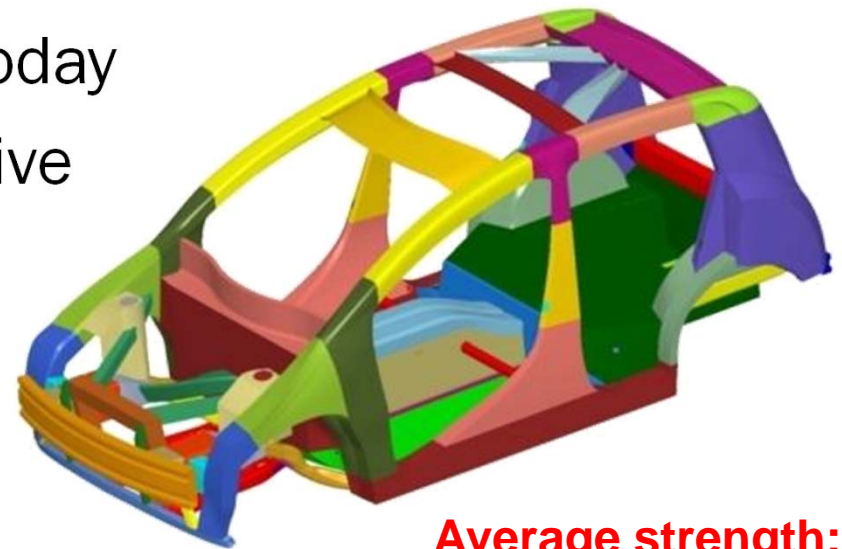


# Materials Competition in Automotive

- Important Considerations:
  - Materials competition driven by new fuel economy regulations leading to +/- 54.5 mpg in 2025
  - Meeting fuel economy requirements is not just a materials issue; engine, powertrain and other advances contribute more to fuel economy
  - Typical timetable from vehicle concept to production is five years

# Lightweighting Potential of AHSS - FutureSteelVehicle (May 2011)

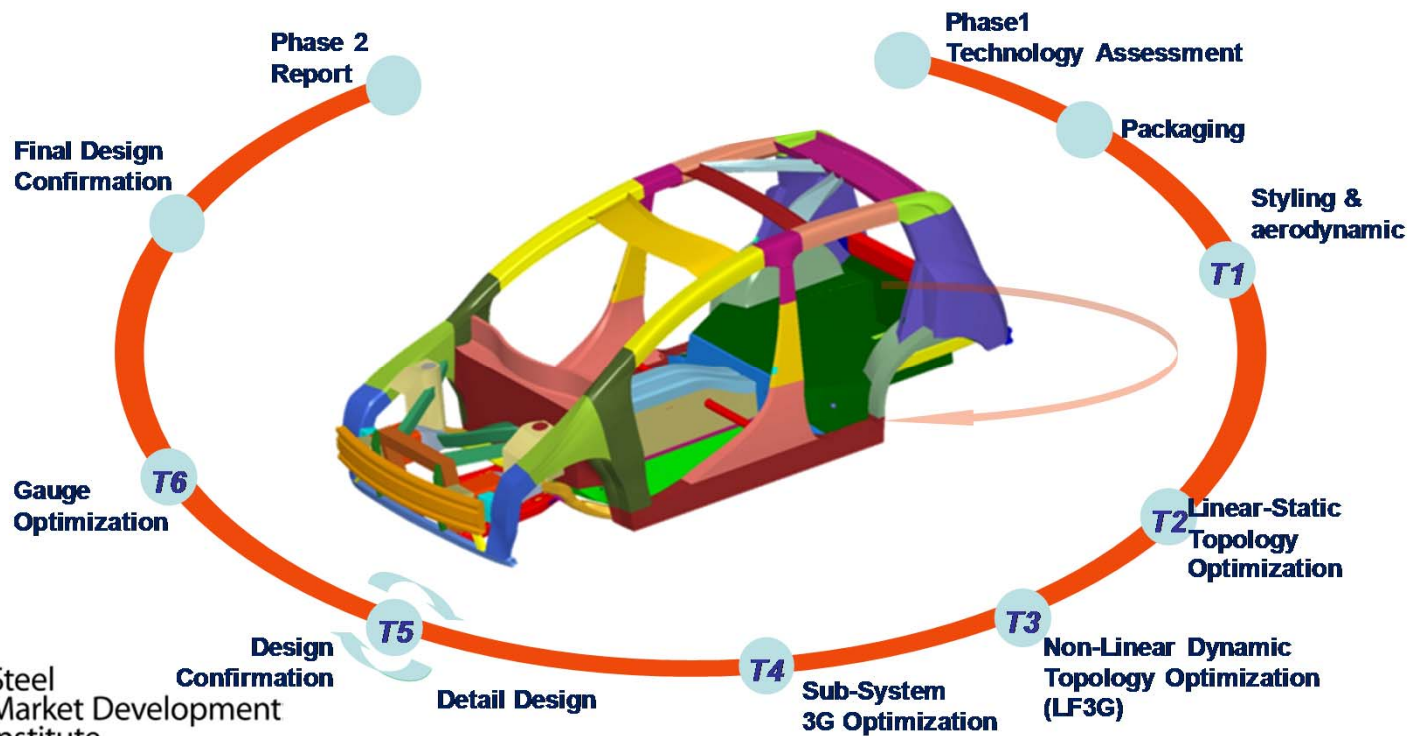
- Achieved a 29% weight reduction
  - A single point solution that was not constrained by real world styling, packaging, size and performance bandwidth, or future safety requirements (e.g., IIHS Narrow Overlap)
- With steel grades available today
- Equivalent weight to alternative materials achieved in suspension parts, at a cost savings



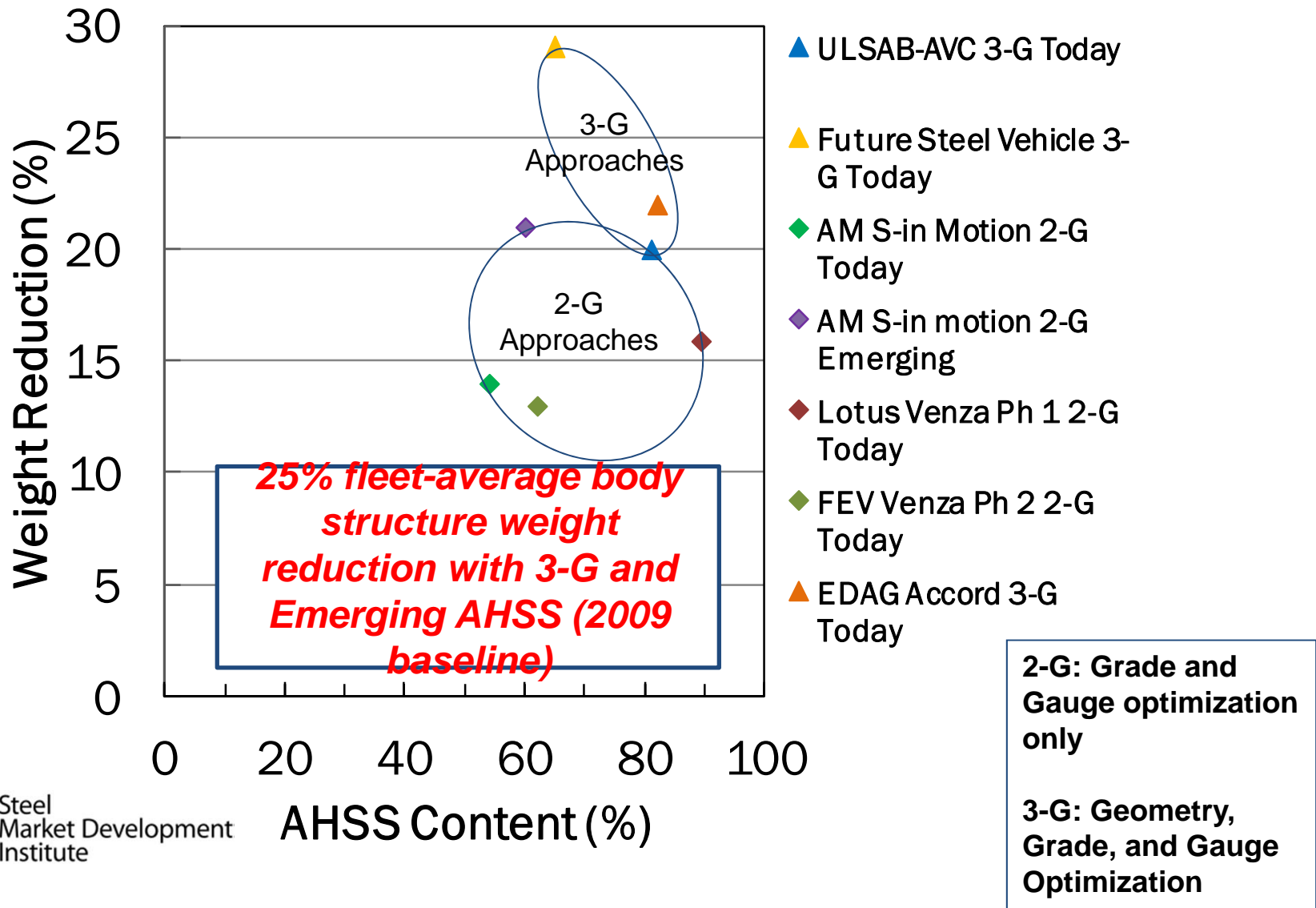
**Average strength:  
> 800 MPa**

# Lightweighting Potential of AHSS (May 2011)

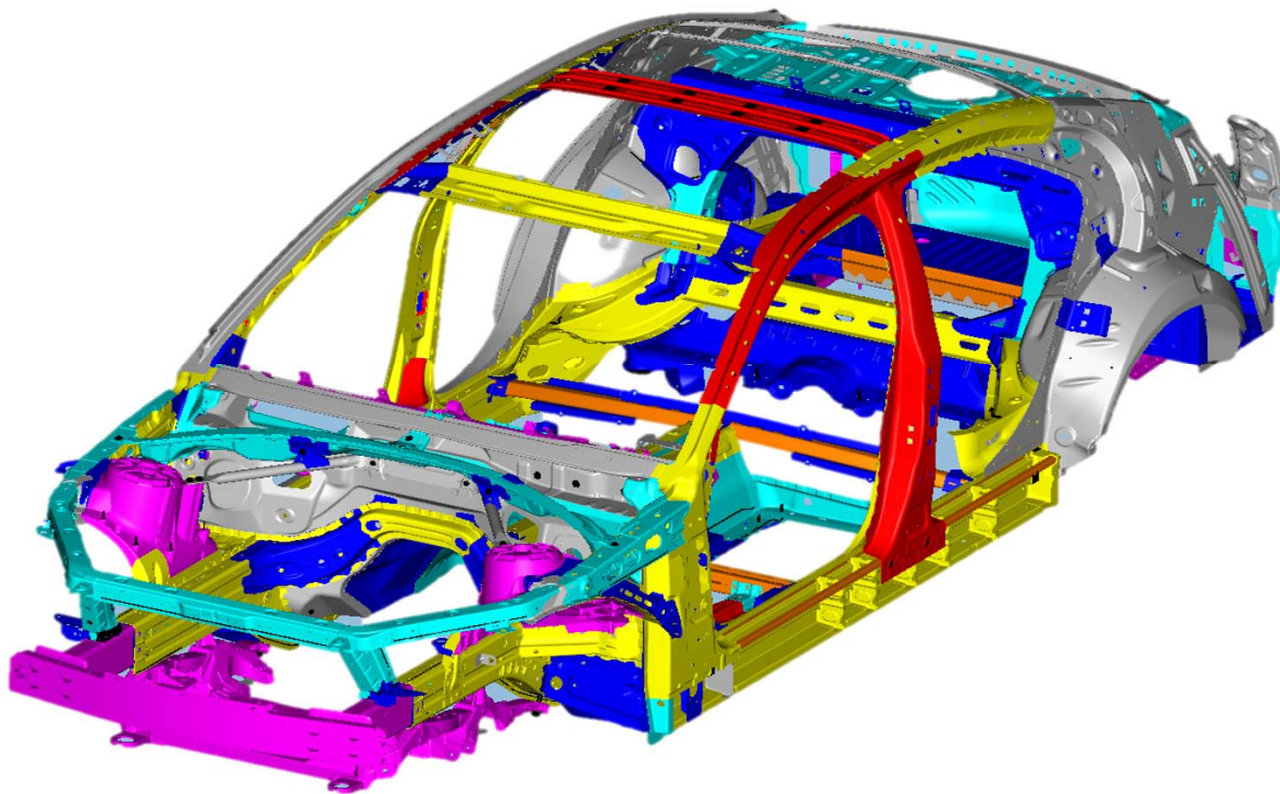
Maximum weight reduction is achieved when advanced materials are combined with efficient load path design considering **Gauge, Grade and Geometry**:



# Lightweighting Potential of AHSS



# 2013 Cadillac ATS Materials Selection



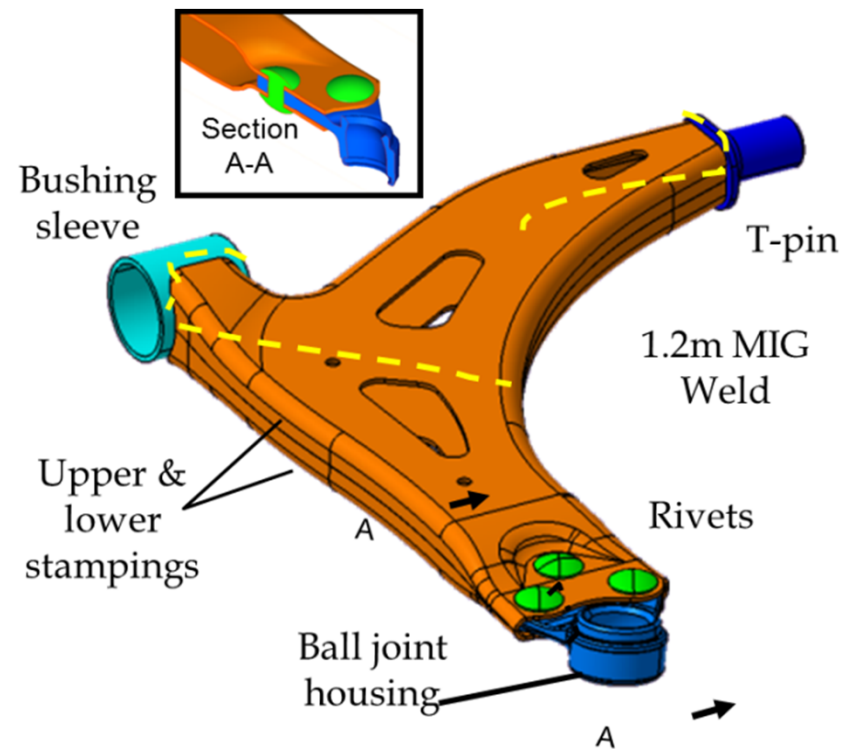
**Average strength:  
429 MPa**

Grey	Mild Steel
Cyan	Bake Hardenable
Blue	HSLA
Yellow	Dual-Phase/Multi-Phase
Orange	Martensitic
Red	Press Hardened Steel
Magenta	Aluminum

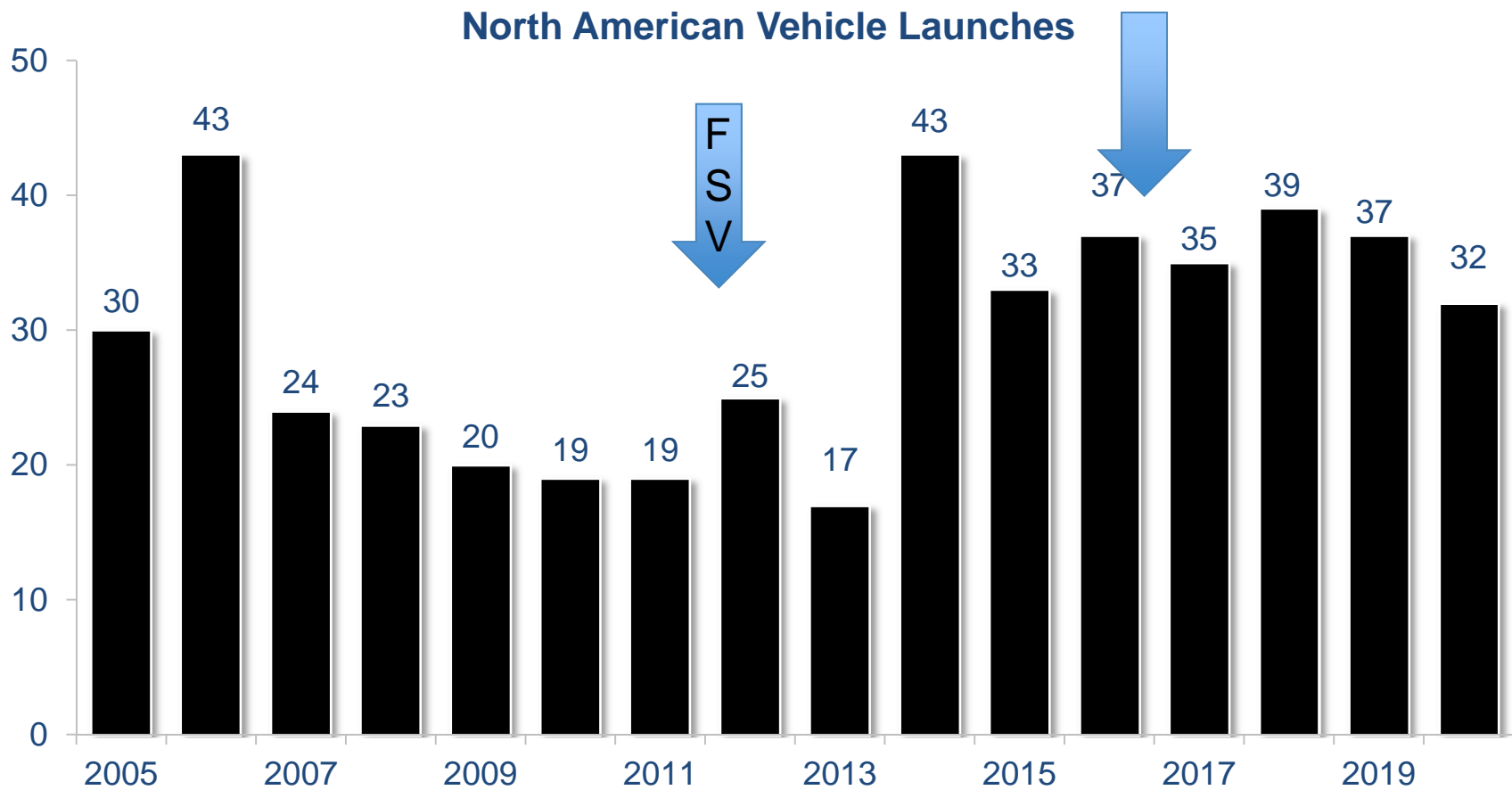
# Commercial 3G Example - Front Lower Control Arm

## AHSS design:

- Matches weight of aluminum baseline
- 34% lower cost at 250K vehicles/year
- Lower total Life Cycle greenhouse gas emissions than aluminum baseline
- Implemented by one OEM on a current vehicle

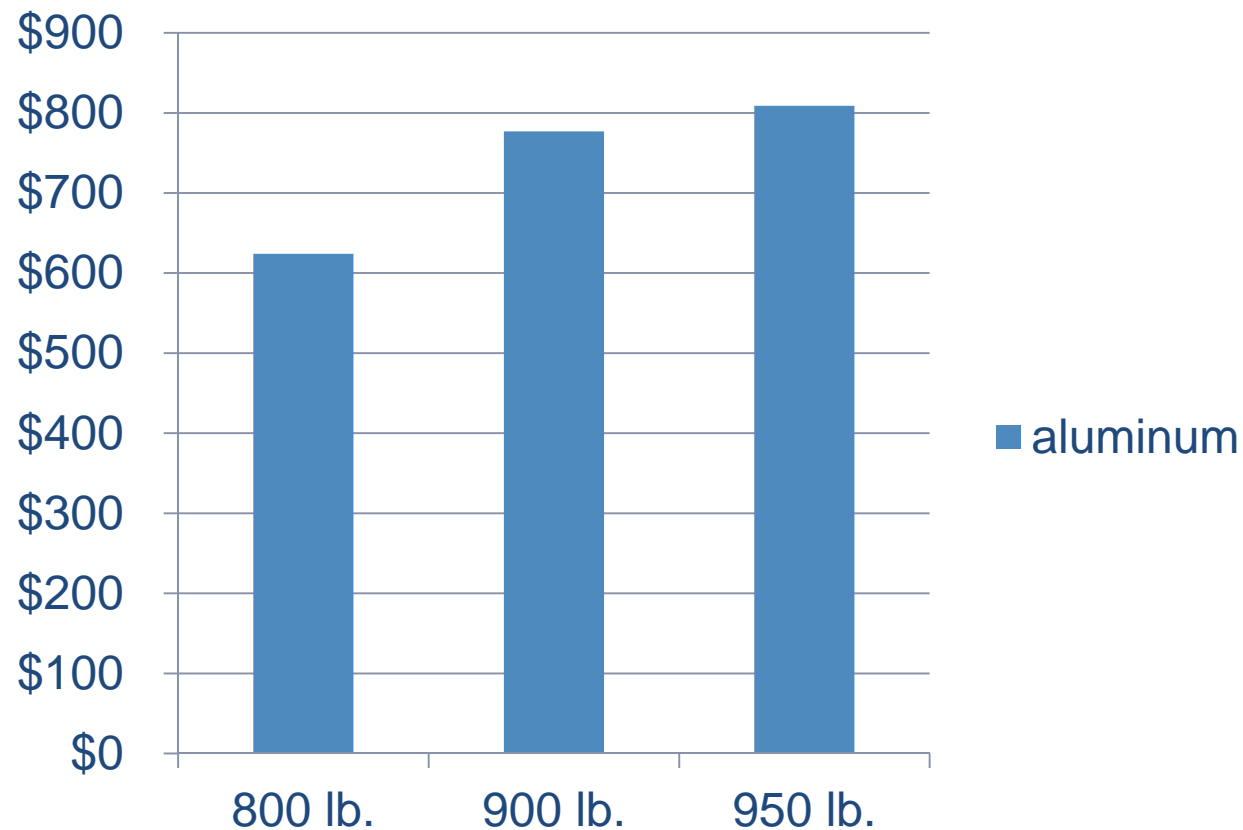


# Market Dynamics - Launch Activity Surges



# Cost Penalty for Aluminum Increases as Steel Closes the Lightweighting Gap

Est. Cost to Replace 1000 lbs. Steel with Aluminum\*



Amount of Al to replace 1000# steel

\*cost data from Future Steel Vehicle report



## Cost of Ownership Also Favors Steel

- In addition to the cost advantage steel affords carmakers...
- Purchasers of aluminum-intensive vehicles will spend more for insurance and repair

*Pittsburgh Tribune Review Estimates: March 23, 2014*

### Part Cost

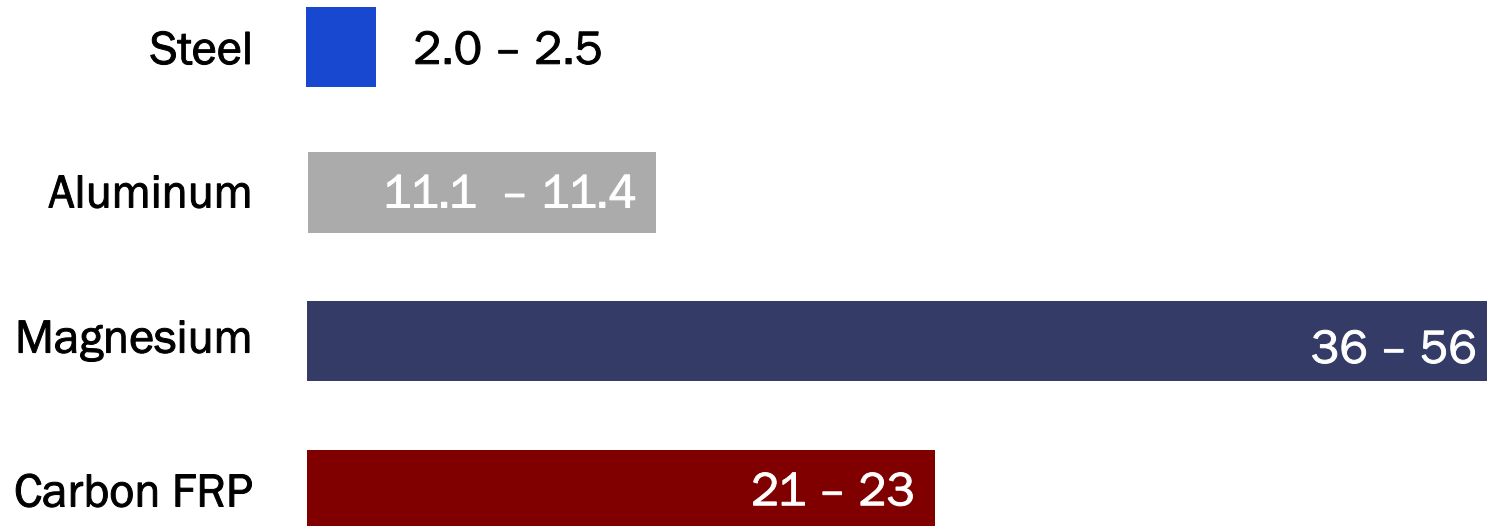
Part	Steel	Aluminum
Fender	\$208	\$ 510
Door	\$510	\$1036



Steel  
Market Development  
Institute

# Importance of Manufacturing GHG Emissions

Greenhouse Gas from Production (in kg CO<sub>2</sub>e/kg of material)



## Summary: The Business Case for Steel

- AHSS are growing, are only partially adopted and more are coming.
- AHSS have matched weight of aluminum parts in commercial applications at substantial cost savings.
- AHSS are the cost effective solution...and getting more cost effective as we get lighter.
  - Insurance and repair costs also lower with steel
- AHSS have environmental advantages vs competing materials.

For More Information

Visit: [www.smdisteel.org](http://www.smdisteel.org)

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A screenshot of the Steel Market Development Institute website. The page features a green header with the institute's logo and navigation tabs for "ABOUT SMDI", "AUTOMOTIVE", "CONSTRUCTION", "CONTAINER", and "SUSTAINABILITY". The main content area includes several articles and sections: "New Life Cycle Assessment Study Shows Replacing Wood Utility Poles with Steel Significantly Lowers Key Environmental Impacts", "Sustainability and Recycling" (highlighting SMDI's role in celebrating sustainability), "CAN IT! Reducing Food Waste with Steel Food Containers", and "Codes and Standards". A prominent section titled "North America's #1 Recycled Material" contains a table comparing the recycling of various materials. The "News" section lists several recent events and seminars. The footer includes a list of investors such as AKSteel, ArcelorMittal, EVRAZ, FLUOR, SSAB, Severstal, U.S. Steel, and Nucor.

Material	Tons
Steel	33,270,563
Paper	31,217,836
Aluminum	1,693,185
Glass	1,289,530
Plastic	972,312