LIGHT CAR AND HEAVY TRUCK SAFETY (ACTIVE / PASSIVE SAFETY)

Zans Butans

Institute of Automobile Transport, Latvia

Keywords: Passenger car, truck, traffic, active safety, passive safety, compatibility, car handling, stability, partner safety, self-defence.

Nowadays, while traffic intensity is constantly increasing, also interest and discussions about car and truck safety improvement possibilities become more and more significant. Despite the fact that both cars and trucks daily use the same public roads, many essential requirements and safety systems are different.

Thesis of my work is related to the research of automobile automotive collision energy and the analysis of car's safety influencing factors. Therefore, today I would like to give some insight into the most essential car safety issues and into the most innovative trends in resolving them.

While working on passenger car body construction, equally much importance is given to both - active and passive safety systems. The main emphases of the active safety systems are aimed at provision of car handling assistance functions. Mainly those are ABS (anti-lock breaking system) which keeps the car handling under intensive braking conditions, the ESC (Electronic Stability Control), which maintains the vehicle's stability during fast manoeuvres, ASR (Anti-Slip Regulation) which controls the skid of driving wheels, as well as other systems.
Statistics show that road traffic accidents more frequently occur between the middle class and middle - light-class vehicles. Although the number of cases of collision between light class and heavy class passenger cars is not the greatest, unfortunately in terms of safety it has the biggest difference. To be able to provide better protection in case of collision between light-class and heavy-class passenger cars is necessary to think about compatibility of both vehicles. Front part constructions of all passenger cars are constructed basing on progressive line of the collected energy amount, which is shown in the figure 1.

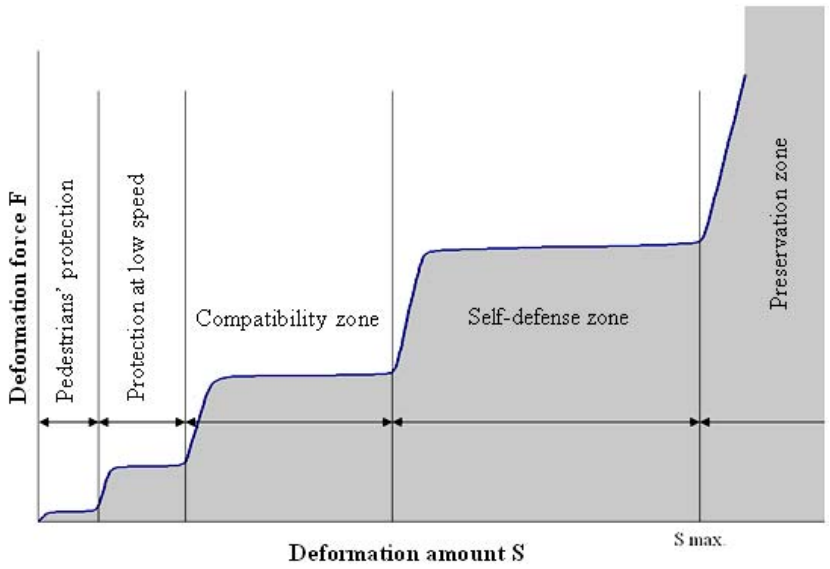

Figure 1

If a collision occurs between a heavy-class and light-class passenger cars, heavy-class vehicle has to ease division of collision partner's kinetic energy and collision forces. This curve represents the principle activity of forces' compatibility zones. Compatibility must be fulfilled in four zones.
The first zone is external and relatively soft deformable elements of the car body, which are designed to protect pedestrians and cyclists in case of collision.

Function of the second zone is provided for collisions at low impact speeds, such as a collision with a relatively hard, non-deformable subject at relatively low speed (5 km/h). In this case, the energy is taken by damping elements, which are located behind the front safety bar (bumper).

The third is compatibility zone, which enters into action if the collision partner's car safety criteria are met. Otherwise, under conditions that the collision occurs between one category vehicles or with heavier vehicle/object, this zone performs as self-defence zone.

The fourth car safety zone is the self-defence zone, which takes care of passengers' safety.

The last and the most important zone, which is shown in Figure 1, is the preservation of survival space in the car.

Besides, while working on a heavy truck construction, more emphasis is given to active safety systems. Also heavy truck deformation forces are not divided in that well marked zones of deformation forces' amount as it was previously shown in case of passenger cars.

Heavy truck is both work and living space for the driver, where he stays for long periods. Therefore, not only provision of stability assisting systems on a heavy truck is an important question, but also driver attention and fatigue detection systems, as well as systems that fix barriers on the road. The systems like vehicle safety distance warning system (vehicle safety distance calculation between moving cars), emergency braking system, road lane detecting systems, collision avoidance systems (warn the driver of any dangers that may lie ahead on the road), which work online, as well as other safety systems.
Constructing a heavy truck, passive safety systems are designed to take care more about partner's protection than about self-defence, because, basing on statistics, cases of collision between heavy trucks are relatively rare. Since the clearance of heavy trucks in comparison with passenger cars is considerably higher, the question of shape compatibility for heavy trucks is very significant.

This issue is being solved by installing lateral protective devices (Figure 2) on heavy trucks, which are provided for energy damping in case of lateral collisions, as well as hold passenger car's from "running" under the heavy truck. These lateral protective devices also protect pedestrians, cyclists and motorcyclists from getting under the heavy truck.

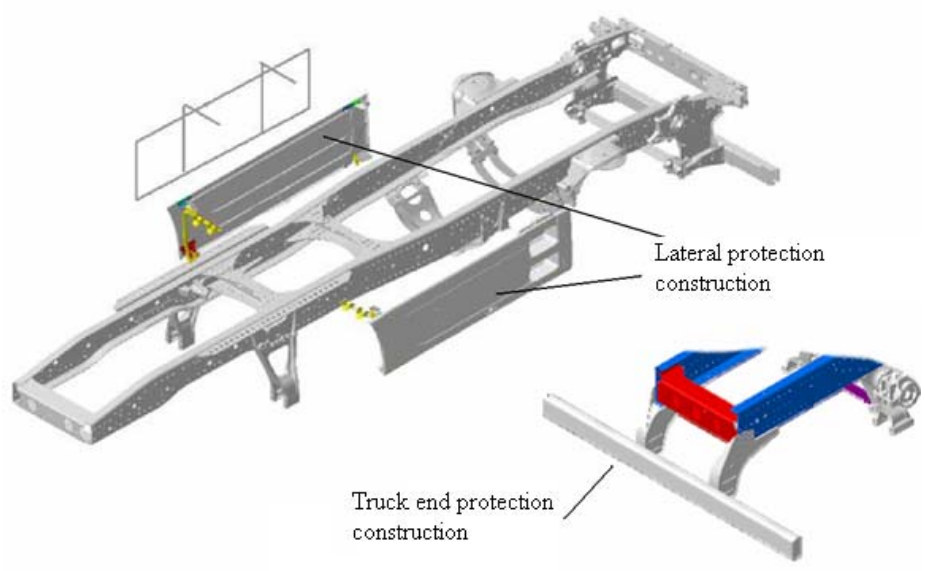

Figure 2

Heavy truck front part construction is designed stable and low, which also performs shape compatibility functions, Figure 3.

Usage of these constructions allow to improve also aerodynamic performance of heavy trucks, thus reducing air resistance, fuel consumption and improving the vehicle's pace.

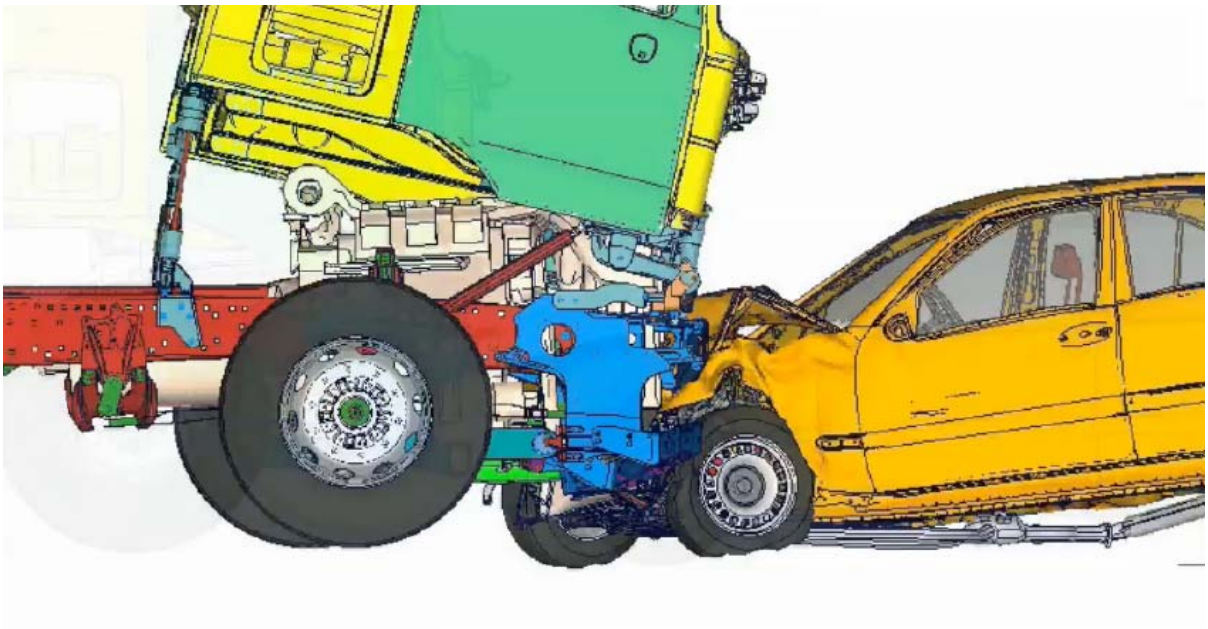

Figure 3

Conclusions

Recently, light class passenger cars are becoming more and more popular in the market, which actualizes light class and heavy class passenger car passive safety requirements in case of collision. As the main criteria for the improvement of passive safety is the necessity of common requirements for car force and shape compatibility, which would make possible to significantly improve performance of collision safety.

Nowadays also vehicle active safety systems are being improved by developing the existing ones and creating new car handling assistance systems.

References

1. Huang M. Vehicle Crash Mechanics. – CRC Press, USA 2002. - 481 pg

2. Baake U. Vorlesungumdruck Industrielle Nutzfahrzeugentwicklung in Globalen Maerkten, Stuttgard, Unterturkheim Daimler, 2008. - 844 pg