Steel Developments for Automotive Lightweighting

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WorldAutoSteel

- Who we are, what we do
- Steel grades development, applications
- Industry accomplishments
- Lightweighting for future mobility

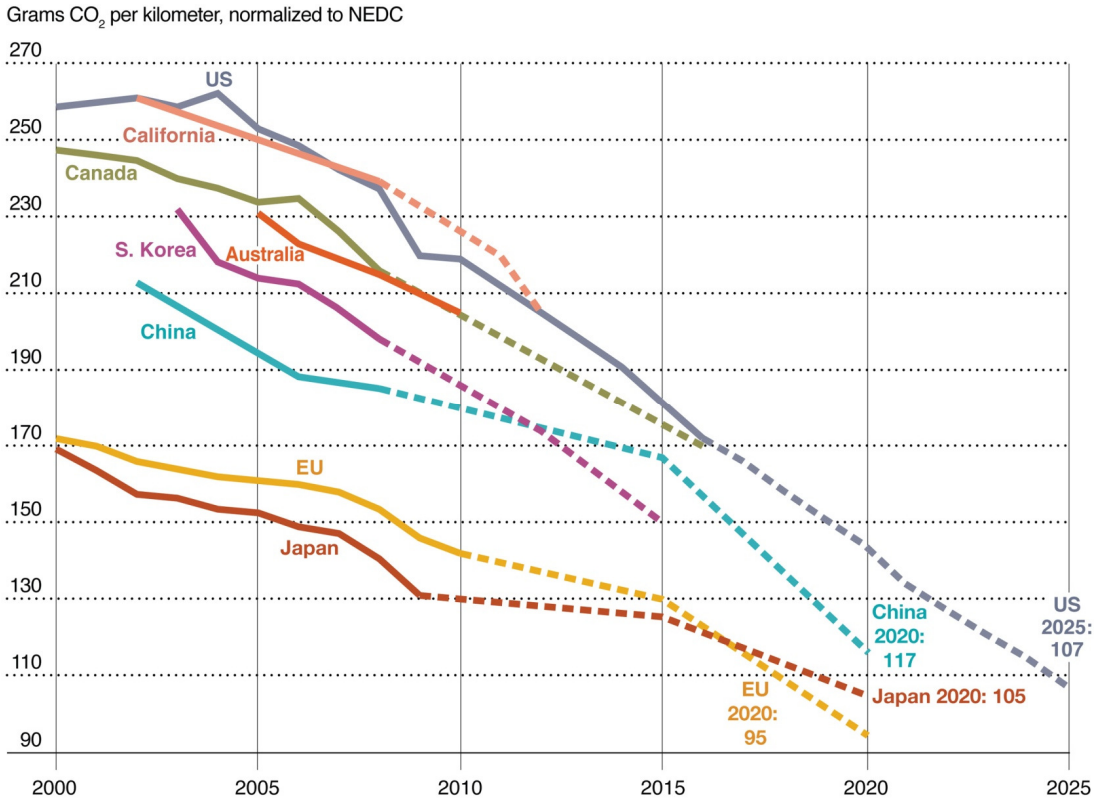
WorldAutoSteel

Automotive Group of the World Steel Association

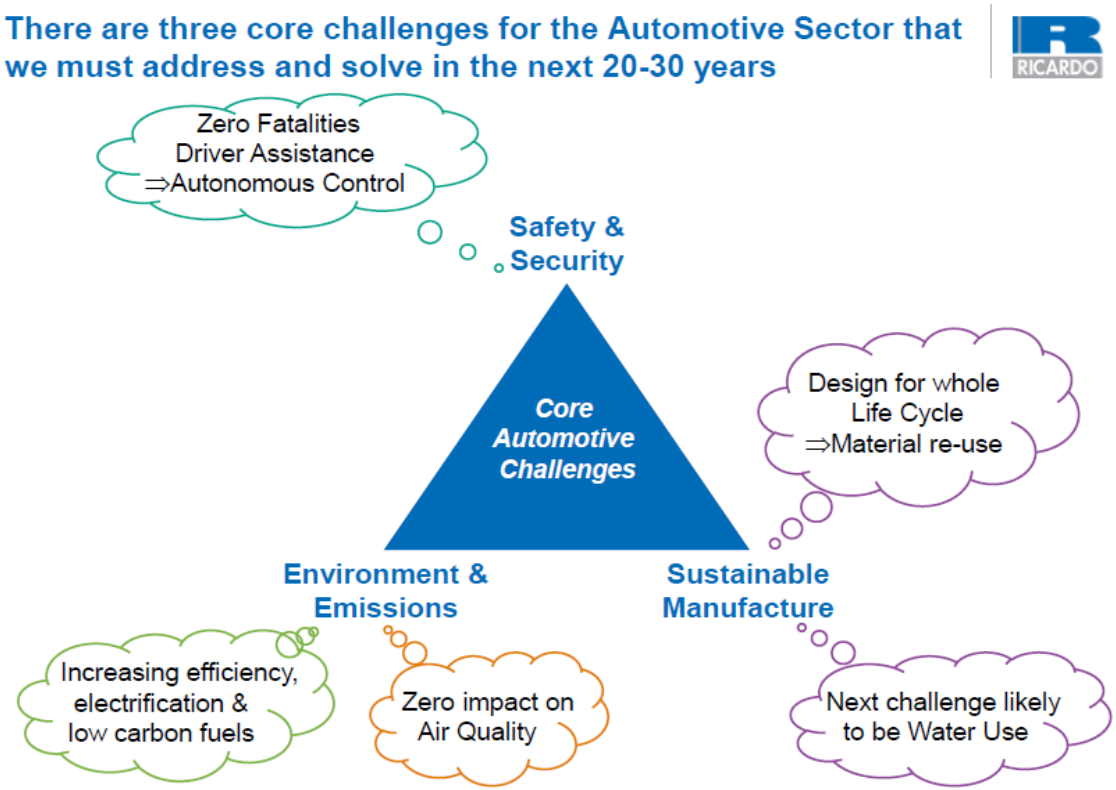
MEMBER COMPANIES:

- AK Steel
- Ansteel
- ArcelorMittal
- Baosteel
- China Steel
- Erdemir
- HBIS
- Hyundai Steel
- JFE
- JSW Steel
- Kobe
- Nippon Steel & Sumitomo
- Nucor
- POSCO
- Severstal
- SSAB
- Tata Steel
- Ternium
- ThyssenKrupp
- USIMINAS
- U. S. Steel
- voestalpine

Driving the industry: stringent regulation

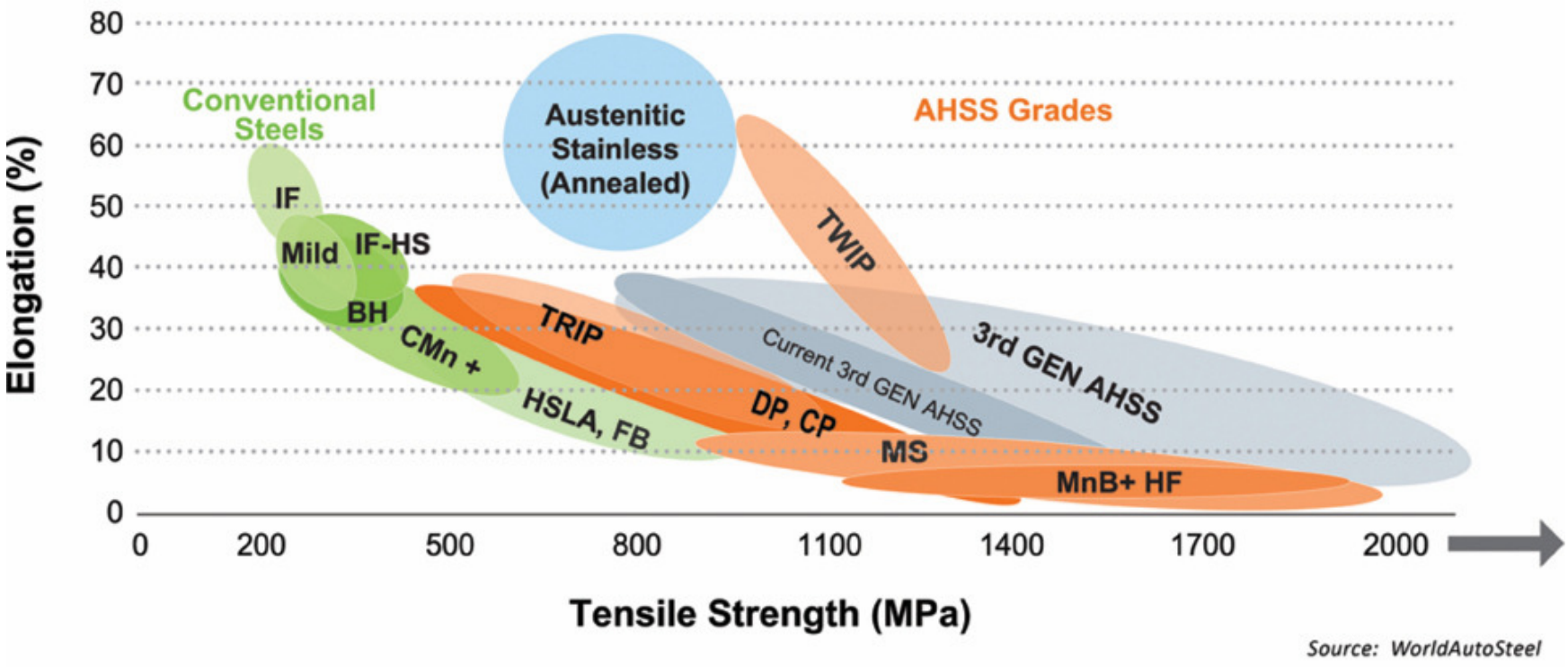


Ricardo – Future Vision

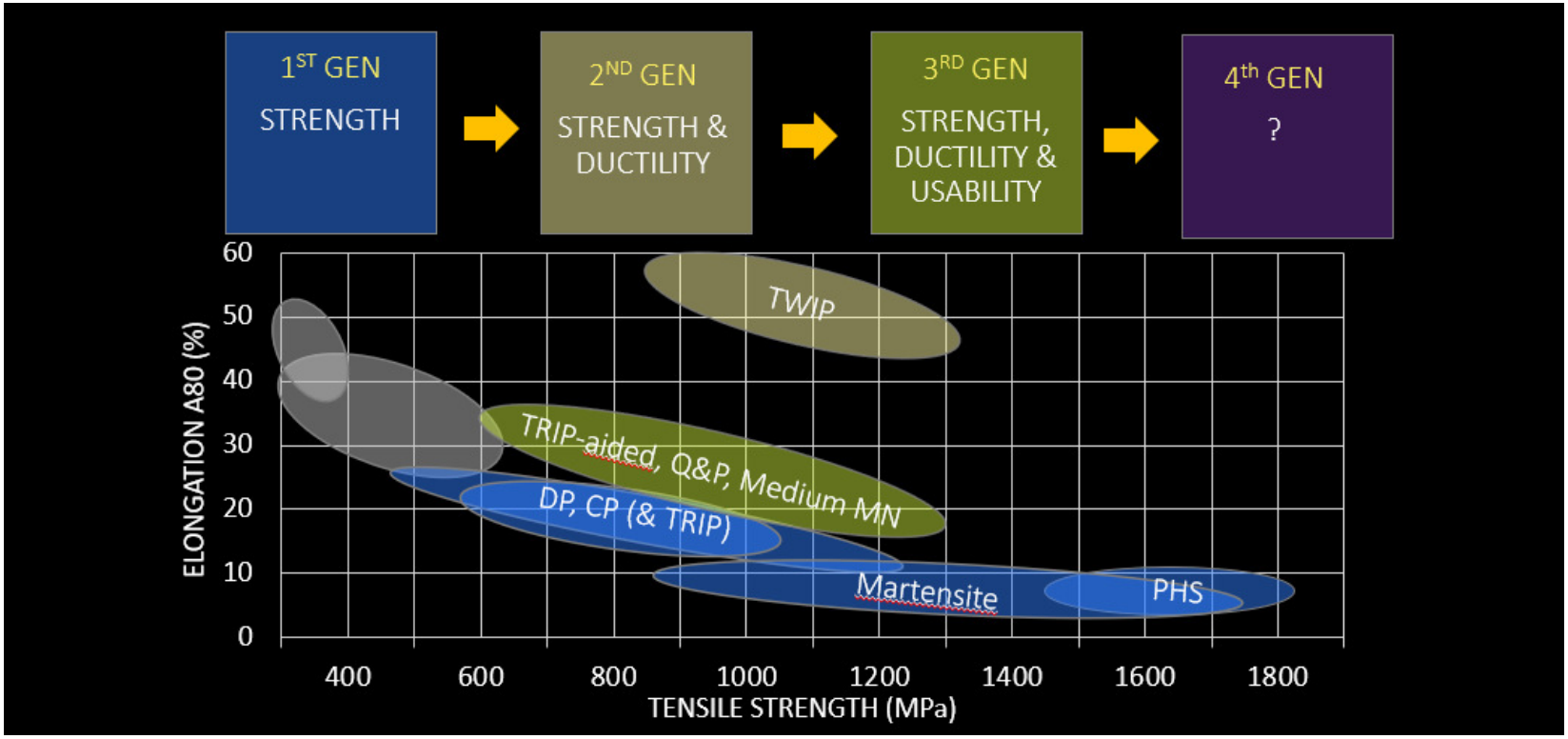


Source - Ricardo

The Steel Strength-Ductility Diagram



Evolution of Advanced High Strength Steels



CP800 High Energy Absorption

CP800 HE
High strength level with good crashability

- CP800 HE is within specifications of CP800 grade but with improved crash properties

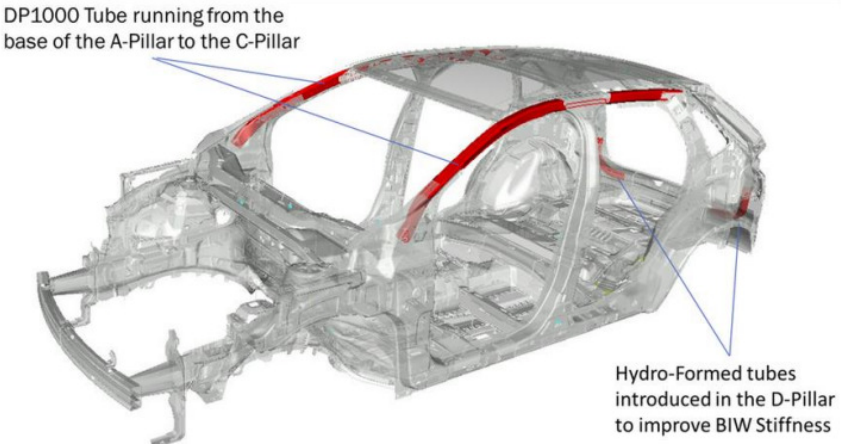
Product		Yield Strength Rp [MPa]	Tensile Strength Rm [MPa]	Min. A80
CP800HE+GI	Typical	656	890	14
CR570Y780T-CP	VDA239	570-720	780-920	10

➔ **The improved crash-ability of CP800HE creates the opportunity for weight saving compared to DP800 for crash structures**

Advanced Fabrication Methods

There are many advanced fabrication methods that enable successful and efficient conversion of AHSS into various components and geometries. These include:

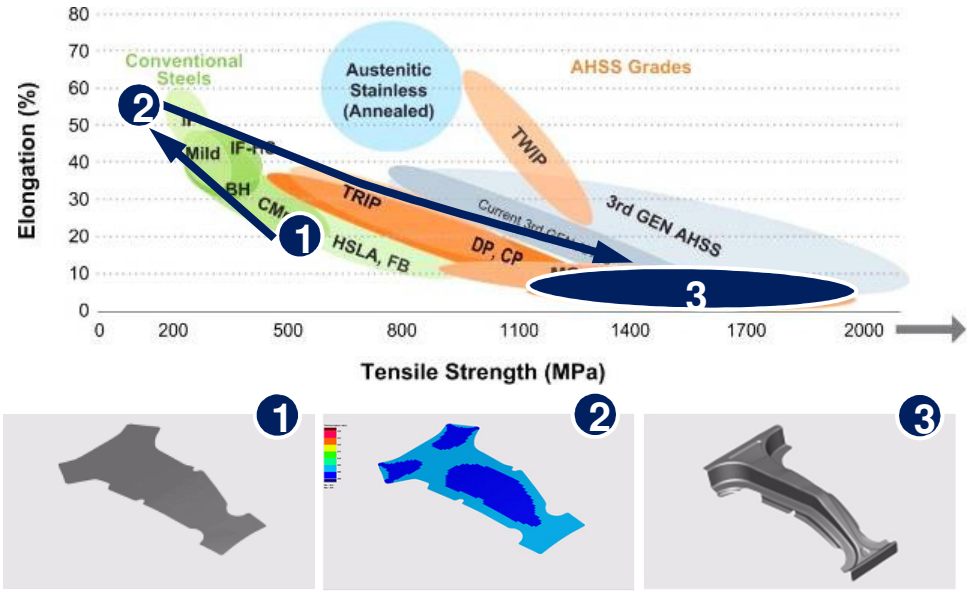
- Hot Forming
- Roll Forming
- Tube hydroforming
- Tailor welded blanks
- Tailor welded coils
- Tailor rolled coils
- And more. . .



Hot Formed Steels

Benefits of Hot Forming:

- Springback issues eliminated, remarkable considering the extreme final part strength.
- Very high strength resists stamping distortion.
- Hot-forming has the highest potential for weight reduction of crash components.
- Controlling the temperature in various locations of the forming die can create zones with different strength levels in the final stamping.

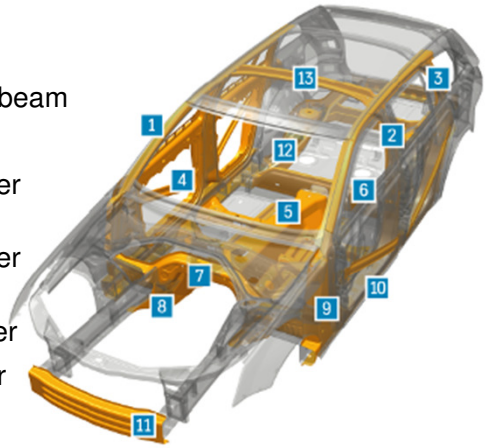


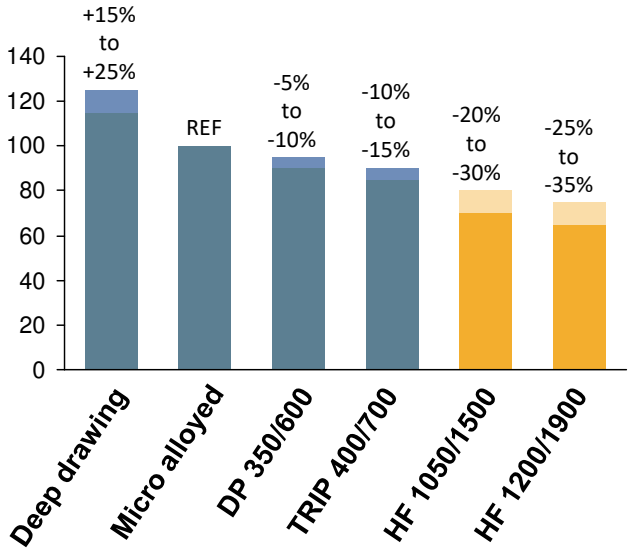
Structural Elements of Passenger Compartment

Lightweight solutions by using hot formed components

- For safety critical parts, maintaining a passenger survival space in crash

1. A-pillar upper
2. B-pillar
3. C-pillar
4. Side impact beam
5. Tunnel
6. Crossmember rear seat
7. Crossmember firewall
8. Long member
9. A-pillar lower
10. Sill
11. Bumper
12. Long member rear
13. Crossmember roof





Chevy Cruz Redesign at GM/Opel Europe

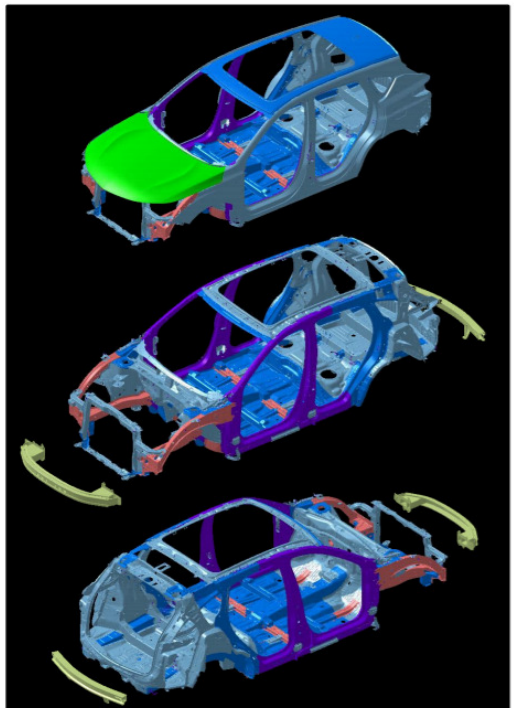
2018 Honda Accord, ACE™ Body Structure

"Highest UHSS Content" to Date in any Honda Vehicle

- 29% UHSS
- 54.2% High-Strength Steel (above 400 MPa)
- 80 kg lighter than its predecessor
- Improved crash energy absorption
- Body torsional and bending rigidity are improved 32 and 24 percent, respectively
- ***Named 2018 Car of the Year***

2019 Acura RDX

Advanced Material Application



50% increase in ultra high strength material

Contributes to 19kg weight-down

- **56**% of whitebody is some form of High Strength Steel
- **26**% of whitebody is Advanced High Strength Steel or higher

NHTSA NCAP 5 STAR

NHTSA

5-Star Safety Ratings

More Stars. Safer Cars.

OVERALL

56%

High Strength Steel

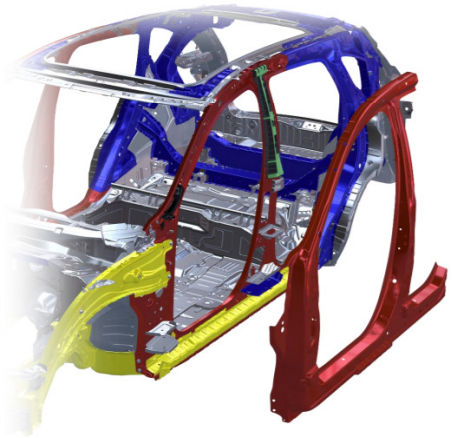
Aluminum Extrusions 6xxx	1.4%	Press Hardened Steel	15.0%
Aluminum Sheet 6xxx	1.4%	Advanced High Strength Steel	11.0%
Aluminum Sheet 5xxx	1.2%	High Strength Steel	30.0%
		Low Strength Steel	40.0%

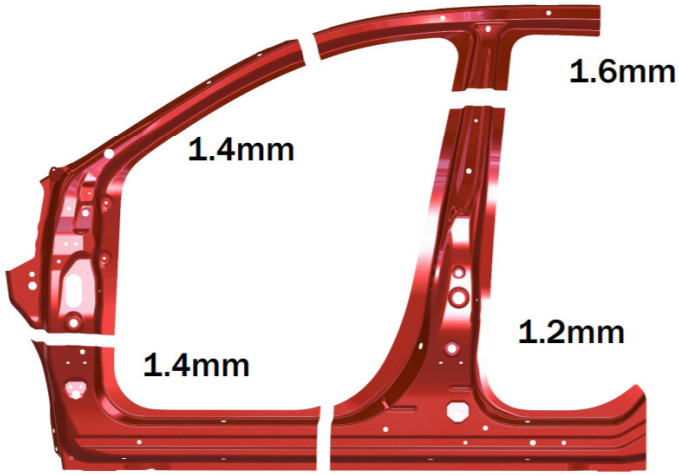
2019 Acura RDX – Hot Stamped Door Ring Concept

Outer Ring

Tailor welding enables thickness optimization around the ring

Maximizes performance & material utilization





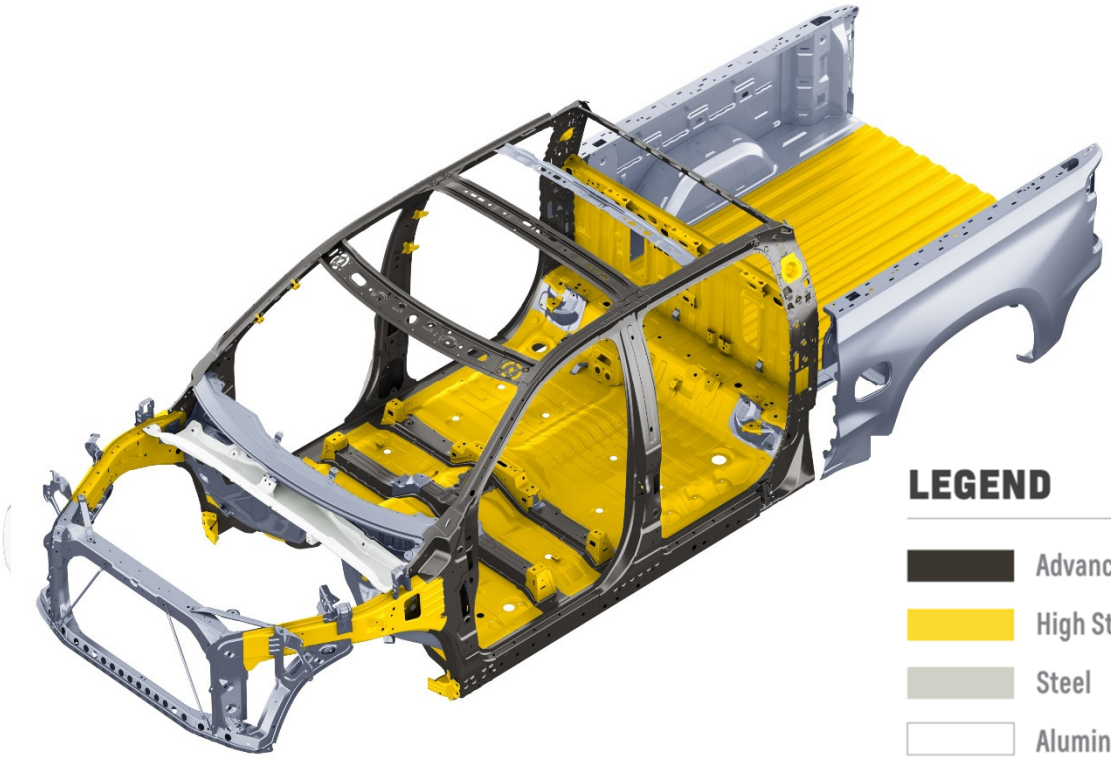
Inner and Outer Tailor-Welded Door Rings

- **~20% mass reduction**
- **Thickness reduction plus improved crash performance**
- **Similar cost**

2020 Ford Escape

- BIW materials targeted efficient strength-to-weight ratios, while maintaining affordability. Heavy usage of HSS and UHSS materials resulted in weight savings despite growth in body structure size.
- Closure panels followed industry trend for additional weight savings: hood is aluminum, whereas doors and other closure materials are ultra-thin gage AHSS for strength, rigidity.

Truck Trends – 2019 Chevy Silverado



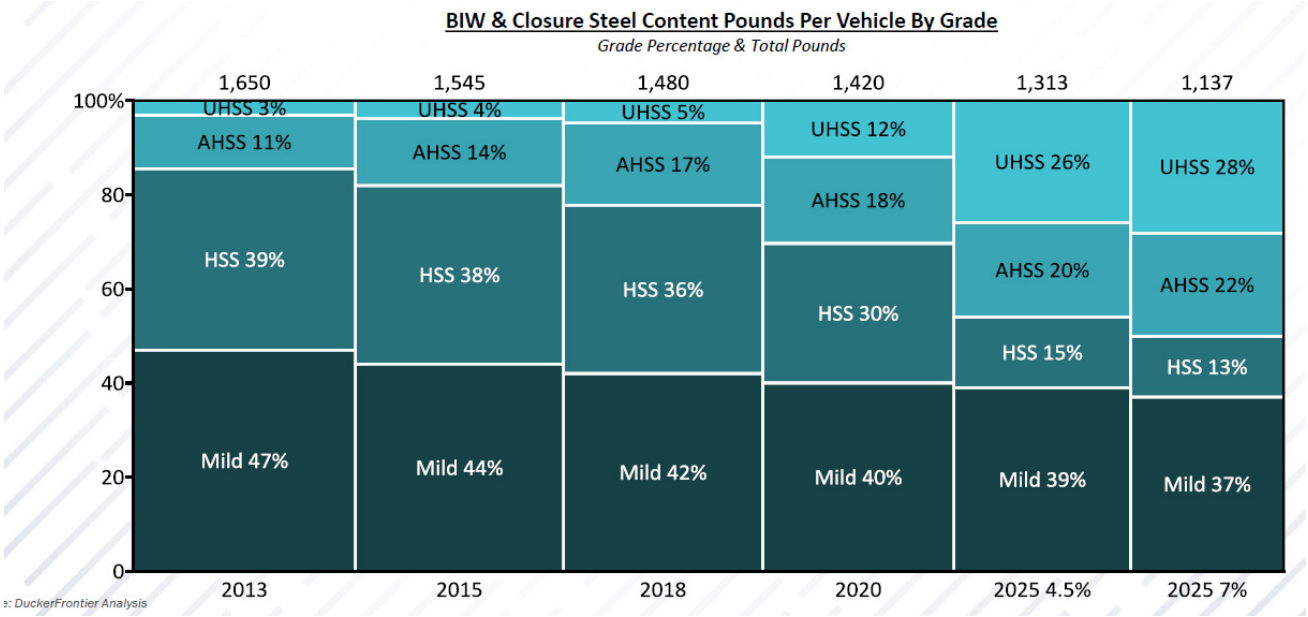
- 204 kg lighter
- Mixed Materials
- 80% HSS Frame
- 10% increase in torsional rigidity
- Best in class cargo volume (20%+ than competitor)

Ducker Worldwide; 2018 Study

Results reported May 15
at GDIS conference

Steel Grade Mix

- Net steel content for BIW and closures will see declines; however, AHSS, UHSS and 3rd Gen AHSS materials will grow at a tremendous pace.



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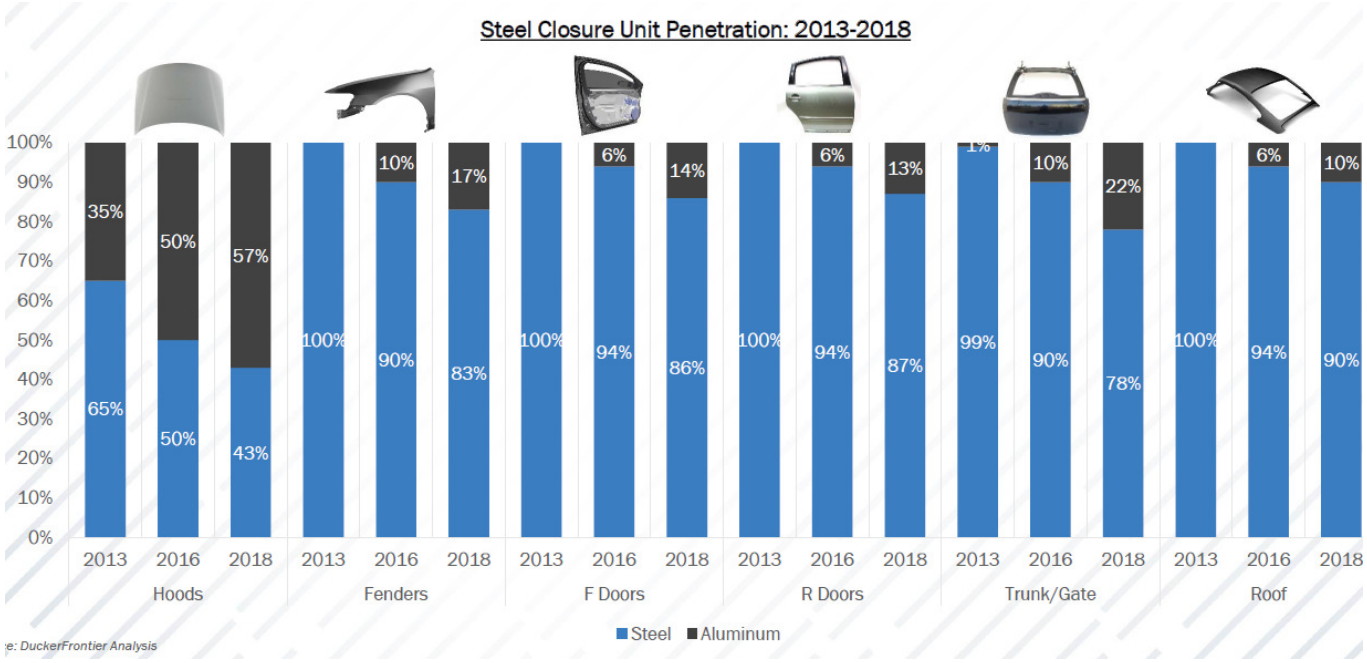
Steel Component Penetration - Closures

- Besides hoods, the remaining closure components remain primarily steel. . .

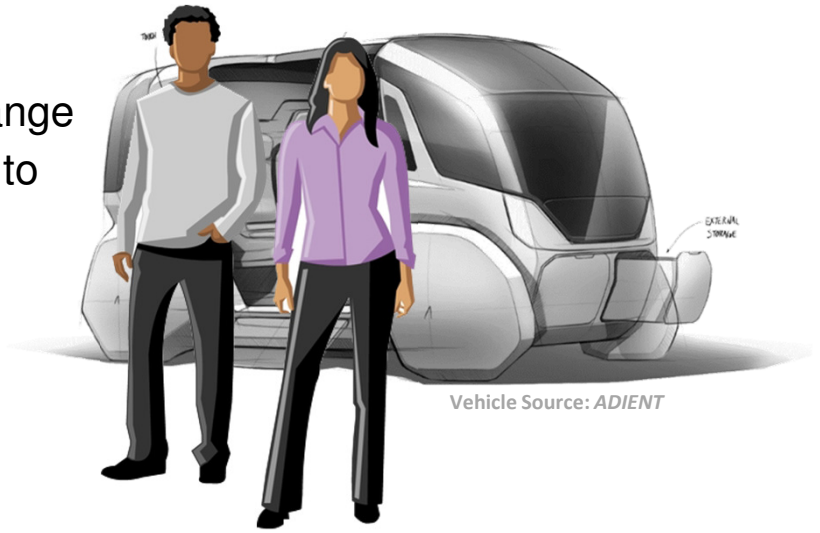


Global megatrends affect efficiency, safety and automatization strategies

1. CO_2 reduction policies escalating
2. Urbanization creates traffic congestion, limited parking, & local pollution
3. Culture shifts – digitalization and ecological awareness, pay per use

Value proposition:
What steel means to the mobility service provider

- Highly durable body and chassis structures that enable efficient, long-term movement of people and things.
- Affordable body and chassis solutions that free significant funds for added batteries to increase range between charges and/or user-facing technologies to enhance the ride experience.
- Lowest total cost of ownership.
- Good environmental performance:
  - Sustainable solutions
  - Reusable, recyclable



Summary – Expected AHSS Growth

- Steel continues to bring great value – from infrastructure, performance, cost and environmental perspectives.
- 3rd Generation AHSS
  - Attractive combination of strength and ductility
  - Potential to replace more expensive solutions
  - Complement to existing AHSS
- 1st Generation AHSS (not disappearing)
  - Optimized over decades, very robust, reliable and cost-effective
  - Still further development potential

Thank you for your attention.

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