PRESENTATION ON THE ADVANTAGES OF SAFETY BELTS IN HEAVY TRUCKS, BASED ON ANALYSIS OF REAL LIFE ACCIDENTS AND THE RESULTS OF A CRASH TEST WITH A MERCEDES BENZ ACTROS 1853

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ABSTRACT

In Germany, safety belts have been mandatory even in heavy trucks since 1992 in accordance with § 35a of the StVZO (Road Traffic Vehicle Licensing Act). The § 21 of the StVO (Road Traffic Act) stipulates the compulsory use of such belts for truck occupants. Although manufacturers have been equipping trucks with suitable belts for years in accordance with the licensing regulations, until now only very few occupants of heavy trucks (estimated at less than 5%) actually use the fitted safety belts.

Accidents in Germany involving trucks are clearly pointing out a benefit of restraint systems. Therefore 109 accidents involving trucks (maximum permitted weight over 7.5 t) were investigated in-depth. Ejected truck occupants were registered in 11 cases (10 %) whereby in 5.5 % of these 11 cases the occupants were killed, **Fig. 1**. Truck occupants face here the greatest probability of being killed in an accident. In 40 cases the truck occupants were jammed in the truck´s cabin with the consequence that 33 % of them were killed. In 58 cases no truck occupants were ejected or jammed. In 7 % of these cases the truck occupants were killed.

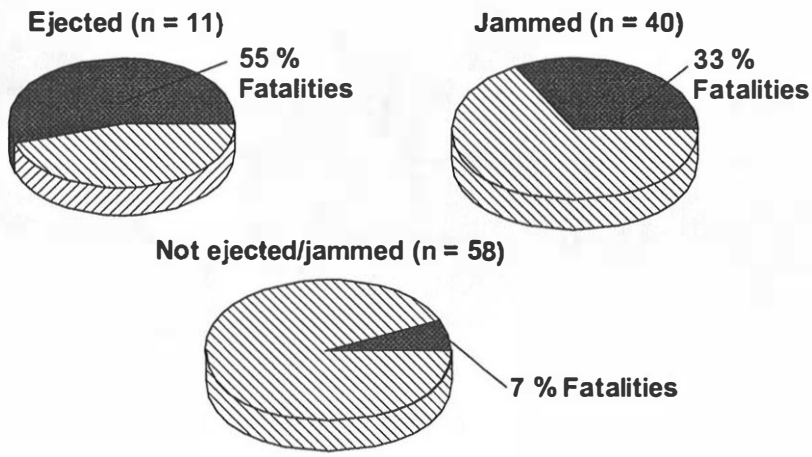

Fig. 1: Comparison of fatality risk in real world accidents between ejected, trapped and neither ejected nor trapped truck occupants

A relevant scenario involving the collision of a Mercedes-Benz Actros 1853, with a mass of 7.2 t and at a speed of 30 km/h, against the rear end of a trailer platform with a mass of 21 t, was simulated in a crash test. The biomechanical loadings acting upon the occupants were measured by means of two Hybrid III dummies (50th percentile male). The dummy in the driver's seat was restrained with the safety belt,

whilst the co-driver's seat was occupied by a not belted dummy, **Fig. 2**. Film evaluations provide a supplementary record of the sequence of movements.

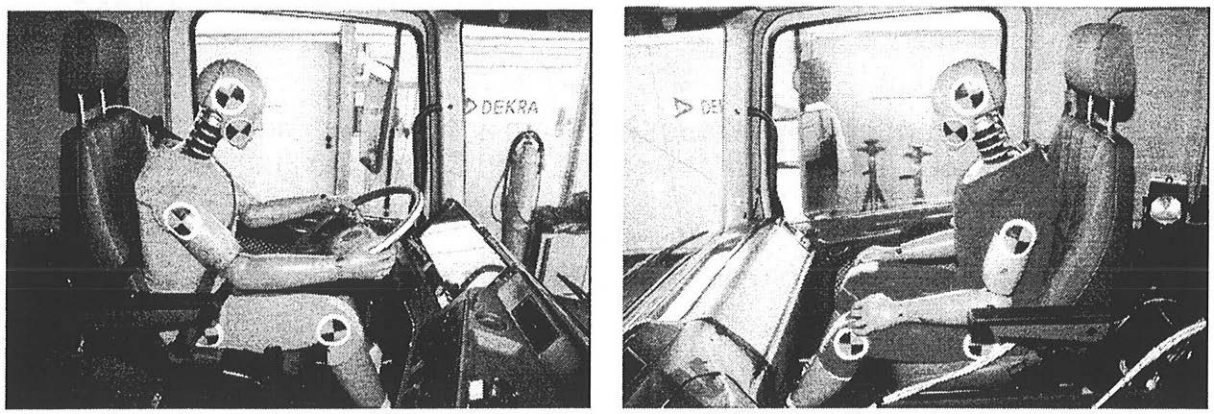

Fig. 2: Belted driver dummy and not belted co-driver dummy

The head of the belted driver dummy reached the position of maximum deflection at t = 0.1 s after the collision start without having an impact and then commuted backwards towards the head rest. The head of the not belted co-driver dummy impacted the instrument panel at t = 0.15 s after the collision start with the chin and at t = 0.16 s with the face. At t = 0.65 s the windscreen, which was loosened by the collision, fell on the dummy´s back part of the head.

Fig. 3 is showing the constellation for the moment when the impact started and the final position of the driver and co-driver dummy. Although the co-driver dummy was not fully ejected an injury-reducing effect of the seat belt was clearly demonstrated also for this situation.

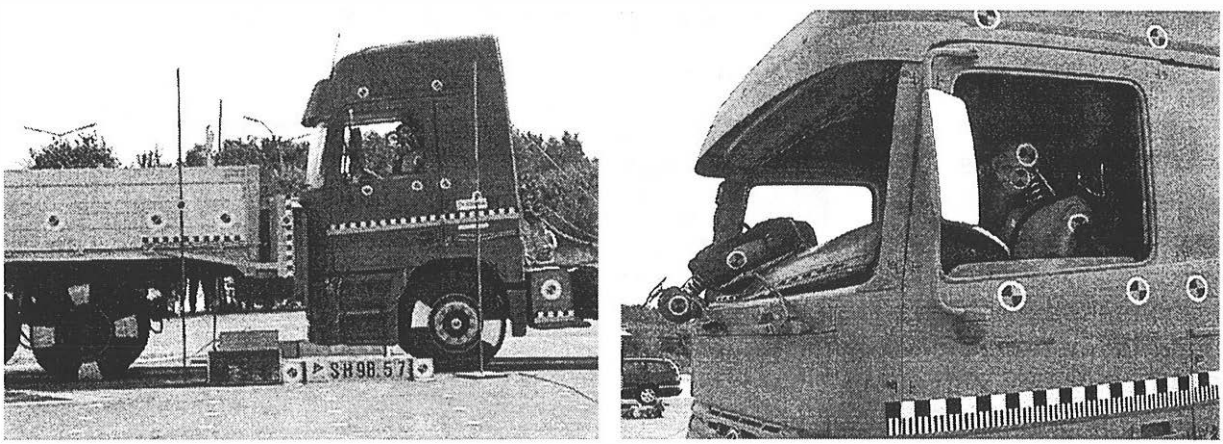

Fig. 3: Impact constellation and final position of the driver and co-driver dummy

In the poster there are presented the decelerations and damages of the truck, the measured stresses of the dummies as well as the results from the film evaluation of this test. The knee stresses of the not belted co-driver dummy are of primary interest. With the deceleration of the upper body in conjunction with the corresponding mass and the length of the upper leg as an active lever arm the moment acting on the knee joint is calculated as M_{Knee} = 566 Nm.