W. Klanner, T. Unger
ADAC Technical Centre, Germany

Concept and First Results of the ADAC Accident Eesearch Based on the Data of ADAC Air Rescue Stations

Abstract

The fact that ADAC Air Rescue handles approximately 4,000 road accident missions every year gave rise to set up an accident research programme for which ADAC Air Rescue provides its data. This data is of initial informational quality and will be supplemented by data from the police, experts, fire brigades as well as hospitals and forensic institutes.

Although the number of cases is still rather low, certain tendencies can be identified. The causes for most accidents occur when joining or intersecting traffic, followed by speeding in road bends and tailgating. Many accidents involve HGV rear end collisions, often causing serious injuries, considerable damage and technical problems for the rescue operations. With regard to the various impact types, it has become obvious that most of the extremely serious injuries are inflicted during a passenger car side impact.

In addition, access to and removal of trapped passengers is becoming more and more complicated, partly due to the increasing use of high-strength materials, and rescue operations tend to be more time consuming.

Introduction

ADAC's history in air rescue goes back more than 30 years. Since an average of 10% of 40,000 missions per year are related to road accidents, the idea was to set up an accident research programme based on our collected data.

The project objectives were defined as follows:

- Discovery of accident and injury causes.
- Further development of on-going consumer protection test projects using real accident data.
- Development of new crash test procedures.
- Identification and solution of technical problems in passenger rescue.
- Correlation of in-hospital and pre-hospital diagnosis.
- Support to improve onsite diagnosis.
- Annual report on ADAC accident research conclusions.

Within the framework of a one-year pilot project, the research team was to define and test the required methods to achieve the above targets. The identified method relies on the initial information from ADAC Air Rescue on registered accidents. This is enhanced with data supplied from the police, experts, fire brigades and hospitals and forensic institutes.

The pilot project has been concluded. It was found that the set objectives can actually be achieved using the developed method. The project findings may contribute to further improve road safety.

First results of the ADAC accident research programme

ADAC Air Rescue took care of patients during 33,940 missions in 2005. The illustration in shows the mission spectrum with 14% involving road accidents (Figure 1).

More than half of the road injuries involve car or HGV passengers, 26% are motorcyclists, 11% cyclists and 5% pedestrians (Figure 2).

To identify the most frequent injuries among the accident victims, we referred to the anonymous emergency physicians' protocols from the ADAC

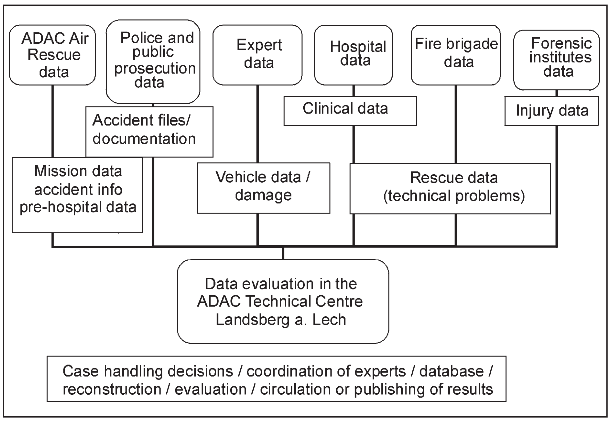

Figure 1: Data sources of the ADAC Accident Research

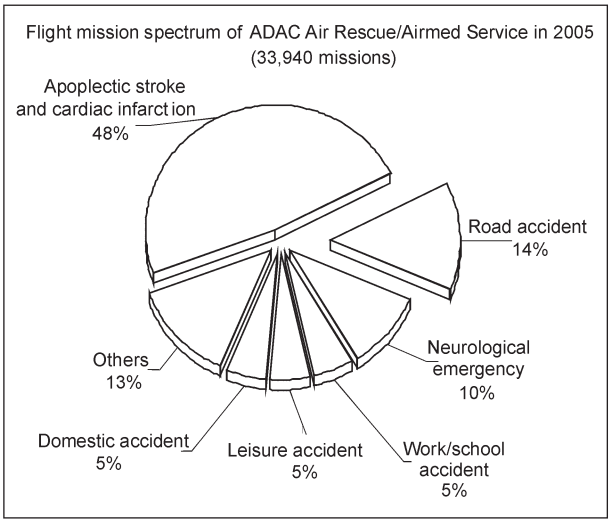

Figure 2: Flight mission spectrum in 2005

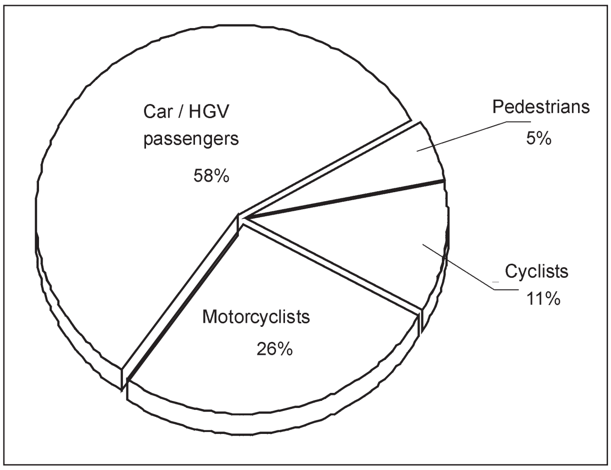

Figure 3: Persons involved in road accidents registered by the ADAC air rescue teams

helicopter crews. The column diagram shows the distribution of the most serious, i.e. life-threatening, and fatal injuries among the individual body parts. The results are plotted for the different groups involved in an accident, i.e. car and HGV passengers, motorcyclists, cyclists and pedestrians.

100% is the total occurrence of the most serious injuries to the individual body areas.

Head injuries are most common in all accident victims. The most frequent and dreaded kind of injury is the serious craniocerebral injury which mostly affects cyclists with a 70% rate. This is a clear indication of how significant it is to wear a helmet when riding a bike.

Pedestrians are also very prone to head injuries when involved in an accident. This supports

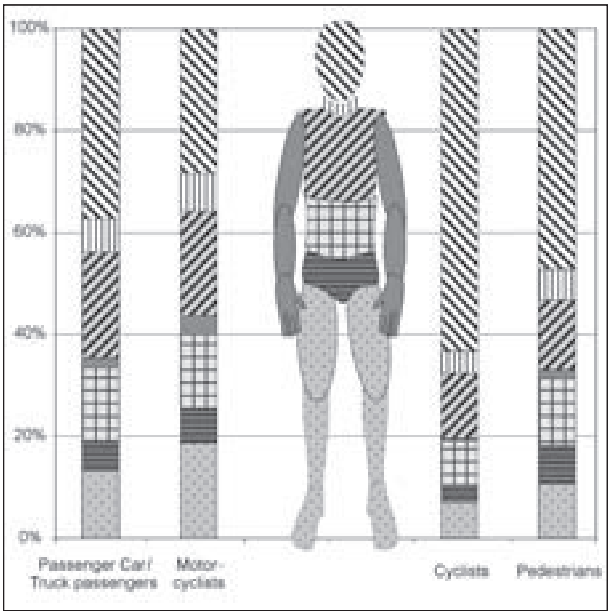

Figure 4: Fatal or life threatening injuries by involved person groups

ADAC's demand for remodelling potential impact zones in the bonnet area to minimise the aggressiveness of vehicle front areas.

Chest injuries range second among the most serious injuries and in most cases imply broken ribs and associated serious lung injuries.

To the exception of motorcyclists, abdomen injuries, mostly affecting the inner organs and involving dangerous internal bleeding, come third.

The third most frequent injury type for motorcyclists are leg injuries. For the other groups these take fourth position. Usually, severest fractures and dangerous complications are involved. Since such injuries often entail extremely long he4ling processes, they must be taken into account in safety developments.

When comparing the data of all ADAC Air Rescue missions in Germany (2005) with the data stemming from only two bases, the random test results are shown to deliver a highly reliable picture of the typical situation in Germany. The selected air rescue bases collect additional important data on road accidents allowing for a more profound analysis of each case. Almost all accident victims recorded at the bases in question have suffered serious injuries (87.5%). Therefore, air rescue data does not provide a complete picture since they primarily relates to severest accidents, whereas the range of general accidents is not covered.

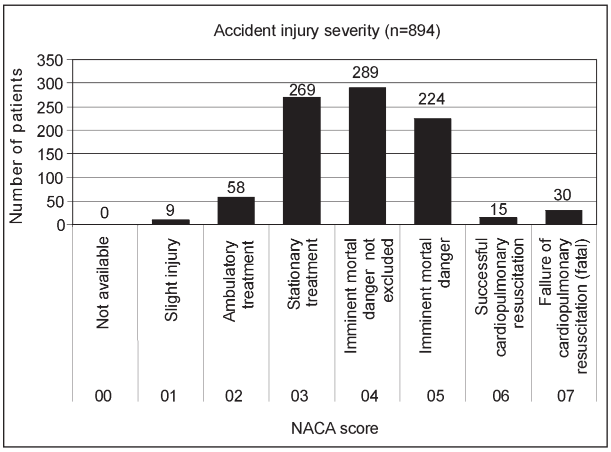

Figure 5: Distribution of the NACA score

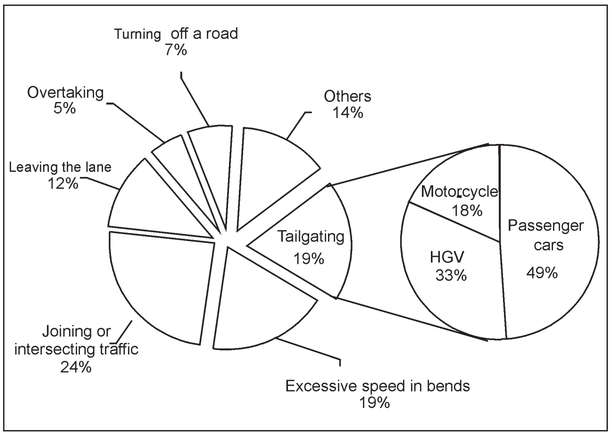

Figure 6: The most frequent accident causes

Figure 5 shows the distribution of the injury severity (NACA score).

The injury severity aspect underlines the immediate necessity to avoid the most serious accidents. We therefore analysed the causes of the accidents and their most important factors referring also to the pertaining data from the police. The analysis revealed again that the accidents are usually caused by human failure.

In most cases, the following three errors account for the most serious road accidents:

1. Error when joining or intersecting traffic.
2. Failure to maintain distance/rear end collision.
3. Speeding in bends.

When joining or intersecting traffic, motorists also make mistakes at crossings with an expressway having right of way and which have good visibility. In these cases the errors can often be ascribed to the wrong assessment of the speed of the vehicle having the right of way.

Future joining/intersecting traffic assistance systems should help drivers to avoid such errors and consequently serious accidents, or at least attenuate them. Systems of the kind are not yet available on the market, but they would certainly account for much safer roads just as ESP does today.

Suitable support systems against errors regarding the safe distance between vehicles/tailgating are already available for some vehicles of the superior class, e.g. the so-called brake assistant plus (BAS+) in the Mercedes S class. Equipping also other vehicles with a comparable system would be a decisive step towards counteracting this error.

It is striking that in rear-end collisions HGV are to a very large extent responsible for the accident. Random tests revealed that on motorways approximately 30% of such accidents involve HGVs. Often, very serious injuries, substantial material damage and technical rescue problems are the consequence. In view of such appalling effects, ADAC calls for the introduction of the emergency brake assistant in commercial vehicles. We are convinced that this type of safety system can reduce rear-end collisions, both involving HGV and HGV or HGV and passenger cars. In either case, accidents are mostly of disastrous proportions.

The widely used driving assistance system ESP has effectively contributed to bring down accident probability caused by excessive speeding in curves. Equipping all new vehicles with ESP will help to reinforce the tendency of reducing this type of accidents.

With regard to the various impact types reported in accidents involving passenger cars, the percentage (relative to the respective case figures) of very seriously/fatally injured passengers is higher in a side crash than in a front crash irrespective of the age of the car.

This tendency would contradict today’s EuroNCAP results which maintain that usually more points are scored in a side crash than in a front crash (i.e. greater safety in a side crash). Consequently, side crash test procedures would have to be intensified. However, this requires verification by means of looking in more detail at a larger number of accidents.

Head, thorax and abdomen are the most frequently injured body areas in passenger car side impacts and are already covered in the EuroNCAP assessment procedure for side crashes. Looking at and evaluating pole crash tests at the same time could also help to improve passenger safety in the case of side impacts.

The side-impact pole test is ideal for an assessment of the structural rigidity of doors, side panels, columns and door sills as well as of the interior and airbag systems. In addition to the local load transmission and the very fast intrusion,

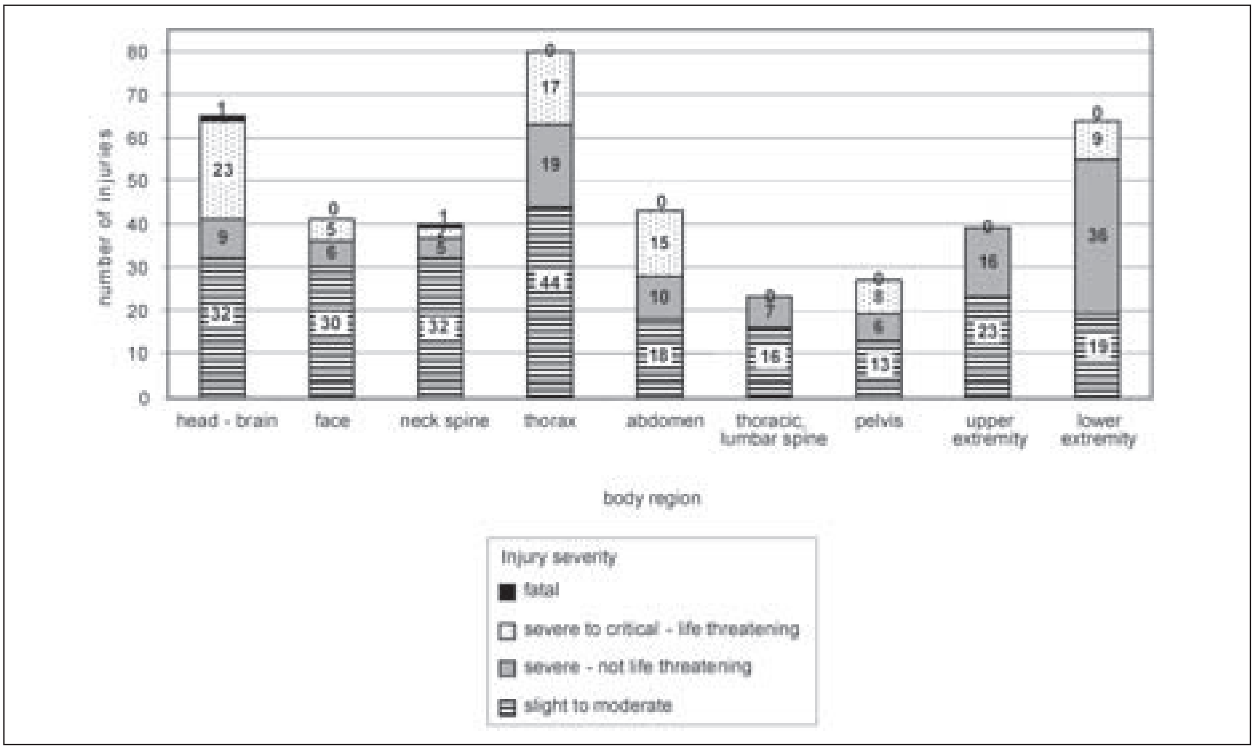

Figure 7: Injury pattern of passengers – frontal collision (n=150)

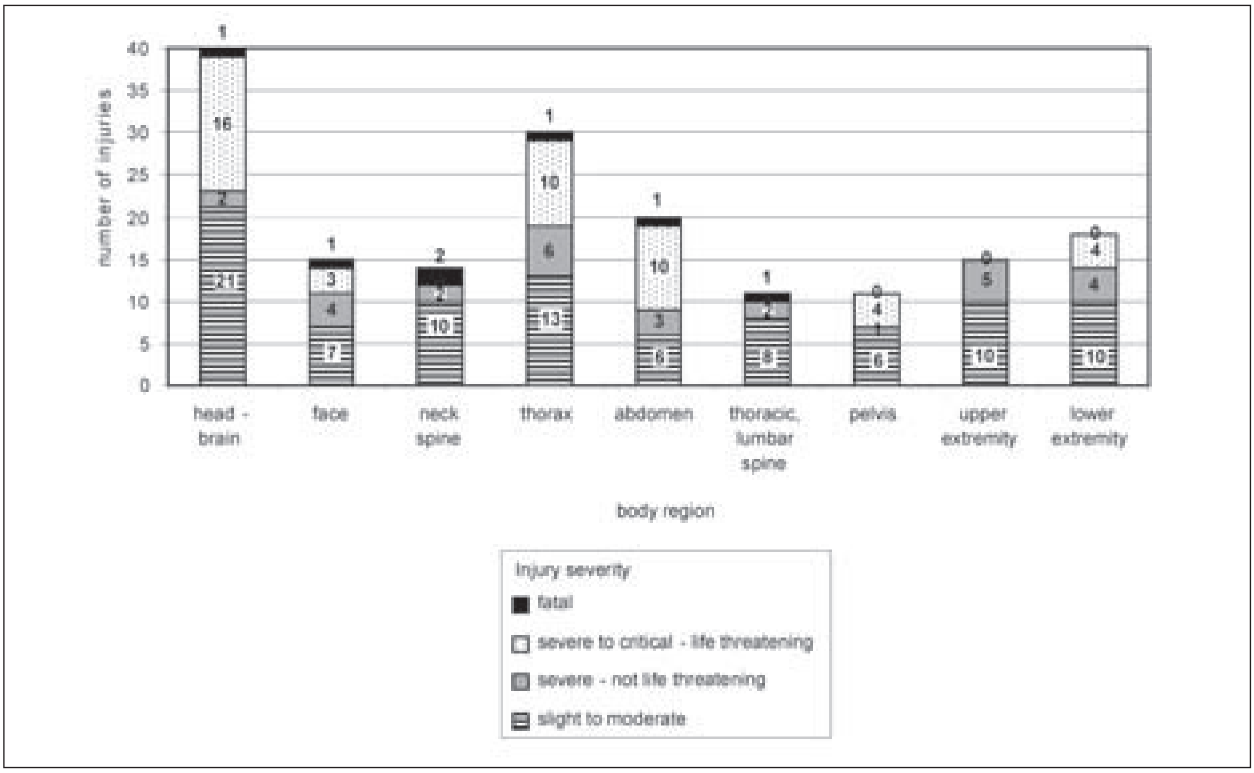

Figure 8: Injury pattern of passengers – side collision (n=63)

the structures and safety systems are given by the acid test. The support functions of A and C columns no longer have an effect, only the perfect interaction of structure and safety equipment is able to achieve a good result.

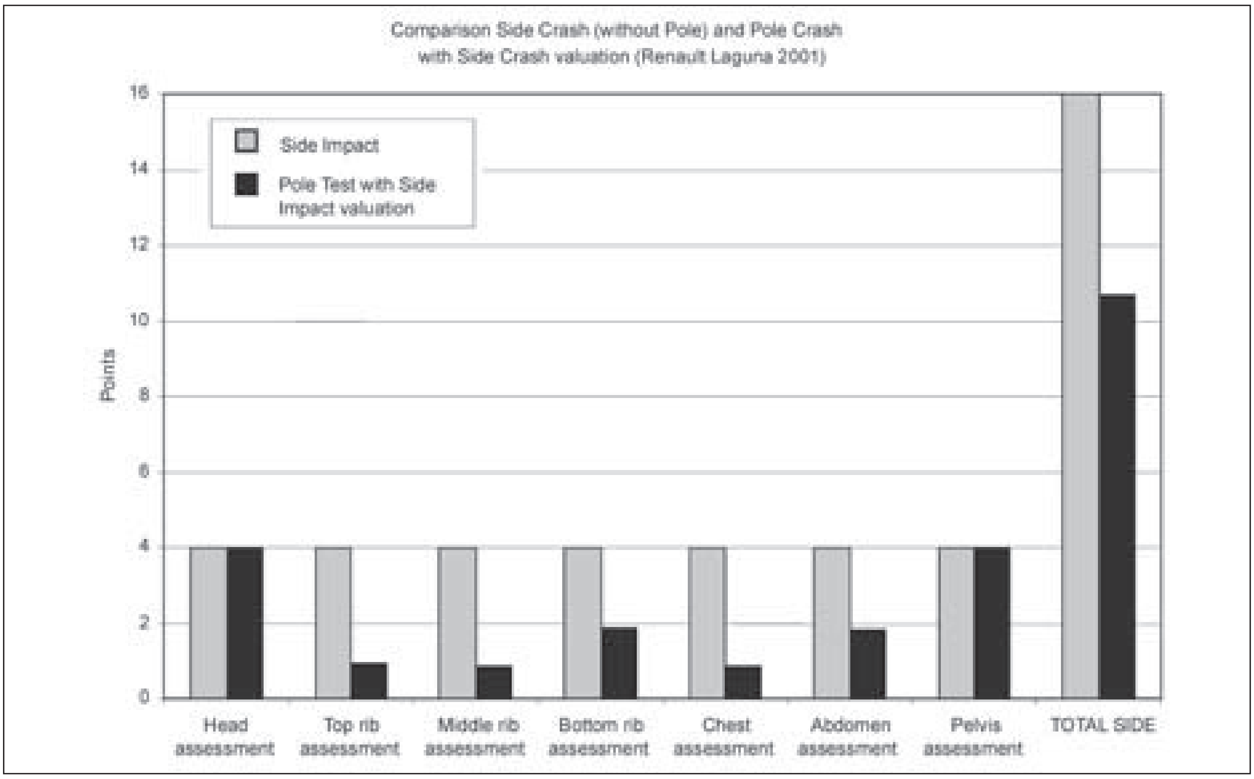

Figure 9: Comparison of side performance – Renault Laguna 2001

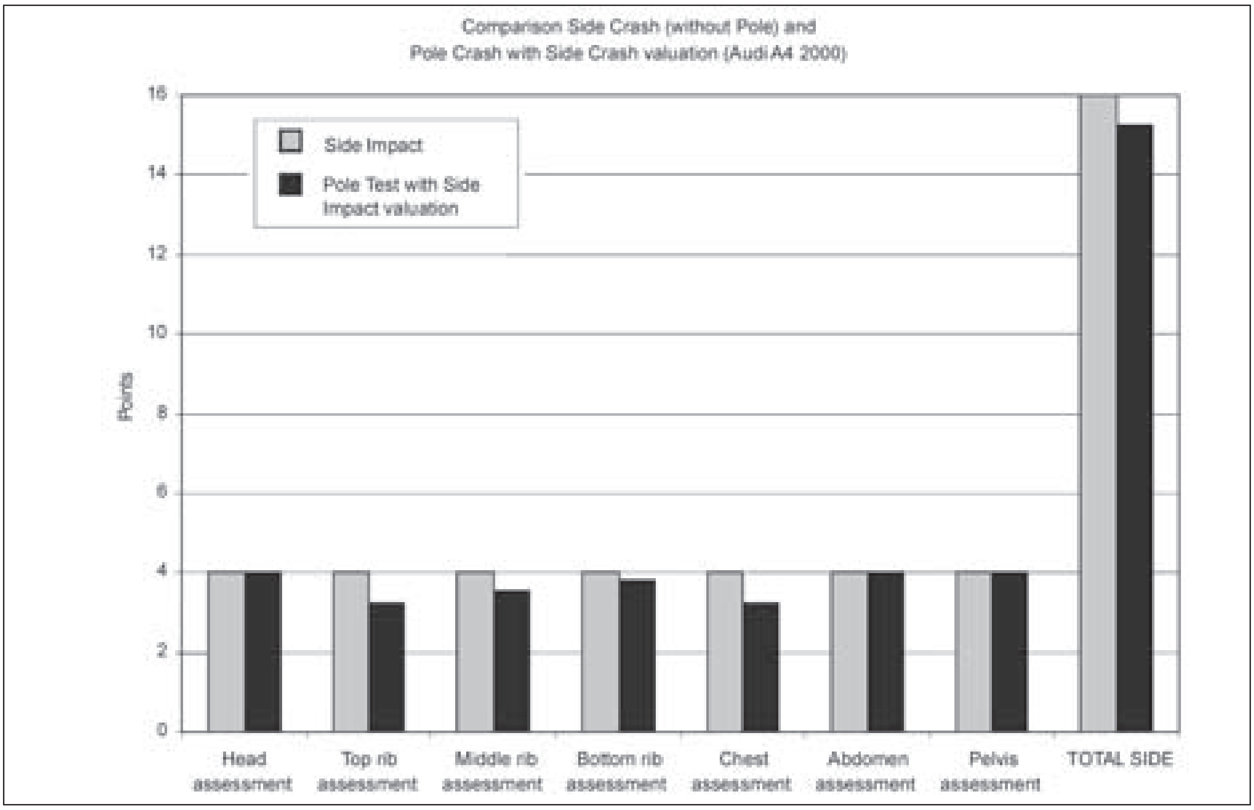

Figure 10: Comparison of side performance – Audi A4 2000

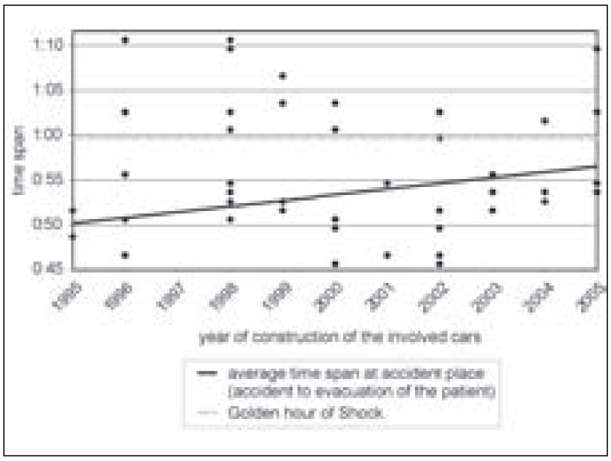

Figure 11: Average time at the accident place – accidents with technical rescue actions

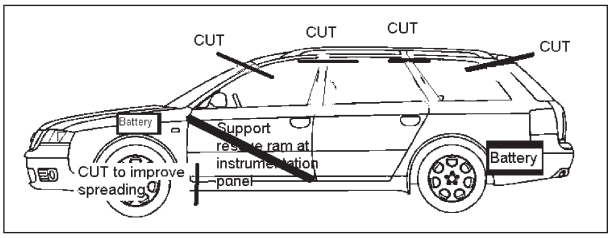

Figure 12: Proposal of a "escue label"

We selected several cars, which were tested in the same laboratory at equal test conditions and according to the official EuroNCAP procedure, to illustrate how differently vehicles of the same class behave during pole testing. The models under review have already been tested in 2000 and 2001.

Pole test results were transferred to the EuroNCAP assessment scheme for side impacts and converted into points in order to compare them with the achieved number of points of side impacts as can be seen in Figure 9 and 10.

It is very evident that the side impact behaviour of individual vehicles can produce very different results even if they were tested under the same conditions. The structural rigidity which is vital during impact considerably affects the injury risk of passengers. The comparison reveals the great potential inherent in the side structures. Further development in this area would advance side crash performance.

The rescue of passengers trapped in today's vehicle models increasingly causes technical problems. The use of high-strength materials challenges the technical equipment of fire brigades. The use of more than one battery in different places may also account for difficulties during rescue. Speedy and optimal discovery of suitable cutting positions at the roof edges for the removal of the roof often proves extremely difficult, because the airbag gas generators cannot be detected easily and the columns may have been reinforced and are very stiff. Naturally, more time is required for the rescue and the transfer of traumatised patients to the hospital is often delayed. A first analysis confirmed the tendency that the period of time between the accident and the patients' transfer to a hospital is growing depending on the crashed vehicle's year of manufacture. In the framework of this study, accidents were evaluated which required technical rescue equipment. Relevant data are currently being collected to verify the described tendency.

The tendency to exceed the defined pre-hospital time ("golden hour of shock") is alarming. The 60-minute pre-hospital time limit is a recommendation to improve survival of traumatised patients.

To counteract these problems, a rescue label could be developed. This label could be introduced to provide the most essential on-site information for rescue requiring technical equipment (max. 4-5 details) and top all other rescue guidelines which are already available but which tend to be rather voluminous. By attaching the label to the vehicle, the most essential details would be available in the quickest, securest and most relevant manner.

Conclusion

First results of the ADAC accident research pilot project underline the efficiency of this new ADAC programme. In addition to individual assistance in an emergency, ADAC Air Rescue also serves the public well by contributing to the improvement of road safety.

Further to the pilot project, the ADAC accident research will continue its programme. The pilot project was limited to only 2 air rescue bases, those in Ulm and Munich. Since November 2005, research has continually been expanded to include all ADAC Air Rescue bases to cover a higher number of cases and achieve more validated results. At the moment, between 1,500 and 2,000 cases per year can be evaluated.

The tendencies already perceivable will now be further analysed and evaluated. The follow-on project will focus on a number of key issues such as the in-depth study of side impacts, the development of a “rescue label” and the correlation of pre-hospital and in-hospital data.

Further future issues concern the safety of children and motorcycle accidents as well as the provision of a profound analysis of accident causes, so that the improvement of road safety can be further promoted.