Advanced High-Strength Steel Technologies in the 2015 Ford Edge

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2015 Ford Edge

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Agenda

• Background
• Material Usage
• Design Approach
• Functional Performance
  – Static Stiffness
  – Dynamic Stiffness
  – Safety
CD Derivatives

- Fusion
- MKZ
- Edge
Platform Changes

- Shock Tower revised to accommodate new stance requirements
- Tunnel Runners modified for increased load capacity
- Rear Floor assembly completely redesigned to account for SUV functionality
Dearborn Manufacturing: Oakville, Ontario – with export to Europe and Asia
MATERIAL USAGE
BIW Materials

Background | Material Usage | Design Approach | Performance

- Martensitic & Boron
- DP1000
- DP800
- DP600
- Mild
- Bake Hard
- HSLA

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DESIGN APPROACH
Front Structure Design

Dash Cross Member acts as a compression member during loading to stabilize the Front Rail.

Hexagonal Front Rail section for improved axial crush performance allowing for the use of lower gages.

S-Brace Rail section angles toward the rocker as it transitions under the dash for improved load path.

Y-Brace replaces the typical Torque Box to distribute load to the rocker and the sled runners.
Rear Under Body – Lion’s Foot

Typical “lions foot” set on pan and joined to rail section only at the weld flanges.

Utilized design developed for the Fusion.

Integrated into the rail section for optimal load transfer to improve joint stiffness – elimination of flange flex

Improved joint contributed to a 7.5% improvement in BIW torsional stiffness.

Local and equivalent stiffness for Subframe and Shock attachments were increased.
Rear Rails

Rail efficiency increased through geometry refinement
Hydro-Form Components

Background | Material Usage | Design Approach | Performance
D-Pillar Hydro-Form
Joining - Adhesive

• Over 25 meters of adhesive in the BIW primarily in the platform
• Added between Body Side Outer and the Hydro-Form A-Pillar / Roof Rail to augment welding
• Primary usage is in the Under Body to improve BIW stiffness
Joining - Welding

- 3.6 meters of laser braze to join the Roof to the Body Side
- A combination of 66 stitch and C-Shaped welds used in the Body Side build
- In addition, the following conventional joints are use:
  - 4800 resistance spot welds
  - 55 gas metal arc welds
  - 192 projection weld nuts
  - 131 weld studs
Static Stiffness

Bending Stiffness (N/mm)
- 53% Improvement

Torsional Stiffness (kN m/rad)
- 14% Improvement

Background | Material Usage | Design Approach | Performance
BIP Dynamic Stiffness

Vertical Bending (Hz)

13.5% Improvement

Torsion (Hz)

Background | Material Usage | Design Approach | Performance
Load Path – Front Structure

Structure utilizes a three load path strategy:

1. Primary crash loads are taken by the front crush cans and front rails. The swept rail design distributes the loads to the sled runners, tunnel runners, hinge pillars, and rockers.

2. The sub-frame provides a lower load path that directs load to the sled runners, tunnel runners, and rockers.

3. The upper load path through the point mobility brackets and shot guns passes loads to the upper structure.

DP600 Front Rails and DP800 Sled Runners are key members in the primary load path

Martensitic rocker provides strength to manage high axial loads and moments

DP1000 hydro-formed A-Pillar provides load path to the upper structure

DP Hinge Pillar and Cowl Side from a portion of the back up structure that supports the Rails and distributes load
- Bumper system Crush Cans and Front Rails absorb most of crash energy.
- Loads are also balanced by the sub-frame, rails, and shotguns
Dash and Floor intrusions are limited due to the performance off the front rail and sub-frame
Roof Strength Load Path

DP1000 Hydro-formed roof rail distributes load to Roof bow, Front header, Hinge Pillar, B-Pillar, and C-Pillar

Boron B-Pillar and Reinforcement provides resistance to bending due to lateral and axial loads

DP800 in the Roof Structure provide a stable load path to the opposite side structure
Roof Strength Animation

Background  |  Material Usage  |  Design Approach  |  Performance
Side Impact Load Path

**Background**

- Martensitic Rocker provides torsion stiffness and transverse load distribution.
- Boron B-Pillar provides resistance to buckling due to lateral loads and distributes load to the Roof Rail and Rocker.

**Material Usage**

- DP1000 Hydro-formed Roof rail distributes load to Roof bow, B-Pillar, Front header, Hinge Pillar, and C-Pillar.
- DP Floor Cross Members and Roof Bow, and Headers provide lateral load path.

**Design Approach**

- DP1000 Hydro-formed Roof rail distributes load to Roof bow, B-Pillar, Front header, Hinge Pillar, and C-Pillar.

**Performance**

- Martensitic Rocker provides torsion stiffness and transverse load distribution.
- Boron B-Pillar provides resistance to buckling due to lateral loads and distributes load to the Roof Rail and Rocker.
Primary load is through the DP800 Rear Rails and into the Rocker

HSLA and DP600 Cross Members and Reinforcements provide resistance to Rail buckling due to axial loading.
Rear Impact

Hydro-formed tubes provide an auxiliary load path to upper structure.
CD539N – Rear Impact
Crash energy is absorbed by the rails protecting the fuel tank area from undesirable intrusion.
Presentations will be available May 18 at www.autosteel.org

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