

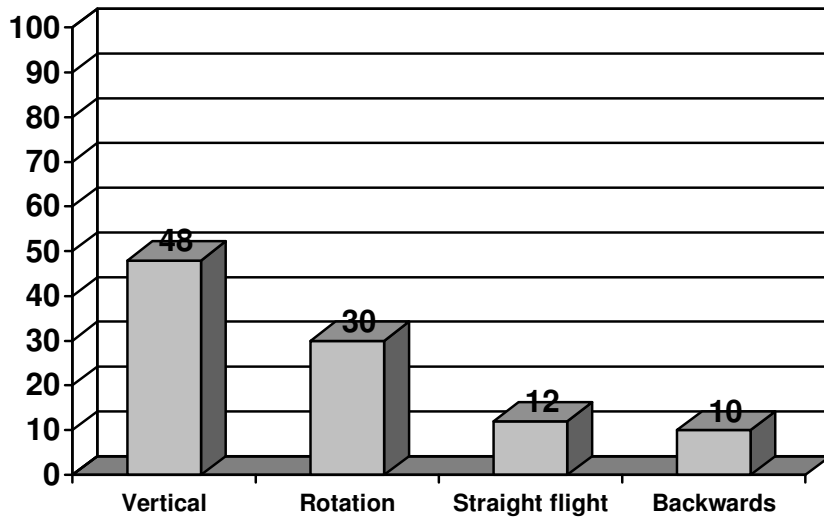
Back protectors in newly certified paraglider harnesses are becoming progressively thinner, smaller and lighter. In some cases it is evident that the protectors have been primarily designed to fulfill certification requirements. Certification testing of protectors is performed by mounting the harness on a dummy and recording the forces vertically transmitted through the protector on impact. Protectors offer the best energy absorption in this configuration. Protection at the back, or by the hips is often minimized or in some cases not present at all. The current trend to minimizing protection must be viewed critically, and could only be supported when practical evidence indicated that only vertical protection was necessary.



Current protector testing according to the LTF. Protector damping is measured after impact from 165cm (dummy base to floor). The deceleration (G) acting vertically on the spine is measured at impact. Limits: Maximum 50G must not be exceeded, a period of 7 ms must not be exceeded at 38G and a period of 25ms must not be exceeded at 20G. Current testing simulates a pilot crashing vertically on his / her bottom.

Looking for representative data, the DHV sent a questionnaire to all pilots who reported an accident with spinal injuries in the years 2009, 2010 and 2011. 72* replies were received from 122 pilots who were sent the questionnaire. The results are an indication of what type of accident scenarios lead to spinal injuries.

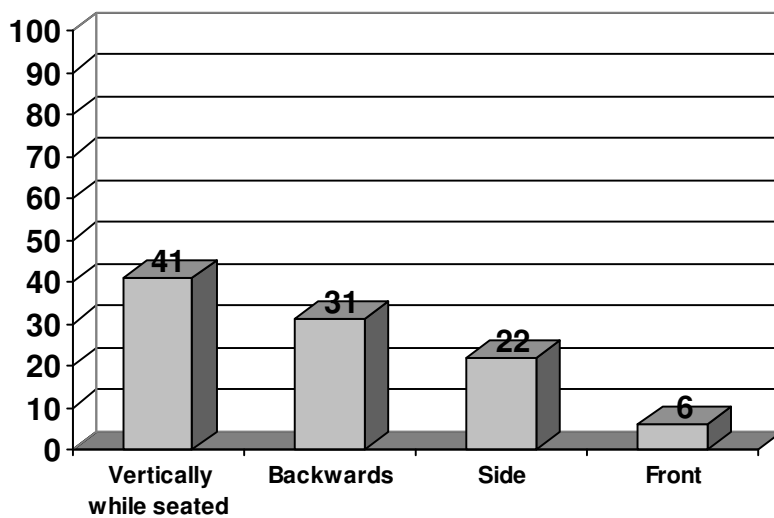
1. Impact direction (%)



Pilots were first questioned to the direction of travel before impact. Results indicate where harness protection is particularly relevant.

In almost half of all reports, the direction before impact was noted as vertical or near vertical. This was followed by impacts from rotational motion. Harnesses offer little protection for impacts from straight flight. Several of the questioned pilots noted that harness protectors which did not reach to the front edge of the seat board were painfully missed.

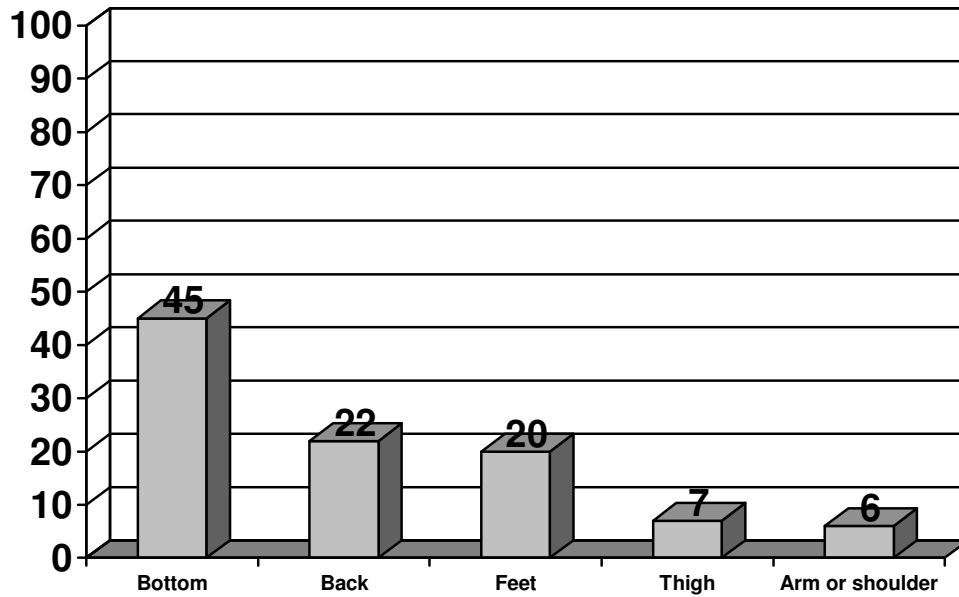
2. How did the impact occur? (%)



* Not all of the 72 pilots answered all questions

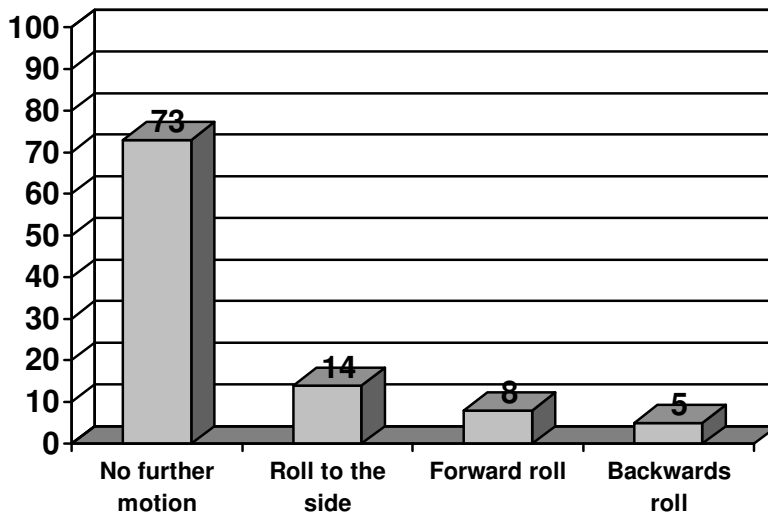
Most impacts occurred vertically, with the pilot in a seated position similar to the way in which protectors are tested during certification. However, it must be noted that in more than half of the reports, impacts occurred to regions which are not evaluated in certification testing (back and hips). The questionnaire asked additionally if the angle of impact was less than or greater than 45°. Reports with angles of impact greater than 45° were seldom.

3. Which bodypart first impacted? (%)

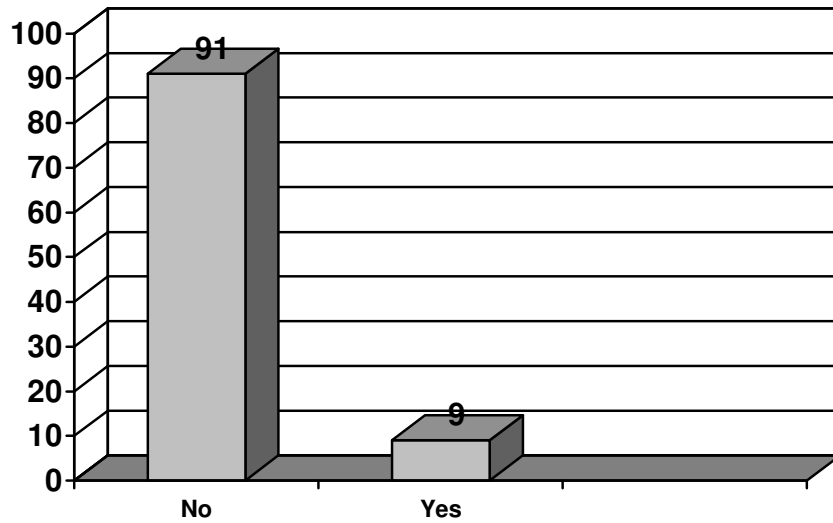


The trends indicated in the first two diagrams are continued here. Vertical impacts with pilots in sitting positions are most common.

4. What occurred after the initial impact? (%)

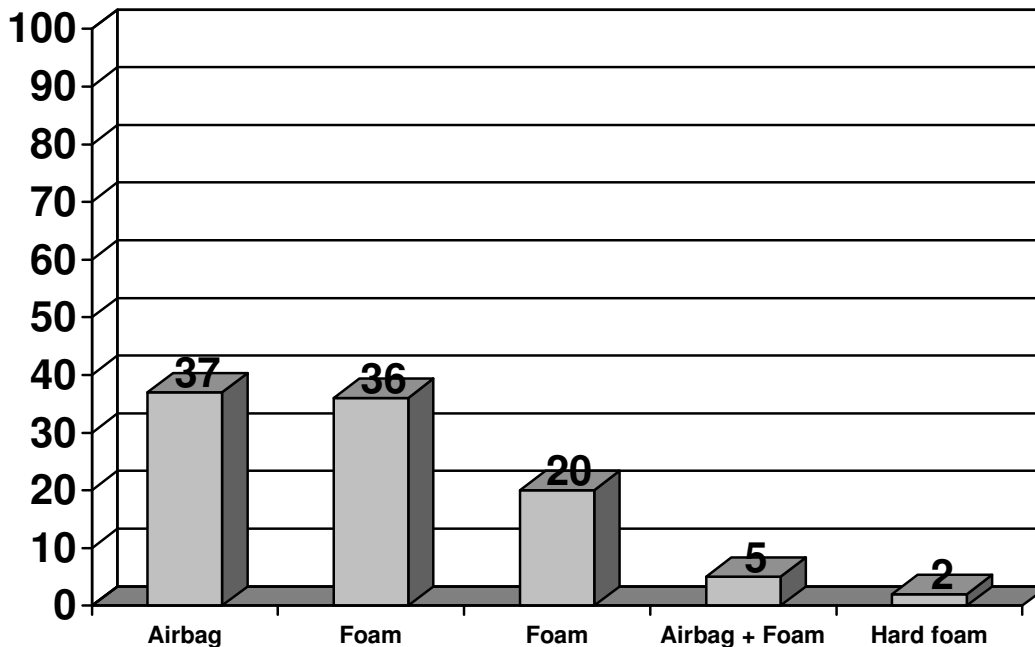


5. Did the protector have secondary impacts after the initial impact? (%)



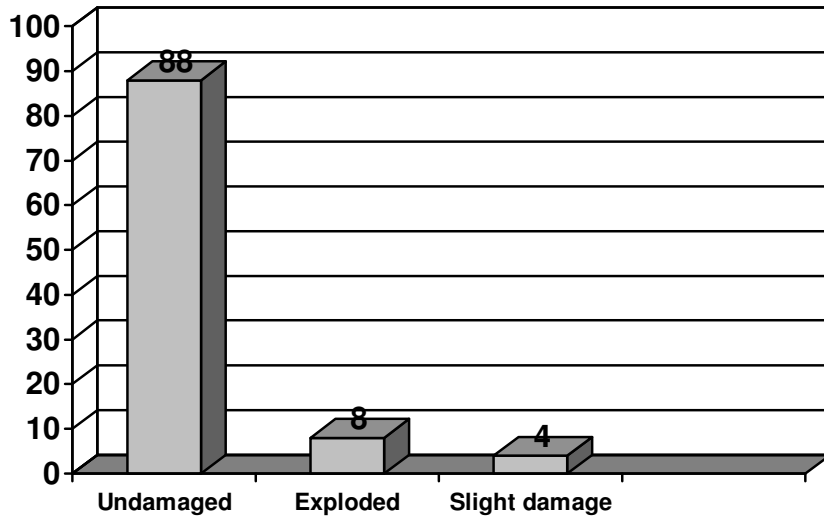
The goal of this question was to find out if harnesses are often required to provide protection for multiple impacts. This is problematic for airbag protectors, where the full damping properties are normally only present for the initial impact. Results indicate that a quarter of all impacts are combined with the pilot rolling over, but that the protector was needed for a secondary impact in less than 10% of all cases.

6. What type of protector were you using? (%)



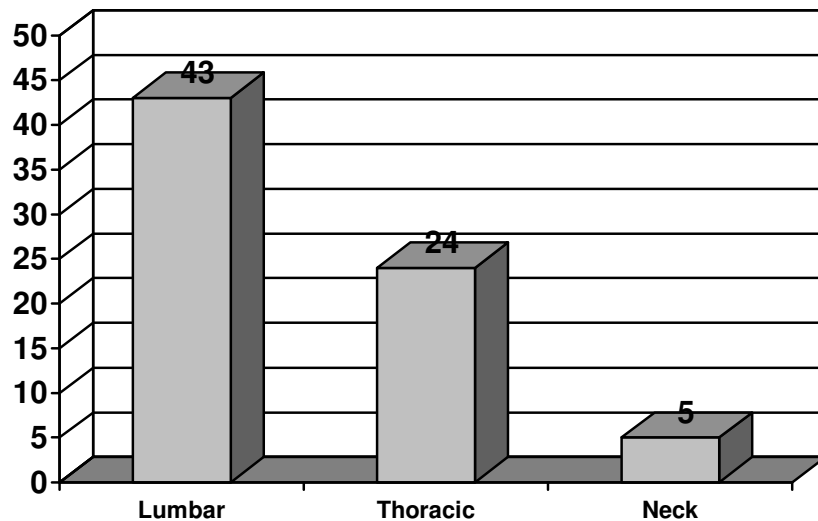
The use of different protector systems is indicated in this diagram.

7. For airbag and airbag/foam protectors: Was the protector damaged by the impact? (%)



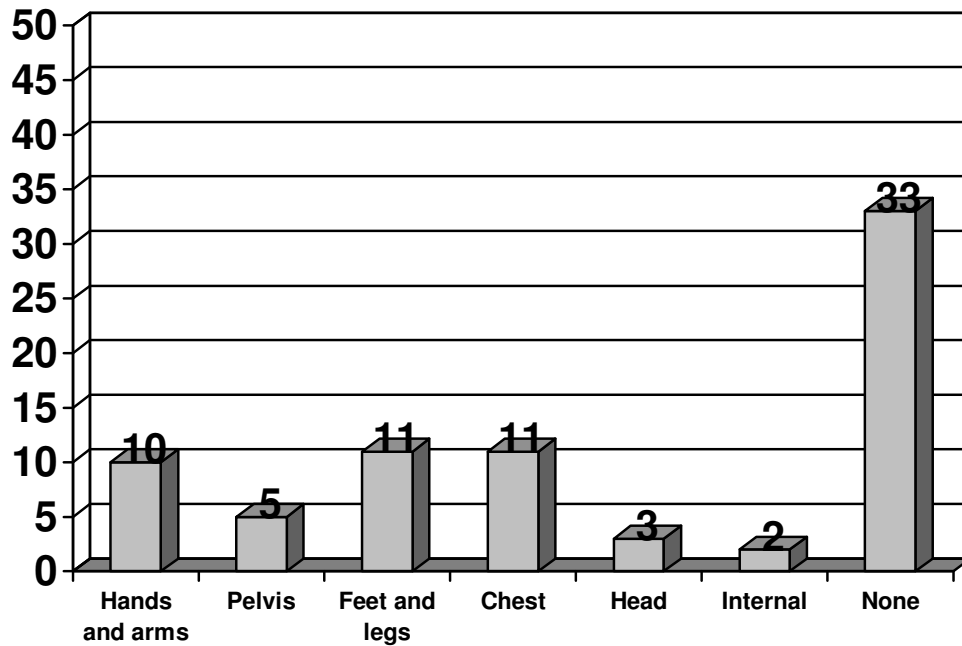
Results indicate that the percentage of exploded airbags lies under 10%.

8. Where did you suffer spinal damage (multiple answers) (absolute numbers)



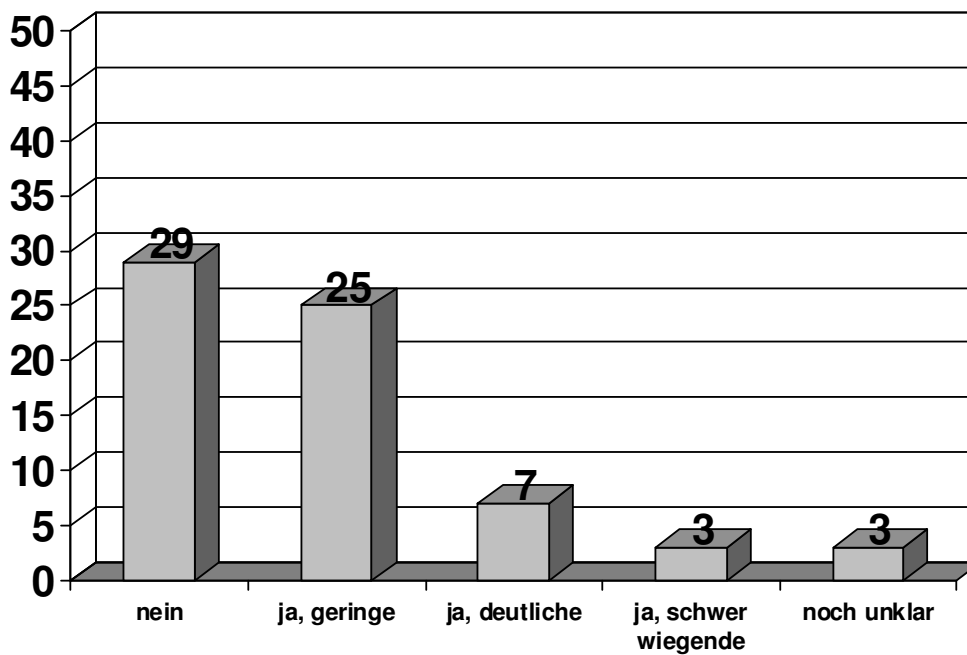
Injuries to the lumbar spine are most common, as to be expected from the number of seated impacts. Injuries to thoracic vertebra (chest region) are mostly due to energy transmitted through legs and other vertebra rather than from direct impact. Results indicated a direct relationship of the number of neck injuries and pilots rolling after impact.

9. Additional injuries (multiple answers) (absolute numbers)



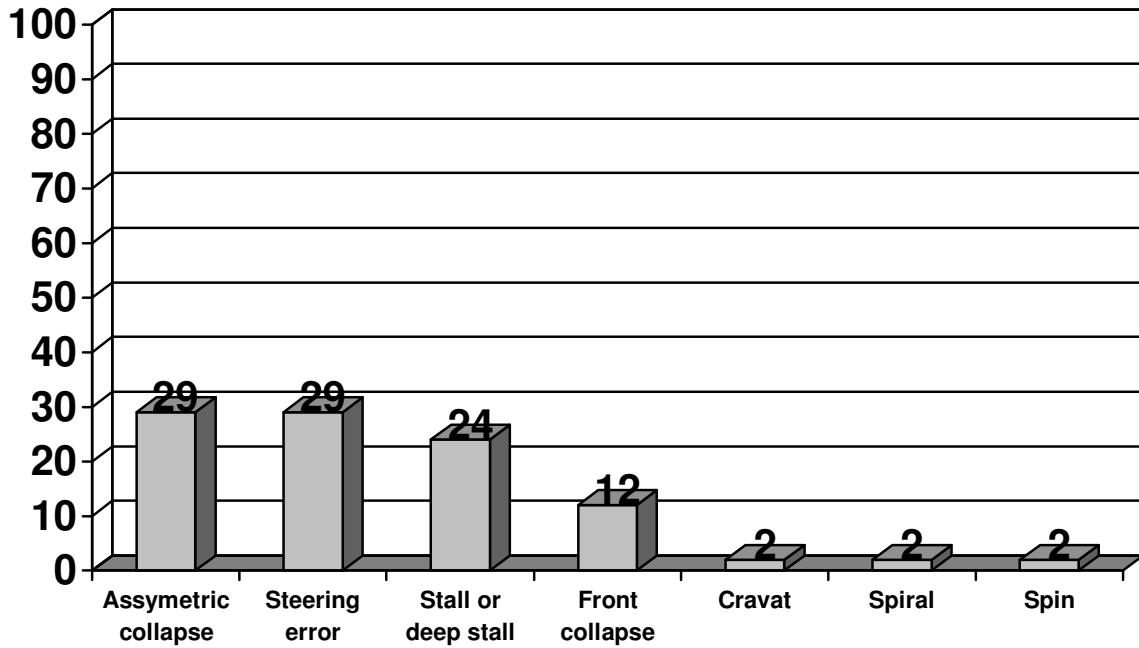
Most reports indicated no further injuries. This was mostly the result when impact occurred vertically in a seated position. Side impacts were often accompanied with broken hands, arms and hip injuries. Pilots who were thrown or rolled after impact often suffered from chest injuries. Particularly hard impacts were accompanied by multiple injuries.

10. Do you suffer with a permanent disability due to the accident? (absolute numbers)



Of the 72 pilots who answered the questionnaire, 3 suffer with paraplegia whereas 29 have made a full recovery after their accidents. As with all statistics, the results here have two sides: positively 54 pilots have no or few problems after having suffered spinal injuries after an accident, negatively over half of all pilots suffering spinal injuries still have permanent medical problems to live with.

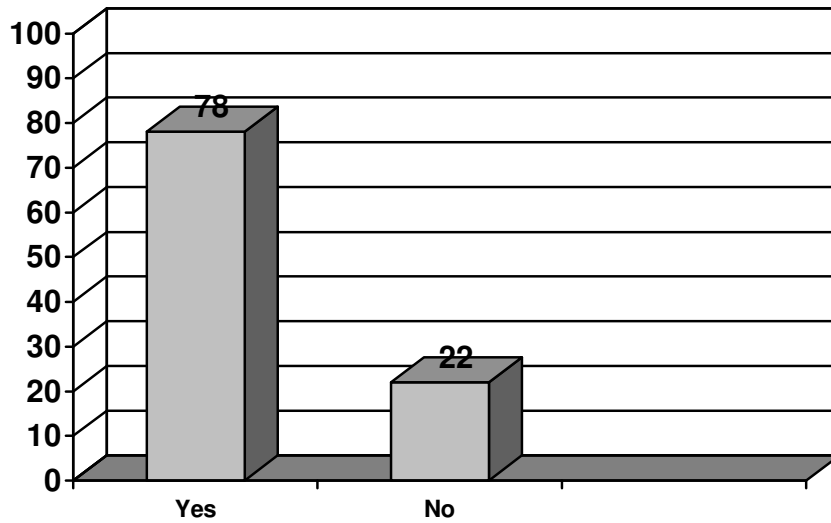
11. What was the cause of your accident? (%)



Additionally: Meteorological conditions 3, technique 1, knotted lines 2, obstacle contact 3.

Canopy collapses (asymmetric and frontal) are the most common cause of accidents leading to spinal injuries. These are followed by pilot errors (e.g. insufficient braking during launching, steep turns during landing etc.), and then stalls (full or deep) due to extreme braking or equipment defects. Other extreme situations are relatively rare (e.g. impact from a spiral dive) but have particularly severe injuries associated with them.

12. Did you have the impression that the protector helped reduce the injuries you suffered (%)



More than $\frac{3}{4}$ of all pilots were of the impression that their harness protector had helped reduce injuries from their accidents. The rest had clear grounds for their negative answers. The most frequent complaint was that the harness did not offer sufficient protection for side- or back impacts. This was followed by frontal impacts, where the harness offered little or no protection.

Conclusions

Current certification testing for harnesses and protectors are relevant for the most common type of accident (vertical impact, seated position) which occurs in approximately 45% of all cases. 25% of all accidents have a side-impact component, and 25% of all accidents indicate a back-impact. The DHV Technical and Safety department is of the opinion that current testing places too much emphasis on vertical impact testing. In more than 50% of all accidents, side- and back-impacts occur. These results should be carefully considered, and the certification Norm should be revised. Additional impact testing at angles of 30° to the back and side would make for a more realistic testing scenario.

Additional results

Multiple protector impacts occurred in less than 10% of all cases.
Problems with airbags exploding on impact were noted in less than 10% of all cases.

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