America Iron and Steel Institute - SMDI
Light Vehicle Steel Content

Executive Summary

March 2011
AGENDA

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- EXECUTIVE SUMMARY
INTRODUCTION AND METHODOLOGY

**Study Background**
- Ducker Worldwide has been a research partner to the American Iron and Steel Institute’s SMDI for several years, providing in-depth market based research on OEM utilization and trends of various grades of steel.
- In the latest iteration of the study and based on market needs, Ducker has been engaged to provide a report regarding steel usage trends on specific high volume vehicles while also providing a “big picture” of automotive flat rolled steel shipments.

**Study Objectives**
- Conduct a “big picture” look at the shipments of all flat rolled steel being used in the North America light vehicle production.
  - Understanding what the current automotive landscape looks like versus tomorrow.
  - Applications of flat rolled steel in light vehicles.
  - Future of advanced high strength steel content and impact of CAFÉ regulations.
- Provide a detailed look at the various grades and types of steels utilized in select, high volume 2011 MY light vehicles.
  - Original vehicle list selected by member steel companies have been expanded to include other “higher than average” advanced steel materials as identified by the OEMs.
INTRODUCTION AND METHODOLOGY

Methodology

Successful program outcome relies on a multifaceted approach of information gathering

Program Approach

- Mining of existing Ducker Worldwide knowledge and data to establish baseline of information
- Targeted secondary research scans with public and private sources to develop bulk of assumptions
- Primary research with key OEMS, AISI members, suppliers, and regulatory agencies

Program Limitations

- Data included in this report should be considered “point in time” in nature and as such, information herein can change with the dynamics of the market
- In instances where limited data is available, reasonable estimations and assumptions are included, particularly specific part weights
- Member feedback was a critical component in assembling many of the Phase I objectives and deliverables – the accuracy of the data provided is believed to be correct at the time of analysis

Vehicle OEMs

Secondary Sources & Internal Databases

2011 SMDI Light Vehicle Steel Content and Shipments

AISI Member Data & Non – Member Data
INTRODUCTION AND METHODOLOGY

Flat rolled steel content data provided for select vehicles follow tensile strength classifications that may be different than other industry classifications due to OEM preference.

- Segmentation of the type of flat rolled steel utilized in select 2011 North American Light Vehicles
- We have found through several years of experience that OEMs prefer the following segmentation to any other we have proposed or suggested and is different to AISI classifications:
  - Carbon steel or mild steel with a tensile strength of 270 MPa or less
  - Bake Hardened or dent resistant steels of all strength levels
  - Medium high strength steels with a tensile strength greater than 270 MPa and up to 350 MPa
  - Conventional high strength steels with a tensile strength of 350 MPa but less than Dual Phase 590 in tensile strength (primarily HSLA 440 MPa)
  - Dual Phase steel of all strengths
  - AHSS and UHSS other than Dual Phase which includes Martensitic, Boron, TRIP, Complex Phase and Recovery Annealed steels with tensile strengths over 700 MPa
Nomenclature used throughout the report is provided below for reference:

**Nomenclature:**
- GA = Galvanealed
- GI = Hot Dip galvanized
- EG = Electrogalvanized
- DQ = Draw Quality Mild Steel
- EDDQ = Extra Deep Draw Quality Mild Steel
- DQSK = Draw Quality Special Killed Mild Steel
- DQAK = Draw Quality Aluminum Killed Mild Steel
- BH = Bake Hardening/Dent Resistant Steel
- IF = Interstitial Free High Strength Steel
- RP = Rephosphorized Steel
- HSLA (XLF) = High Strength Low Alloy (not necessarily HSS by our definition)
- MHSS = HSLA 340 MPa Tensile Strength
- CHSS = HSLA 440 MPa Tensile Strength
- DP = Dual Phase 590, 780 and 980 MPa Tensile Strength
- R = Low yield ratio steel such as 590R as per Honda Specification
- CP = Complex Phase (Bainetic)
- SF = Stretch Flange
- M (T) = Martensitic
- TRIP = Steel with Transformation Induced Plasticity
- TWIP = Twinning Induced Plasticity
- RA (XF) = Recovery Annealed
- B = Boron Steel/Press Hardened
AGENDA

- INTRODUCTION & METHODOLOGY
- EXECUTIVE SUMMARY
Steel in its various forms including flat rolled, long products and structural shapes has accounted for an estimated 58% of the material share of curb weight in 2010 and is expected to be the dominant material share leader well past 2015

Flat rolled AHSS is 4% of the 2010 average vehicle curb weight; however, is estimated to be over 7% of the average vehicle curb weight in 2015

The growth of AHSS in light vehicle applications grew by over 12 percent in 2009 to 2010, a tremendous achievement for any light vehicle material

- The share growth of AHSS does however come at the expense of other high strength low alloy steels

AHSS content has nearly doubled from 2006, where the average North American light vehicle contained just 81 pounds of AHSS or 2.2% of the average curb weight, to an all time high in 2010, topping 156 pounds of AHSS or 4% of average curb weight

- Full frame vehicles demonstrate the best

Advancements in the manufacturing and forming of AHSS (for light vehicle applications) continues provide new and innovative processes that further emphasizes growth for AHSS in both traditional and non-traditional applications
North American Light Vehicle Production is expected to continue to recover at a fast pace and is forecasted to surpass 2006 levels by 2014.

Source: Global Insight
Unibody Vehicle growth is likely to be the principal reason for the recovery after 2011

- Full frame pickups demonstrate slight growth while other full frame vehicles are expected to decline
- Unibody vehicles will account for any loss in volume of other full frame vehicles
  - Example Ford Explorer – the 2009 is a full frame design, while the 2011 Explorer is on a unibody platform

Source: Global Insight
The increase of Unibody architecture in North American light vehicles is reducing the average curb weight of vehicles in the future.

**Effect of Architecture on Curb Weight**

This chart excludes other weight saving benefits, such as the use of more HSS, AHSS and Aluminum after the year 2009.

Mix shift will save 80 pounds/vehicle.

**2011 Forecast of NA Light Vehicle Architecture**

Source: Global Insight
Steel content, particularly flat rolled, is more a function of the base curb weight than the fully loaded curb weight. Non standard engines, AWD and entertainment systems add hundreds of pounds per vehicle to curb weight, but don’t use much flat rolled steel.

Note: These estimates do not reflect minor weight savings from material substitution after 2010.
Note: The assumptions built into the steel consumption estimate have a positive bias and the actual 2010 consumption was actually in the range of 13.6 million tons and 14.9 million tons depending on the assumptions on part weights and recovery. Part weight estimates are the principal source of the variation in the final estimate.
In 2010, North American light vehicle manufacturers consumed 14.5 million tons of flat rolled steel for the production of 11.9 million vehicles:

- **Types of Flat Rolled Steel**
  - Mild: 60%
  - HSS | BH: 31%
  - Dual Phase: 7%
  - Other AHSS: 2%
  - AHSSCR: 2%

  - **Total:** 14,469,000 Tons
  - HSS and AHSS account for ~40%

- **Types of Flat Rolled Steel**
  - MHR: 15%
  - HSSCR: 25%
  - DPCR: 7%
  - HSSHR: 6%
  - MCR: 45%

  - **Total:** 14,469,000 Tons
  - ~79% was cold rolled based
  - ~21% was hot rolled based

- **Coatings for Flat Steel**
  - Galvanealed: 35%
  - Hot Dip | GI: 19%
  - Aluminized: 16%
  - Uncoated: 30%

  - **Total:** 14,469,000 Tons
  - ~70% of all flat rolled was coated
EXECUTIVE SUMMARY – THE BIG PICTURE FOR STEEL

Coatings for Mild Steel
- Aluminized 2%
- EG 7%
- Galvannealed 33%
- Hot Dip | GI 23%
- Uncoated 35%

8,681,400 Tons

Coatings for HSS | BH Steel
- Uncoated 20%
- EG 30%
- Hot Dip | GI 16%
- Galvannealed 34%

4,485,390 Tons

Coatings for DP Steel
- EG 7%
- Galvannealed 57%
- Hot Dip | GI 6%
- Uncoated 31%

1,012,839 Tons

Coatings for Other AHSS
- *EG | Aluminized 49%
- Galvannealed 0%
- Hot Dip | GI 12%
- Uncoated 39%

289,380 Tons

*Galvanized & Aluminized cannot be broken out without divulging competitive member info.
In 2010, Unibody vehicles had over 150 pounds of AHSS in their body, closures and bumpers; while Full Frame vehicles only had 138 pounds.
Executive Summary – The Big Picture for Steel

Key Assumptions are Mix Dependent and only apply to Calendar Year 2010

2010 Body, Closure & Bumper Flat Rolled Steel Content
- Excludes ~9lb.’s of AHSS for wheels, suspensions & subframes –
- As a Percentage of Curb Weight also -

- Mild Steel, 613, 52%
  - 15.9% of CW

- HSLA/BH, 406, 35%
  - 10.5% of CW

- Dual Phase, 114, 10%
  - 3% of CW

- Other AHSS, 33, 3%
  - 1% of CW

1,166 Net Pounds
3,863 Pounds Average Curb Weight
Key Assumptions are Mix Dependent and only apply to Calendar Year 2010

* This category includes unibody subframes/cradles/crossmembers/bumpers/wheels/suspension/powertrain and interior components made from flat rolled steel

** Full Frame Architecture includes Frame as well
EXECUTIVE SUMMARY – THE BIG PICTURE FOR STEEL

Key Assumptions are Mix Dependent and only apply to Calendar Year 2010

**2010 Flat Rolled Steel Content in NA Light Vehicles**
- 1,628 Pounds per Vehicle +1% / -5% -

- **BIW or Cab, 680, 42%**
- **Pickup Full Frame, 133, 8%**
- **Pickup Cargo Box, 53, 3%**
- **Closures 256, 16%**
- **Wheels, 55, 3%**
- **Subframes & Bumpers, 130, 8%**
- **Suspension, Steering Brakes, 125, 8%**
- **Powertrain, Fuel & Exhaust, 121, 7%**
- **Interiors, 75, 5%**

1,547 - 1,644 Pounds per Vehicle
A conservative look at the future reveals steady growth with nearly 350 pounds of AHSS content per vehicle by 2020.

* OEM Surveys
** Calculated from Trend
*** From Shipments & Select Vehicles
The future of AHSS and other light weighting strategies will depend on the 2017 Café Law.

2012 – 2016 CAFE Law

2016 Mandate for Passenger Cars (Not Including Credits) is 39.5 Miles Per Gallon with tailpipe emissions of no more than 225 grams of CO2 per mile.

2016 Mandate for Light Trucks (Not Including Credits) is 29.8 Miles Per Gallon with tailpipe emissions of no more than 298 grams of CO2 per mile.

The combined car and light truck mandate is 35.5 Miles Per Gallon with tailpipe emissions of no more than 250 grams of CO2 per mile. All the values are regulatory test procedure values. Real world mpg values are 20% lower.
Analysis on the Forecast of AHSS Content in North American Light Vehicles (EPA study data)

* EPA study for release after July 2011
Flat rolled steel content and shipments will recover, but not to the levels of the last decade.

These charts assume no further losses to other materials.
Iron and steel will continue to dominate the light vehicle material mix well into the future.

**Historical 2010**
- Ferrous: 22%
- Aluminum: 4%
- Other Metals: 8.5%
- Non-Metallics: 65.5%

3,863 Pounds +/- 25
156 Pounds of
Flat rolled AHSS
*Plus 330 lbs. of Aluminum*

**Forecast 2015**
- Ferrous: 23%
- Aluminum: 4%
- Other Metals: 10.5%
- Non-Metallics: 62.5%

3,725 Pounds +/- 50
300 Pounds of
Flat rolled AHSS
*Plus 393 lbs. of Aluminum*

Source: Ducker
This concludes our report. Thank you.

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