2011 Ford Explorer

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Ford Motor Company

Agenda

- Explorer History
- Platform Strategy
- Material Usage
- Design Approach
- Functional Performance
  - Static Stiffness
  - Dynamic Stiffness
  - Safety

Explorer History

1st Generation: 1991 – 1994
- Designed as a replacement for the Bronco II
- Introduced as 2 Dr and 4 Dr
- Body on Frame Design
- Average Annual Volume ≈ 400,000 units

2nd Generation: 1995 -2002
- Major vehicle re-freshening
- Introduction of the Mountaineer & Sport Trac
- Average Annual Volume ≈ 400,000 units

3rd Generation: 2002 - 2005
- Completely re-designed Explorer
- Introduction of the Lincoln Aviator
- Average Annual Volume ≈ 400,000 units

4th Generation: 2006 - 2010
- Completely re-designed Sport Trac
- Major refreshening of Explorer & Mountaineer
- Average Annual Volume ≈ 150,000 units

Platform Strategy

Body on Frame Architecture

Benefits

- Ideal for Off Road Use
- Excellent Towing Capability

Draw Backs

- Substandard Vehicle Dynamics
- Insufficient NVH Performance

Platform

Taurus

Flex

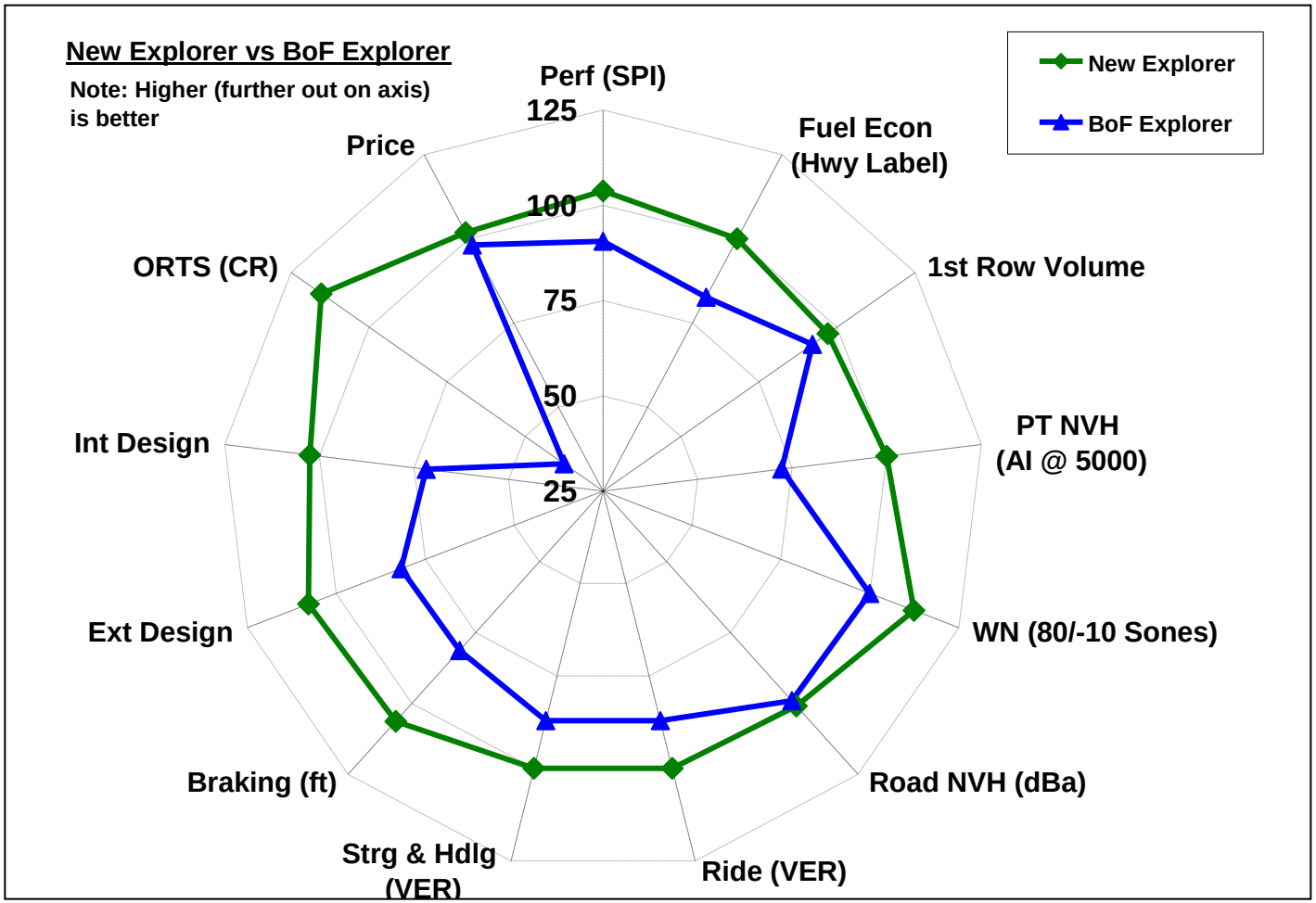
Explorer

MKS

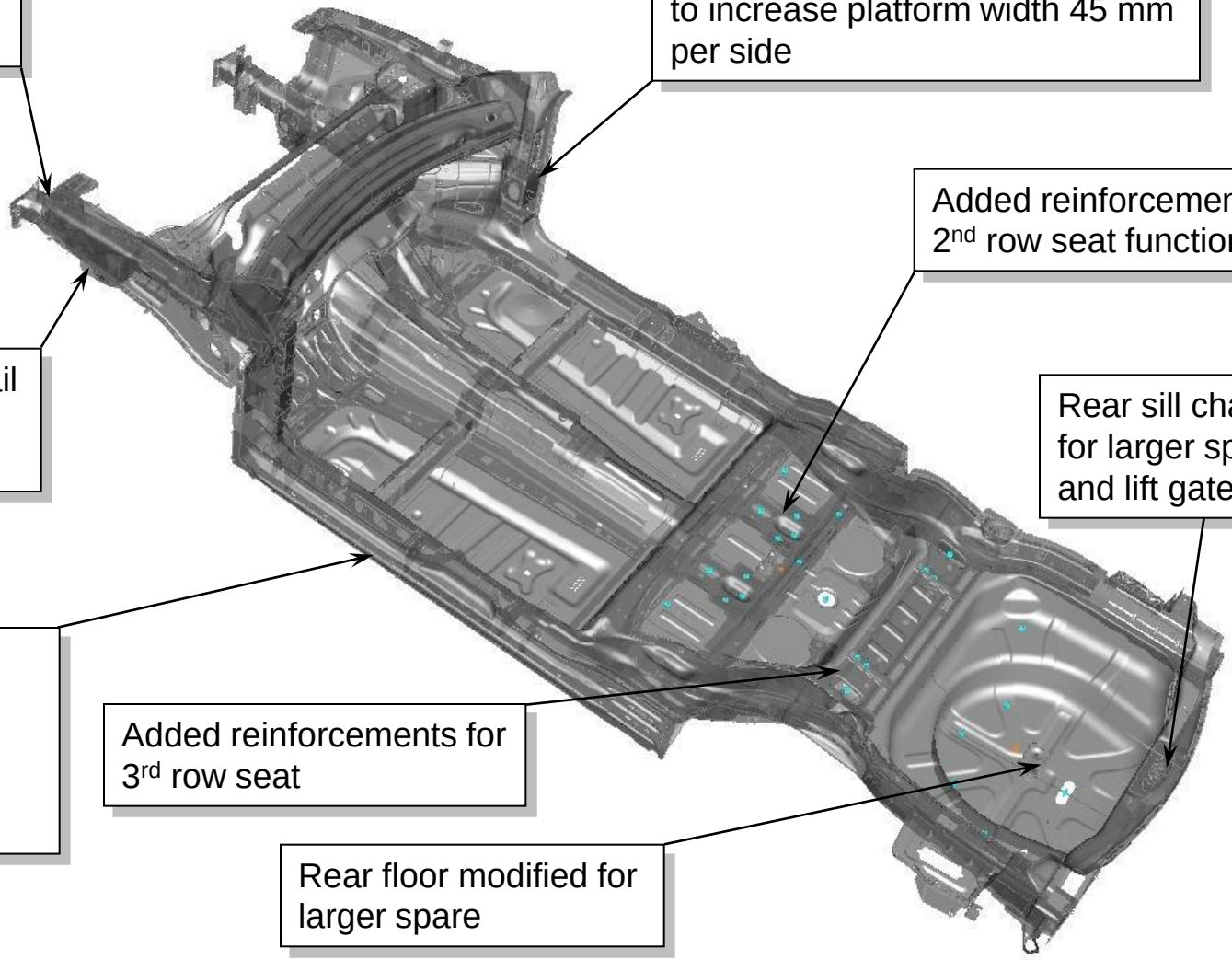
MKT

- *Utilize the D-Car Platform*
- *Originally developed by Volvo*
- *Uses a Swept Front Rail design for optimal load transfer*

Performance Improvements



Platform Modifications



Front end length reduced by 25 mm

Cowl side inner depth increased to increase platform width 45 mm per side

Added reinforcements for 2nd row seat functionality

Hydro-formed front rail replace multi-piece stamped design

Rear sill changes for larger spare and lift gate

Rocker and side sill depth increased to increase platform width by 45 mm per side

Added reinforcements for 3rd row seat

Rear floor modified for larger spare

Technology

Adaptive Cruise Control

Trailer Sway Control

Advance Trac with Stability Control and Curve Control

Intelligent 4-Wheel Drive Terrain Management System

My Ford Touch

Inflatable Rear Restraints

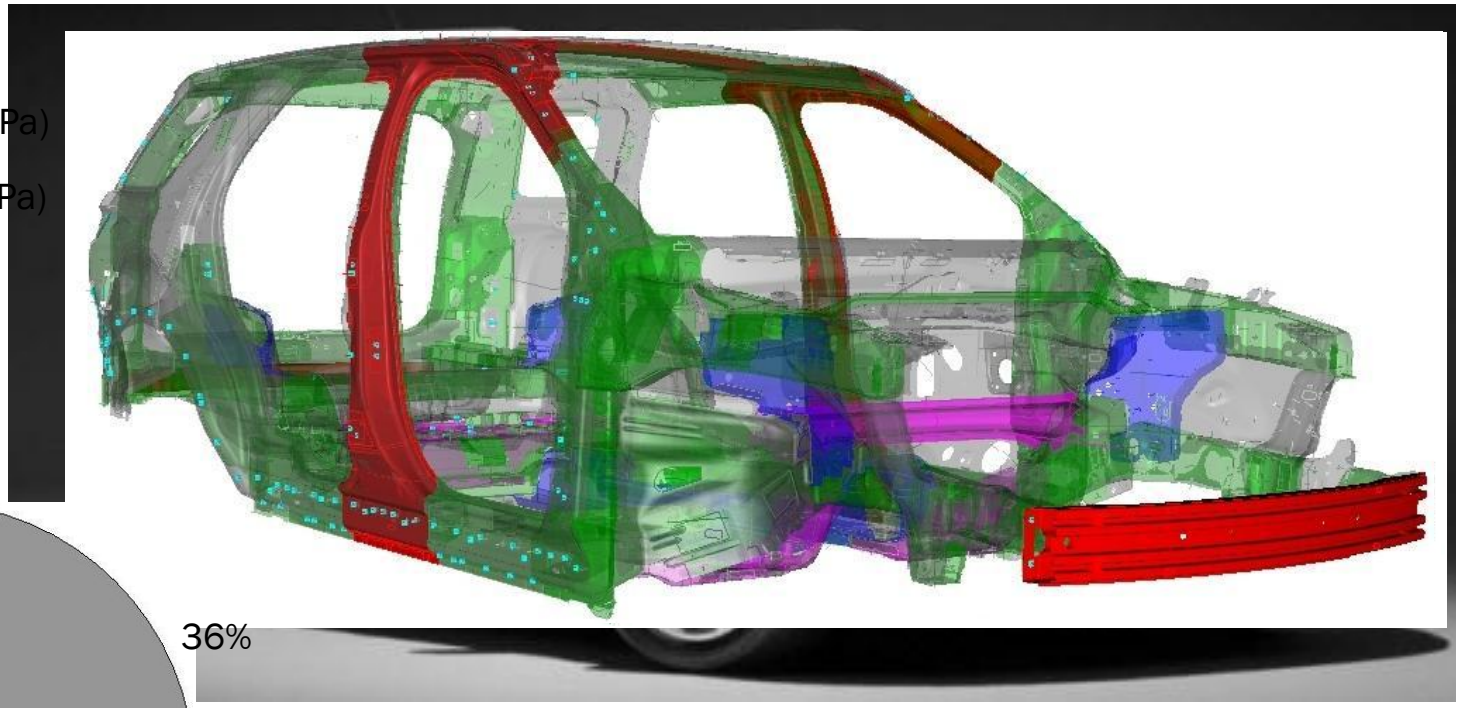
Blind Spot Information System

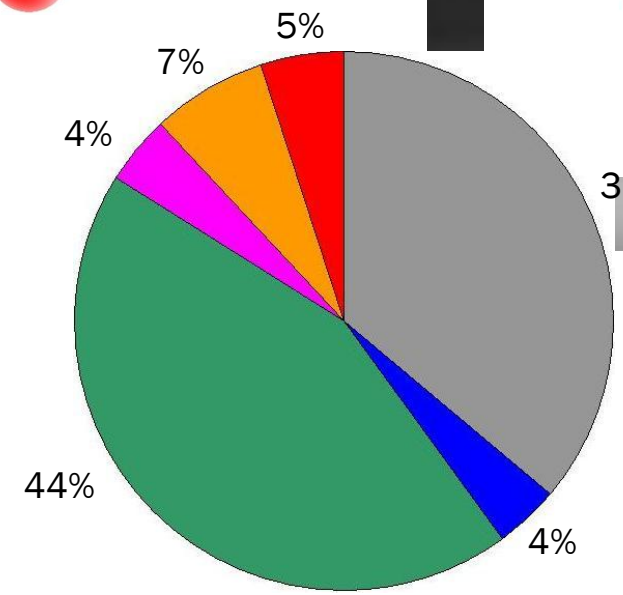
Collision Warning System

Material Usage

Material Usage - BIW

- Mild Steel
- BH – HSLA (<300 MPa)
- HSLA (300 – 400 MPa)
- DP600
- HSLA 550 - DP780
- Boron / Martensitic

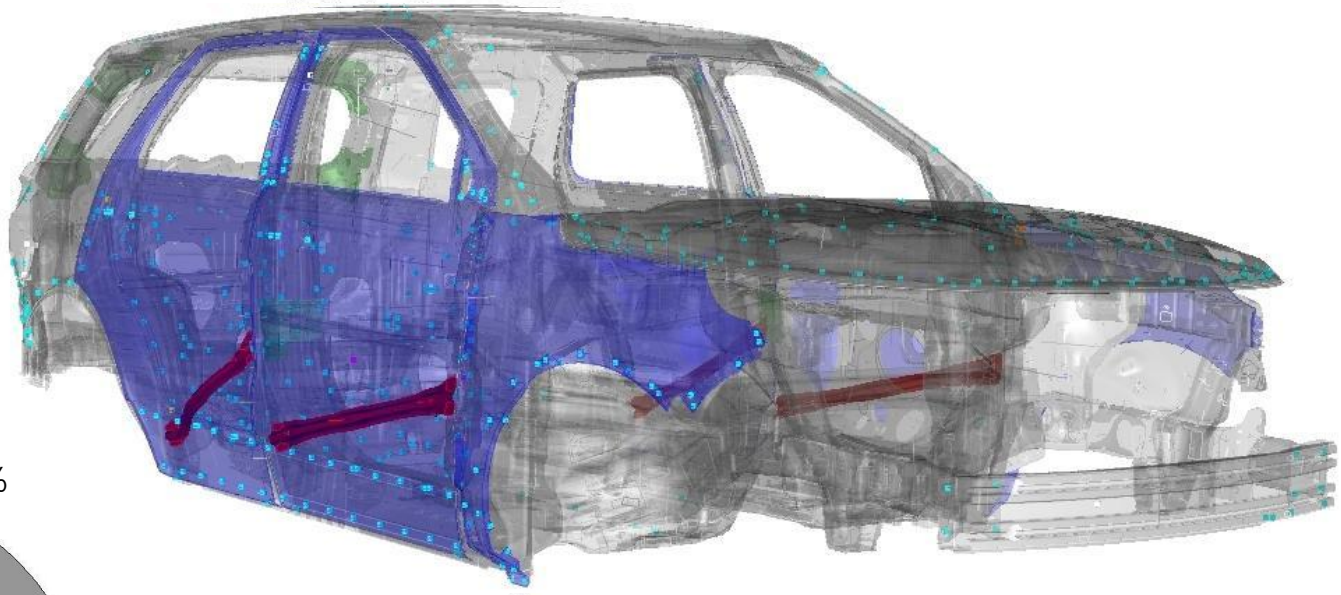


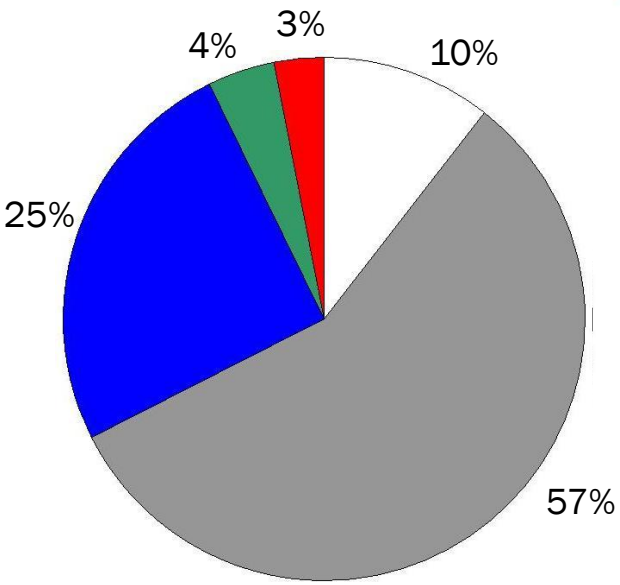


Average Yield Strength ≈ 315 MPa

Material Usage - Closure

- Mild Steel
- BH (200 – 300)
- HSLA (300 – 400 MPa)
- Boron

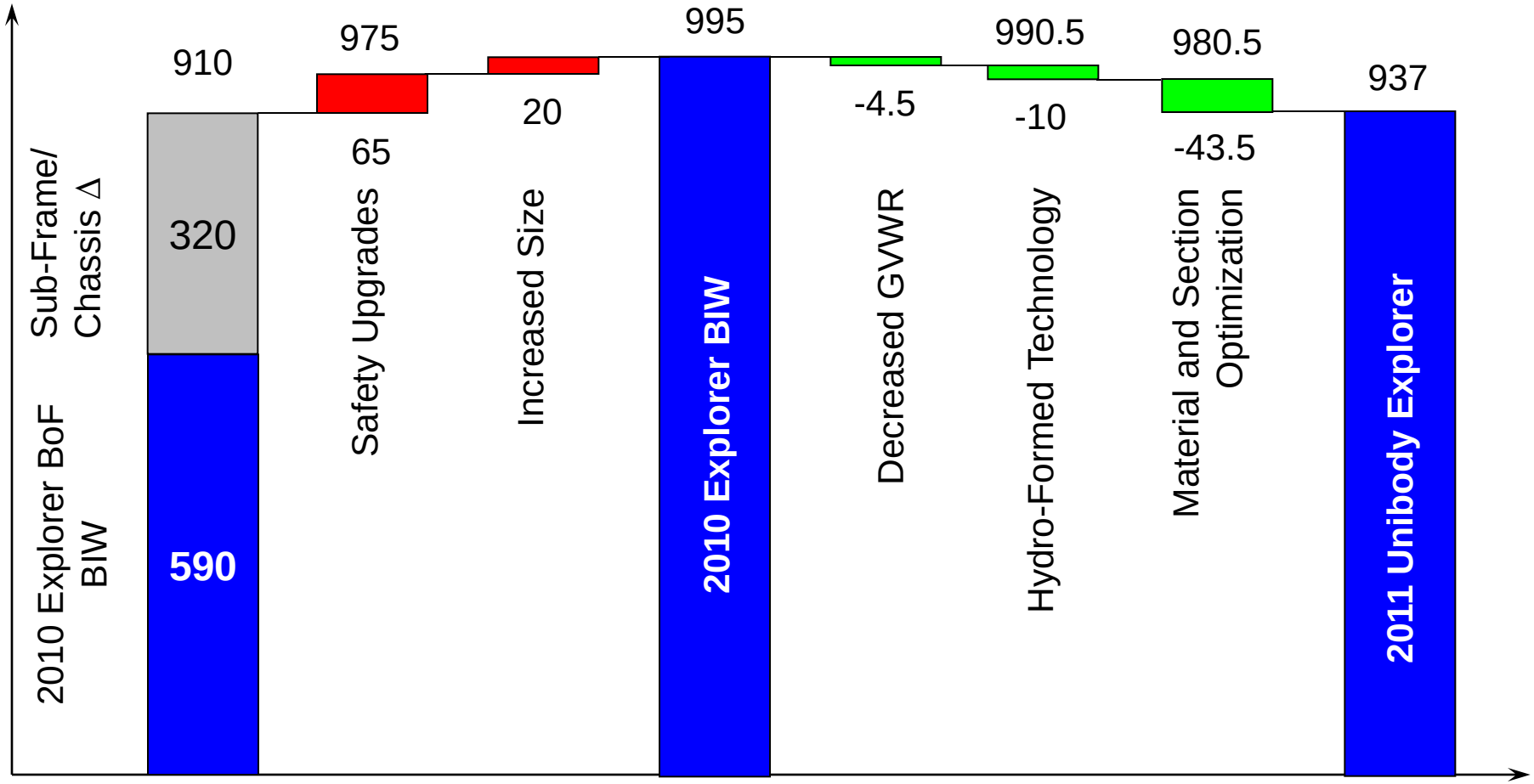




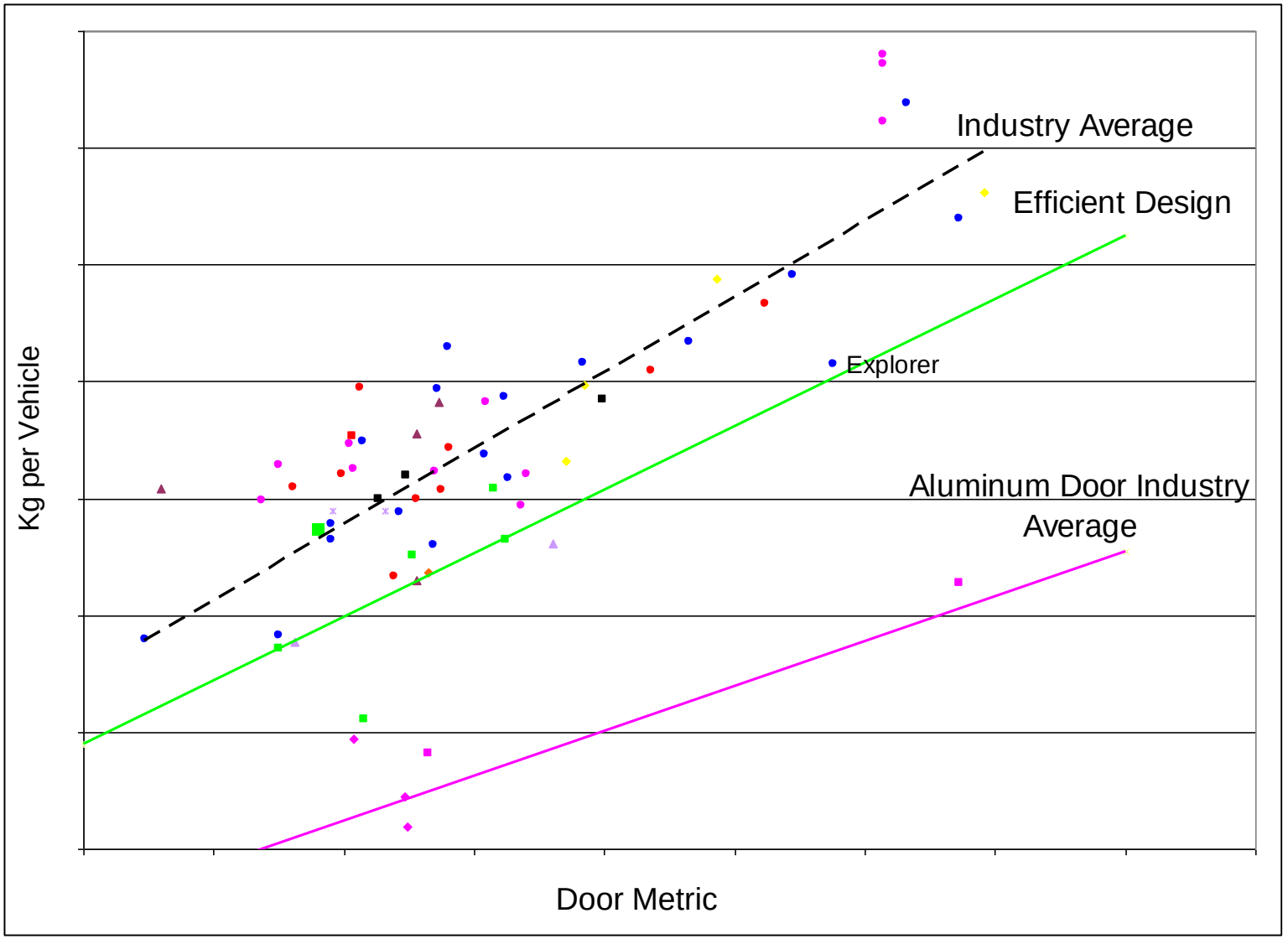
Average Yield Strength ≈ 198 MPa

Design Approach

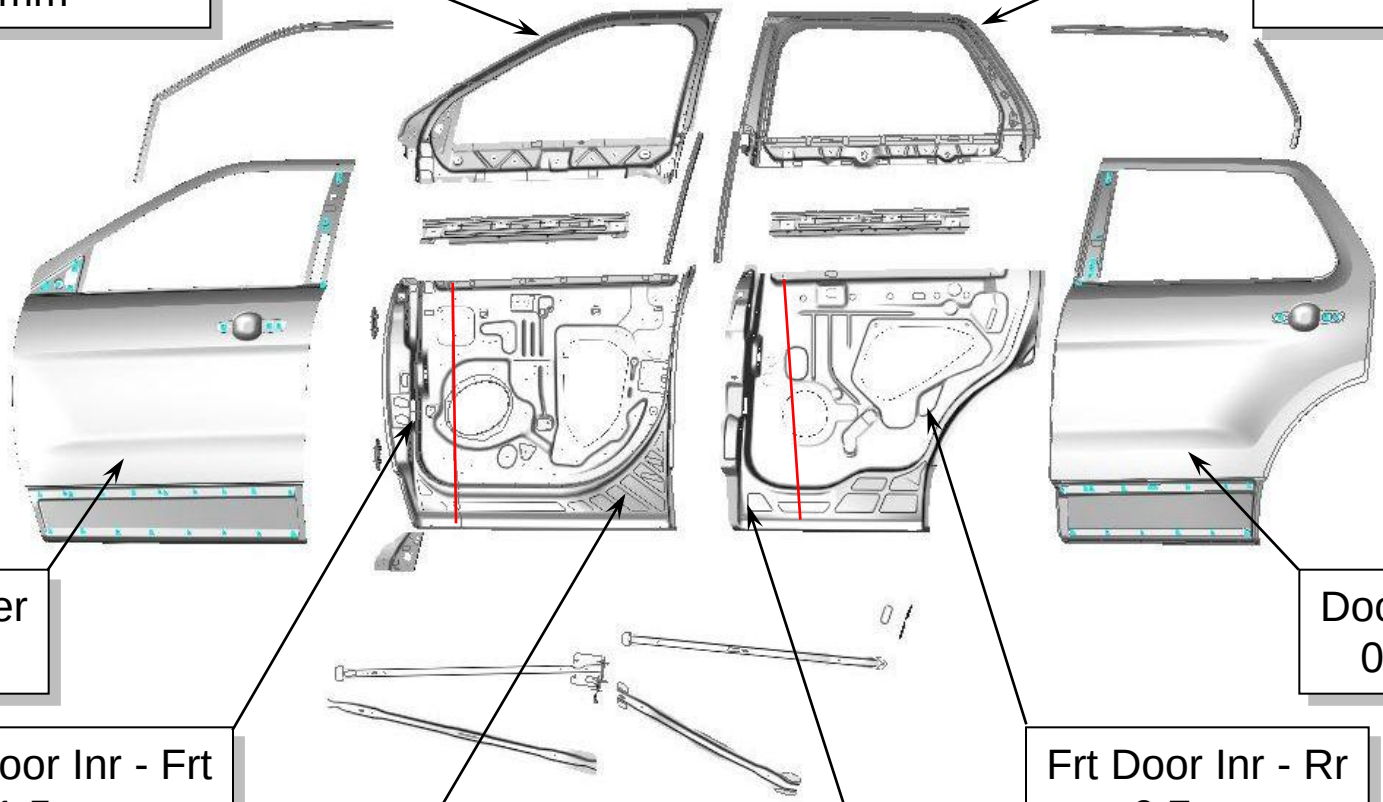
BIW Weight Walk



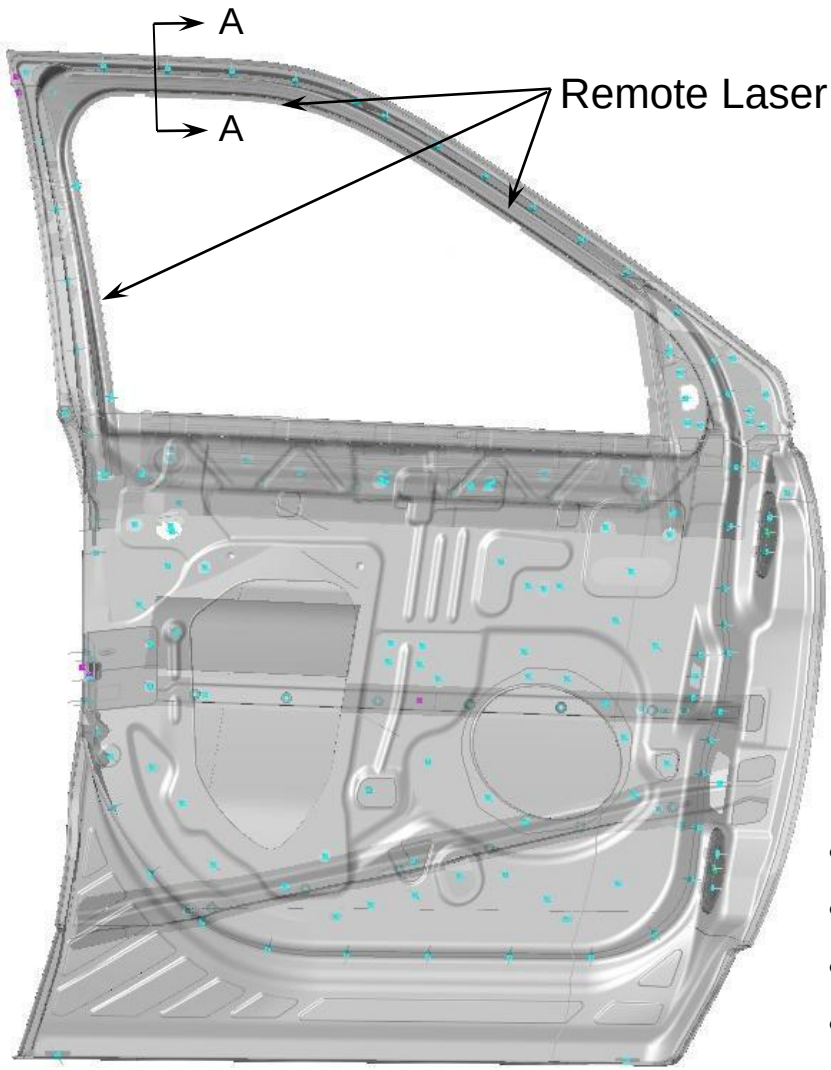
Door Efficiency

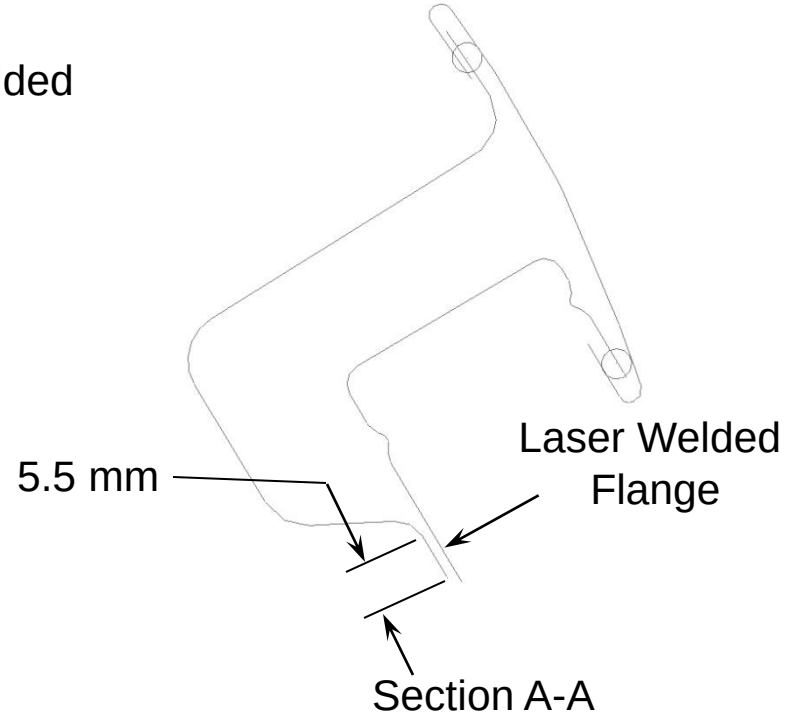


Door Gauge Distribution



Remote Laser Welded





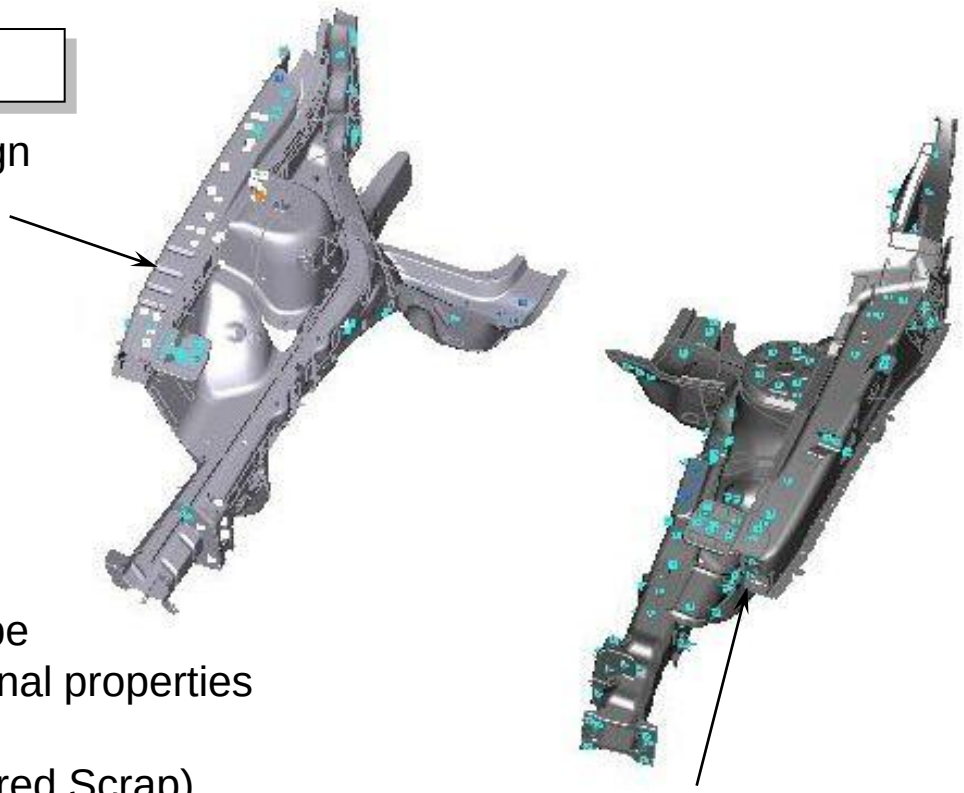
- Reduced cycle time
- Minimized assembly cells
- Reduced weld flange
- Reduced system weight – 1 lb / vehicle

Lift Gate Gauge Distribution

Hydro-Formed Front Rail

Taurus Front Rail Assembly

Based on Volvo / Ford S-Rail Design
Multi-Piece Rail
Laser Welded Blank Rails



Hydro-Form Advantages

- Part consolidation
- Improved structural continuity
- Optimal section in a given package envelope
- Continuous closed section optimizes sectional properties
- Improved tolerance & process control
- Improved material utilization (<5% Engineered Scrap)
- Material gauge changes without modifying forming die

All of these advantages lead to:

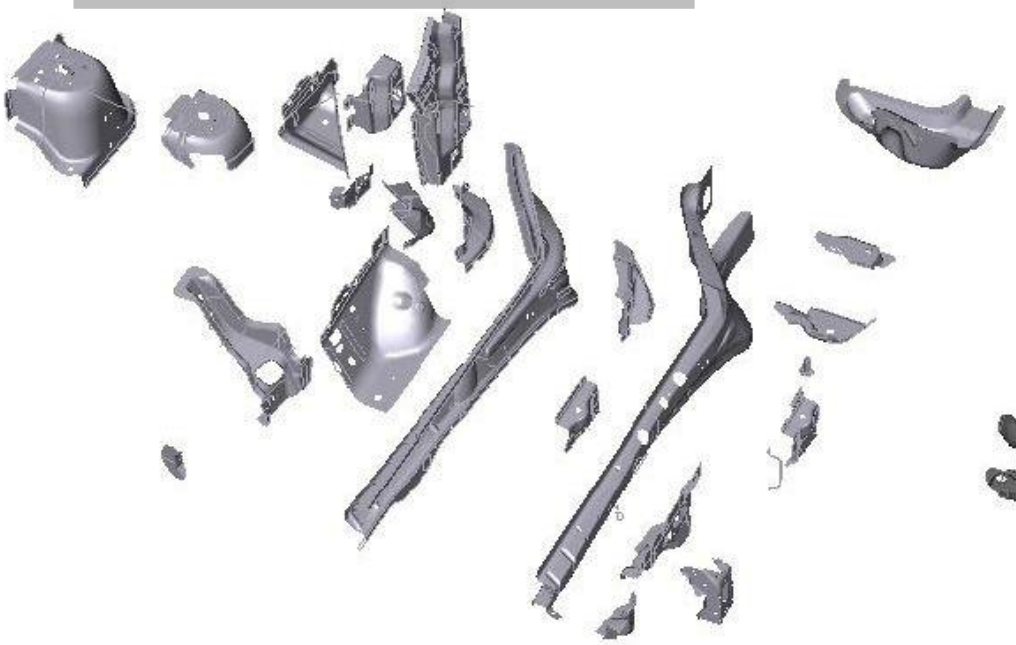
- Reduced cost
- Reduced weight
- Lower tooling investment

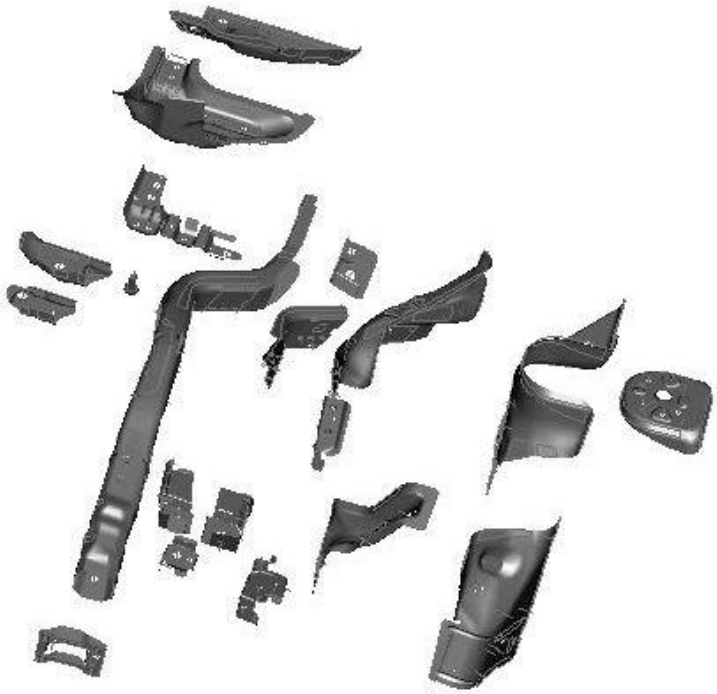
Explorer Front Rail Assembly

Based on Volvo / Ford S-Rail Design
Hydro-Formed Tube Replaces Rail Inner and Outer

Hydro-Formed Front Rail

Taurus Front Rail Assembly





Explorer Front Rail Assembly

Part Reduction:

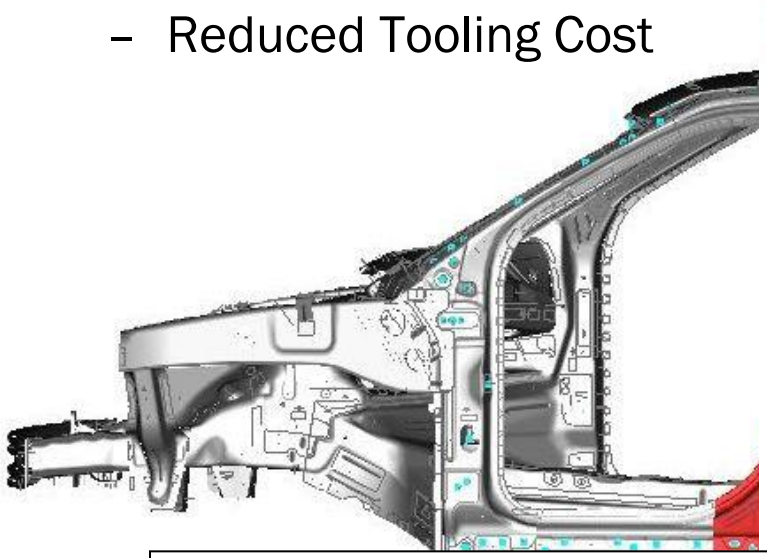
- Taurus Parts: 25
- Explorer Parts: 21

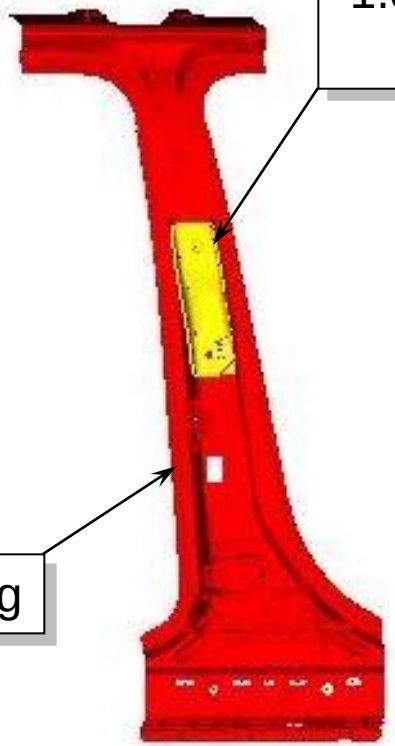
Improved Performance:

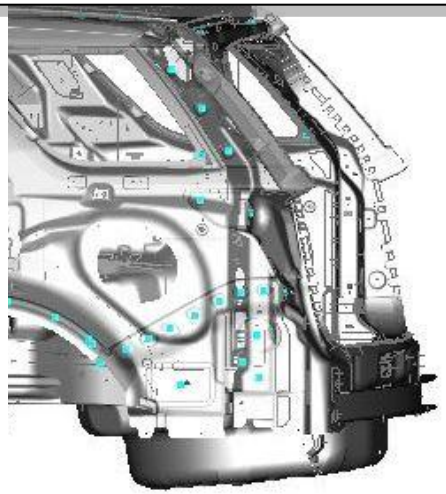
- Reduced Rail Length with Increased GVW

Center Hinge Pillar Design

- B-Pillar strength is critical to the structures performance in Side Impact and Roof Strength
- Introduced Ford's first Patch Welded Hot Stamped part
  - Improved Strength
  - Reduced Tooling Cost







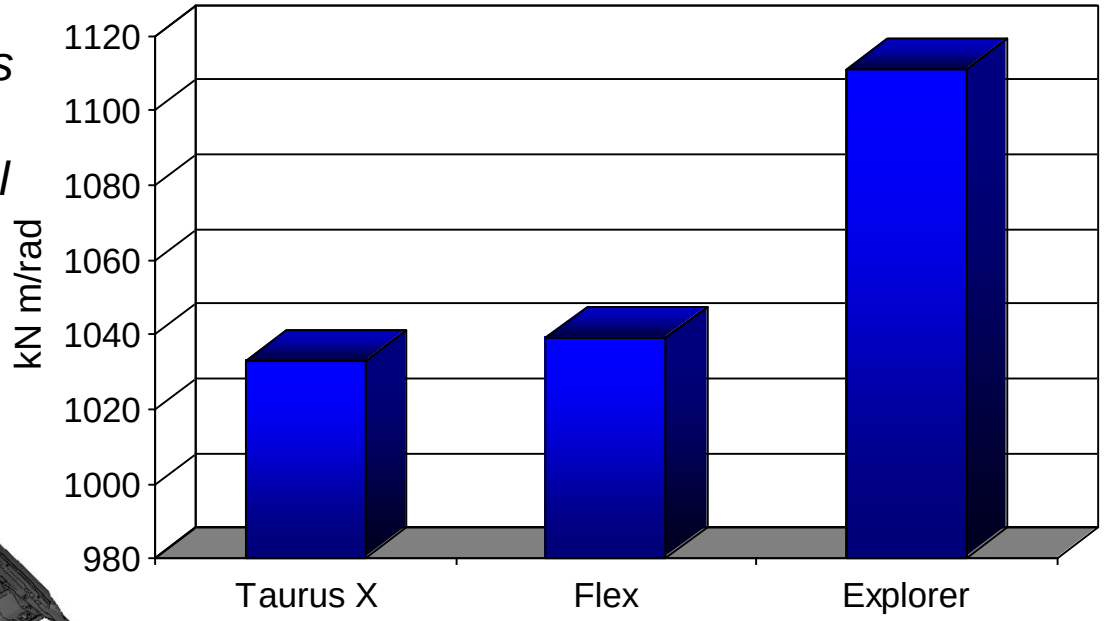
1.3 mm Boron Patch to resist buckling loads

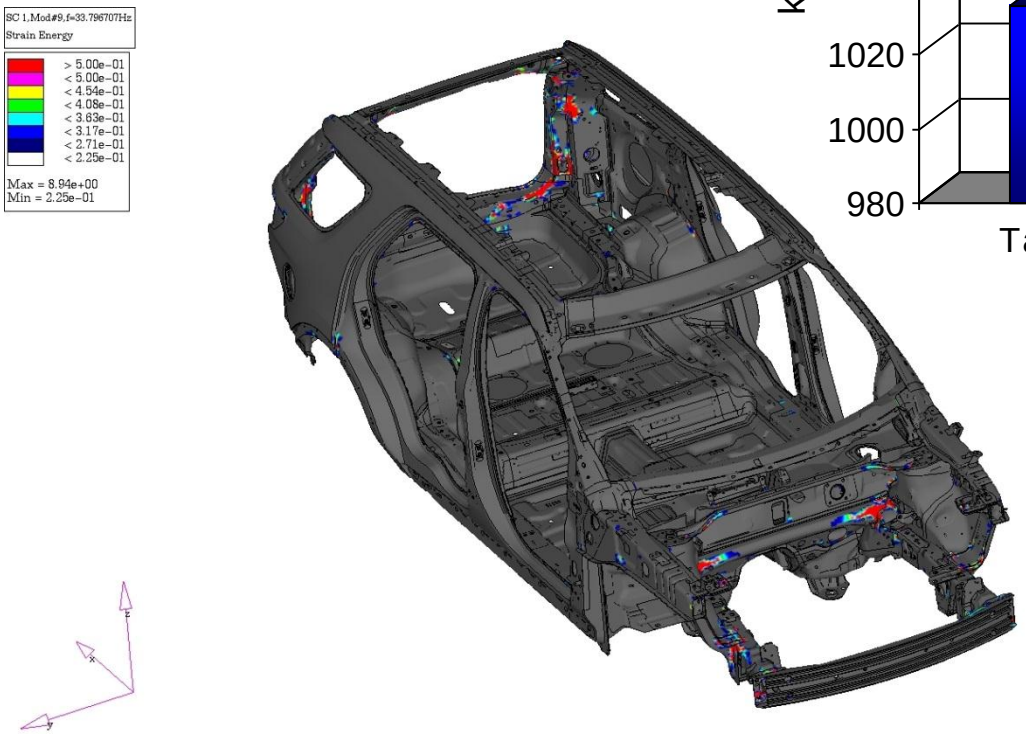
1.3 mm Boron Main Stamping

Performance

Static Stiffness - Torsion

Drive to increase Torsional Stiffness from Program to Program through improvement of joints and structural continuity.





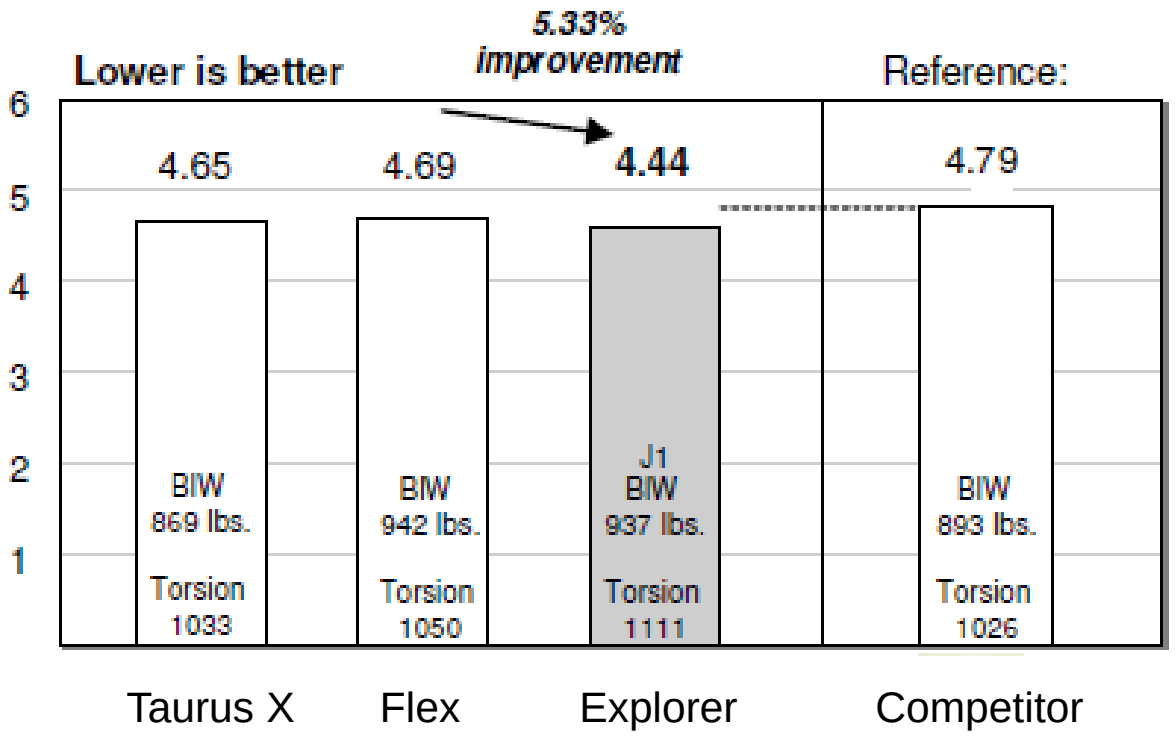
Improvements in Torsional Stiffness lead to:

- *Improved Vehicle Dynamics*
- *Improved NVH performance*
- *Reduced Squeak and Rattle*

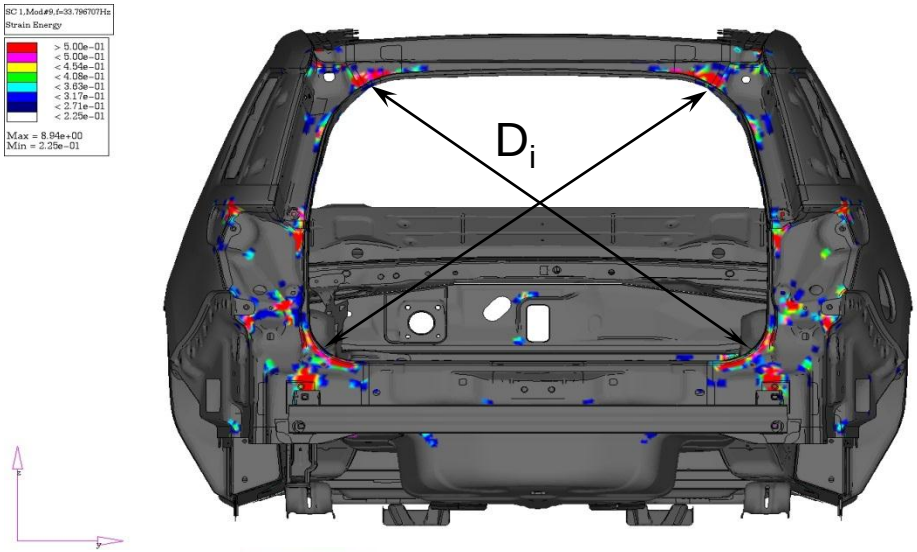
BIW Efficiency

Utilize BIW Mass and Torsional Stiffness to measure BIW efficiency year over year and against the competition.

$$\text{L-Factor} = \frac{\text{BIW Mass} * 1000}{\text{Torsion Stiffness} * \text{Footprint}} \left[\frac{\text{lbs}}{\text{N-m/rad} * \text{m}^2}\right]$$



Diagonal Distortion

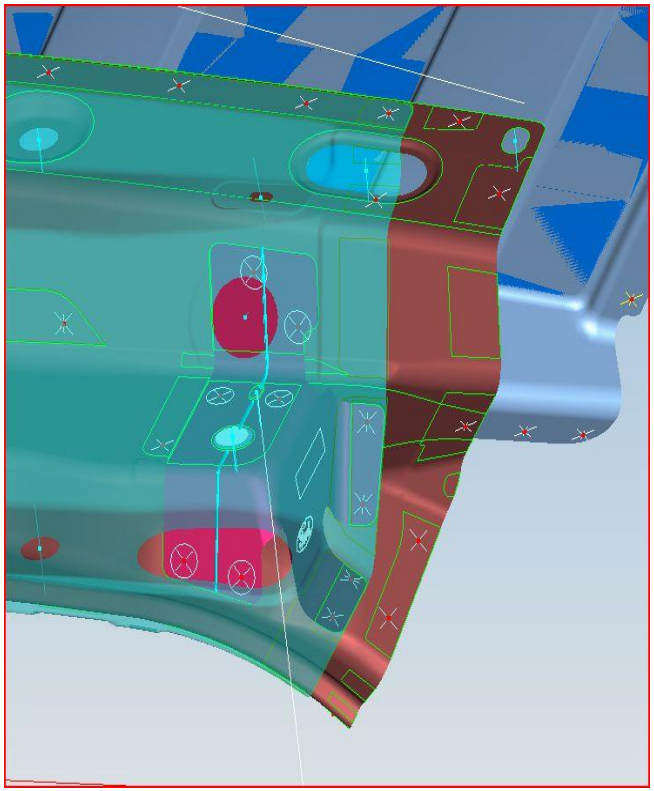


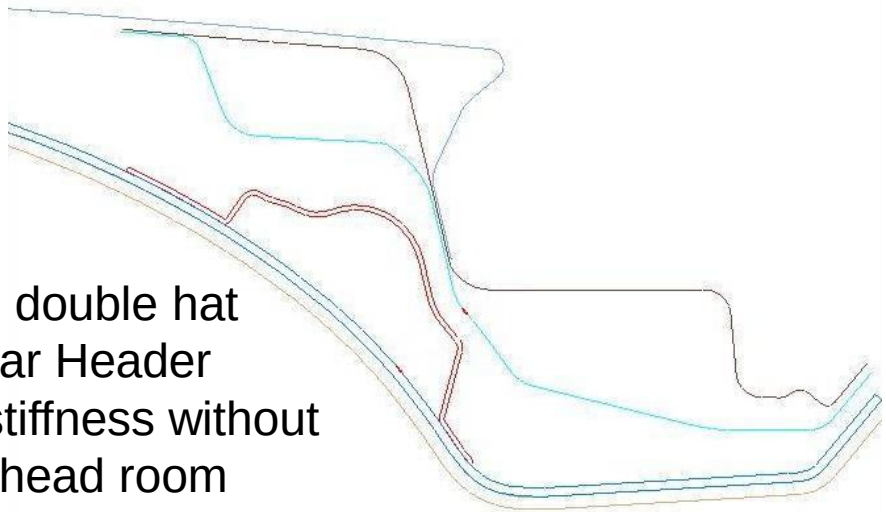
Diagonal Distortion = D_d / D_i

Where:

D_d is the Diagonal Distance of the opening under load

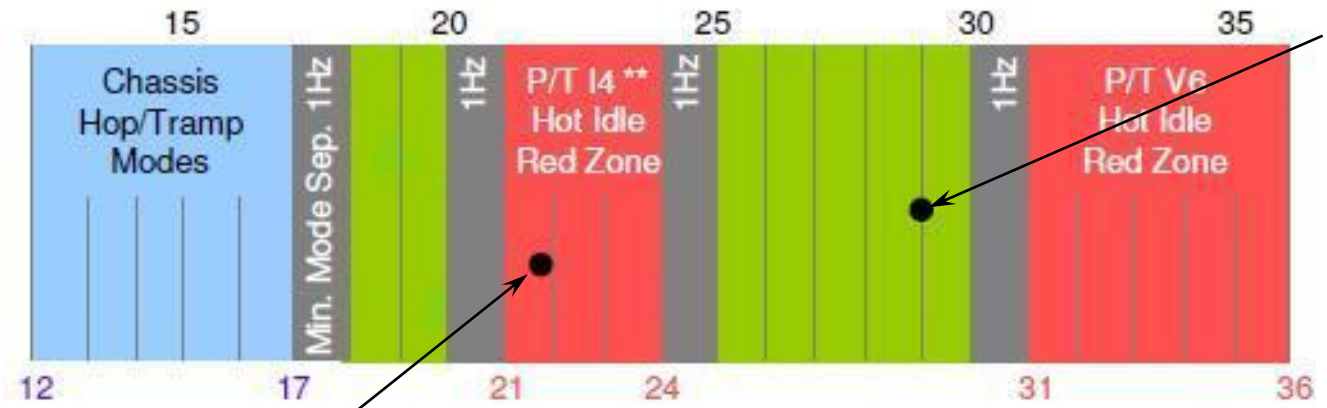
D_i is the initial Diagonal Distance of the opening





Two piece, double hat section Rear Header improves stiffness without sacrificing head room

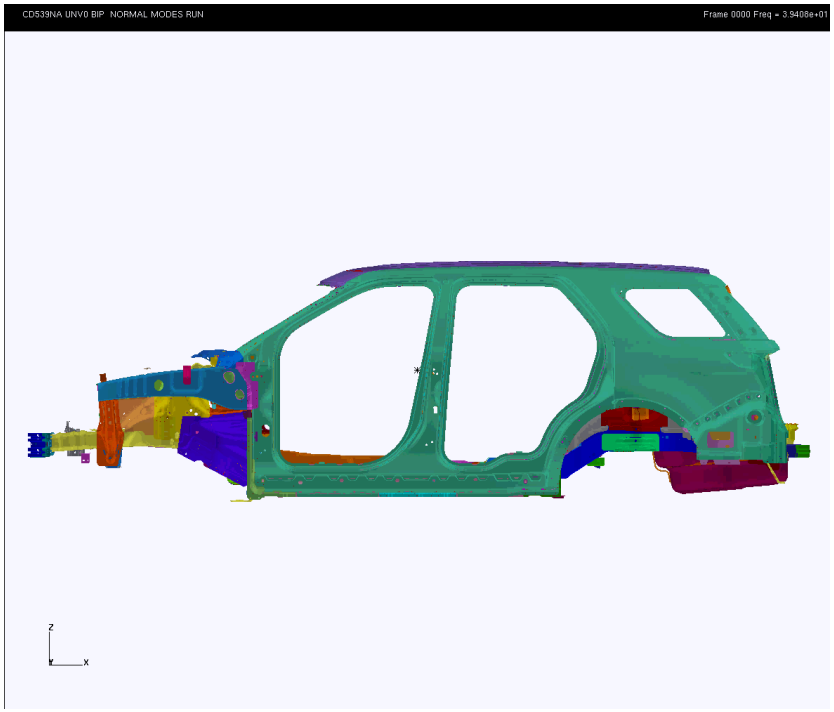
Dynamic Stiffness - Bending



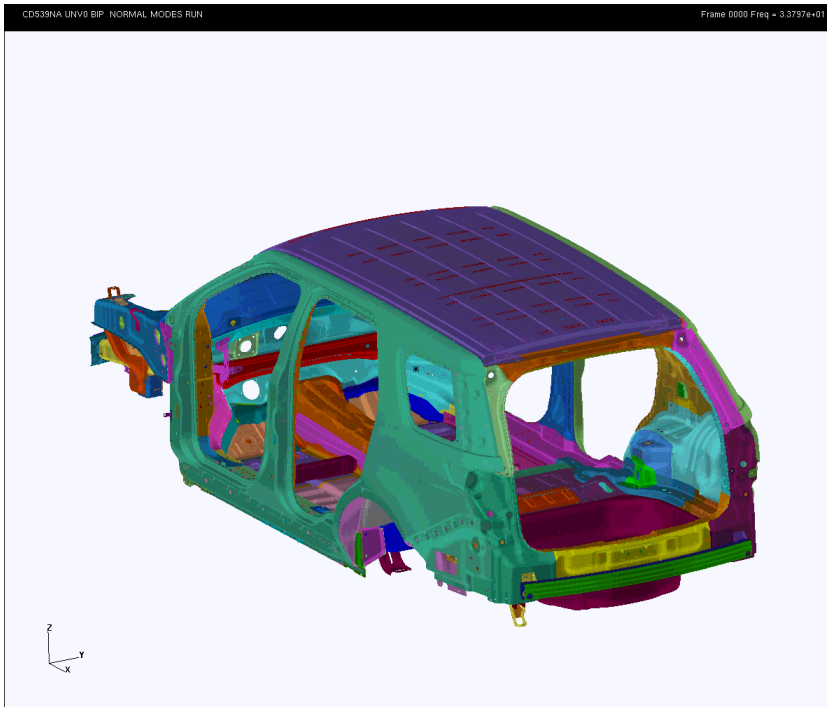
1st Bending - Vertical

1st Bending - Lateral

- *Focus on keeping body modes out of Power Train idle frequencies*
- *Trade offs made depending on severity of the input to the customer*



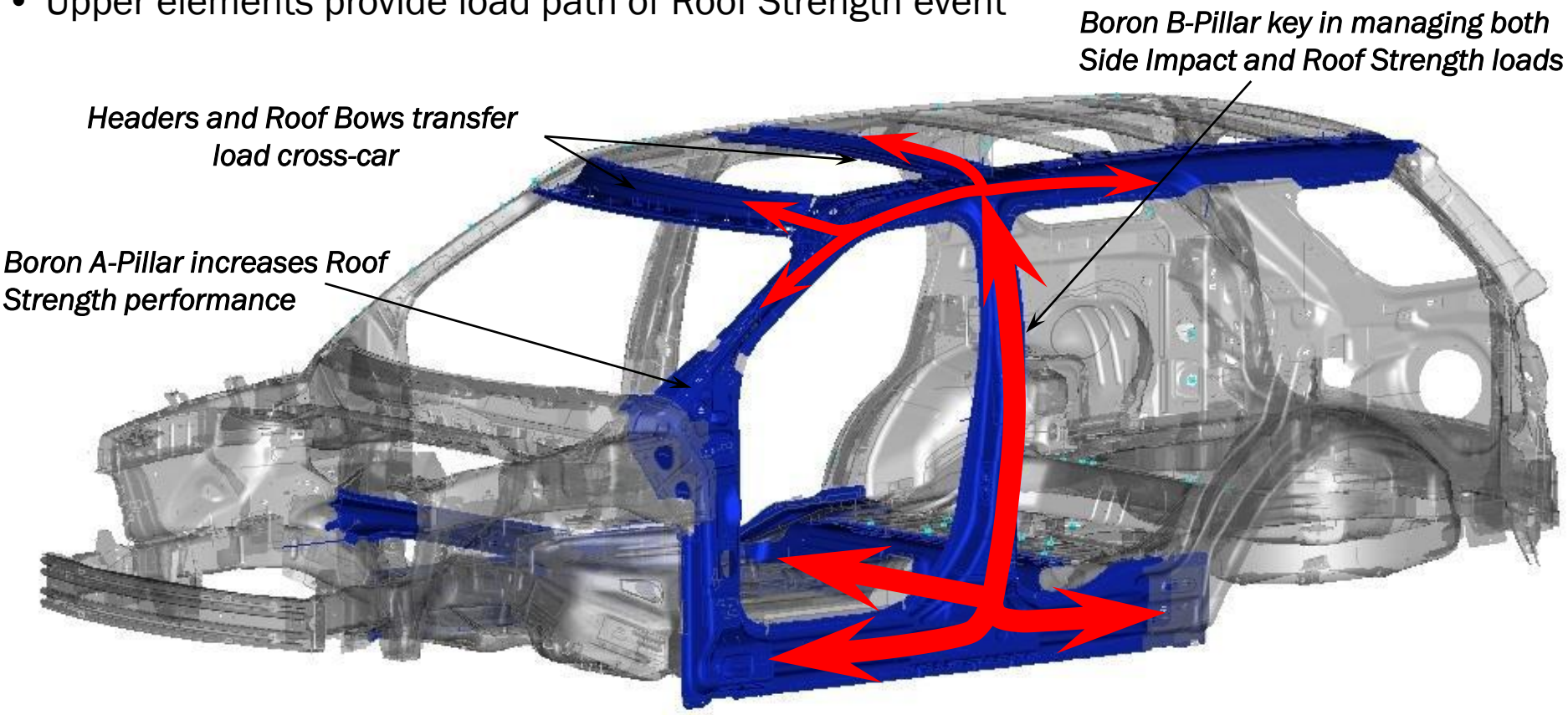
Dynamic Stiffness - Torsion



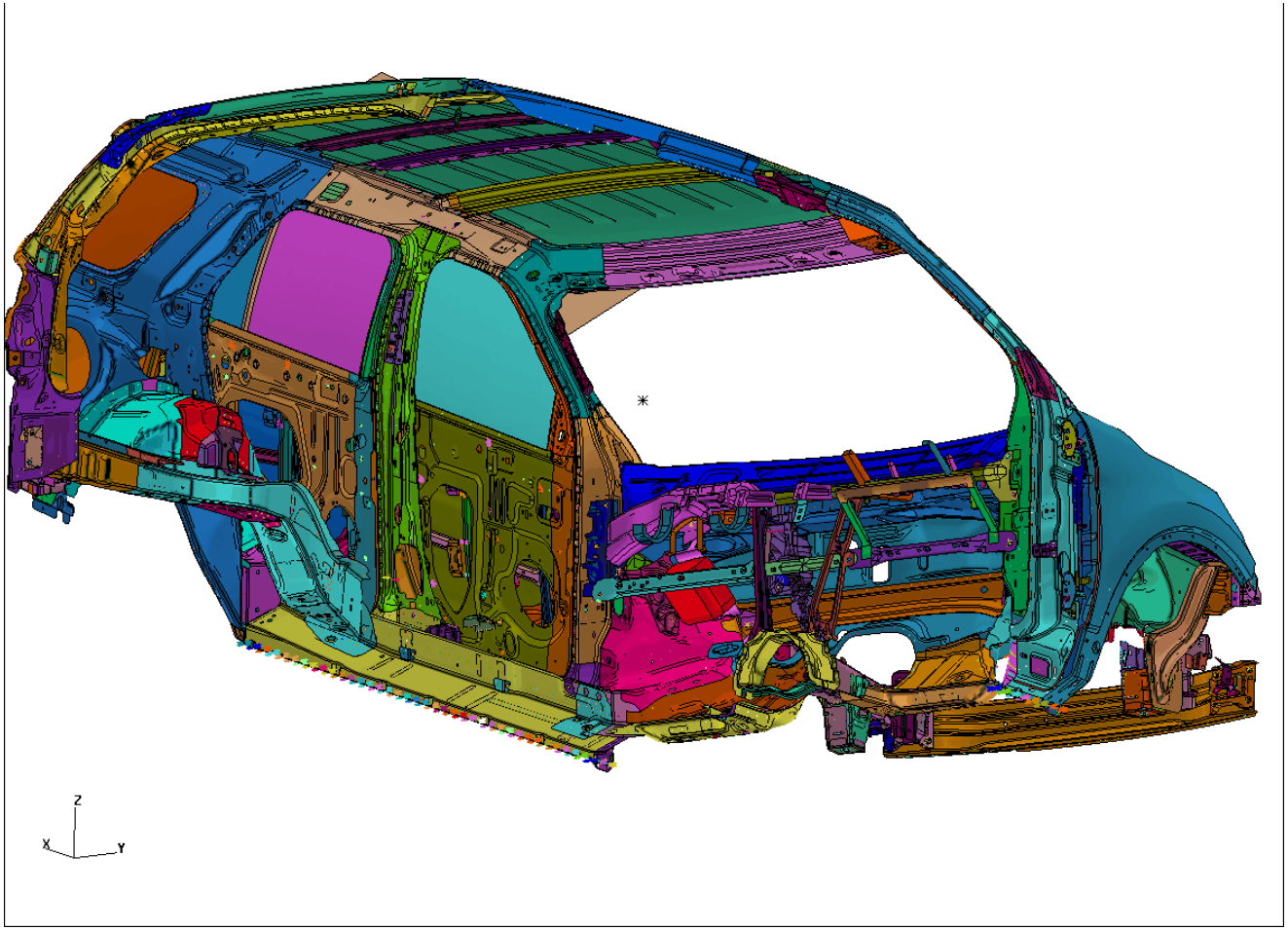
- *Focus on keeping body modes out of Power Train idle frequencies*
- *Separate major modes by minimum of 1 Hz*

Side Impact and Roof Strength Concept

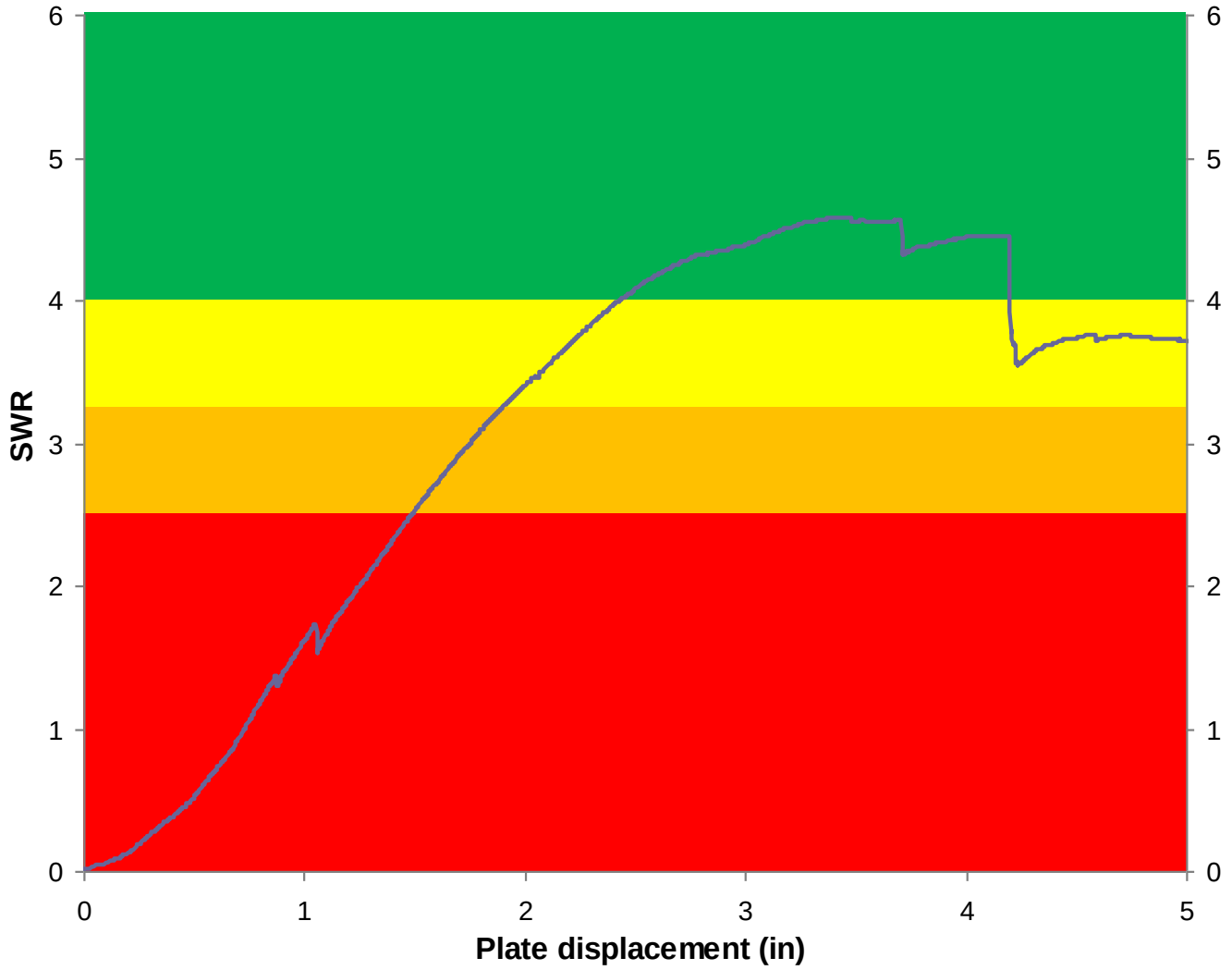
- Rocker, B-Pillar and Floor Structure act as primary load paths for Side Impact
- Transfer load to the opposite side with lateral members (Headers and Bows)
- Upper elements provide load path of Roof Strength event



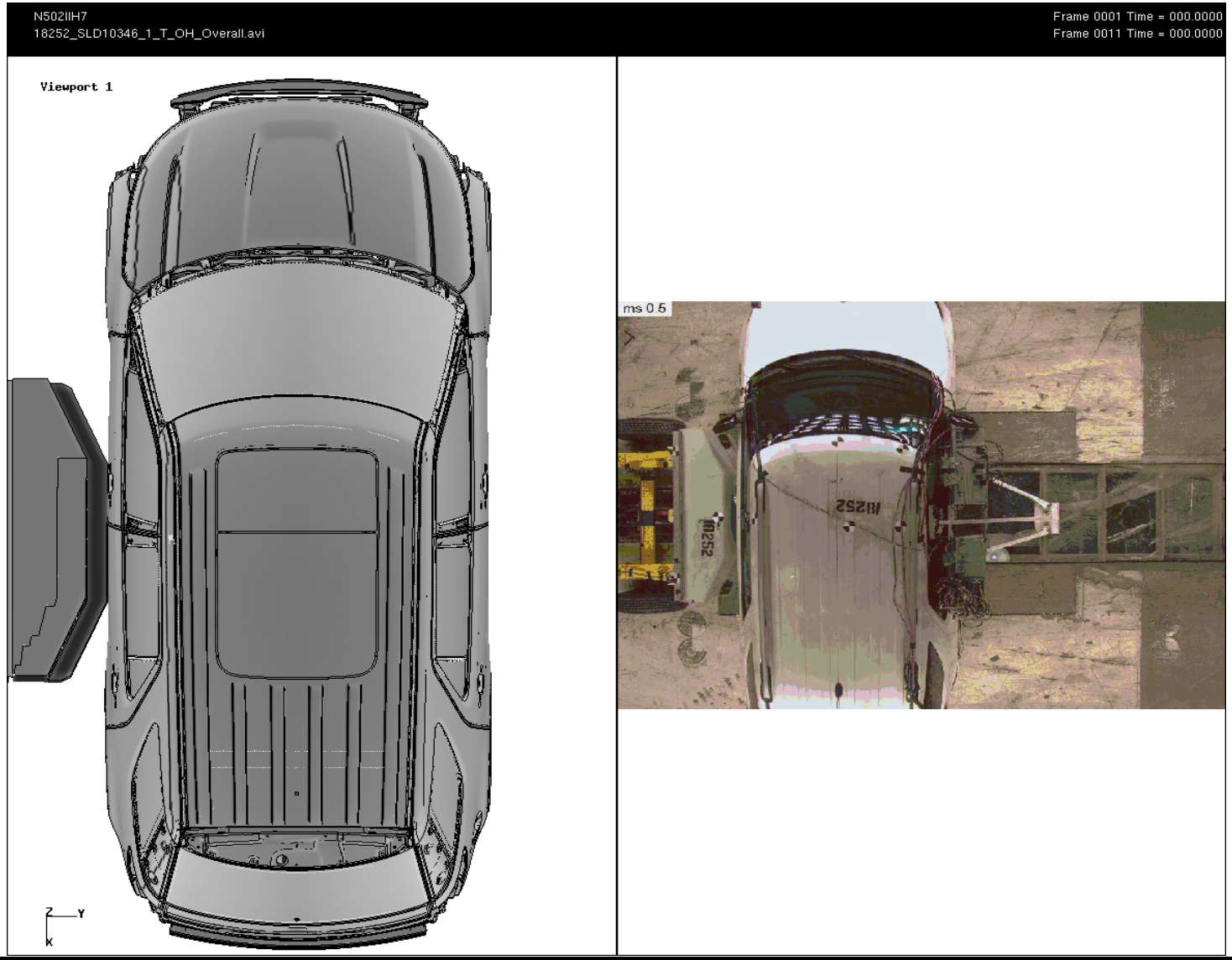
Roof Strength Performance



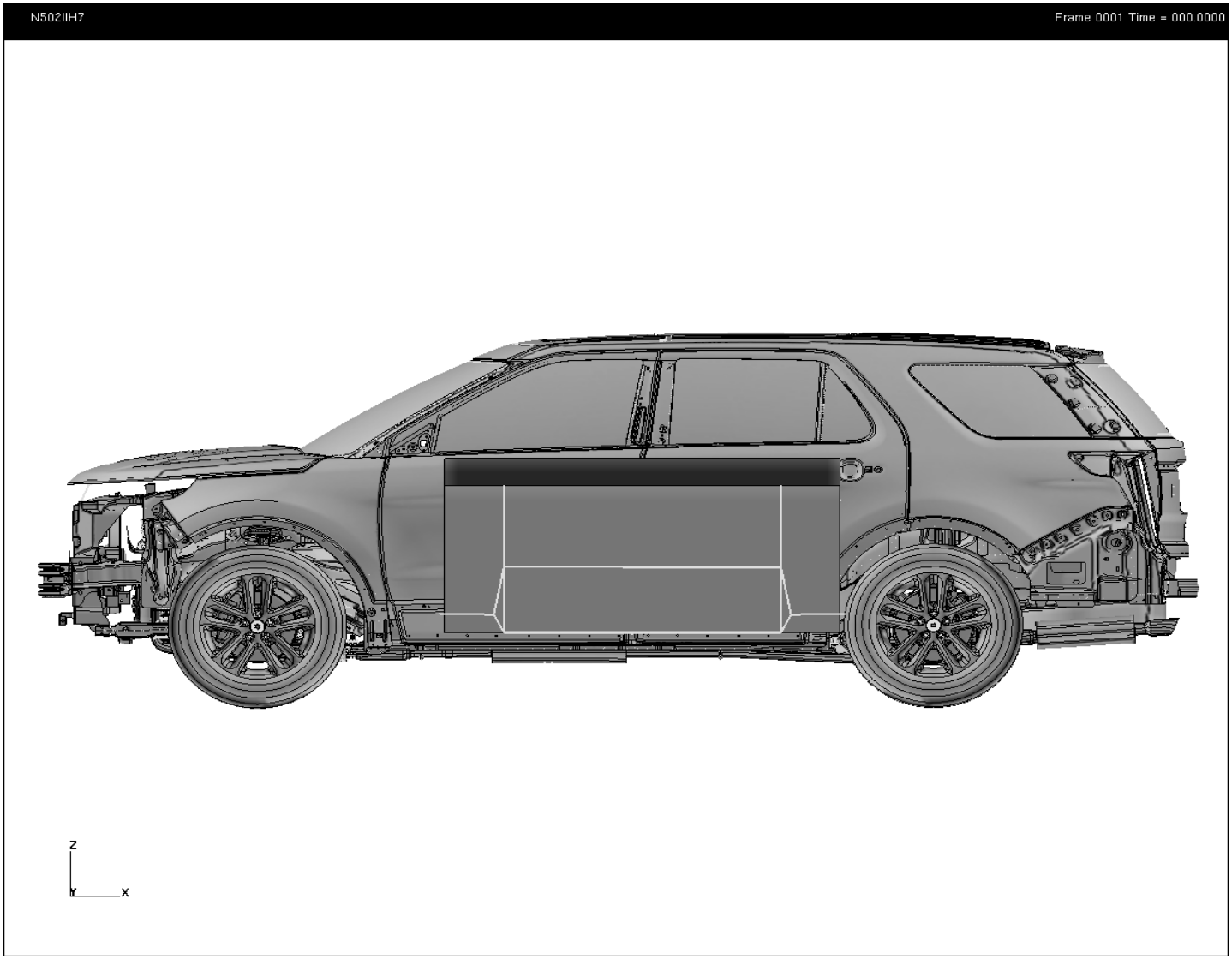
Roof Strength Performance



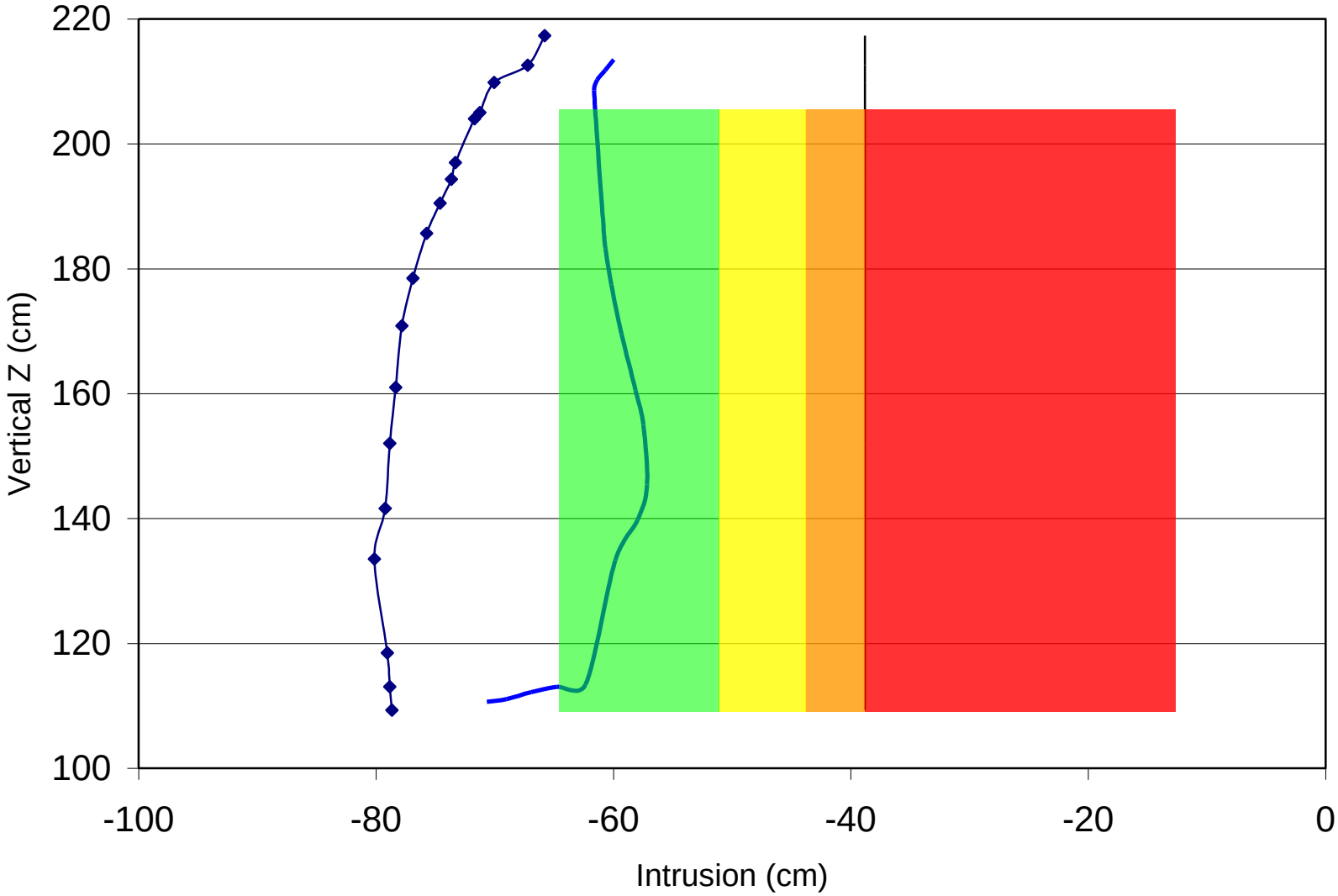
Side Impact Performance



Side Impact Performance



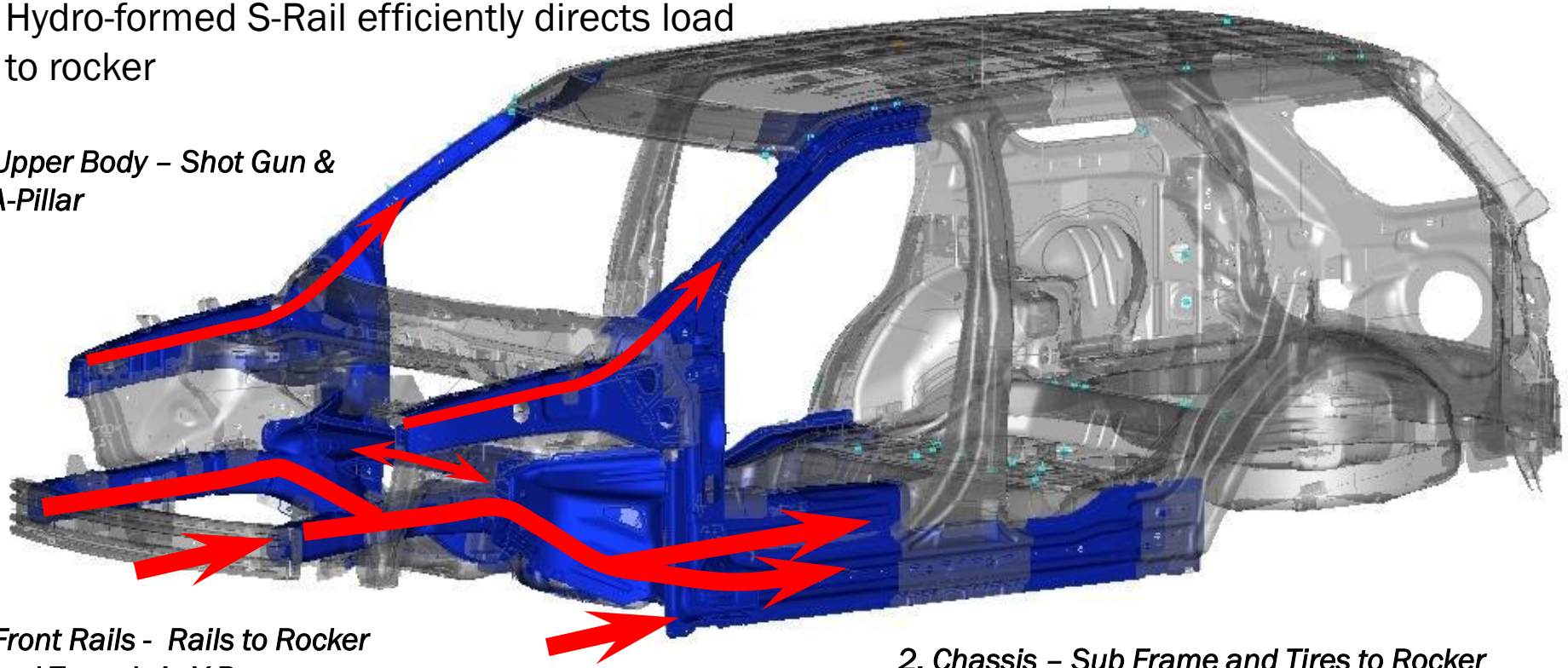
Side Impact Performance



Front End Load Path

- Utilize a 3 Load Path Strategy
  - Front Rails
  - Chassis
  - Upper Body
- Manage majority of load in front structure & rocker
- Hydro-formed S-Rail efficiently directs load to rocker

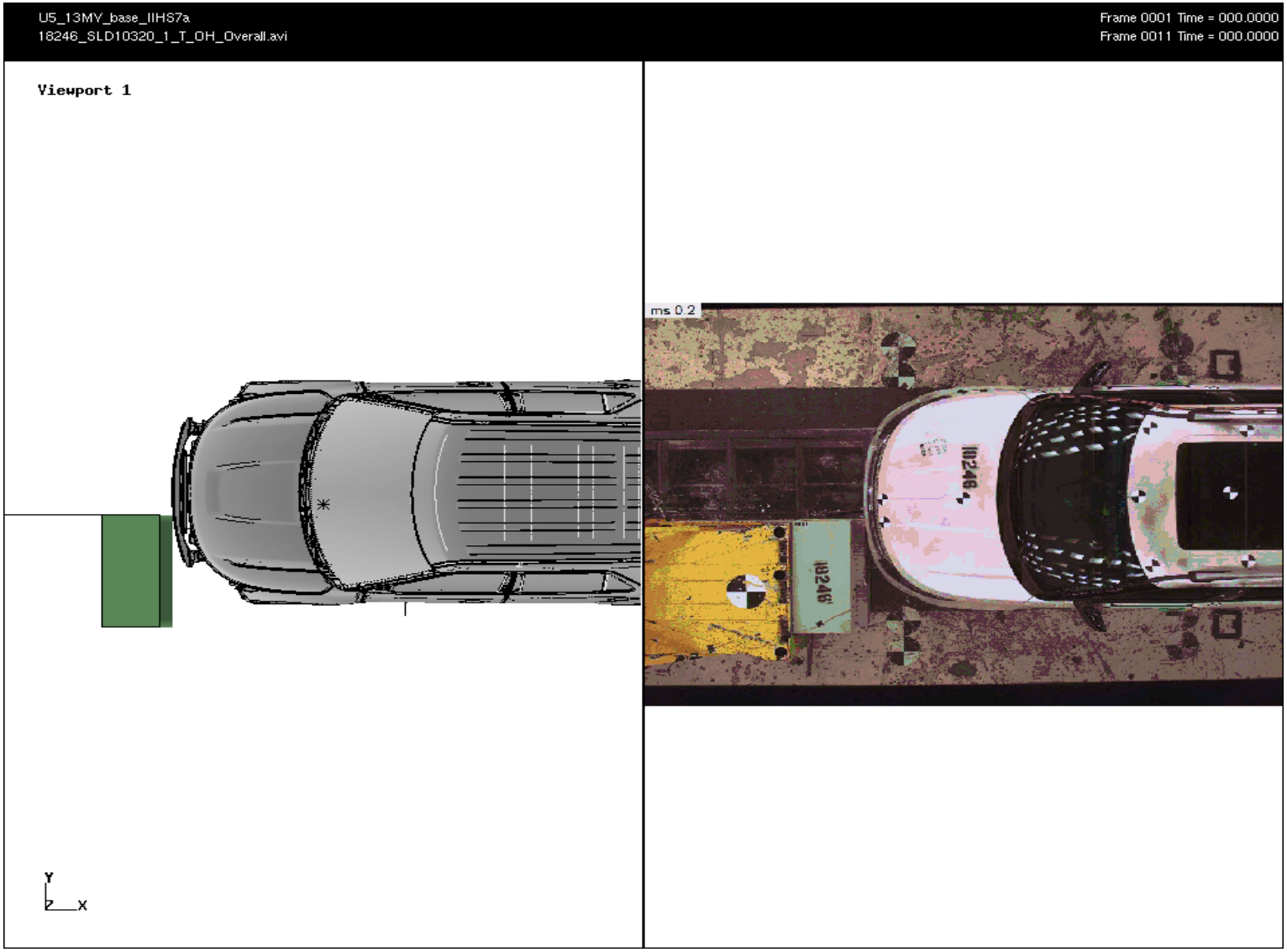
3. Upper Body – Shot Gun & A-Pillar



1. Front Rails - Rails to Rocker and Tunnel via Y-Brace

2. Chassis – Sub Frame and Tires to Rocker

IIHS Off Set Performance



IIHS Off Set Performance

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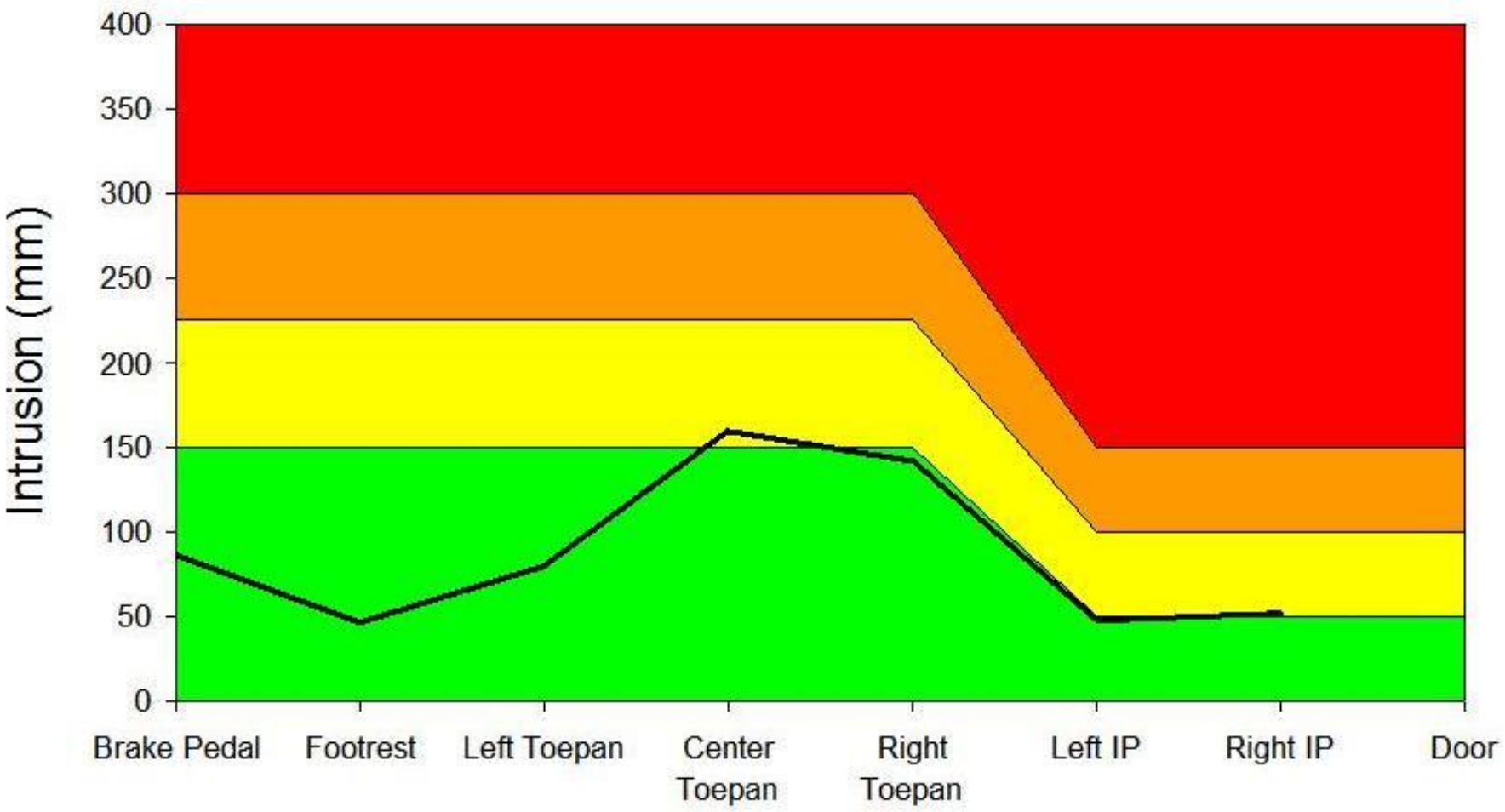

Thank You for Your Attention