

Great Designs in

STEEL

2013!!

2014 Chevrolet Silverado/GMC Sierra Body 1500 Cab Structure Review

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General Motors
Company



GM

Vehicle Introduction–Chevrolet Silverado



Silverado's exterior design blends strong Chevy truck heritage with a refined, modern aesthetic...



Hauling goods since 1918...



Vehicle Introduction – GMC Sierra

GMC designers approached the exterior with respect for its predecessors, evolving its familiar shape while adding distinctive details...



A century of truck production...





High-level Changes From Current Truck



- Improved safety performance
- Larger forward-facing rear doors on double cab
- Electric power steering
- Disc/disc brakes



- Improved Noise and Vibration performance
- New inset door design – Triple seal system, reduced wind noise



2013 rear door opening



2014 rear door opening



High-level Changes From Current Truck



- Increased rear door length on crew cab.
 - Four inches more foot swing
 - Two inches more knee room
 - 5% more foot room



- Added 6'6" standard box to Light Duty crew

- Direct Injection, Active Fuel Management, and Variable Valve Timing powertrains are standard across the lineup
- The first Direct Injected V-8 in a light duty pickup



5.3L V-8 EcoTec3 AFM VVT DI



Anticipated Segment Firsts



- Standard projector headlamps on GMC Sierra
- Standard DuraLife™ brake rotors
- Forward Collision Alert /Lane Departure Warning /Safety Alert Seat
- Real aluminum interior trim
- Ultrasonic front park assist





All New Cargo Box Innovations



- CornerStep rear bumper
- Moveable cargo box upper tie-downs
- LED under-rail box lighting





Regular Cab

- 8' box shown
- 6'6" available



Double Cab

- 6'6" box shown



Crew Cab

- 5'8" box shown
- 6'6" available



Redesigned Interior: Silverado Shown





All New 8" Color Touch Screen Option





Redesigned Seating: Sierra Shown



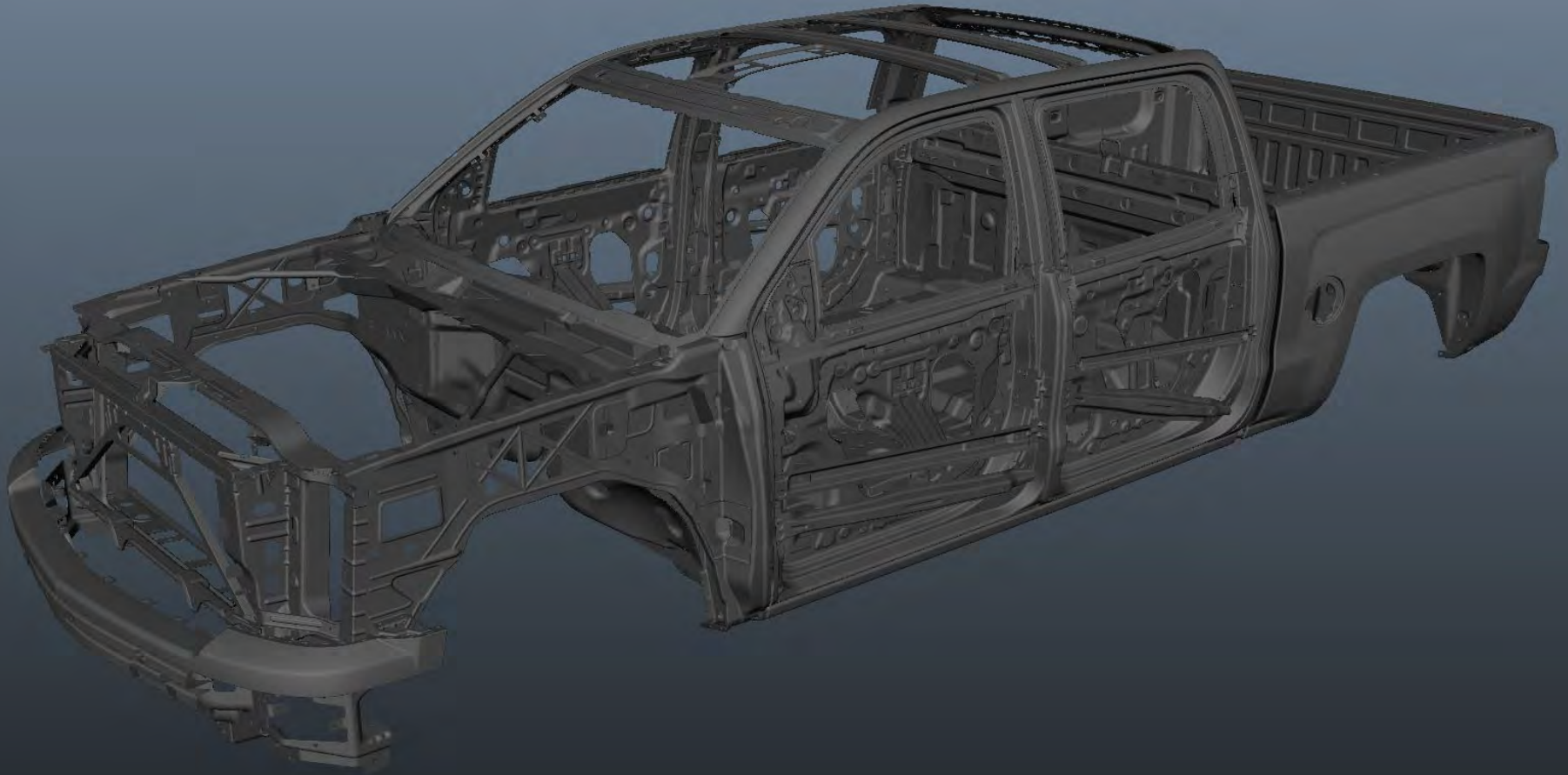


Interior Functionality: Silverado Shown





Cab Structure Development: Introduction



Cab Structure Development: Agenda



1. Body in White Objectives
2. Vehicle durability
3. Material selection
4. Part commonality
5. Safety structure
6. Mass reduction strategies
7. Noise/Vibration management



Objectives of the Body in White Design

- **Performance goals of the BIW:**
 - Outstanding performance on all governmental and consumer safety metrics.
 - Enhanced overall stiffness for handling and Noise/Vibration performance.
 - Mass Reduction without compromising Durability.
- **Manufacturing goal**
 - Drive part commonality to enable production in three assembly plants.





Vehicle Durability Video





Vehicle Durability Video



Material Selection – Upper Structures

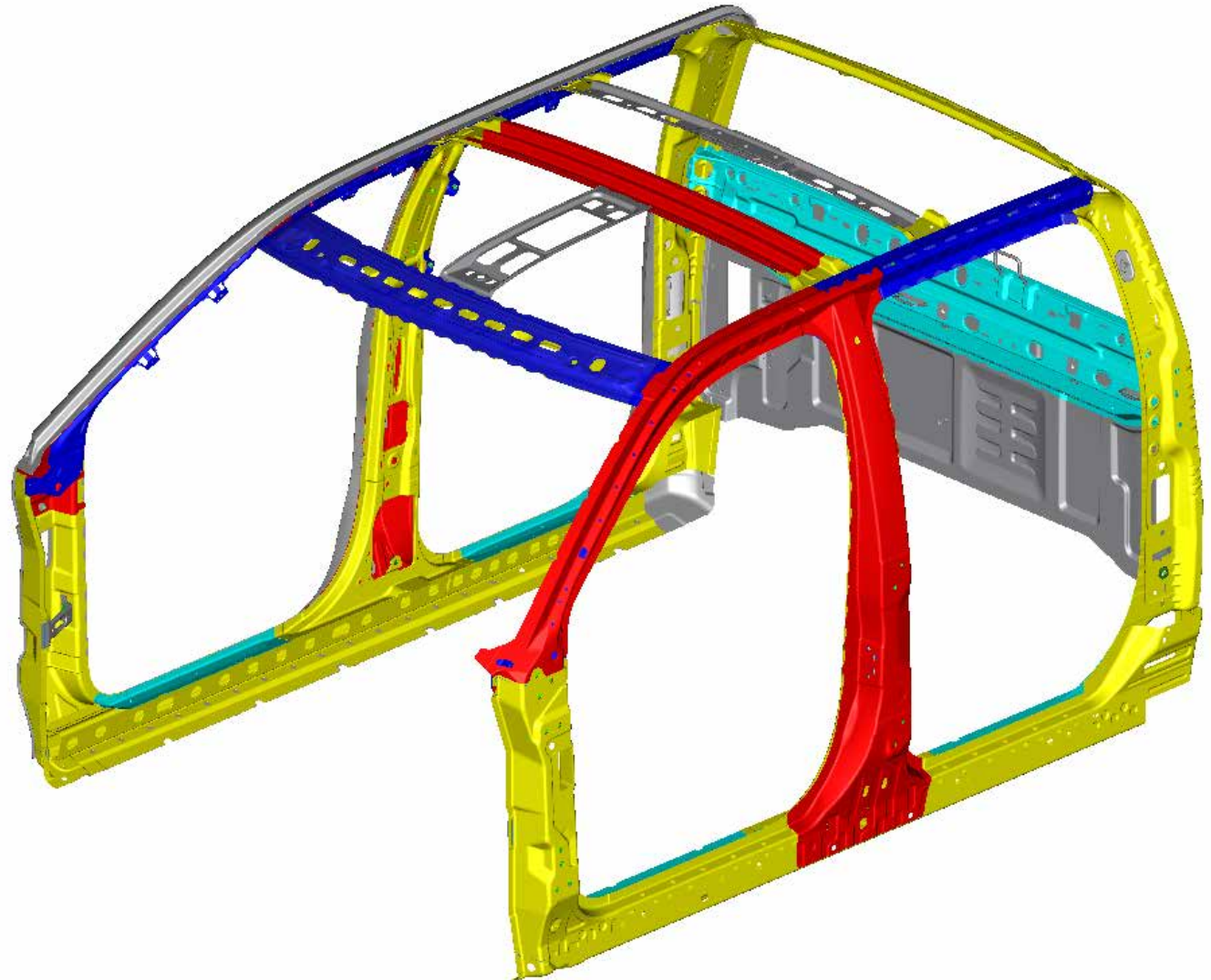
Mild Steel

Bake Hardenable

HSLA

Dual-Phase/Multi-Phase

Press Hardened Steel



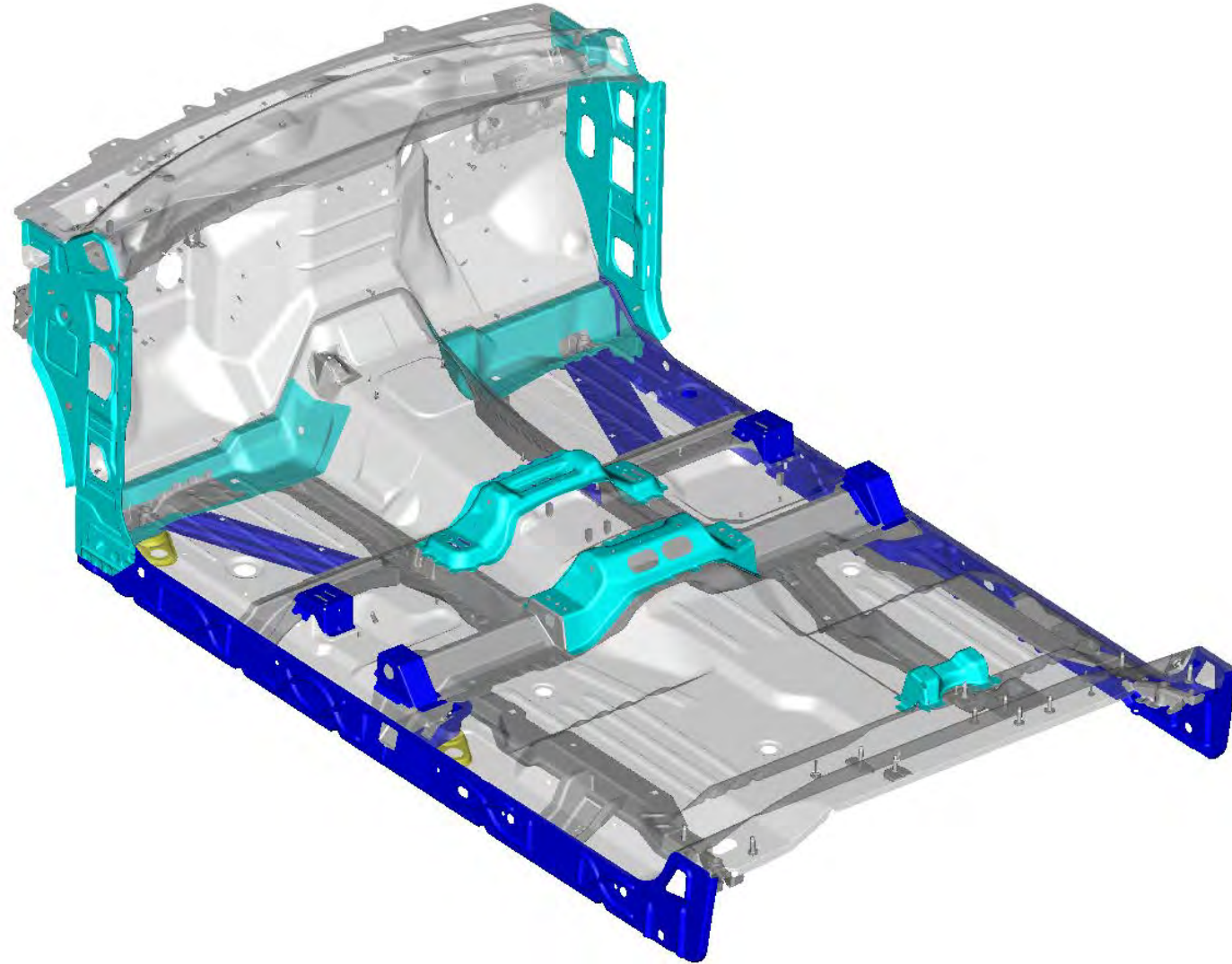
Material Selection – Lower Structures

Mild Steel

Bake Hardenable

HSLA

Dual-Phase/Multi-Phase

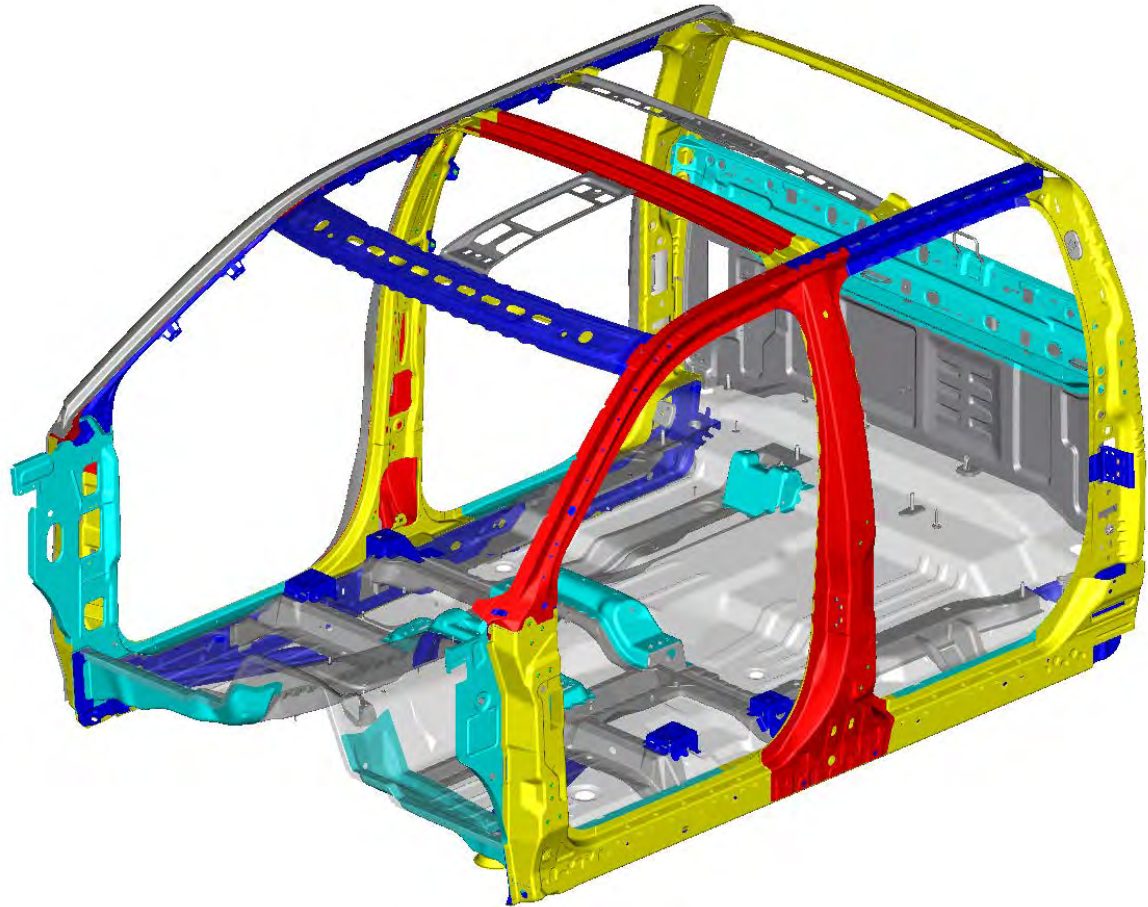
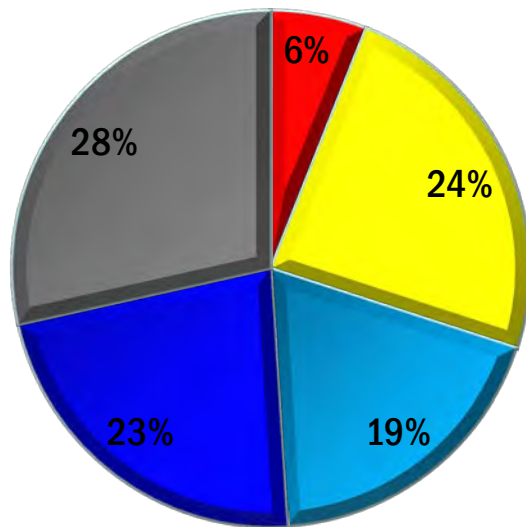




Material Selection – Extensive Use Of Press Hardened Steel

	Mild Steel
	Bake Hardenable
	HSLA
	Dual-Phase/Multi-Phase
	Press Hardened Steel

Material Breakdown by part count



Manufacturing Footprint

2012 Silverado and Sierra total sales volume: 575,497

Flint Asm, Michigan

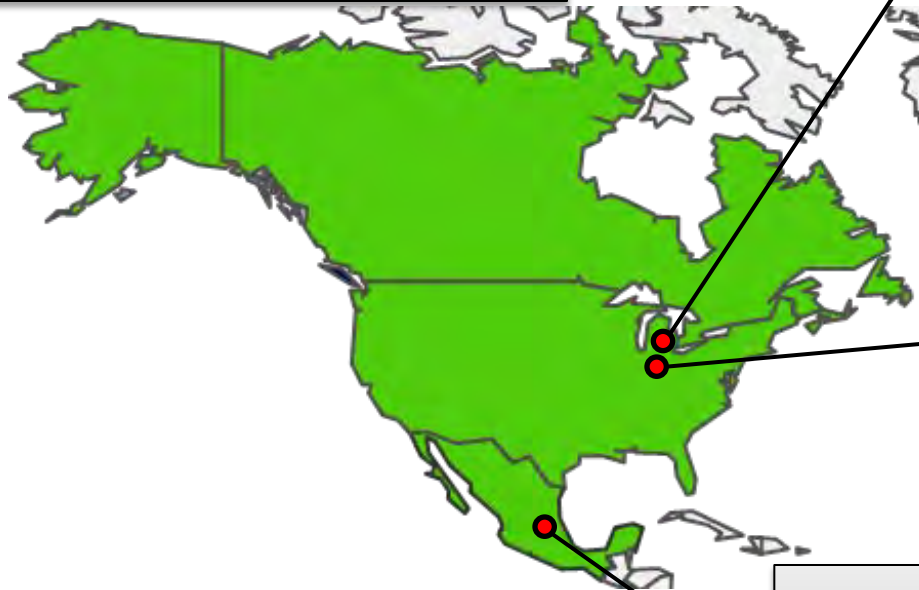
- Crew Cab
- Regular Cab

Fort Wayne Asm, Indiana

- Double Cab
- Regular Cab

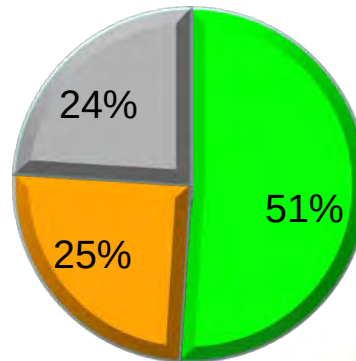
Silao Asm, Mexico

- Crew Cab
- Regular Cab

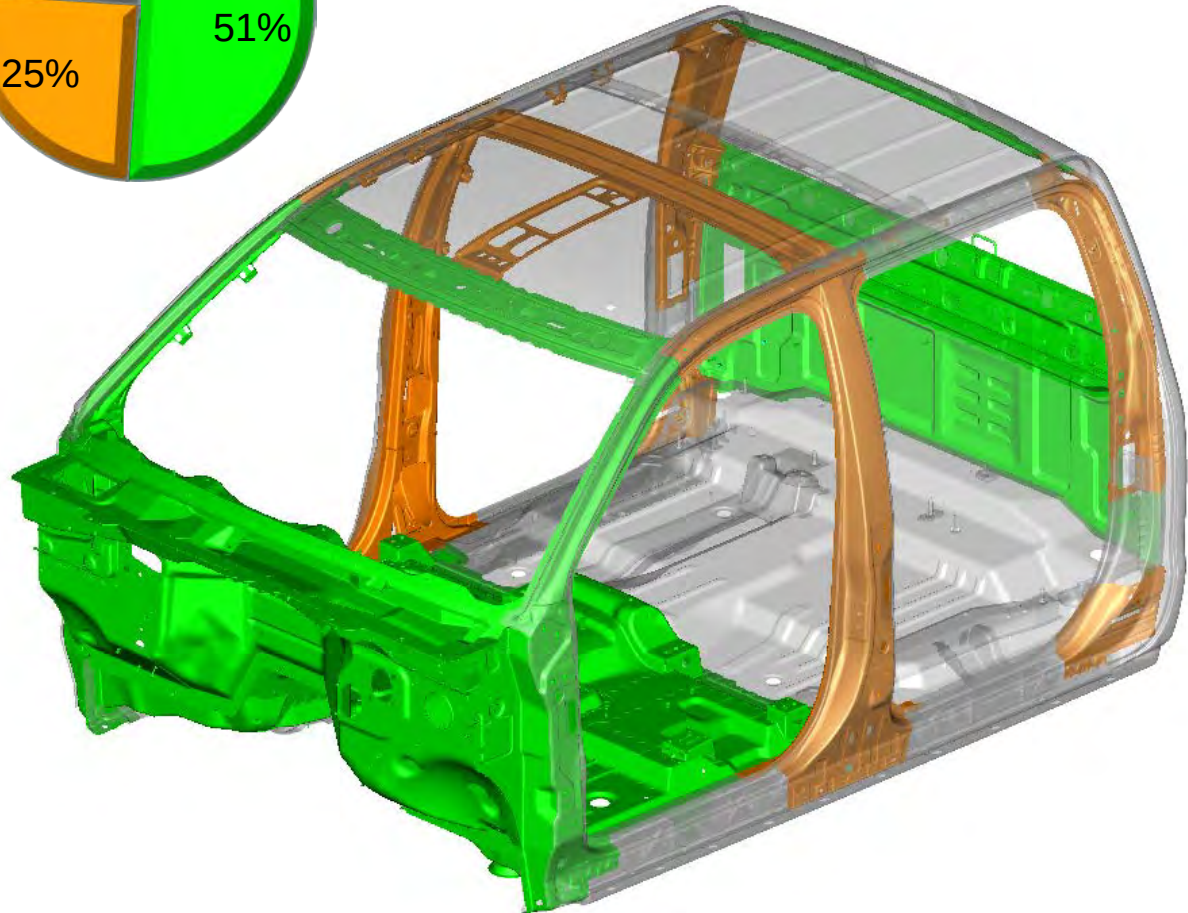


Part Commonality Across Three Cab Configurations

	Common on all Cab's
	Common Double and Crew Cab
	Unique to Crew Cab



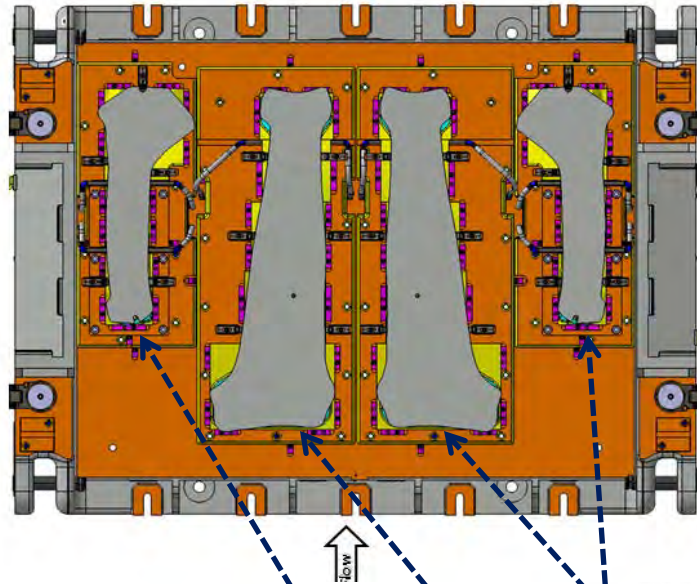
Crew Cab commonality
breakdown by part count



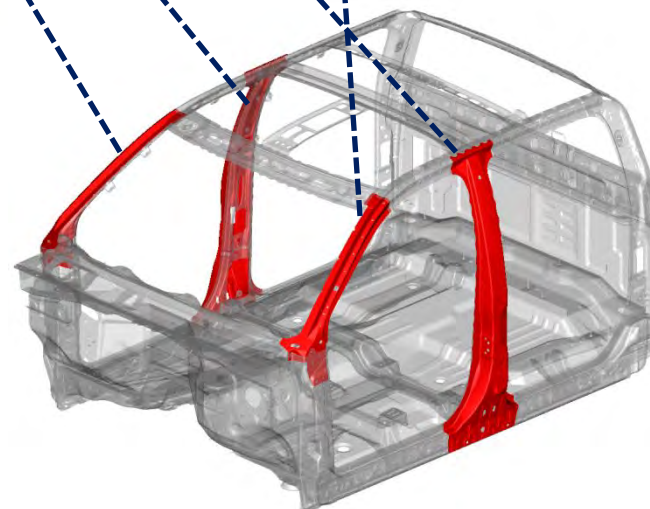
- Common door hardware system
- Flexible assembly tooling
- Reduces investment, piece cost

Part Commonality Across Three Cab Configurations

- Common Press Hardened Steel die tooling
- Dual cavity tooling reduces investment
- Higher volumes decrease piece cost



Dual cavity tool

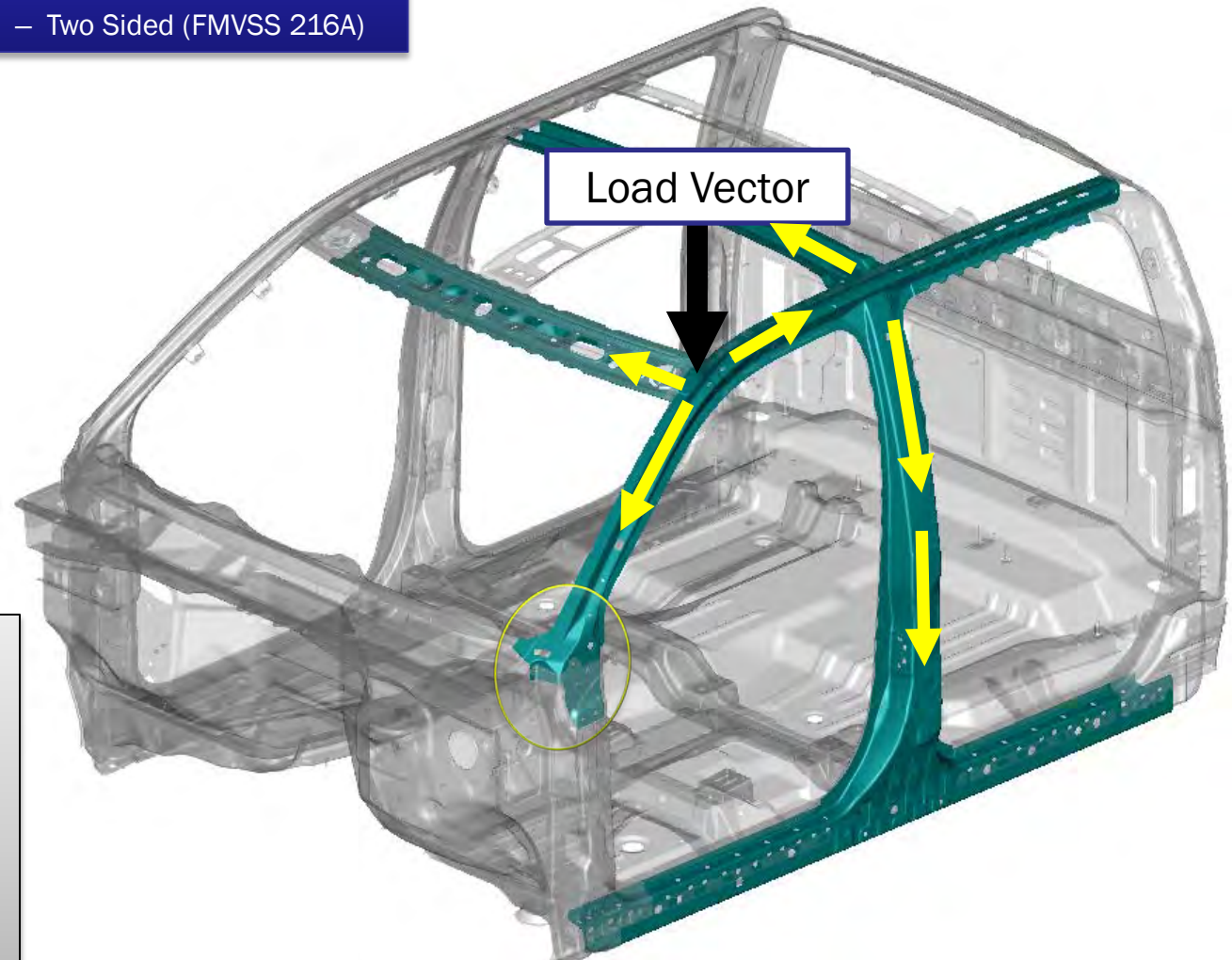


Reinforcement Safety Cage



U.S. Roof strength:

- IIHS
- Two Sided (FMVSS 216A)



Loads are carried by:

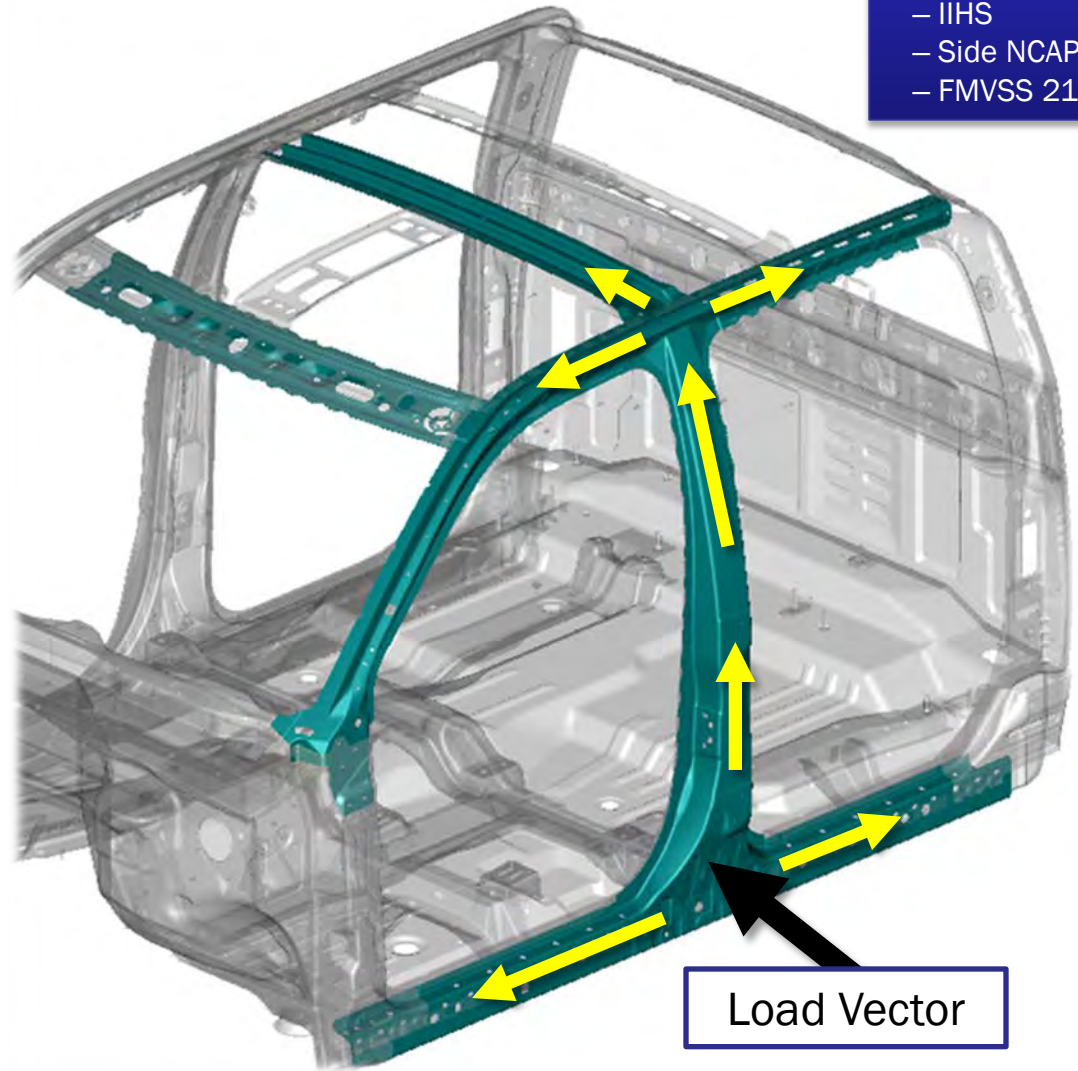
- Front roof header
- #2 Roof bow
- PHS roof rail outer
- Center pillar assembly with shear plate

Reinforcement Safety Cage



Side Impact:

- IIHS
- Side NCAP
- FMVSS 214

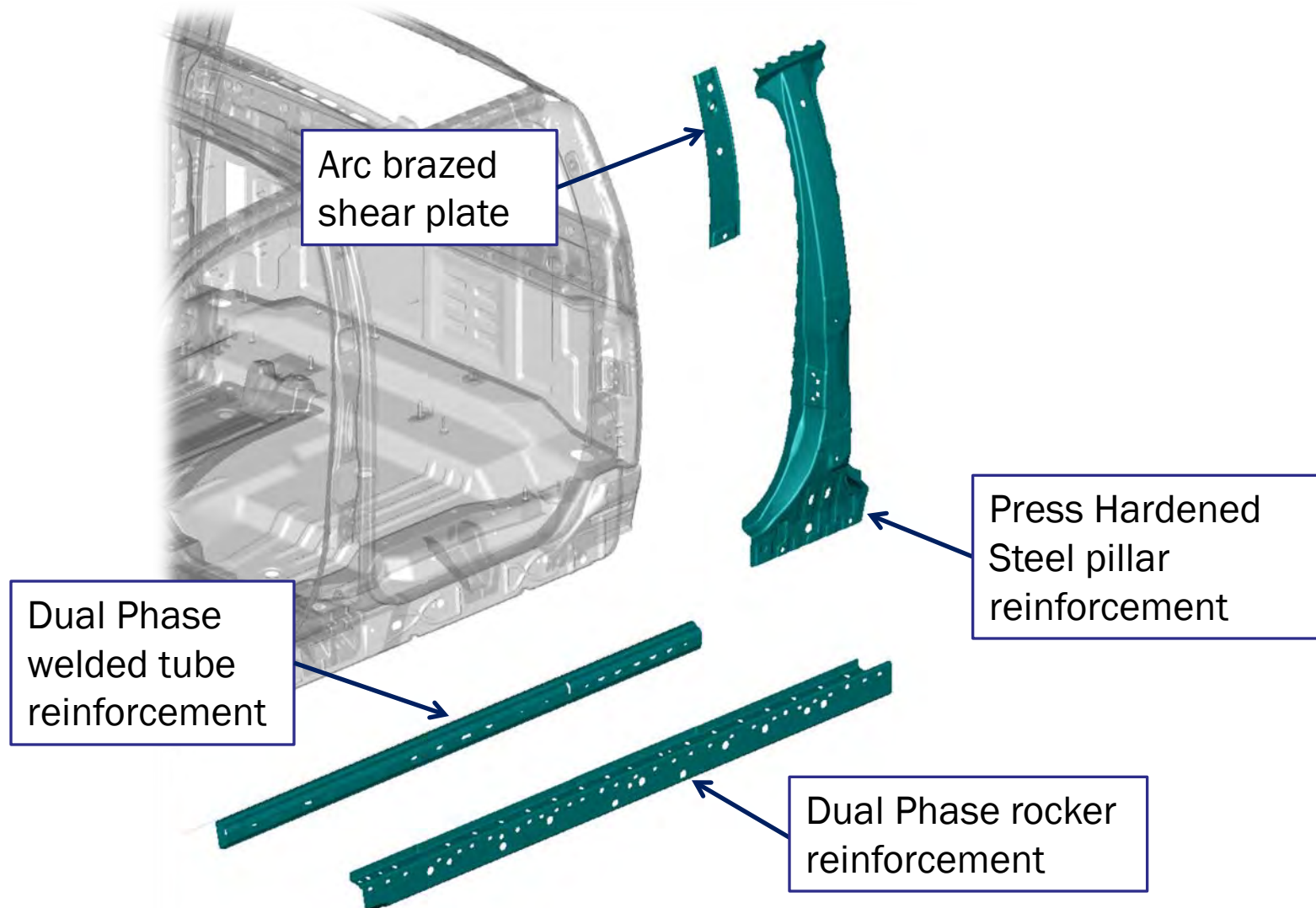


Load Vector

Side impact loads are dissipated through:

- PHS center pillar assembly
- Rocker outer assembly
- PHS roof rail assembly
- #2 PHS roof bow

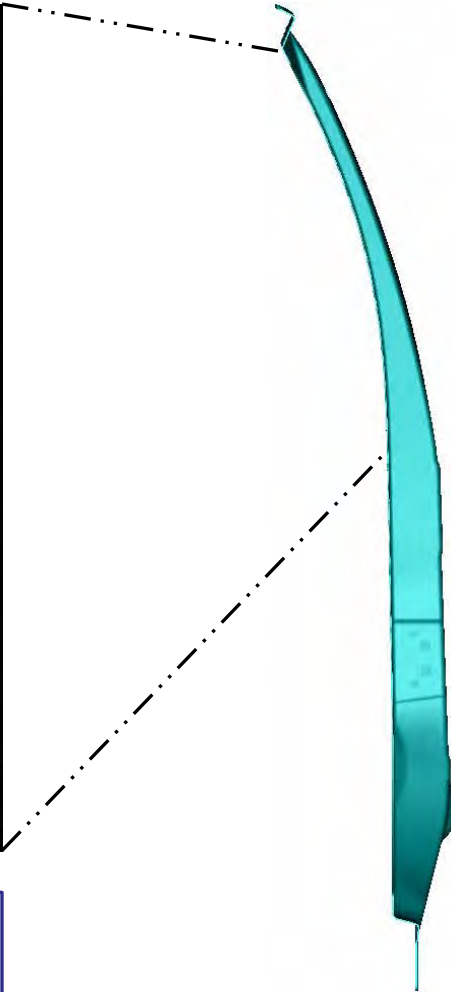
Safety Cage – Key Reinforcements



Reinforcement Safety Cage – Center Pillar Asm



Arc brazed Low Alloy shear plate



- Consistent geometry in load path, initiator free
- Shear plate offsets smaller cross section
- Arc brazing reduces B&R weld flange stack-up

Press Hardened Steel pillar reinforcement asm

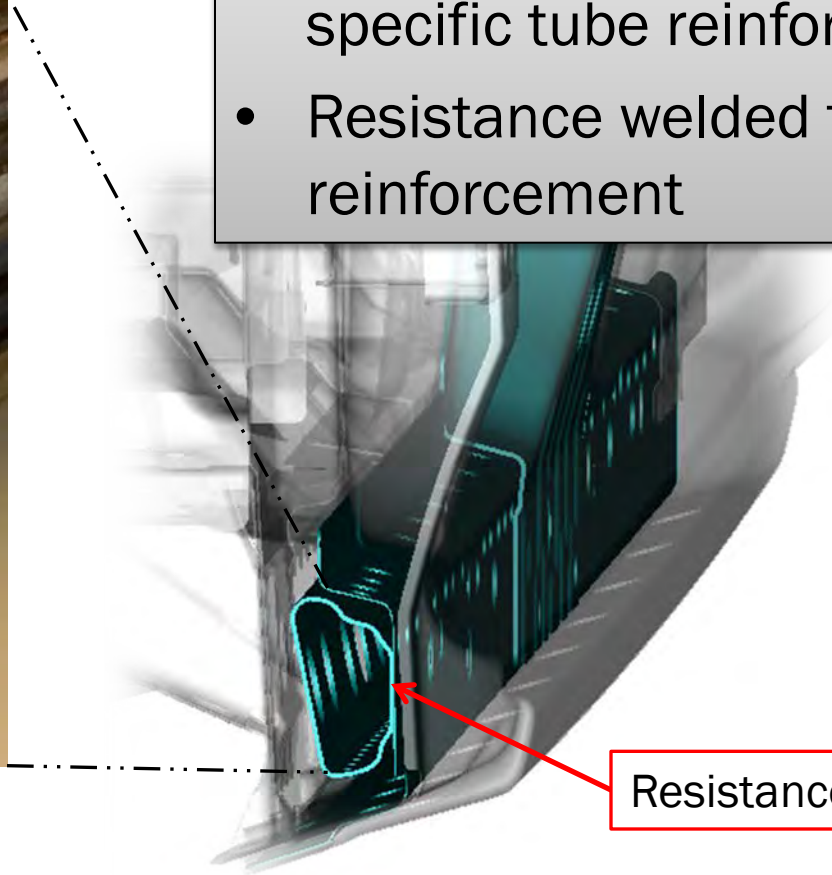
Reinforcement Safety Cage – Rocker Asm

High-Frequency
Induction weld joint



Dual Phase
welded tube
reinforcement

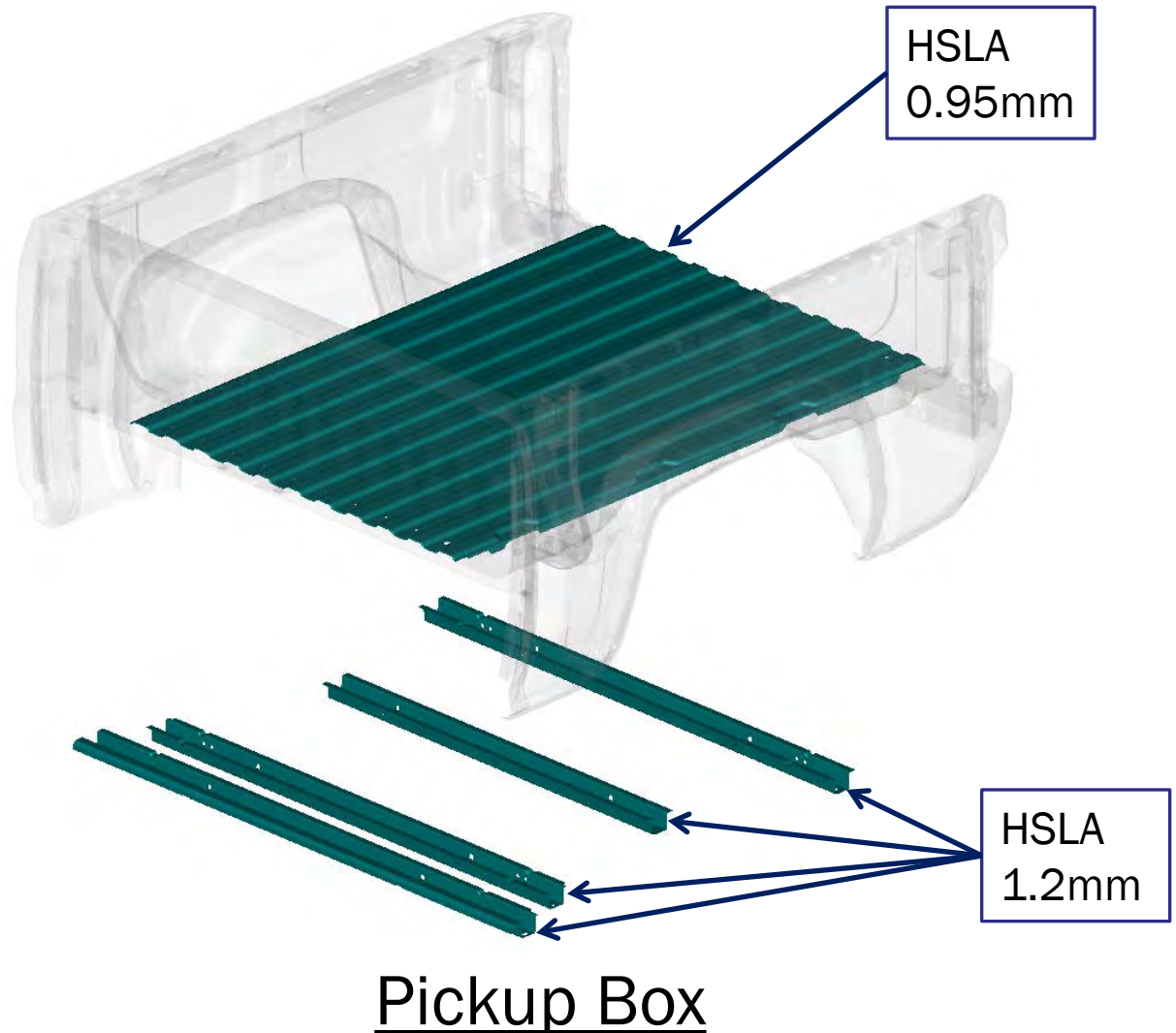
- High-frequency induction welding, enables a design specific tube reinforcement
- Resistance welded to rocker reinforcement



Resistance weld joint

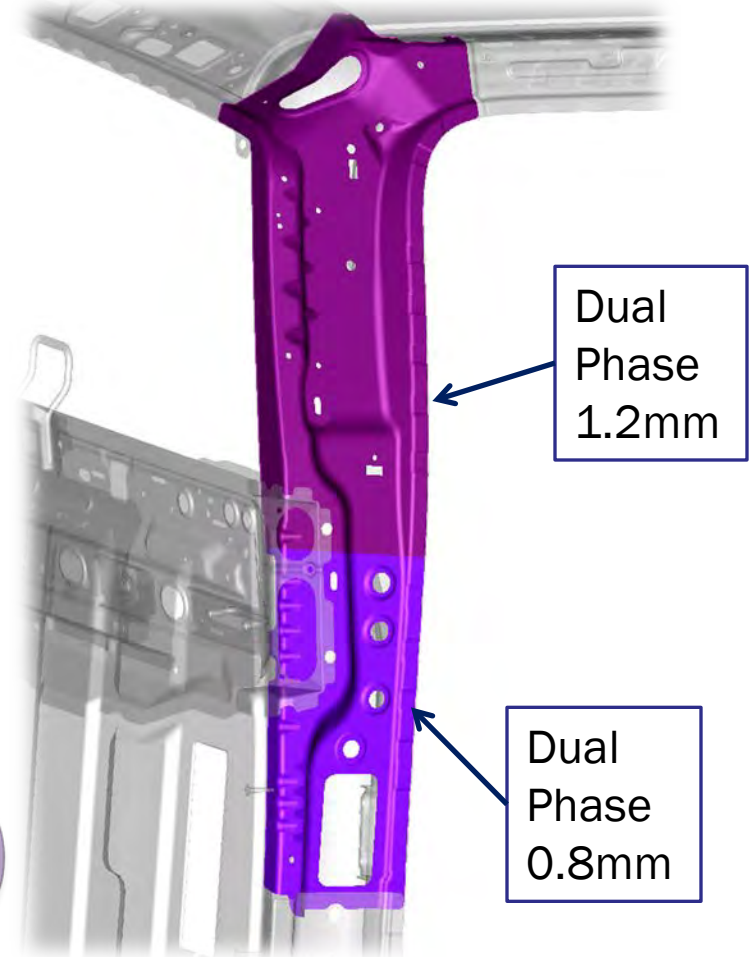
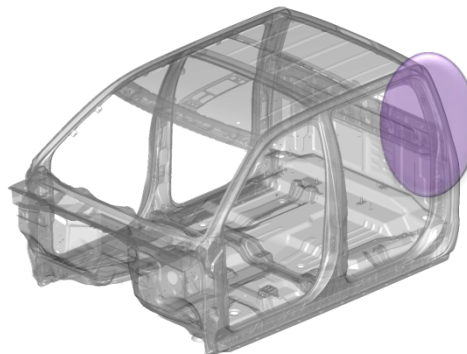
Mass Reduction Strategies – Roll Forming

- Roll formed platform for lower mass and higher cargo capability
- Minimizes thinning for increased durability
- Roll formed cross sills

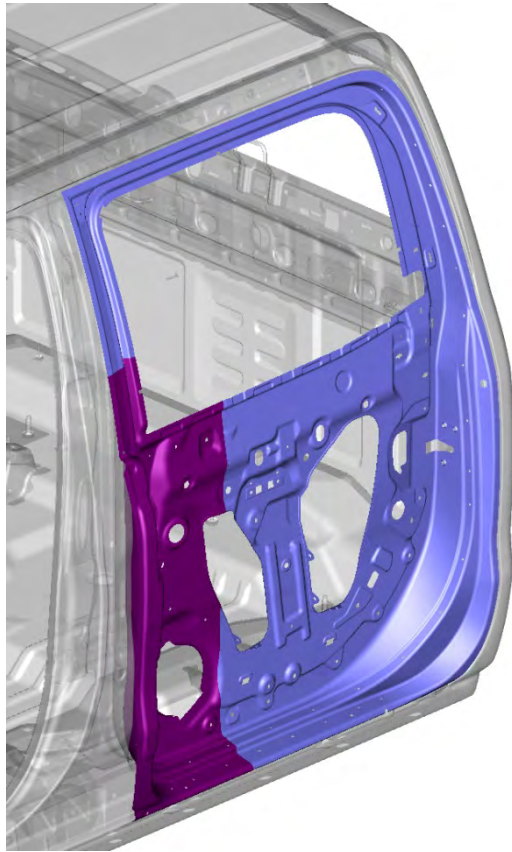


Mass Reduction Strategies – Tailor Welded Blank

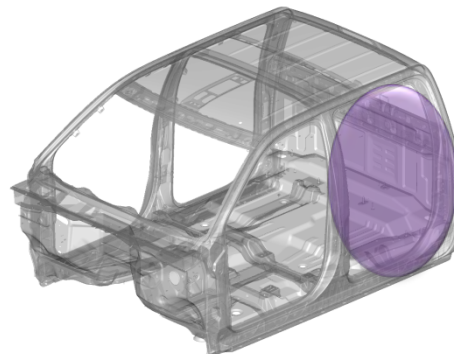
- Gage reduction outside of load path
- Enables current assembly process
- Joint avoidance in load sensitive area



Mass Reduction Strategies – Tailor Welded Blank



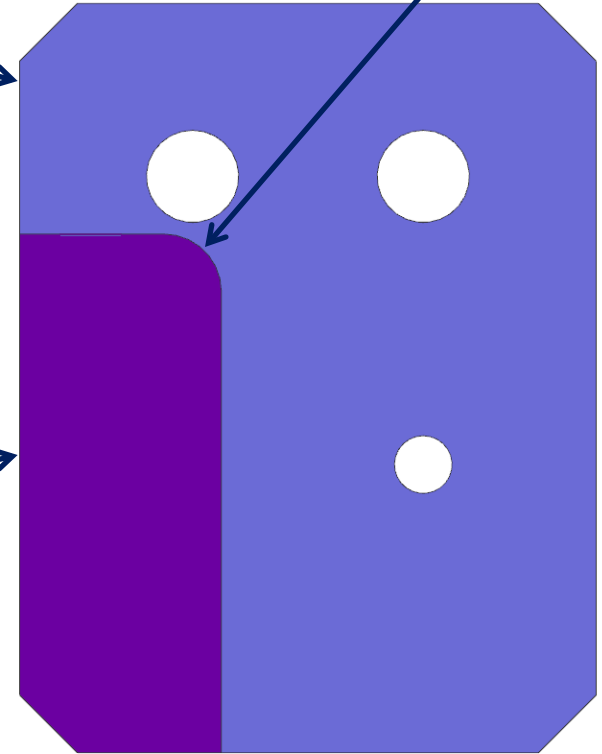
Door inner



Mild Steel
0.75mm

Bake Hardenable
1.6mm

R100



Rear door Blank

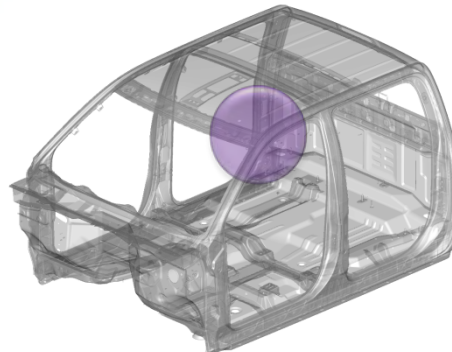
Mass Reduction Strategies – Part Consolidation

Design for Six Sigma project enabled an integrated sun visor attachment related to FMVSS 201 execution

Dual Phase reinforcement

Mild steel mounting plate reinforcement

Reference Design



Dual Phase reinforcement

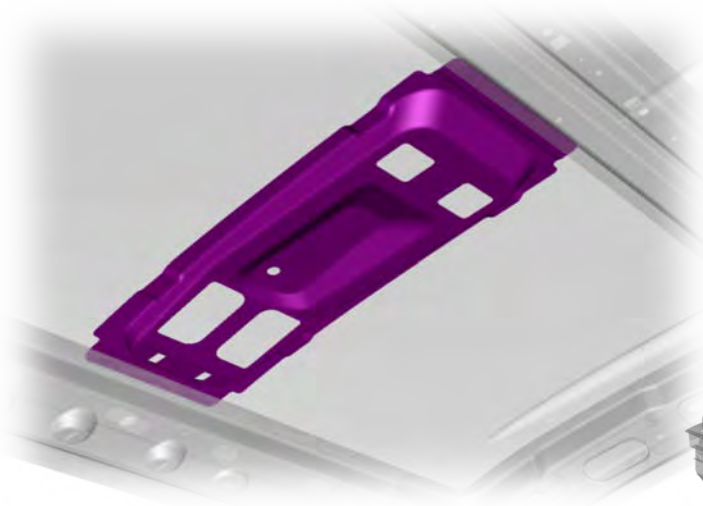
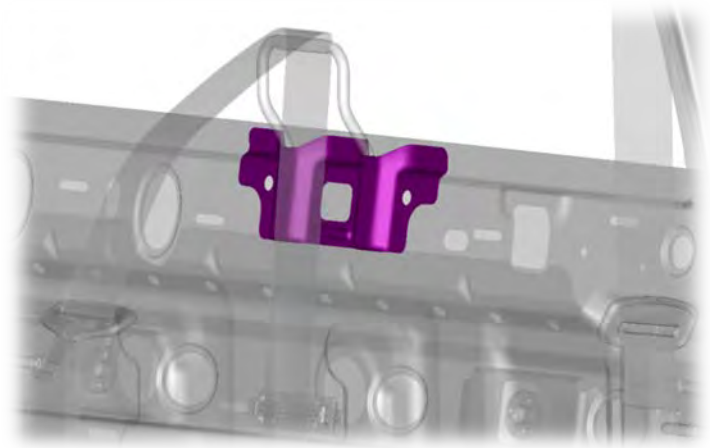
Optimized Design



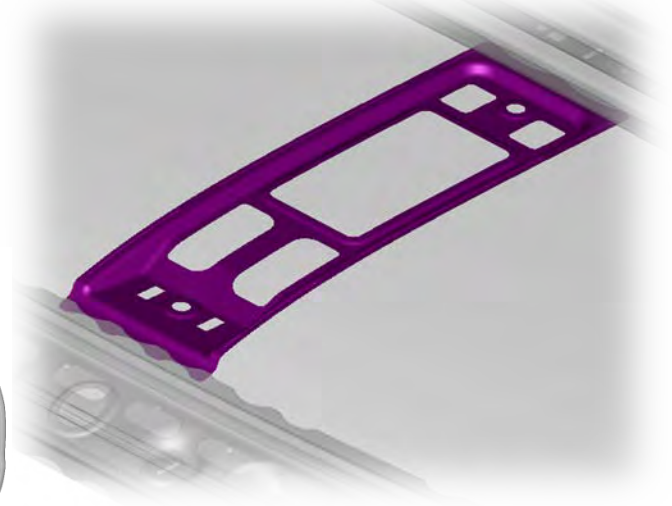
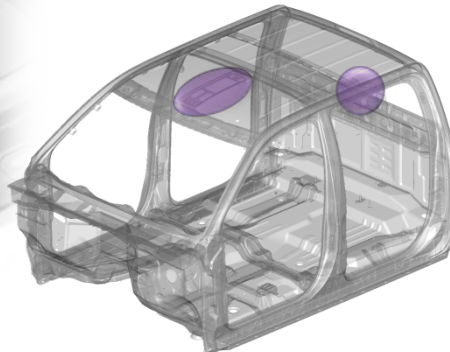
Mass Reduction Strategies – Part Boundary Reduction



Material
upgrade
enabled



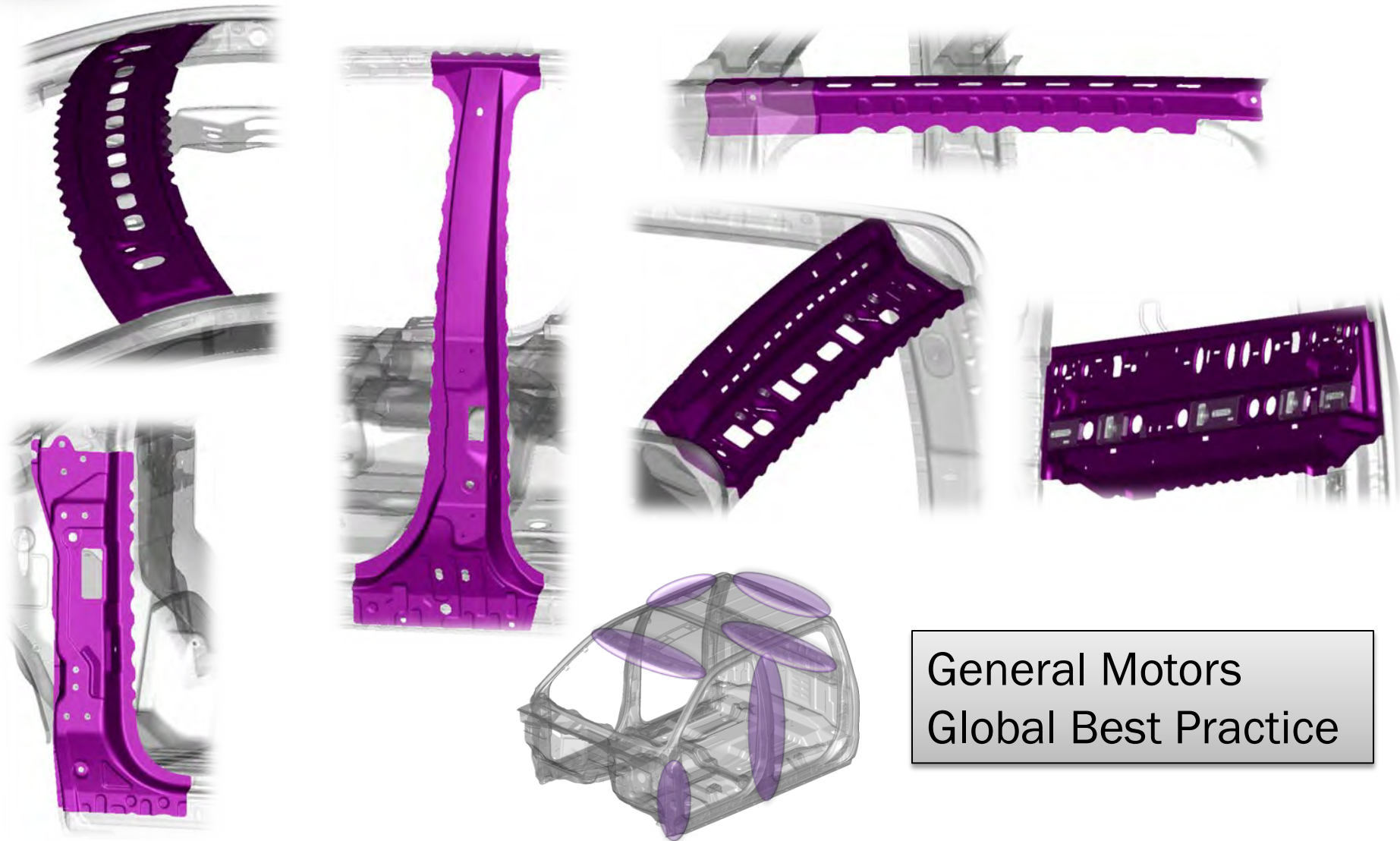
Reference Design



Optimized Design



Mass Reduction Strategies – Scallop Flange Utilization



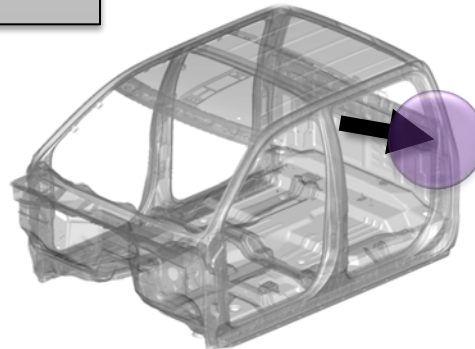
General Motors
Global Best Practice

Mass Reduction Strategies – Torsional Optimization

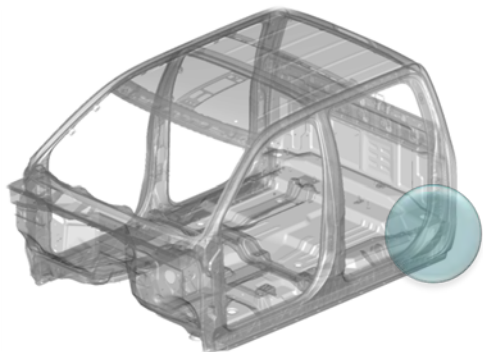
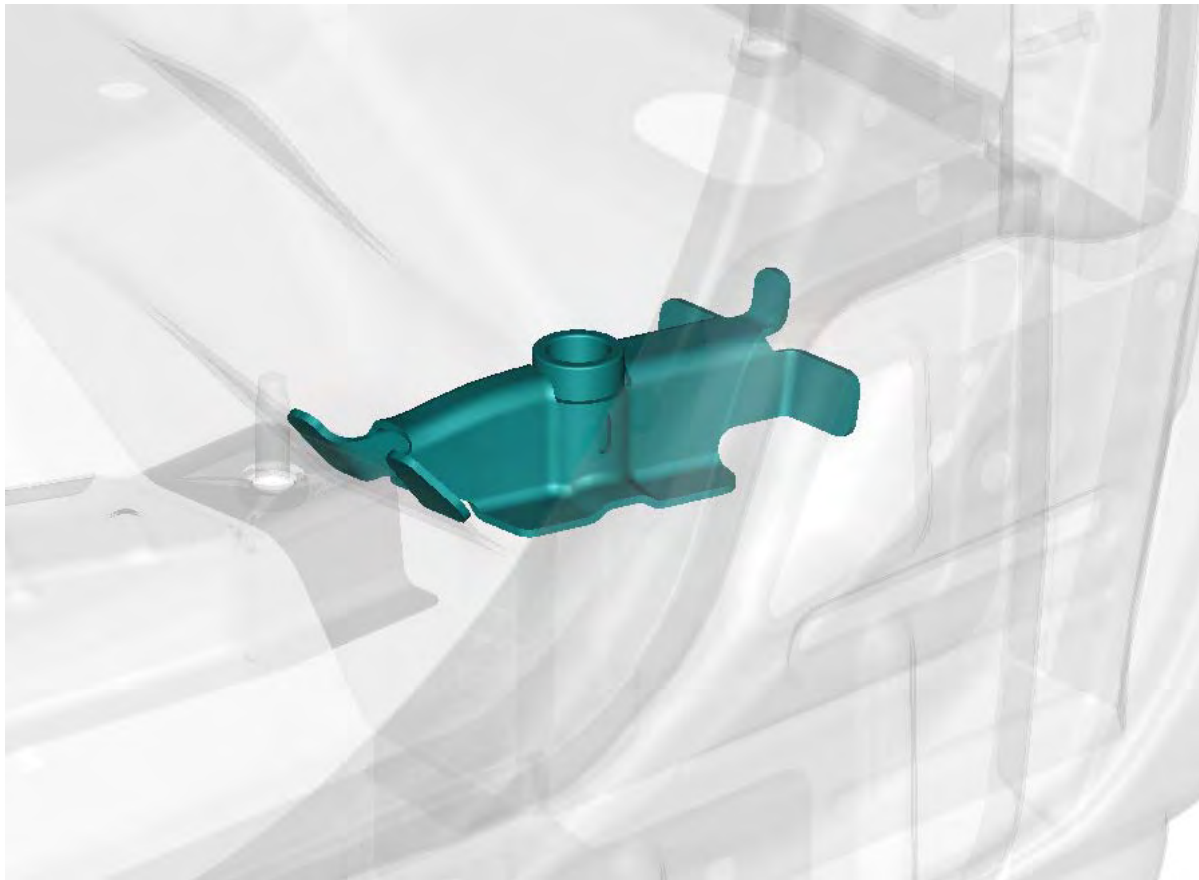
- Welded corner bracket provided a 4% increase in torsion performance
- Enable the removal of a less efficient reinforcement.
- Created down gaging opportunity's on surrounding panels



View inside cab



- Change to shear-style body mount insulator
- 50% increase in local structure stiffness required

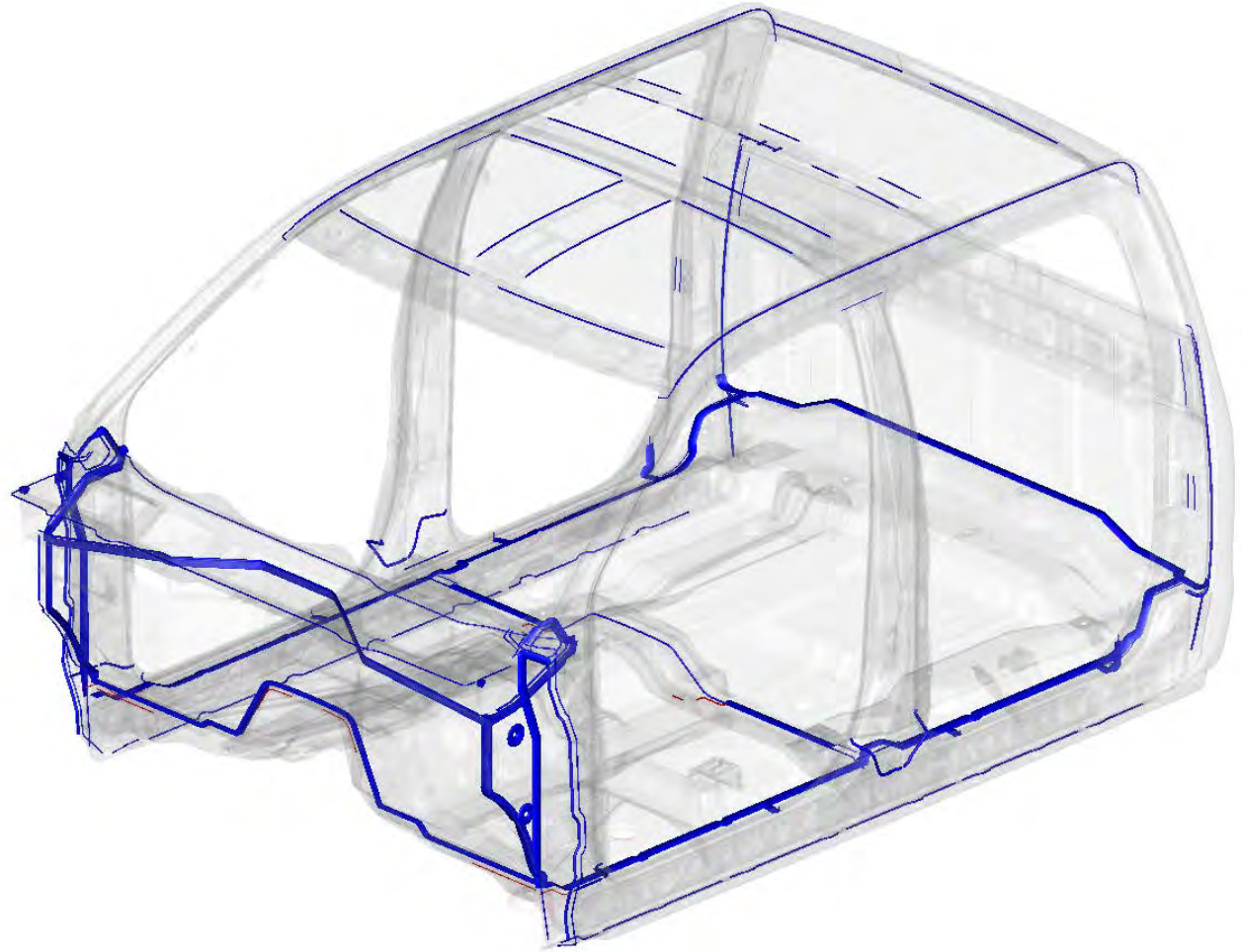


Noise & Vibration Management – Sealing Strategy

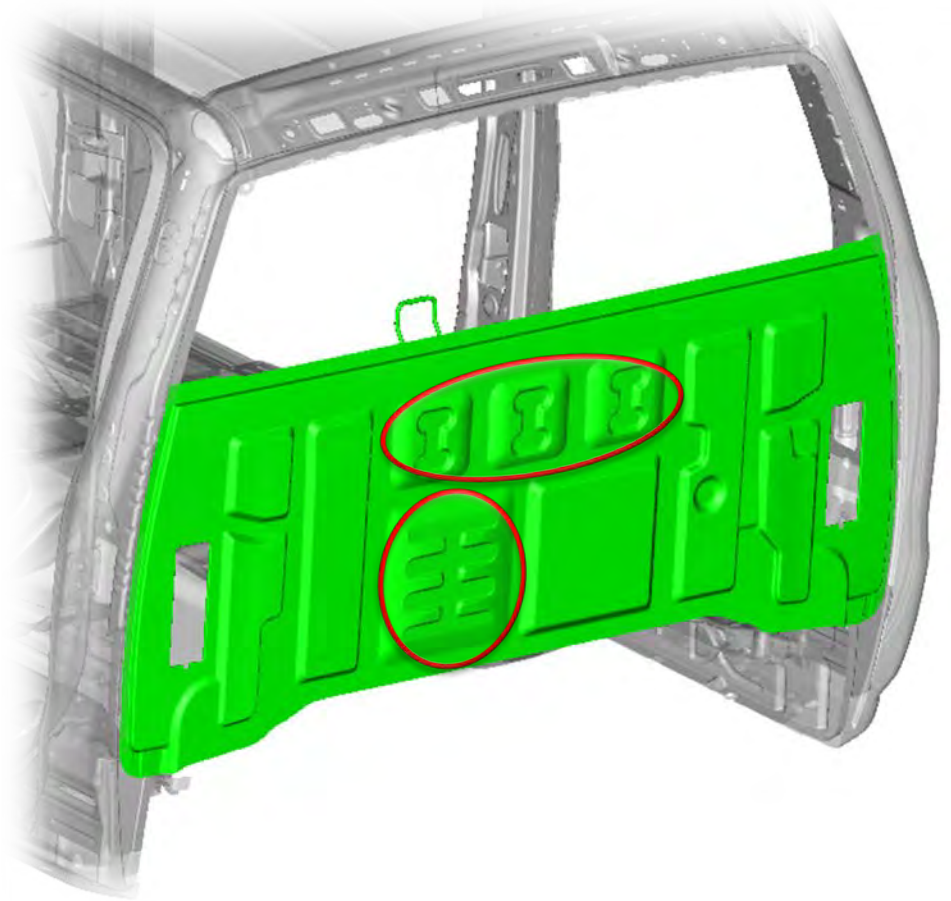
Body sealer

Structural adhesive

- Optimized body joints to enable robust sealing
- 103% increase in structural adhesive
- 44% reduction in airborne noise paths.

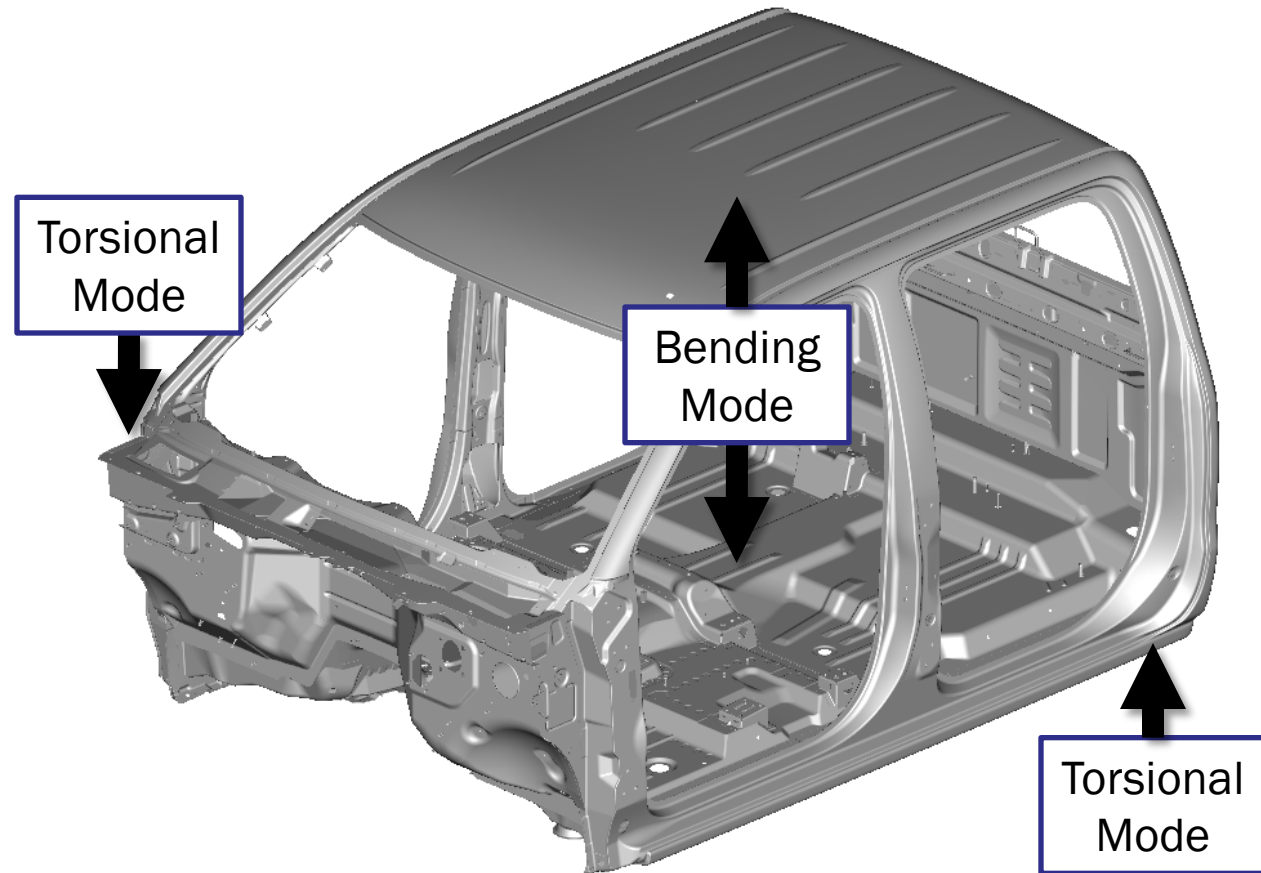


Design for Six Sigma methodology applied to developed bead shapes resulting in reduced back panel vibration.



Noise/Vibration Management – Body Stiffness

- 17% increase in Global Torsional performance
- 10% increase in Global Bending



Summary

- Ultra High Strength Steel stampings enabled a significant increase in safety performance with mass efficiency
- Part commonization strategy reduced tooling investment
- Optimized part geometry enables mass efficiency
- The 2014 Silverado/Sierra weighs 110 lb less on average than its major competitor





THANK YOU

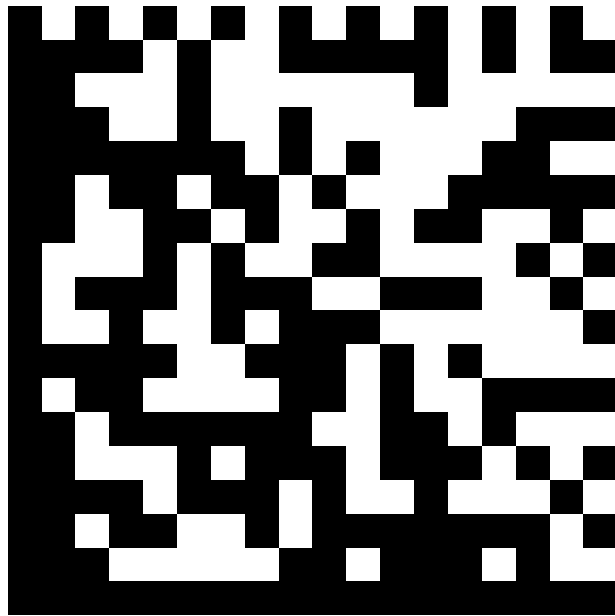
Thomas Grabowski
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Steel
Market Development
Institute

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