GREAT DESIGNS IN STEEL

ROLE OF STEEL IN FUTURE MOBILITY

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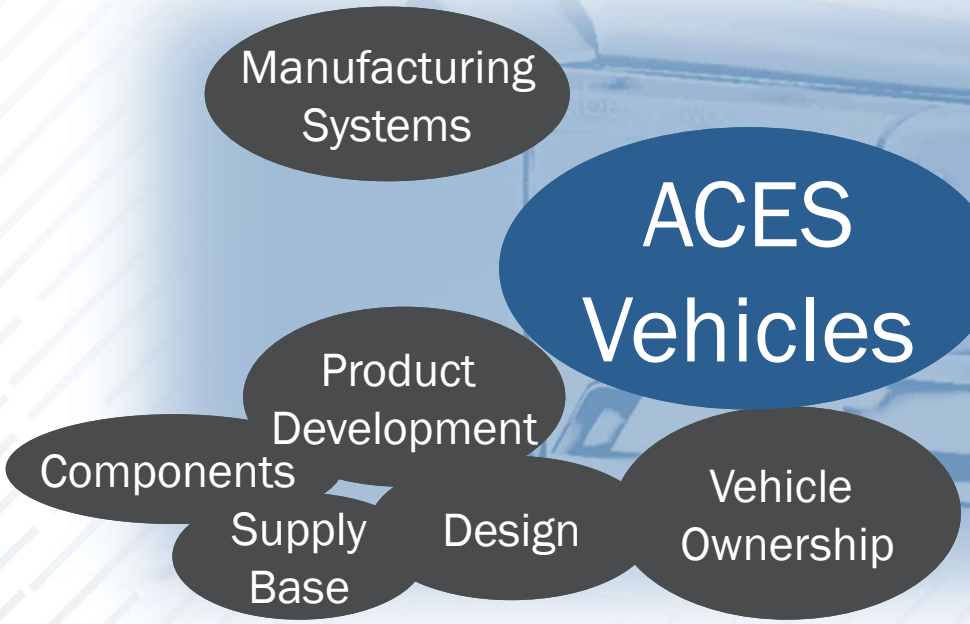
Future Mobility

- A gradual shift in transportation sector towards more efficient and affordable vehicle sharing
- Will not exclude individual ownership as part of the
- Autonomous, Connected, Electric, and Shared Vehicles *(ACES)*** automotive industry
- An opportunity to better the quality of life through enhanced mobility and reduced congestion and pollution

*** "The Great Divide: What Consumers Are Buying vs. The Investments Automakers & Suppliers Are Making in Future Technologies, Products & Business Models", Carla Bailo et al, Center for Automotive Research (CAR), February 2018*

Broad Interactions

ACES Influence on Vehicle Development



Ownership Model Evolution

Ownership

GDIS

Current

- Individual owners/Drivers
- Safety/Reliability
- Aesthetics/Technology
- Vehicles operate a fraction of the day

Future

- Mobility providers/Fleet operators
- Safety/Reliability
- Pleasant interior/Comfortable ride
- Vehicles operate almost all day

Design and Development

Design

Current

- Safety and occupant protection
- Durability and reliability
- Expressive exteriors/Crafted interiors
- Mass and cost efficiency

Future

- Safety and occupant protection
- Durability and reliability
- Economical to operate
- Ride experience

Manufacturing Systems

Manufacturing

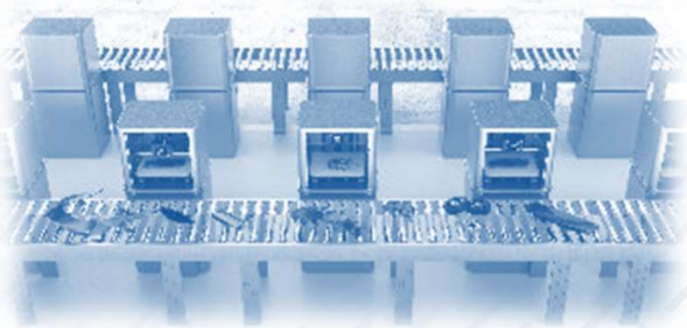
GDIS

Current

- Dominated by high volume processes
- Established with incremental improvements
- Integrated supply base
- Capital intensive

Future

- More low volume processes
- Additive manufacturing
- Increased supplier integration
- Modular assembly



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:

- Stri
  pro
- Vehicle lightweighting for improved fuel economy and reduced tailpipe emissions

FUTURE MOBILITY WILL BE NO EXCEPTION

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

Role of Steel in Future Mobility

GDIS

Development Challenges

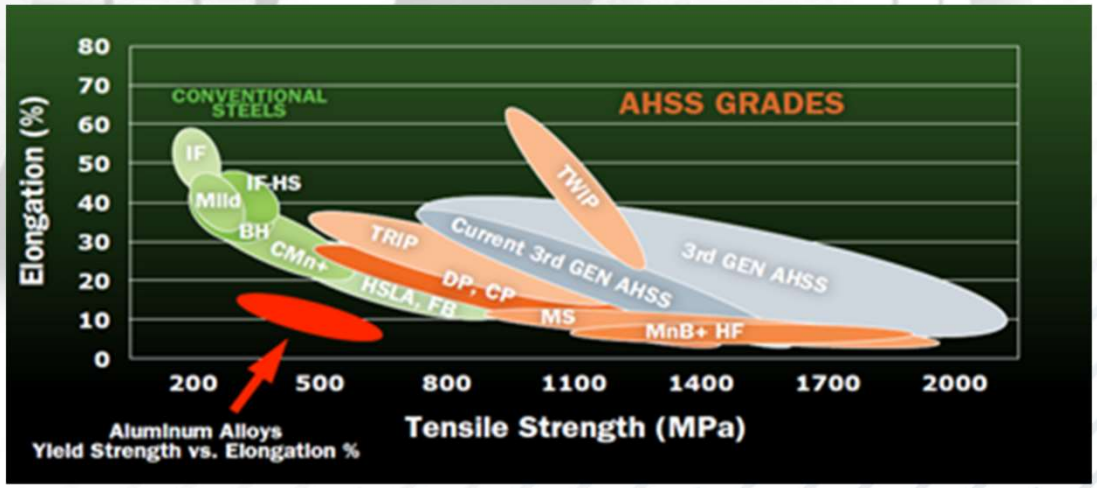
- New crash energy management strategies and restraint system designs
- Mass efficient and cost-effective design solutions
- Increased durability requirements and component fatigue life targets

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

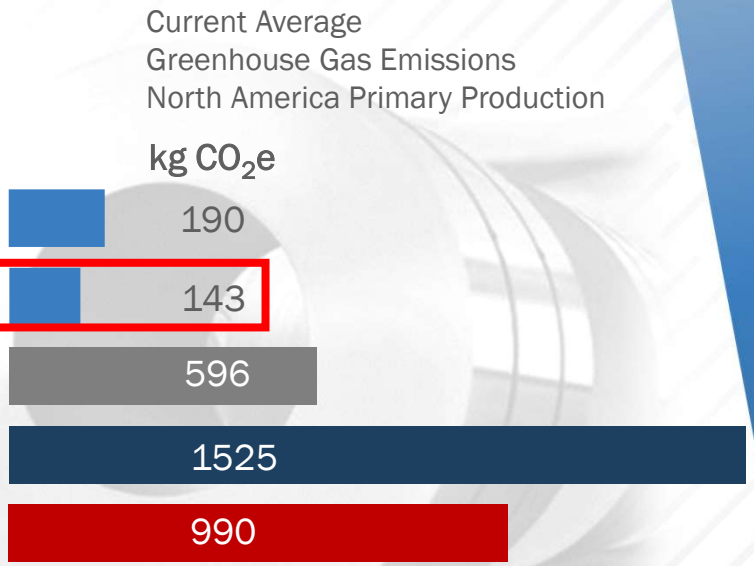
Innovations in steel forming technologies such hydroforming, roll-forming, hot stamping, etc., as well as advancements in steel, and mixed material, joining technologies enable:

- 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

Steel: The Material of Choice

	kg CO_2e / kg	Estimated Part Weight (kg)
Mild Steel	1.9	100
AHSS	1.9	75
Aluminum	8.9	67
Magnesium	30.5	50
CFRP	22	45



Material Production GHG Emissions for Common Body Structure and Closure Materials Accounting for Estimated Part Mass Reduction

St Source: SMDI, "The Importance of the Production Phase in Vehicle Life Cycle GHG Emissions," Southfield, MI, USA, 1 Mar 2016
Al Source: The Al Assoc. "The Environmental Footprint of Semi-Finished Aluminum Products in North America: A Life Cycle Assessment Report." Dec. 2013
Mg & CFRP Source: Geyer, Roland University of California Santa Barbara, "Automotive Materials Greenhouse Gas Comparison Model", V4.0 Oct. 2013

THANK YOU

GREAT DESIGNS IN STEEL

Presentations will be available for download on SMDI's website on Wednesday, May 22