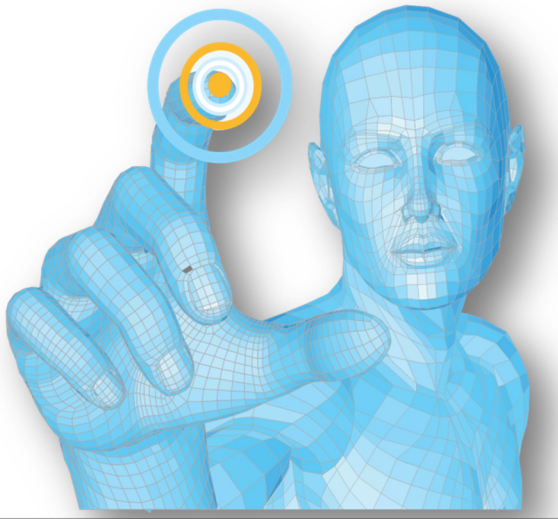
DEP MeshWorks

Full Vehicle Mass Optimization of an SUV

About the Client

The client is one of the leading automotive OEMs in North Americas, with several models under its banner.

Read more online at
www.depusa.com



The Challenge

The client contacted DEP to minimize the mass model of an SUV, using gauge and shape parameterization, while maintaining performance targets. In addition, they wanted the optimized CAD model to be given to their design teams.

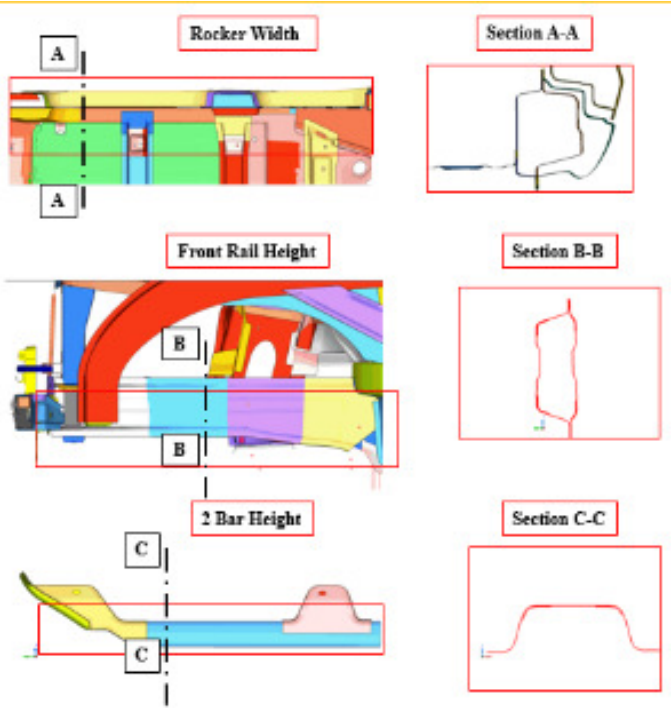
The Solution

The key approach involved DOE based Multi-Disciplinary Optimization and CAD morphing using DEP MeshWorks. The main steps were:

- CAE Model Built-Baseline study-Load Cases verifications for Various Disciplinary
- Parameter-Variable range as per the design feasibility considering all the architecture points
- Shape and Gauge Parameterization of the baseline CAE model in DEP Meshwork's
- DOE based design Generation and Load case application for Variable Disciplinary
- Results Interpretation-Response surface Method
- Optimization Study.
- Verification of the optimized design
- Applying Parametric Attributes into CAD-Using DEP CAD-Morpher and generating the optimized CAD (Output)

Shape Parameters: Under Body

Parameters	Range	
	Min	Max
Front Rail Height	-20	20
Front Rail Width	0	20
Tie Bar Height	-20	20
Rocker Height	-10	10
Rocker Width	-10	10
Shot Gun Height	-10	20
Ski Rail Height	-10	10
Ski Rail Width	-15	15
Tunnel Rail Height	-10	10
Tunnel Rail Width	-15	15
Rear Rail Height	-15	0
Rear Rail Width	-15	0
Shock Brace Height	-8	8
Cowl Bar Width	-15	15
Torque Box Height	-5	5
Torque box Width	-8	8
1,2,3,4,5 Bar Height	-10	10
1,2,3,4,5 Bar Width	10	10



© 2015 Detroit Engineered Products(DEP), 850 East Long Lake Rd., Troy, Michigan 48085, USA

The DEP Edge

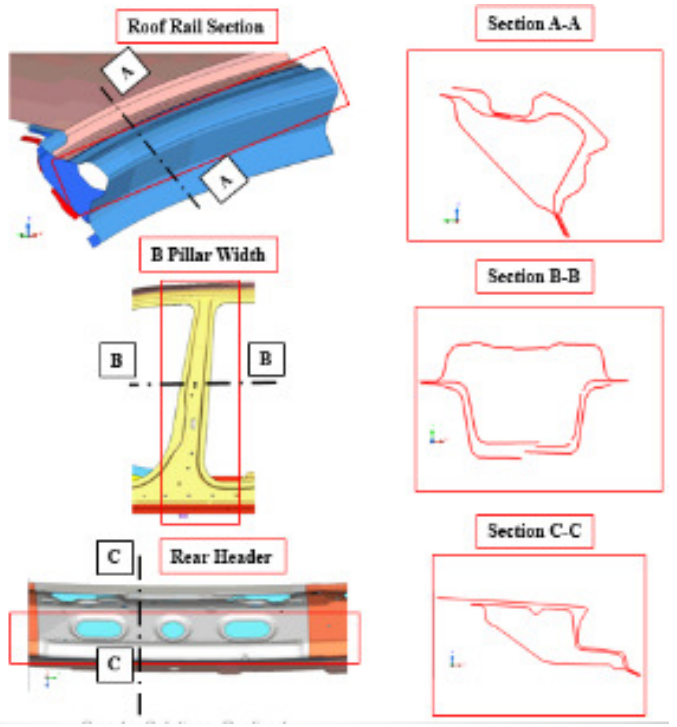
- Using the minimalistic approach by DEP, resulted in 60% time savings compared to the DoE approach
- Using MeshWorks for de-featuring of ribs on block and head and design space creation saved 70% time compared to the conventional approach
- Due to CAD Morpher used, an optimized CAD model could be given directly to the design team

The performance constraints were:

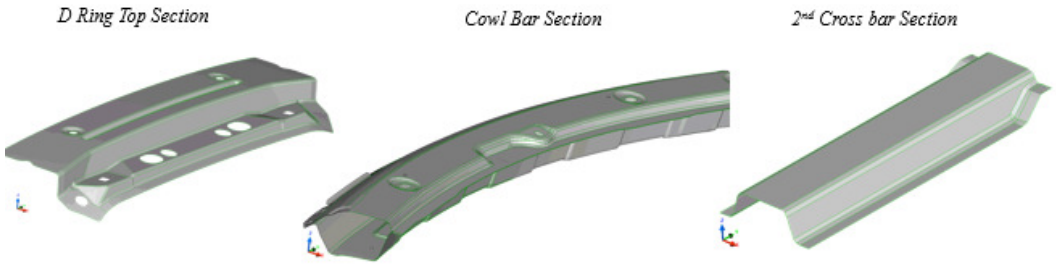
- Torsional stiffness should meet the target of 20kN-m/Deg.
- Bending stiffness should meet the target of 20kN/mm
- Torsion Mode should meet the target of 40Hz
- Bending Mode should meet the target of 50Hz
- Local Stiffness should not be less the Baseline performance
- Stress of the major components should not be less than the Yield stress of the Material.

Shape Parameters: Upper Body

Parameters	Range	
	Min	Max
Hinge Pillar height	-10	10
Hinge Pillar Width	-10	10
B Pillar Height	-20	20
B Pillar Width	-10	10
Front Header Width	0	20
Front Header Height	-20	20
Roof Bow 1,2,3 Height	-10	10
Roof Bow 1,2,3 Width	-10	10
A Pillar Section	-10	10
Roof Rail Section	-10	10
Rear Header Height	-15	10
Rear Header Width	-10	18
C Pillar Section	-15	15
CD Bridge Width	-15	0
CD Bridge Height	-15	0
D ring Section Height	-10	10
D ring Section Width	-5	10
Banana Section	-7	7



CAD Morphing



The Result

DEP's parameterization based MDO approach using MeshWorks helped to save about 12% of mass by still meeting all the performance targets.

© 2015 Detroit Engineered Products(DEP), 850 East Long Lake Rd., Troy, Michigan 48085, USA