Front Underrun Protection

AB Volvo
Conditions

- A system which is designed to ensure safety features of passenger 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
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
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
"Simple" simulations in Catia only on the beam to find the first draft of section design
LS-dyna simulations at Sapa Technology to find the right behavior and strength 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 varied where it’s needed
  ➔ Lower weight
  ➔ Ductility – crash performance
  ➔ …
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
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 evaluates 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