The All New Lincoln Continental

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Ford Motor Company

Agenda

- History / Background
- Platform Lineage
- Material Usage
- Design Concepts
- Functional Performance
  - Static Stiffness
  - Dynamic Stiffness
  - Safety

History / Background

1940 LINCOLN CONTINENTAL

Under the direction of Edsel Ford, designer E.T. "Bob" Gregorie conceived the original Continental design by modifying a Lincoln Zephyr with more elegant proportions. Renowned for its long hood and clean side panels, it has been hailed as one of the most beautiful cars of all time.

1956 CONTINENTAL MARK II

William Clay Ford resurrected the Continental nameplate and, in the process, introduced the Continental Division. The Mark II's expansive hood and classic, clean sides and roofline were consistent with the original, while its front end and rear taillight are often credited with helping usher in modern automobile design.

1961 LINCOLN CONTINENTAL

The "suicide doors" make the 1961 model instantly recognizable. Its crisp, understated style, highlighted by the slab-sided design, eschewed the trends of the day. It remains an icon of American pop culture, continuing to appear in movies and television that seek to evoke the unbridled enthusiasm of that era.

Platform Development

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CD Sedan

Fusion

MKZ

CD SUV / CUV

Edge (NA)

Edge (AP)

S-Max

Galaxy

MKX

D Sedan

Taurus (AP)

Continental

Design and Manufactured in Michigan

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Engineering: Dearborn

Manufacturing: Flat Rock, MI

Materials

Body In White Materials

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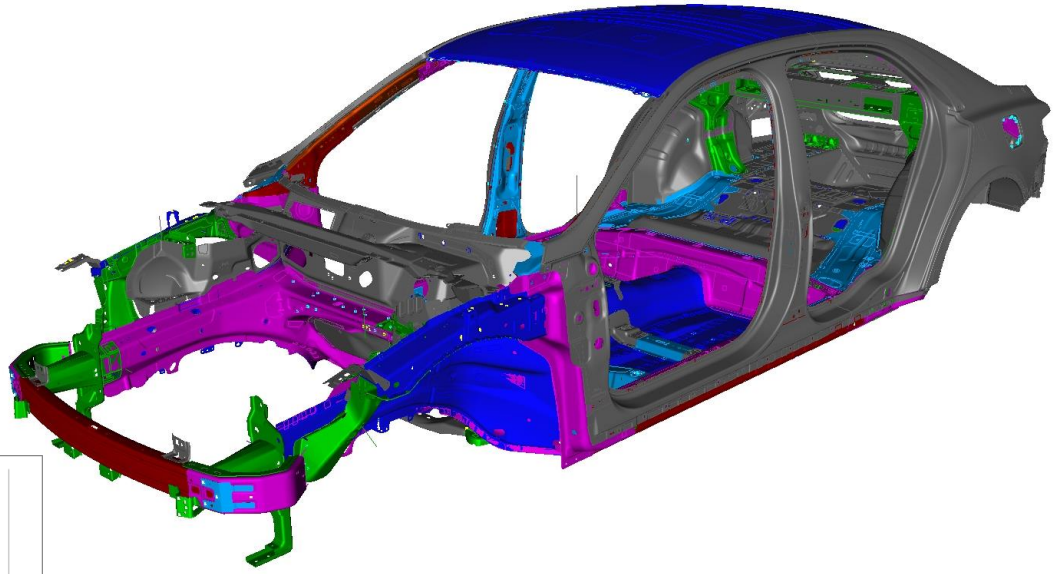
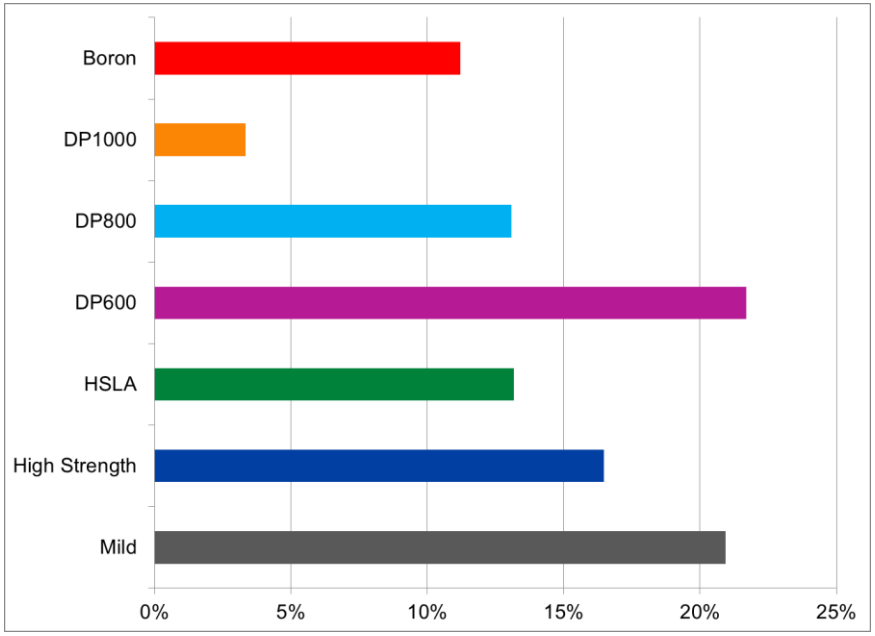
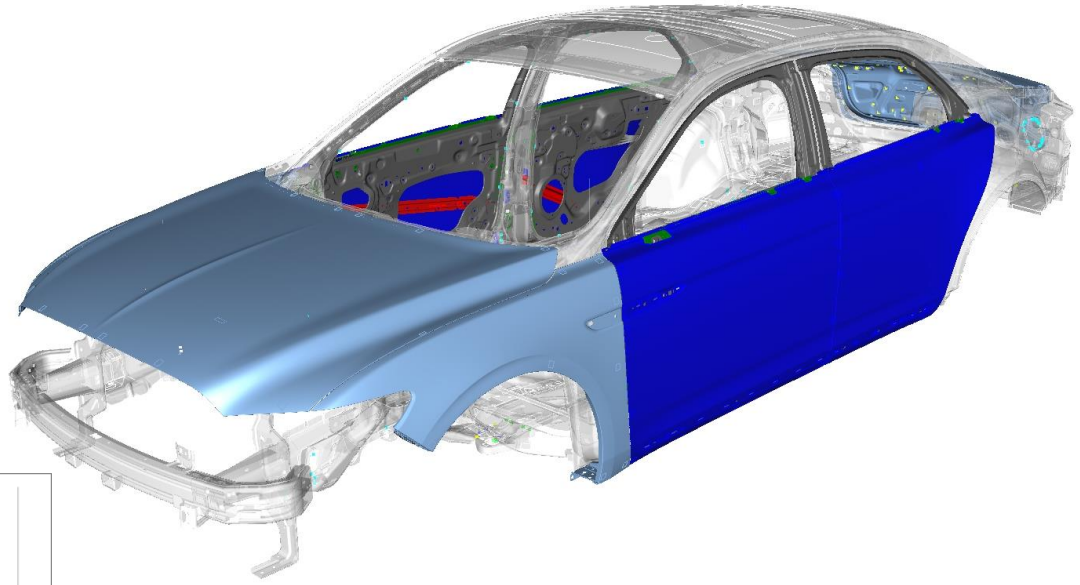
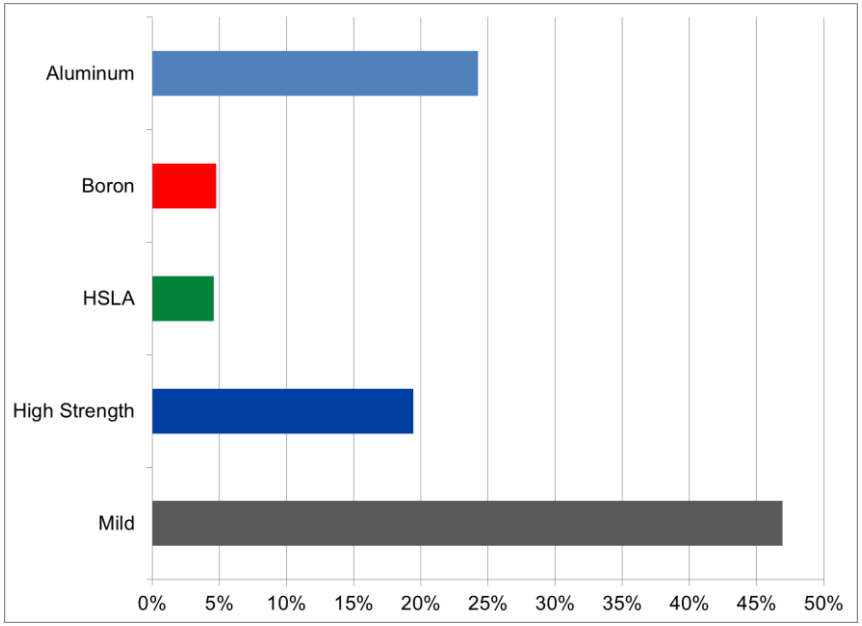




- Increase in DP600 to offset increase in vehicle mass compared to other platform derivatives
- Yield Strength increase on Pan stampings
- Significant increase in use of DP800 over previous models
- Boron / Martensitic steel usage is aligned with current strategies
- Average BIW Yield Strength ≈ 340 MPa

Closures Materials





- Continued use of Bake Hard 240 for outers to meet gauge minimums
- Increased use of aluminum adding fender and deck lid

Design Concepts

Package Comparison

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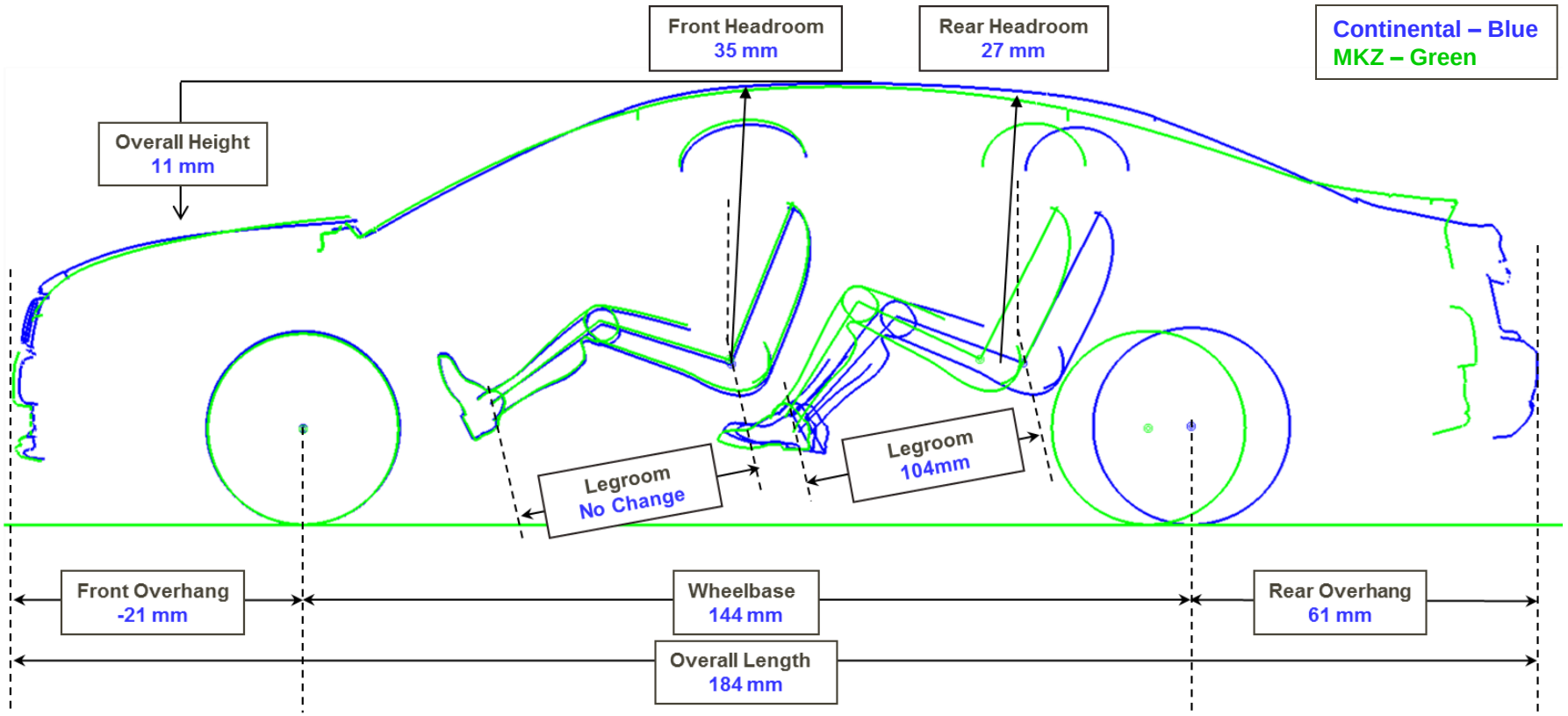
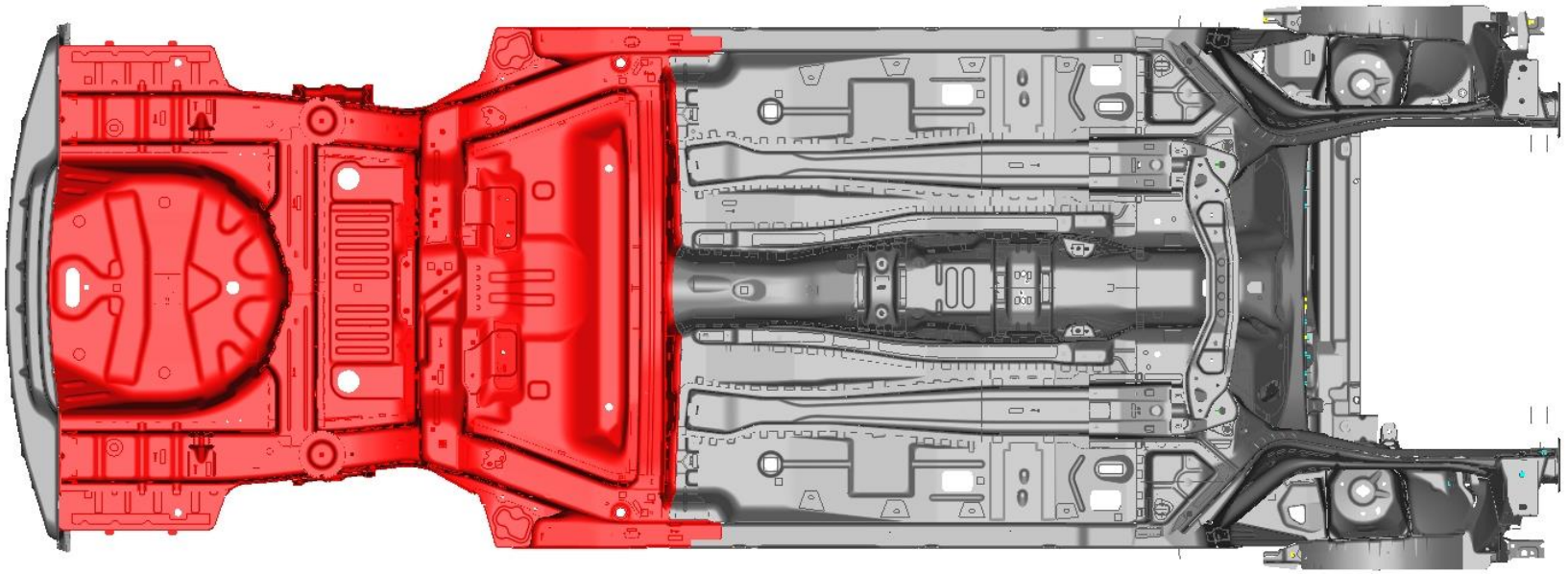


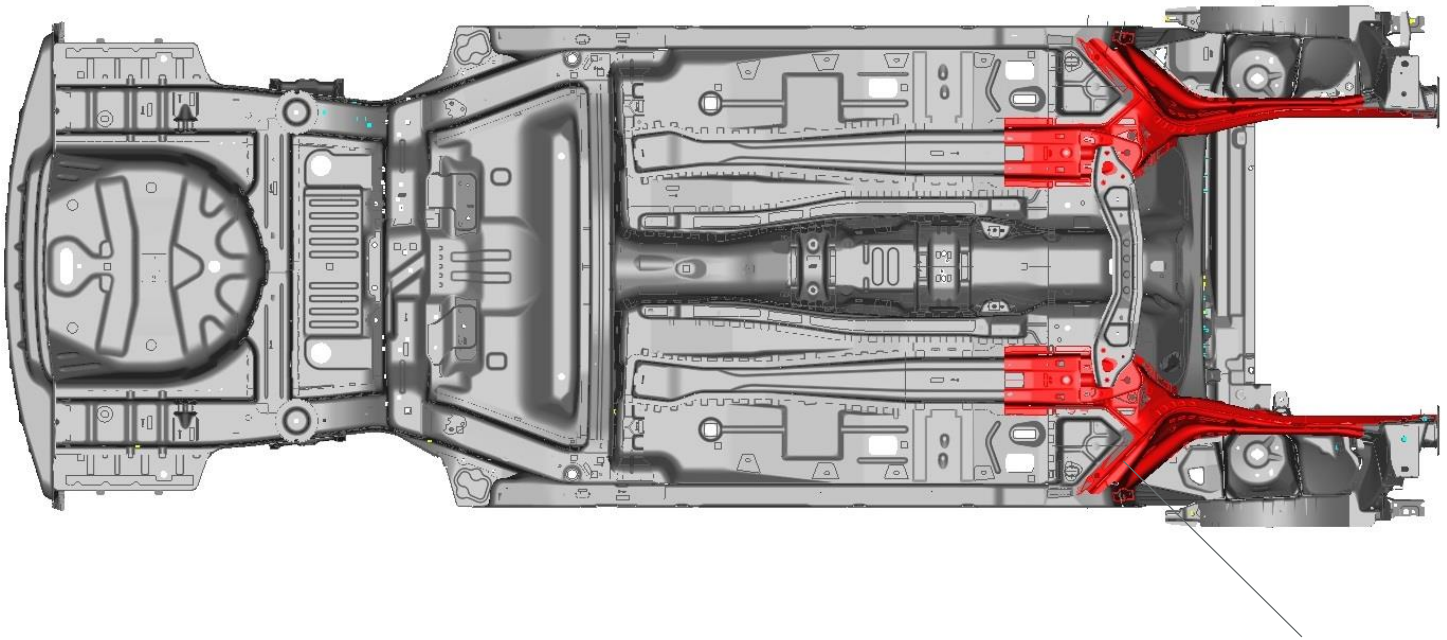
Key Dimension Changes:

- Continental wheel and tire sizes increased to 20”
- Unique suspension with an increased tread (27mm frt / 63mm rr)
- Continental is 150mm longer in the wheelbase versus the MKZ providing a significantly improved 2nd row legroom



- Rear of the Front Floor Pan is extended 134 mm to adjust for a portion of the wheel base increase
- Sled Runners and Tunnel Runners extended to match the length of the Front Pan
- Remainder of the vehicle length increase is accounted for in the all new Rear Pan Assembly

Front Rail Design

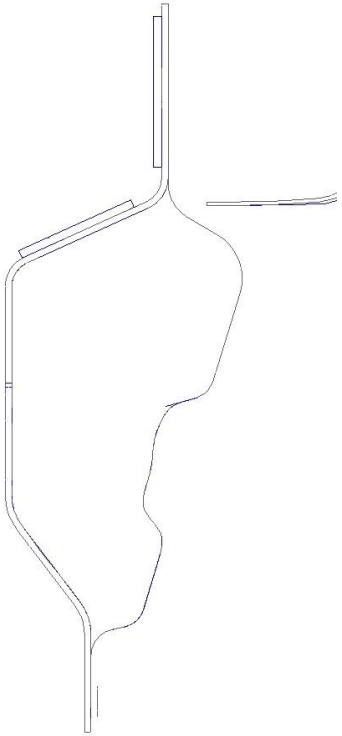


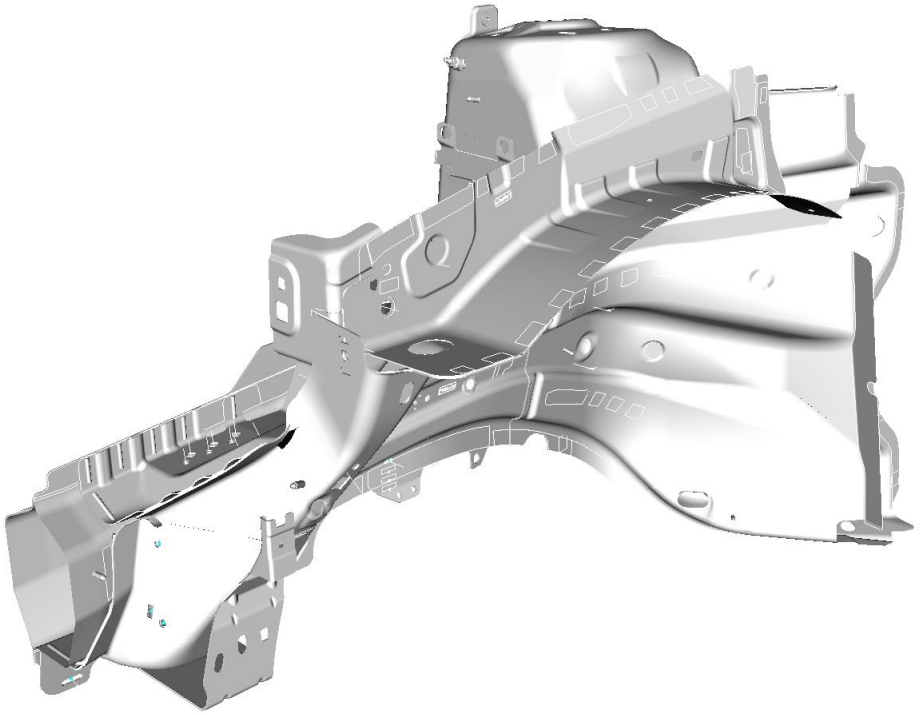
Front Structure is based on the Fusion design and uses an S-Brace Rail section angles toward the rocker as it transitions under the dash for improved load path.

Hexagonal front rail section for improved axial crush performance

Y-Brace replaces the typical Torque Box to distribute load to the rocker and the sled runners

Front Rail Design

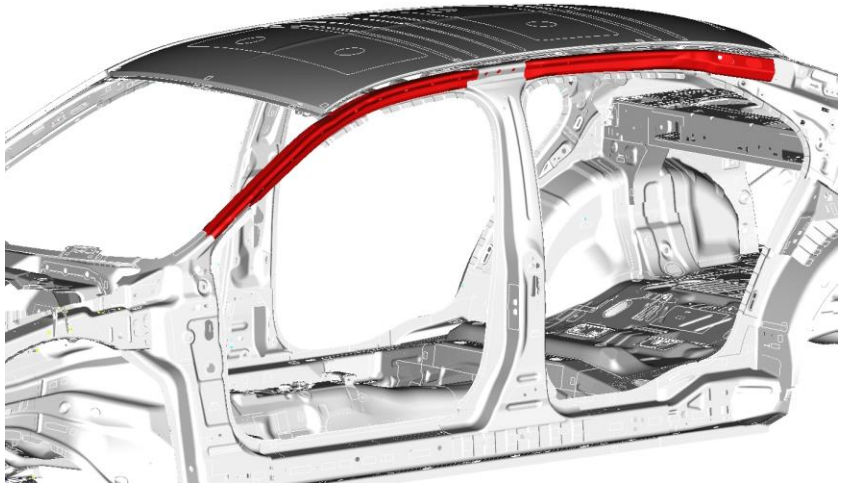




Front Rail geometry is the common with the Fusion

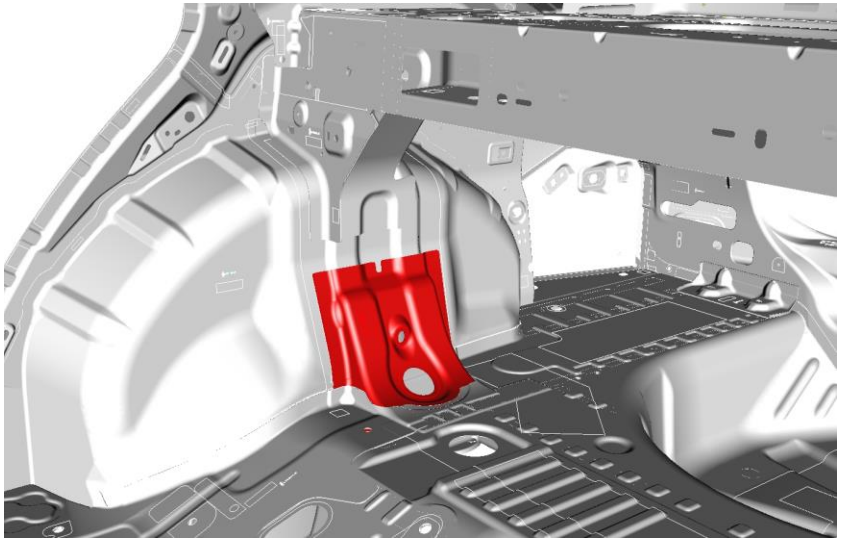
- Cross section identical except for local differences driven by package conditions
- Length of Rails are identical

Rail Inner material grade changed to DP600 to manage the energy associated with the higher vehicle mass



Advantages associated with the performance of continuous closed sections:

- Enabler for use of AHSS
- 25% Reduction in Variable Cost
- 9% Reduction in Mass



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

Improved joint resulted in the following improvements in BIW torsional stiffness by13%

Local and equivalent stiffness for Sub-frame and Shock attachments were increased 10%

Platform Mass Savings – Floor Pan

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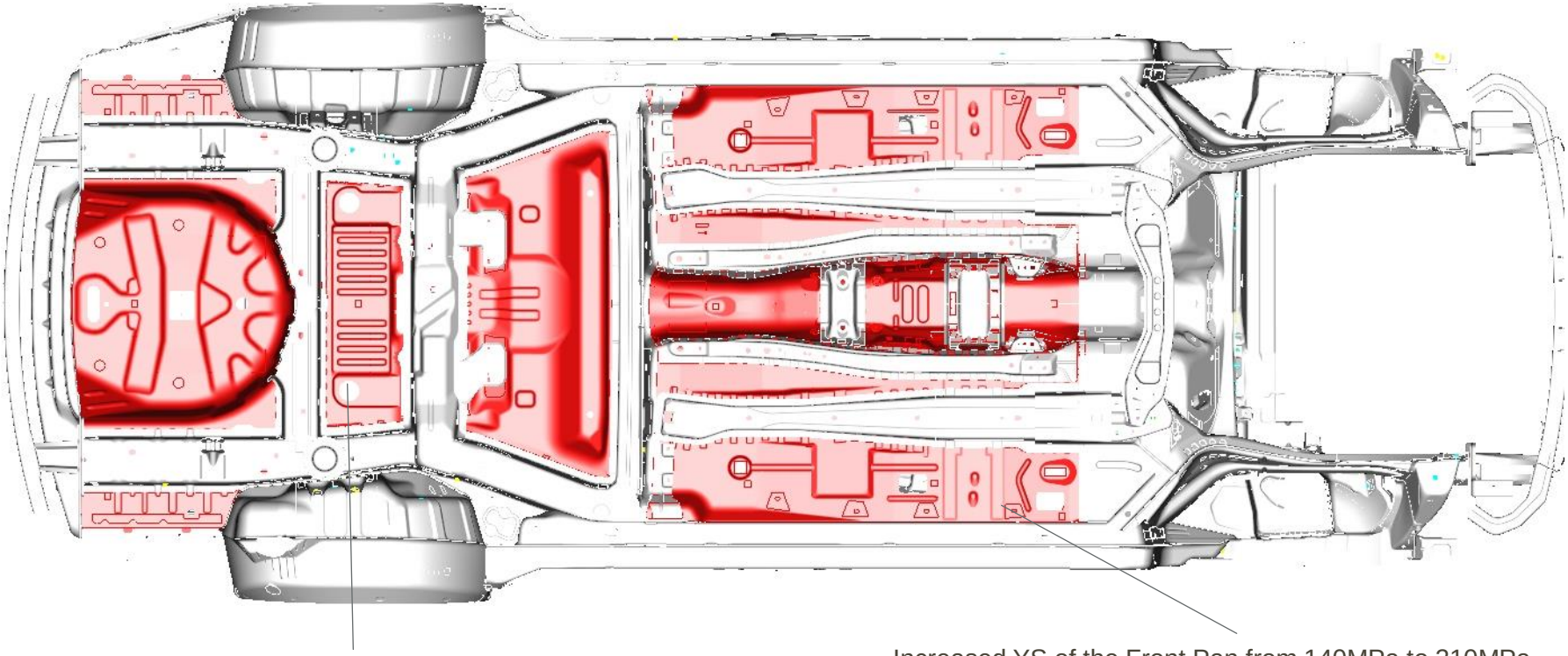

- Rear pan utilizes a laser welded blank to:
  - Consolidate parts and reduce tooling
  - Utilize grades and gauges were required
- Increased YS of center section of the floor pan from 140 MPa to 210MPa resulting in about a 1kg reduction in mass
- Tire tub area uses mild steel for improved stamping performance

Increased YS of the Front Pan from 140MPa to 210MPa

- Improved performance during high strain events
- Gauge reduction over typical standard resulting in a 3% mass savings

Rear Rail

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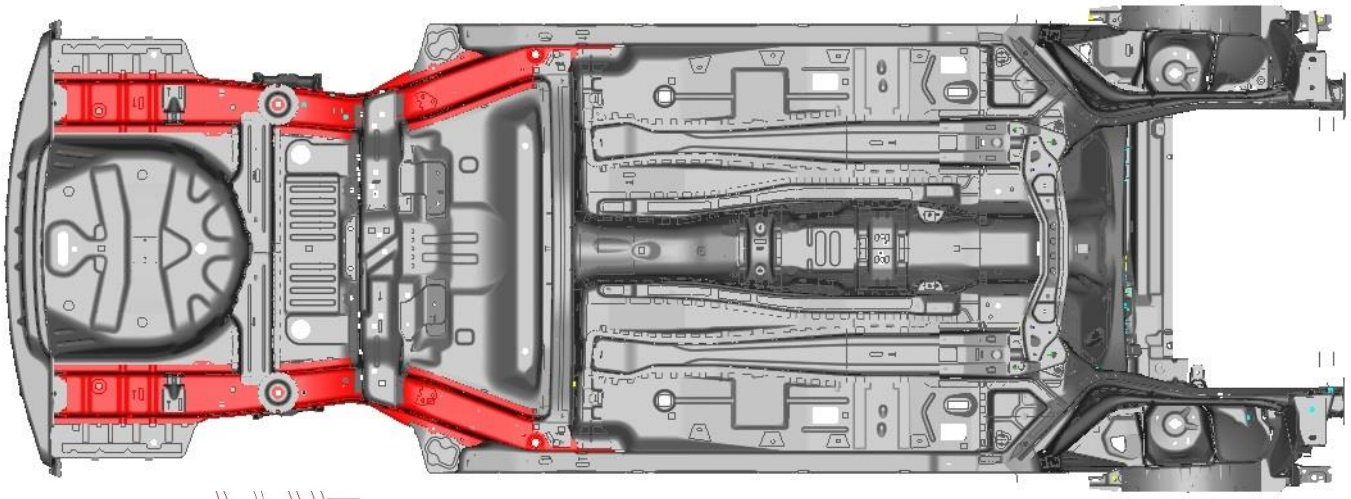
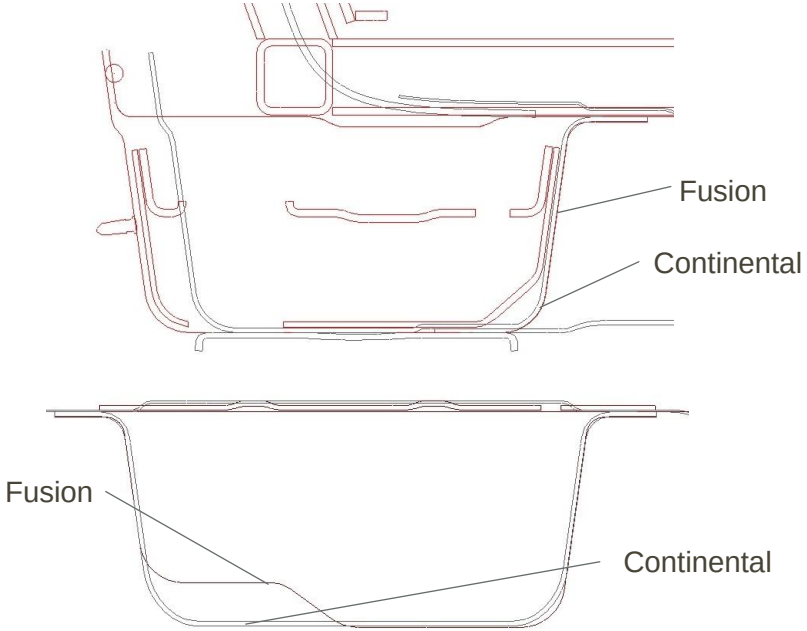


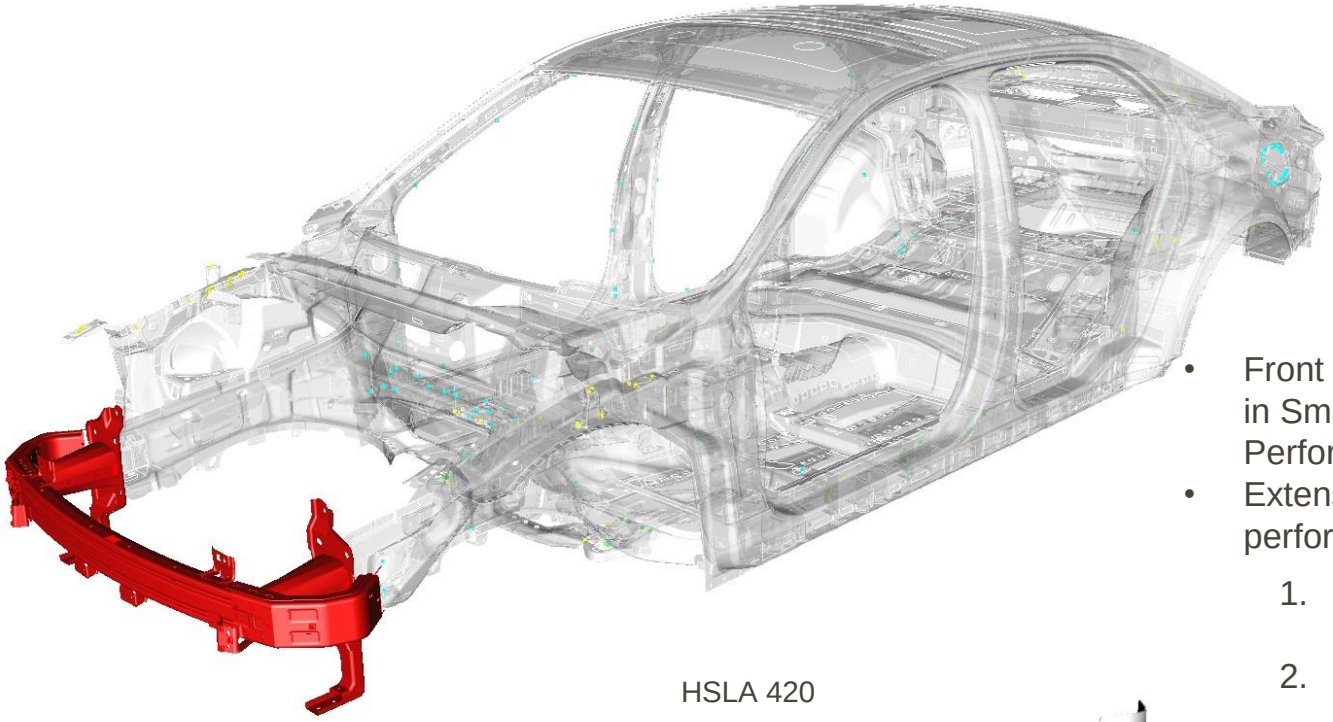


Rear Rail section is comparable to the section of the Fusion

- Increased material grade from DP600 to DP800
- Material change allowed for a gauge reduction of 6% despite the increased vehicle mass

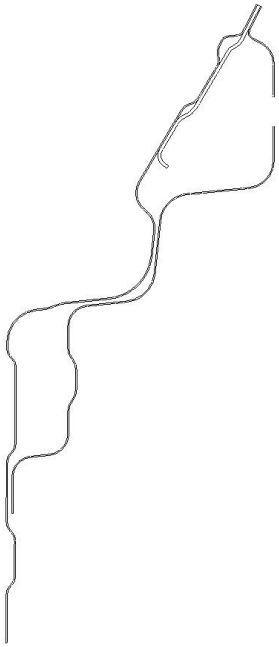
Combined with the gauge reduction in the Rail Cap also achieved with the use of DP800, a total of 3.5 kg were removed

Front Bumper Beam

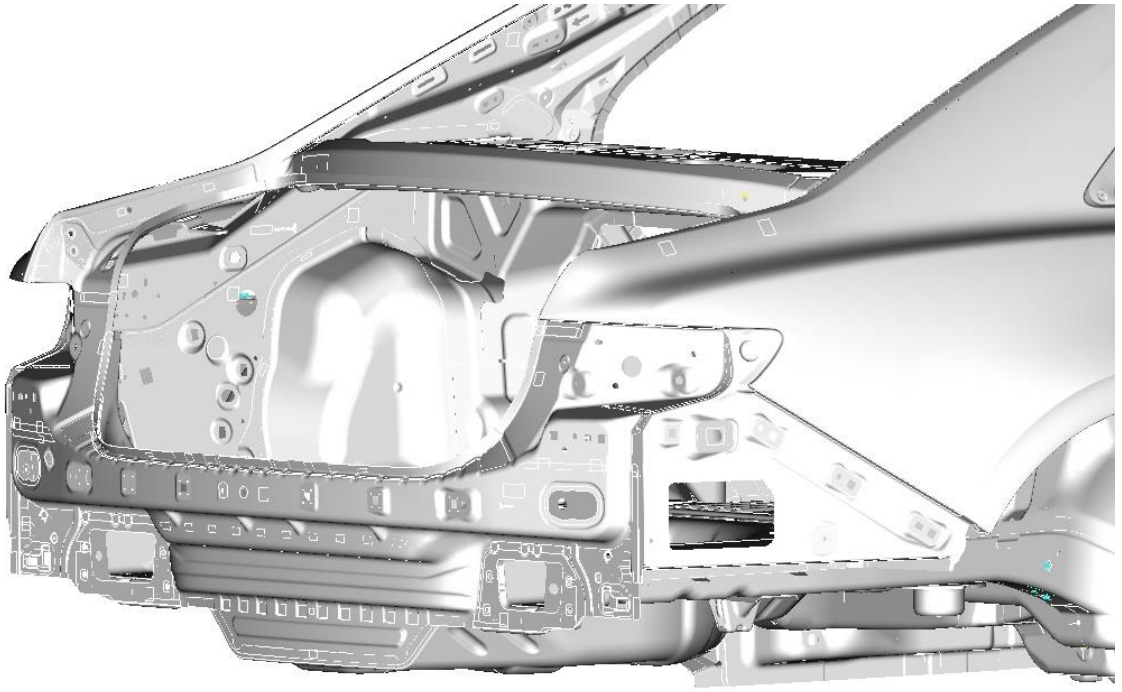


- Front Bumper Beam plays a major role in Small Offset Rigid Barrier Performance
- Extensions engage the barrier and perform two tasks:
  1. Initiate rotation of the vehicle about the barrier
  2. Engage the Front Rail to absorb energy

Back Panel Design



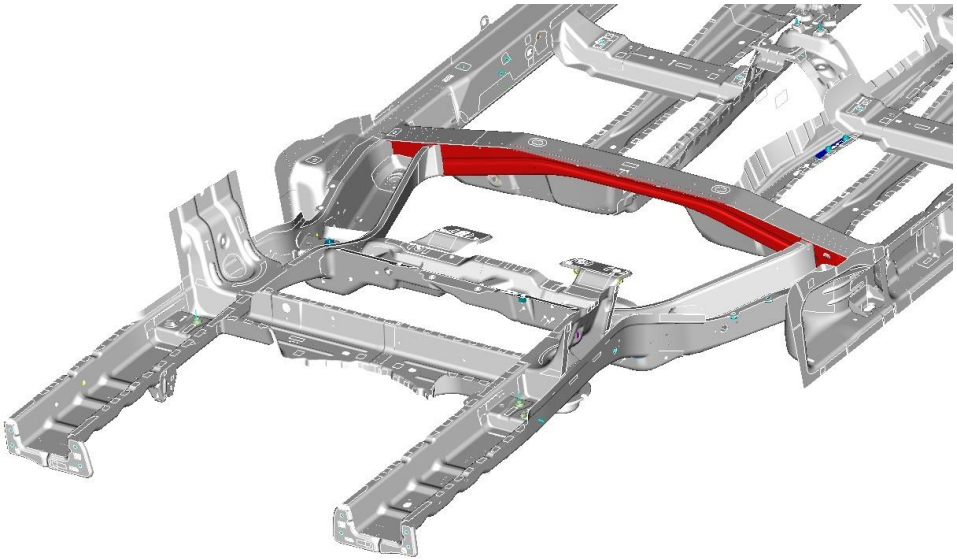
Y=0 Section

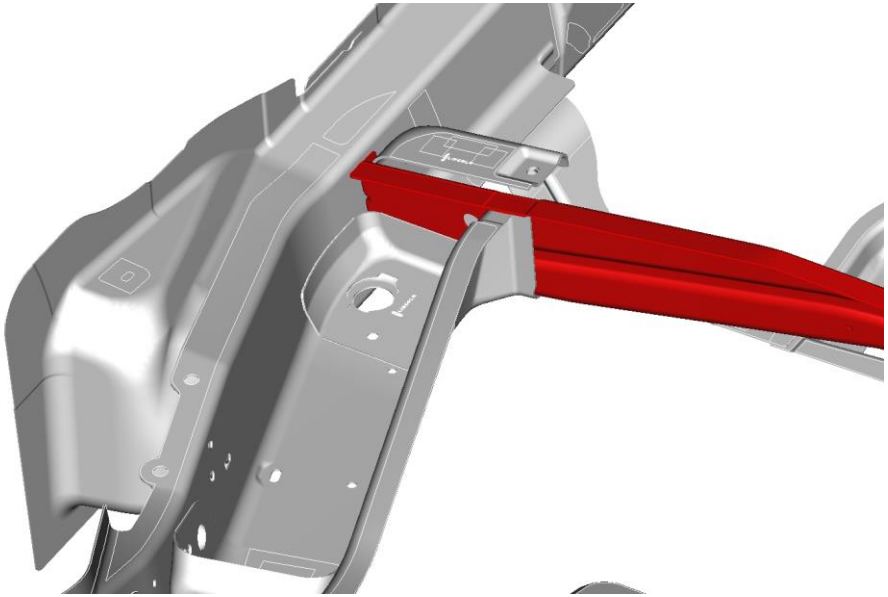


Double Cell Back Panel construction provide the following benefits:

- Improved stiffness at the Deck Lid Latch
  - 128% improvement in lateral stiffness
  - 44% improvement in vertical stiffness
- 29% increase torsional rigidity
- Reduced intrusion during rear impact
- Improve Tire Tub durability

Kick Up Cross Member





Typical joint between the Kick Up Cross Member and the Rear Rail is made on the inboard side of the Rail

Continental construction moves the joint to the outboard side of the Rail providing:

- Increased rigidity by minimizing the rotation at the joint
- Improved side impact performance due to early engagement of the cross member

Package Tray Enhancements

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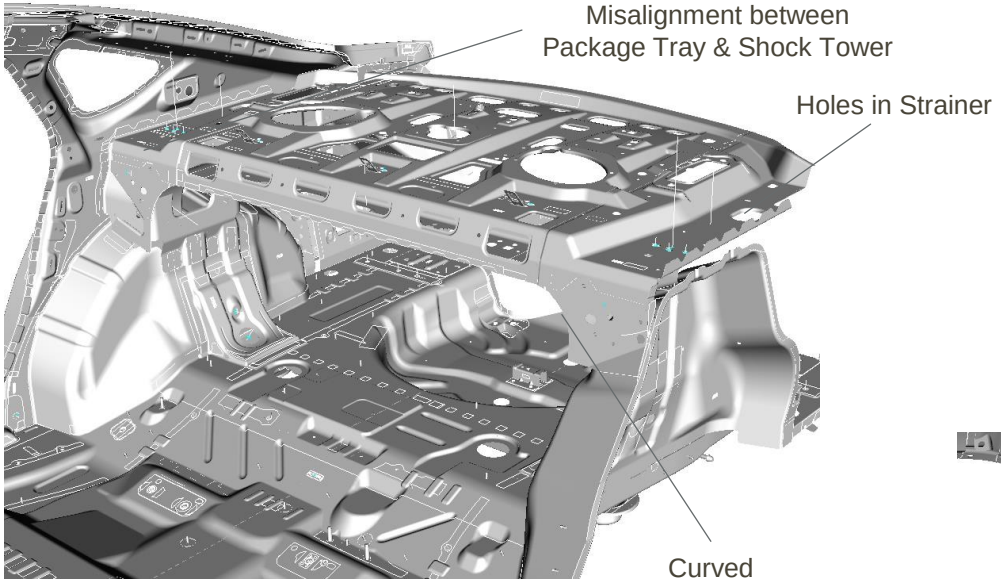
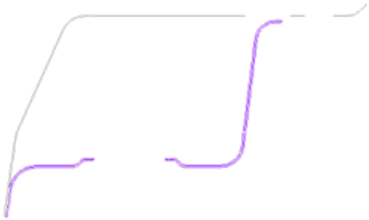
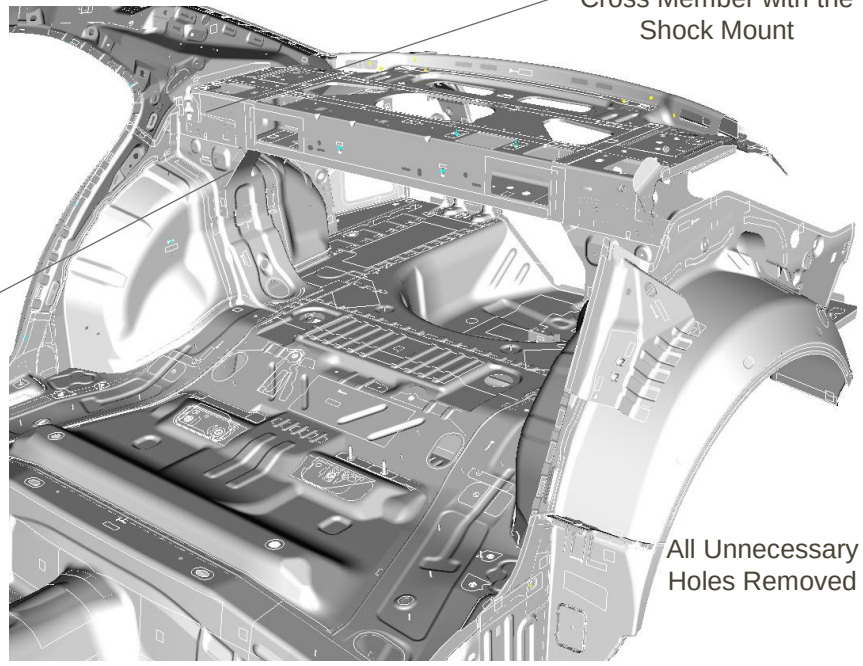


Conventional Package Tray



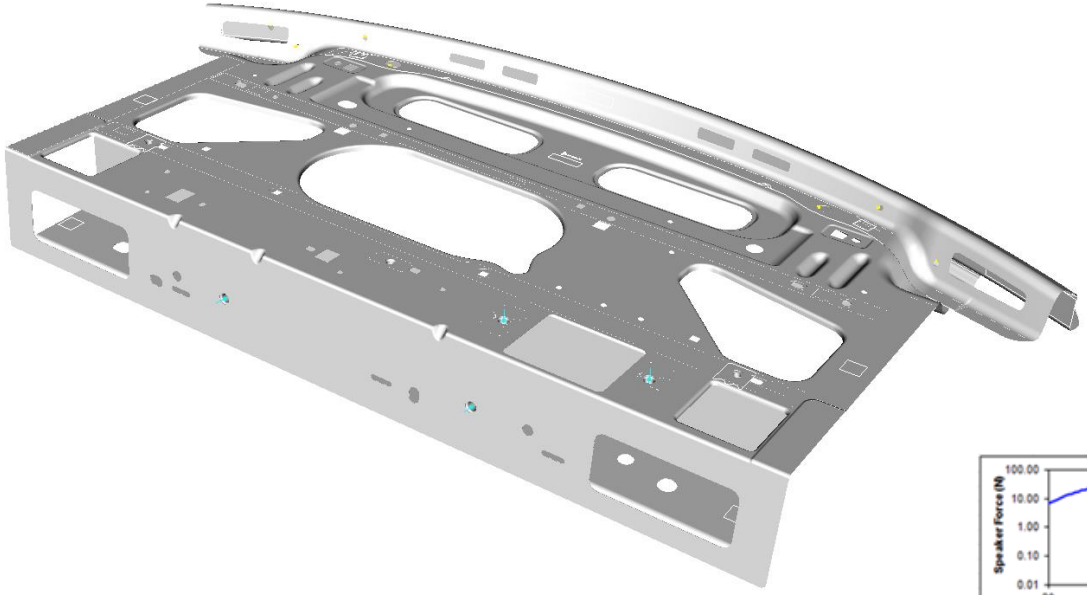
Conventional Package Tray
Cross Member Section



Continental Package Tray
Cross Member Section

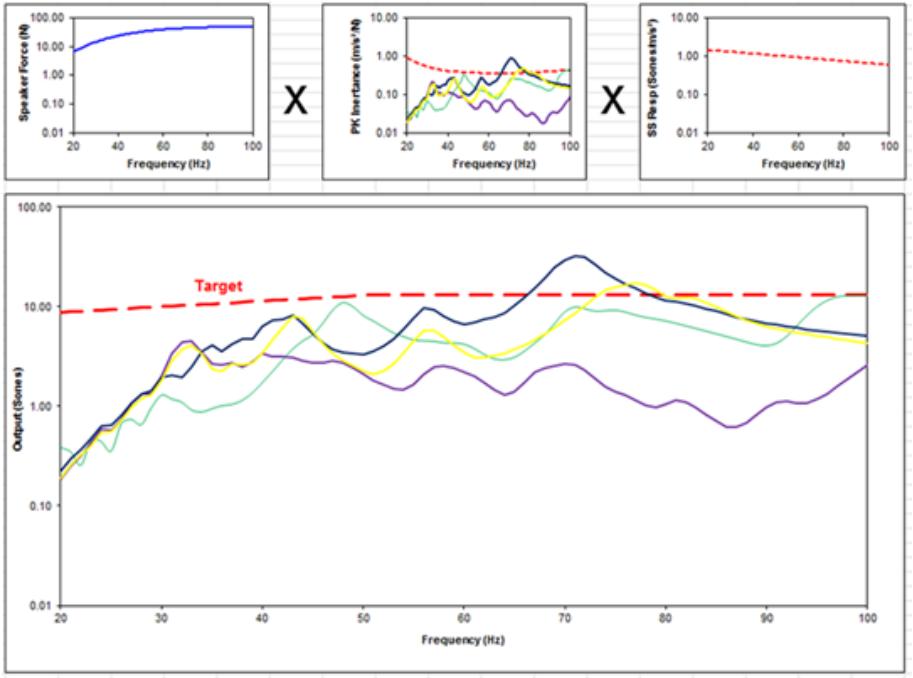
Continental Package Tray

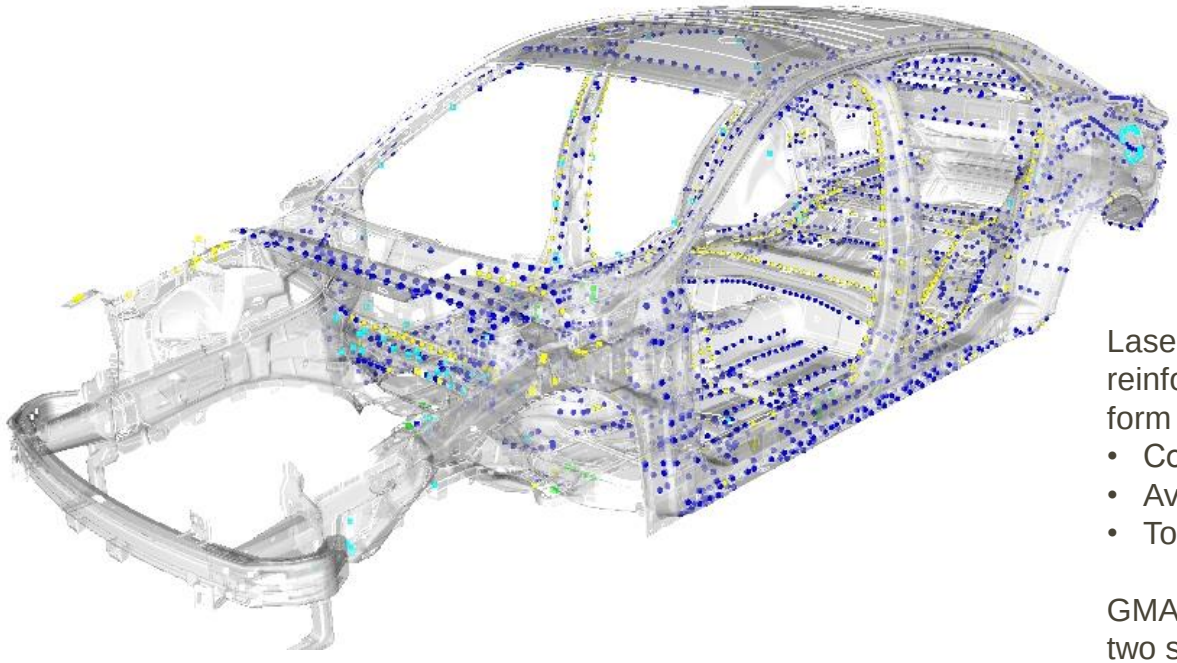
Package Tray Enhancements



- Simplified stamping geometry
- Reduced assembly complexity through part elimination
- Mass reduction of 8.5kg
- Improvement in torsional stiffness of 205 kNm/rad

System Response to Subwoofer Input





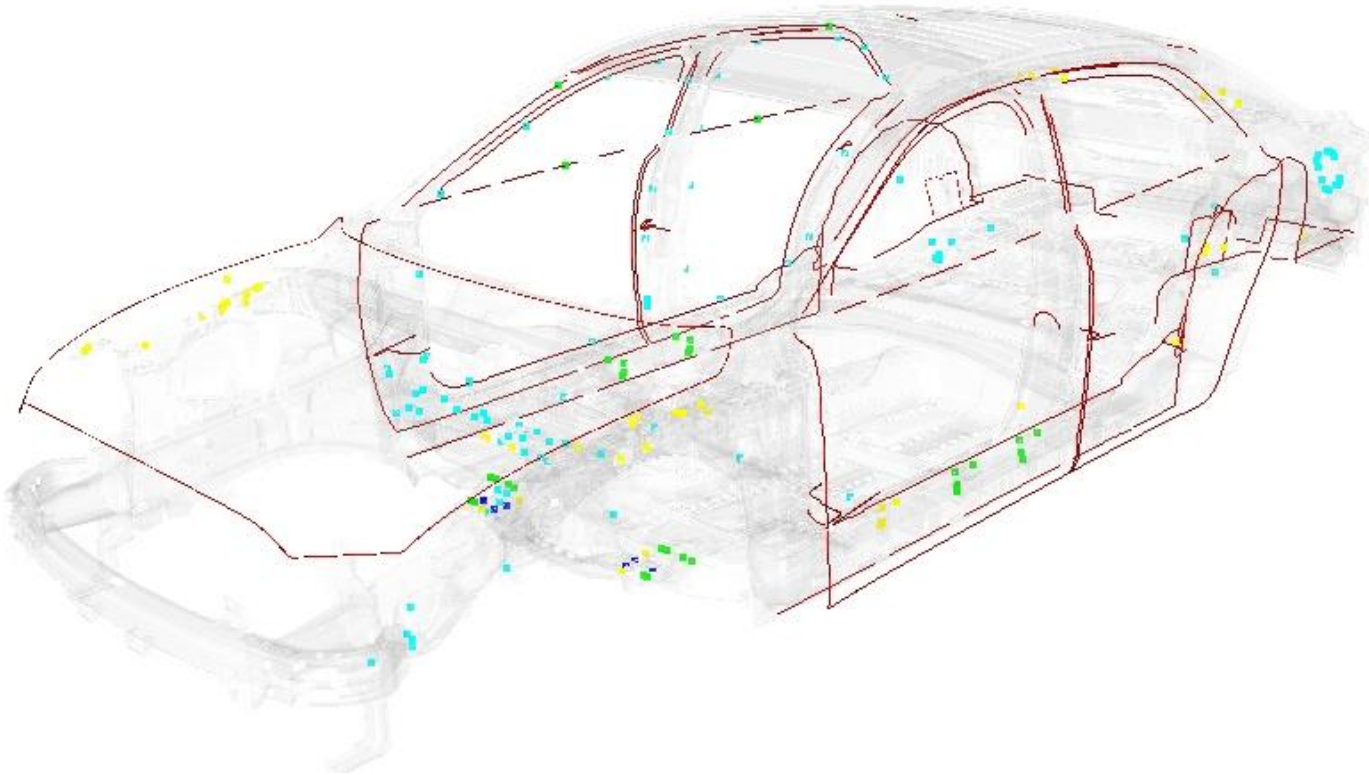
Laser welds are used in the Body Side for joining of reinforcements and Body Side Outer to the hydro-form A-Pillar / Roof Rail

- Combination of stitch and “C” welds
- Average length of laser welds is 25 mm
- Total laser weld length approximately 6.1 meters

GMAW are only used in areas critical areas where two sided access is not available

System	Spot	Laser	GMAW	Nut	Stud
Body Side	394	210	2	54	4
Framing	900	34	14		2
Under Body	1105	N/A	N/A	17	52
Front Structure	409	N/A	N/A	N/A	N/A
Total	2808	244	16	71	58

Joining - Bonding



- 23 meters of adhesive in the BIW primarily in the platform
- Material used to improve stiffness and NVH performance
- Added between Body Side Outer and the Hydro-Form A-Pillar / Roof Rail to augment welding
- Additional adhesive used in the closure hems

Static & Dynamic Stiffness Performance

Static Stiffness Performance - Bending

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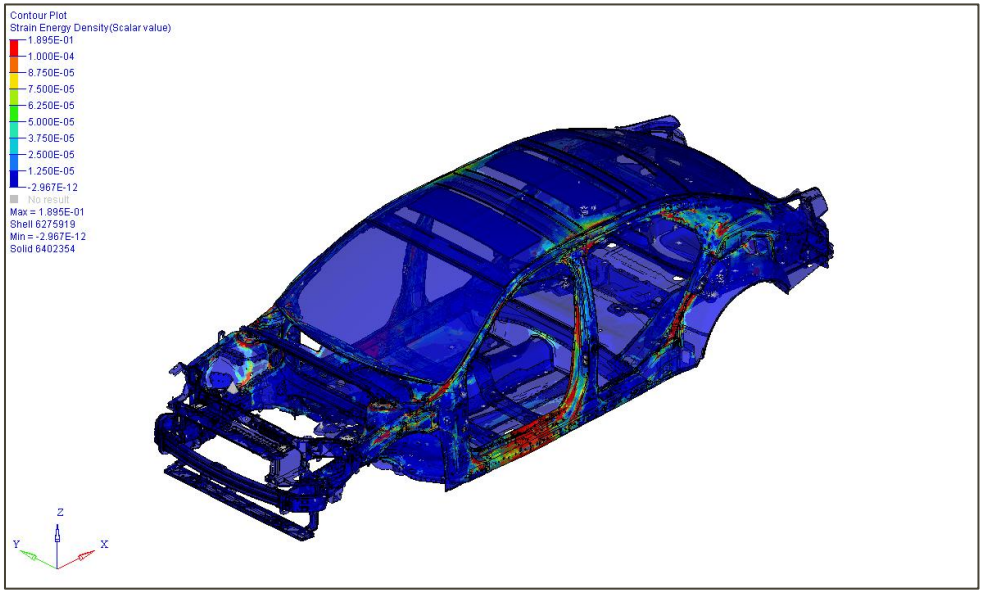

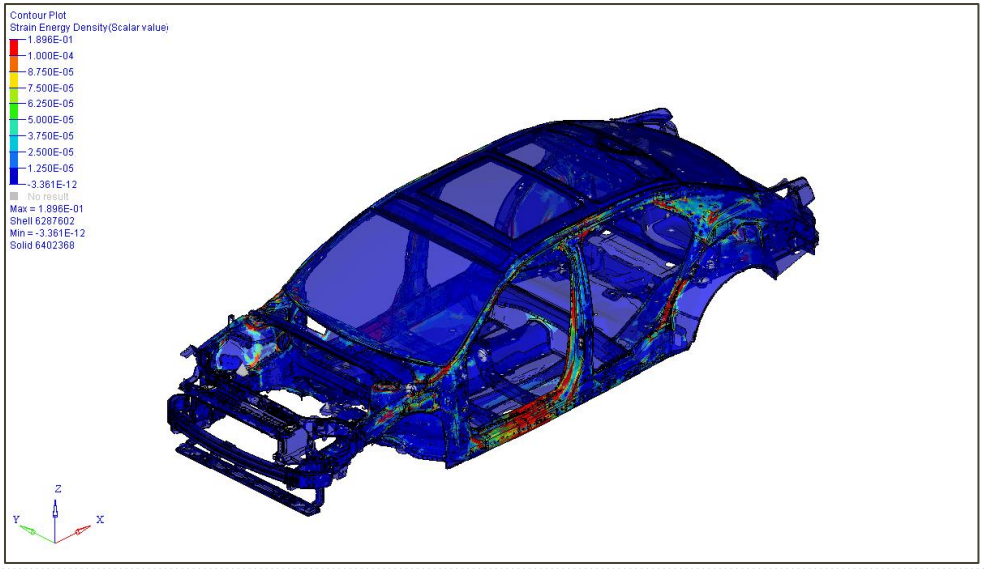

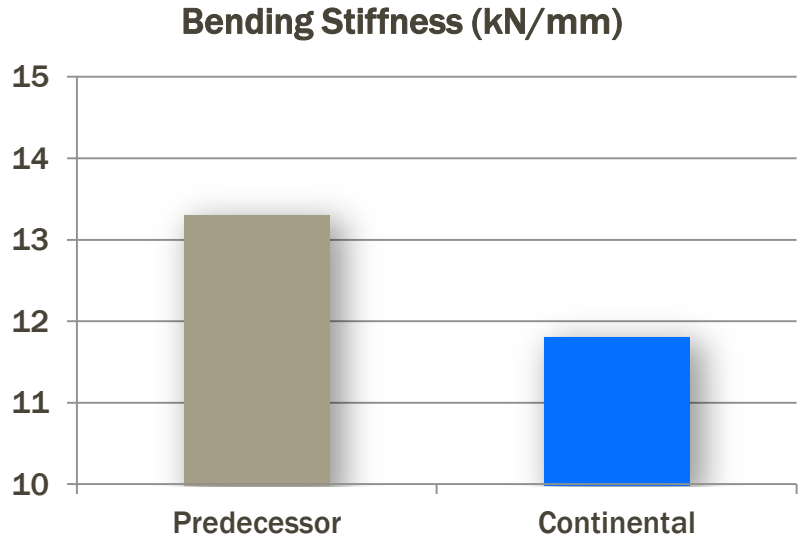

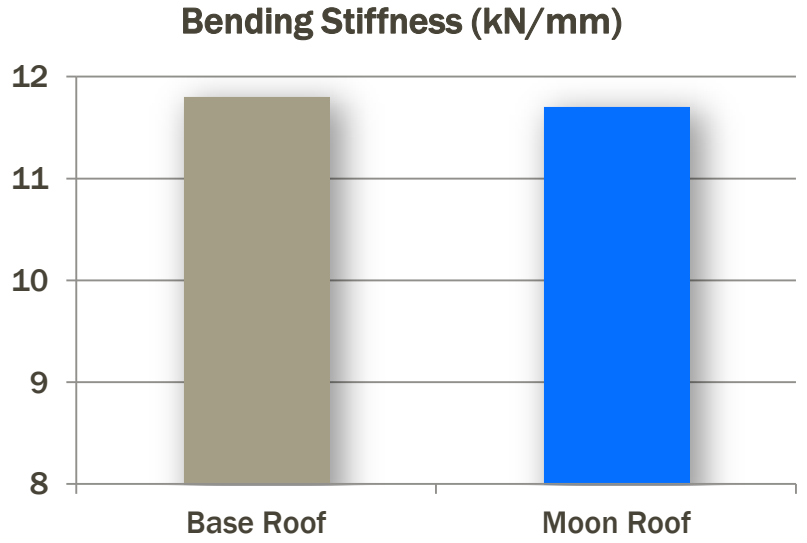

Static Stiffness Performance - Torsion

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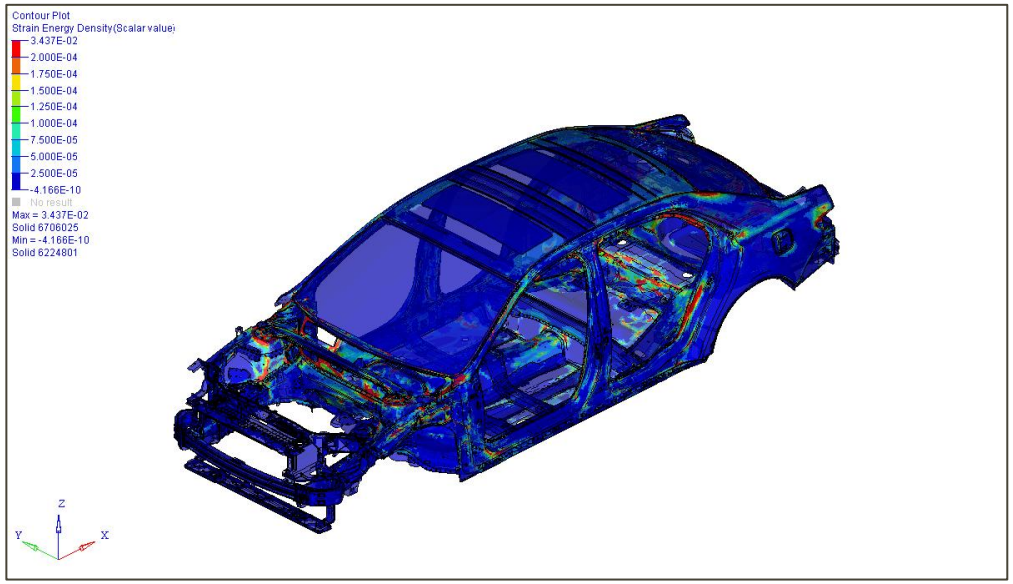

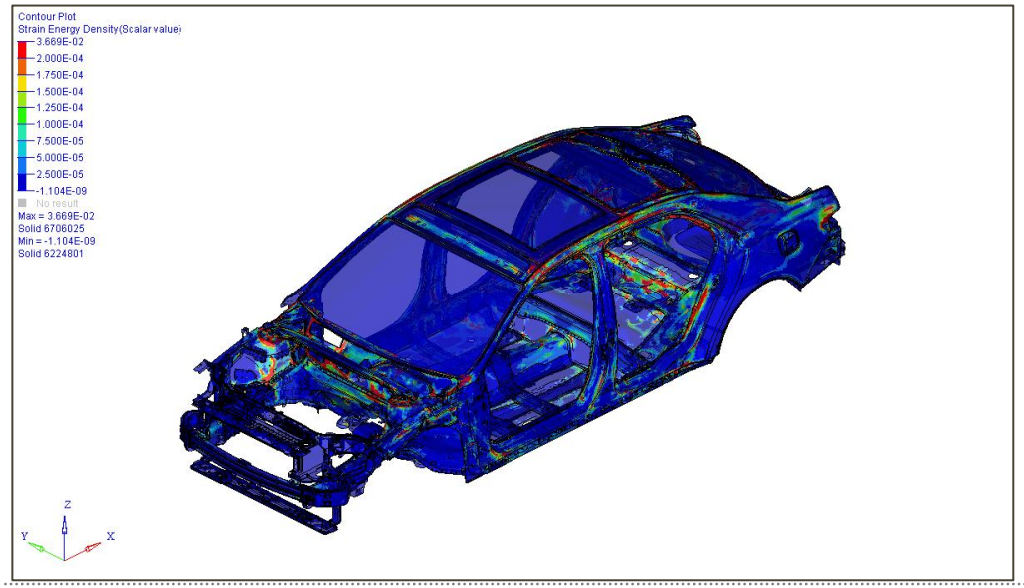

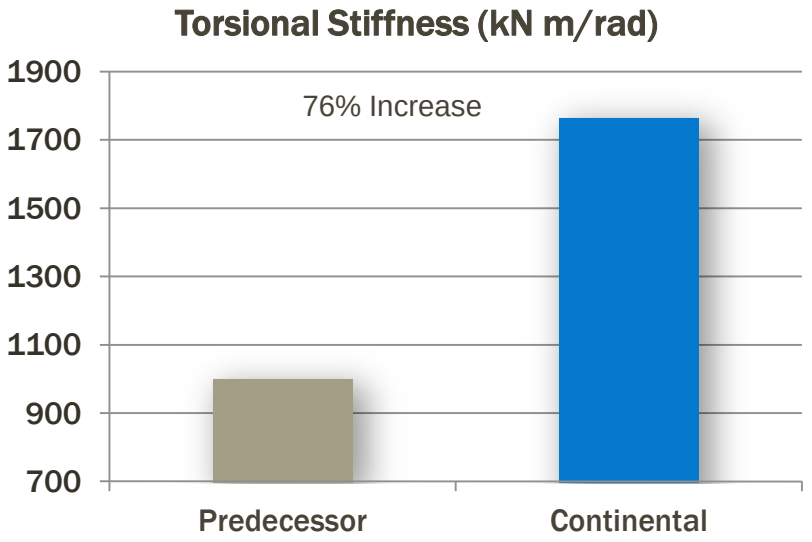

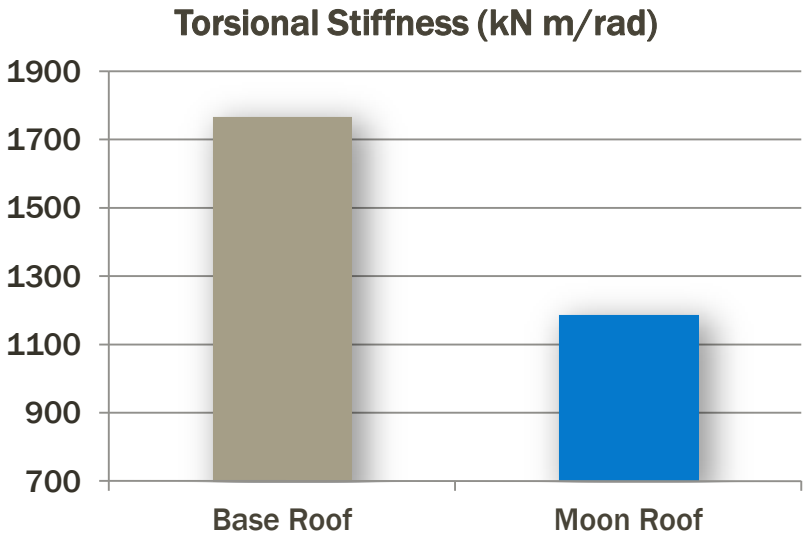

Dynamic Stiffness – Vertical Bending

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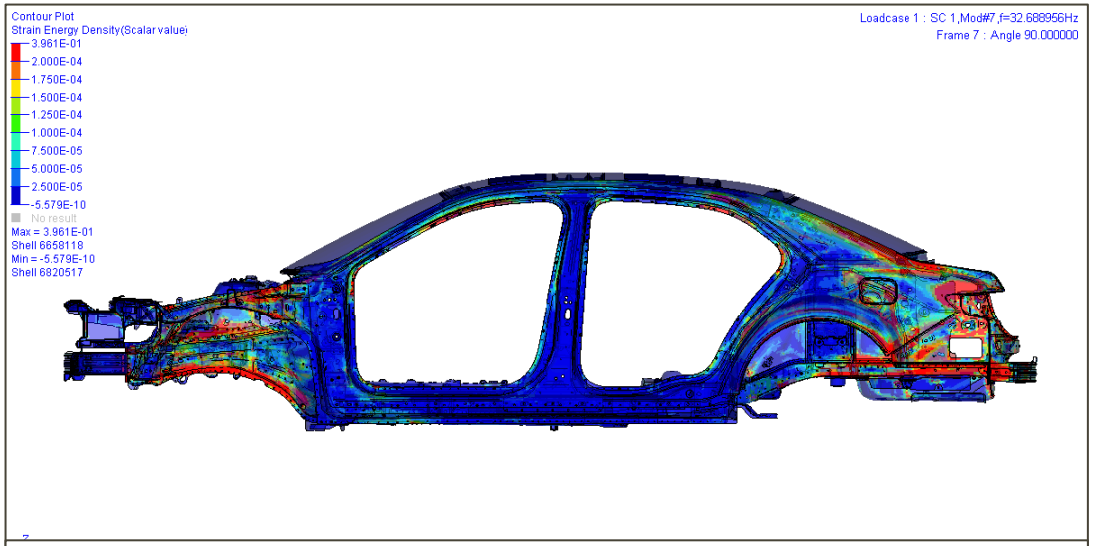

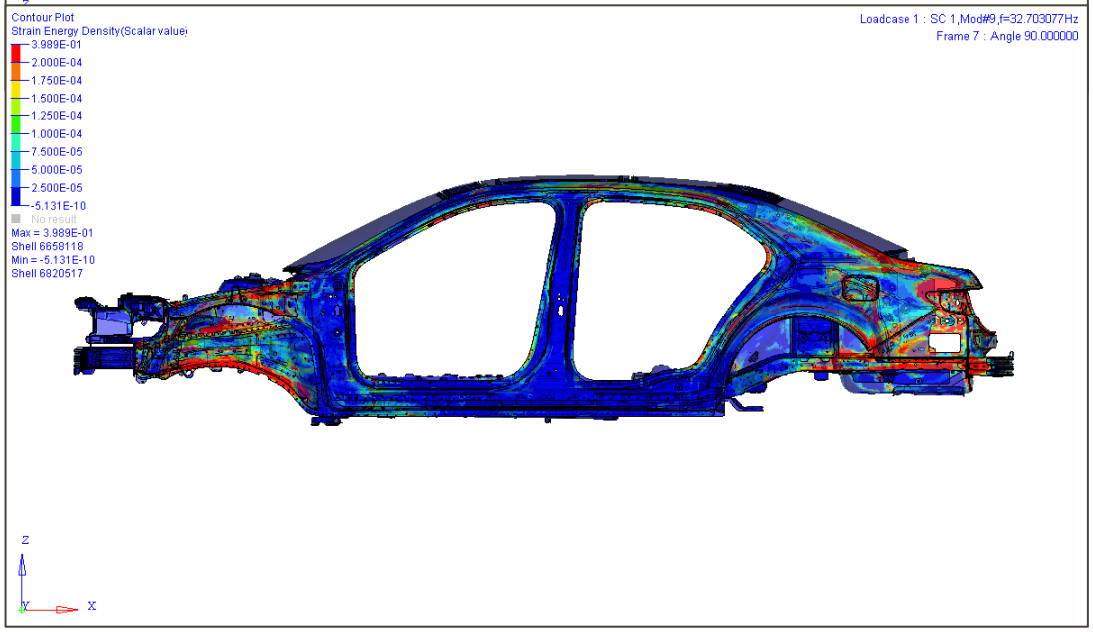

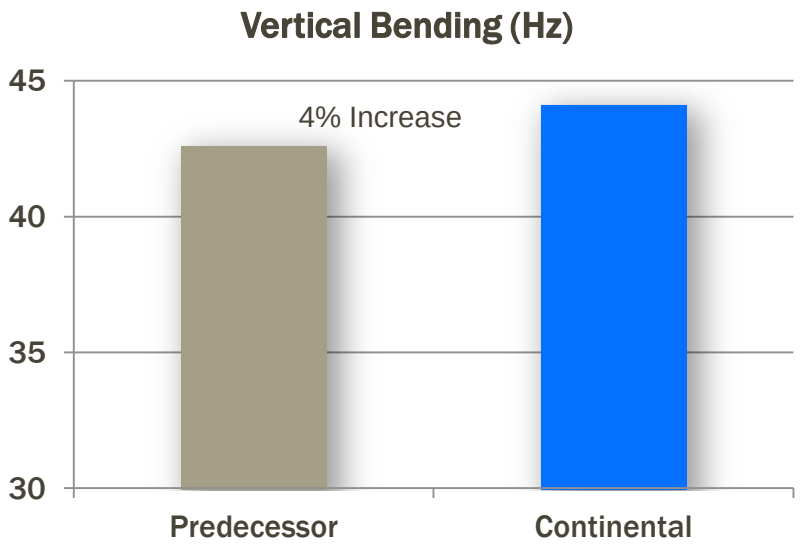

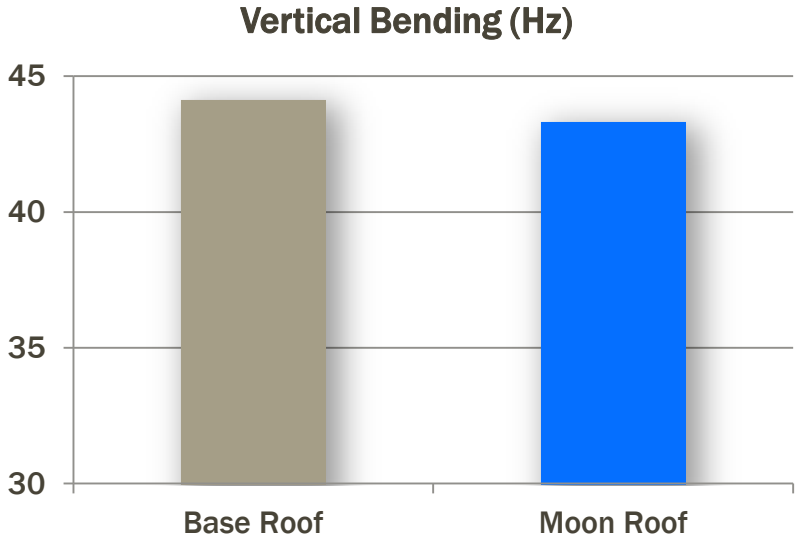

Dynamic Stiffness – Lateral Bending

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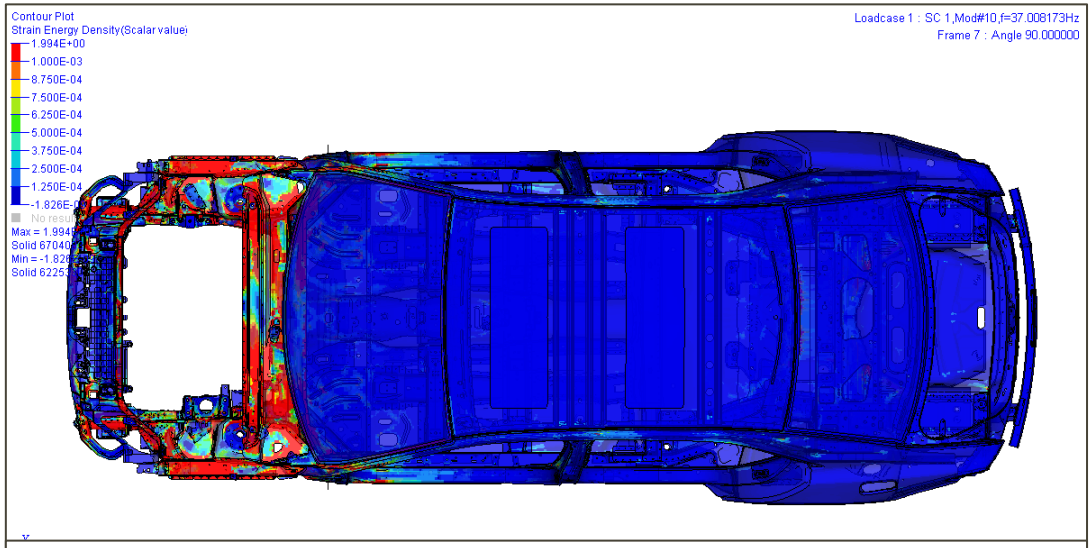

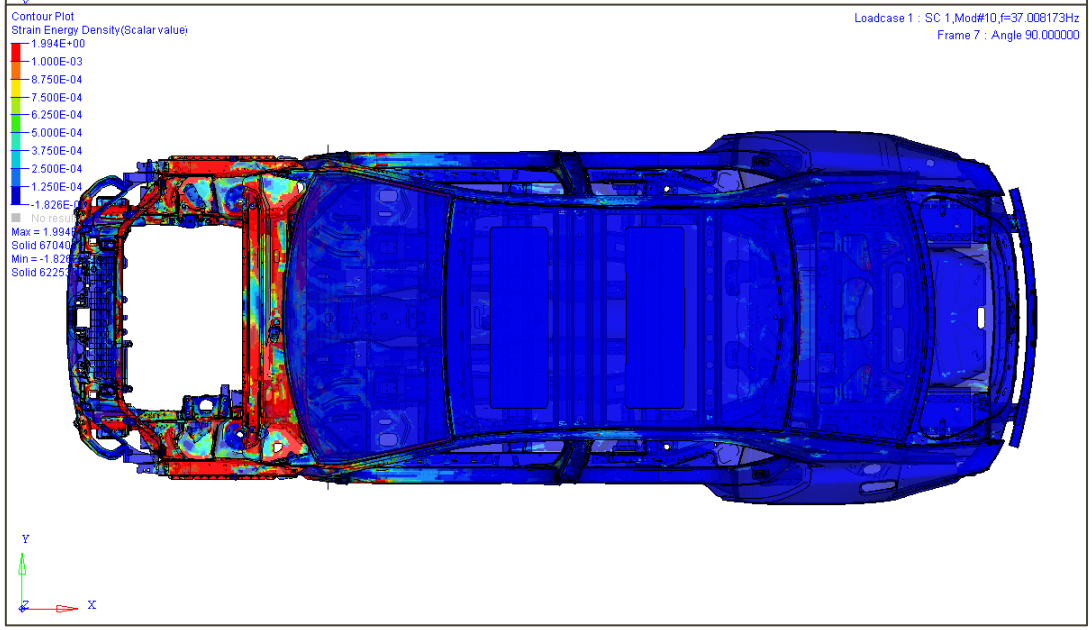

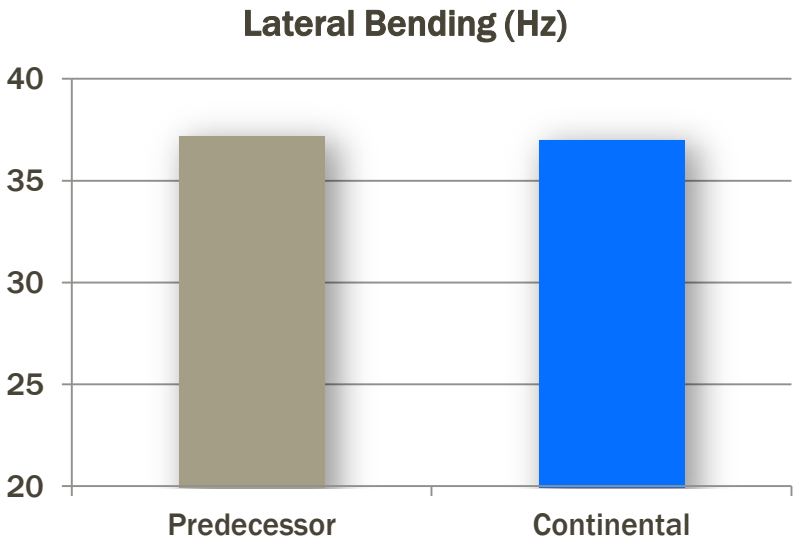

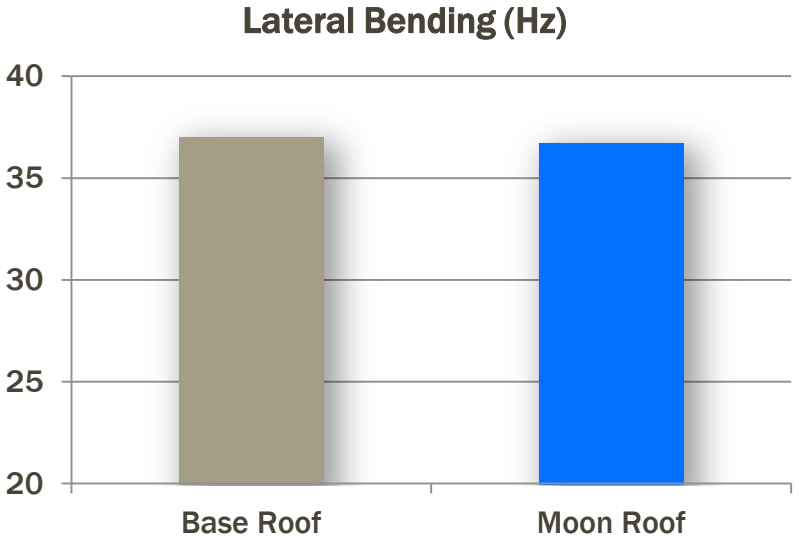

Dynamic Stiffness - Torsion

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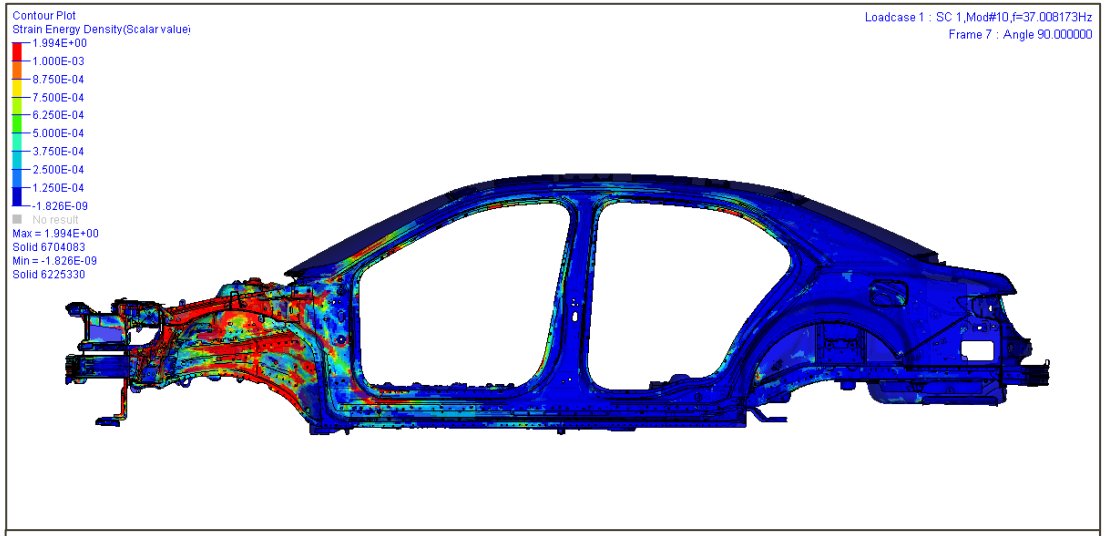

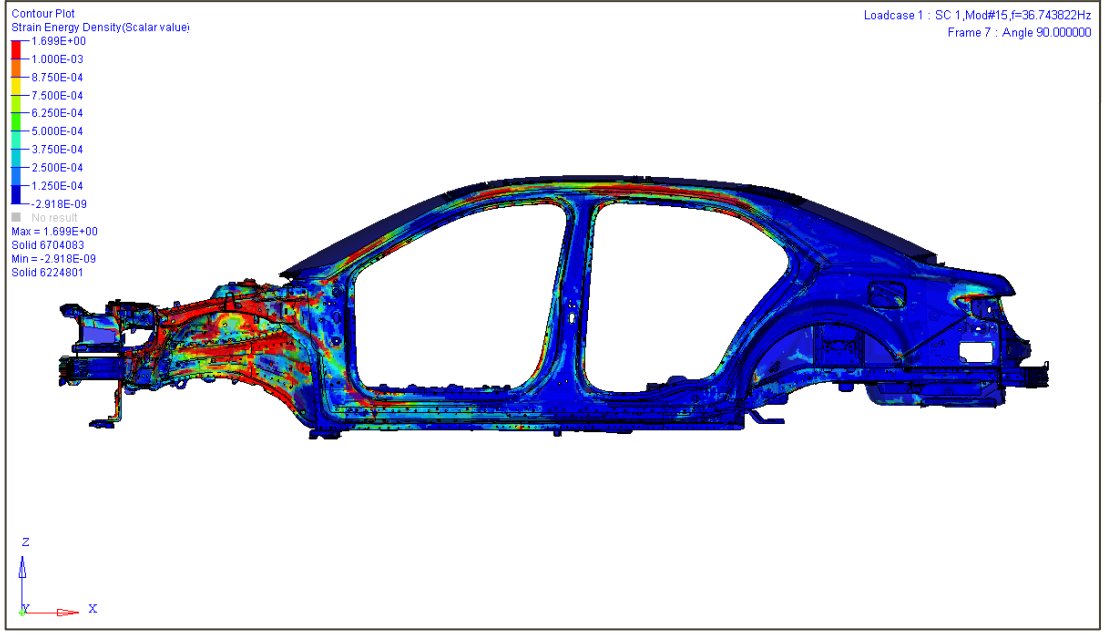

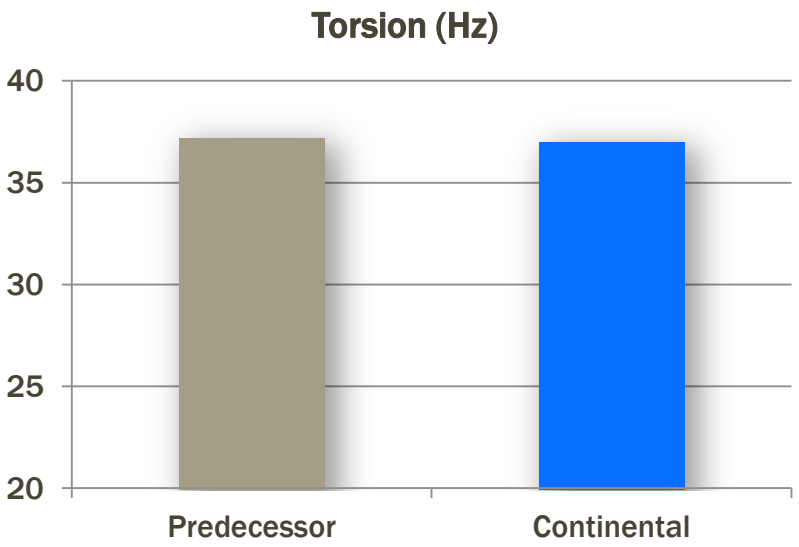

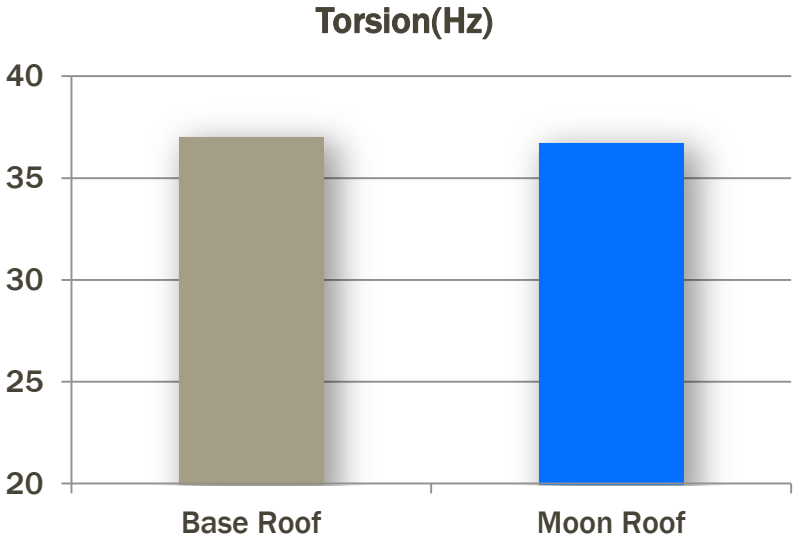

Safety Performance

Load Path: Front End

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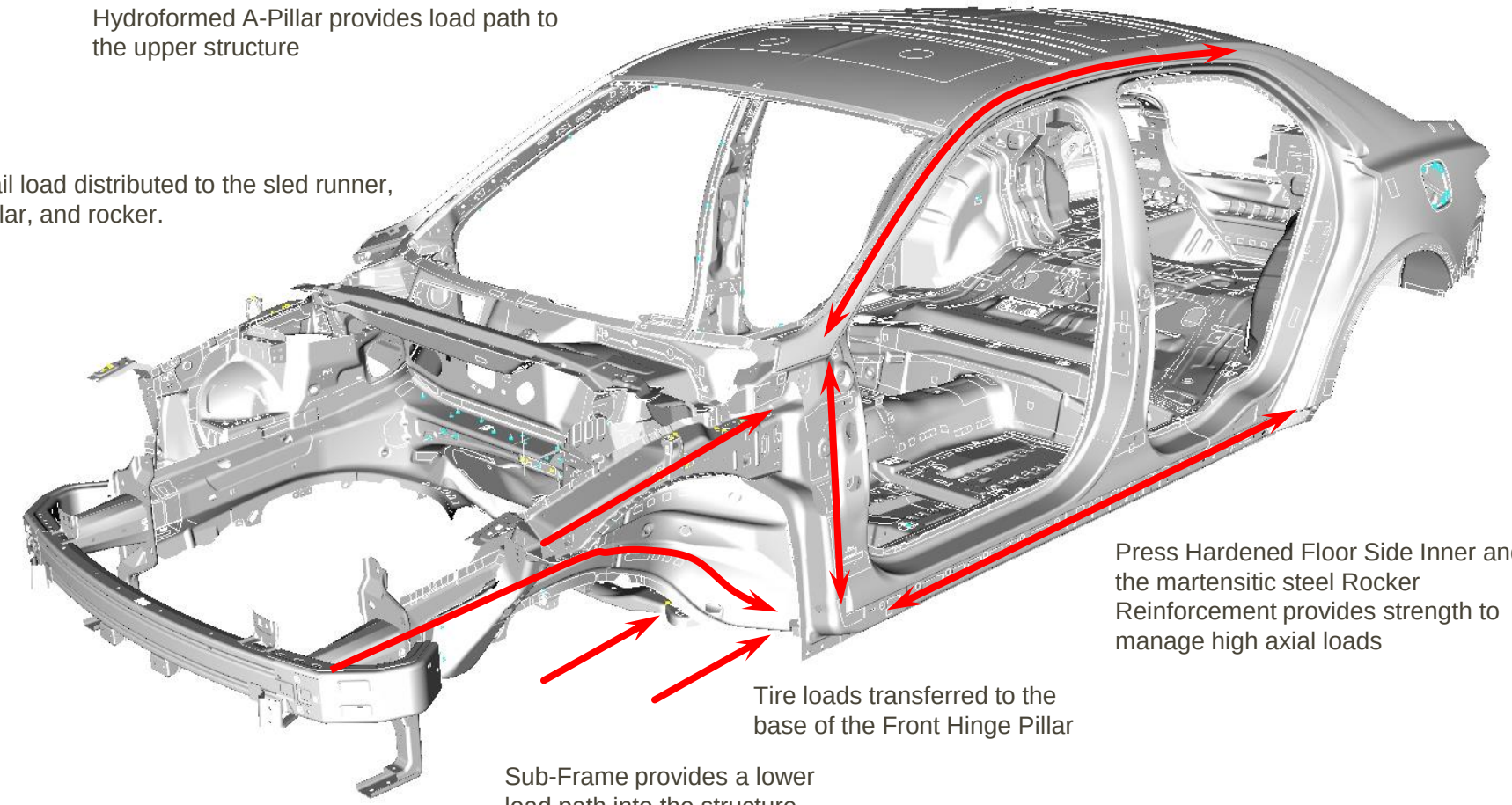
Hydroformed A-Pillar provides load path to the upper structure

Front Rail load distributed to the sled runner, hinge pillar, and rocker.



Press Hardened Floor Side Inner and the martensitic steel Rocker Reinforcement provides strength to manage high axial loads

Tire loads transferred to the base of the Front Hinge Pillar

Sub-Frame provides a lower load path into the structure

Bumper Extensions added to engage the Small Offset Rigid Barrier

NCAP Frontal Barrier

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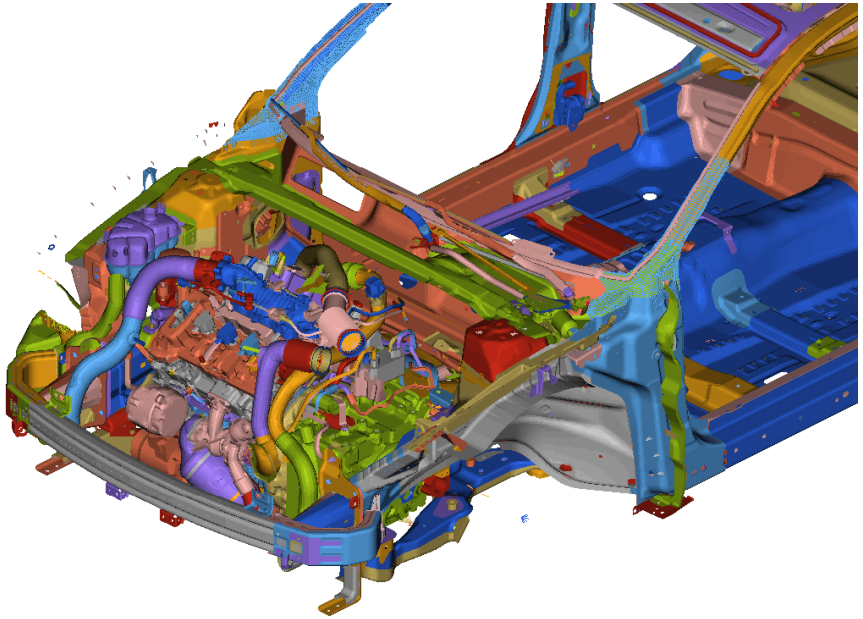
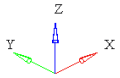
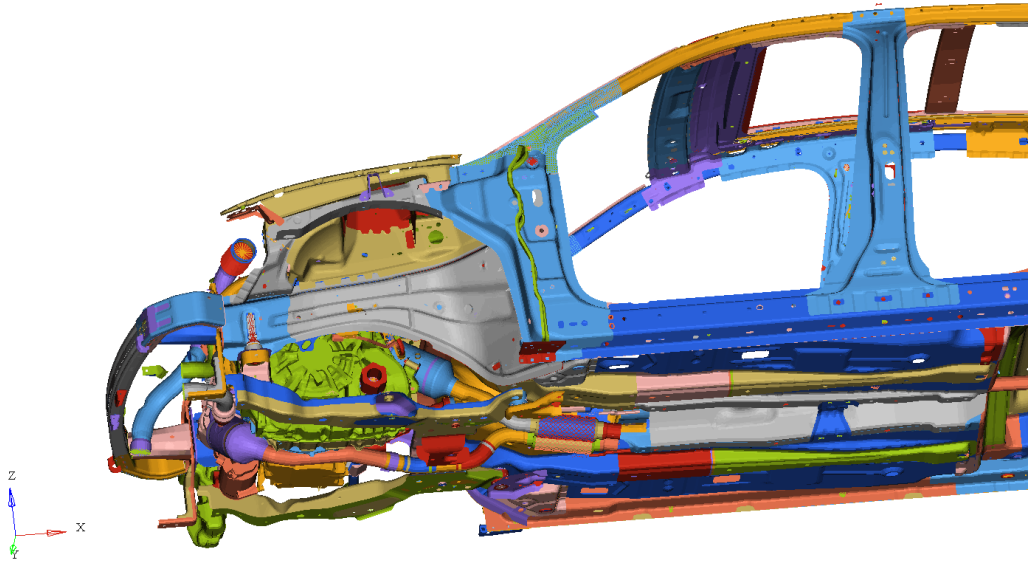
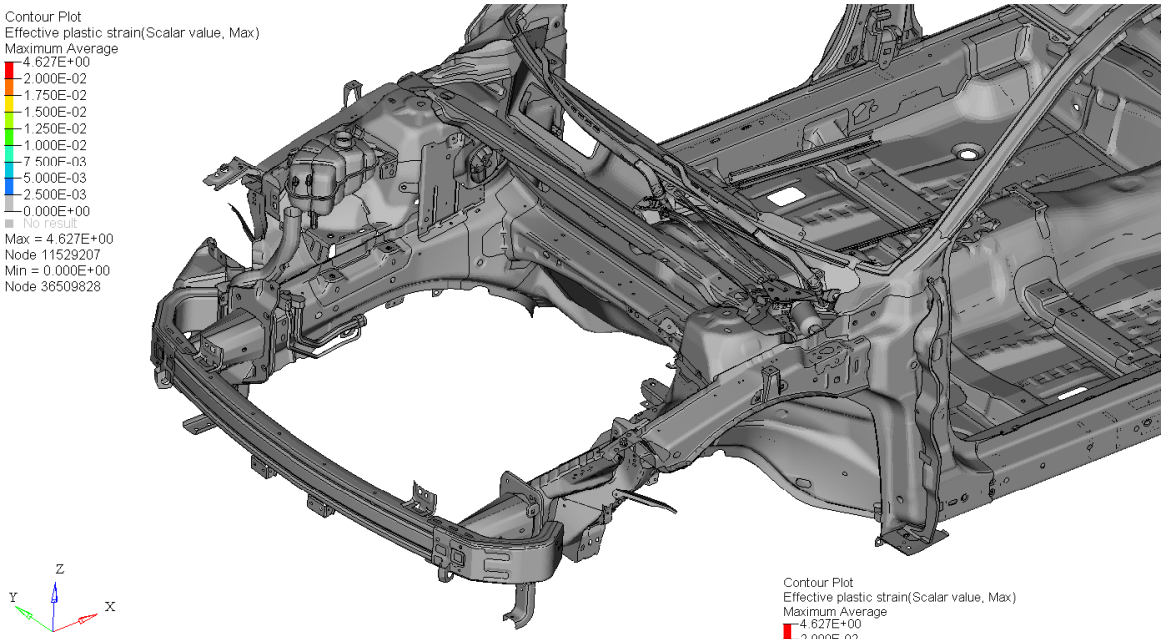


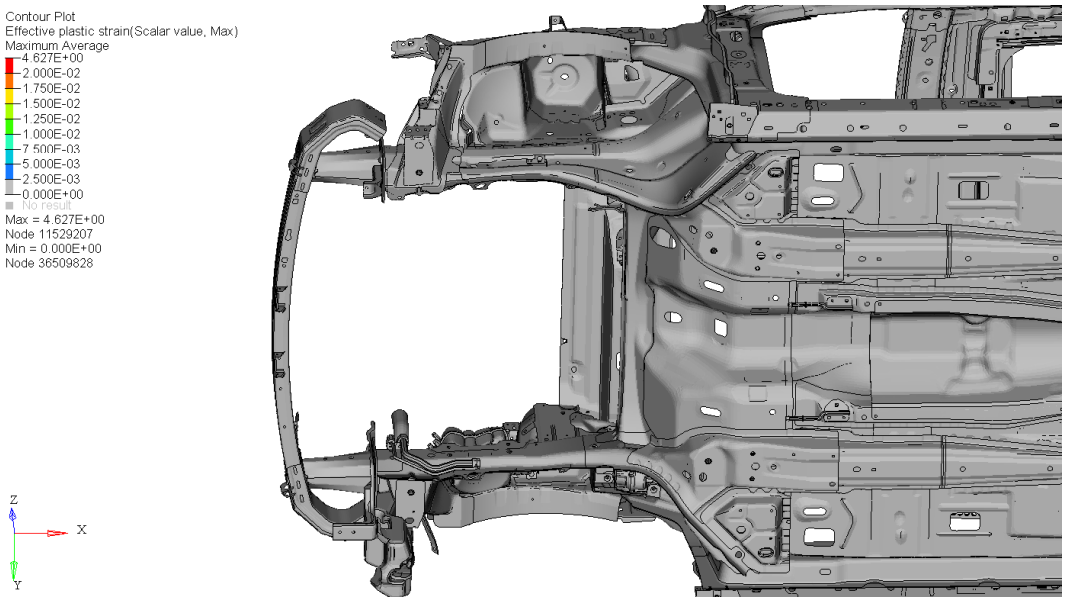




NCAP Frontal Barrier

THE LINCOLN MOTOR COMPANY

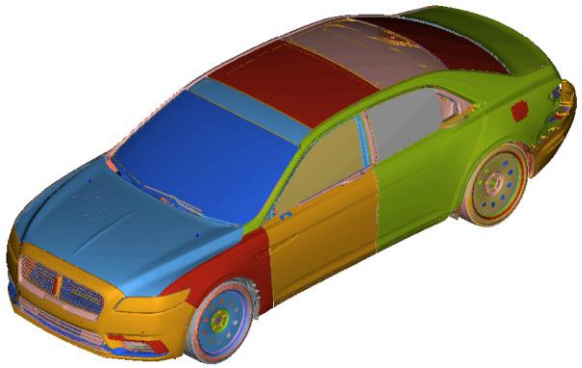


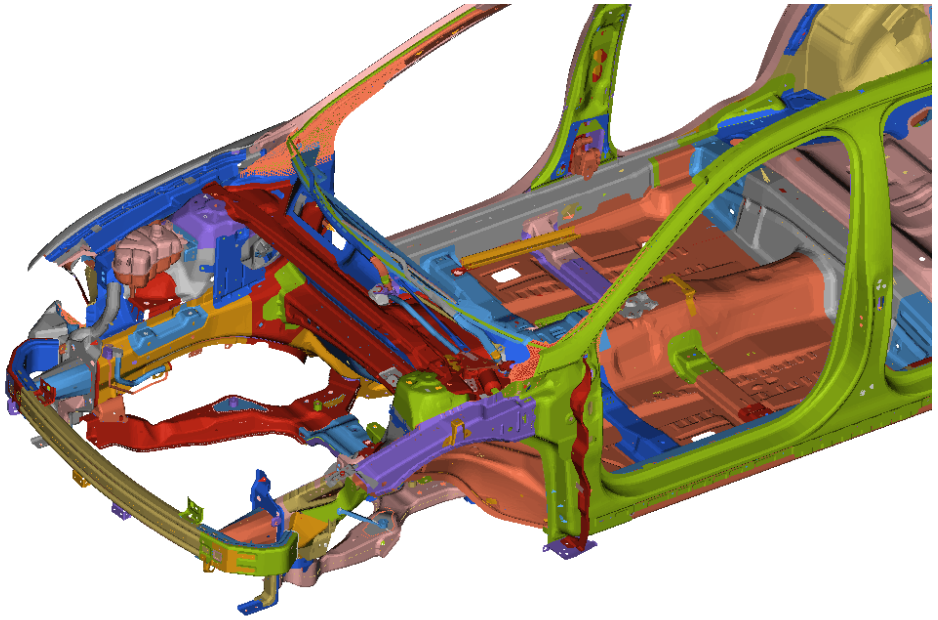


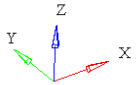
Frontal Offset

THE LINCOLN MOTOR COMPANY

Model info: C:\Users\NSAHA3\Documents\D544_VP\D544VP_ODB_091815\MS_floor\D544VP_ODB_MSfloor.k
Result: C:\Users\NSAHA3\Documents\D544_VP\D544VP_ODB_091815\MS_floor\MS.d3plot
Loadcase 1 : Time = 0.000000
Frame 1



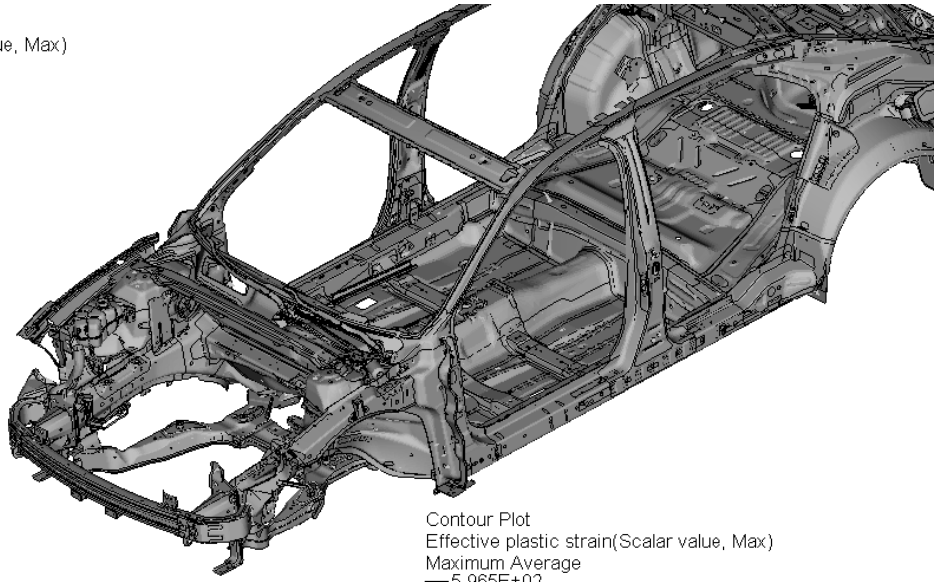


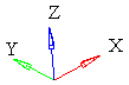


Frontal Offset

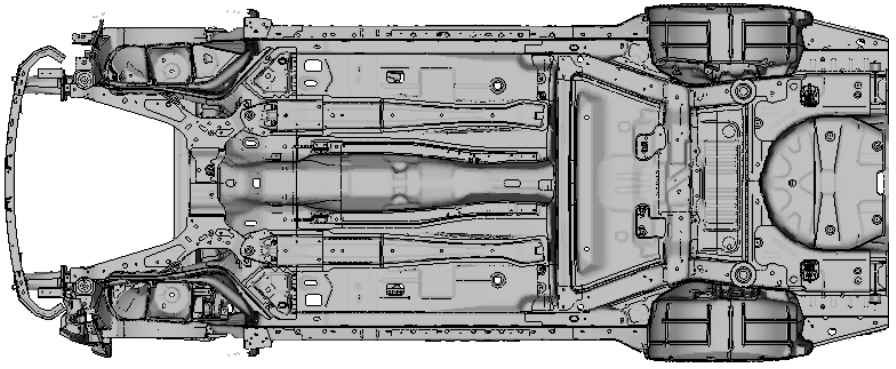
THE LINCOLN MOTOR COMPANY

Contour Plot
Effective plastic strain(Scalar value, Max)
Maximum Average
5.965E+02
2.000E-02
1.750E-02
1.500E-02
1.250E-02
1.000E-02
7.500E-03
5.000E-03
2.500E-03
0.000E+00
No result
Max = 5.965E+02
Node 36021661
Min = 0.000E+00
Node 36500928



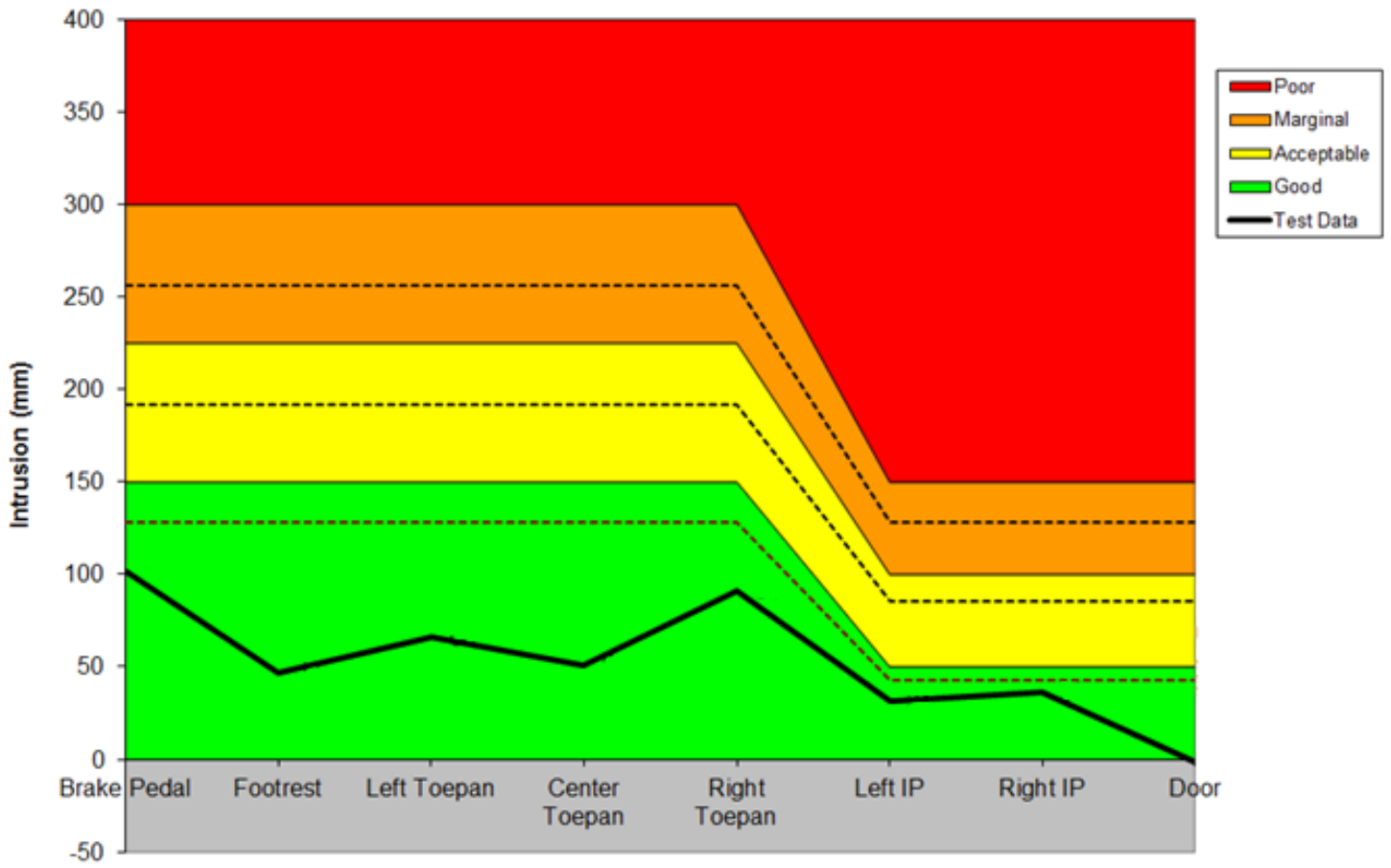


Contour Plot
Effective plastic strain(Scalar value, Max)
Maximum Average
5.965E+02
2.000E-02
1.750E-02
1.500E-02
1.250E-02
1.000E-02
7.500E-03
5.000E-03
2.500E-03
0.000E+00
No result
Max = 5.965E+02
Node 36021661
Min = 0.000E+00
Node 36500928



Frontal Offset

THE LINCOLN MOTOR COMPANY

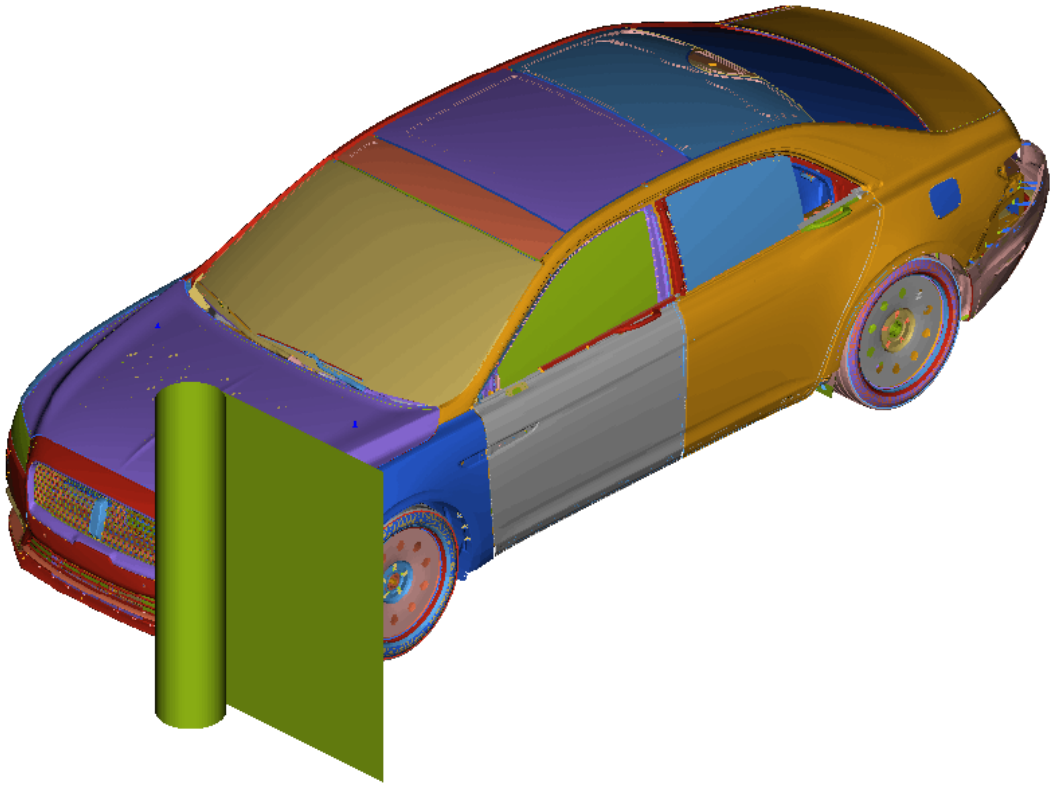


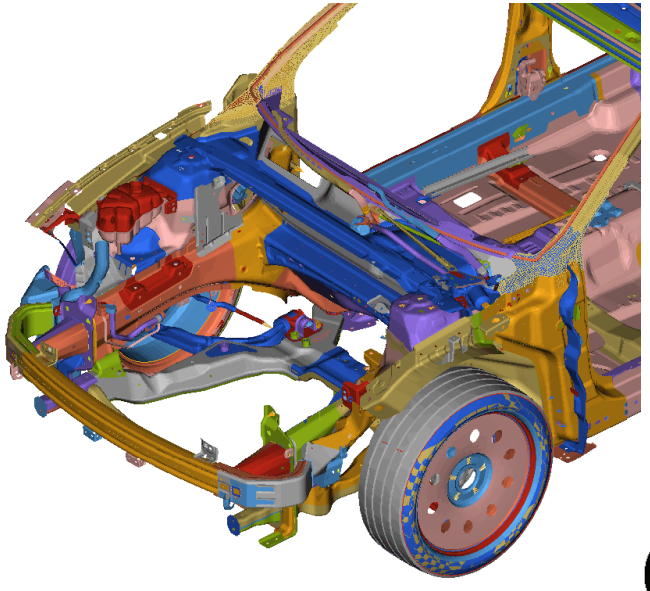
Data represents internal test performance

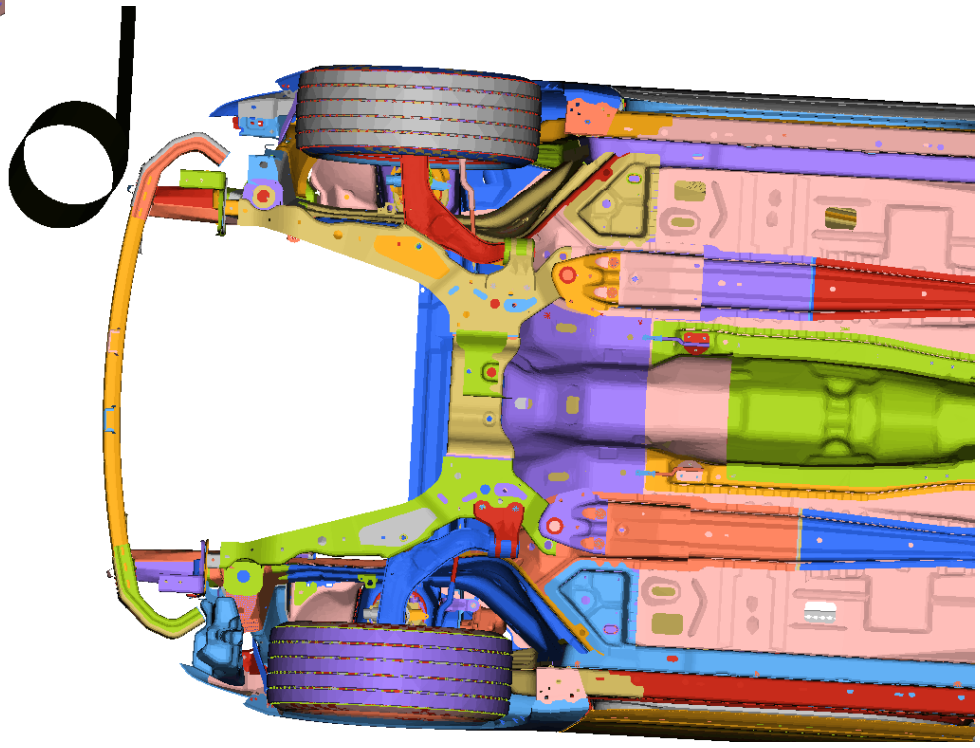
Small Offset Rigid Barrier

THE LINCOLN MOTOR COMPANY

Model info: C:\Users\NSAHA3\Documents\D544_VP\VP_D544_SORB_3L33\3L100_SKF_SORB\D544VP_3L100_SORB.k
Result: C:\Users\NSAHA3\Documents\D544_VP\VP_D544_SORB_3L33\3L100_SKF_SORB\3L100SKF.d3plot
Loadcase 1 : Time = 0.000000
Frame 1



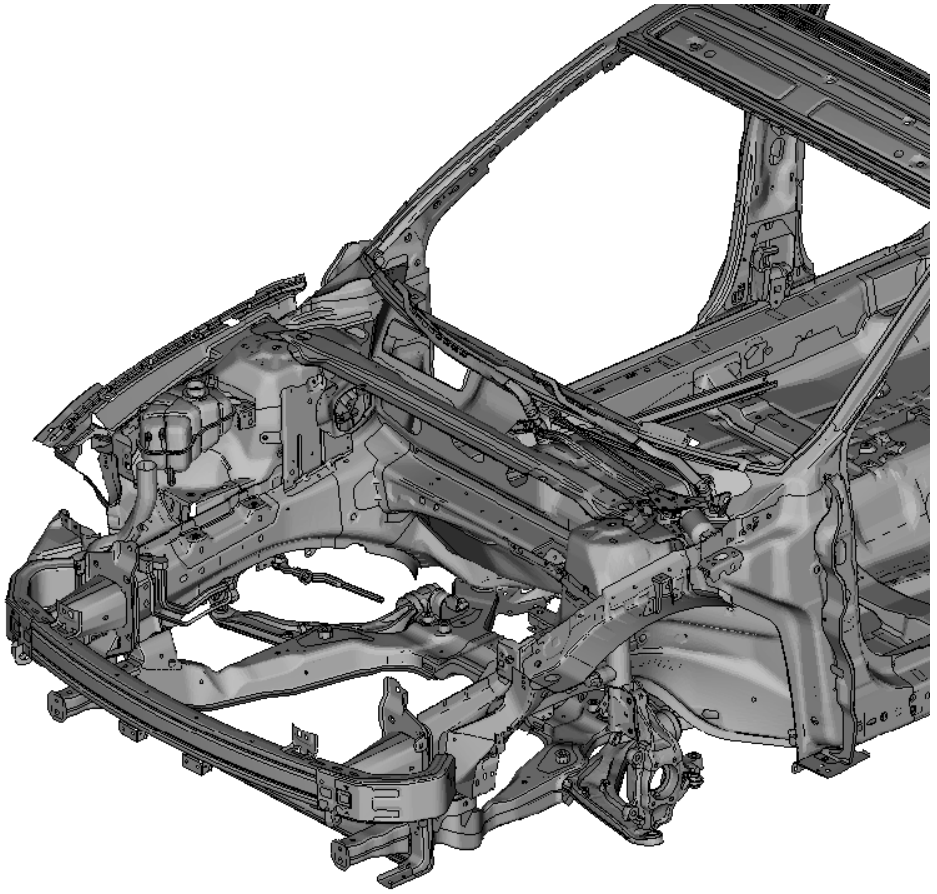


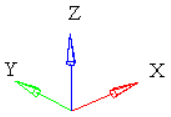

Z
X
Y

Small Offset Rigid Barrier

THE LINCOLN MOTOR COMPANY

Contour Plot
Effective plastic strain(Scalar value, Max)
Maximum Average
3.275E+00
2.000E-02
1.750E-02
1.500E-02
1.250E-02
1.000E-02
7.500E-03
5.000E-03
2.500E-03
0.000E+00
No result
Max = 3.275E+00
Node 36020489
Min = 0.000E+00
Node 14024914

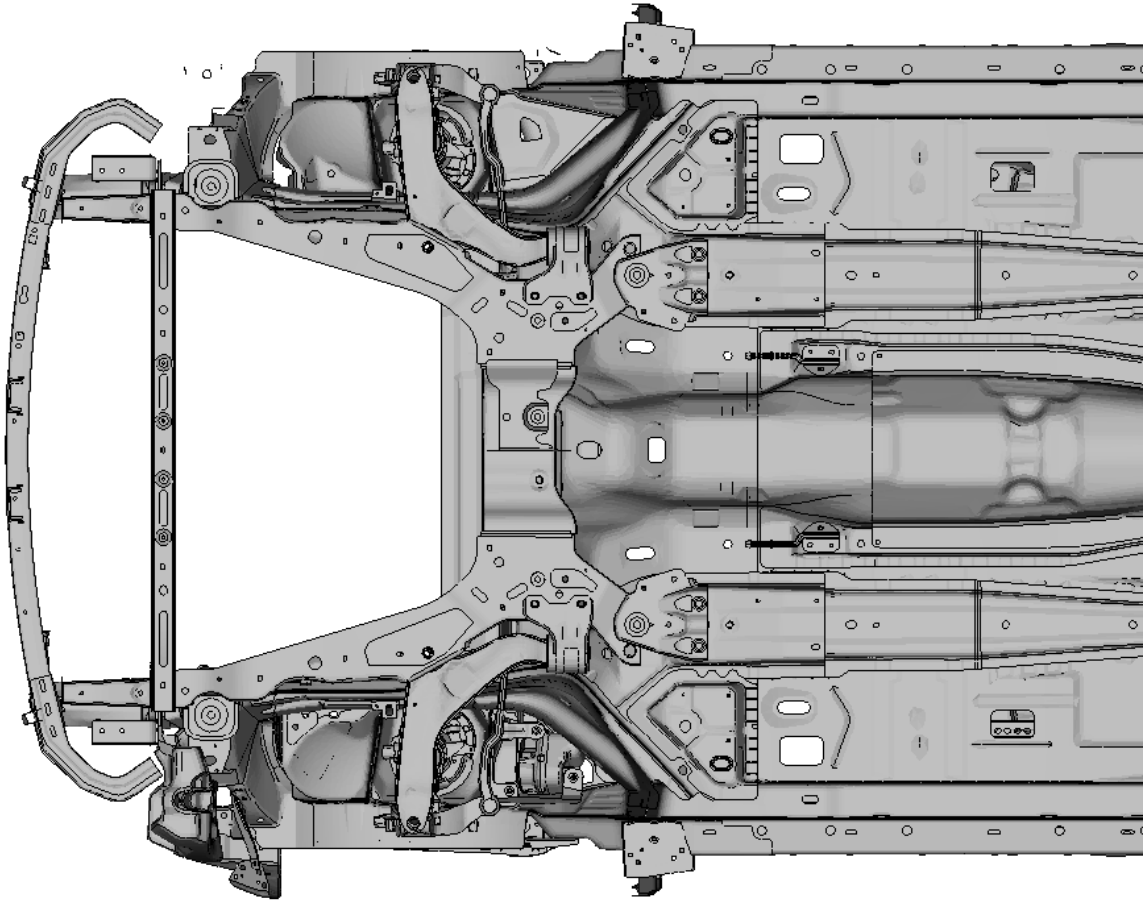


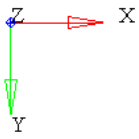


Small Offset Rigid Barrier

THE LINCOLN MOTOR COMPANY

Contour Plot
Effective plastic strain(Scalar value, Max)
Maximum Average
3.275E+00
2.000E-02
1.750E-02
1.500E-02
1.250E-02
1.000E-02
7.500E-03
5.000E-03
2.500E-03
0.000E+00
No result
Max = 3.275E+00
Node 36020489
Min = 0.000E+00
Node 14024914





Small Offset Rigid Barrier

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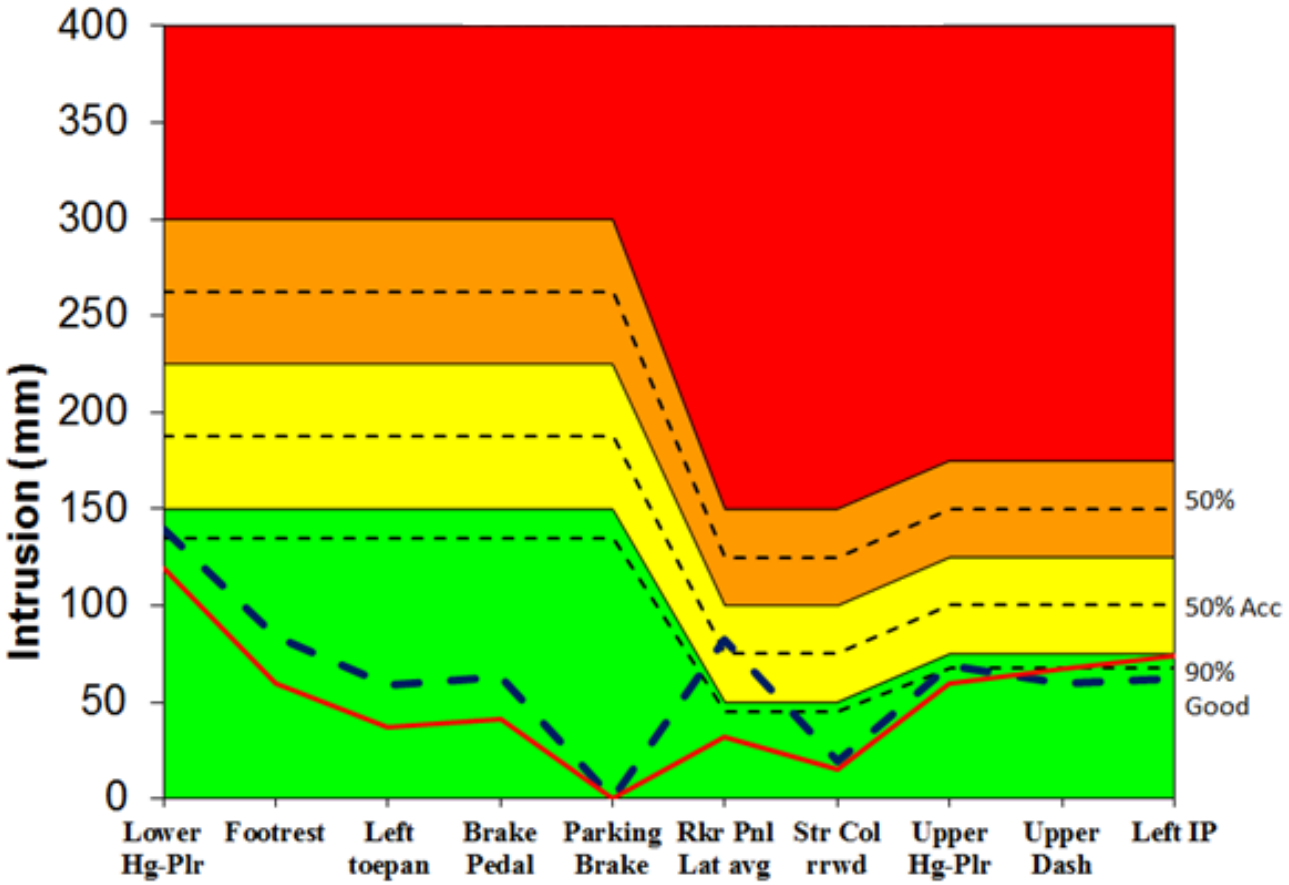

Data represents internal test performance

Load Path: Roof Strength and Side Impact

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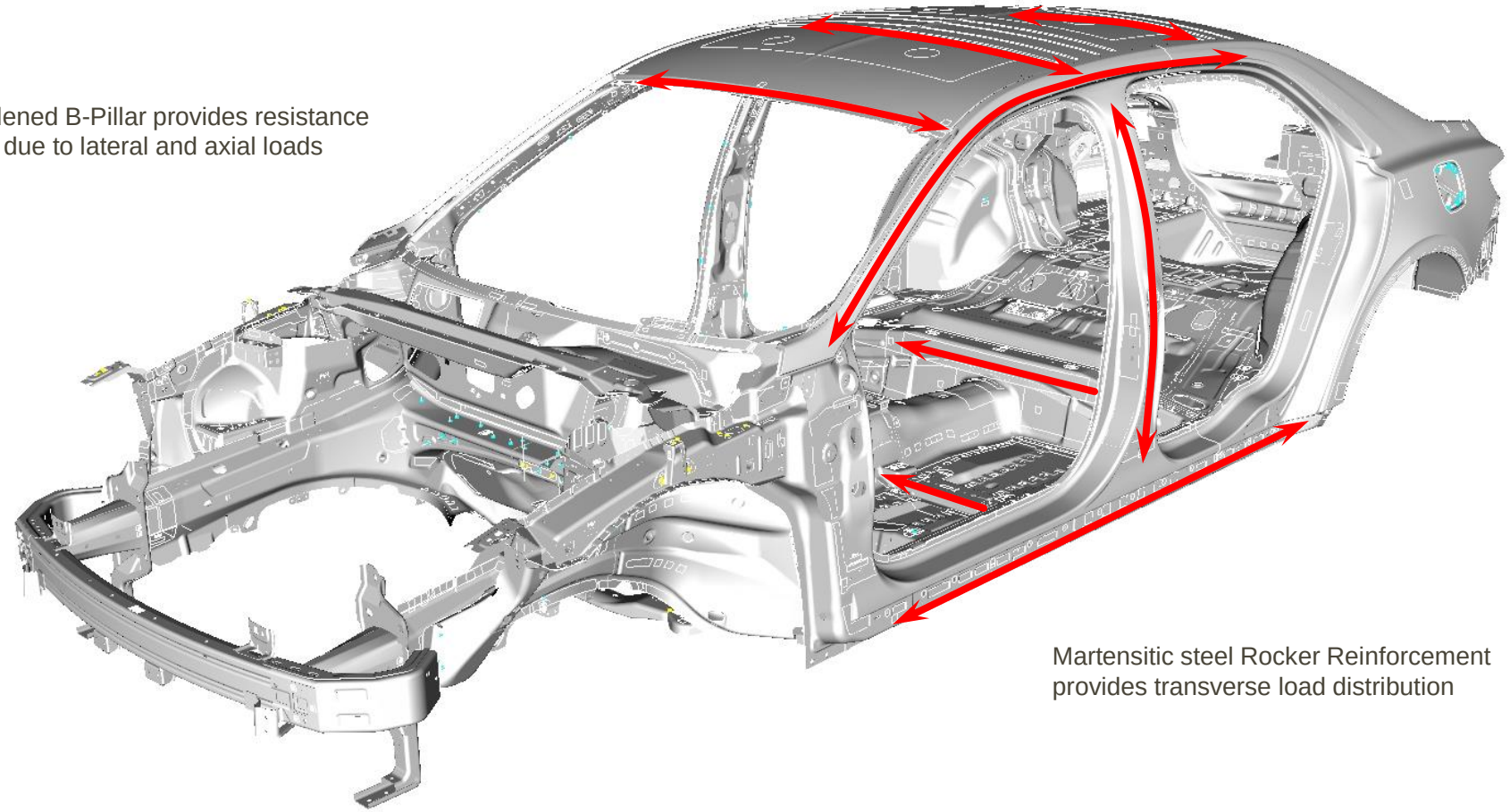
Hydroformed A-Pillar distributes load to Headers, Hinge Pillar, and B-pillar

Press Hardened floor cross-member and AHSS Headers provide paths for cross vehicle load sharing

Press Hardened B-Pillar provides resistance to buckling due to lateral and axial loads



Martensitic steel Rocker Reinforcement provides transverse load distribution

Roof Strength Performance

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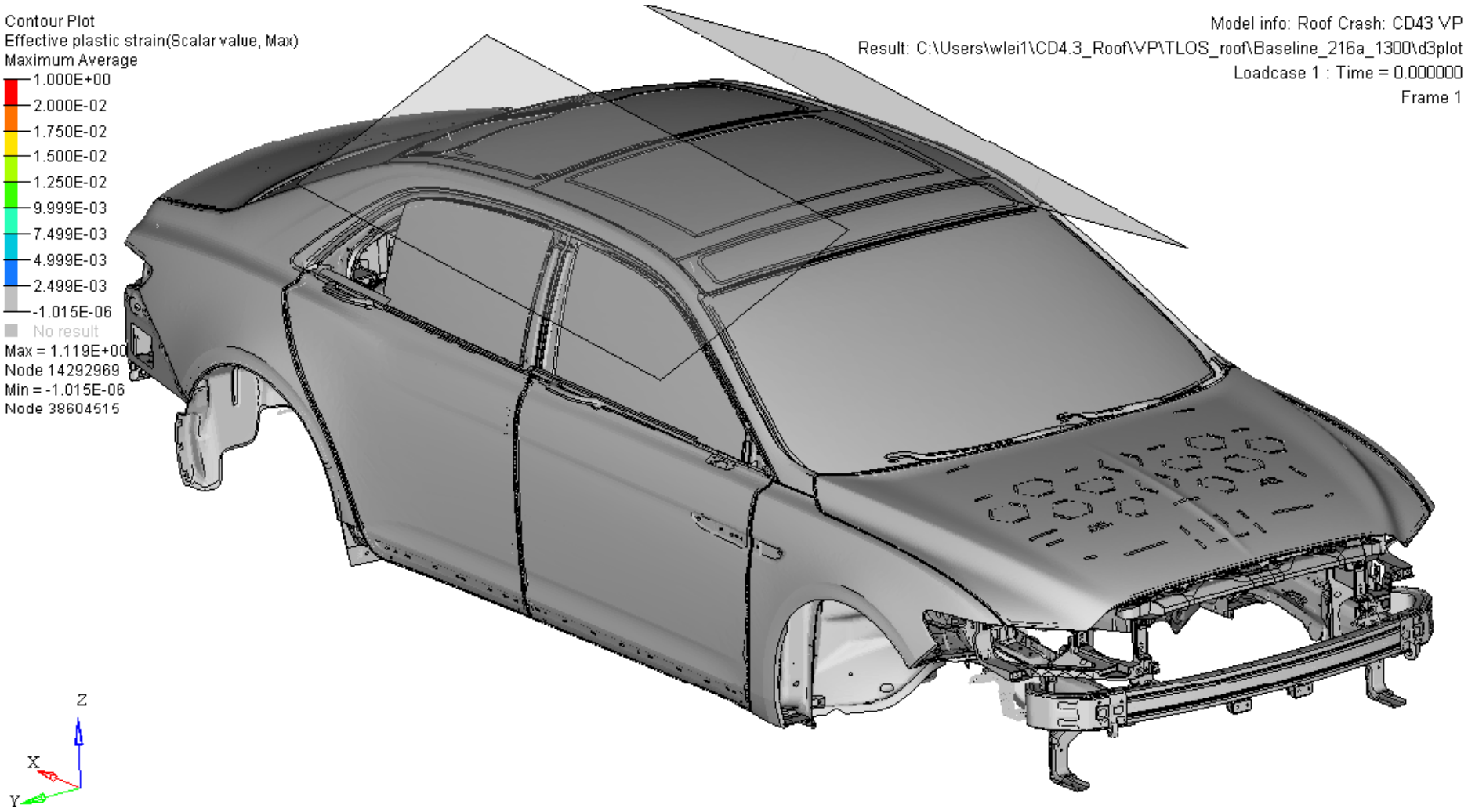
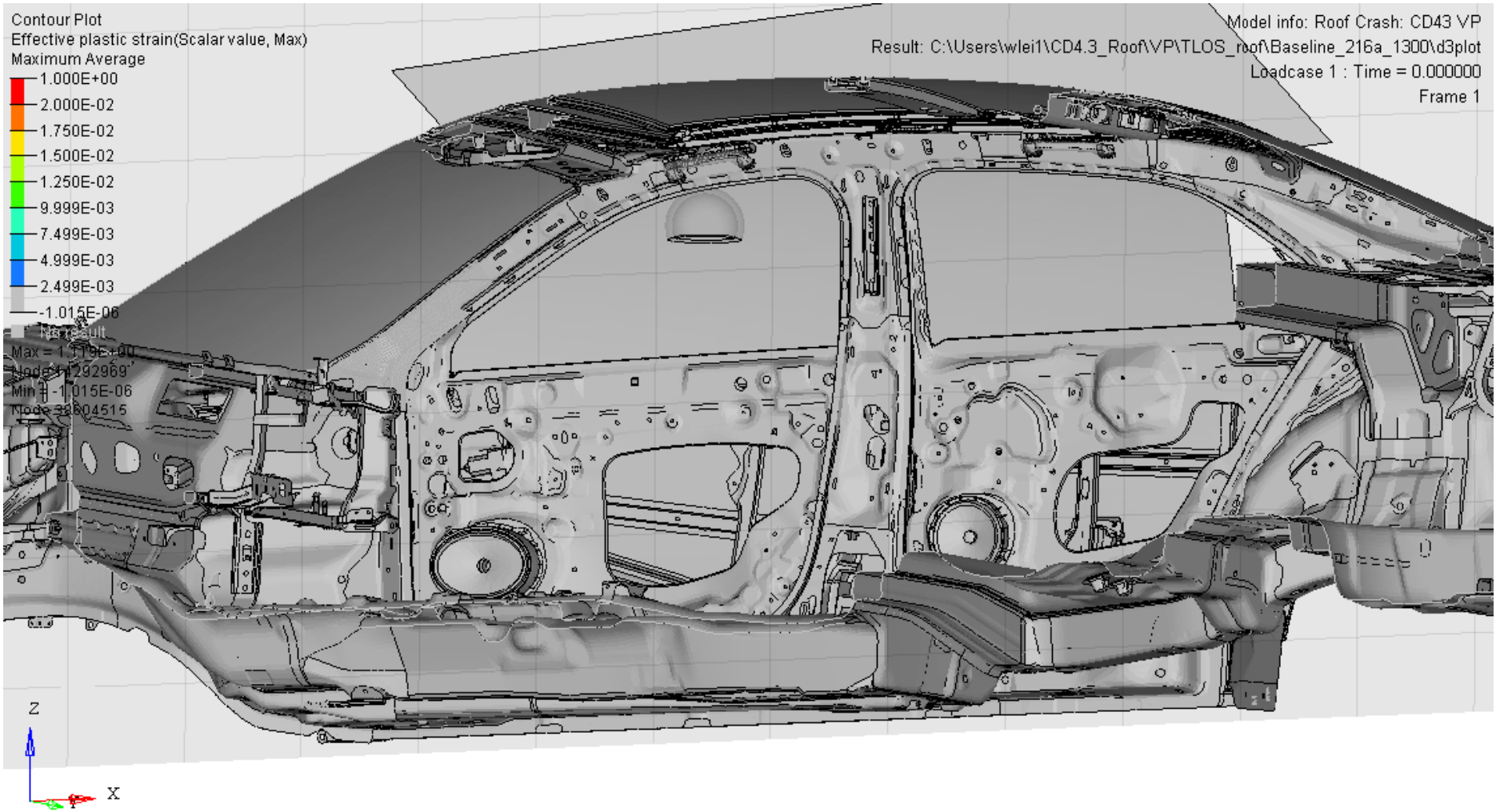


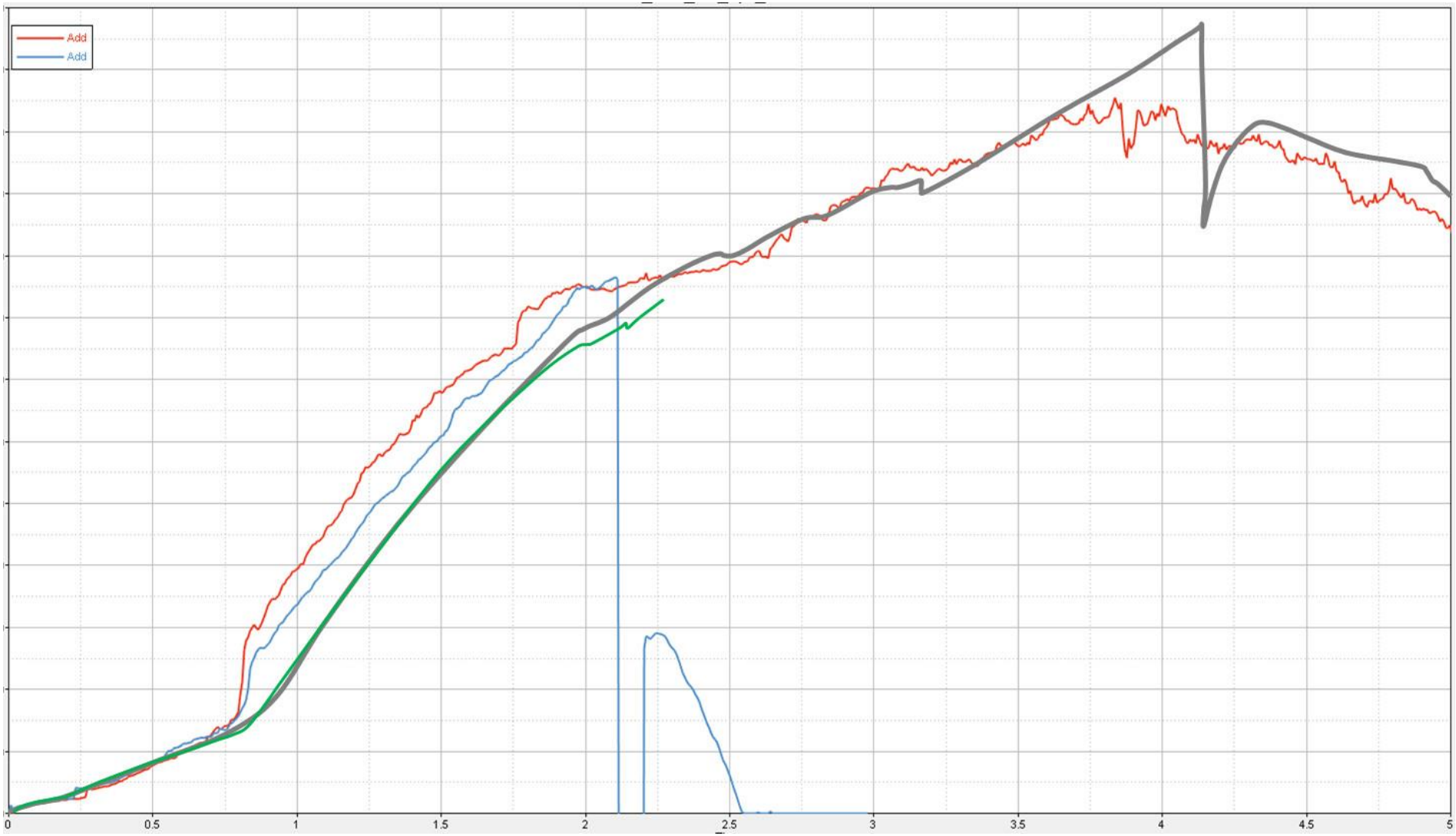
Roof Strength Performance

THE LINCOLN MOTOR COMPANY



Roof Strength Performance

THE LINCOLN MOTOR COMPANY



Side Impact Performance

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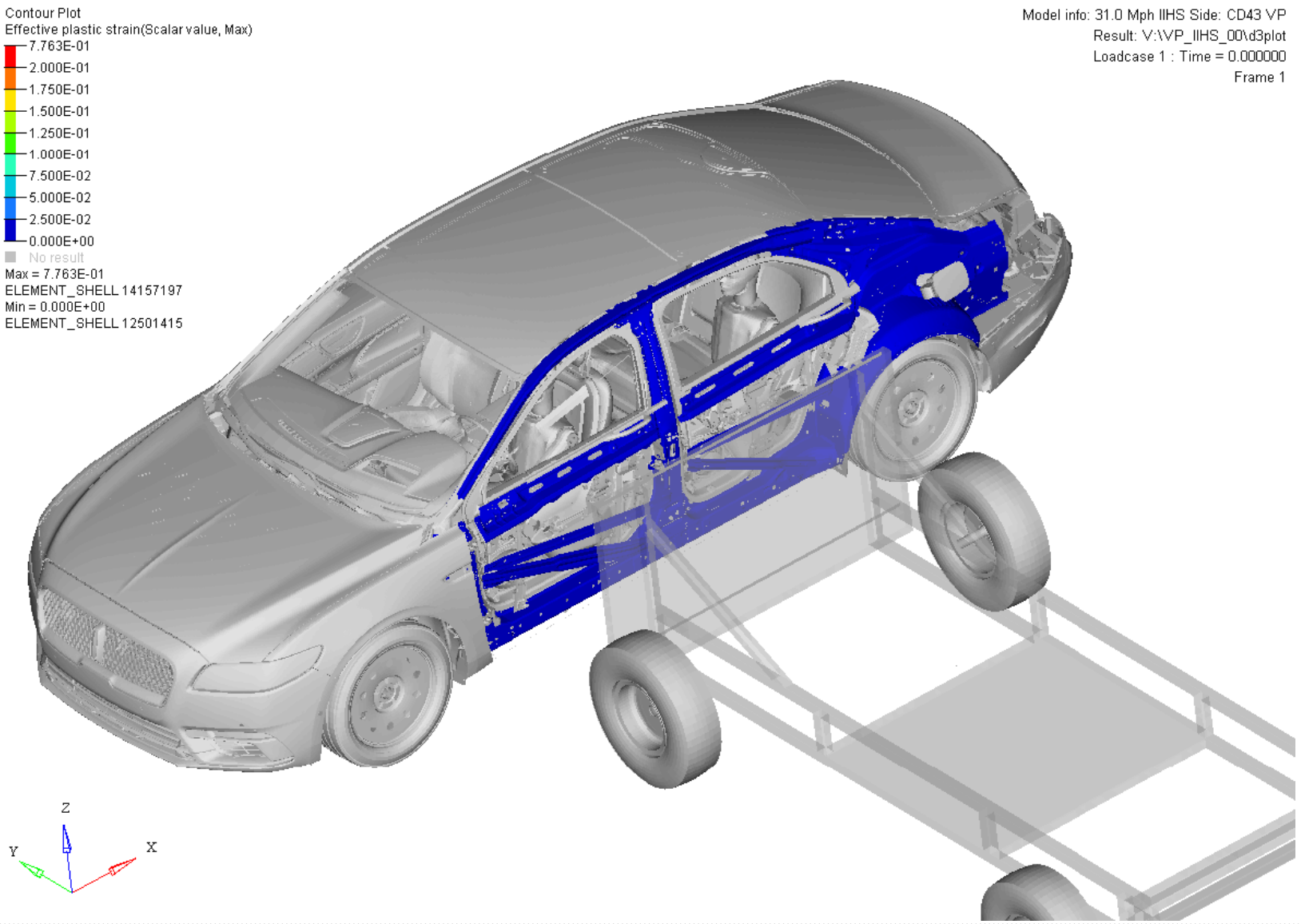

Thanks for you attention