



# Rivian R1 Body Structure Evolution and Repairability

D. Black, M. Tummers, V. Krishnardula, D. Sosa, A. Das, J. Hasier

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# Authors



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**John Hasier**

Sr. Manager, Materials Engineering



# Safety



# Vehicle Safety at Rivian

IIHS Top Safety Pick and Top Safety Pick+ Award History

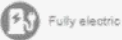


**2023** TOP SAFETY PICK+ ⓘ

**2023 Rivian R1S**

LARGE SUV / 4-DOOR SUV

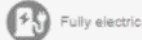
Award applies only to vehicles built after January 2023



**2024** TOP SAFETY PICK ⓘ

**2024 Rivian R1S**

LARGE SUV / 4-DOOR SUV



**2025** TOP SAFETY PICK+ ⓘ

**2025 Rivian R1S**

LARGE SUV / 4-DOOR SUV

Award applies only to vehicles built after August 2024



IIHS adds updated side test and updates TSP and TSP+ award criteria

IIHS adds updated moderate overlap test and updates TSP+ award criteria

IIHS updates TSP and TSP+ award criteria

**2022** TOP SAFETY PICK+ ⓘ

**2022 Rivian R1T**

LARGE PICKUP / CREW CAB PICKUP



**2023** TOP SAFETY PICK+ ⓘ

**2023 Rivian R1T**

LARGE PICKUP / CREW CAB PICKUP



**2024** TOP SAFETY PICK+ ⓘ

**2024 Rivian R1T**

LARGE PICKUP / CREW CAB PICKUP



**2025** TOP SAFETY PICK ⓘ

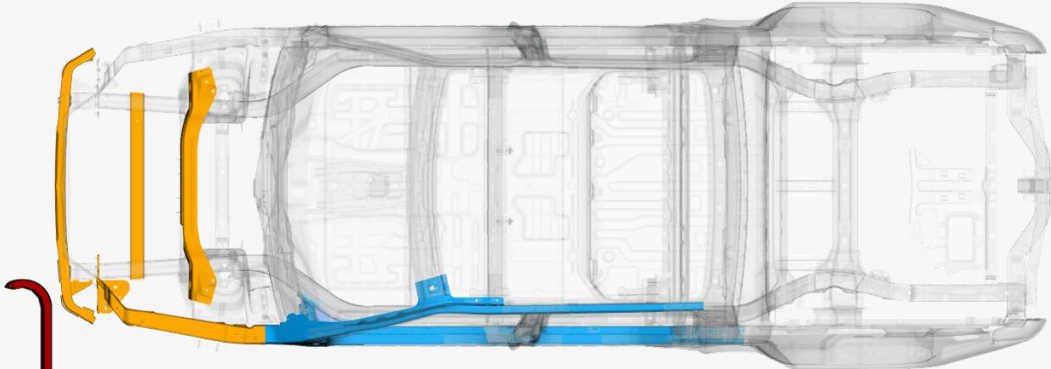
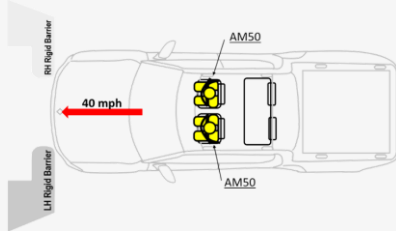
**2025 Rivian R1T**

LARGE PICKUP / CREW CAB PICKUP

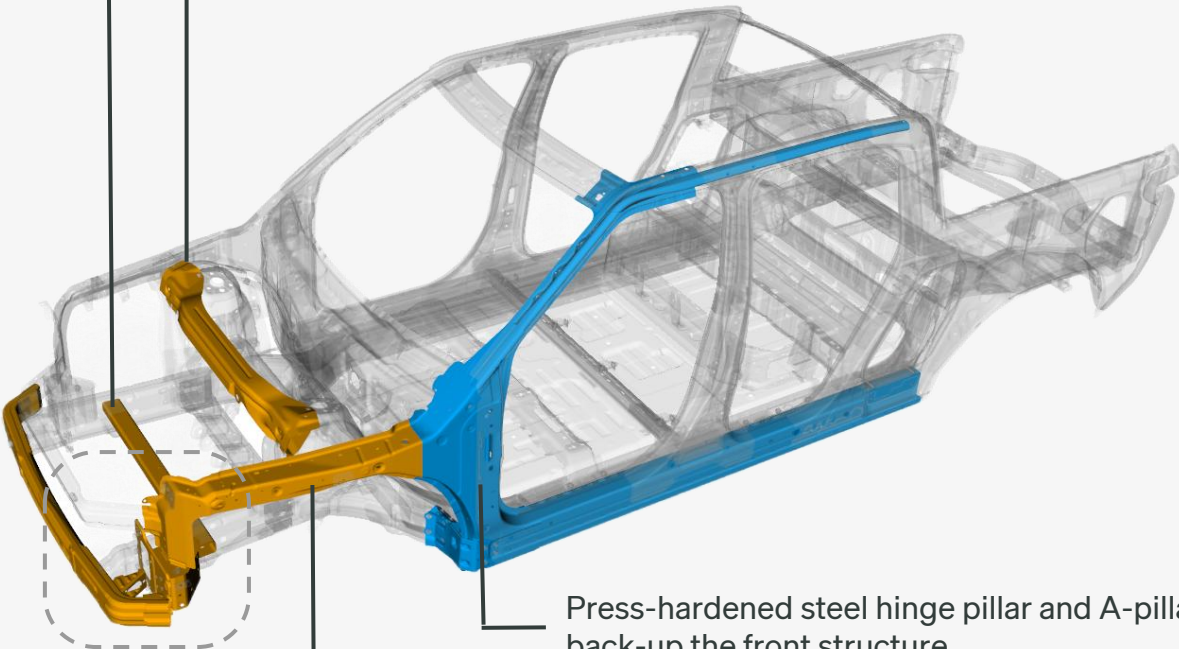


# IIHS SORB Strategy

- Orange Offensive Structure
- Blue Defensive Structure

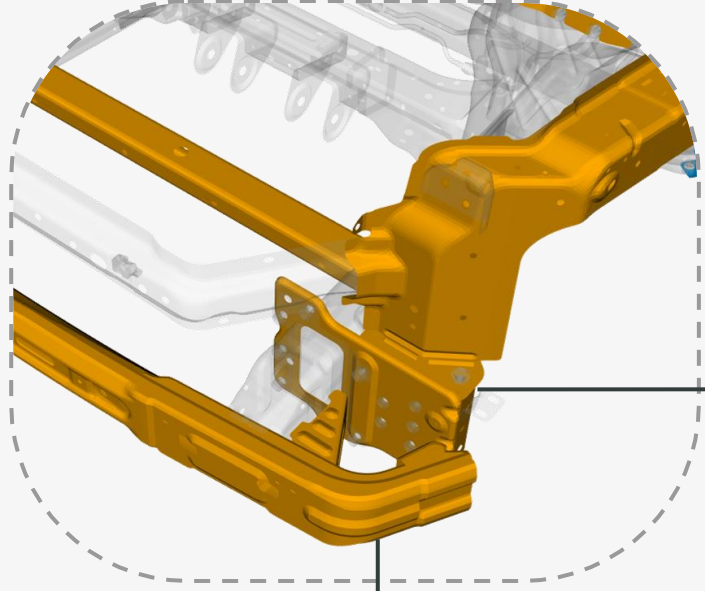


Cross-members provide lateral support for offensive structure



Press-hardened steel hinge pillar and A-pillar back-up the front structure

Reinforced shotgun guides the vehicle away from the barrier



Extruded aluminum crush section provides offensive loads

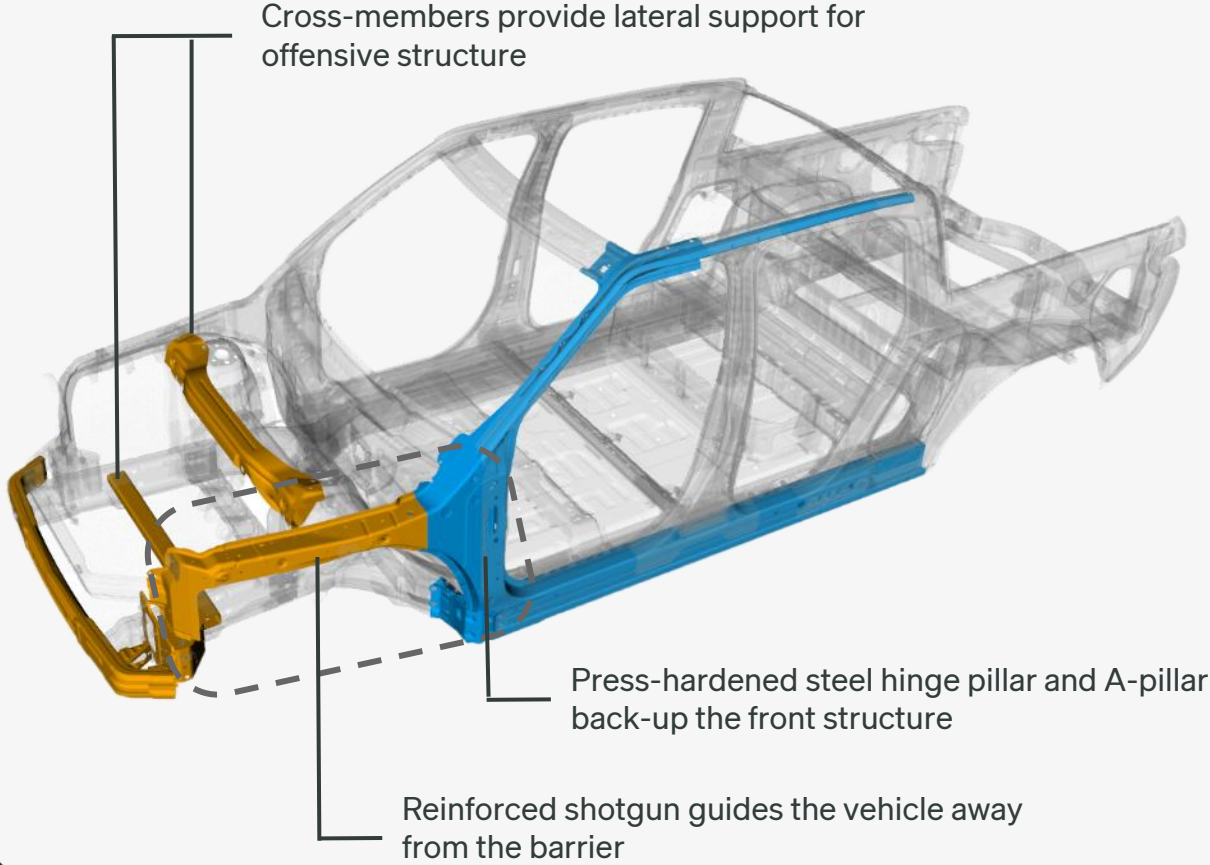
Reinforced steel bumper beam extends 240 mm past crush cans



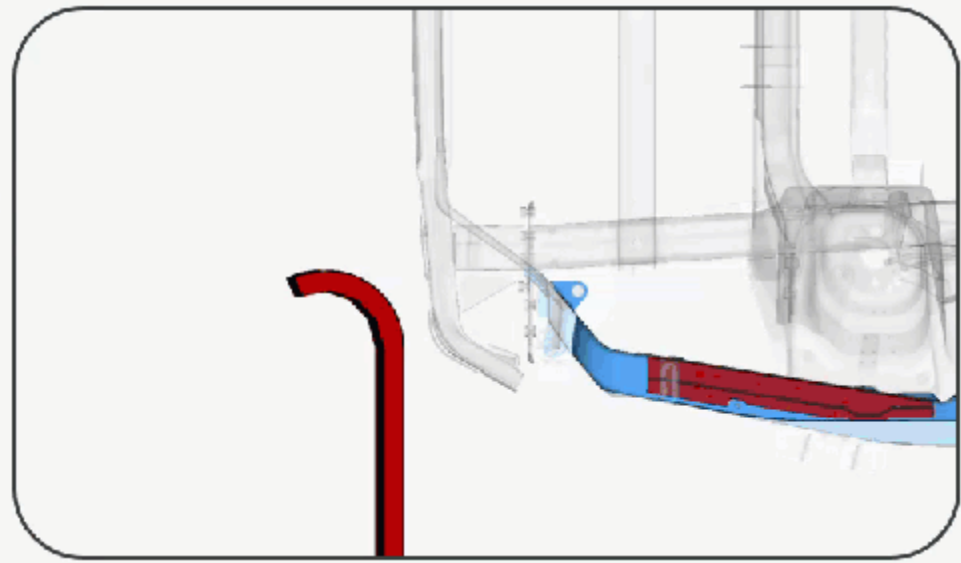
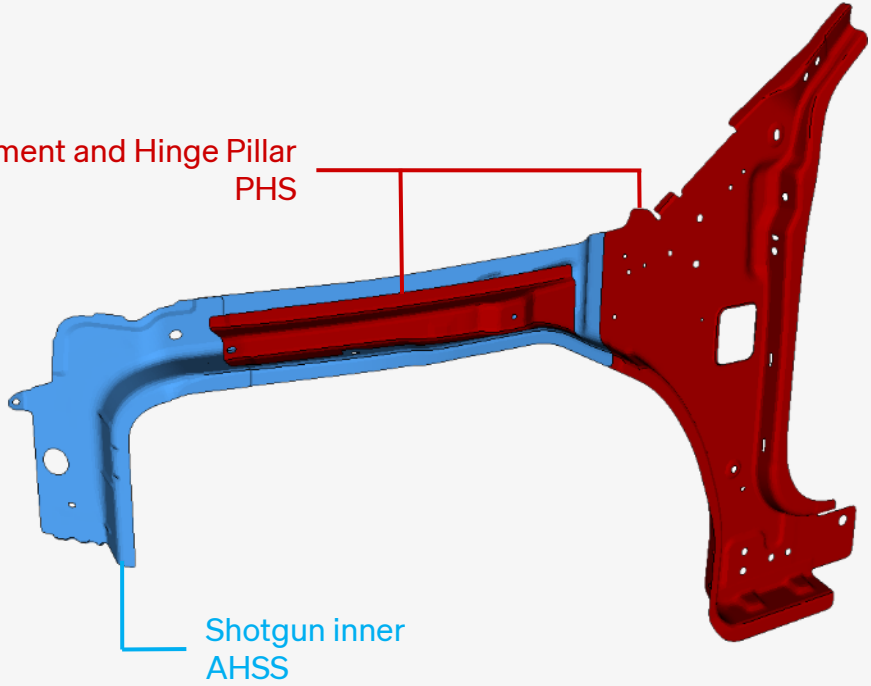
# IIHS SORB Strategy

Offensive Structure

- Orange square: Offensive Structure
- Blue square: Defensive Structure



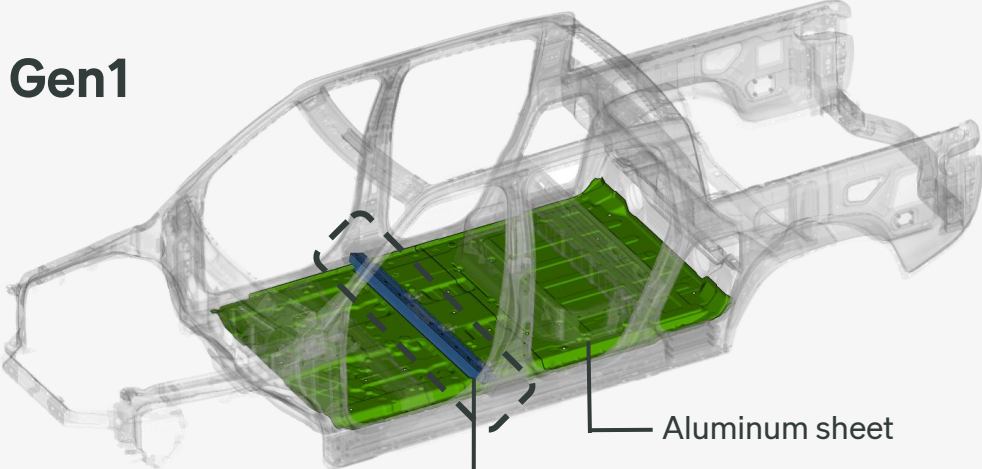
Shotgun Reinforcement and Hinge Pillar PHS



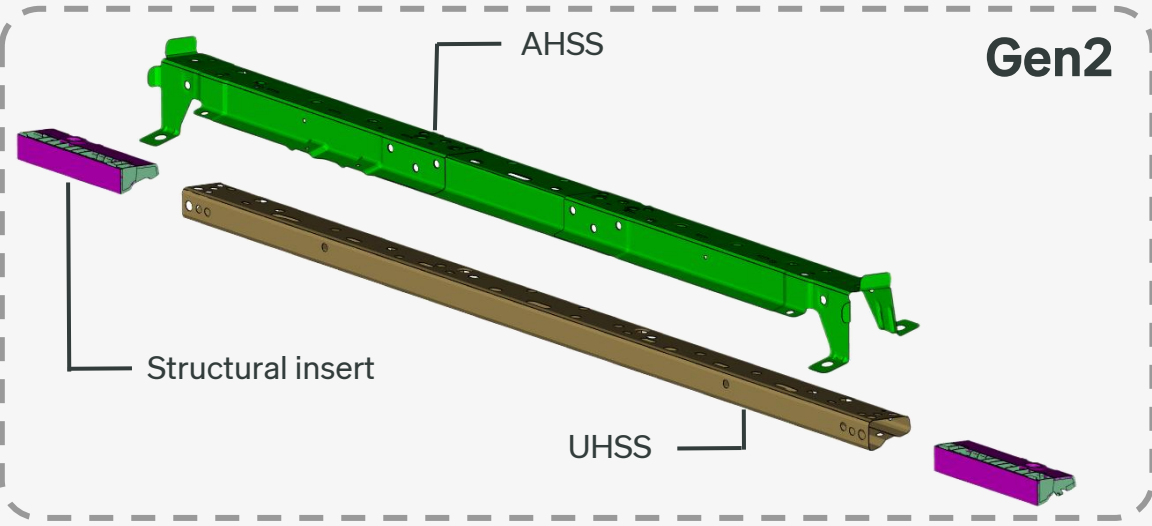
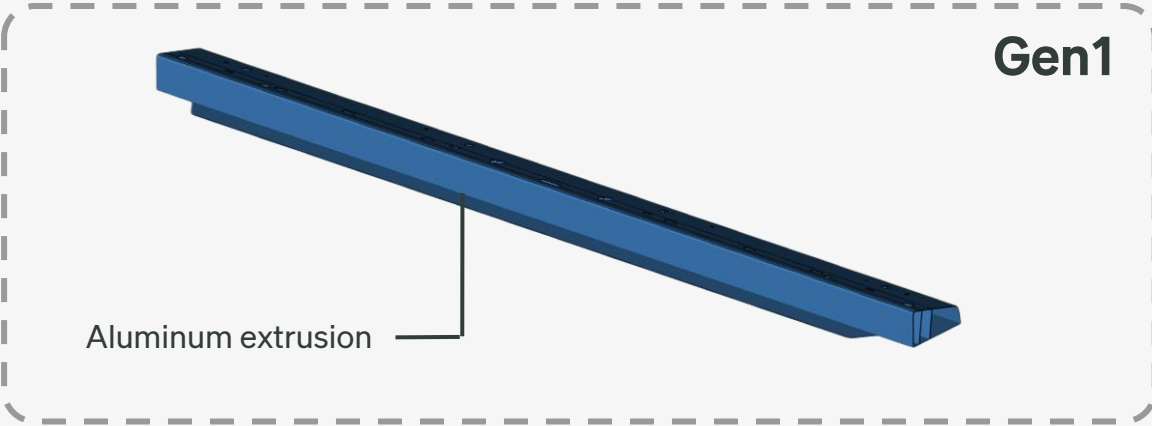
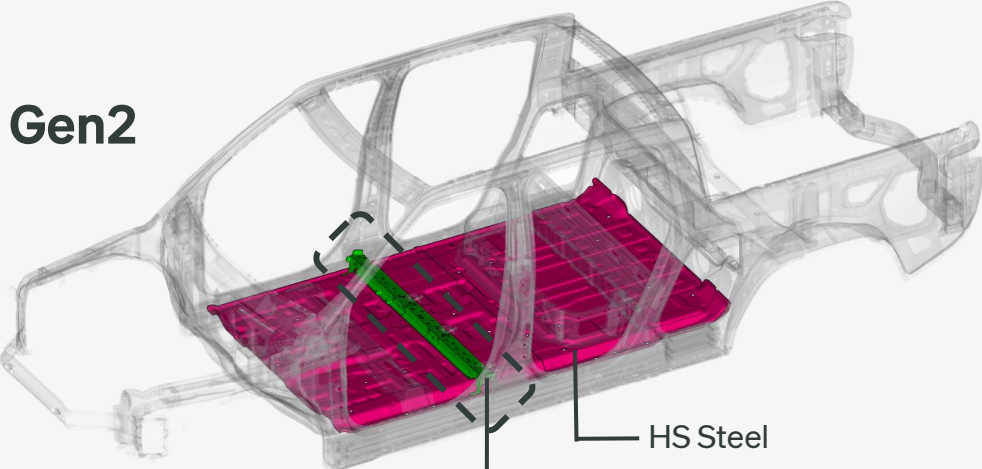
# Body Structure Evolution

Aluminum to Steel Floor Assembly

**Gen1**

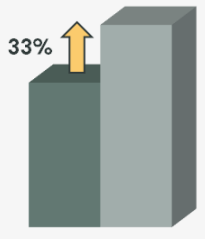
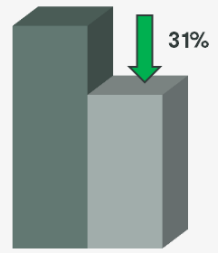


**Gen2**



Cost Impact

Mass Impact

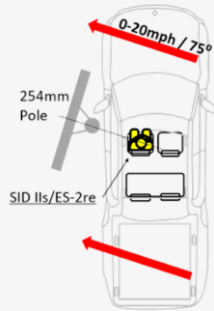


= \$15/ kg savings

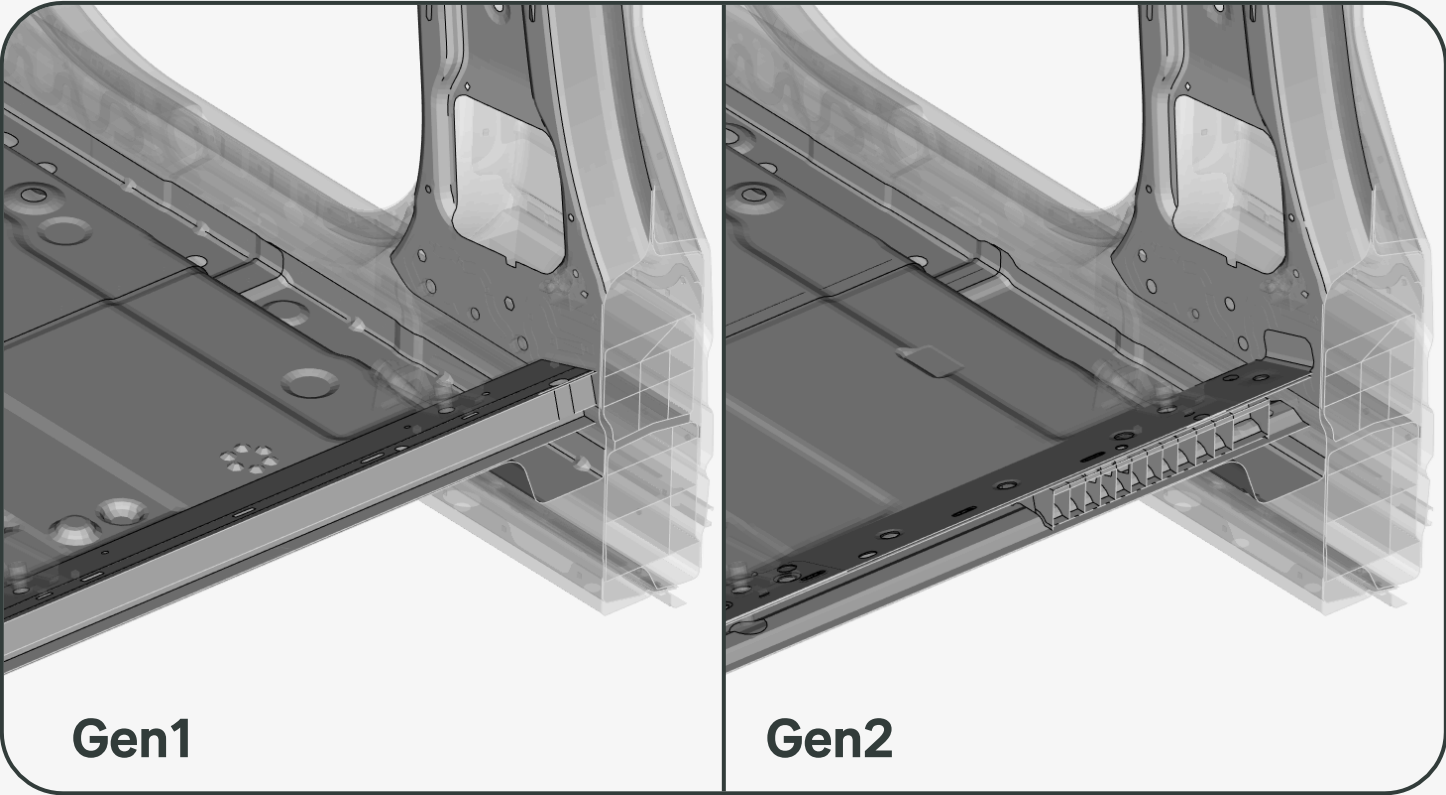
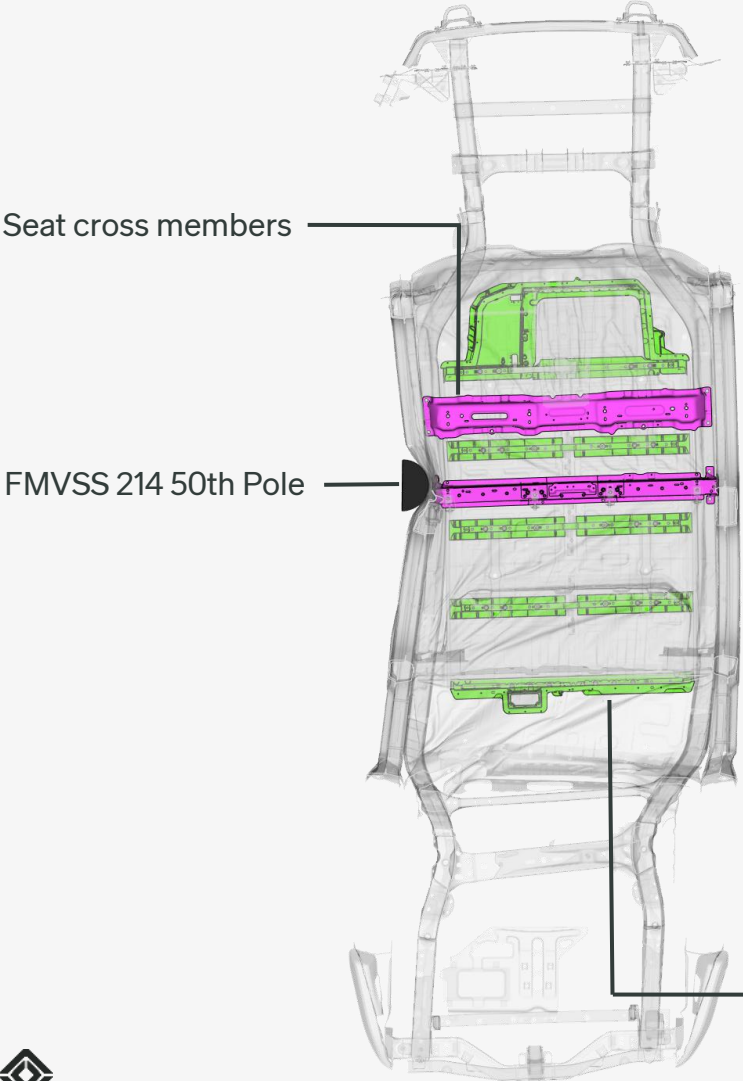


# Body Structure Evolution

Side Crash Energy Management



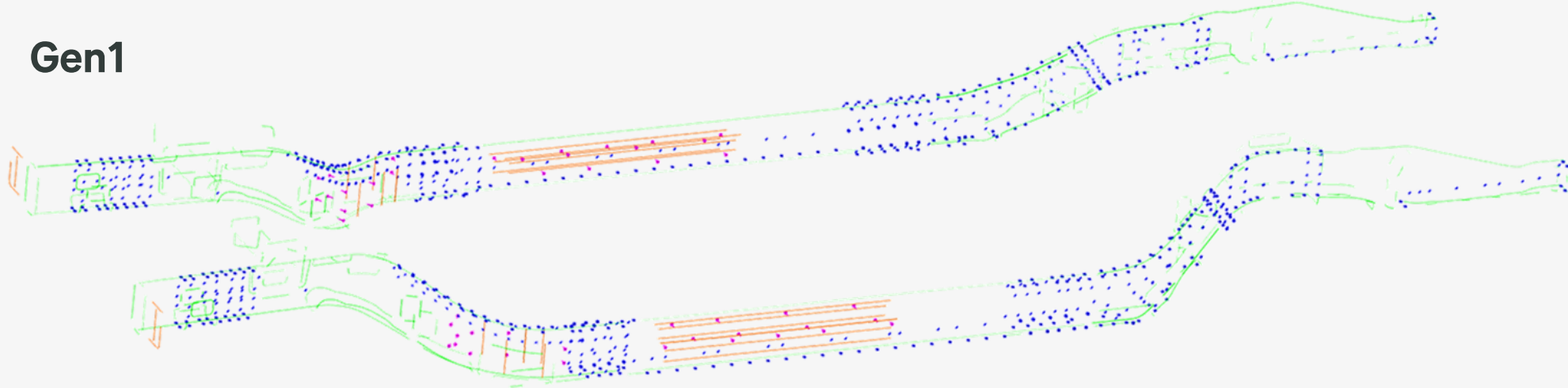
FMVSS 214 50th pole position side crash energy management



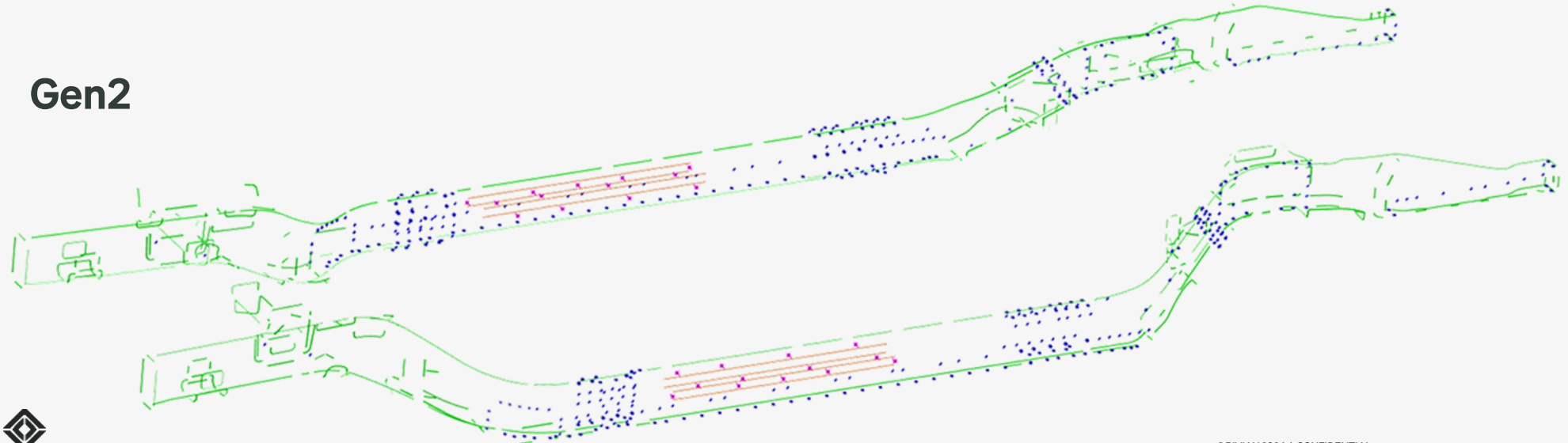
# Body Structure Evolution

Frame Joining Optimization

## Gen1



## Gen2



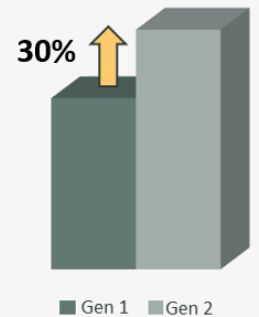
### Joining reduction / frame

RSW	300+
GMAW	8000+ mm
FDS	20+
Structural adhesive	5000+ mm
DA stud	10+

### How did we achieve it ?

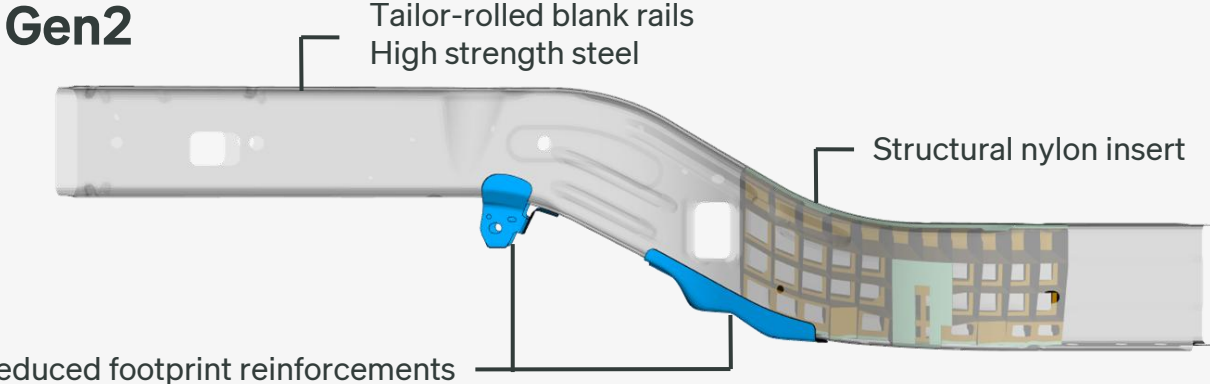
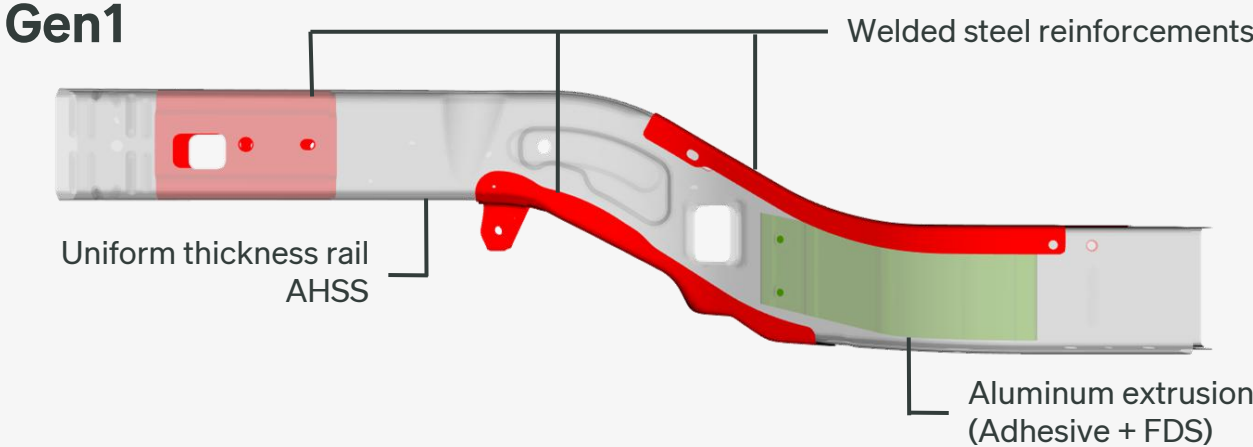
- By consolidating parts using technologies like Tailor Rolled Blank (TRB)
- By using structural composite inserts to reduce joining requirements
- By re-assessing attribute requirements

Frame Mfg.  
Line Output

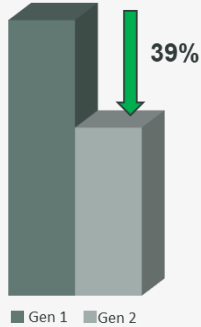


# Body Structure Evolution

Frame Cost Reduction and Part Consolidation



Cost Impact



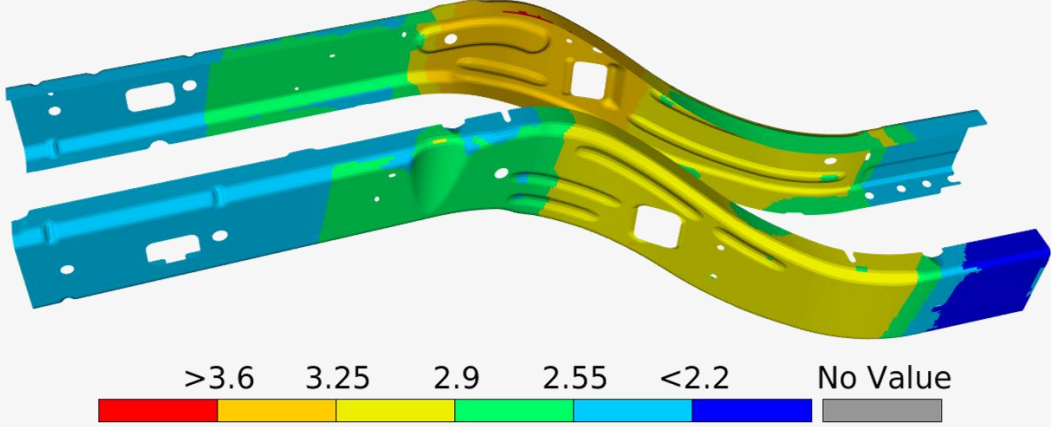
Mass Impact



How were we able to reduce the amount of welded steel reinforcements in Gen2?

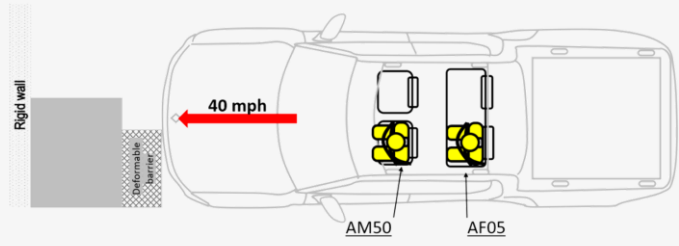
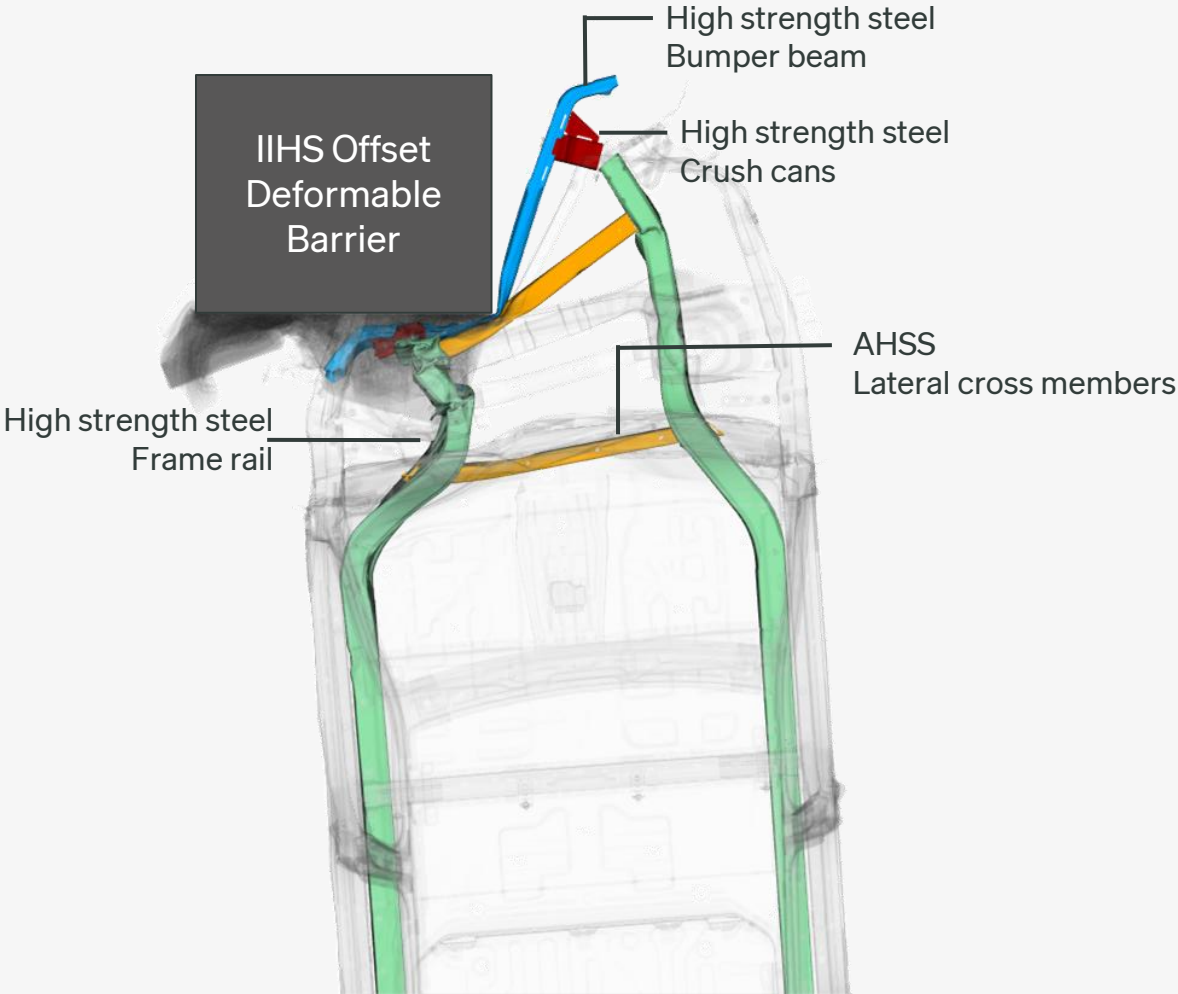
- Tailor-rolled blank (TRB) technology allowed for thickness of the rail to be increased in locations where reinforcements typically would have been needed.

Rivian's R1 Gen2 TRB Rails

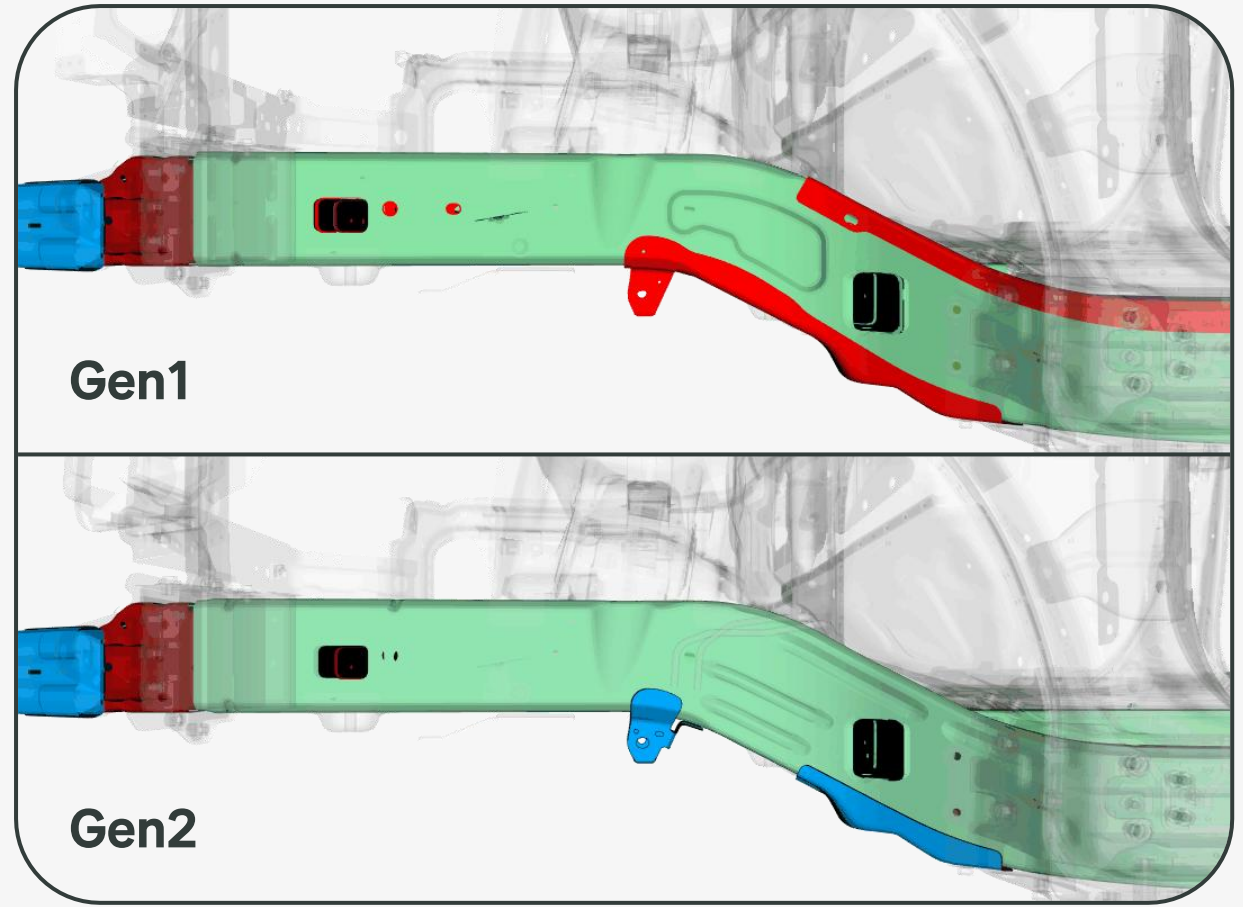


# Body Structure Evolution

Frontal Crash Energy Management



IIHS 40 mph offset deformable barrier crash energy management

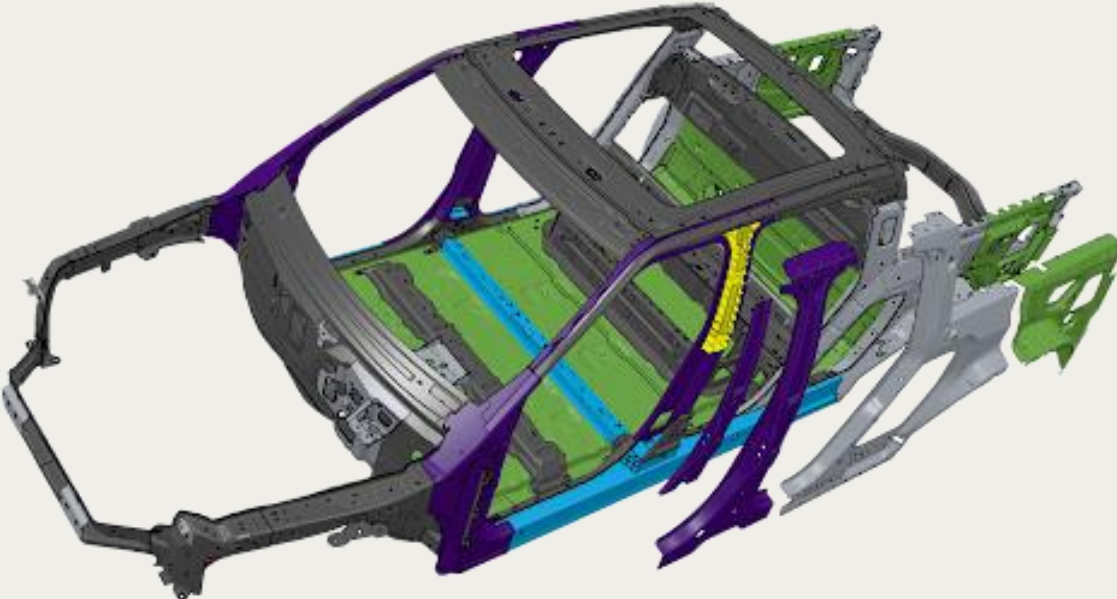


# Collision Repair

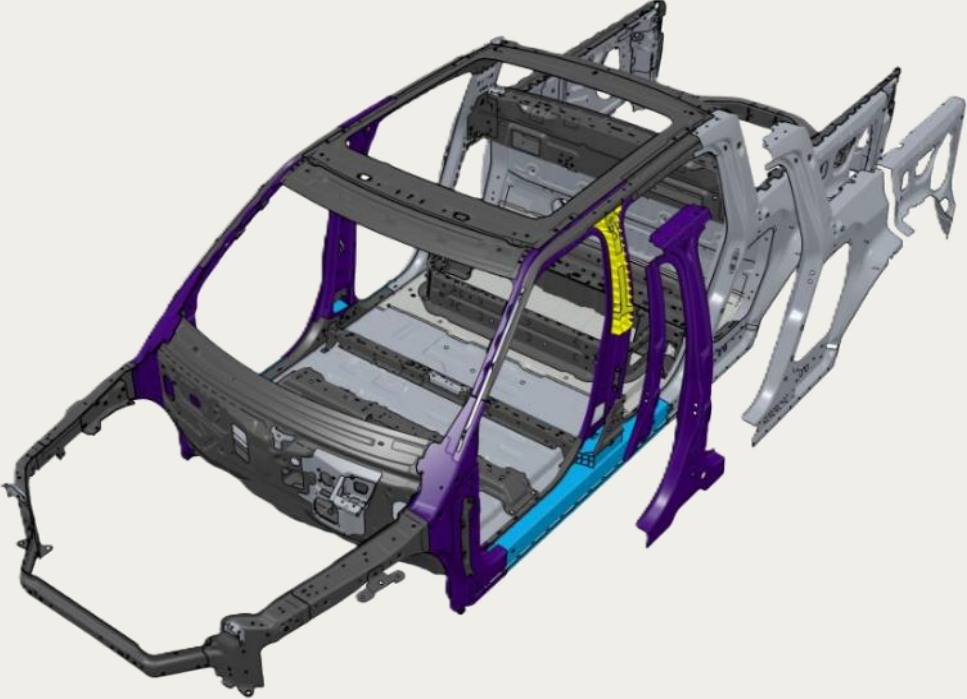


# Material Matrix

R1T- Tophat



Gen 1



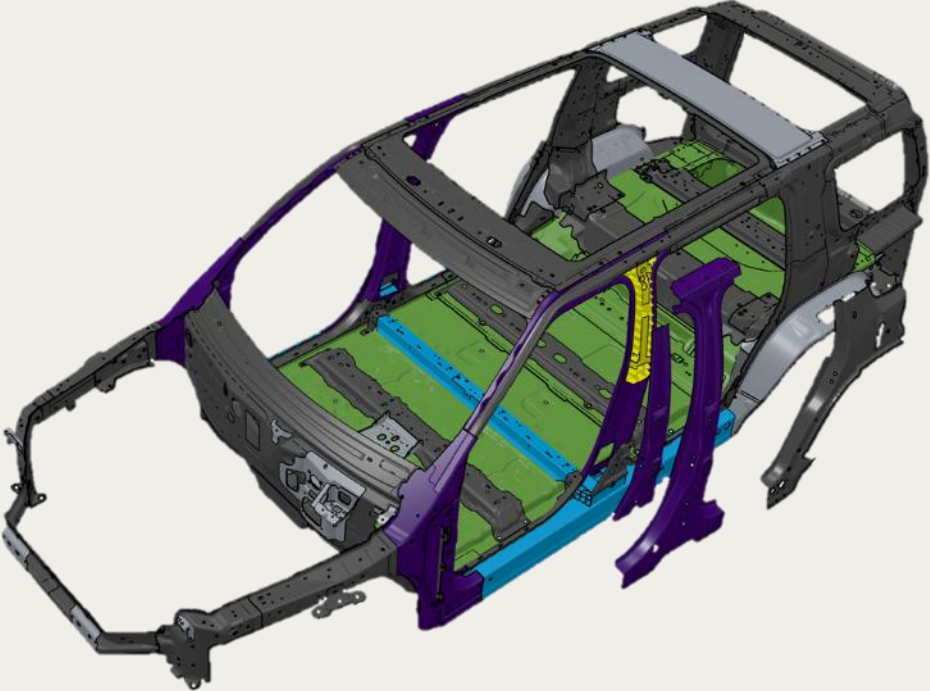
Gen 2

- Conventional Steel
- Advanced High Strength Steel
- Press Hardened (Hot Stamped) Steel
- Aluminum Sheet
- Aluminum Extrusion



# Material Matrix

R1S- Tophat



Gen 1



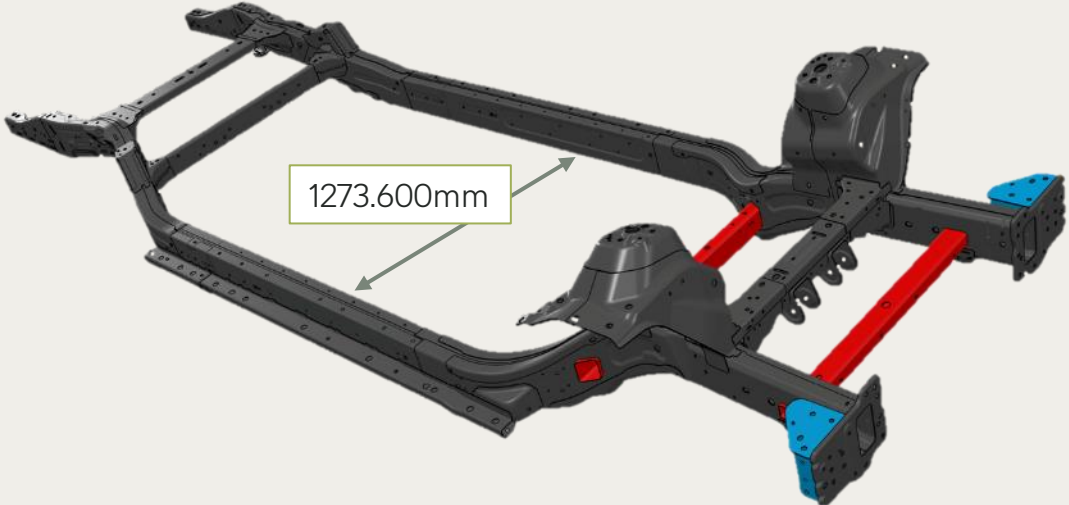
Gen 2

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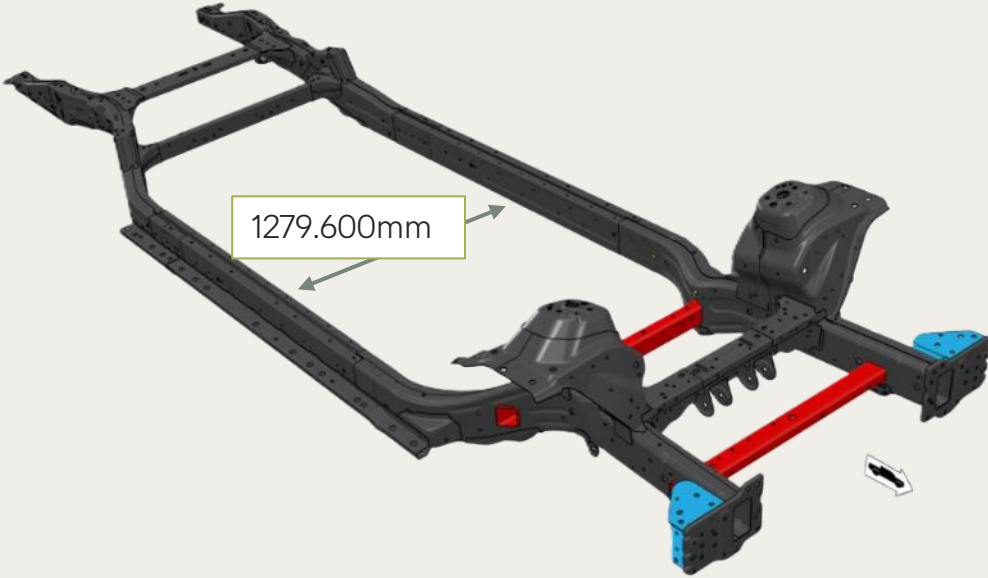


# Material Matrix

## R1T Frame Dimensions





Gen 1





Gen 2

- 6mm Variance
- Gen 2 Battery Pack Provisions

 Conventional Steel

 Advanced High Strength Steel

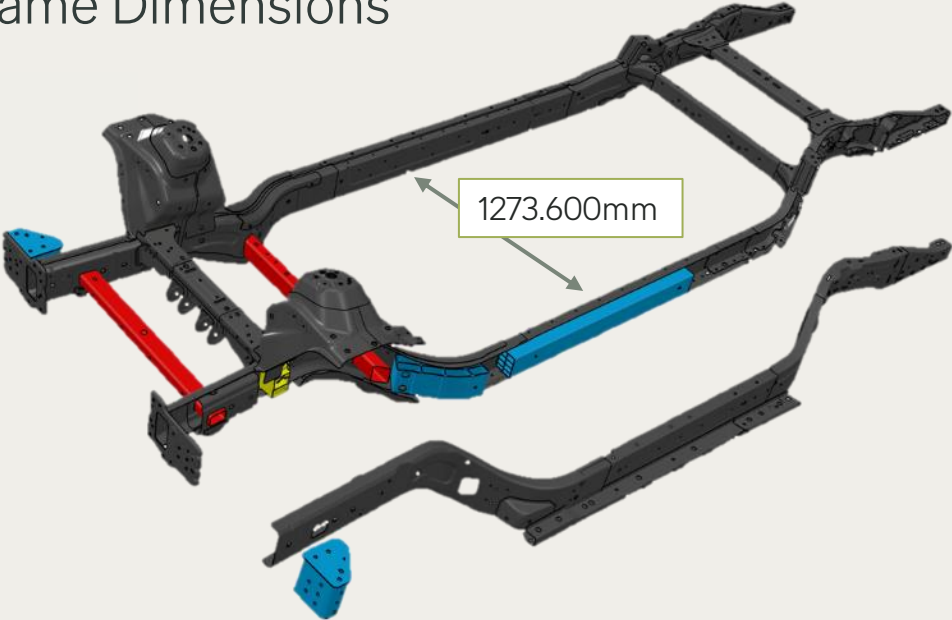
 Ultra High Strength Steel

 Aluminum Extrusion

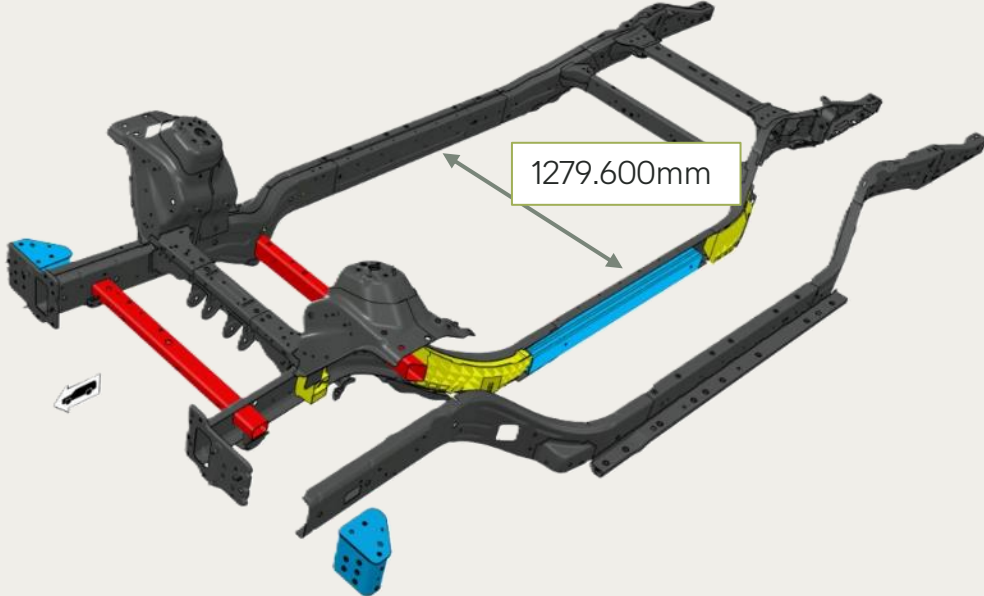


# Material Matrix

## R1S Frame Dimensions



Gen 1



Gen 2

Conventional Steel

Advanced High Strength Steel

Ultra High Strength Steel

Aluminum Extrusion

Composite



# Collision Repair Development

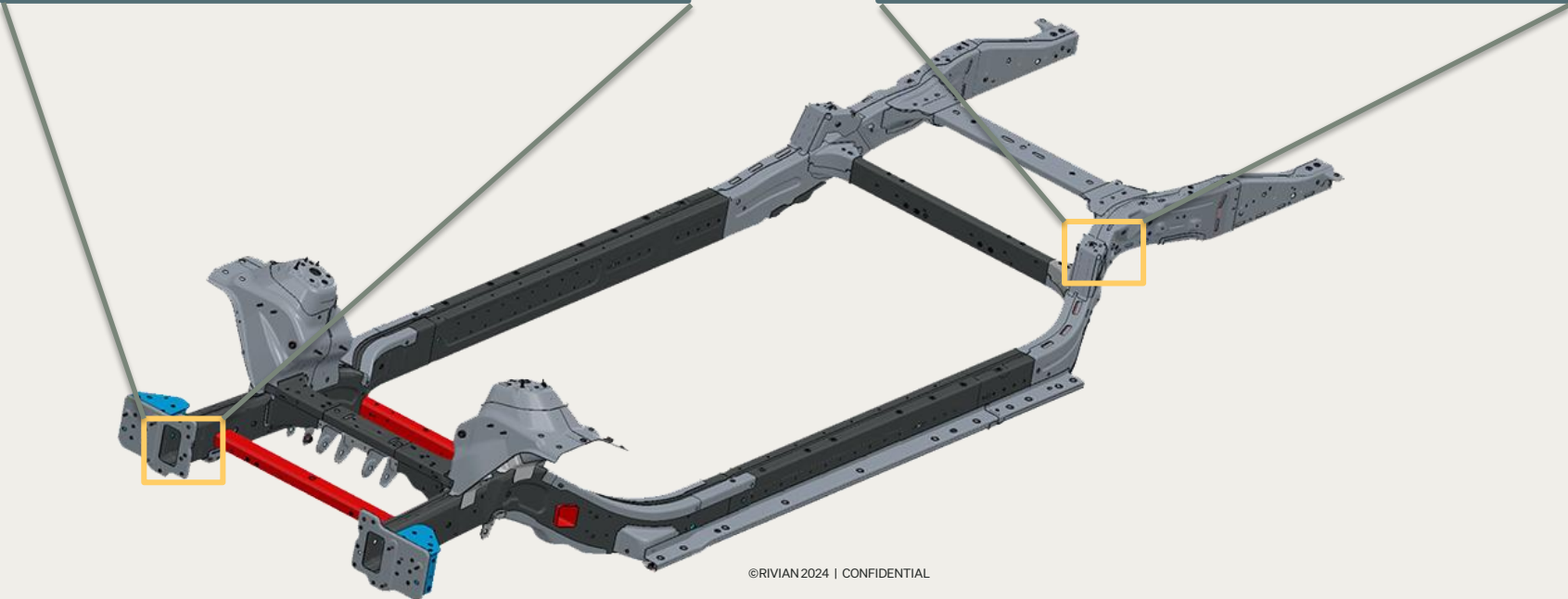
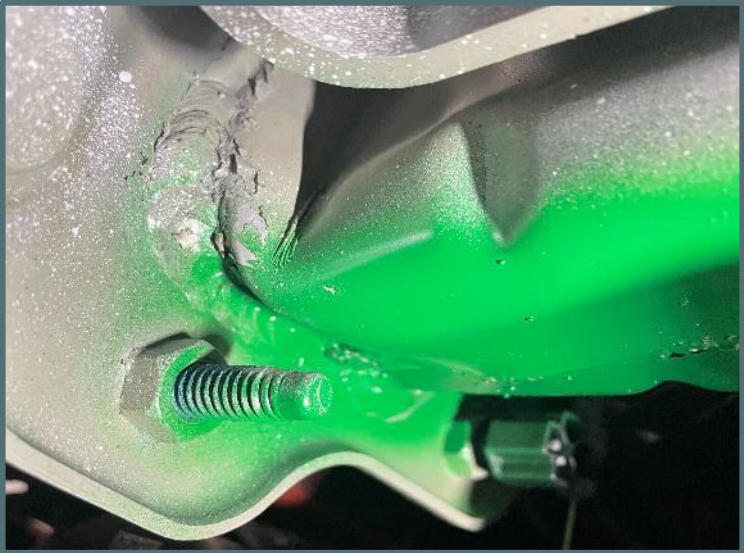
Problem Statement

## Background

Frame rail damage can occur in low/moderate speed impacts

## Problem Statement

Rivian must develop repair solutions for when this type of damage occurs



# Collision Repair Development

## Front & Rear Frame Rail Procedure

Repair Concept

CAE Validation

Component Testing

CAE Correlation

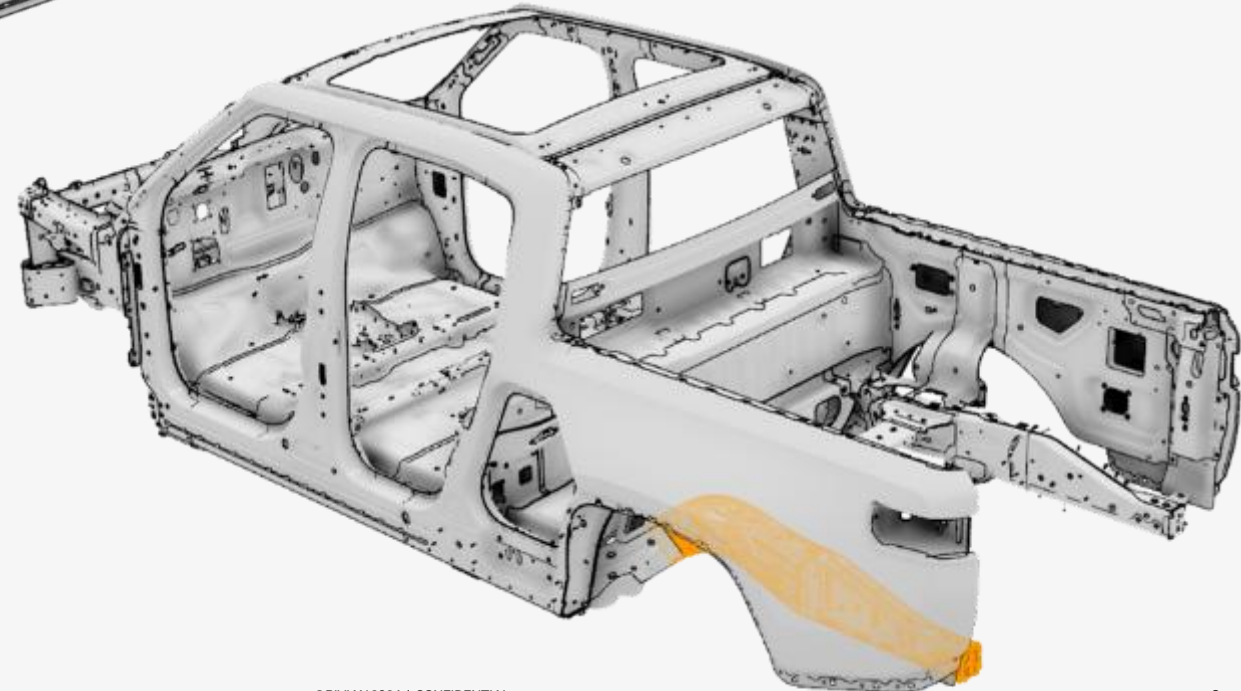
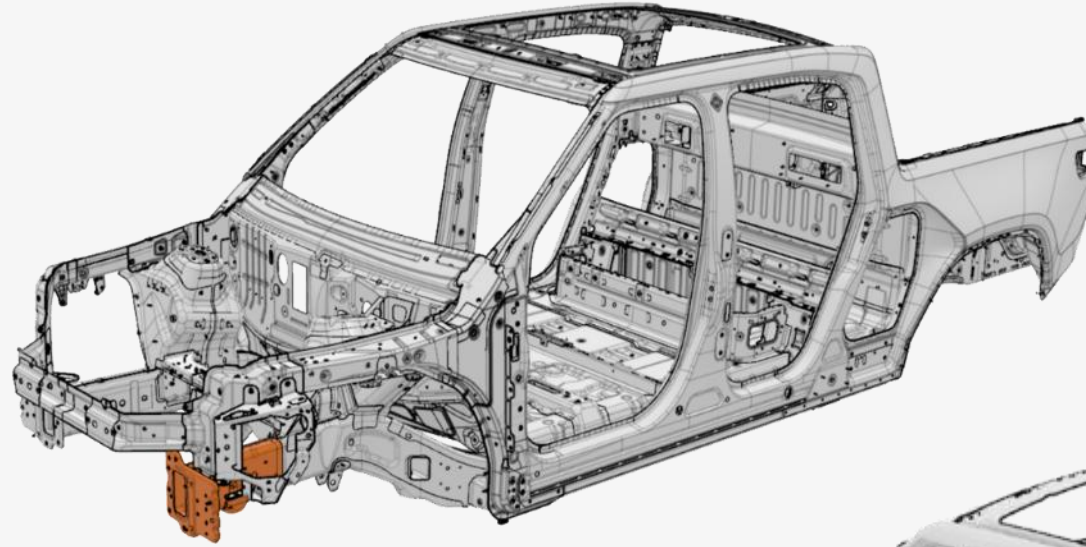
Durability Validation

Prototype Fabrication

Repair Process  
Validation

Service Part  
Finalization

Final Design  
Approval



# Collision Repair Development

Front & Rear Frame Rail Procedure

**Repair Concept**

CAE Validation

Component Testing

CAE Correlation

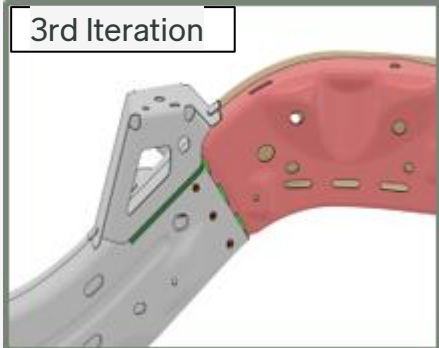
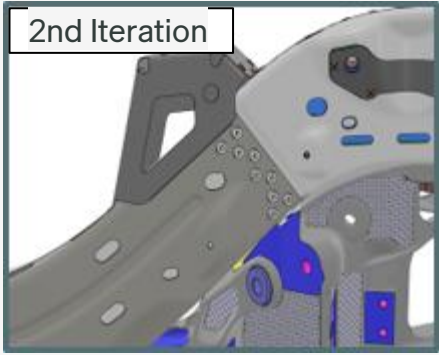
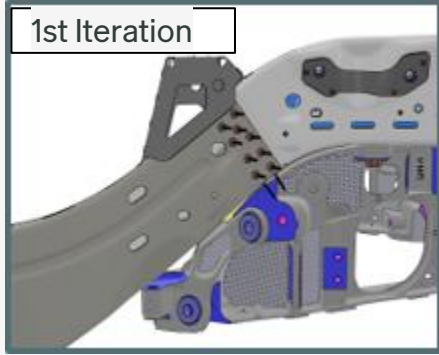
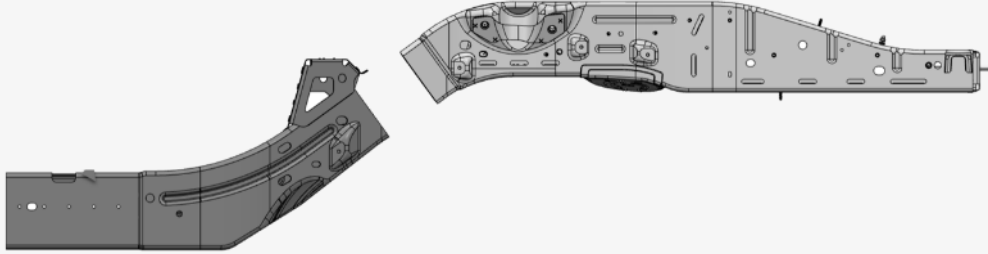
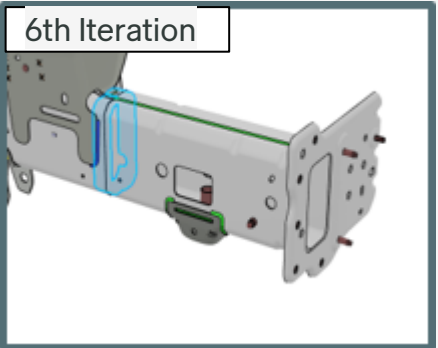
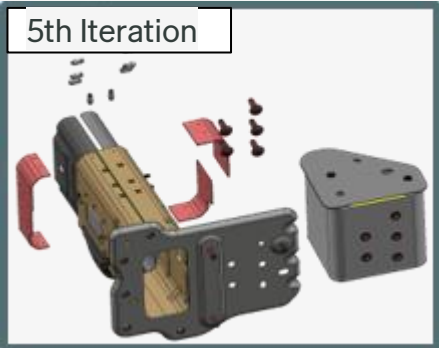
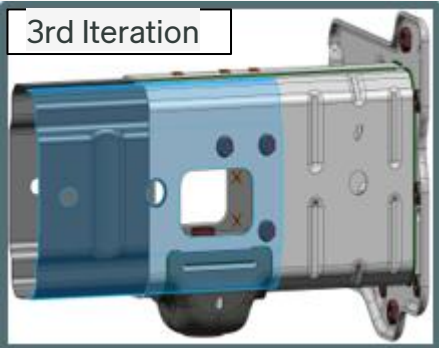
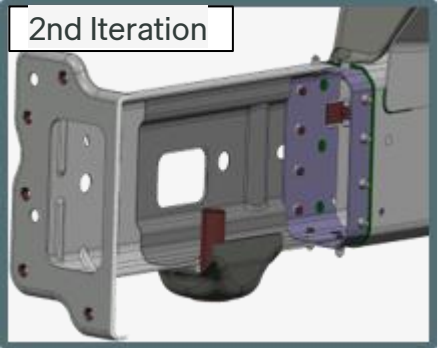
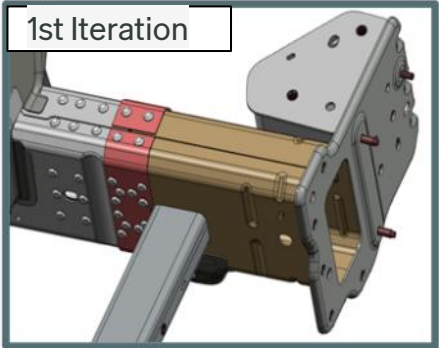
Durability Validation

Prototype Fabrication

Repair Process Validation

Service Part Finalization

Final Design Approval



# Collision Repair Development

Front & Rear Frame Rail Procedure

Repair Concept

**CAE Validation**

Component Testing

CAE Correlation

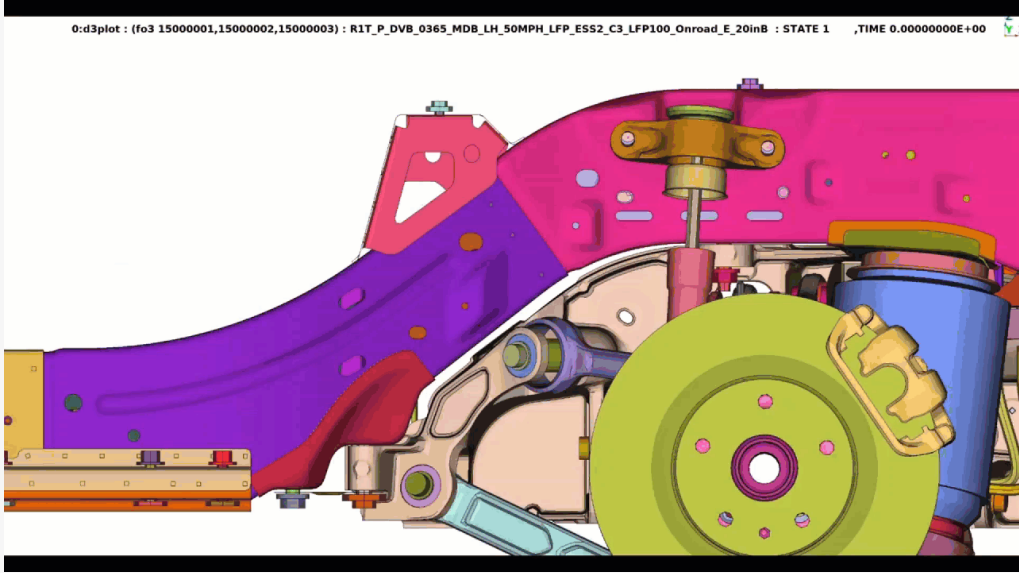
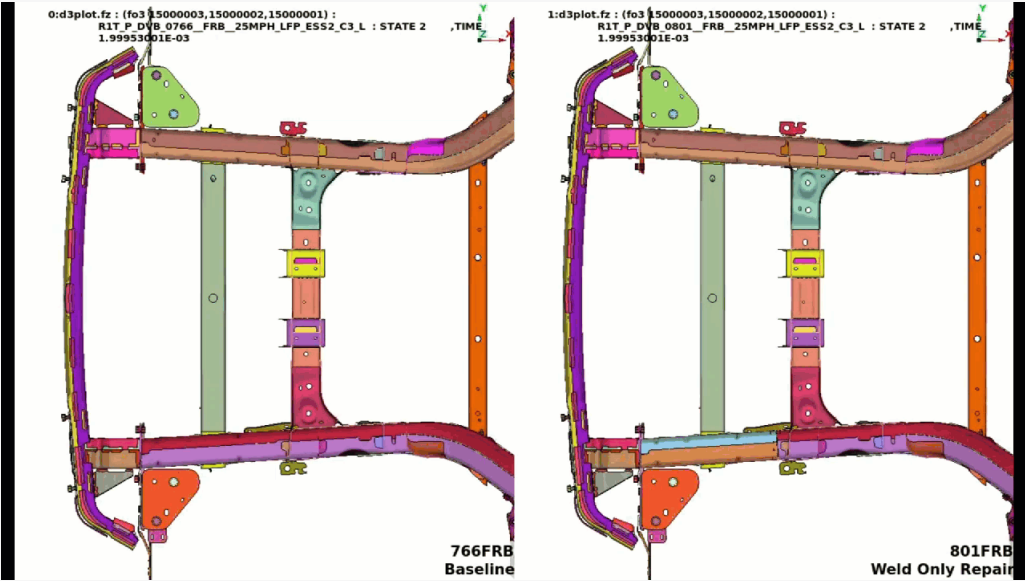
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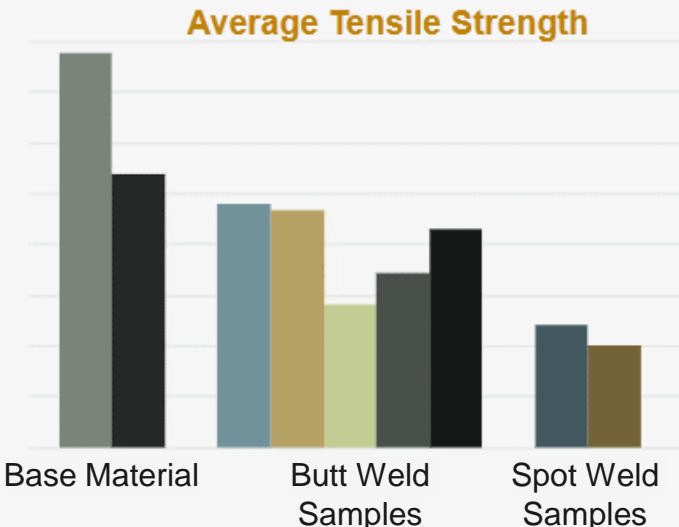
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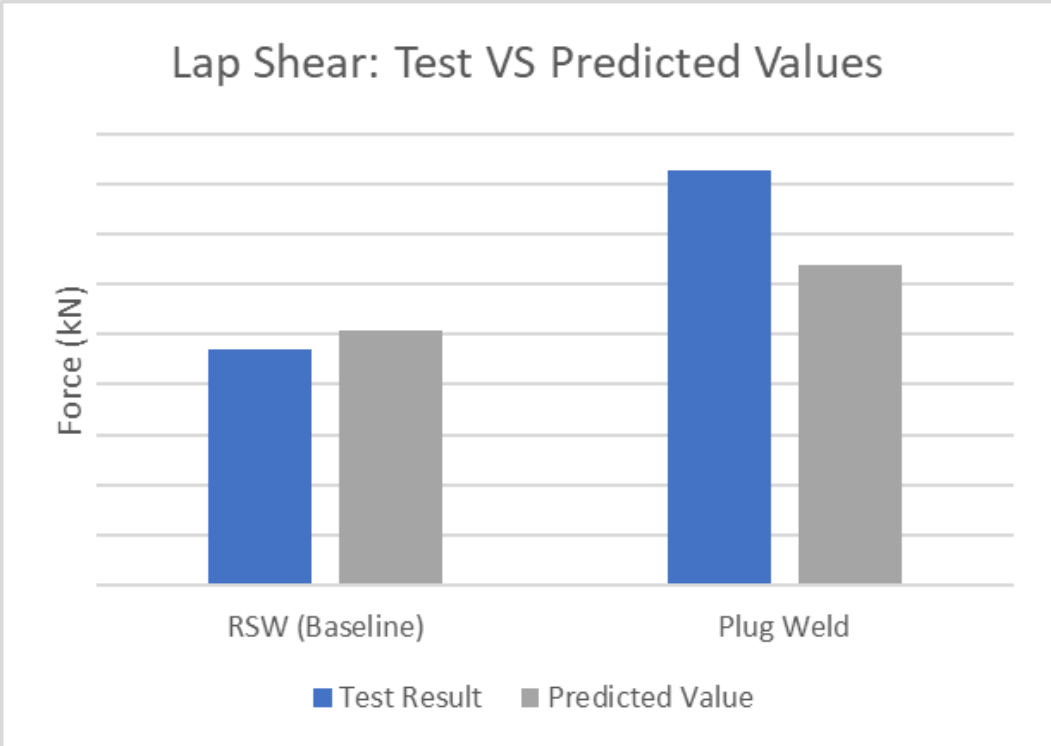
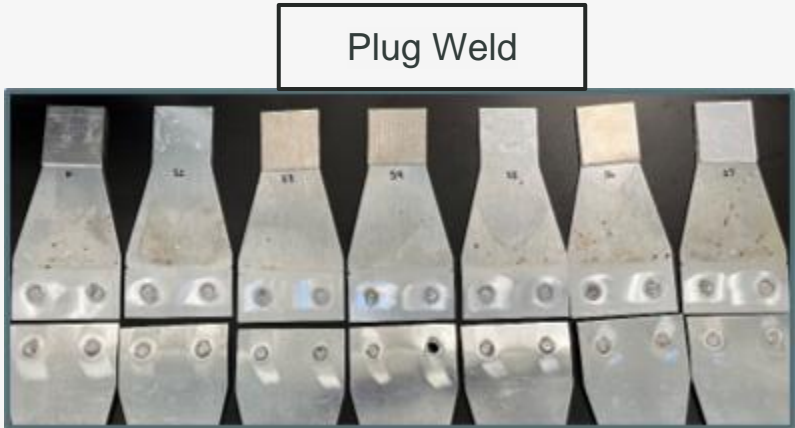
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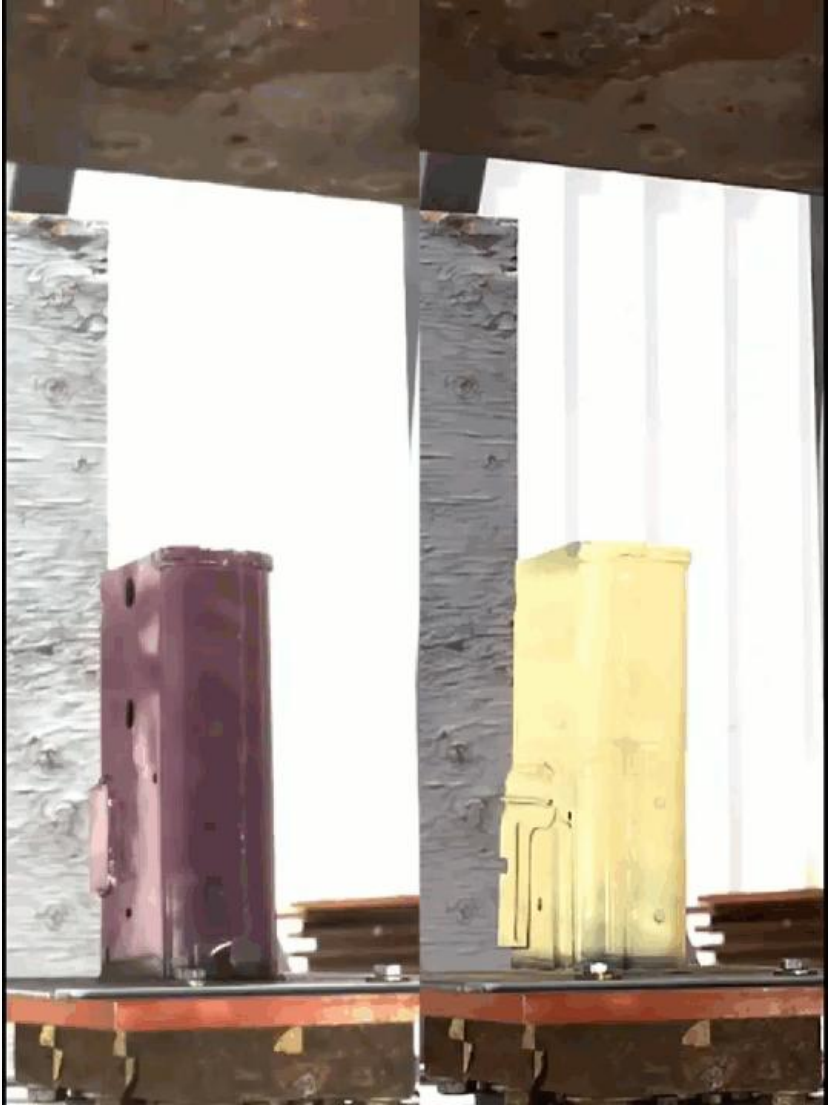
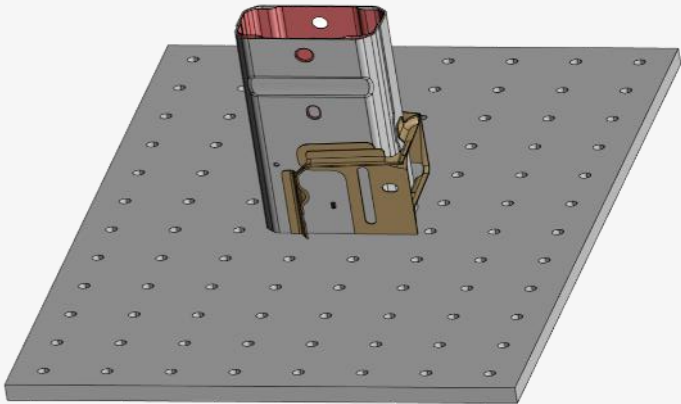
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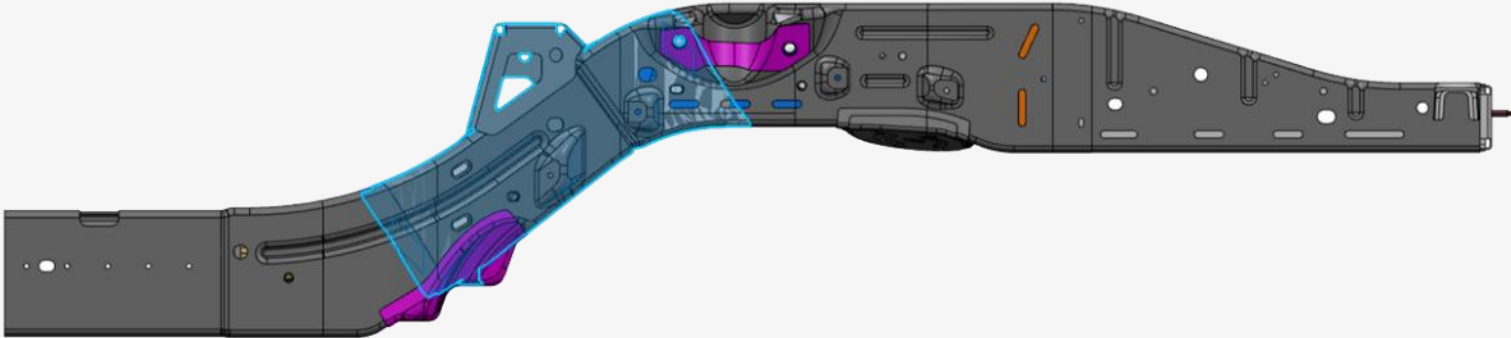
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# Collision Repair Development

## Front & Rear Frame Rail Procedure

Repair Concept

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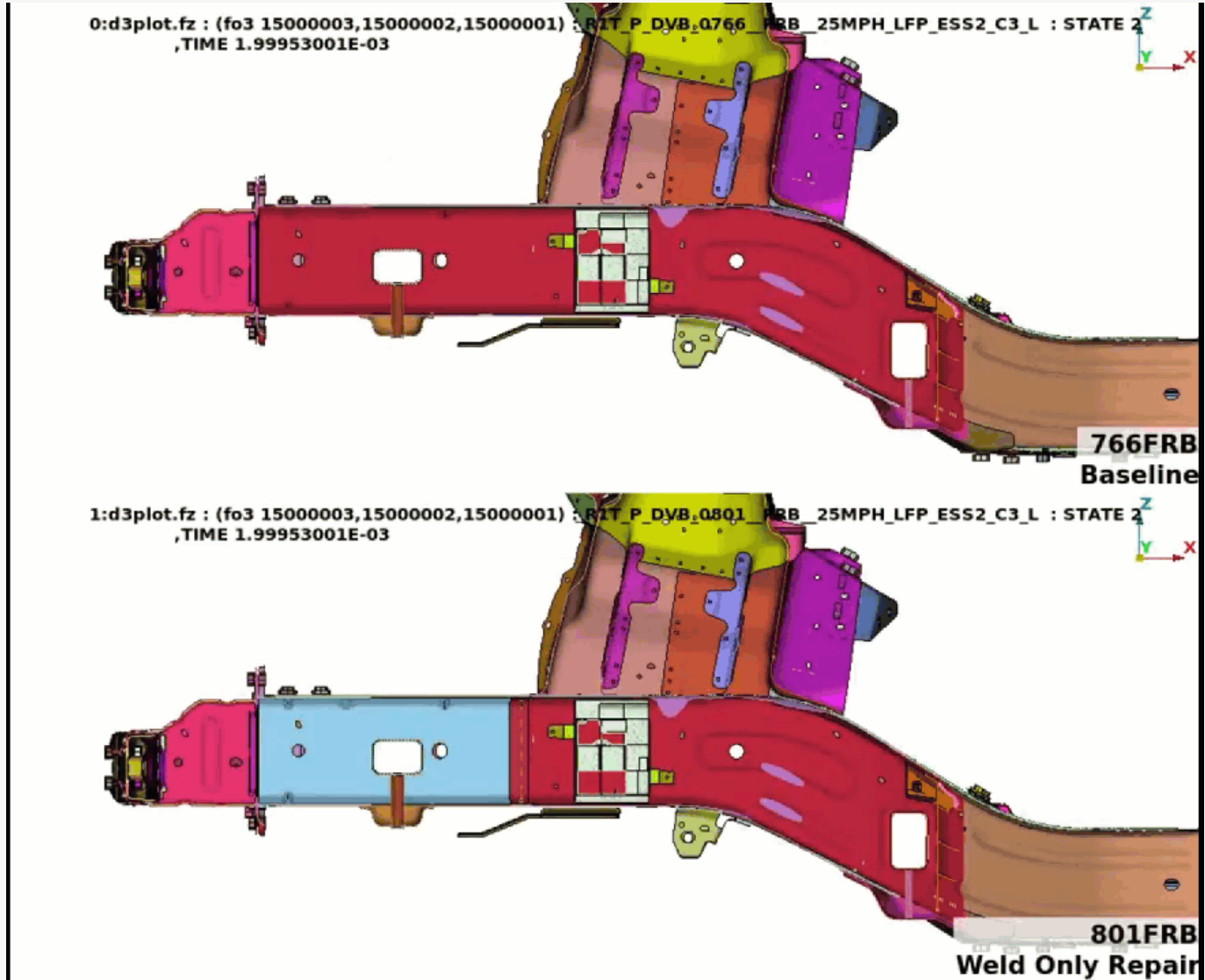
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# Collision Repair Development

Front & Rear Frame Rail Procedure

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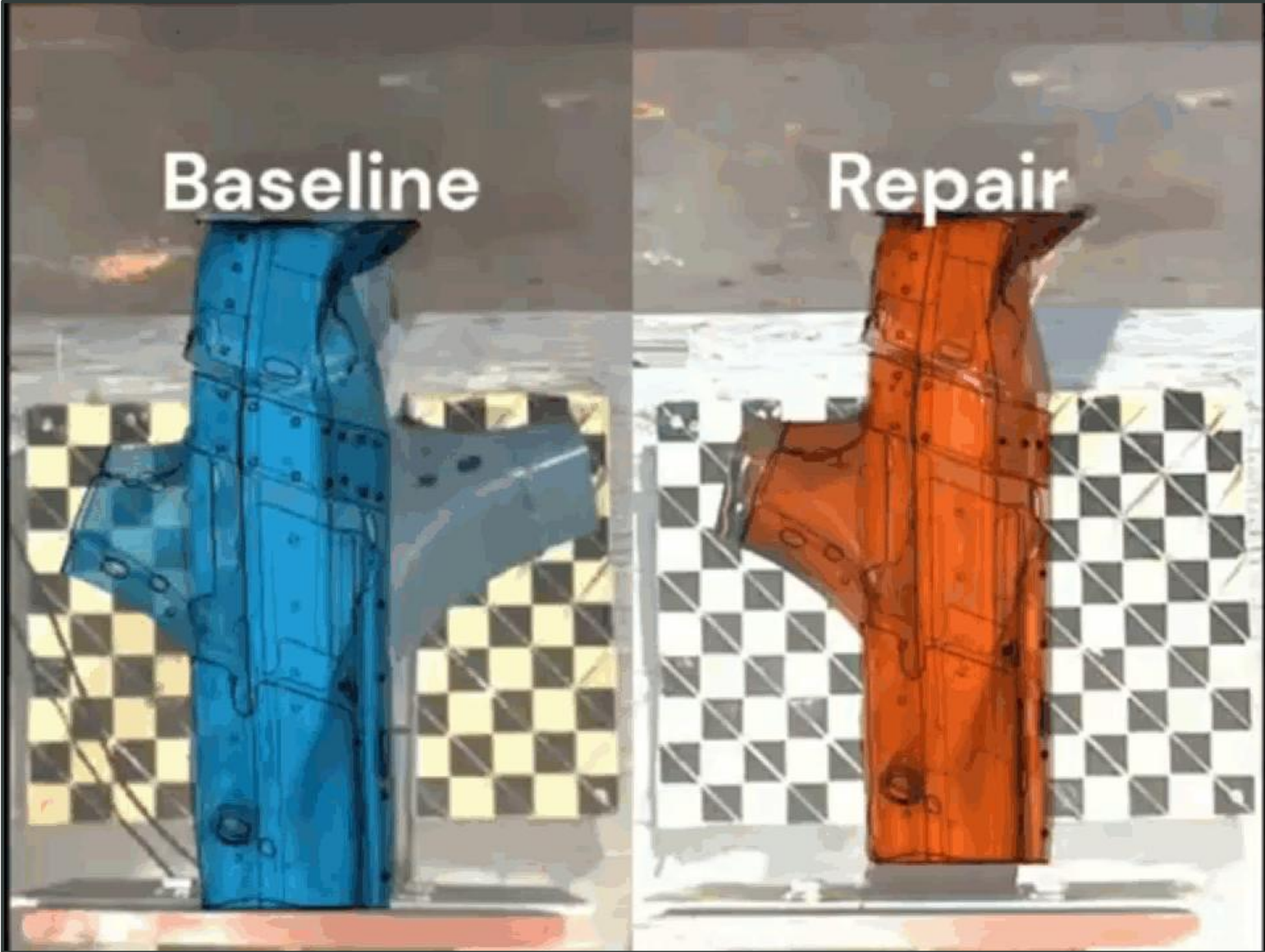
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# Collision Repair Development

Front & Rear Frame Rail Procedure

Repair Concept

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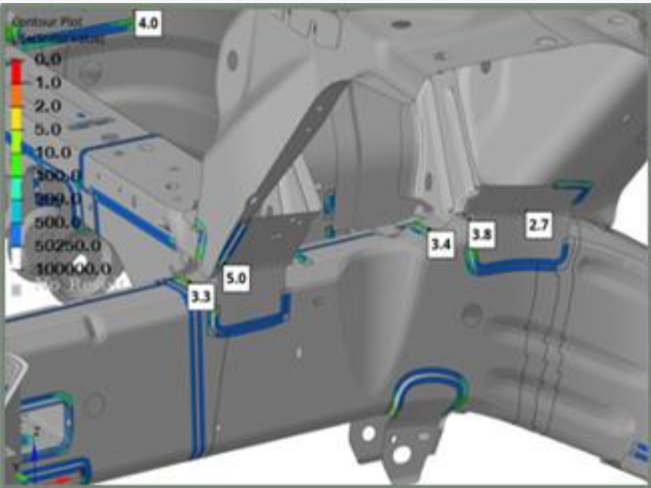
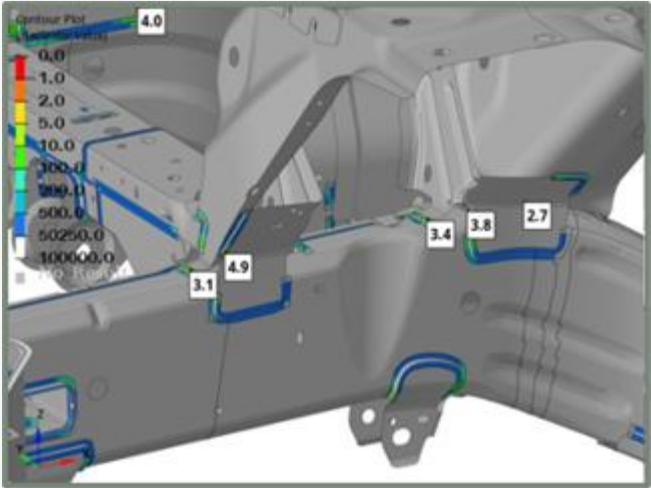
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# Collision Repair Development

## Front Frame Rail Procedure

Repair Concept

CAE Validation

Component Testing

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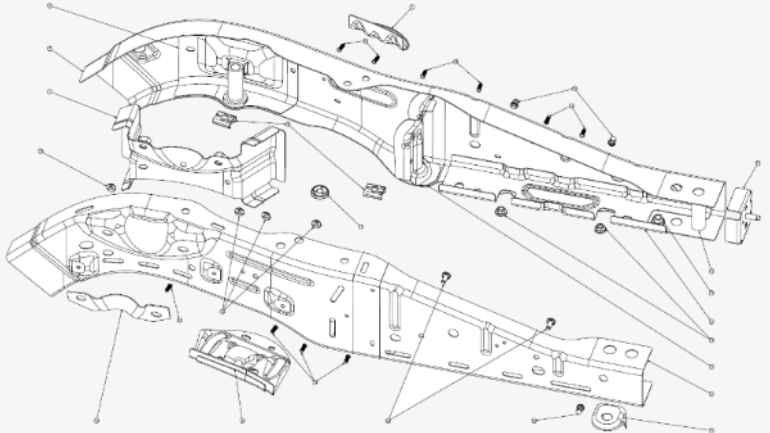
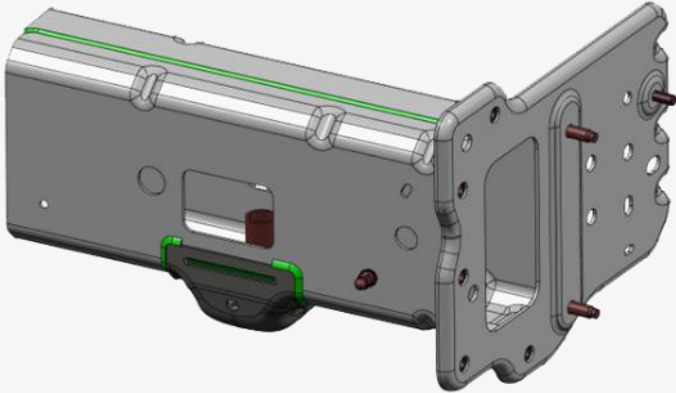
Durability Validation

**Prototype Fabrication**

Repair Process Validation

Service Part Finalization

Final Design Approval



PFD16031-1-1 RAY REC - KIT Rear Service Rail LH	
REV	DESCRIPTION
1	INITIAL RELEASE
2	REVISION
3	REVISION
4	REVISION
5	REVISION
6	REVISION
7	REVISION
8	REVISION
9	REVISION
10	REVISION
11	REVISION
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98	REVISION
99	REVISION
100	REVISION



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Front & Rear Frame Rail Procedure

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Final Design Approval



# Collision Repair Development

## Front & Rear Frame Rail Procedure

Repair Concept

CAE Validation

Component Testing

CAE Correlation

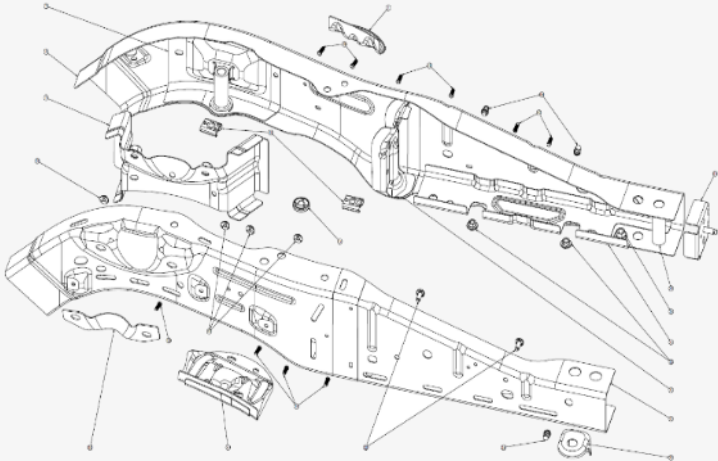
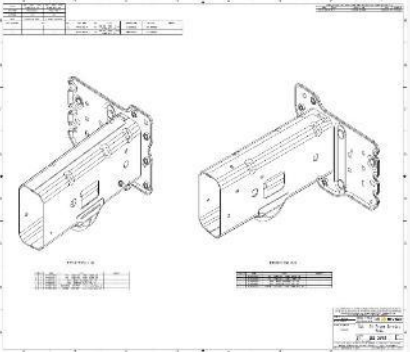
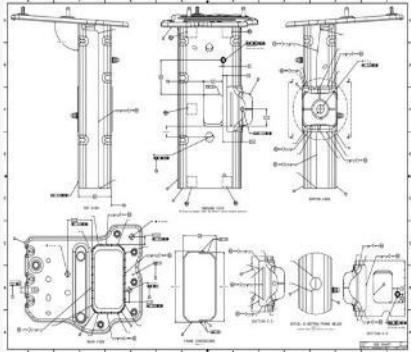
Durability Validation

Prototype Fabrication

Repair Process Validation

**Service Part Finalization**

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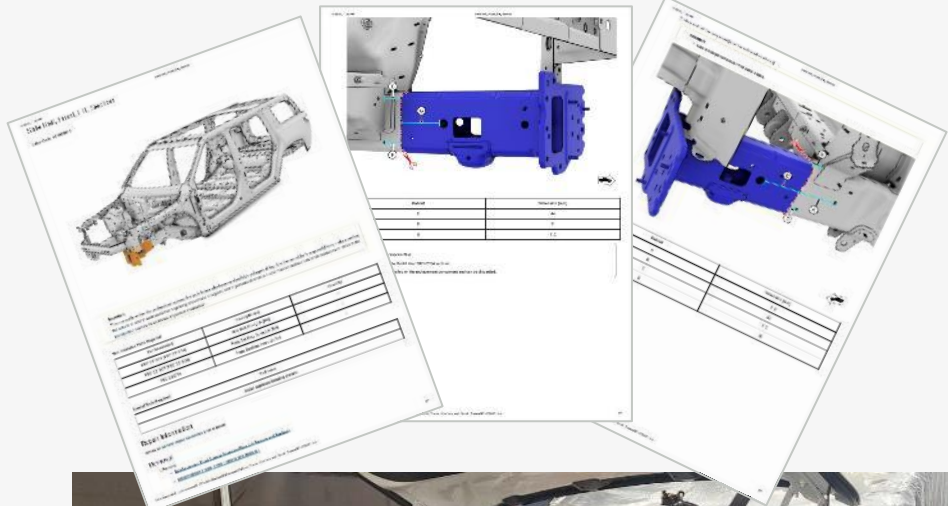
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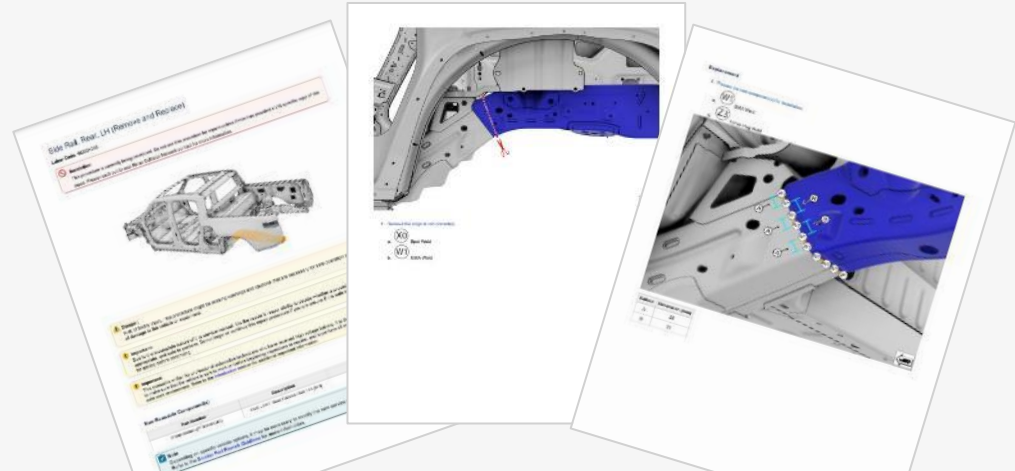
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# Thank You

