VDI

Berlin Declaration on Vehicle Safety

VDI Fields of Action
June 2019

Photo: © turfix/shutterstock.com

Preface

European transport policy has a vision: Vision Zero, which aims to achieve a road traffic system where fatalities on European roads no longer occur. Several milestones have been set along the path towards this goal: Within each decade, the number of road traffic fatalities in the European Union is to be halved.

The safety experts of the VDI Society for Automotive and Traffic Systems Technologies also support the goal of halving the number of road deaths. They have committed themselves to this in the "Berlin Declaration on Vehicle Safety" in 2011. The VDI Expert Committee is currently examining the potentials and risks of automated driving with regard to road safety; this with a view to the year 2030.

One of the key platforms for periodic exchange between German industry experts and independent research institutes is the biennial VDI Conference Vehicle Safety.

Being an independent technical-scientific association with a large membership, VDI offers experts a forum where they can unite their personal commitment with professional expertise. This is how the initiative for establishing the VDI Expert Committee was born in 2011 among the participants in the above-mentioned conference.

They all share the desire to collaborate, beyond the boundaries of their own specialities, in reducing the number of traffic casualties.

We invite you to contribute your expertise to the VDI Expert collaboration Committee of the "Berlin Declaration on Vehicle Safety" and join this interdisciplinary collaboration for achieving the goal of Vision Zero.

Düsseldorf, June 2019

Prof. Dr.-Ing Rodolfo Schöneburg
Chairman of the Technical Advisory Council
Safety, Methods and Processes of the
VDI Society Automotive and Traffic Systems
Technologies

Contents

1 Objective and approach

The approach adopted by the VDI Expert Committee "Berlin Declaration on Vehicle Safety" is to analyse accidents comprehensively and investigate the interaction of the various technical options and approaches. For each aspect, there is an expert spokesperson who communicates to the other members the progress and findings in his or her field. Key issues and priorities for optimising the effectiveness of the individual measures and for generating new ideas emerge from the discussion among the committee members.

The VDI Expert Committee meets at least twice a year to discuss the current trend of accident rates and, in particular, the potential contributions by automotive technologies to further progress. In view of the current trend, topics going beyond the automotive technology issues have also been included in discussions since 2015.

However, the focus of work by the VDI Expert Committee is still on technical measures on vehicles. The committee is open for adding new aspects resulting from the analysis of real accidents, and it seeks the exchange with related technical fields and with political and social stakeholders in order to put its findings into practice. Figure 1 shows vertically the different topics of vehicle safety that the group deals with as well as horizontally the respective acting topics/expert groups.

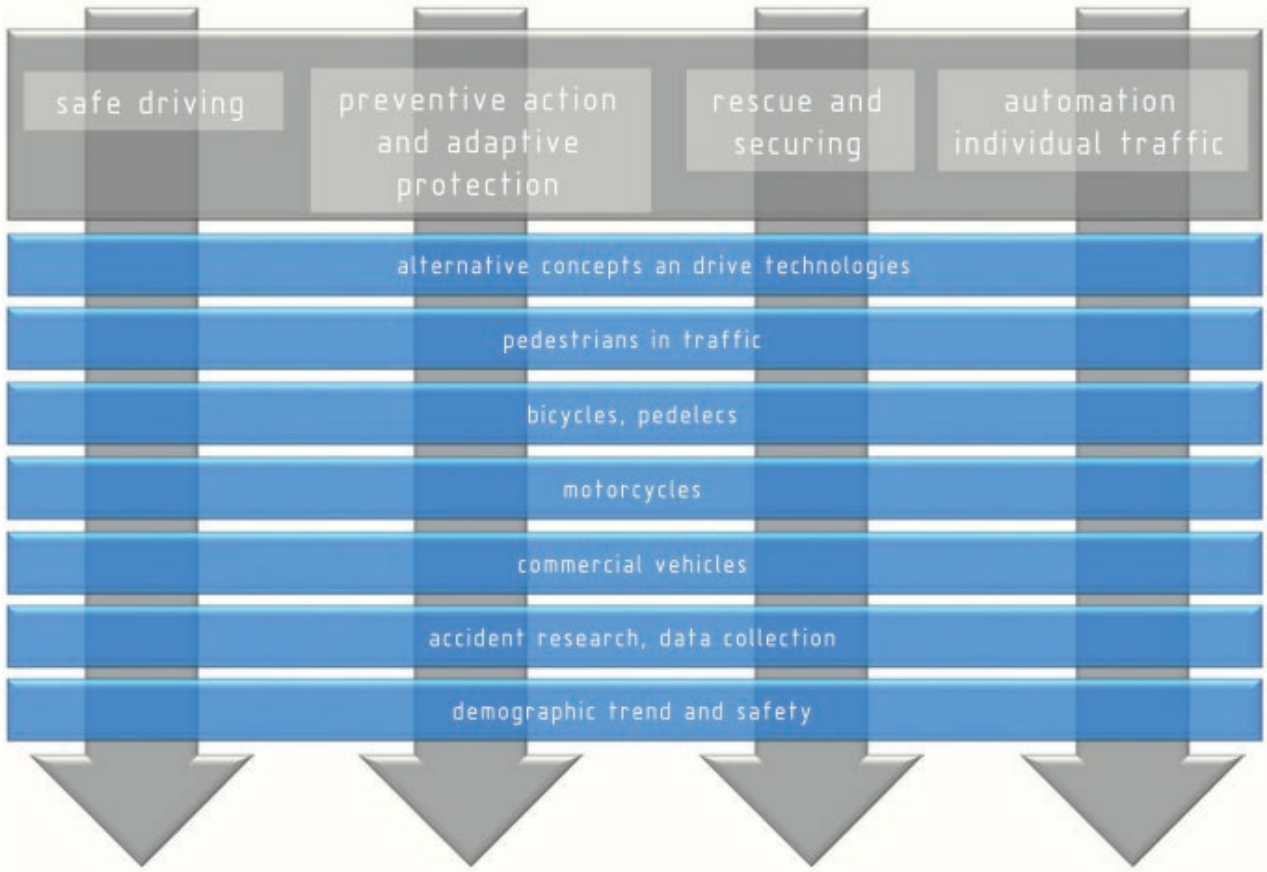

Figure 1. Structure of VDI Expert Committee "Berlin Declaration on Vehicle Safety"

2 Fields of Action

2.1 Sustainable vehicle concepts meeting highest safety standards

A number of new vehicle concepts have been optimised for their specific application (e.g. limited range in densely-populated cities) and for energy efficiency. Of course, passenger protection in collisions with conventional automobiles must also be ensured in the case of particularly light or small vehicles. Tougher compatibility requirements can be fulfilled by means of predictive safety systems. Such predictive systems allow purposefully decreasing the speed prior to an unavoidable collision. The risk of injury to all persons involved in the accident can thus be reduced. Furthermore, specific alert signals can draw the driver's attention to an imminent danger. This opens up the potential for complete collision avoidance in situations when the driver has enough time to react.

Vehicles with electric drive systems require additional safety measures. Integrity of the live parts and energy storage systems must be ensured in the event of an accident; possible short-circuits must not pose a hazard to passengers and rescuers. With regard to these requirements, relevant research activities and international standardisation of the safety requirements have already been initiated. The automotive industry systematically intensifies and implements these initiatives.

2.2 Protect vulnerable and unprotected road users

For the goal of halving the number of road traffic fatalities to be achieved, it becomes increasingly important that even the most vulnerable road users, primarily pedestrians and cyclists, be provided with more effective protection. This calls for a comprehensive road safety concept. So far, a wide range of passive measures for pedestrian protection have been taken on the vehicle side. However, their effect in pedestrian accidents is but limited as only the primary impact with the vehicle is mitigated. The risk of injury from a possible secondary impact with the road surface is not prevented. Only predictive safety systems can reduce the impact velocity through intervening measures such as alerting, brake preconditioning and automatic emergency braking. In many cases, a collision can thus be avoided altogether. As early as 2010, the working group "Forward-looking collision avoidance systems" (vFSS) was established with participation of the German automotive industry, with the aim of developing generally accepted test methods and evaluation procedures for such safety systems. In collaboration with the German Federal Road Research Institute and technical experts, this working group deduces requirements for emergency braking systems from accident research findings. A reasonable approach to sustainable protection of vulnerable road users seems to be the combining of active and passive systems, aiming to:

- Ensure basic passive protection in unpredictable accident scenarios which predictive systems can detect only late, if at all.

- Design predictive safety systems for predictable accident scenarios which can clearly be detected by driving environment sensors. It is to be questioned whether the existing pedestrian protection requirements specified by legislation and consumer advice organisations promote the implementation of the most effective protection measures. Specifications that evaluate all measures, both active and passive, on the same, linear scale would be ideal.

2.3 Develop cooperative safety systems

Currently available driving-environment sensors detect unhidden objects in the field of view of the vehicle. This concerns, e.g., vehicles driving ahead or crossing pedestrians. A further technological leap is required to allow timely detection of accident-prone situations which, today, still have to be regarded as unpredictable. Cooperative safety systems in the traffic infrastructure and on board of the vehicles are a possible approach. In future, fusion of data from on-board and cooperative systems is to provide an even more detailed traffic map so as to enable collision avoidance alerts or automatic vehicle reactions. Infrastructure systems bear a large potential for improving road safety. They monitor the traffic situation, creating a traffic map. In situations of imminent danger, a request to activate intervening measures can be transmitted to the vehicles concerned.
Such a technology can contribute, in particular, to reducing the number of accidents at intersections or traffic lights. Cooperative safety systems offer the

advantages of clear object classification and a more accurate prediction of the behaviour of all road users involved in a critical situation, as they use considerably larger amounts of data and can also take into account hidden objects. For instance, the automotive industry has teamed up with component suppliers, telecommunication companies and infrastructure operators in the funded project "Safe and Intelligent Mobility – Test Field Germany (SIM-TD)" to work on the development and evaluation of cooperative systems. Area-wide penetration by means of appropriate launch scenarios must be a priority goal.

2.4 Intensify and harmonise research into accident causes and accident consequences

Instead of evaluating individual features, the analysis should in future focus more on vehicle safety as an overall system. Measures taken have to be judged by their effectiveness in real accidents. Internationally harmonised accident databases which allow detailed country-specific accident analysis are required as a basis. Authorities and automobile manufacturers are to work out and agree upon methods for reliable prediction of the efficiency and effectiveness of safety systems. Accident research is to apply the same principles internationally. Free access to data for scientific studies must be provided. The scope of data collection must be extended to include the pre-crash phase or the causes leading to an accident.

2.5 Create a reliable framework

Current requirements specified by legislation and consumer advice organisations focus on the evaluation of passive safety systems by means of standardised laboratory crash tests. Future extensions to the requirements will have to include active safety measures in the scope of evaluation. An objective evaluation of active and passive safety measures in the overall system must be based on field effectiveness. To this end, authorities and automobile manufacturers must jointly develop new test methods and evaluation procedures. Great progress in road traffic safety can be achieved by implementing automatic emergency assistance systems. The legal framework for the introduction of such autonomous driver assistance systems must be improved.

2.6 Short-term approaches

How will modern safety technology influence the goals of the "Berlin Declaration on Vehicle Safety" until the year 2020?

In Germany, the average age of a passenger car is 9 years, and that of a motorcycle is over 16 years. A study by the German Federal Highway Research Institute (Market penetration of vehicle safety systems, Report M 258, 2015) illustrates how long it takes for modern safety technology, taken for granted by us as engineers and also by the customers, to notably penetrate the overall vehicle fleet.

Therefore, modern safety technology will have very limited effect on the short-term accident statistics up to the year 2020. Technology and innovations are investments into the future which, naturally, take many years to show positive results.

Other topics need to be focused on when asking "What can have a positive impact until 2020, i.e. within the next four years?" and "What brings us closer to halving the number of accident casualties?" Not an easy task, admittedly, for although many of the fields of action addressed so far are highly effective, they are of relatively little relevance in such a short term. Now it is crucial to highlight only the topics that are likely to have effects by 2020. Results are fields of activity in which the 2020 goal is achievable. If at all, this will only be possible in combination with the human factor and the analysis of infrastructural influences.

2.7 Potentials and limits of automated driving

As a promising approach for the improvement of vehicle safety is the obvious choice to want to limit the effects of human error on safety as far as possible. Automated driving and a wide range of driver assistance systems are a very good enhancement of human capabilities here.

Today, we already have a large number of driver assistance systems and monitoring functions which assist human drivers on **automation levels 1 and 2.** It can be demonstrated that many of these functions have an effect on typical dangerous situations. Analyses carried out by authorities, insurance companies and automotive manufacturers have shown that it was possible to reduce the frequency of accidents by an average of over 29 % with the help of active vehicle safety systems such as the automatic emergency

Figure 2. Passenger compartment scenario in a fully automated vehicle (source: Chesky/shutterstock.com)

braking function provided in various classes of vehicle (mid-range and luxury classes).

Automated driving on levels 3 to 5 is a logical continuation of the established assistance systems. The range of functions these offer will expand more and more until they finally take over the driving of the vehicle by automatic means.

Increasing automation offers the potential to minimize the "human error" factor – at least with regard to one's own vehicle. We can expect automation to improve road safety in the following situations in future:

- leaving the lane due to inattention
- pile-ups due to inattention
- accidents owing to inexperience, lack of training or a negative emotional state of the driver
- accidents at intersections
- accidents while turning off the road
- accidents due to inappropriate speed
- accidents while changing lanes
- accidents due to excessive tiredness

According to estimates made by the VDI Technical Advisory Council „Safety, Methods and Processes", the number of road deaths in Germany will drop by up to 20 % by 2020 as a result of the increasing spread of automated driving functions on all levels.

The introduction of automated driving will also lead to new challenges for passenger protection systems in the vehicles, as we expect passengers to demand a larger degree of freedom for themselves in the passenger compartment (Figure 2). The passenger protection systems will have to take this into account and make allowances for the altered situation. As a simple example, it seems logical that a retractable steering wheel will no longer allow an airbag to be integrated into the steering wheel hub in the conventional manner. Also, we do not yet have any finished solutions for developments such as seats which can be rotated out of the direction of travel, examples of which we have already seen in concept cars.

The work of the VDI Expert Committee is therefore devoted to the potentials and limits of automated driving with a time horizon of 2030.

3 Open to Collaboration

The “Berlin Declaration on Vehicle Safety” aims to bring experts from various fields together to work collectively in a cooperative and open-minded atmosphere. What matters to us is taking our work on the road, literally. We therefore seek communication with whoever wishes to contribute to our initiative.

This brochure cannot, by its nature, point out all the approaches and ideas that have emerged, and still will emerge, from the ongoing work of our committee. It provides initial information which is intended to spark your curiosity to learn more. If the goal and task of avoiding traffic victims is something you have in common with us and you would like to work with us and learn more, please contact us.

Join the VDI Expert Committee of the “Berlin Declaration on Vehicle Safety” with your expertise and help us achieve the goal of Vision Zero through interdisciplinary collaboration.

VDI Society Automotive and Traffic Systems Technologies

The VDI Society Automotive and Traffic Systems Technologies (FVT) with its eight Technical Divisions offers a home for engineers from a wide range of disciplines in the fields of “road”, “rail”, “air” and “water” transport. Through active interplay with the working groups of the VDI Regional Associations, the students and young engineers as well as the other VDI Technical Societies, the VDI FVT is networked nationally and internationally with other cooperation partners. The stated task of the VDI FVT is to strengthen the perception of the engineering profession and to establish the VDI as a technical-scientific opinion leader in professional circles, politics and society. The aim here is to promote the interaction of the various mobility areas and to provide technical impetus, as well as to develop perspectives for cross-sectional topics relating to “People and Mobility” and “Means of Transports and Infrastructure”.

VDI

Spokespersons, designers, networkers

We are driven by a fascination for technology: For 160 years now, the VDI Association of German Engineers has given important impetus for new technologies and technical solutions for better quality of life, improved environmental conditions and higher prosperity. With its about 145,000 members, VDI is the largest technical-scientific association in Germany. As a spokesperson for engineers and engineering, we are actively shaping the future. Every year, more than 12,000 honorary experts process the latest findings to promote our technology location. As the third largest standards organisation, VDI is a partner for the German business community and scientific organisations.

VDI – The Association of German Engineers
VDI Society Automotive and Traffic Systems Technologies
Dipl.-Ing. Christof Kerkhoff
Phone +49 211 6214-645
kerkhoff@vdi.de
www.vdi.de