Design Simulation of Crash Box in Car

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Abstract

It has become a very common thing to hear about an accident in our daily life. But, all these struggles for our life is just to leave it in minutes? As food, as shelter, as clothes, transportation and automobiles have also become a very common part in our daily lives. Nobody wants to be part of an automobile accident, but it is a fact of our environment: accidents occur. Some are small fender benders – usually nothing more than a little paint, metal, and somebody's pride are hurt in a minor skirmish. For a variety of reasons, some driver's will be involved in life threatening accidents. In the 1950's and 1960's, cars were solid – built like tanks. Heavy frames, thick metal panels, large bumpers, and very little structural plastic made these cars appear to provide good protection for the occupants. But the modern day cars are not made that way for various other reasons. So, there is every need to take proper precautionary measures against accidents. Even though we cannot avoid accidents, if we can reduce the impact (crash) caused by them, we can save many lives. There are many existing technologies like airbags, seatbelts etc., which are still not that effective. And now, here is another trail in the process and it is Crash box. Absorbing the kinetic energy that drops from a high speed to zero after the crash is the key in this case.

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1. Introduction

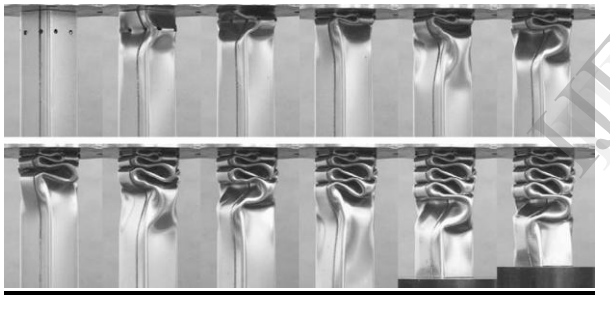
In the design of an automobile, a most important task is to minimize the occurrence and consequences of automobile accidents. Automotive safety can be improved by "active" as well as "passive" measures. Active safety refers to technology which assists in the prevention of a crash. Passive safety includes all components of the vehicle that help to reduce the aggressiveness of the crash event. Crash protection priorities vary with the speed of the car when crash occurs. In principle, aluminum can also be used for both foam and honeycomb energy absorber. Aluminum foams as well as aluminum honeycomb structures offer excellent energy absorption characteristics and have been successfully used in prototype and niche applications. But up to now, there are no known applications in larger series. As an example, Faurecia is working on modules that combine an aluminum honeycomb structure with foam or plastic energy absorbers. The weight saved is 25% to 30% compared to all metal solutions. Another benefit is the extra space gained by reducing the vehicle's front overhang.

2. Need of Crash Box

Crash box, with which a car is equipped at the front end of its front side frame, is one of the most important automotive parts for crash energy absorption. In case of frontal crash accident, for example, crash box is expected to be collapsed with absorbing crash energy prior to the other body parts so that the damage of the main cabin frame is minimized and passengers are saved their lives. Conventionally, a crash box is equipped with several ditches called "crash beads", so that those crash beads may initiate buckling deformation and make the crash box easily collapse. Recently, it has been strictly required to satisfy both reduction of body weight and improvement of crash worthiness and thus, regarding crash box, it is required to ensure high energy absorption using sheet as thin as possible. However, there is often the case that the crash beads do not work as designed when a thin sheet is applied as the material for a crash box and thus, it has become difficult to acquire sufficient energy absorption only by the crash beads. In this report, attention is focused upon finding an optimum cross sectional shape of a crash box to ensure high capability for energy absorption without crash bead. By making use of FEM, first a mechanism through which a body part absorbs crash energy in axial collapse was clarified and then, the influence of cross sectional shape of the part on energy absorption was quantitatively revealed. Finally, a new design scheme of cross sectional shape of a crash box was proposed.

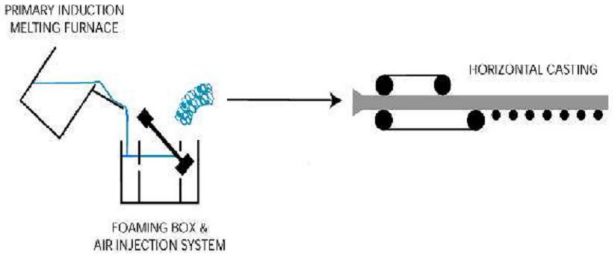
3. Development of Deformation

Development of the deformation element of a passenger car rear bumper. Geometry optimization of the crash-box for the low-velocity crash Experimental Aluminum bumpers are extruded from either 6xxx (Al-Mg-Si) or 7xxx (Al-Zn-Mg) heat-treatable alloys. The high strength 7xxx bumpers offer higher potential for weight reduction since thinner sections can be used. The required high-energy absorption capacity is met by special alloys and tempers combining good ductility and strength with extrudability and weld ability. Also, the design of the extrusion plays an important role for the energy absorption in a collision, e.g. multihole extrusions have more favorable folding characteristics than single hole extrusions.In case of frontal crash accident a crash box is expected to be collapsed with absorbing crash energy prior to the other body parts so that the damage of the main cabin frame is minimized and passengers are saved their lives Conventionally, a crash box is equipped with several ditches , called “crash beads”, so that those crash beads may initiate buckling deformation and make the crash box easily collapse

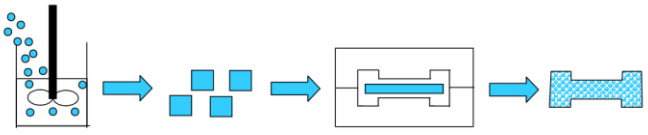


Converting an Existing Word Paper

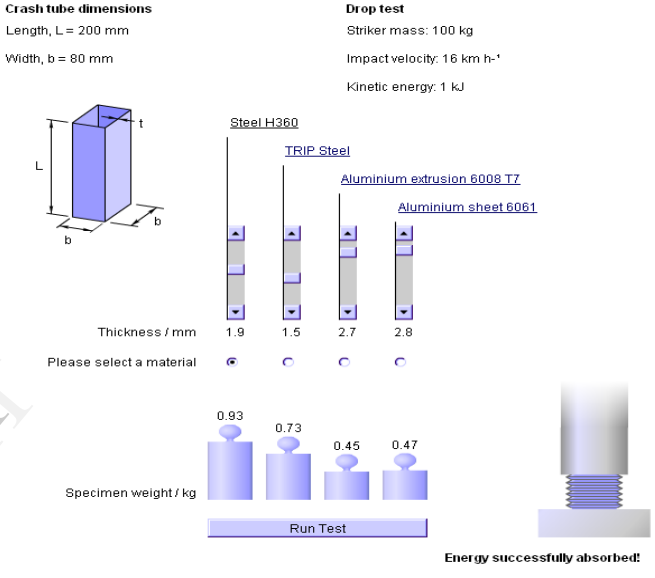
1. Sheet Casting

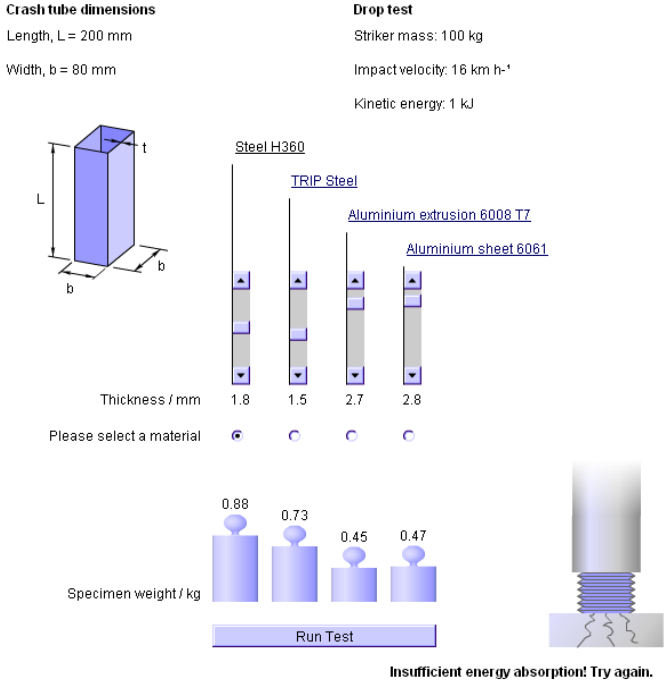


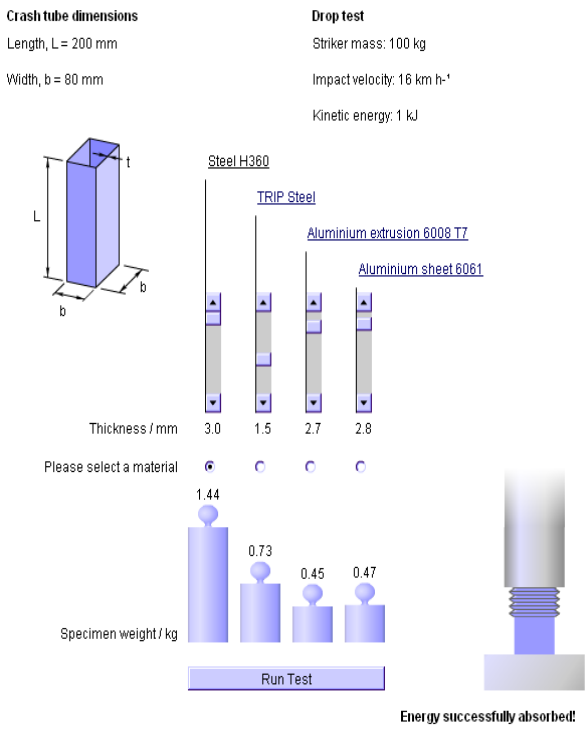
2. Low Pressure Casting and Precursor technology



MATH



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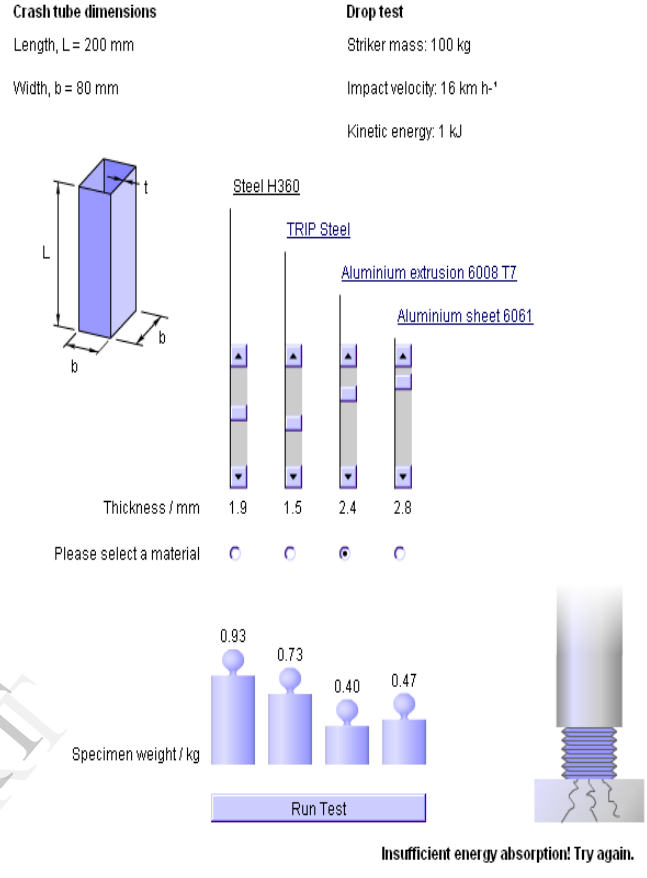
Length, L = 200 mm
Width, b = 80 mm
Drop test
Striker mass: 100 kg
Impact velocity: 16 km h-1
Kinetic energy: 1 kJ
Steel H360
TRIP Steel
Aluminium extrusion 6008 T7
Aluminium sheet 6061
Thickness / mm
3.0
1.5
2.7
2.8
Please select a material
1.44
0.73
0.45
0.47
Specimen weight / kg
Run Test
Energy successfully absorbed!


Crash tube dimensions
Length, L = 200 mm
Width, b = 80 mm
Drop test
Striker mass: 100 kg
Impact velocity: 16 km h-1
Kinetic energy: 1 kJ
Steel H360
TRIP Steel
Aluminium extrusion 6008 T7
Aluminium sheet 6061
Thickness / mm
1.9
1.5
2.4
2.8
Please select a material
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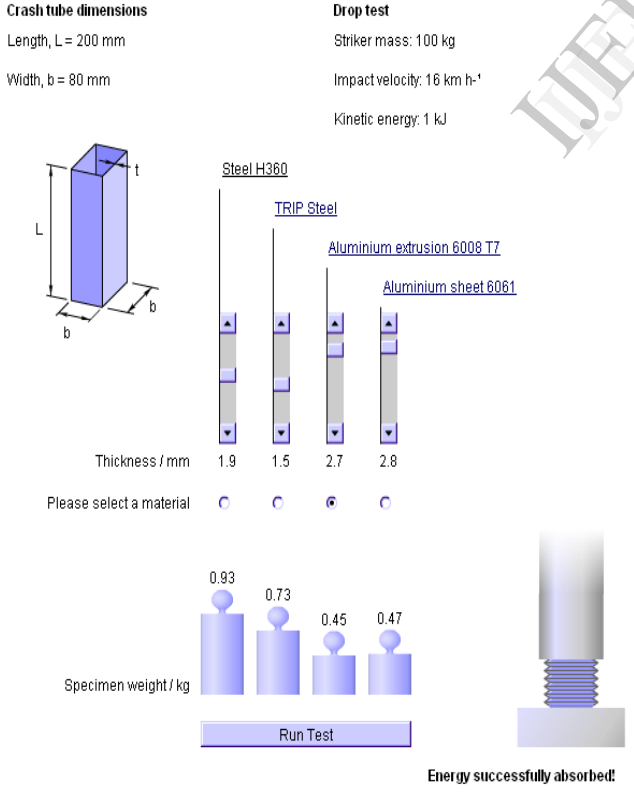
0.73
0.40
0.47
Specimen weight / kg
Run Test
Insufficient energy absorption! Try again.


Crash tube dimensions
Length, L = 200 mm
Width, b = 80 mm
Drop test
Striker mass: 100 kg
Impact velocity: 16 km h-1
Kinetic energy: 1 kJ
Steel H360
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2.8
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0.73
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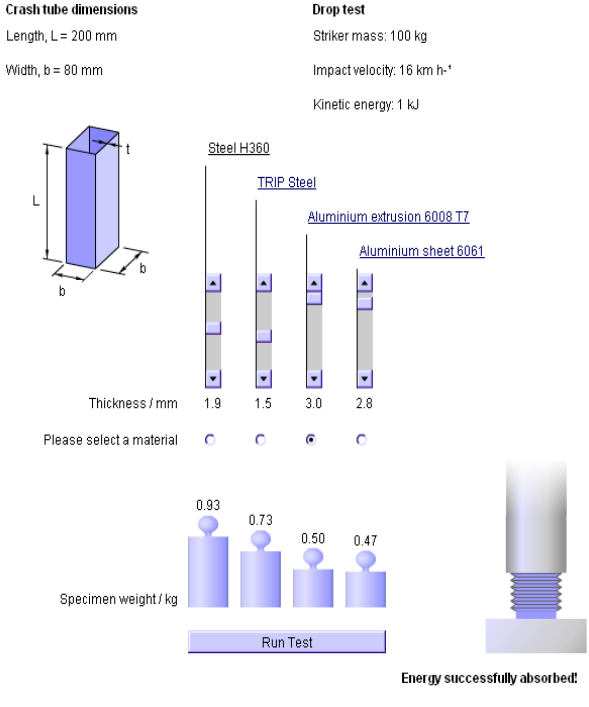
Run Test
Energy successfully absorbed!


Crash tube dimensions
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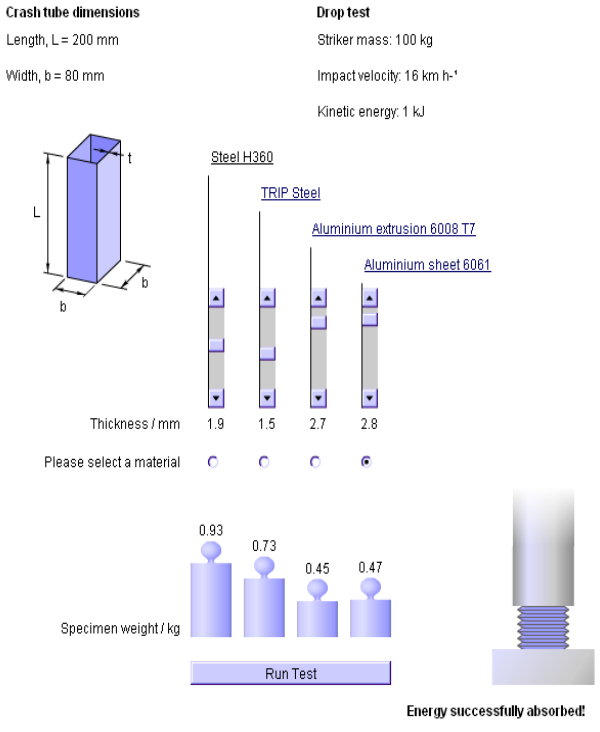
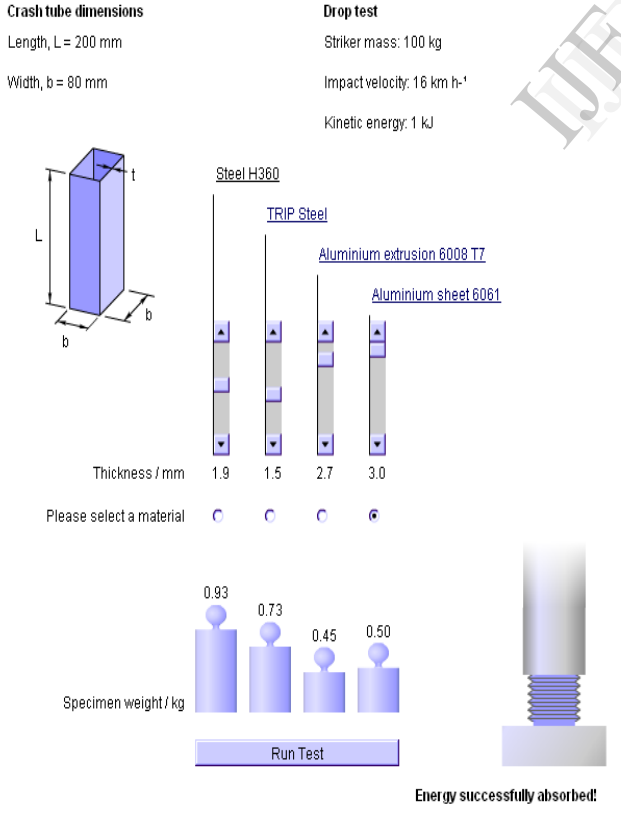
Drop test
Striker mass: 100 kg
Impact velocity: 16 km h-1
Kinetic energy: 1 kJ
Steel H360
TRIP Steel
Aluminium extrusion 6008 T7
Aluminium sheet 6061
Thickness / mm
1.9
1.5
3.0
2.8
Please select a material
0.93
0.73
0.50
0.47
Specimen weight / kg
Run Test
Energy successfully absorbed!





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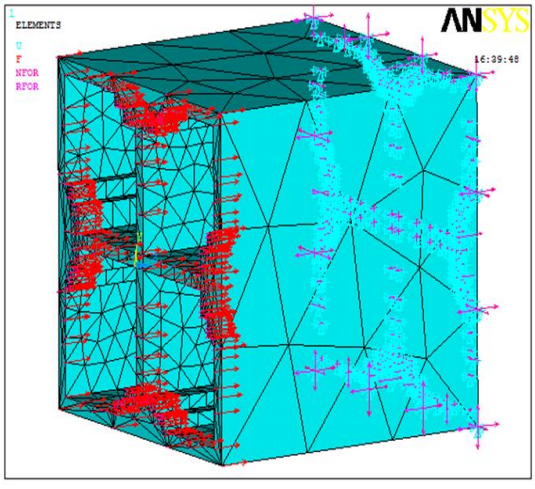

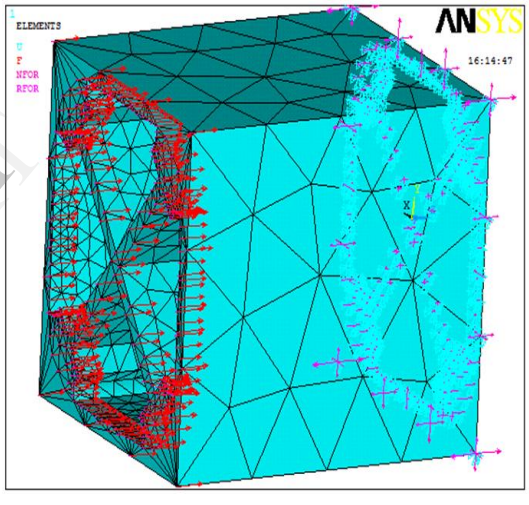

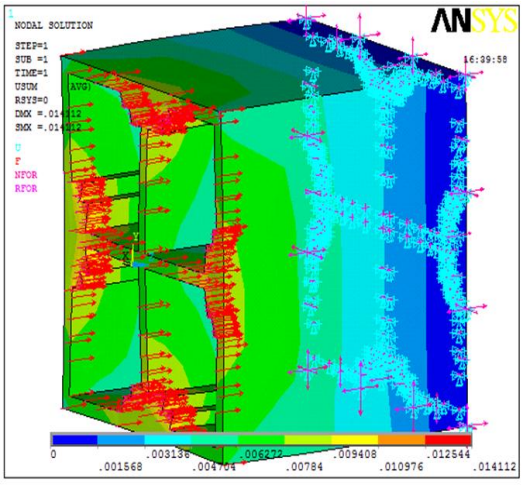

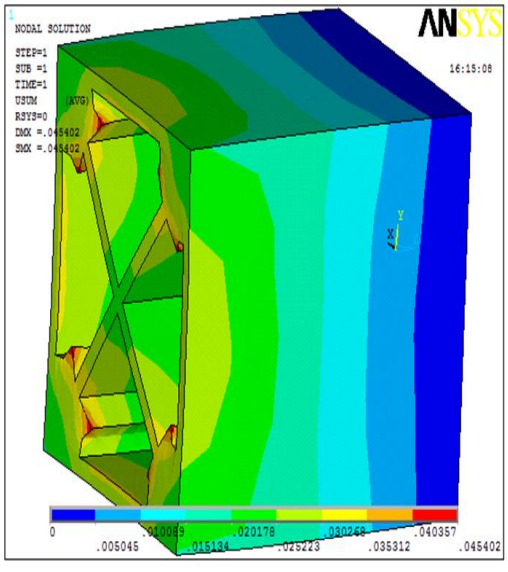

References

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- Development Of Crash-Box For Passenger Car With High Capability For Energy Absorption by Yoshiaki NAKAZAWA, Kenji TAMURA, Michitaka YOSHIDA, Katsutoshi TAKAGI and Mitsutoshi KANO.