



APROSYS FINAL EVENT

Integrated Project on Advanced Protection Systems



Intelligent Safety Systems

Advanced side impact system for crash mitigation

Pre-Crash Actuator System for Side Impact Protection

FUNCTIONALITY

- Pre-crash system for side impact protection
- Actuator couples reversibly door to seat up to the unstruck side
- Actuator reinforces car structure to reduce intrusion in survival areas
- Restraint systems can be deployed more efficiently
- Simple and low cost safety applications are foreseen

EXPLOITATION

- market the SMA actuator
- use the knowledge gained about structural crashworthiness in other products

SOCIO-ECONOMIC IMPACT

A next big step in the reduction of severe and fatal road accidents is expected from a broad introduction of pre-crash protection systems.

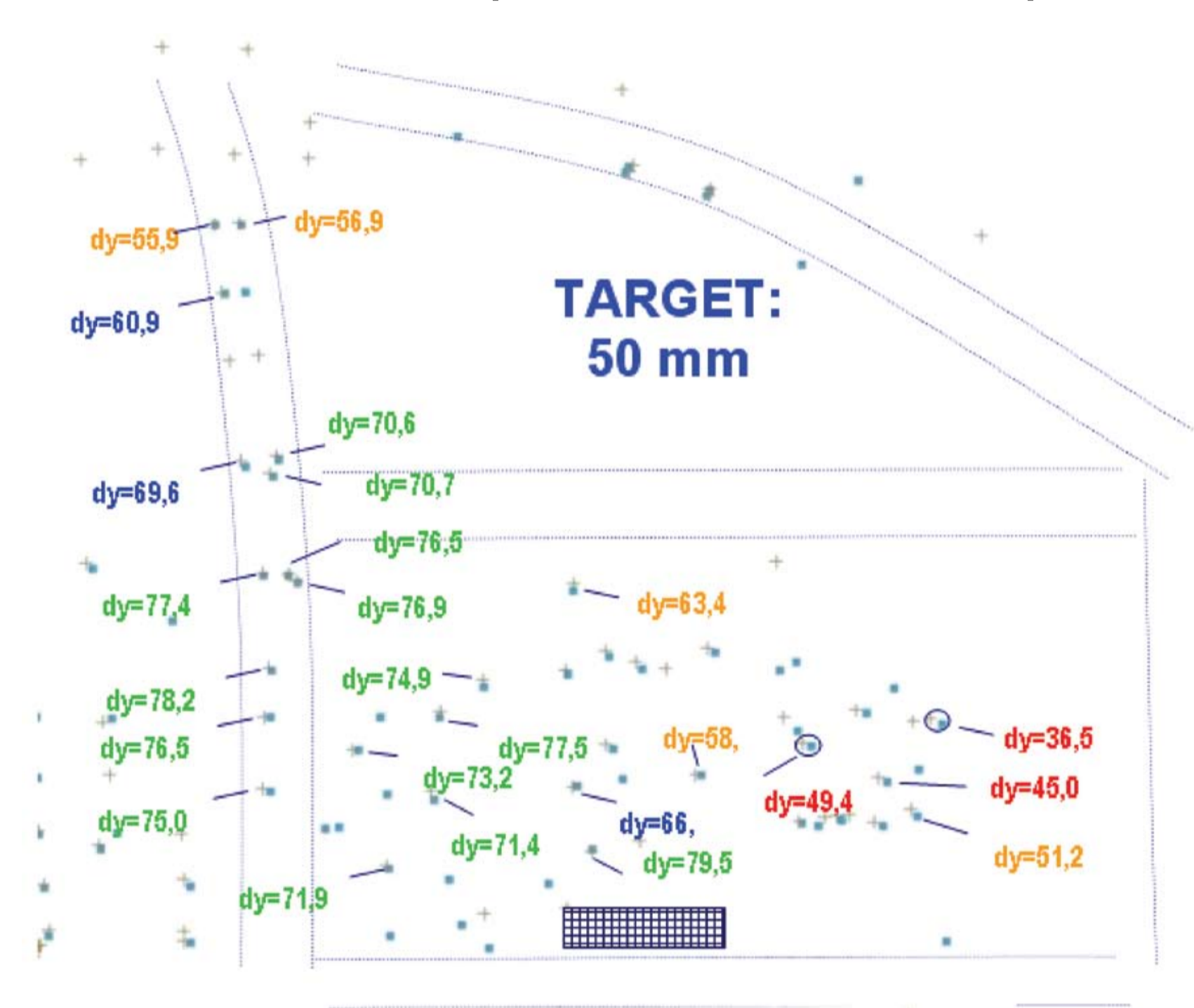
TECHNICAL DESCRIPTION

Objective

Within APROSYS SP6, a pre-crash system for side impact was developed. In rough terms, a pre-crash system comprises a sensor, a data fusion unit and an actuator. The incoming impact (a car, a motorcycle, a pole) is sensed by the sensor, which transmits this information to the decision unit. When impact is imminent, the actuator receives a command to act. Now, the pre-crash actuator occupies space which in normal driving situation is used by other car functions (e.g. space in door box for glass travel) This sharing of functions enables a pre-crash system to be more powerful than actual passive solutions. For APROSYS it was decided that the actuator should apply for structural performance only, on top, the actuator was required to be reversible. By this, any damages caused by the deployment especially at false alarms is considerably reduced.

undeployed state stands upright and does not hinder the normal travelling of the glass. When fired, this beam rotates into a horizontal position filling the complete door. The second part of the actuator is a tube with a popping out bolt which is mounted transversally above the crush box. In normal driving conditions the space between seat and door is free, when deployed, the bolt creates a tight engagement of the door and the transversal tube mounted in the seat. The release of the bolt uses the principle of Shape Memory Alloys (SMA). The SMA wire being electrically heated in a precise temperature domain, shrinks and by this activating the mechanism for the bolt to be pushed out in a very small time span. The activated system forms a consistent chain of parts able to direct loads from the impacted door to a stiff region on the unstruck side. By this the actuator system is installing a new load path which unloads the B-pillar.

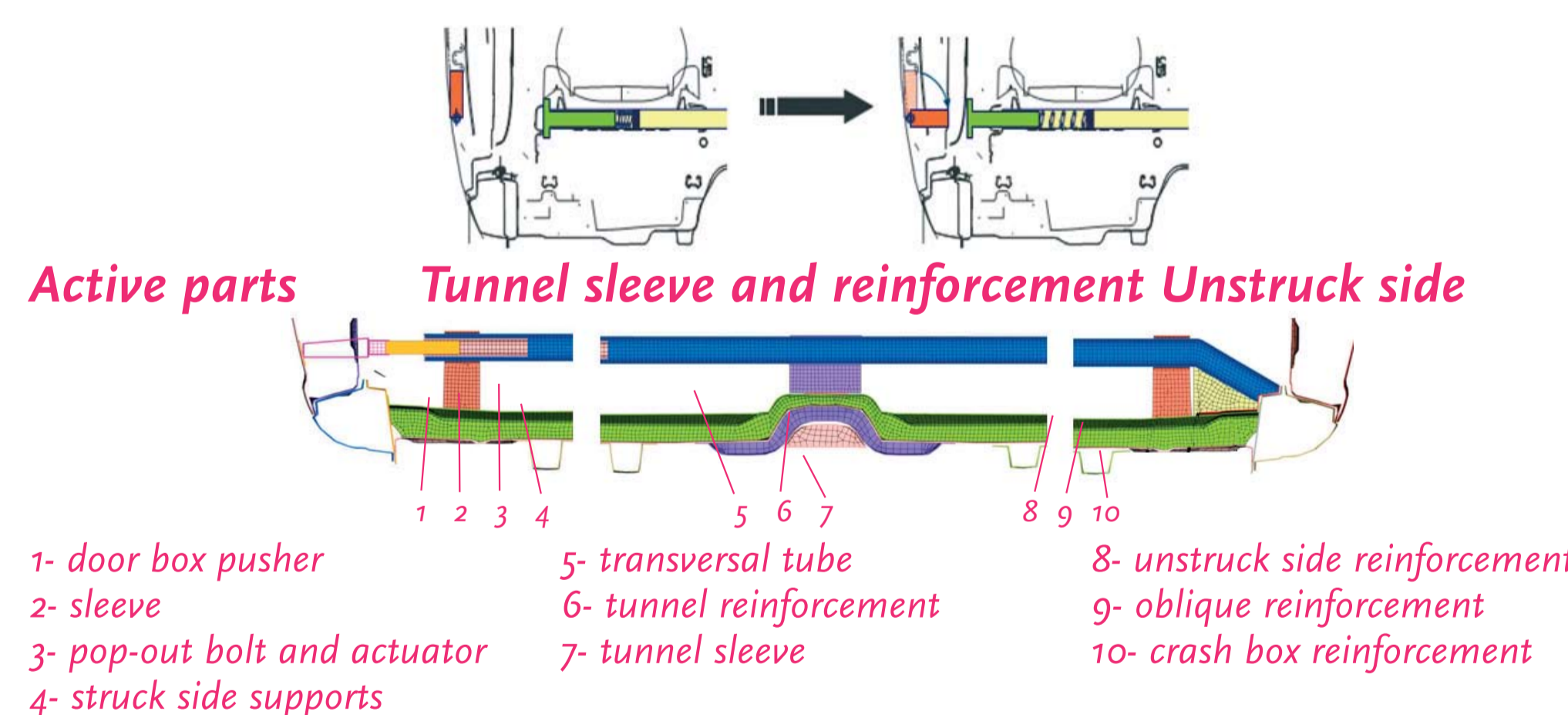
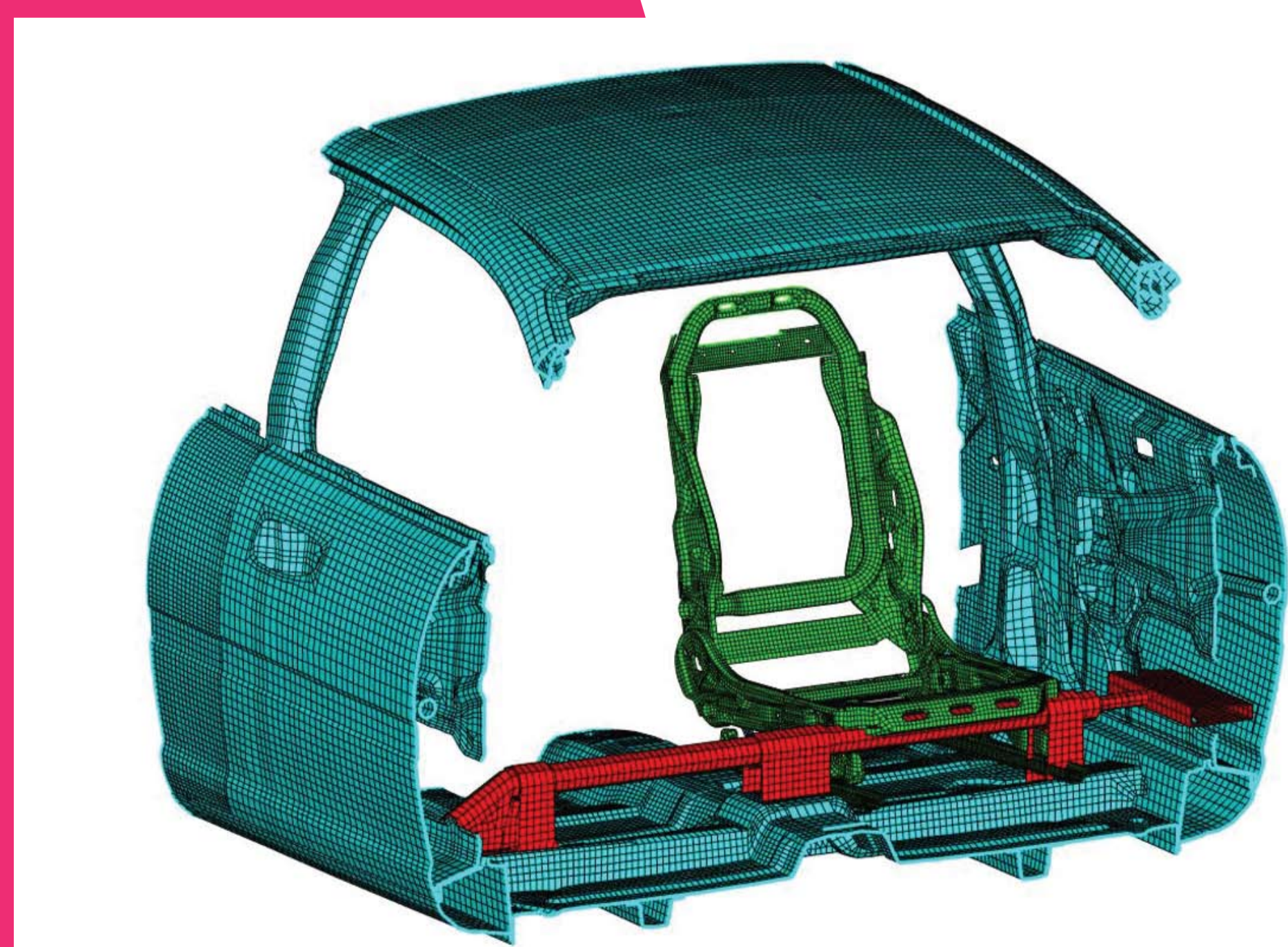
implemented actuator, i.e. the intrusion reduction. The intrusion reduction amounts to more than 50 mm and is spread all over the door but especially where the occupant sits. This translates in valuable survival space for the occupants!



The reduction of deformation velocity of the door in critical regions for the occupants (corresponding to thorax and abdomen) rises up to 2 m/s. The intrusion is reduced in the regions where the occupant's life is jeopardised!

Conclusions

- The actuator system enables to increase the side impact crashworthiness, such as:
- restraint systems have more space and time to deploy more efficiently (e.g. airbag);
 - contact time is delayed and with this contact forces are reduced as well as the other biomechanical values;
 - intrusion is reduced exactly where the occupant sits, survival space and time are gained;
 - a new load path changes the crash modes of the side structure.



Results

The actuator performance was assessed based on numerical results and crash tests, using the full car model of the DC Neon model year '94-'99. The Figure shows the differences of intrusion in a reference car without actuator and a car with

Approach

The pre-crash actuator mainly consists of two parts: a rotating door beam which in an

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