CURRENT AND FUTURE MOBILITY DRIVEN BY STEEL

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Role of Steel in Current Mobility

Steel: The Material of Choice
The broad spectrum of steel grades enables automotive designers to develop mass and cost efficient solutions capable of meeting or exceeding; safety, durability and other performance requirements.
Steel remains the material of choice; accounting for over 50% of automotive content
  - The 2018 North American light vehicle is estimated to have an average of ~1,480 pounds of flat rolled steel
AHSS continues its growth trajectory with approximately 258 pounds per vehicle in 2018, surpassing our estimates in 2013 by ~4 pounds per vehicle
AHSS use in North American produced light vehicles expected to grow significantly to 570 pounds by 2025
In 2018, flat rolled steel accounts for 70%+ of all closures, 55% of all hoods, 50% of all bumpers
Domestic OEMs, Ford, FCA and General Motors, have increased their utilization of AHSS, while BMW and Honda are the AHSS/UHSS leaders for non-domestic OEMs
  - The Silverado for 2019 will include higher strength steels for the frame and BIW, increasing the share of AHSS and UHSS by ~5%
  - The redesigned Honda Civic added applications for UHSS accounting for ~26% of the BIW, replacing some mild and AHSS applications

Steel remains the material of choice

2013 Material Share of Curb Weight
- Steel: 55%
- Aluminum: 9%
- Other Metals: 3%
- Conventional SMC/Fiberglass: 2%
- Glass: 7%
- Iron: <1%
- Magnesium: <1%
- Polymers: <1%
- CFRP SCM >1.25G: <1%
- Other Materials, Rubber, Fluids, Etc.: <1%

2015 Material Share of Curb Weight
- Steel: 55%
- Aluminum: 7%
- Other Metals: 4%
- Conventional SMC/Fiberglass: 9%
- Glass: 10%
- Iron: <1%
- Magnesium: <1%
- Polymers: <1%
- CFRP SCM >1.25G: <1%
- Other Materials, Rubber, Fluids, Etc.: <1%

2018 Material Share of Curb Weight
- Steel: 54%
- Aluminum: 8%
- Other Metals: 4%
- Conventional SMC/Fiberglass: 9%
- Glass: 12%
- Iron: <1%
- Magnesium: <1%
- Polymers: <1%
- CFRP SCM >1.25G: <1%
- Other Materials, Rubber, Fluids, Etc.: <1%
The 2018 AHSS and UHSS use in North American produced light vehicles is 329 pounds per vehicle, a significant increase from 2013, translating to an additional 90 pounds or a 38% growth from 2013.

Applications of AHSS and UHSS (PH & Gen 3 Steels)

3rd Gen AHSS Applications Replacing HSS & HSLA

3rd Gen AHSS Applications Augmenting PHS/AHSS

2020+ NA LV Steel Content - Material Mix

- The 2015 AHSS use in North American produced light vehicles is 279 pounds and expected to grow significantly to 570 pounds by 2025.

Future Mobility

- A gradual shift in transportation sector towards more efficient and affordable vehicle sharing
- Will not exclude individual ownership as part of the bigger picture
- A catalyst for significant innovations within the automotive industry
- An opportunity to better the quality of life through enhanced mobility and reduced congestion and pollution

Broad Interactions

ACES Vehicles

- Manufacturing Systems
- Societal Influence
- Energy Infrastructure
- Regulatory
- Communications Infrastructure
- Automotive Manufacturers
- Product Development
- Vehicle Ownership
- Components
- Design
- Supply Base
ACES Influence on Vehicle Development

- Manufacturing Systems
- Product Development
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- Design
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ACES Vehicles
Role of Steel in Future Mobility

Development Challenges

1. New crash energy management strategies and restraint system designs
2. Mass efficient and cost-effective design solutions
3. Increased durability requirements and component fatigue life targets
Role of Steel in Future Mobility

Steel: The Material of Choice
The broad spectrum of steel grades enables automotive designers to develop mass and cost efficient solutions capable of meeting or exceeding:

- The future crash and occupant protection requirements
- The increased durability and fatigue targets
Role of Steel in Future Mobility

Steel: The Material of Choice

Innovations in steel forming technologies such as tubular and sheet hydroforming, roll-forming, hot stamping, etc., as well as advancements in steel, and mixed material, joining technologies enable:

- More architectural creativity and freedom to address future integration and design challenges with superior structural performance
- Flexible modular architectures to accommodate different configurations, needs and uses
- Scalable production volumes
Role of Steel in Future Mobility

The steel industry has a long history of successfully partnering with global automakers to develop highly optimized, cost effective and mass efficient solutions to address:

- Stringent crash energy management and occupant protection requirements,
- Vehicle lightweighting for improved fuel economy and reduced tailpipe emissions

The resulting steel executions provided automotive partners with exceptional performance at an affordable cost.

FUTURE MOBILITY WILL BE NO EXCEPTION
Steel: The Material of Choice

<table>
<thead>
<tr>
<th>Material</th>
<th>kg CO₂e / kg</th>
<th>Estimated Part Weight (kg)</th>
<th>kg CO₂e</th>
<th>Current Average Greenhouse Gas Emissions North America Primary Production</th>
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<tr>
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Material Production GHG Emissions for Common Body Structure and Closure
Materials Accounting for Estimated Part Mass Reduction

Thank You / For More Information

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