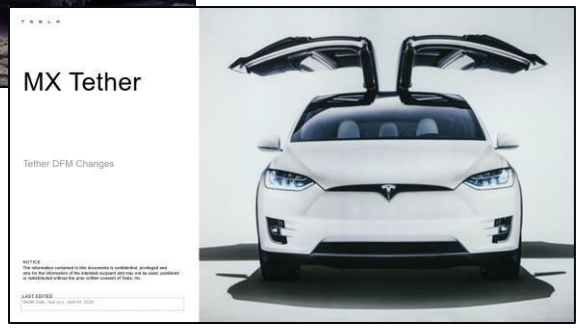
End of Internship Showcase

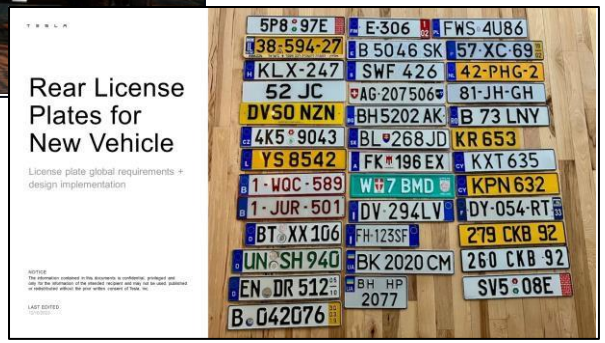
Loren Baret
Exteriors Mechanical Design Intern
August 28th to December 22nd

12/10/2023

Introduction and Agenda

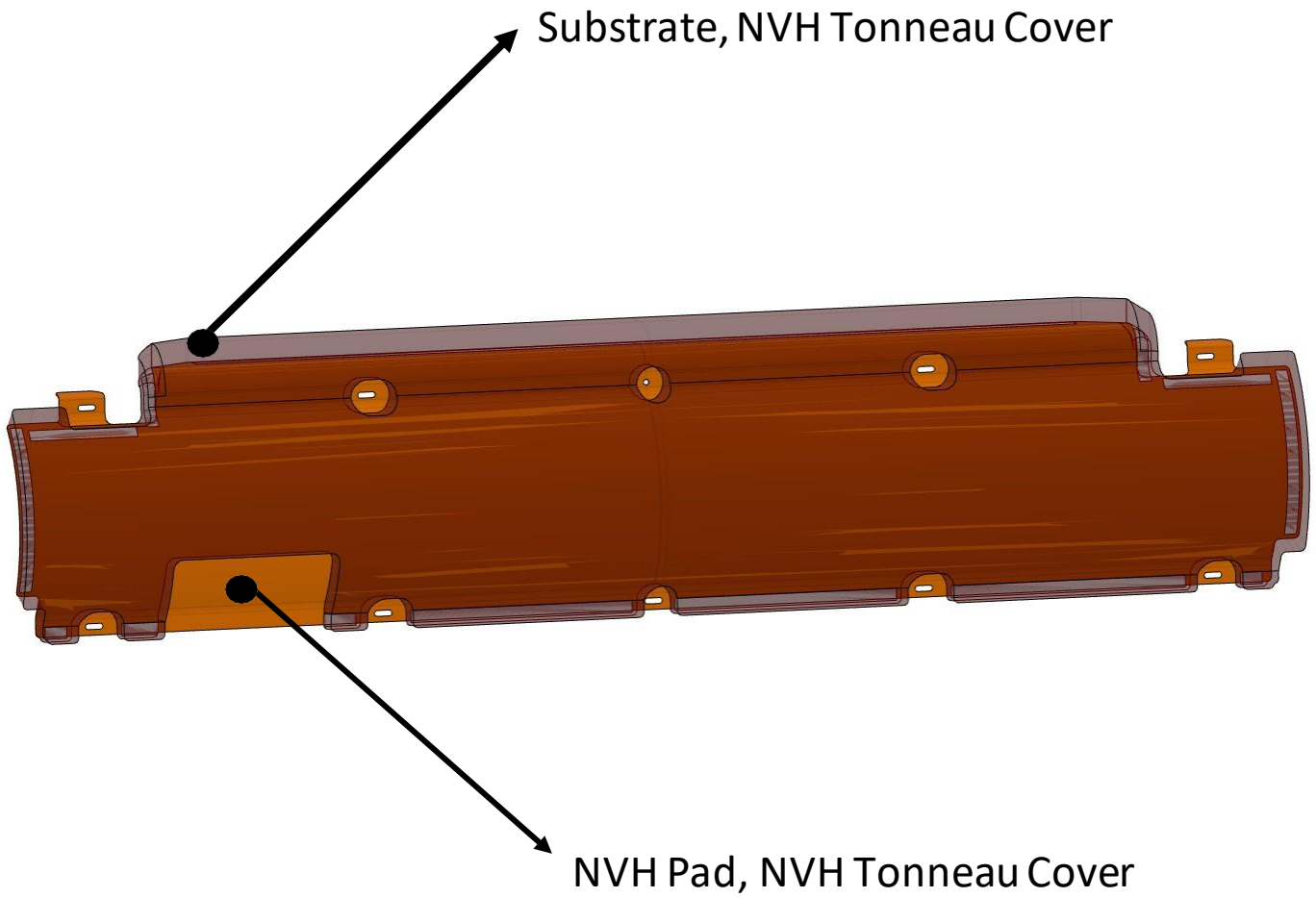
Project Introductions





CT NVH Tonneau Cover

Design through production process



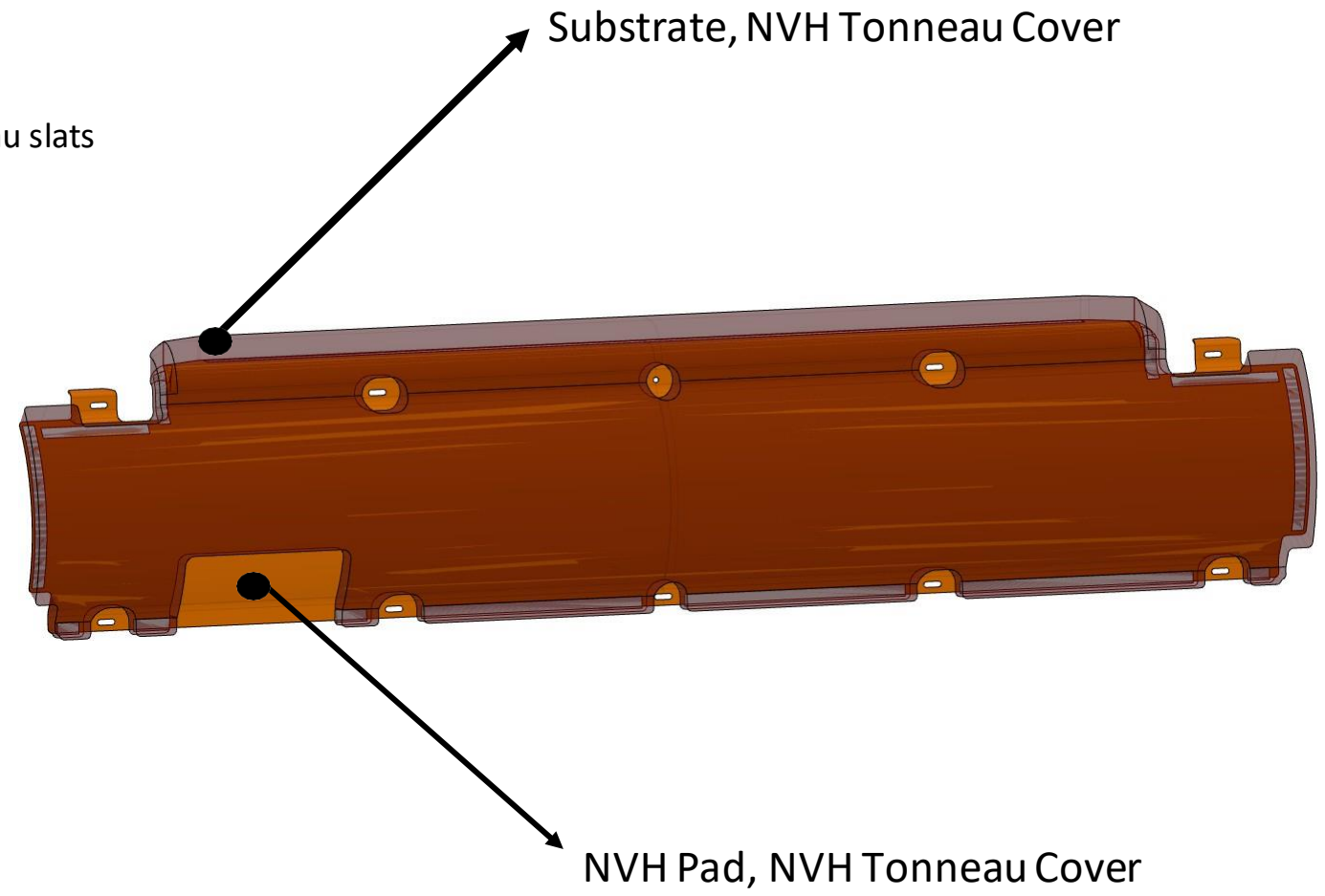
LAST EDITED
12/12/2023

Substrate Part Requirements:

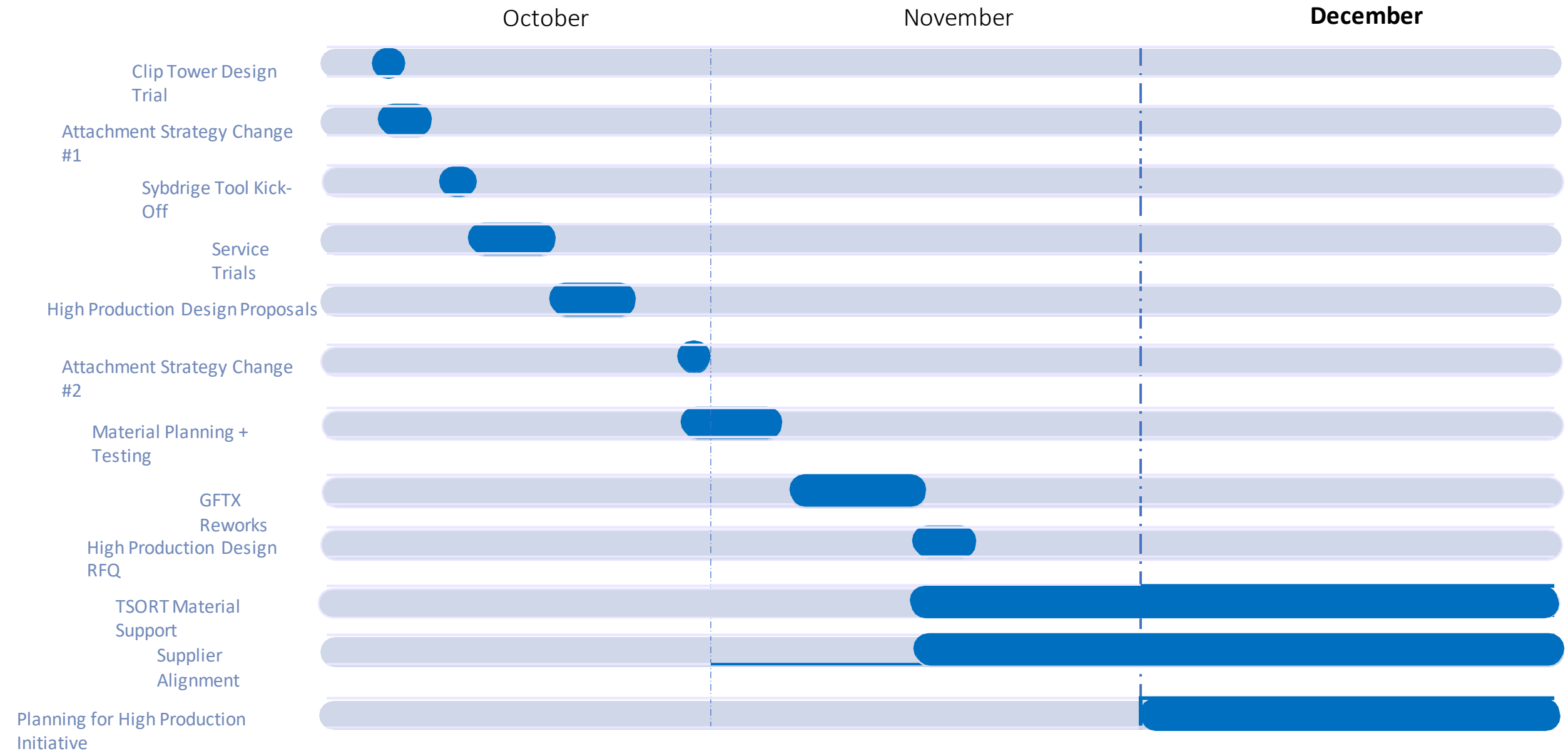
- Surface Density: 3000 gsm
- Cover as much area as possible
- 20mm clearance with the tonneau slats

NVH Pad Requirement:

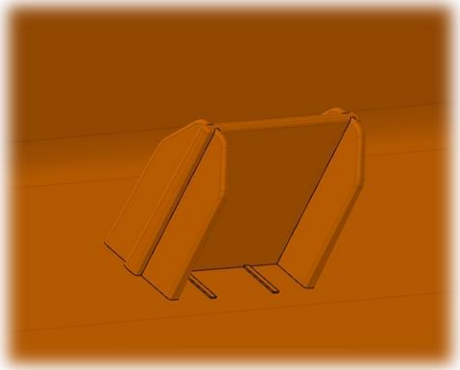
- Material: PP+PE
- Surface Density: 450 GSM
- Thickness: 25mm
- Edge Sealed



TIMELINE


October
November
December
Clip Tower Design Trial
Attachment Strategy Change #1
Sybdrige Tool Kick-Off
Service Trials
High Production Design Proposals
Attachment Strategy Change #2
Material Planning + Testing
GFTX Reworks
High Production Design RFQ
TSORT Material Support
Supplier Alignment
Planning for High Production Initiative

Clip Tower Design Trial



Trial Results:

- Clip towers snaps
- Metal clip retention force was high
- Metal clip slipped

»»

Next Steps:

- Trial New Attachment Strategy

Attachment Strategy Change #1

Self-tapping Screw Trial:

- Quick cycle time: 30 seconds with impact gun
- Robust
- No additional machining process required
- Same-day stakeholder meeting

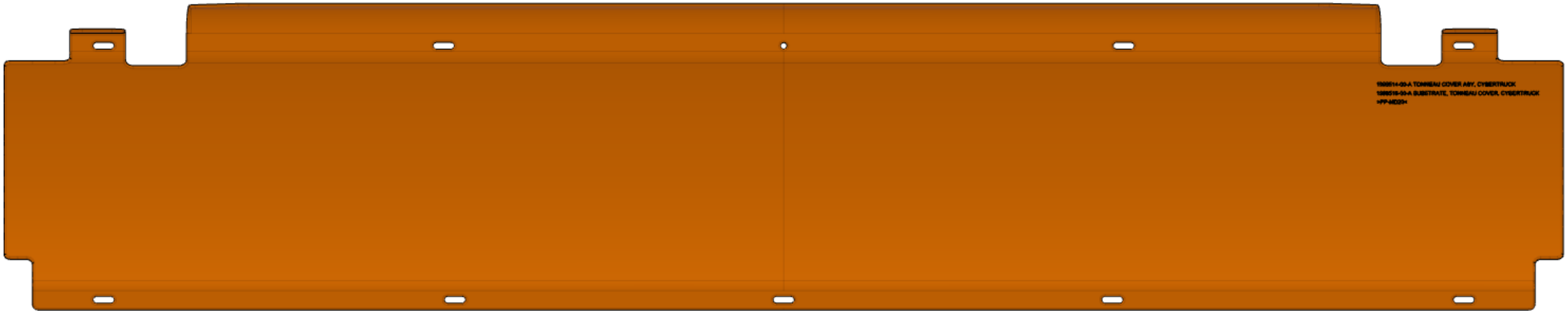
Dry Fit Trials

Dry-fit Results:

- Tonneau Cover did not fit
- Interfered with busbar harness
- Realized GFTX Reworks would require more work

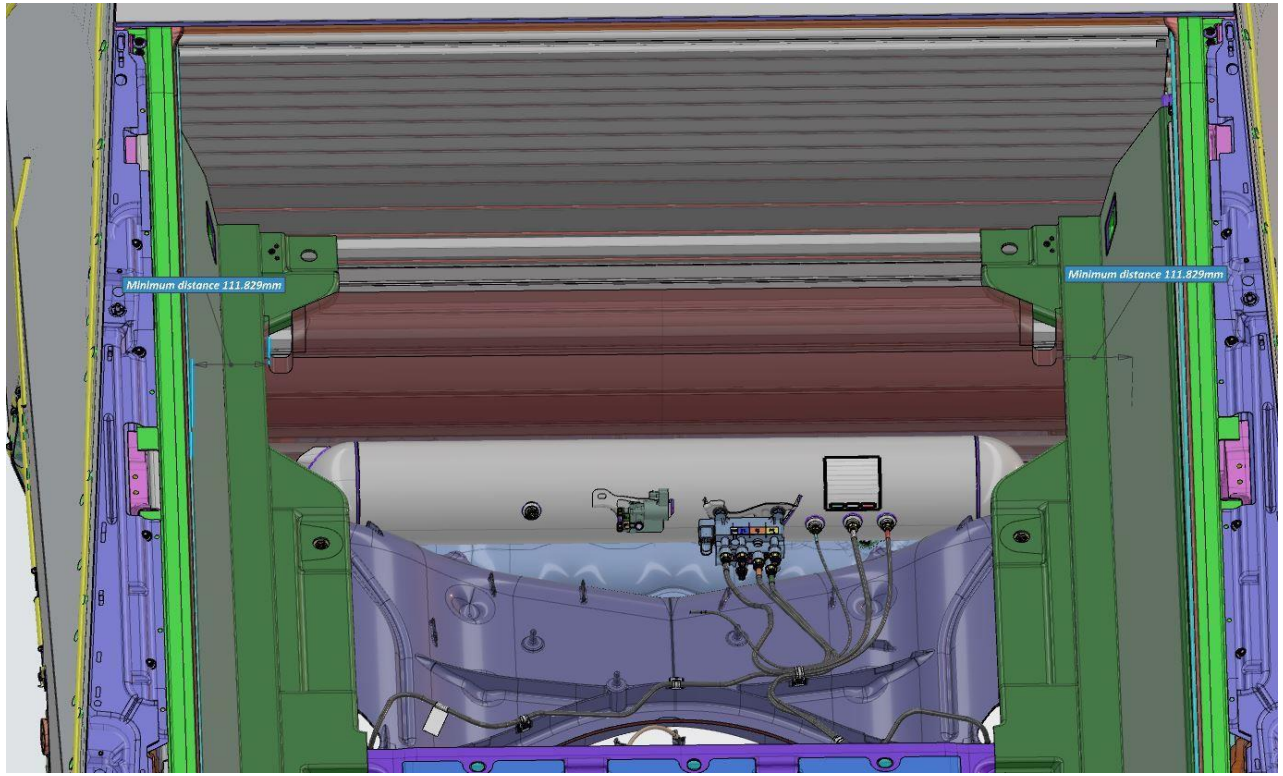
Sybridge Tool Kick off

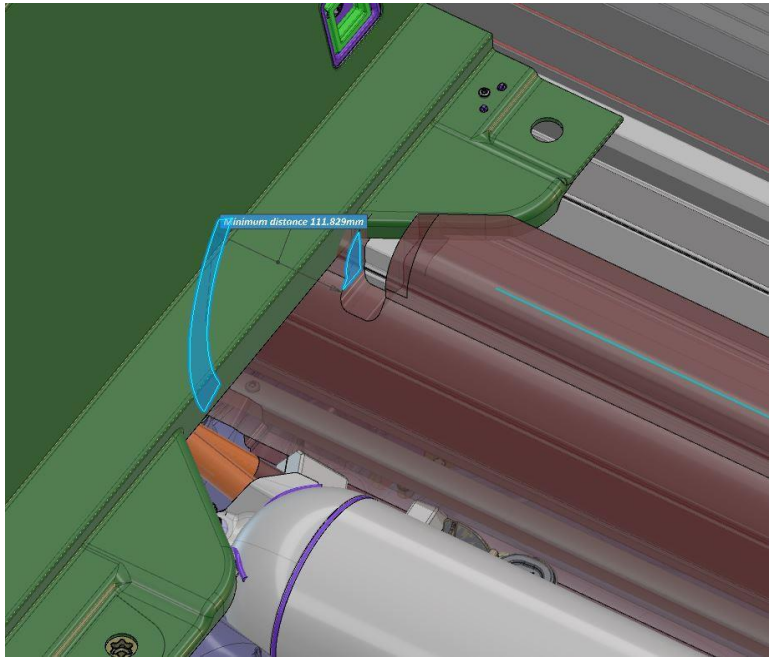
- Updated the design based on trial
- Attachment strategy was to use bolts to fasten the tonneau cover into the metal crossbeams
- Kicked-off an injection molded tool and received parts in 23 days!



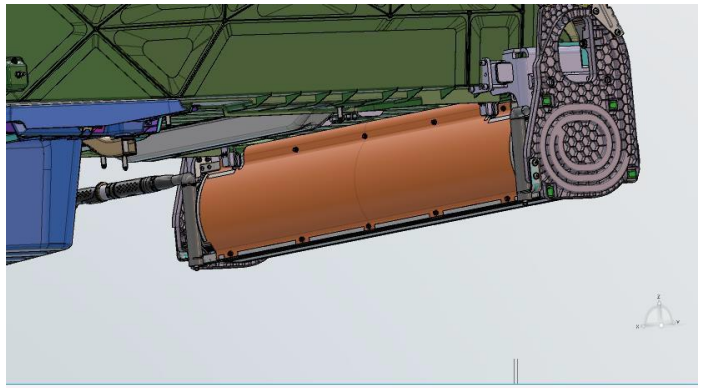
Service Study

- Current design adds cost & long removal times for service
- Service team proposed to trim ~112mm from each end to clear the bed panels

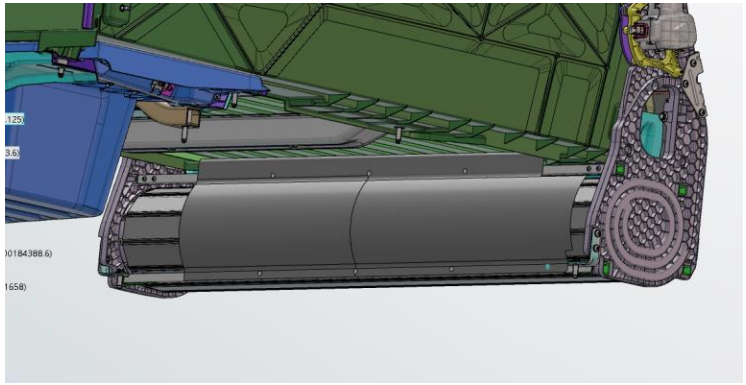




Design Proposals

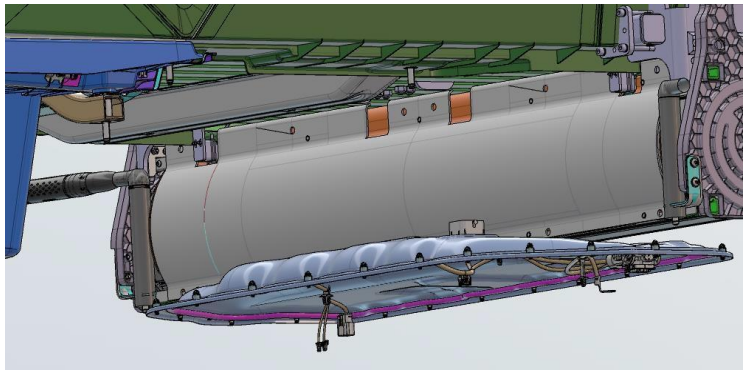


Option 1: Keep Original Design



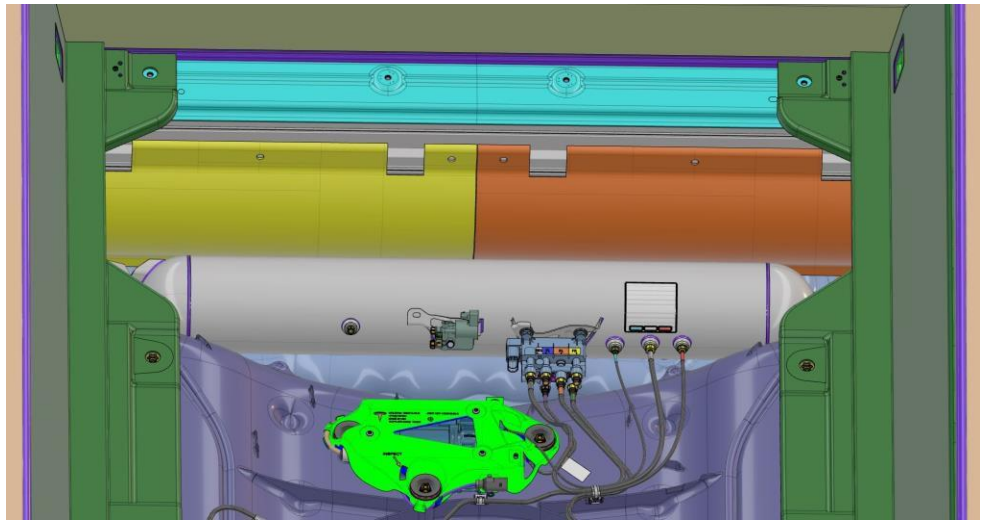
Option 2: Asymmetrical Design

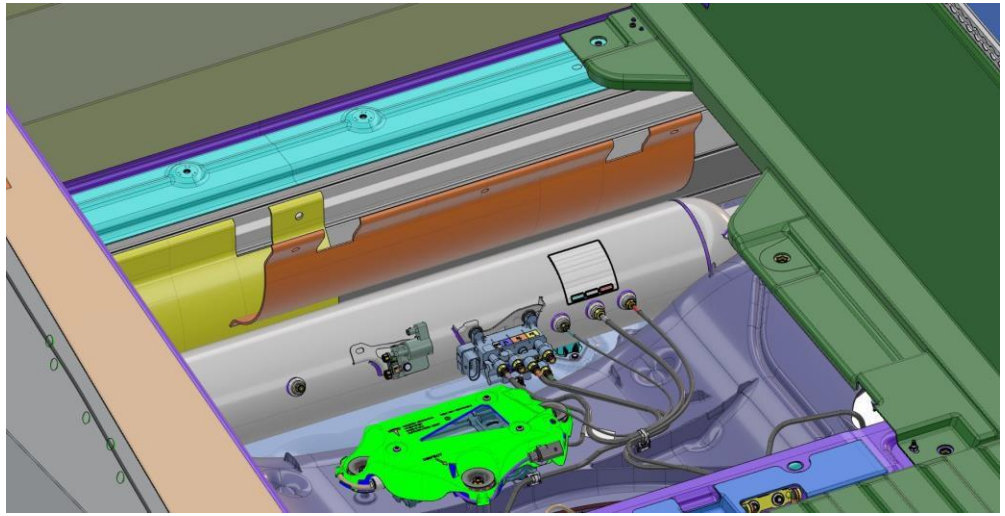
- 1 tool
- Less surface area
- Improved serviceability



Option 3: Symmetrical- 2 Part Design

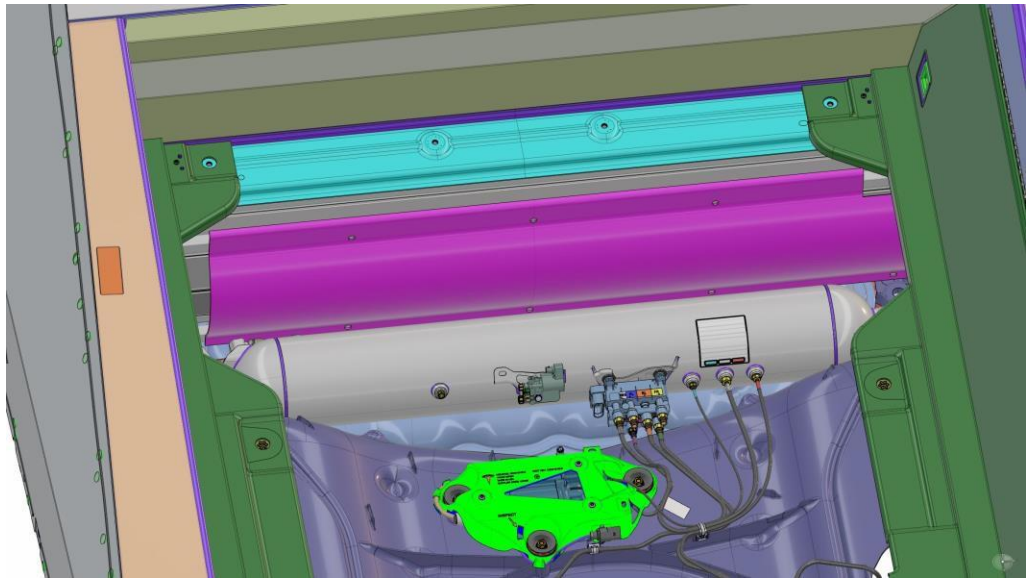
- 1 tool
- More surface area
- Improved serviceability

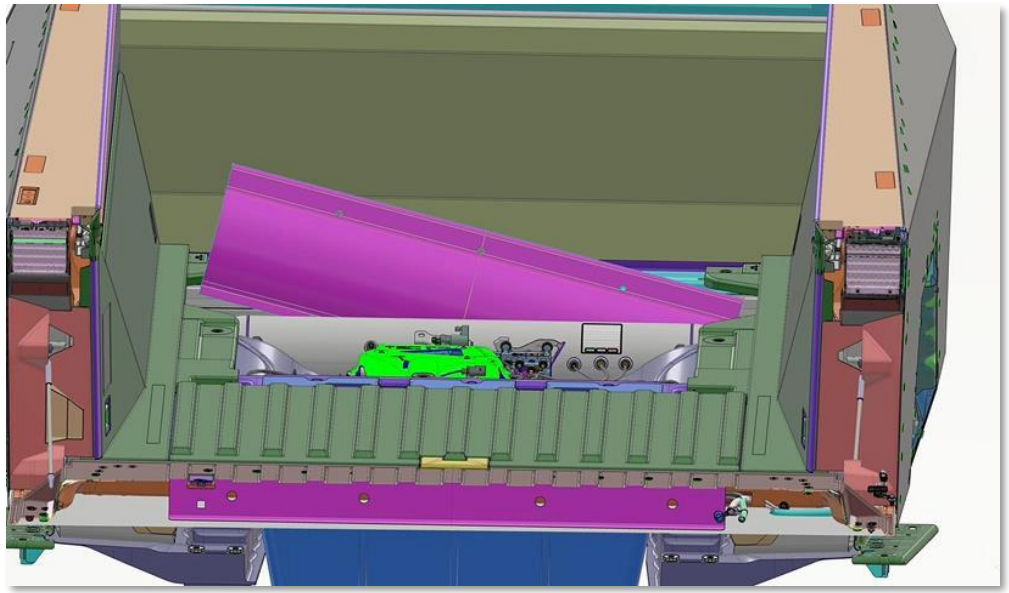




Symmetric Cover

	Symmetric Cover	Original Design
Removal Time	🕒	🕒 🕒
Install Time	🕒	🕒 🕒
Labor Cost	$	$$





Asymmetric Cover

	Asymmetric Cover	Original Cover
Removal Time	🕒	🕒 🕒
Install Time	🕒	🕒 🕒
Cost	$	$$

Service Trial Take-Aways

1. Busbar interference
2. No screw accessibility
3. Time consuming + challenging
4. No self-tapping screws

10 Days Before SOP

Closures Team Sync

1. Current attachment strategy was a no go
2. No access to bottom crossbeams due to packaging
3. Structural integrity of the tonneau is dependent on those cross members
4. NVH Pad to Substrate Bond Integrity
5. Risk controlled decisions without validation

Solution

1. Implement new strategy
2. Use dual-lock
3. Only need to remove one cross beam
4. Met with Materials team for line of defense
5. Ran adhesive trials
6. Material Planning for worst-case

Low Volume Design

→

High Production Design

	Low-Volume Design	High Production Design
Assembly Piece Price	$$	$
Sybridge Injection Molding Tool Price	$$$	$$
Serviceability Costs	$$$	$

Next Steps

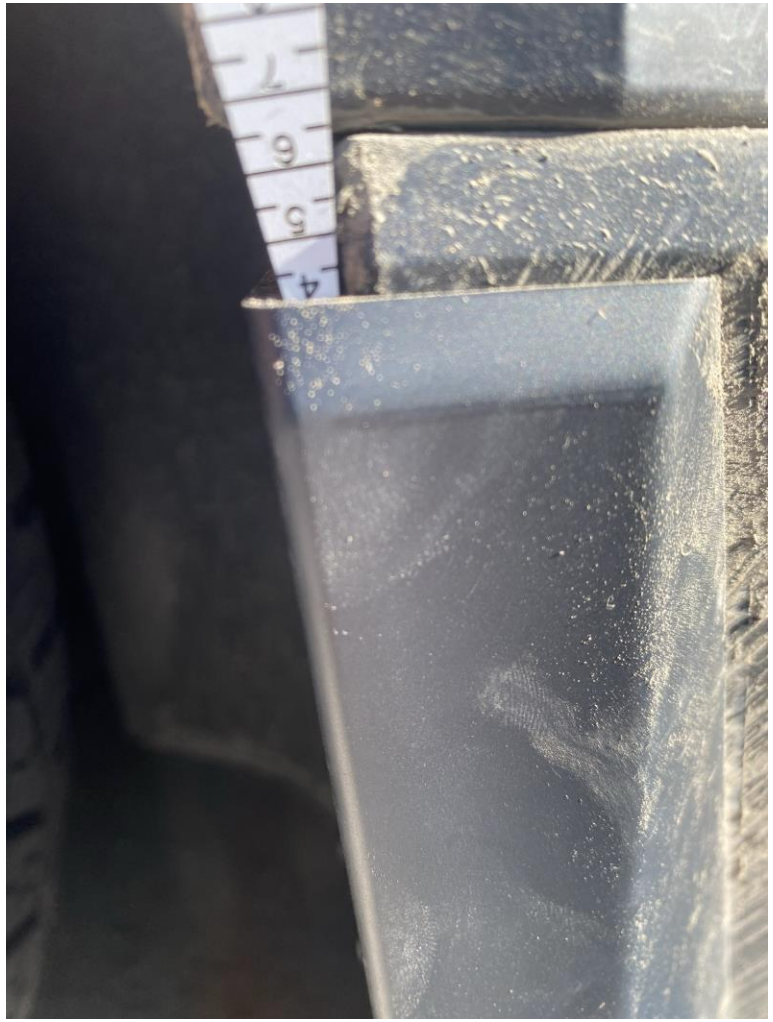
- Commercial Agreement for production
- Award supplier
- Validate

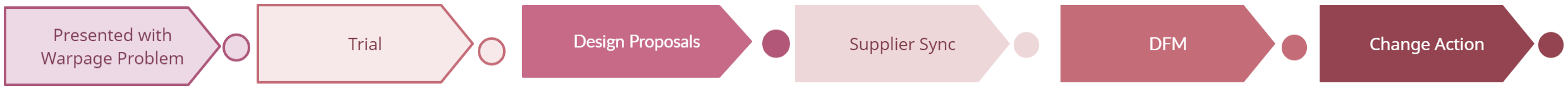
CT Mudflaps Gap Condition

Trialed and proposed cost-effective design changes

LAST EDITED

Problem: Warpage caused unacceptable gap condition




Presented with Warpage Problem
Trial
Design Proposals
Supplier Sync
DFM
Change Action

Proposal 1: Hole to Slot

Gap Condition: <1mm

Proposal 2: Adhesive at critical deflection

Gap Condition: ~0mm

3M Acrylic Plus Tape EX4008

Proposal	Action	Items per Assembly	*Added* Cost per Part	Total Δ Cost Projection for 1M vehicles	Gap Condition
Increase Tolerance on Z-Shot hole	Injection Mold Tool Update	1	0	$	<1mm
Add adhesive at Critical Gap Location	Material Planning + Adhesive purchase + Rework planning	2	$	$$$$	0mm

Next Steps

1. Align with SIE
2. Kick-off new tool
3. Release Change Action

Rear License Plates for New Vehicle

License plate global requirements + design implementation

12/10/2023

Studio Requirement:
No rear license brackets
No visible dimples with NA LP

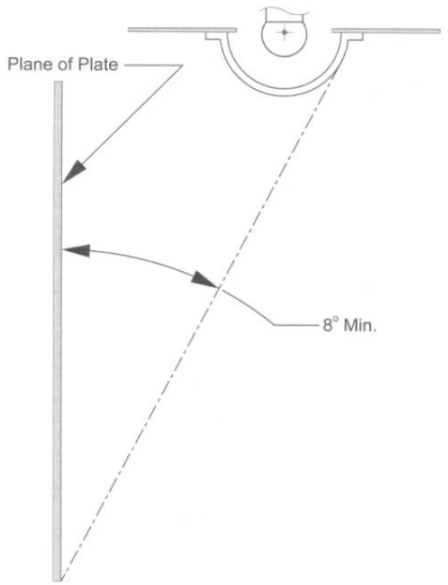
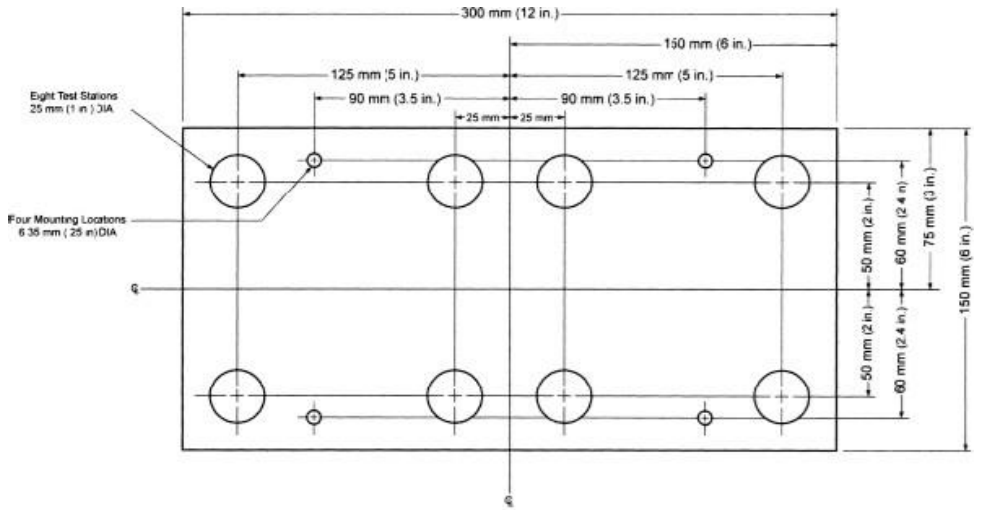


Figure 20
License Plate Lamp Measurement of Incident Light Angle



Test Plate for Vehicles other than Motorcycles and Motor Driven Cycles

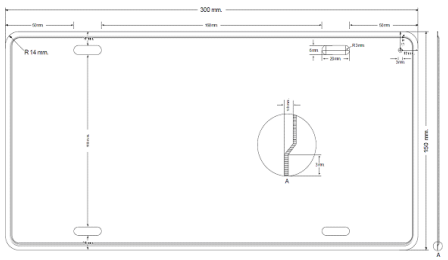
Lighting Requirement:
Angle of Incidence
Dark regions

License Plates Considerations

Considerations:

- License Plate Dimensions
- Bolt Location
- Attachment
- Angle Requirement
- ‘Virtually Flat’
- Lighting Requirement

Well-defined: North America, China, Japan



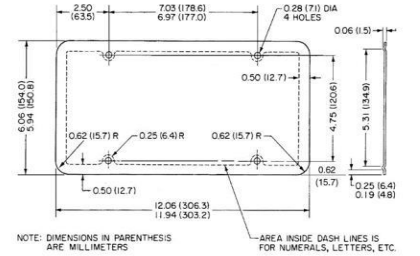


FIGURE 1—DIMENSIONS FOR PASSENGER CAR AND TRUCK LICENSE PLATES

Not well defined: Europe, Australian Region

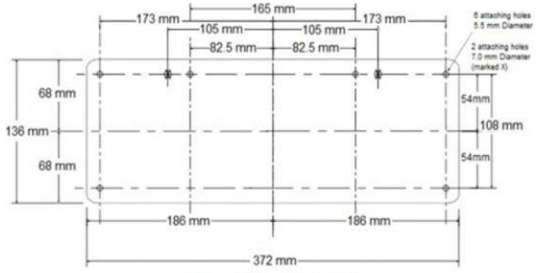


Figure 1: Registration Plate

TOLERANCES
External Dimensions: ± 1 mm; Diameter of Fixing Holes: ± 0.5 mm; Other Dimensions: ± 0.5 mm

Problem: Undefined European LP Requirements

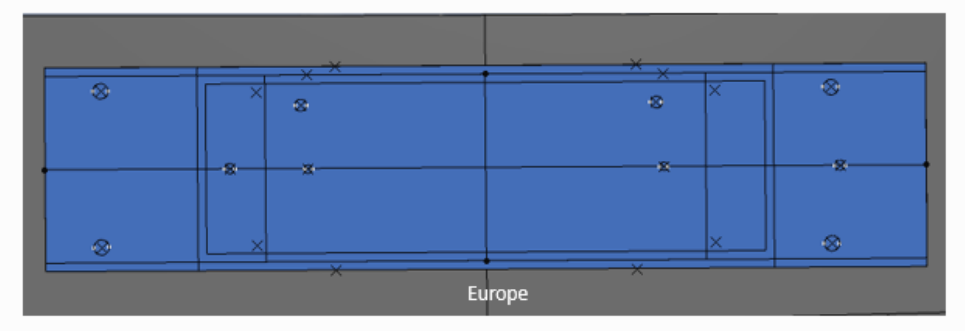
Italy

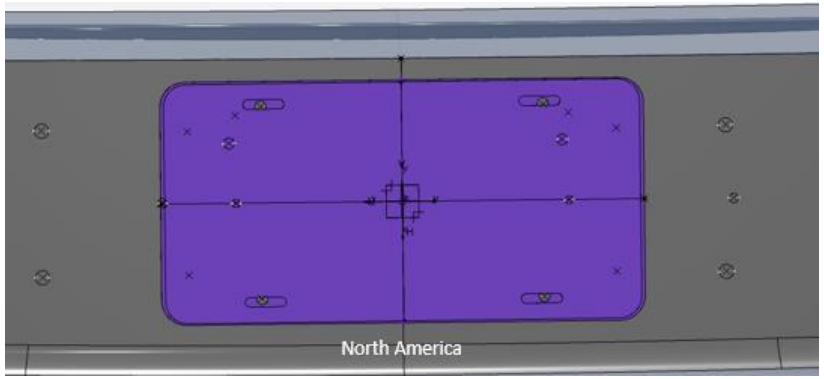
Legal Lighting Requirement

Solution


Reaching out to Tesla Contacts
Compiling LP Dimensions + Regulations
Categorizing LP
Homologation
Team Alignment

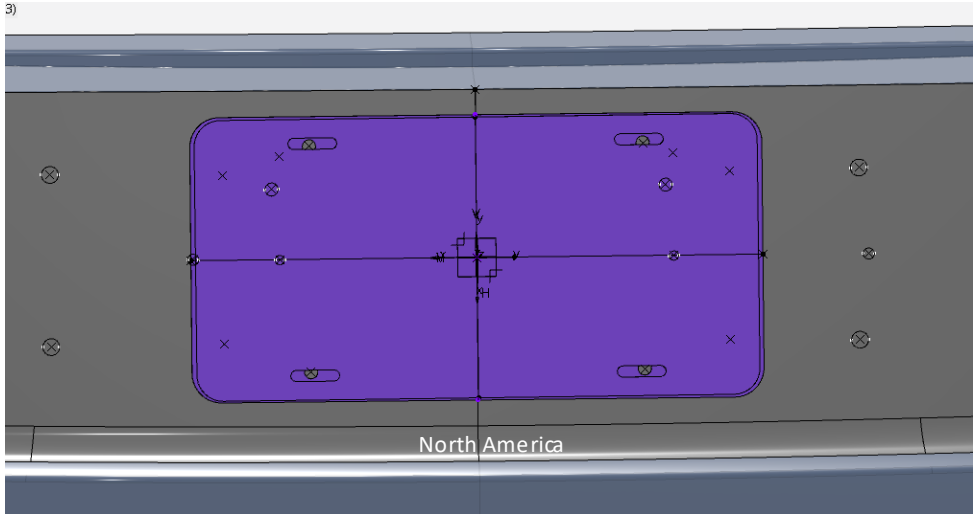
European LP Challenges

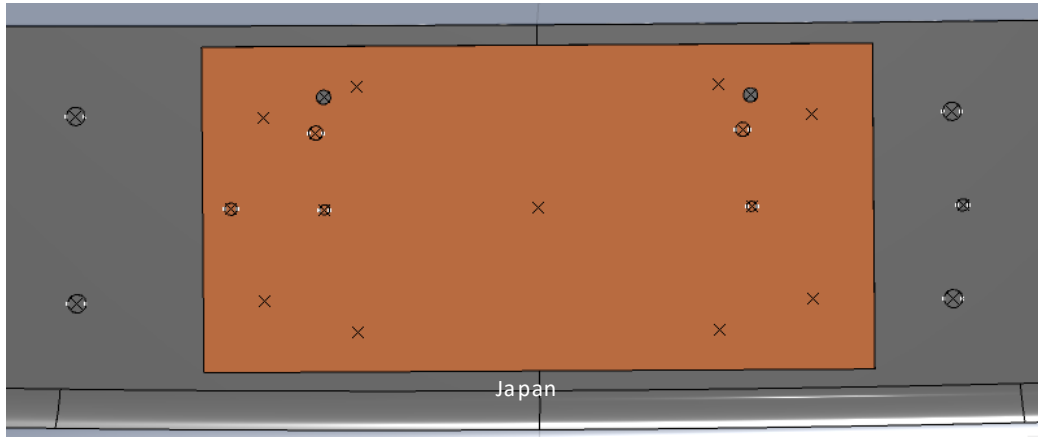


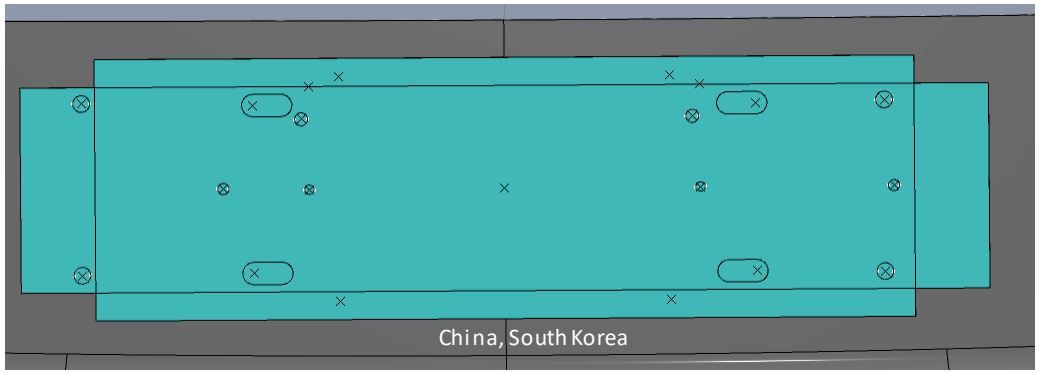


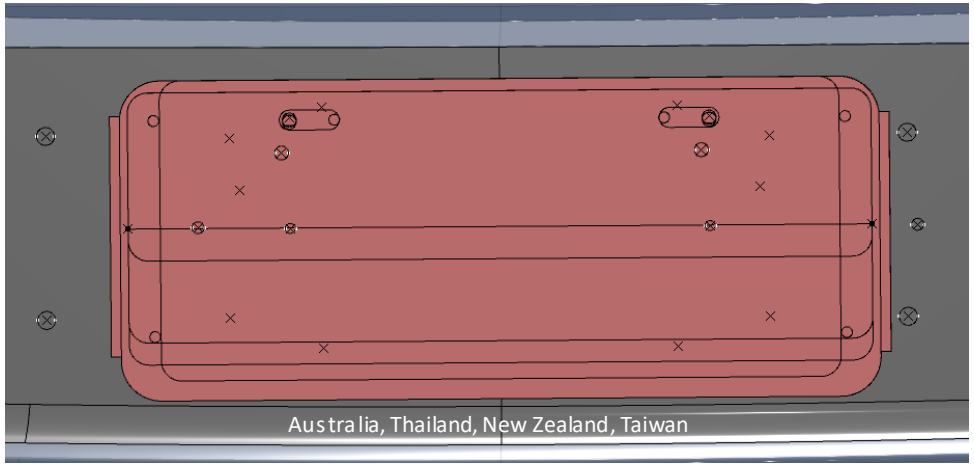
Challenge	Implication
Asymmetric Hole Pattern (e.g Italy + Finland + Denmark)	Infringing on Studio Requirement
Unknown Attachment Requirements	Homologation Infringement
Unknown LP Dimensions	Homologation Infringement
Shorter LP available	Possible Alternative Solution

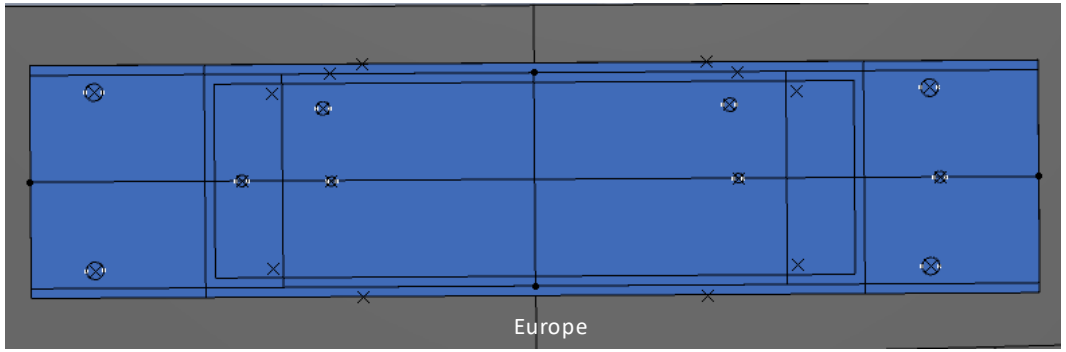
Accommodating for all







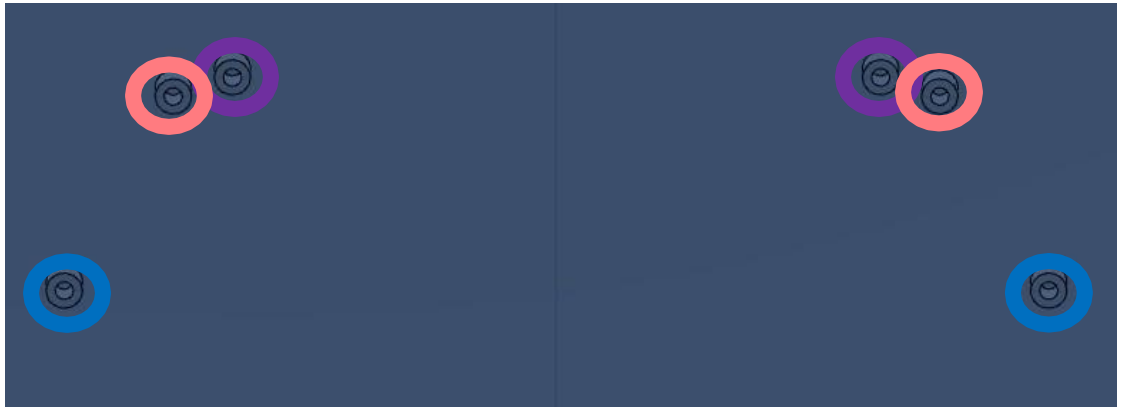




North America: US, MX, CA

“AU” Region: Australia, New Zealand, Thailand, Taiwan

Europe



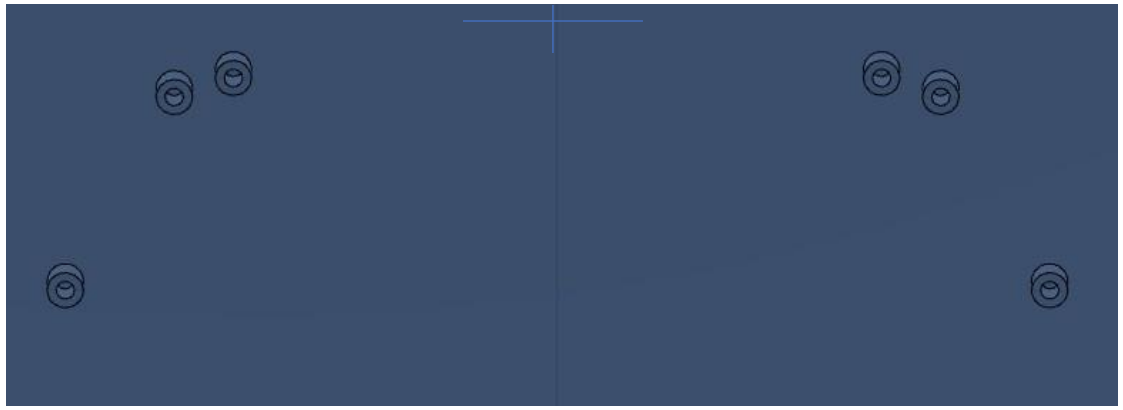
Separate Stamping Feature for Gov’t Provided Bolts

Japan

China

Next Steps:

- Ensure customer has a way to install license plate directly onto the fascia
- Service Centers might need fixtures for mounting the license plates
  - Middle of the fascia
  - Scrim

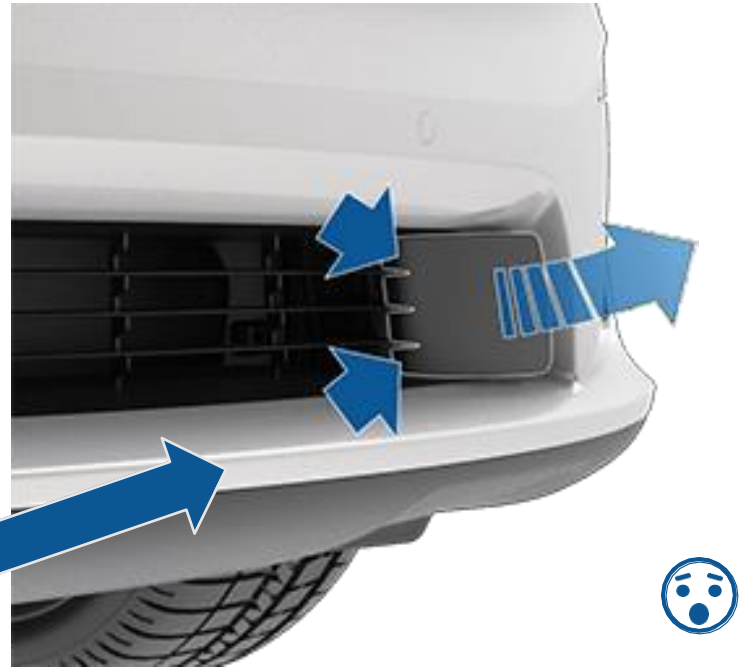


MX Tether

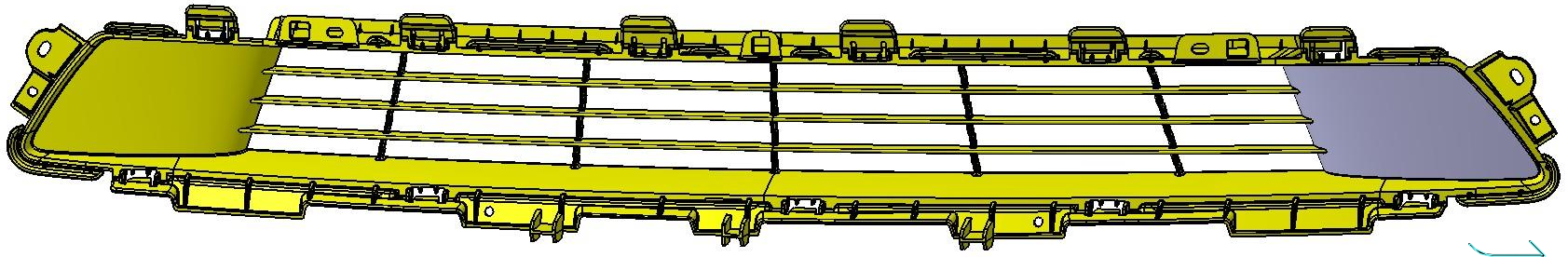
Tether DFM Changes

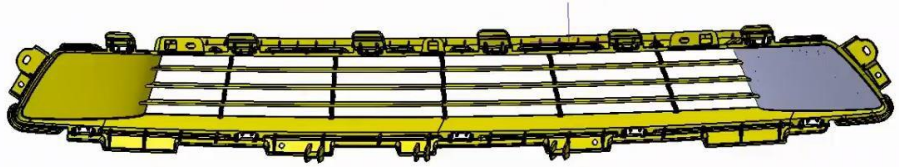
12/11/2023

Problem: Customer Quality Issue on Model X Cars

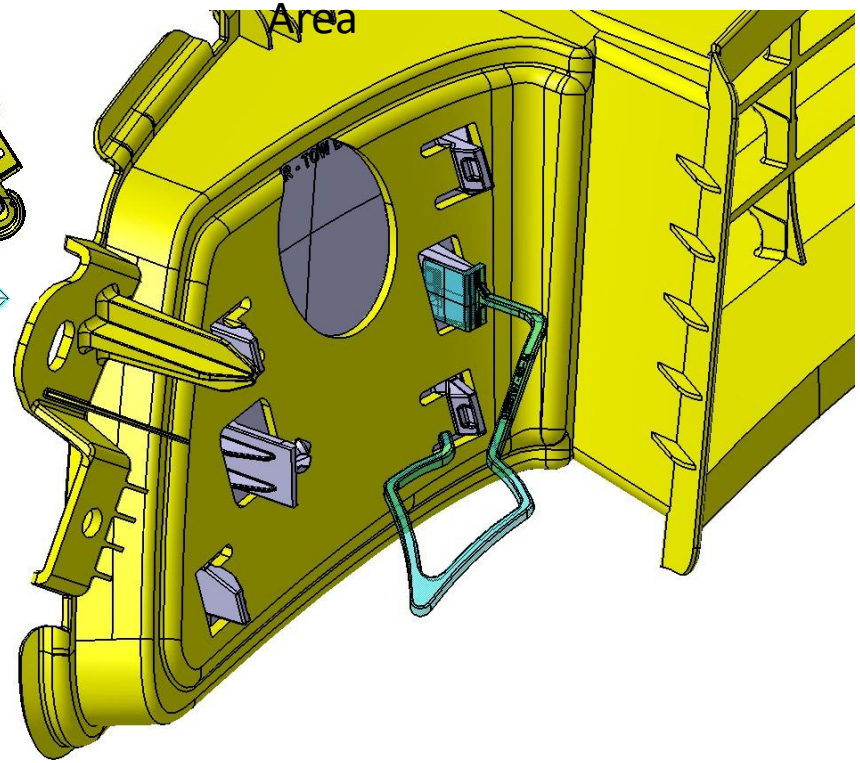


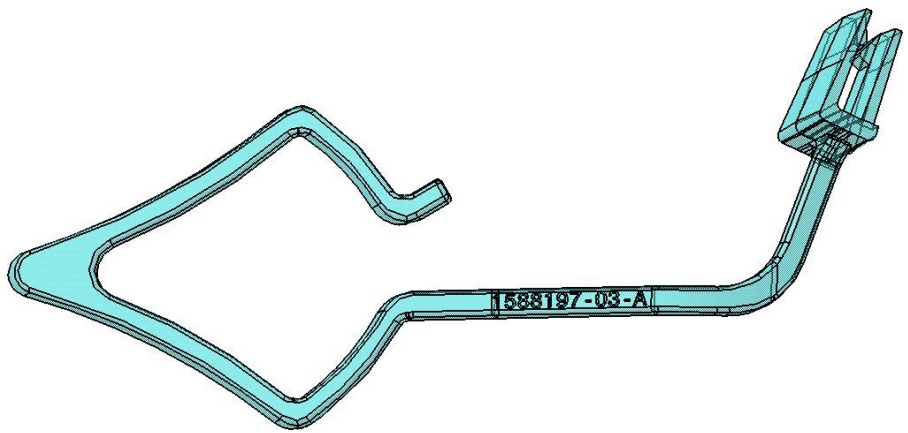
Intro: MX Tether

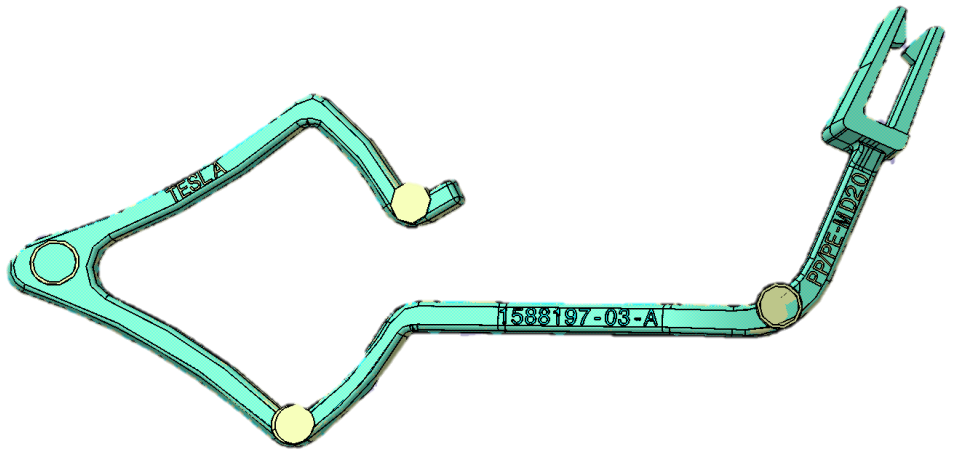




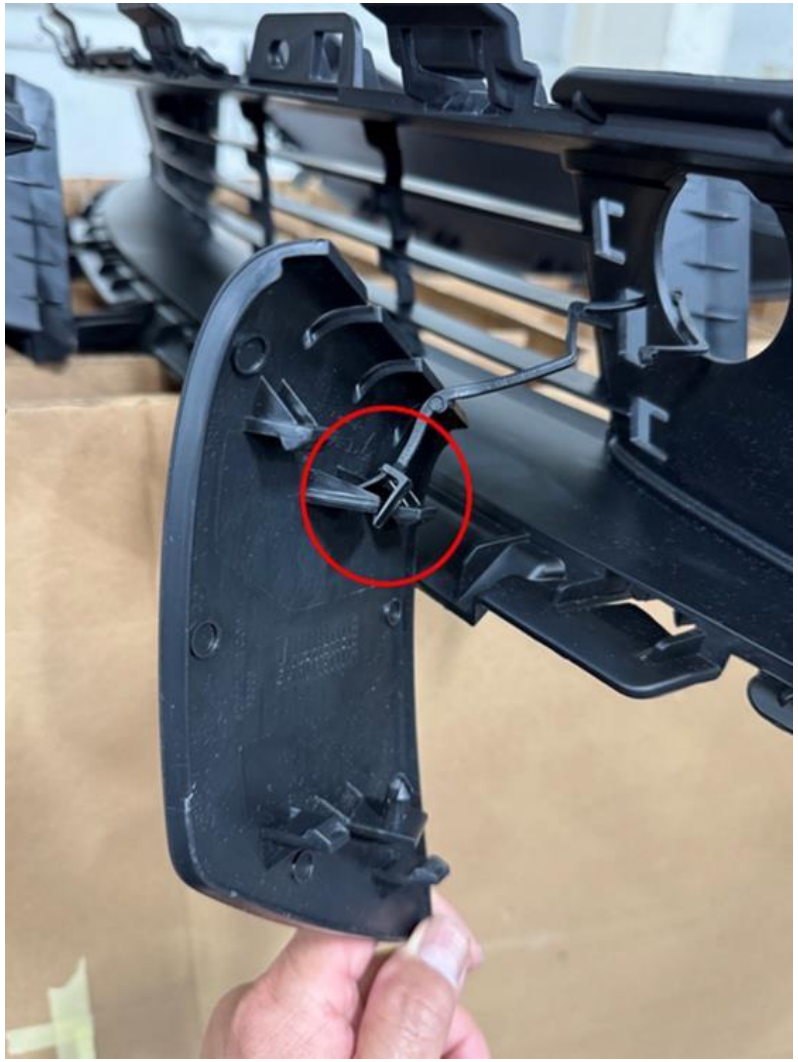
Added Ejection Pin Area



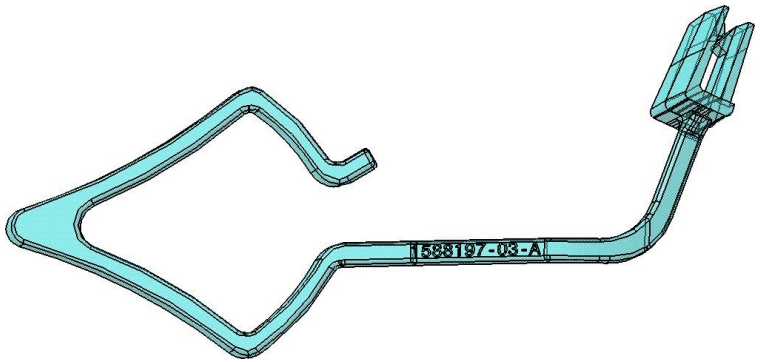

588197-03-A

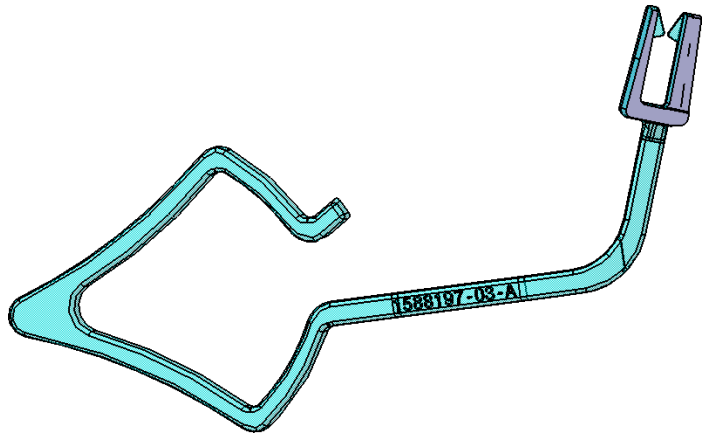

TESLA
588197-03-A
PP/PE-MD20

Issue: Clip Retention Force



Design Changes





Number of Retractions

Iteration	Injection Molded Baseline	Tough 2000 Baseline	Tough 2000 1mm Rib addition	SLA 0.3mm Rib Addition
1	8	12	2	1
2	9	14	2	1
3	4	11	1	1
4	9	-	-	-

Key:

Slipped before snap features disengaged

Retention Force > PLA Property Yield Strength

Retention Force > Tough 2000 Property Yield Strength

Tether Design Trial

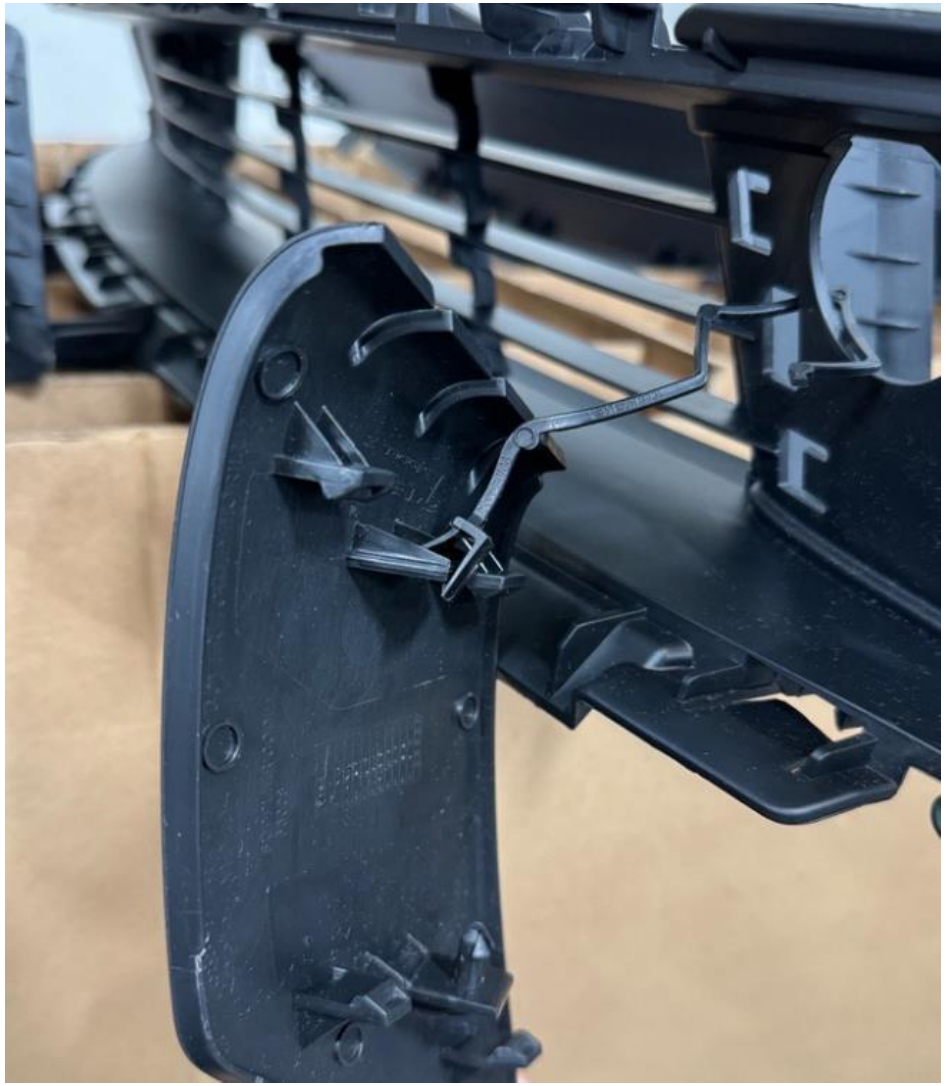
Slipped before snap features disengaged

Retention Force > Tough 2000 Property Yield Strength

Retention Force > PLA Property Yield Strength

Next Steps

1. Run a high-volume trial at the factory
   a. Determine if tether design change is needed
2. Review Supplier quote + DFM
3. Release Change Action



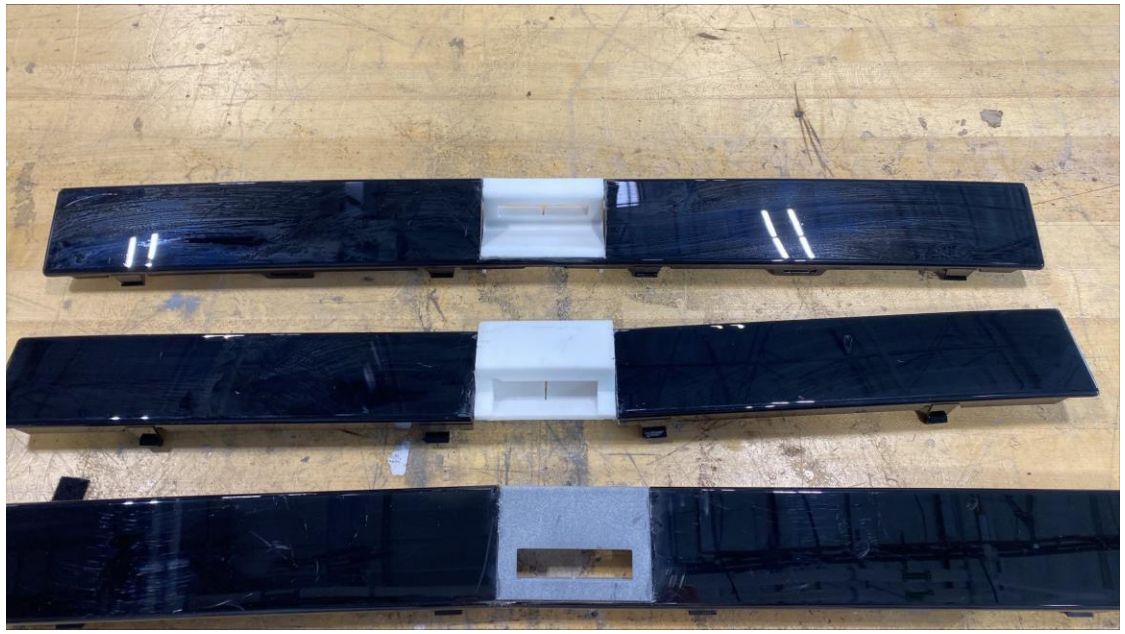
Frunk Power Gate Button Study

Ergonomics Study

-
p

12/12/2023

Problem: Frunk Lift Button Unlocatable



1. Quickly reworked the appliques with 3D parts
2. Conducted a survey
3. Determined ergonomic preference

Problem: Frunk Lift Button Unlocatable

Conclusion

- Rapidly understood what each project needed and sprinted into action
- Proactively reached out to others, working with other teams (GSM, NPI, GA, Service, SIE, Studio)
- Learned about the different requirements of a part: serviceability, natural frequency, aerodynamics, studio aesthetics, etc.
- Challenged ideas frequently, staying curious
- Designing injection molded parts
- Managing and speaking with suppliers
- Rapid prototyping and problem solving
- Taking a product from ideation to a physical component on a production vehicle
- Always looking for cost-effective solutions

Thank you!

Loren Baret
Graduation Date: May 2025

LAST EDITED
12/10/2023