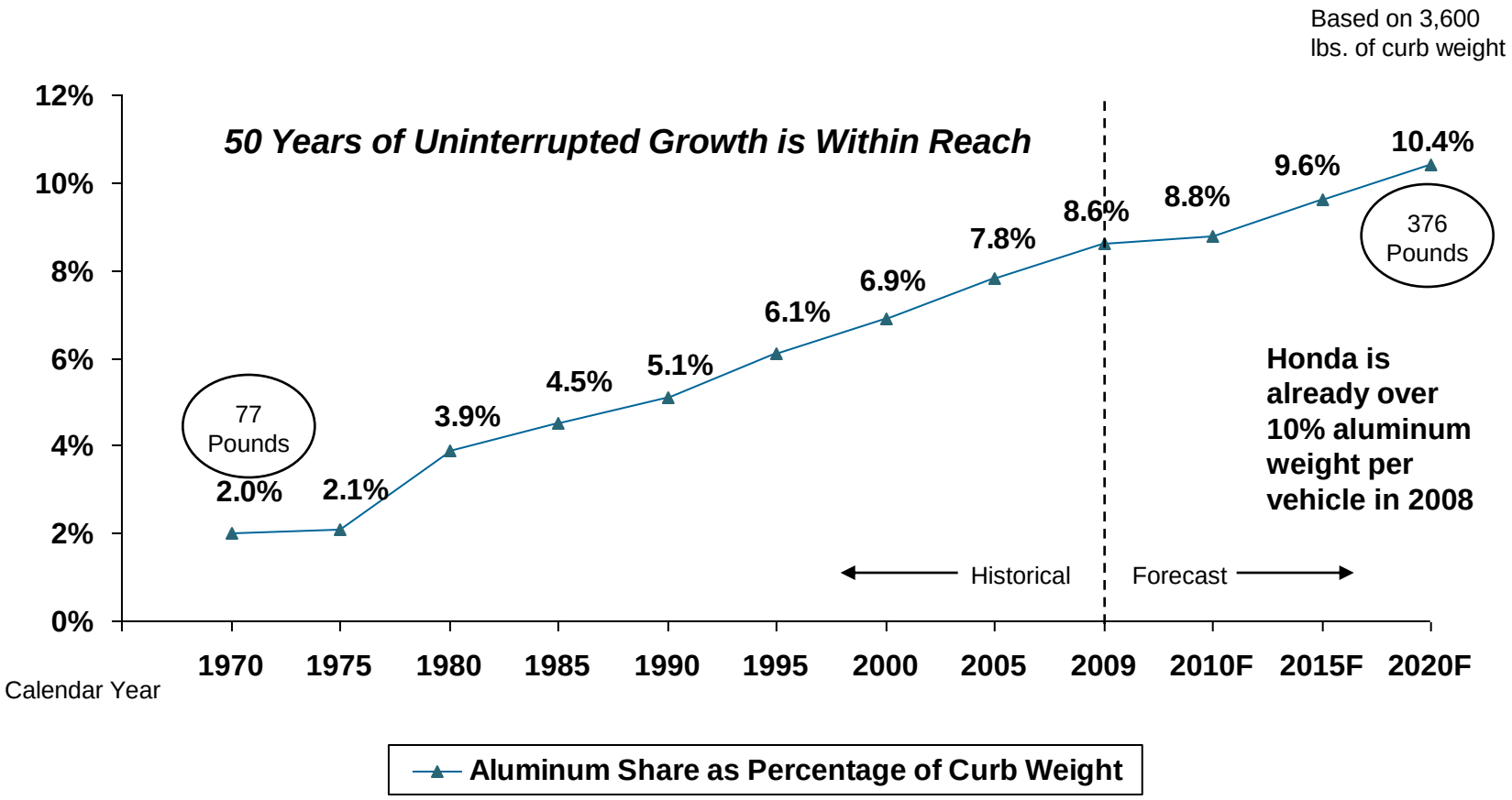
What Will it Take to Get to 376 Pounds of Aluminum per Vehicle in 2020?

- The **"Most Likely Case"** will require the following (assuming 16M vehicles are assembled in 2020):
  - 140,000 complete aluminum bodies adds 3 pounds per vehicle
  - 480,000 partial aluminum bodies adds 4.5 pounds per vehicle
  - 9.6 million aluminum hoods or the equivalent in roofs and other body panels adds 10 pounds per vehicle
  - 13.6 million aluminum engine blocks adds 10 pounds per vehicle, but hybrid blocks will be lower in weight
  - Less than one million diesel engines with iron blocks, but one million diesels with aluminum blocks are included in the 13.6 million aluminum total
  - 48 million aluminum wheels adds 5 pounds per vehicle
  - 30 million aluminum knuckles adds 4 pounds per vehicle
  - 25 million aluminum control arms and links adds 4.5 pounds per vehicle
  - 10 new pounds per vehicle of aluminum growth from other parts such as bumpers, heat shields, brake calipers, ABS and driveline components, cylinder heads, bed plates and a few other components
  - Average Curb Weight of at least 3,600 pounds. A larger drop in curb weight will hurt aluminum part size and weight per vehicle. Hybrids can hurt overall aluminum weight due to the small size of the internal combustion engine, but hybrids can help increase the use of aluminum structural parts and closures

Executive Summary

North American Light Vehicle Aluminum Content as a Percent of Curb Weight

- History and Forecast -



EXECUTIVE SUMMARY – PHASE II

Executive Summary

- This is the first time Ducker has collected enough information to estimate the aluminum content for light vehicles on a worldwide basis. Our estimate for 2009 is 248 pounds per vehicle for the approximately 70 million light vehicles that are likely to be manufactured in North America, Europe (including Russia), Japan, South Korea, India, South America, Africa, Australia and the remainder of Asia and the Middle East (excluding North Korea).
- Based on the CSM September 2008 forecast of 72.3 million light vehicles of worldwide production in 2009, we are forecasting that these vehicles will contain 18 billion pounds of aluminum, 18.4 billion pounds of iron, 94.5 billion pounds of flat rolled steel, 40.2 billion pounds of other steel products, 9.9 billion pounds of other metals and 49.3 billion pounds of non-metallic materials, not including scrap and spare parts.
- If the current worldwide recession continues for all of 2009, the above numbers **could be ten percent or even fifteen percent lower**, but the proportions of each material in the mix will not substantially change.
- Light vehicle aluminum content growth in North America, Japan and the EEU countries has definitely slowed over the last three years when compared to the rates from the late 1990's and the period of 2000 to 2006. Aluminum content per vehicle in North America is up eight pounds to 324 pounds, Europe is up 14 pounds to 273 pounds and Japan is up 11 pounds to 261 pounds since 2006, excluding A Segment vehicles. If we include the A Segment vehicles, Japan drops to 253 pounds per vehicle. **These increases are 50 percent less than the annual increases from 2000 to 2006.**

Executive Summary

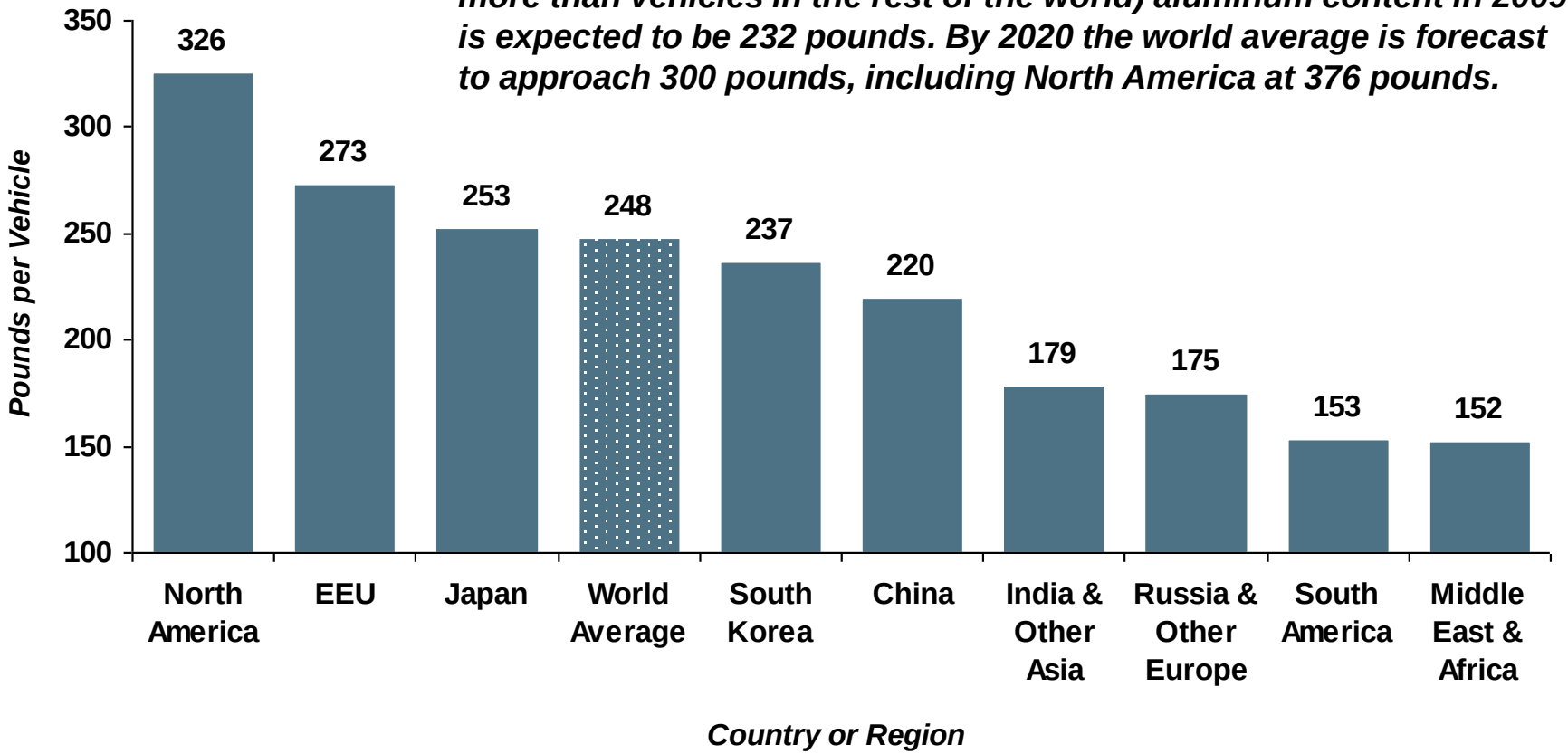
- North American light vehicle aluminum content would have increased by 15 pounds per vehicle rather than 10 pounds if not for the 2008/2009 shift to smaller vehicles. This shift did not occur to the same degree in Europe, Japan or the rest of the world as in North America.
- Although growth has slowed compared to the rate during the 1996 to 2006 time frame, it is in line with the long term growth rate established from the late 1970's to the mid 1990's. The period from 1996 to 2006 may have been a growth aberration. We still expect long term, worldwide light vehicle aluminum content growth to be in the 4 to 5 pounds per vehicle per year range, approaching 300 pounds per vehicle worldwide by 2020.
- Four to five pounds per year may not appear to be significant growth, but when combined with the nearly 100 million light vehicles likely to be built in 2020, it would grow aluminum content from the current 17 to 18 billion pounds per year to 28 to 30 billion pounds of aluminum content per year by 2020, not including scrap and spare parts.
- Some worldwide vehicle trends that impacted aluminum content over the last few years and are likely to continue over the next ten years include:
  - *Automatic transmissions declining from 50% to 47% of worldwide production*
  - *Diesel engines holding steady at 22.5% of production (65% of the diesels are in Europe)*
  - *Hybrid powertrains increasing fourfold to 2.1 million units*
  - *Full frame vehicles declining from 16.2% of worldwide production to only 12%*
- All these trends favor aluminum penetration except the decline in automatic transmissions.

Executive Summary

2009 Aluminum Content for 72.3 Million Light Vehicles in All Segments

- Pounds per Vehicle by Country or Region -

If we exclude North America (with vehicles that weigh over 20 percent more than vehicles in the rest of the world) aluminum content in 2009 is expected to be 232 pounds. By 2020 the world average is forecast to approach 300 pounds, including North America at 376 pounds.

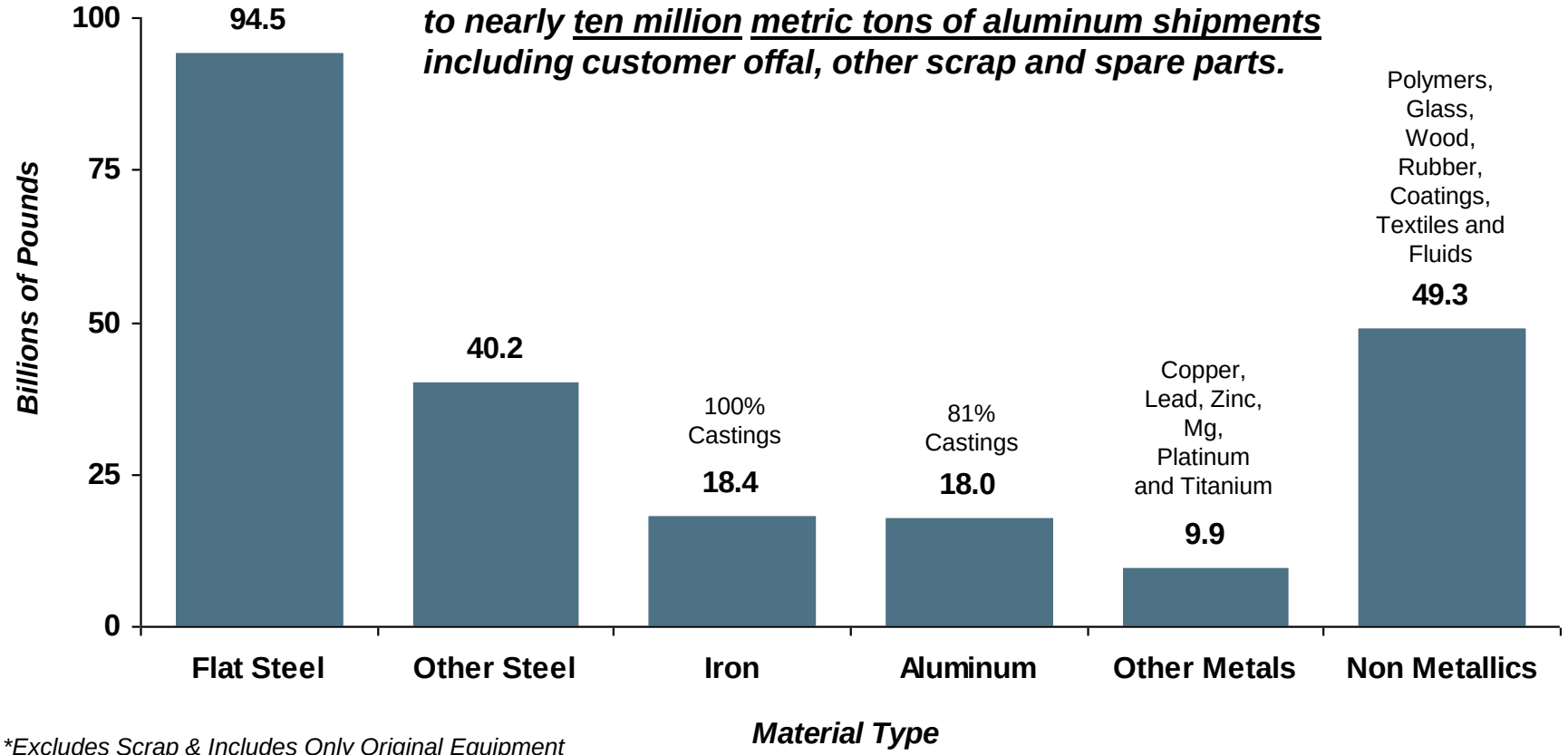


Executive Summary

2009 Worldwide Light Vehicle Material Content All Segments

- Segmented by Type of Material* -

66.4 percent of the material content is ferrous based. Aluminum is 7.8 percent of the total content. This equates to nearly ten million metric tons of aluminum shipments including customer offal, other scrap and spare parts.



**Excludes Scrap & Includes Only Original Equipment*

Light Vehicle Aluminum Content Per Vehicle

-2002 and 2006 Revised Estimates Versus 2009 Forecast-

-Pounds per Vehicle

Segment	North America			European Union			Japan (Excludes A Segment)		
	2002 R	2006 R	2009 F	2002 R	2006 R	2009 F	2002 R	2006 R	2009 F
Engines	92.66	113.84	122.64	80.60	90.22	94.38	98.00	99.0	107.31
Transmission & Driveline	62.04	69.46	66.0	34.00	34.19	34.6	45.30	48.0	48.19
Chassis, Suspension & Steering	13.76	18.73	18.37	18.10	22.63	25.51	6.50	7.85	7.89
Wheels	49.32	52.06	55.49	31.35	39.74	44.56	39.20	42.59	44.53
Heat Exchangers	32.00	31.56	31.46	24.30	27.03	27.1	26.40	30.0	30.05
Brakes	5.48	8.32	9.1	6.00	10.48	11.33	3.69	7.52	7.72
Closures	4.32	5.52	5.93	5.30	10.77	11.35	0.60	4.08	4.27
Body & IP Beams	1.00	1.30	1.33	3.90	6.2	6.36	0.30	0.46	0.22
Heat Shields	3.82	4.06	4.21	2.60	3.00	3.3	1.20	2.36	2.43
Bumper Beams	1.35	1.91	2.4	3.13	6.07	6.0	1.71	1.52	1.28
All Other Components	9.03	9.02	9.41	8.50	8.49	8.65	6.10	7.01	7.11
Total	**271.78**	**316.16**	**326.34**	**217.78**	**258.82**	**273.14**	**229.00**	**250.40**	**261.00***

*253 with A Segment Vehicles Included

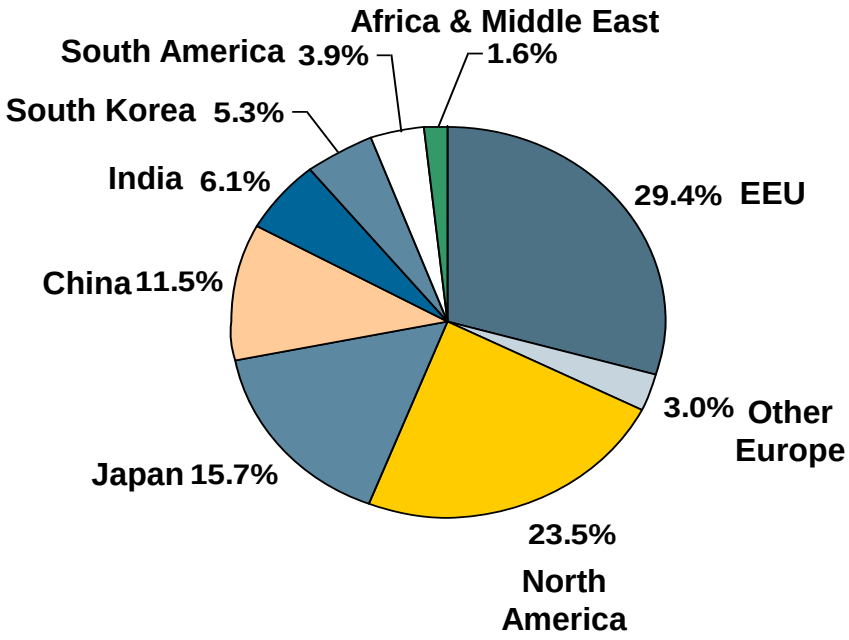
Executive Summary

- **Worldwide highlights for 2009 light vehicle aluminum content are as follows:**
  - Worldwide average aluminum content will be 7.8% of the average worldwide light vehicle curb weight of 3,183 pounds in 2009.
  - North America has the highest aluminum penetration at 8.6% of N.A. curb weight and Africa/Middle East have the lowest aluminum penetration at 5.1% of their curb weight.
  - Aluminum wheels, excluding spares and aftermarket units, should total 124 million units in 2009 and increase aluminum's worldwide share of light vehicle wheels by 3% to 42.8% in 2009 compared to 39.8% 2006. The total is over 140 million units with spares.
  - Worldwide aluminum engine block penetration will increase from 45% in 2006 to 53% in 2009.
  - Since 2006, aluminum closure programs have grown from 231 programs to 263 programs or 14%. New programs are the best indicator of continued growth for aluminum closures.
  - Aluminum hood penetration, which is another barometer of aluminum growth, will be the highest ever next year in North America at 22.3% compared to 20% in Europe and 11.6% in Japan. The comparable numbers in 2006 were 18.6%, 21% and 12.5%. Europe and Japan however, use more aluminum fenders, doors and decklids than North America.
  - Growth for chassis, suspension, steering components and bumpers are mixed with only knuckles and are steady or growing in all regions. Aluminum suspension components are growing in North America and Europe, and China will have one aluminum control arm program in 2010. Cradles, crossmembers and subframes and bumpers are threatened by Dual Phase steel and other advanced high strength steels; and growth is very hard to find for cradles and crossmembers in most regions.

Executive Summary

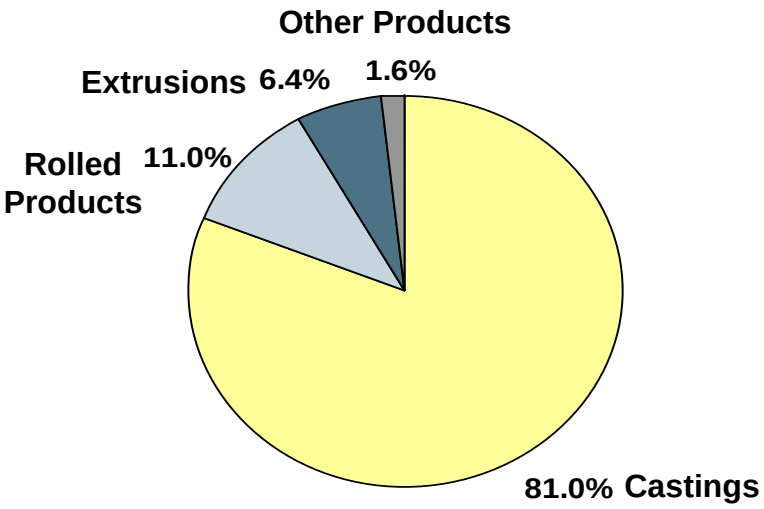
2009 Worldwide Light Vehicle Aluminum Content

Segmented by Country



17.95 Billion Pounds

Segmented by Product



17.95 Billion Pounds

Executive Summary

- Over forty 2009 North American vehicles will contain more than 400 pounds of finished aluminum, and over 50 vehicles, shown on the next page, will contain over 10% aluminum based on curb weight. Fifteen vehicles exhibit both characteristics.

North American 2009 Light Vehicles with Over 400 Pounds Aluminum Content* Based on Curb Weight		
Acura MDX	Chevrolet Impala	Honda Pilot
Acura TL	Chevrolet Suburban	Honda Odyssey
BMW X5	Chevrolet Tahoe**	Hummer H3
BMW X6	Chevrolet Traverse	Jeep Grand Cherokee
Buick Enclave	Chrysler Town & Country	Lincoln MKS
Cadillac CTC	Daimler MB GL-Class	Lincoln MKT
Cadillac CTS	Daimler MB ML-Class	Lincoln Town Car
Cadillac CTW	Daimler MB RL-Class	Nissan Altima**
Cadillac DTS	Dodge Caravan	Nissan Maxima
Cadillac Escalade**	Dodge Challenger	Nissan Quest
Cadillac SRX	Dodge Charger	Subaru Tribeca
Cadillac STS	Dodge Viper	Toyota Sienna
Cadillac XLR	Ford Explorer	Volkswagen Routan (Made by Chrysler)
Chevrolet Avalanche	GMC Acadia	*** Hybrid and Non Hybrid*
Chevrolet Corvette	GMC Yukon**	

** Some versions of these models may have less than 400 lbs of aluminum based on selected options such as steel wheels and engine size*

Executive Summary

- In light of shift to smaller vehicles with less horsepower, aluminum intensity based on the percentage of curb weight is a more accurate long term measure of aluminum usage than actual pounds.

North American 2009 Light Vehicles with Over 10% Aluminum Content*		Based on Curb Weight
Acura CSX	Dodge Caliber	Nissan Altima**
Acura TL	Dodge Challenger	Nissan Maxima
Buick Allure /Lacrosse	Dodge Charger	Nissan Sentra
Buick Lucerne	Dodge Journey	Nissan Versa/Tilda
BMW X6	Dodge Viper	Pontiac G5
Cadillac BRX	Ford Fiesta	Pontiac G6
Cadillac CTC	Ford Focus	Pontiac Solstice
Cadillac CTS	Ford Mustang	Pontiac Vibe
Cadillac CTW	Ford Taurus	Subaru Legacy
Cadillac DTS	Honda Accord	Saturn Aura**
Cadillac STS	Honda Civic**	Saturn Sky
Cadillac XLR	Honda Pilot	Saturn Vue*
Chevrolet Aveo	Hyundai Santa Fe	Toyota Avalon
Chevrolet Camaro	Hyundai Sonata	Toyota Camry**
Chevrolet Cobalt	Lexus RX 350 / 450H**	Toyota Corolla
Chevrolet Corvette	Lincoln MKS	Toyota Highlander**
Chevrolet Impala	Lincoln MKT	Toyota Matrix
Chevrolet Malibu**	Mitsubishi Galant	***Hybrid and Non Hybrid Models*

** Some versions of these models may have less than 10% aluminum based on selected options such as steel wheels and engine size*

Executive Summary

- There are over 50 vehicles that will be made in Europe in 2009 that will contain over 400 pounds of finished aluminum. The average aluminum weight in Europe, including Russia, is less than 260 pounds.

European Union 2009 Light Vehicles with Over 400 Pounds Aluminum Content* Based on Curb Weight		
Aston Martin DB9	Ferrari F599	Opel Signum
Aston Martin DBS	Ferrari F612	Porsche 911
Aston Martin Vantage	Jaguar XJ	Porsche Boxter
Audi A6	Jaguar XK	Porsche Cayanne
Audi A7	Lamborghini Gallardo	Porsche Panamera
Audi A8	Lamborghini Murcielago	Renault Espace
Audi R8	Land Rover Defender	Renault Vel Satis
Audi TT Coupe	Land Rover Discovery 3	Rolls Royce Drophead Coupe
Audi TT Roadster	Land Rover Range Rover	Rolls Royce Phantom
Bentley GT	Land Rover Range Rover Sport	Rolls Royce Sub Phantom
Bentley GTC	Maybach 57/62	Saab 9-3
BMW 5 Series	Mercedes Benz C-Class	Saab 9-5
BMW 6 Series	Mercedes Benz CLK	Volkswagen Phaeton
BMW 7 Series	Mercedes Benz E-Class	Volvo V70
BMW Z4	Mercedes Benz S-Class**	Volvo XC90
Citroen C6	Mercedes Benz SL	***Hybrid and Non Hybrid Models*
Ferrari F430	Opel Insignia	

** Some versions of these models may have less than 400 pounds of aluminum based on selected options such as steel wheels and engine size*

Executive Summary

- There are eighteen 2009 vehicles in Japan that will contain more than 400 pounds of finished aluminum. There are also thirteen smaller vehicles, shown in the second table, with high aluminum content. This content, however, does not quite add up to 400 pounds due to engine size.

Japan 2009 Light Vehicles with Over 400 Pounds of Aluminum Content* Based on Curb Weight	
Acura RL	Lexus LS**
Acura NSX	Lexus SC
Honda Legend	Nissan Cima
Infiniti EX35	Nissan Fuga
Infiniti FX45	Nissan Skyline
Infiniti G35	Toyota Crown Majesta
Infinity M35/45	Toyota Crown Royal
Infinity QX56	Toyota Prrius**
Lexus GS**	Toyota Soarer
*** Hybrid and Non Hybrid Models*	

Vehicles with Slightly Less than 400 lbs Based on Curb Weight
Daihatsu Copen
Honda Accord
Honda Civic**
Honda S2000
Lexus IS 250/350
Mazda Roadster
Mazda RX-8
Mitsubishi Lancer Evolution
Nissan GT-R
Nissan Fairlady Z
Nissan Fairlady Z Roadster
Nissan X-Trail
Subaru Legacy

** Some versions of these models may have less than 400 pounds of aluminum based on selected options such as steel wheels and engine size*

Executive Summary

Future Worldwide Aluminum Highlights

- Of the 17.95 billion pounds of 2009 light vehicle aluminum content, 14.5 billion pounds will be cast. Rolled products, primarily fin stock and brazing sheet, will be 2 billion pounds. Extruded products will be 1.15 billion pounds, and forgings, impacts and other products will be 300 million pounds. In developed countries, the mix will favor mill products going forward.
- Europe including Russia, North America and Japan will be 72% of the 2009 total. By 2020, these countries will only be 60% of the total. China will use more aluminum for light vehicles than Japan by 2020.
- By 2020, the expected aluminum content for light vehicles of 28 to 30 billion pounds will still be over 75% cast aluminum and secondary aluminum will continue to represent at least 50% of the total use, providing scrap is available.
- The necessary and in some cases mandated improvements in CO2 reduction and fuel economy in North America, Europe and Japan will come from a variety of vehicle and powertrain changes. The powertrain experts say that 50% of the improvements will have to come from weight reduction. Ducker maintains that weight reduction including segment shift will only contribute 25% of the improvement in fuel economy and CO2 reduction required by 2020. That means that aerodynamic improvements, low rolling resistance tires, non-powertrain friction reduction and a 42-volt electrical system will have to contribute the remaining 25% of the improvements required, providing powertrain can deliver the promised 50%.