Front Underrun Protection

AB Volvo

Conditions

- A system which is designed to ensure safety features of passanger cars are deployed during a front-on collision and prevent underrunning.
- The system is expected to reduce fatalities and the severity of injuries.
- Legal requirement ECE R-93

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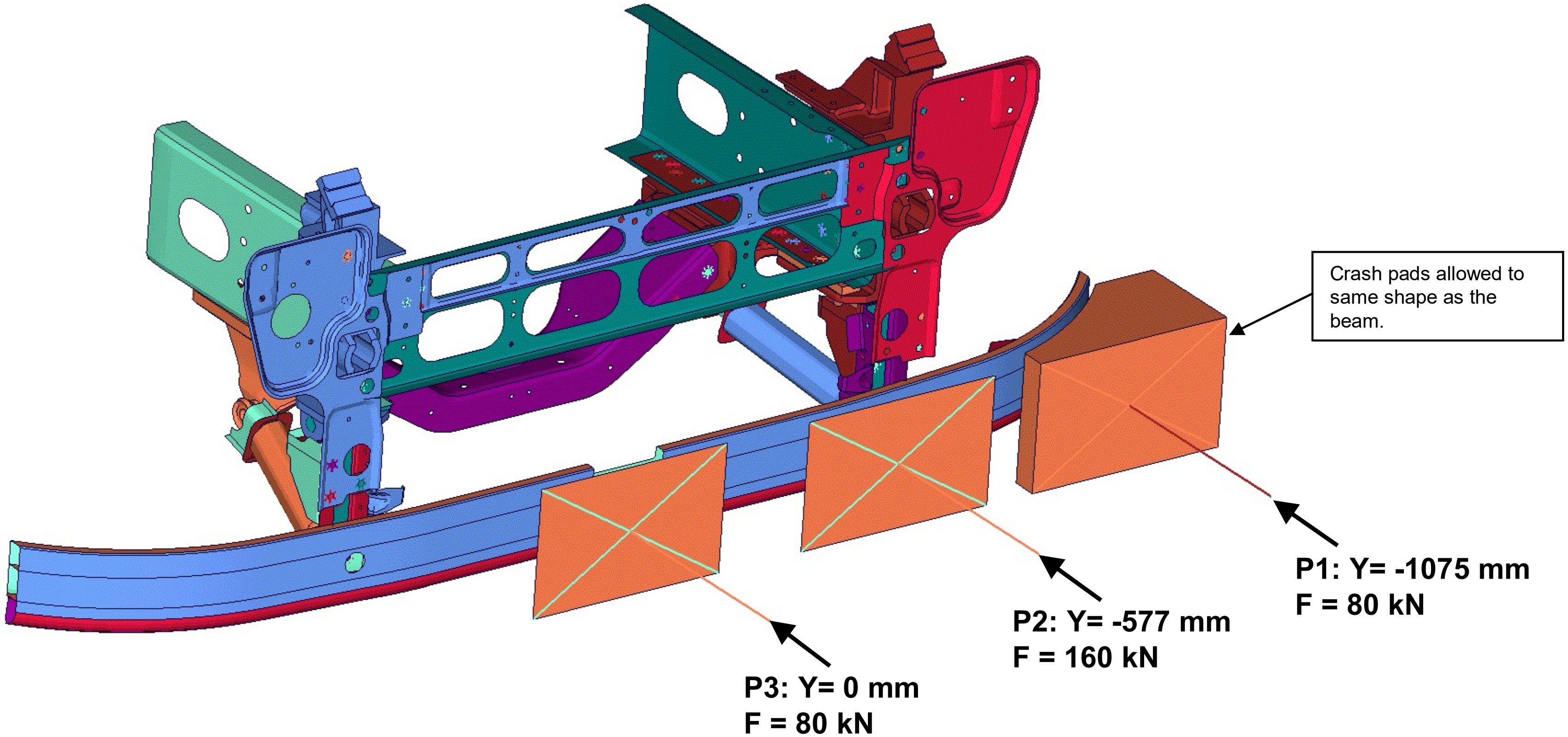
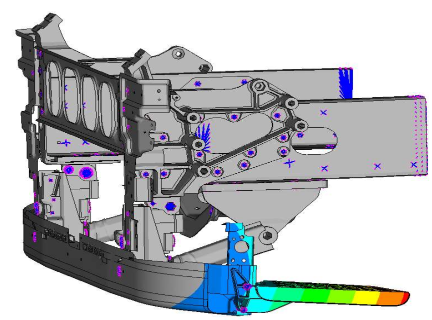


Other adding requirements could be:

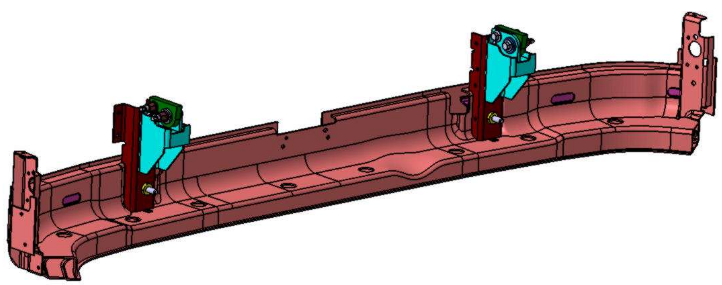
- Increased crash requirements
- Stiffness / max deflections for ie side steps
- Other requirements for interfacing parts (e.g. fatigue test, more hinges for the Frontstep)



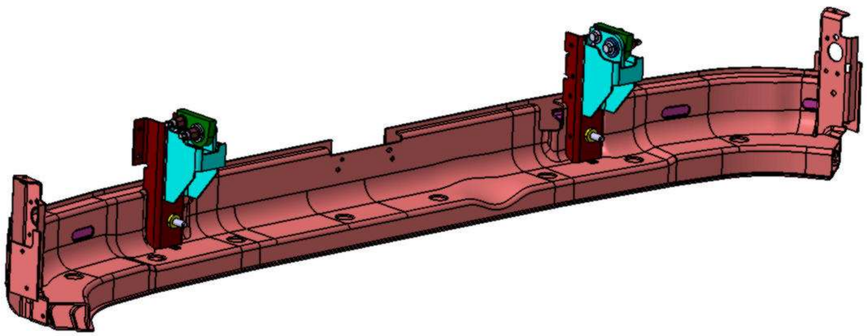
Business case – Example I

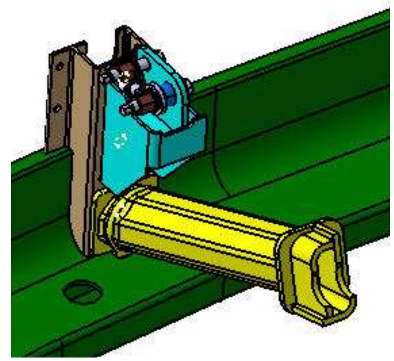
- Common concept within the group of different brands
  - Brand 1 only to fulfil legal requirement
  - Brand 2 have increased crash requirements with robustness and progressive deformation characteristic
  - Different interfacing parts and concept between the brands

The beam is common and brackets unique



Business case



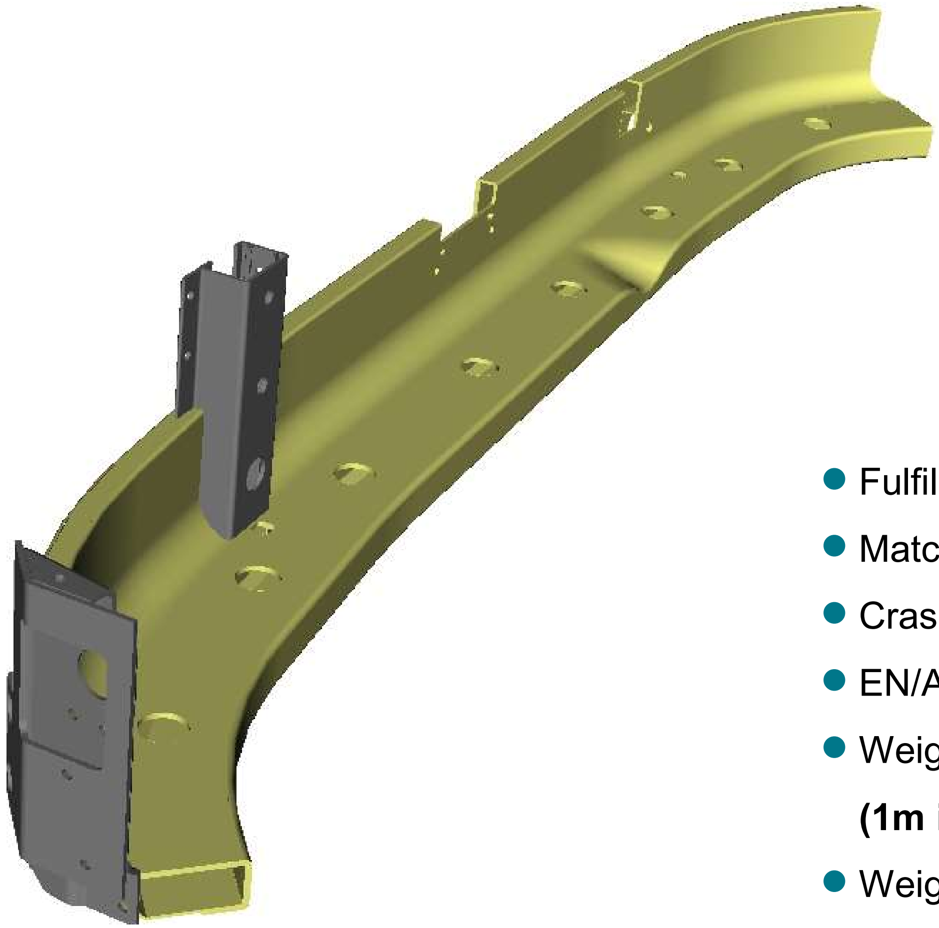


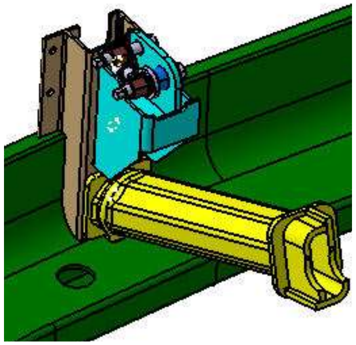
Customer want robustness and progressive deformation characteristic
to handle collisions with cars in 70 km/h, 50% offset

Crash box and shear bolts

- Material in the beam is steel (T=4,0 mm; Rp0,2 = 590 MPa)
- Material in the crash box is steel (T=3,0 mm; Rp0,2 = 350 MPa)
- Weight beam = **48,2 kg** (+6,3 kg for brackets)
- Weight crash boxes = **10,6 kg**

Sapa solution for the customer

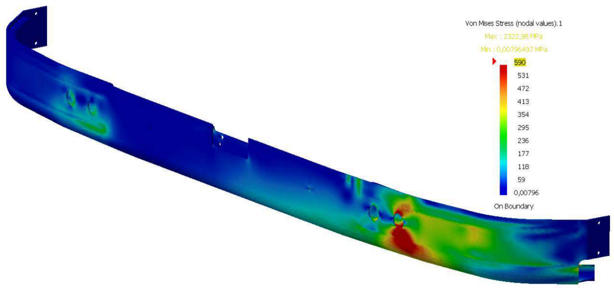


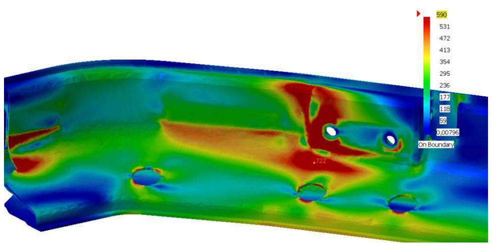


- Fulfil the crash requirements
- Match all interfaces
- Crash box and shear bolt bracket not included
- EN/AW 6005A-T6
- Weight beam = 20,0 kg   => **60% saving**
  (1m in front of the Front Axle)
- Weight brackets = 2,7 kg => **60% saving**

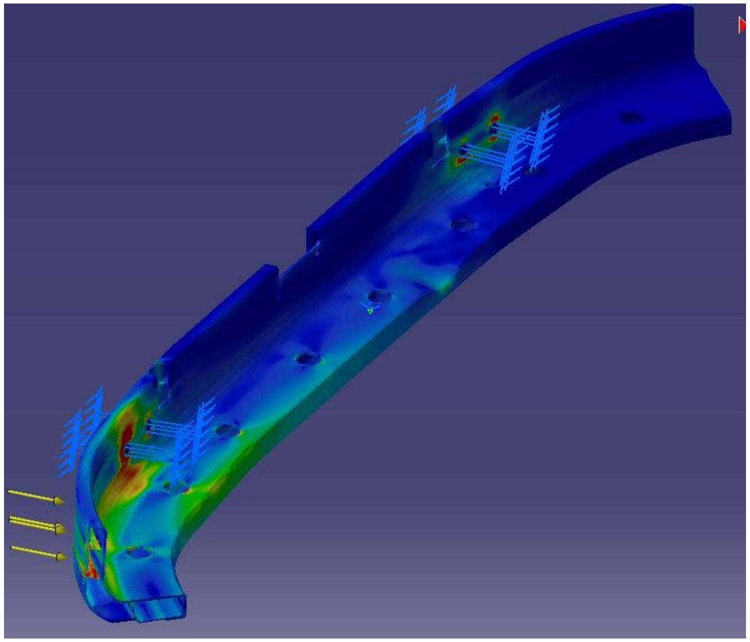
Catia simulation

Original beam in steel





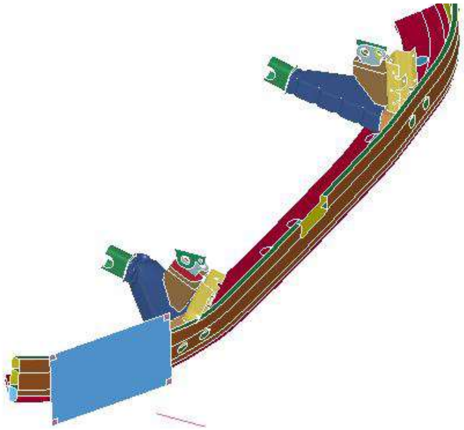
Sapa beam in aluminium

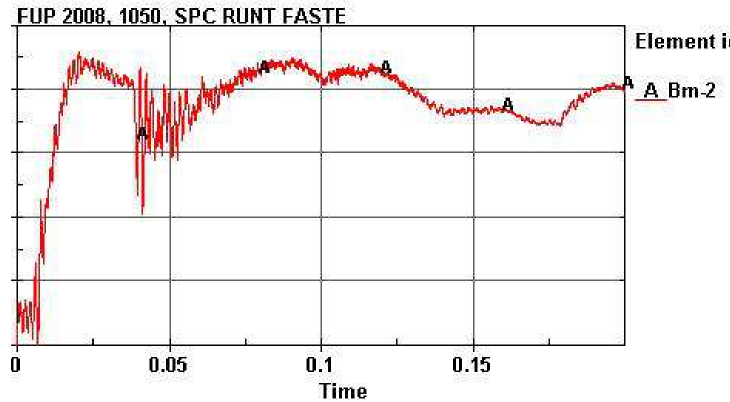


”Simple” simulations in Catia only on the beam to find the first draft of section design

LS Dyna simulation

P1





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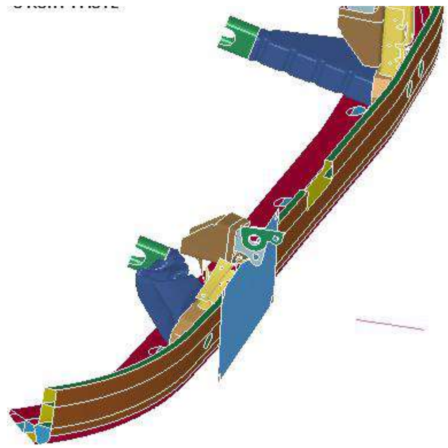
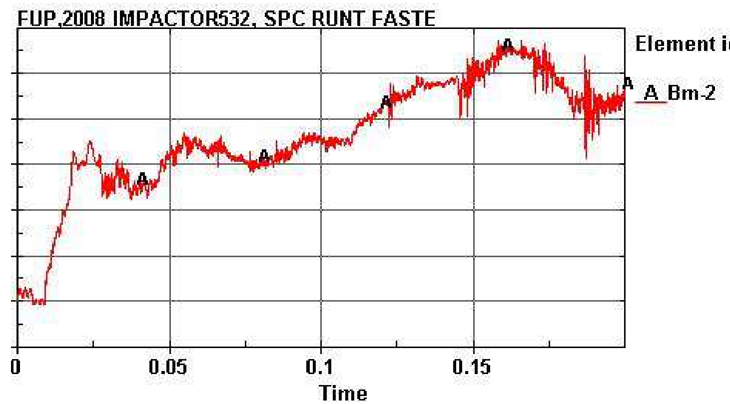
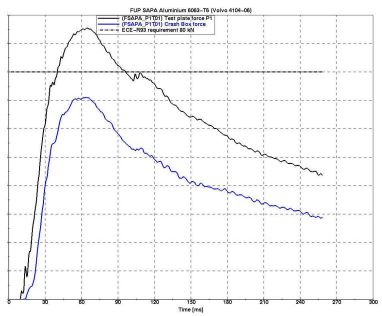
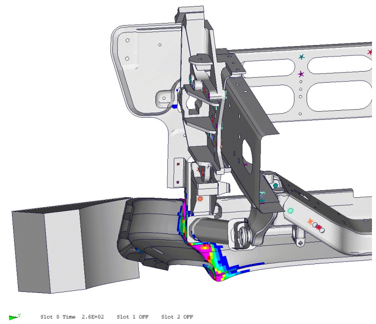


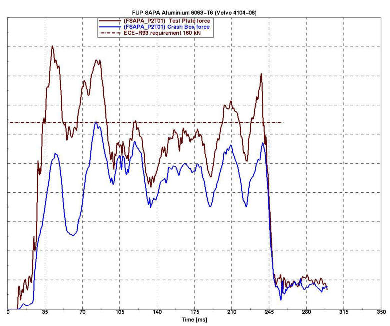


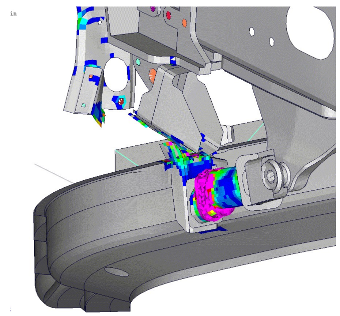
LS-dyna simulations at Sapa Technology to find the right behavoir and strengt levels

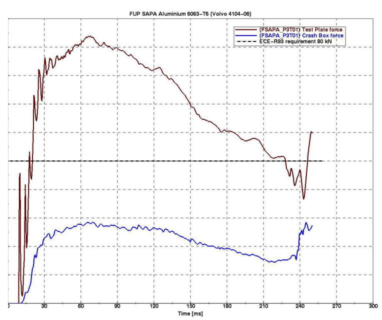
Customer simulation on complete system

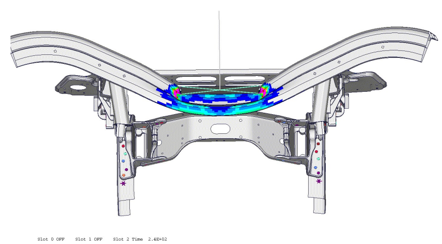






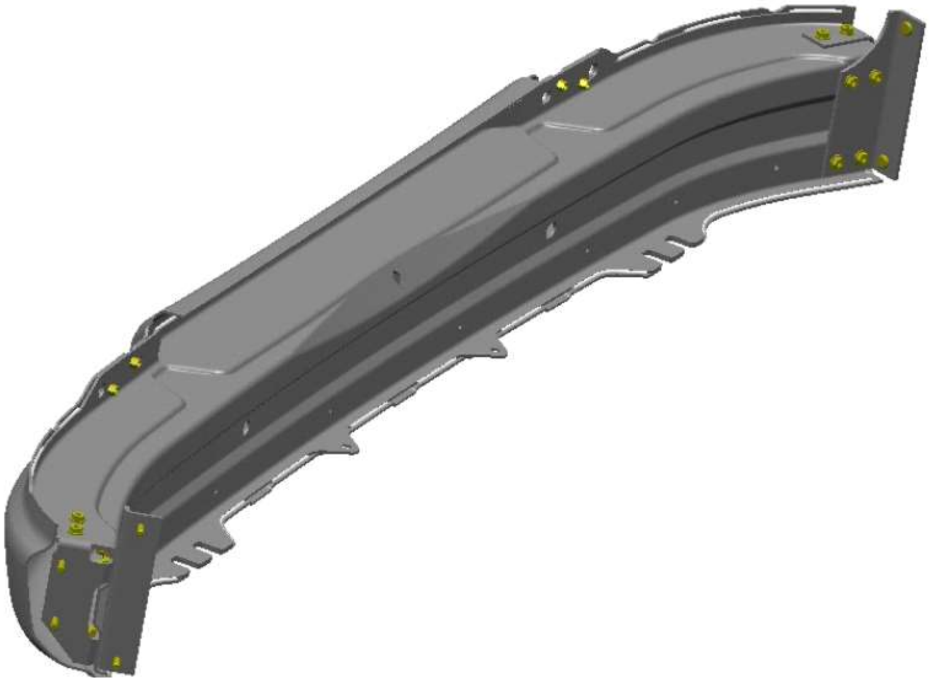


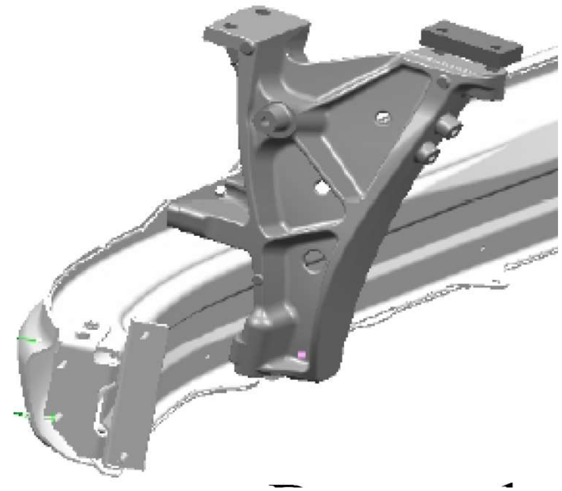




CAE simulations at customer on complete system/truck to verify correct behavior

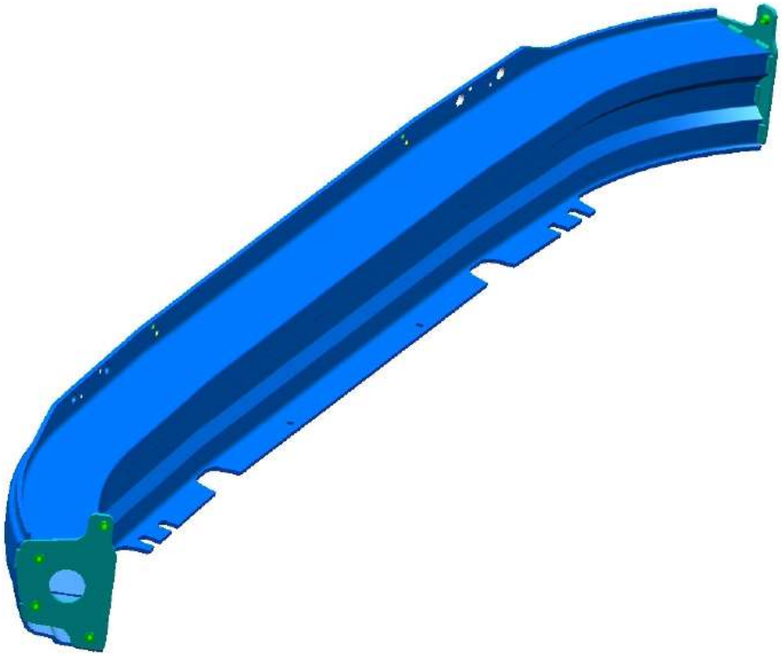
Business case – Example II

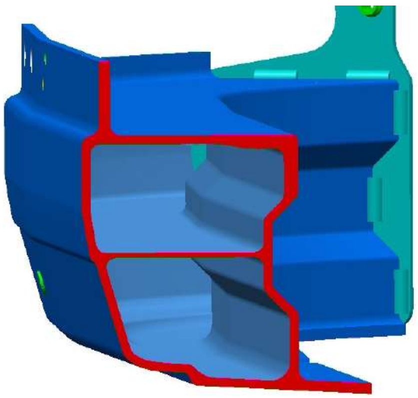




- Same package space as current model
- Same interfacing part to be used
- Front and rear sheet in steel T=3,0 mm
- Weight Steel 34,8 kg

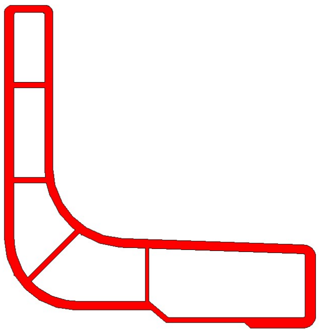
Business case – Example II

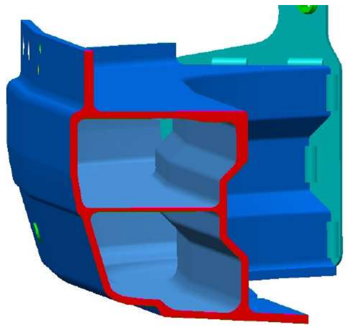


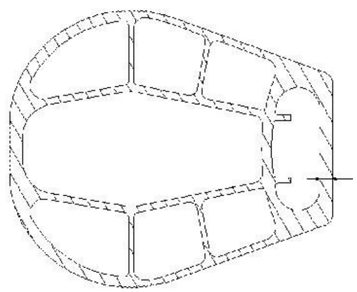


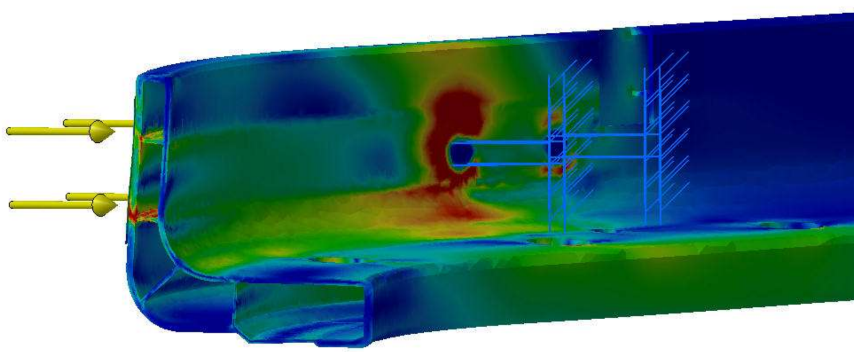
- Fulfil the crash requirement
- Match all interfaces
- EN/AW 6005A-T6
- Material thickness between 4-8 mm
- Weight beam = 20,3 kg   => **42% saving**

Why extruded aluminium



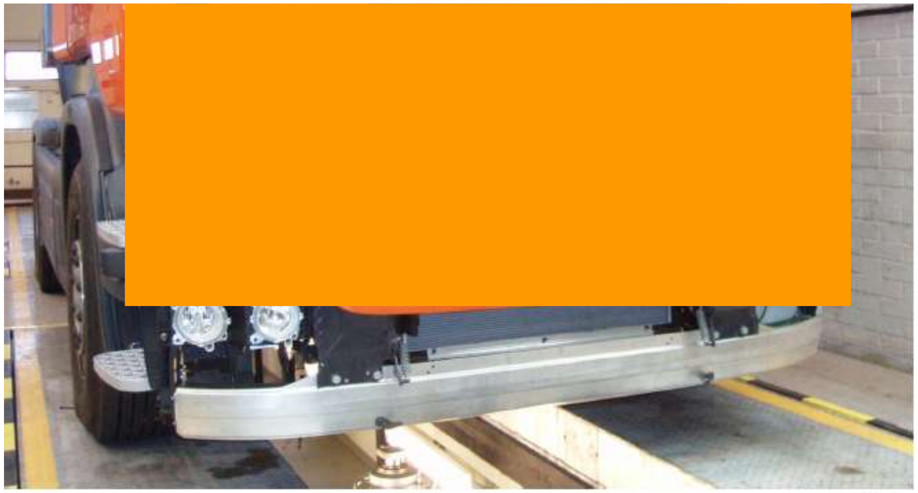


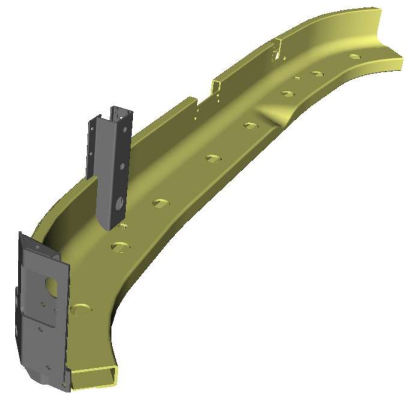


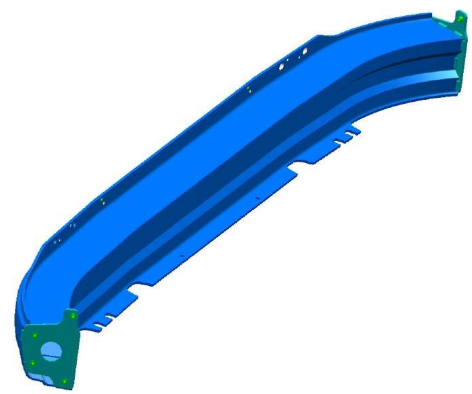


- Main force is bending in x-direction
  - ➔All walls have not same strength requirements
- Disadvantages with steel
  - ➔ Same thickness all over
- Advantages with Aluminium
  - ➔Thickness can be variated where it´s needed
  - ➔lower weight
  - ➔Ductility – crash performace
  - ➔…

Summary



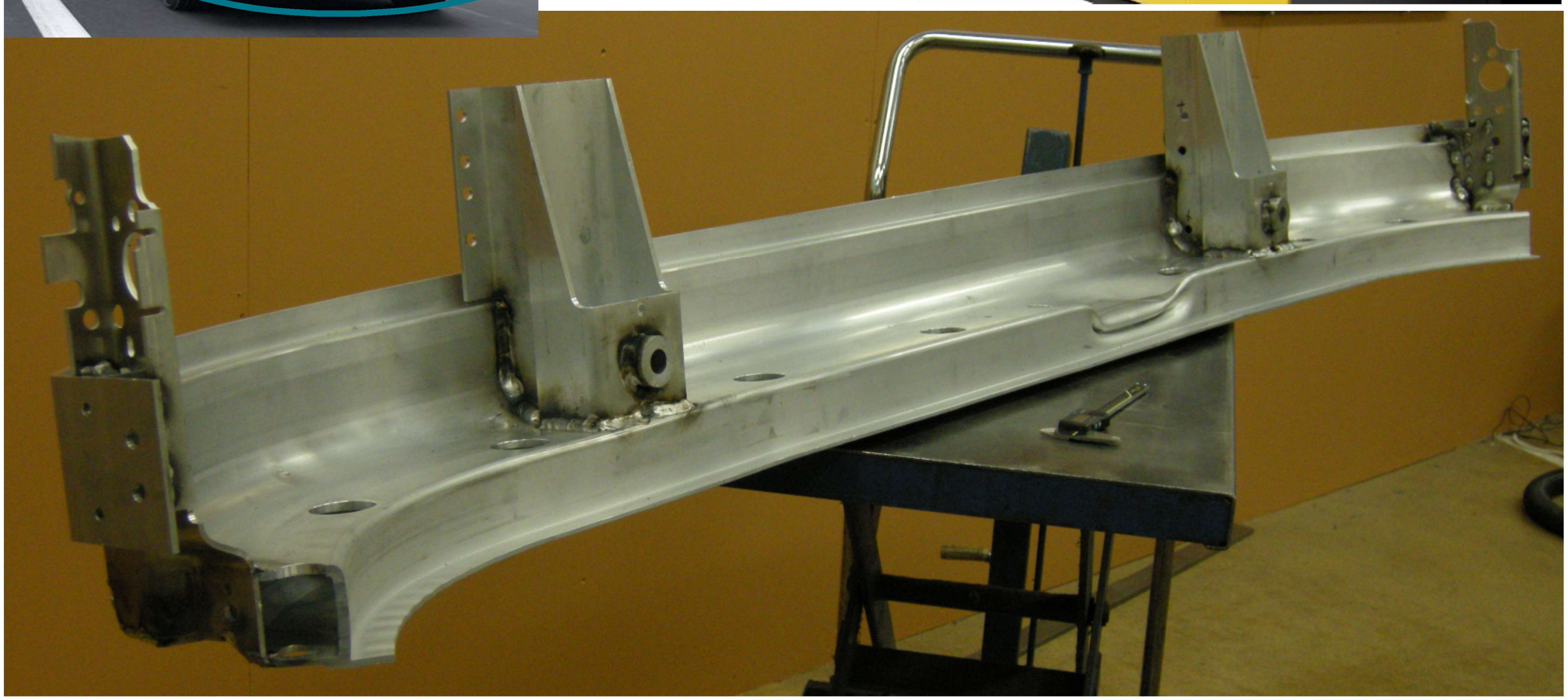




- Sapa can find solutions fulfil all requirements
- Weight saving on 60%
- Sapa have the skills and knowledge to make complex concept solutions including simulations

Work with Sapa to find a FUP solution in extruded aluminium !

Volvo Trucks & Renault Trucks Front Underrun Protection



Next step

Proposal how to continue the cooperation between Volvo NA and Sapa:

1) Volvo NA delivers CAD model and package space from a chosen project
2) Volvo NA specifies which requirements that are valid for the FUP

3) Sapa evalutes the time and workload for a concept
4) Sapa comes up with a first draft of FUP in extruded aluminium

5) Volvo NA makes CAE simulations to verify the proposal