2ND WORKSHOP ON APPLIED AND SUSTAINABLE ENGINEERING

THE IMPACT OF THE MASS AND VELOCITY ON THE OVERLOAD DURING COLLISION OF A CAR WITH CONSTANT BARRIER

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SUMMARY

The hereby article discusses the issues of reconstruction of traffic accidents. It describes the process of collision with a constant barrier. An analysis of overloads that might contribute to various body damage, created during the collision with different velocity and vehicle mass was carried out.

INTRODUCTION

In nature collisions of bodies are quite common. The consequences of body collisions can be positive/desired (in the process of material grinding) and negative (traffic accidents). In case of the negative ones, it is necessary to undertake proper preventive measures that shall prevent or limit the destructive influence onto the vehicles or accident participants. The best solution is to prevent tits occurrence through introduction of traffic rules, collision-free crossroads, proper road infrastructure etc. (Wicher J., 2012).

Safety is most important from the perspective of humans. The threats connected with the car industry are growing. This happens because of the increasing number of cars on the roads and the possibility of them reaching considerable speeds. When a vehicle hits a stiff barrier, the process of its deformation takes place. The course and reach (depth) of such a deformation depends, among others, on the vehicle mass, its collision speed and stiffness of the car supporting structure (Prochowski L., Żuchowski A., 2006). The thus created vehicle deformation contributes to dispersion of collision energy and therefore to transfer of the dynamic load by the car construction elements onto the people present in the car (Wicher J., Stawicki R., 1999).

The level of safety offered by cars has a major influence on the clients' decisions concerning car purchase. The basic source of information are collision tests conducted by independent agencies. Passenger car crash tests are usually conducted in closed laboratories of major car companies. The most popular organization that developed standards and conducts crash tests on their basis is Euro NCAP.

Another way of obtaining the information necessary for conducting analysis of the course and consequences of a collision of mechanic vehicles with each other, with other traffic participants and with field obstacles is conducting a simulation using proper software (McHenry R. R., 1993).

The software used in the hereby work was V-Sim used for analysis of the influence of vehicle mass and velocity on safety during collision with a constant barrier.

RESULTS OF RESEARCH

The software used in the hereby work was V-Sim used for analysis of the influence of vehicle mass and velocity on safety during collision with a constant barrier. A simulation of collision with a constant barrier was conducted for Skoda Felicia. The simulations were carried out for active environment elements: surface type and parameters (road, roadside) - dry asphalt, μ: 0,80/0,75, resistance: 0,015; ground inclination - horizontally, height 0,00 m; speed and direction of wind - wind-free.

The simulation using V-Sim software was conducted for varying vehicle velocity and different total mass. In case of the passenger car, the vehicle mass was determined by changing the number of passengers (the mass of one passenger-68kg). In the first stage of the tests it was assumed that at the speed of 30 km/h the load-free vehicle will manage to brake directly before the barrier. The situation view of the place of the accident is presented in fig. 1.

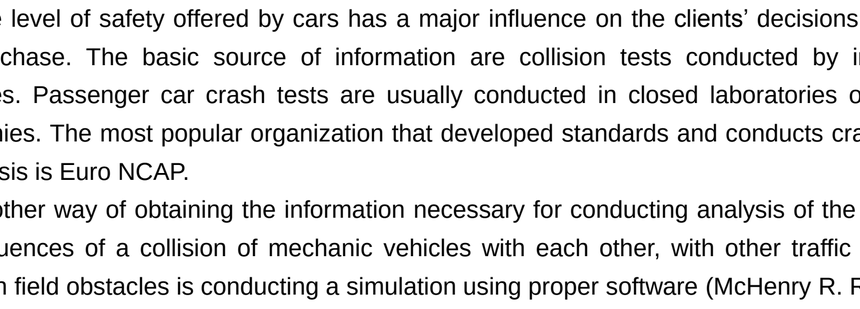

Fig. 1. Plan of the place of the accident made in V-Sim program

Table 2 presents the results of forces (maximum overloads) that affect the vehicles at the moment of collision with the barrier, with different initial velocity (at the moment of beginning the braking) and different loads

Table. 1. The overloads affecting the vehicle at the moment of collision

Initial velocity [km/h]	**Max overload [g]**		
	Min.- without the load – only driver	½ of the load 2 passengers	Max. load 4 passengers
30	0,8	18,1	16,6
50	33	30,6	29,6
70	47	44,5	42,1
90	62	57	53

Fig. 2 presents the influence of vehicle initial velocity onto the maximum overload during collision with a constant barrier.

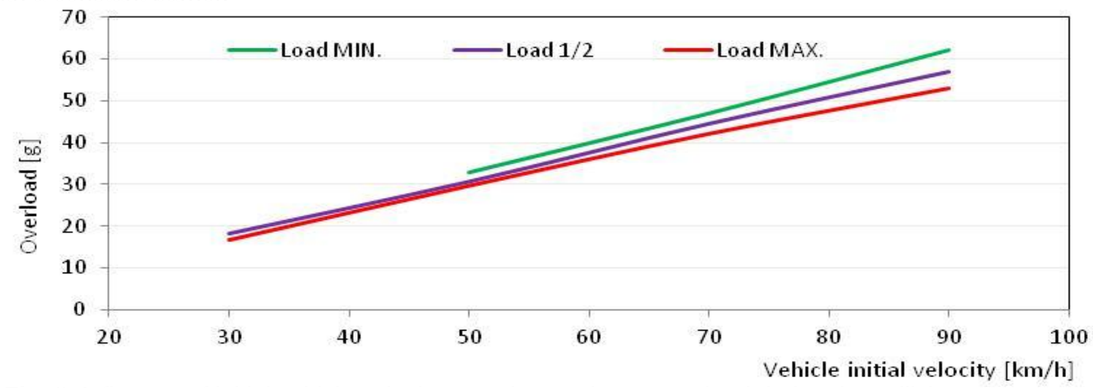

Fig. 2. Influence of initial vehicle velocity onto the maximum overload during the collision with a barrier

Exemplary course of the velocity, path and overload in force during collision with the initial velocity of 70km/h of a vehicle with maximum load (4 passengers), is presented in fig. 3.

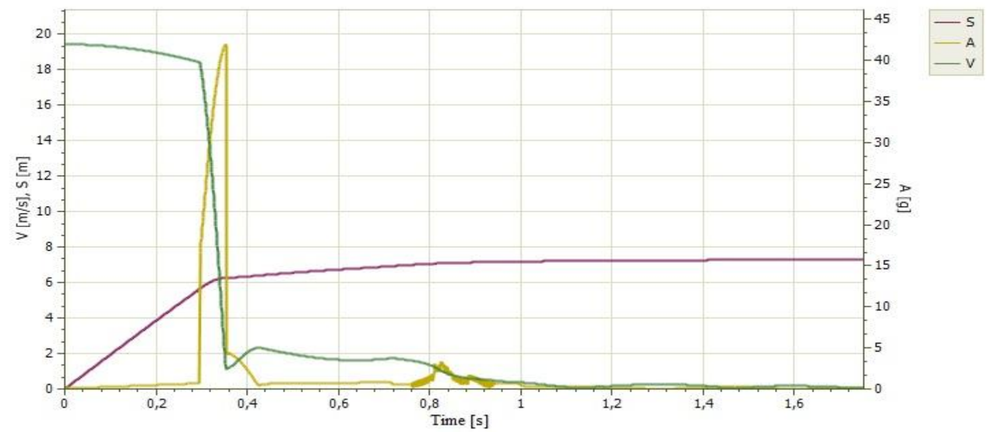

Fig. 3. Influence of initial vehicle velocity onto the maximum overload during the collision with a barrier

Fig. 4 presents exemplary values of deformations of a vehicle with maximum load (4 passengers) traveling with the initial velocity of 70km/h.

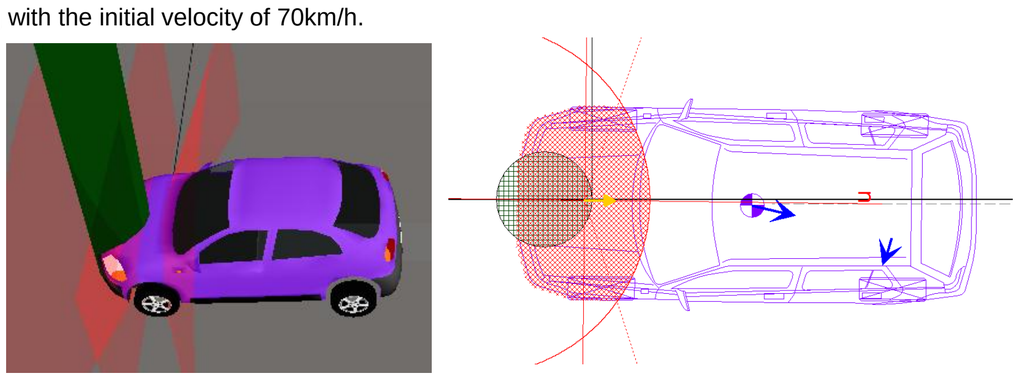

Fig. 4. Value of deformation of vehicle with maximum load (4 passengers) during collision with a constant barrier - initial velocity :70km/h

CONCLUSION

The conducted analysis should serve as a warning to those who are often unaware of the danger they create on the road by behaving irresponsibly. What is particularly dangerous to the health of the travelers are the overloads occurring during collision with barriers. As the vehicle velocity increases, the value of the maximum overloads grows. Depth of deformations, even with relatively low speed of 50km/h, causes deformations that reach as far as the whole vehicle engine chamber.

LITERATURE

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