DEKRA Automobil GmbH

ROAD SAFETY REPORT 2012 – PEOPLE AND TECHNOLOGY

Strategies for preventing accidents on European roads

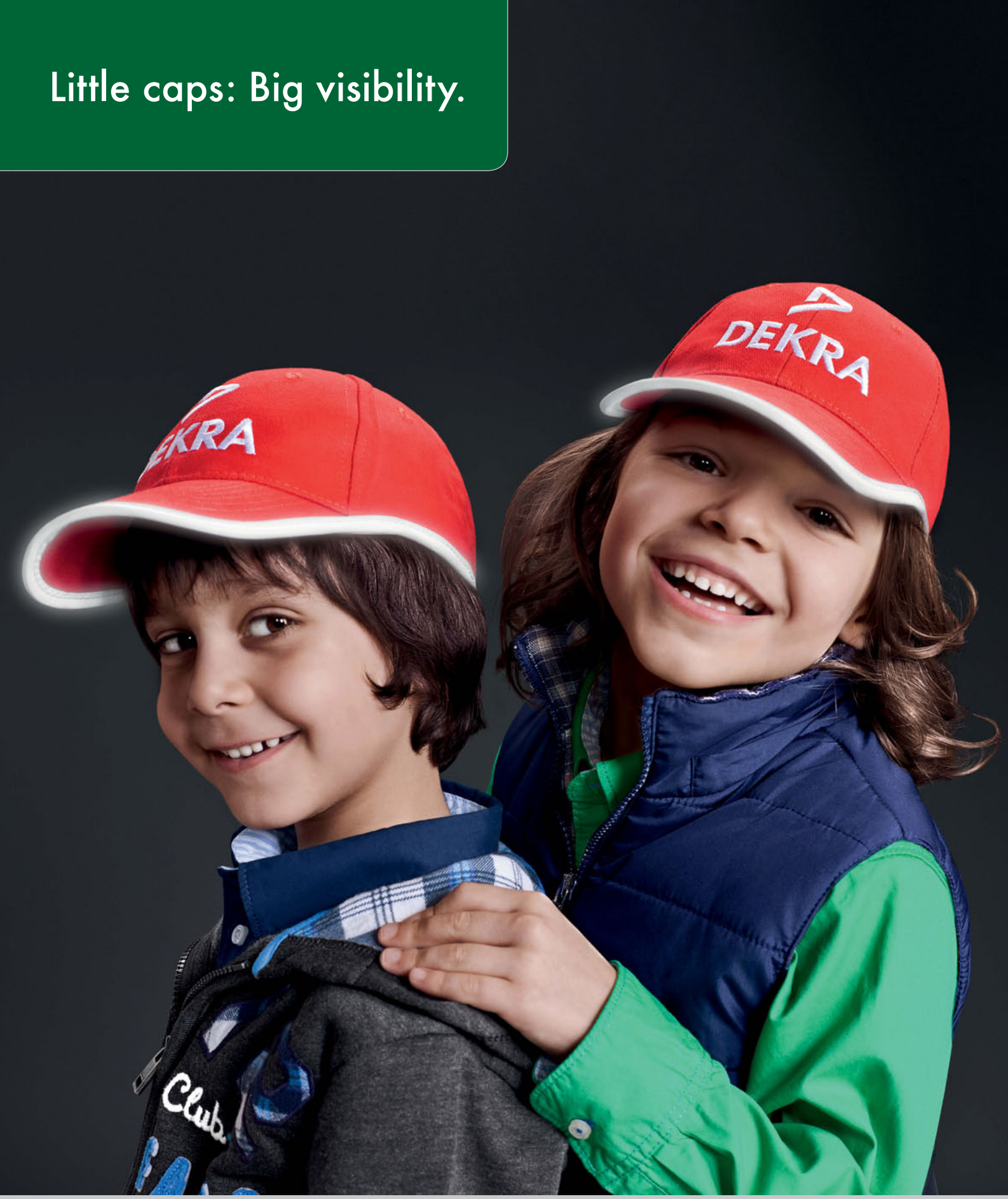
DEKRA

Human factor: Minimising risk through a greater sense of responsibility

The incidence of accidents: Systematic use of tried-and-tested safety systems

Vehicle and inspection technology: Optimising the human-machine interface

Little caps: Big visibility.



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Automotive — Industrial — Personnel

DEKRA
On the safe side.

At the interface between people and technology

Preliminary estimates show that in 2010 approximately 33,000 people were killed in road accidents in the EU (EU 27). Roughly 40 per cent of those lost their lives in accidents in built-up areas. Some 48 per cent of those were pedestrians and cyclists. While there has been a clear downward trend in the number of deaths among pedestrians and cyclists in many EU countries for years, this cannot, however, be interpreted as an all clear. Most at risk are children under 15 and elderly people over 65. In the light of demographic developments, the latter will account for an increasing proportion of road users, not only in Germany.

Assistance and information systems such as driving dynamics control, adaptive cruise control, the emergency brake assistant and lane departure warning systems, and many other electronic systems, which increase safety and comfort, are an essential component of modern vehicles. Their effectiveness is beyond doubt. According to a study carried out by Allianz Centre for Technology (AZT), almost half of accidents could be prevented or their seriousness reduced, if driver assistance systems were systematically developed and their use was more widespread. That is why EU projects and initiatives such as eSafety, eSafetyAware and iCarSupport have been up and running for years, with the participation of DEKRA, with the aim of equipping vehicles with the most effective safety systems.

However, driver assistance systems can overwhelm and irritate drivers or lull them into a false sense of security. The feeling of being overwhelmed is being addressed by, among other things, the EU recommendations ESoP (European Statement of Principles) on HMI (Human Machine Interface). These contain a set of requirements that the human machine interface must meet to prevent a driver from becoming overwhelmed or over-stimulated. But whichever driver assistance system is used, responsibility always lies with the driver. That will not change for the foreseeable future.

TECHNOLOGY IS TOO COMPLICATED FOR MANY

The results of a survey on interaction with modern technology in vehicles, which was carried out by DEKRA in our branches nationwide in spring 2012, are interesting. They show that more than two-thirds (77 per cent) of all drivers polled sometimes or often have difficulty using, in particular, the electronic systems and functions in the vehicle. On the other hand, the majority of drivers (78 per cent) are also convinced of the advantages of the technical progress made in relation to the motor car in terms of safety and comfort. More than a quarter of those surveyed (27 per cent) mentioned that modern technology had spared them from even worse things. The results show that there is a potential as well as a need to make progress as regards interaction with technology in vehicles.

PROVIDING THOUGHT-PROVOKING IMPULSES

The interface between people and technology reflects the many different aspects of a complex situation, as this road safety report shows in detail. Vehicle technology seeks to compensate as far as possible for people's inappropriate behaviour behind the wheel. The fact is that, when it comes to analysing the causes of road accidents, in addition to external conditions and technical vehicle faults, people behind the wheel, or as pedestrians or cyclists, play a central role. The range of 'human' risk factors is extremely broad and covers inappropriate speed, inadequate safety distance, the influence of alcohol or drugs, overtiredness, overload, inexperience, deliberate infringements of traffic regulations, lack of awareness of safety instructions in the vehicle and ignorance.

The DEKRA Road Safety Report 2012 presents the many different aspects of this complex situation and examines these problem areas from the viewpoint of accident research,

Dipl.-Ing. Clemens Klinke, Member of the Board of DEKRA SE and Chairman of the Management Board of DEKRA Automobil GmbH

traffic psychology and inspection technology. As in previous years, this publication seeks first and foremost to provide thought-provoking impulses for politicians, transport experts, manufacturers, scientific institutions and organisations. At the same time, the report is intended to give advice to all road users on how, through appropriate behaviour, greater awareness of risks and compliance with safety standards, they can help to further reduce the number of dead and injured on Europe's roads.

The latest figures from Germany show that, in the future too, all available potential must be exploited to increase road safety. Figures provided by the Federal Office for Statistics for 2011 show that, for the first time in 20 years, more people lost their lives in road traffic accidents. In 2011, 3,991 people died on German roads, which is 343 deaths or 9.4 per cent more than in 2010. In 2011, the number of people seriously or slightly injured increased by 5.5 compared to the previous year to approximately 391,500. As a result, the systematic reduction in the number of fatalities is and remains a challenge to which DEKRA will respond.

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Technology, safety and responsibility

A high level of mobility is the basis of our highly developed society and economy. Mobility is of an evolving nature, with ever new requirements – especially in terms of technology. This also holds true for efficiency potential, which we must gradually harness. We cannot respond to the rapid growth in traffic simply by upgrading infrastructure – important as it is.

With road traffic becoming increasingly dense, driver assistance systems will gain in importance. Driver assistance systems are intended to make driving easier, more comfortable and, last but not least, safer. They support drivers by providing them with information or alerting them to dangers and they can also counteract possible incorrect behaviour. They support drivers where technology can react faster than people. Driver assistance systems therefore mean more safety on the roads. They also make an important contribution to increasing the capacity of road transport by making it more efficient, more comfortable and, last but not least, more environmentally friendly.

This does not mean, however, that driver assistance systems release drivers from their responsibility; this always lies with people. With any important technology, it must also be ensured that it does not distract or overextend the driver. The basic requirement for the use of driver assistance systems is, therefore, that all users find them easy to understand. Their use must not lead to new risks or dangers that are likely to compromise the achievements made in road safety.

INTELLIGENT ORGANISATION OF OUR MOBILITY

As part of the so-called "eSafety activities" for the European Commission we have – in collaboration with DEKRA, among others – also contributed our ideas and requirements internationally. These include making it impossible to tamper with and misuse electronic assistance systems. That is why we have suggested that the "European statement of principles in the human-machine interface" should be revised with regard to protection against interference and misuse and also with regard to special problems associated with portable systems.

However, for safety in public transport, something else is decisive: the ultimate requirement for varied and safe transport is and remains compliance with the rules. Without this, millions of people would not be able to use the roads safely on a daily basis. That is why I, as Federal Minister for Transport, am calling on each and every road user to use the roads with the necessary attentiveness and consideration. This is not only a legal but also a social obligation – especially towards vulnerable road users. What we need is intelligent organisation of our mobility, with, ultimately, the focus entirely on people.

Dr Peter Ramsauer MdB
Federal Minister for Transport, Building and Urban Development

Sustainable optimisation at all levels

People, technology, infrastructure: these three fields of action will continue to determine all measures for further improving safety on Europe's roads and significantly reducing the number of people killed in traffic accidents yet again. According to the most recent EU policy orientations on road safety the number of road deaths will halve by 2020.

From the bobby car to the walking frame, mobility is a basic need for people of all ages. However, whether people get around by car or lorry, astride a two-wheeled motor vehicle or as a pedestrian, for private or professional purposes, traffic requirements are becoming ever more demanding. The reasons for this are of the most diverse nature. The constantly increasing density of traffic, combined with time pressure, stress and hustle and bustle, as well as sensory overload caused, for example, by road signs, illuminated advertisements, music or cluttered dashboards, and distraction through the use of a telephone or a navigation device, are all aspects which help to increase the risks of accident.

A safety study carried out by the Allianz Centre for Technology (AZT) on the basis of a representative survey of car drivers in Germany, Austria and Switzerland, which was published in December 2001, underlined that ten per cent of car accidents are caused by distractions while driving. The most common distractions in the car are operating devices, conversations and arguments. Forty per cent of car drivers use their mobile phone without using a hands-free set. Thirty per cent confirm that they read, and 20 per cent that they write, text messages while driving. Fifty four per cent input the destination in the navigation device while driving. According to the study, young drivers are at great risk, with 18 to 24 year-old drivers reporting 16 per cent more distraction than 25 to 64 year-old drivers, and over 40 per cent more distractions than elderly drivers (over 65).

1909: In the then German Reich a single driving licence is introduced, which is valid for the entire country (German Motor Vehicles Act).

1917: In the USA the first automatic traffic signal is patented.

1933: In Copenhagen the first set of pedestrian traffic lights in Europe is installed.

1951: Introduction of the main inspection (HU) for motor vehicles. The aim of the HU is to ensure that the proportion of vehicles with safety deficiencies on Germany's roads is as low as possible.

1905 1910 1915 1920 1925 1930

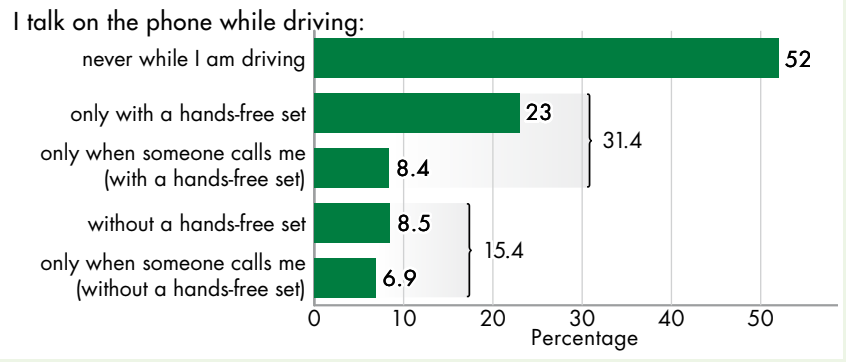
Milestones for greater road safety

A comparable survey of 2,000 road users was carried out in December 2011 by the market research institute Ipsos on behalf of the German Road Safety Council (DVR) (Figure 1). This survey showed that, while one in three car drivers (31.4 per cent) made or received phone calls while driving, they always used a hands-free set. However, one in seven (15.4 per cent) also conducted phone conversations without using a hands-free set. The results of this survey may not be as alarming as those of the AZT; nonetheless the DVR calls on all car drivers to systematically eliminate these sources of distraction while driving. The safest driver is the driver who never makes or receives phone calls while on the move.

Distraction due to a telephone or a navigation device, among other things, is undoubtedly a not insignificant danger to road safety and can have serious physical effects on driving similar to those of momentary nodding off (so-called microsleep). For example, if a car is travelling at 100 km/h and the driver is distracted for five seconds by using the navigation system or glancing at an incoming text message and is therefore unable to react, in that time the vehicle covers a distance of almost 140 metres out of control. This is shown by the following calculation:
5 s x 100 km/h =
5 s x 100,000 m / 3,600 s =
5 s x 27.78 m/s = 138.88 m.

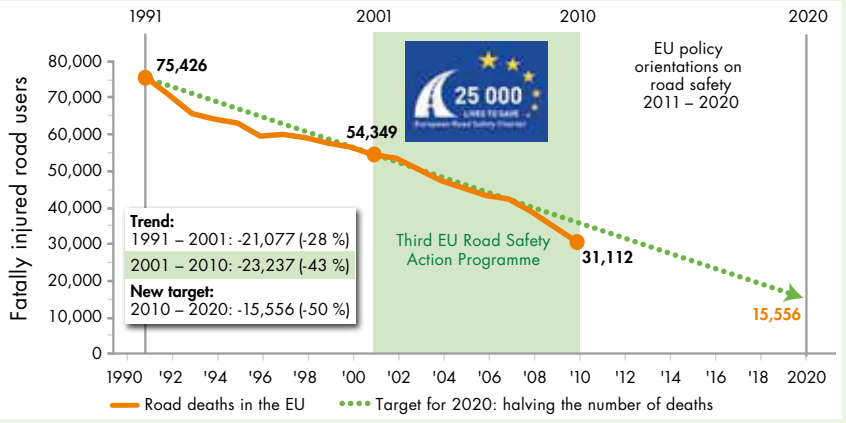
On the other hand, modern information technology also helps to direct traffic flows and make road transport safer. The "carIT Congress: Mobility 3.0" at the International Motor Show (IAA) in Frankfurt in September 2011 impressively demonstrated the potential of the "smart car" with, to name but a few key features, driver assistance systems such as road sign recognition devices, brake assistants and driver fatigue detectors, as well as systems that enable vehicles to communicate with each other and with traffic control centres. The new information and assistance systems will sooner or later help prevent traffic jams and accidents by, for example, applying the brakes automatically if another vehicle does not brake quickly enough. And, using a mobile phone or WLAN connection, in a few years, a modern car will be able to send information to, and receive information from, other road users so as to defuse hazardous situations. This shows that cars are becoming increasingly comfortable on the one hand, yet increasingly complex to operate, on the other.

1
Only one driver in two refrains from using their mobile phone while driving



Source: DVR

2
Road deaths in the EU (EU 27) since 1991 – old and new targets



Source: CARE

Status: July 2010 EU policy orientations on road safety 2011–2020

ROAD ACCIDENTS IN THE EUROPEAN UNION

As far as accident figures are concerned, there is a clear downward trend in the number of people killed in road accidents at European level. An analysis of the Community Database on Accidents on the Roads in Europe (CARE) shows that this has been the case since 1991. According to the available results, in 2010

1954: The medical-psychological examination (MPU) of aptitude to drive is introduced in Germany.

1957: A 50 km/h speed limit in built-up areas is introduced in Germany.

1958: The central index of traffic offenders in Flensburg begins its work.

1961: The inspection sticker is introduced as proof that a main inspection has been carried out.

1966: First mechanical ABS (Jensen FF with Dunlop Maxaret ABS).

1968: The International Conventions on Road Traffic and on Road Signs and Signals are signed in Vienna.

1935 1950 1955 1960 1965 1970

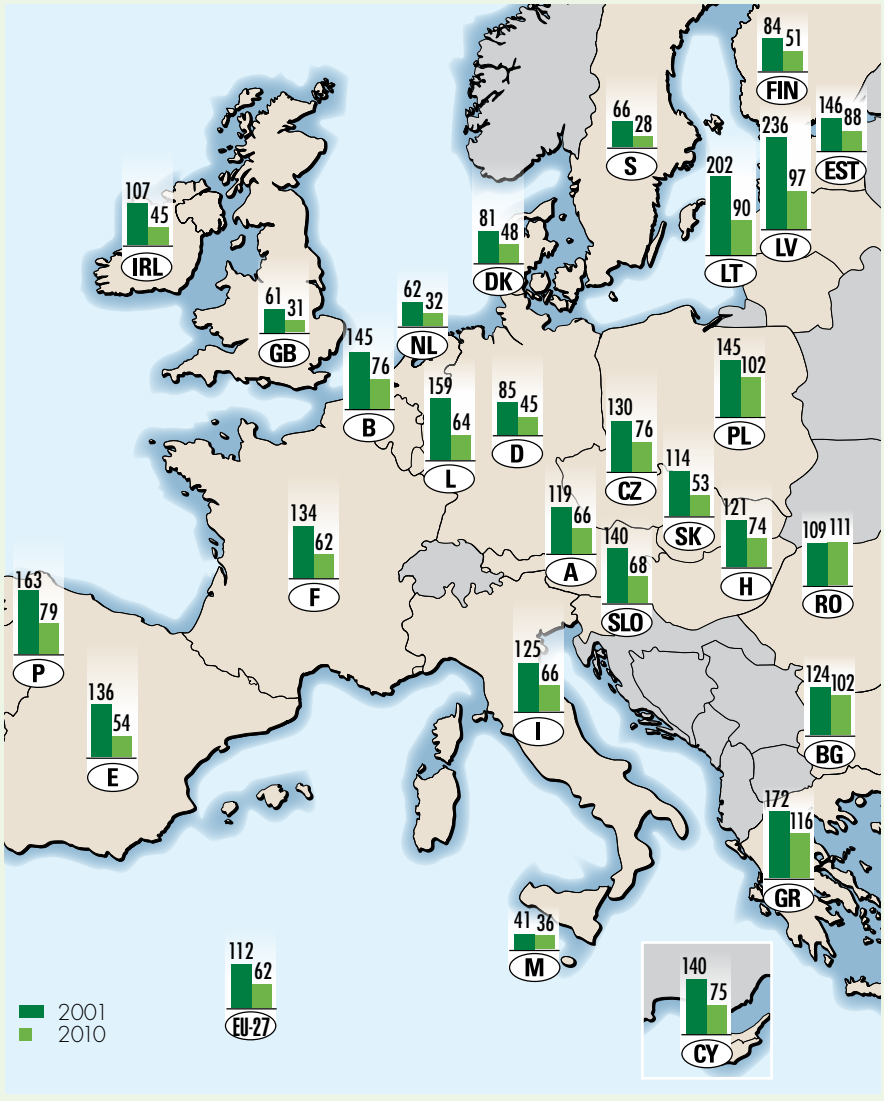
roughly 31,000 people lost their lives in road accidents (Figure 2) throughout the EU. In relation to the entire population of all EU countries, this represents, on average, 62 road accident victims per one million inhabitants. In Germany, the figure is 45, which places the Federal Republic in sixth place within the 27 countries of the EU. In Sweden, with a figure of 28, the fewest people died in road accidents measured in terms of population numbers, followed by the United Kingdom with 31 and the Netherlands with 32 per million inhabitants. The risk of being killed in a road accident was much greater in Greece, the figure being 116 per one million inhabitants, and in a number of Eastern countries in the EU, such as Romania with 111 and Poland and Bulgaria, each with 102 road accident victims per one million inhabitants (Figure 3).

In its Third Road Safety Action Programme of 2001 the Commission of the European Communities formulated the ambitious goal of halving the number of road deaths by 2010. In 2001 a total of approximately 54,350 people lost their lives in road accidents in the 27 countries of the current EU. To achieve this goal, the number of fatalities in the EU would have had to fall to 27,175 in 2010. In fact the number fell by "just" 43 per cent to approximately 31,100 (Figure 4).

In Germany, the number of people killed in road accidents in the same period fell by almost 48 per cent, falling short of the target by two per cent. Eight of the 27 EU Member States nonetheless succeeded in reducing the annual number of road deaths by at least a half. These were the four Eastern European countries, Latvia, Estonia, Lithuania and Slovenia, as well as Spain, Luxembourg, France and Sweden. Poland, Bulgaria and Romania, among others, were far behind, with a reduction of 29 per cent and less.

In July 2010, therefore, the Commission developed new ambitious plans, again with the aim of halving the annual number of road deaths on the roads of Europe, which were included in the 2011–2020 Road Safety Guidelines published in March 2011. For Germany, this objective would have meant reducing road deaths to around 1,800 in 2020. The initiatives proposed in the Guidelines range from higher standards for vehicle safety to infrastructure measures, better training of road users and stricter enforcement of road traffic

3
Road deaths by country (per 1 million inhabitants)



Source: European Commission, status: July 2011

1970

1973: Introduction of the 0.8 per mille drink-drive limit for the blood alcohol concentration value.

1974: Introduction of the points system (Section 4 of the German Road Traffic Act (StVG), which is still in use today, as a replacement for the guidelines for the treatment of repeat offenders.

1974: From 1st January three-point seat belts become mandatory for the front seats of newly registered passenger cars in the Federal Republic of Germany. Three-point seat belts become mandatory for the rear seats of newly registered passenger cars on 1st May 1979. A fine for the non-use of a seat belt is imposed from 1st August 1984.

1975

1979: First electronic ABS (Mercedes-Benz S Class and the BMW 7 series).

1980: First German car fitted with an airbag (Mercedes-Benz S Class).

1980

regulations. Seven strategic goals were established:

- improved safety measures for lorries and cars,
- safe traffic routes,
- development of intelligent vehicles,
- improvements in driver training and obtaining a driving licence,
- better enforcement of the regulations,
- more efficient measures for dealing with the injured and relating to first aid,
- greater attention to motorcyclists.

NATIONAL ROAD SAFETY PROGRAMME

The Road Safety Programme 2011, which was presented by the Federal Minister for Transport, Building and Urban Development in November 2011, goes in a similar direction to the Guidelines. As on the part of the EU Commission, people, infrastructure and vehicle technology are seen as the three major fields of action. According to the Federal Minister for Transport, Dr Peter Ramsauer, the "people" field of action will focus in particular on the must vulnerable road users, i.e. children, young people, young novice drivers and the elderly, and will also address those who pose the greatest threats. The "infrastructure" field of action focuses on mitigating danger points and ensuring a better flow of traffic through innovative technology. Finally, the "vehicle technology" field of action will ensure a more widespread use of „intelligent" safety systems, which can contribute significantly to preventing accidents.

The elderly are much more mobile today than one or two decades ago.

4 Road deaths in the EU

Member State	Road deaths		Change
	2001	2010	2001 – 2010
Latvia	558	218	-61%
Estonia	199	78	-61%
Lithuania	706	300	-58%
Spain	5,516	2,470	-55%
Luxembourg	70	32	-54%
France	8,160	3,992	-51%
Slovenia	278	138	-50%
Sweden	531	266	-50%
Portugal	1,671	845	-49%
Ireland	412	212	-49%
Germany	6,977	3,648	-48%
United Kingdom	3,598	1,943	-46%
Slovakia	625	353	-44%
Belgium	1,486	840	-43%
EU 27	**54,349**	**31,112**	**-43%**
Italy	7,096	4,090	-42%
Austria	958	552	-42%
Netherlands	1,083	640	-41%
Hungary	1,239	740	-40%
Czech Republic	1,333	802	-40%
Cyprus	98	60	-39%
Denmark	431	265	-39%
Finland	433	272	-37%
Greece	1,880	1,281	-32%
Poland	5,534	3,908	-29%
Bulgaria	1,011	775	-23%
Malta	16	15	-6%
Rumania	2,450	2,377	-3%

Sources: CARE (January 2012), ETSC (June 2011)

1981: Combination of driver-airbag and passenger-airbag belt tensioners (Mercedes-Benz S Class).

1986: The "driving licence on probation" is introduced in Germany.

1987: First acceleration skid control system (ASR) (Mercedes-Benz S Class).

1988: Motorcycle ABS in production (BMW K100).

1992: The "Technical Inspection", the French counterpart to the German HU, becomes mandatory in France for all vehicles, the first time after four years and thereafter every two years.

1985 1990 1995

Swerve safely in an emergency braking situation with ESP and ABS.

The provisional figures for 2011 from a number of EU Member States show that work is needed to further improve safety on Europe's roads. From January to December 2011, 3,991 died in road accidents in Germany. That is 9.4 per cent more than in 2010. Experts believe that one reason for the rise could be the weather. The good weather in spring resulted in a higher volume of traffic, with a rise in the number of motorcyclists and cyclists. However, the number of fatal accidents also rose throughout the rest of the year.

The fact is that, when it comes to analysing the causes of road accidents, a large number of influencing factors must always be taken into consideration. In addition to external conditions and technical vehicle faults, the person behind the steering wheel or as a pedestrian or cyclist plays a central role. Inappropriate speed, insufficient safety distance, the influence of alcohol or drugs, overtiredness, overload, inexperience, deliberate infringements of traffic regulations, ignorance of safety instructions in the vehicle and or are just a few examples. The range of 'human' risk factors is wide.

INTERFACE BETWEEN PEOPLE AND TECHNOLOGY

To compensate for human inadequacies and inappropriate behaviour to a certain degree, the automotive industry is increasingly investing in driver assistance systems that are capable of identifying critical situations early, warning of dangers and, if necessary, actively intervening and taking control. A number of systems, such as the anti-lock brake system (ABS) or the electronic stability programme (ESP) are now standard in new vehicles. Other systems, such as adaptive cruise control (ACC), active brake assist (ABA), lane guard system (LGD), lane change assist (LCA) and the turning assistant system (TAS), on the other hand, are still unknown to many vehicle purchasers. It was also stressed once again at the Tenth German Traffic Expert Day of the Gesellschaft für Ursachenforschung bei

1994: A navigation system is installed as standard for the first time (BMW 7 series).

1995: An ESP braking system by Bosch is installed as standard for the first time (Mercedes-Benz S Class).

1996: First motorcycle with ASR (Honda).

1997: Breakthrough for the ESP with the "elk test" with the A Class.

1998: Introduction of the 0.5 per mille drink-drive limit for the blood alcohol concentration value.

1998: First German car with proximity control (SRT) (Mercedes-Benz S Class).

1999: The EU Regulation on the right to drive enters into force.

1990 1995 2000

Verkehrsunfällen (Association for Research on Road Accident Causes e.V. (GUVU)), which took place at the end of June 2011 in Cologne, that the potential of these systems can only have full effect with a high level of market penetration. However, the danger that assistance systems may lead to excessive demands being placed on the driver, or may distract the driver, because of the wealth of information they provide and because they are complicated to use, cannot be ignored.

It should also be borne in mind that, as various investigations have shown, a vehicle's electronics are subject to a certain wear and tear. They are not free from system faults and can be tampered with, switched off and even removed from the vehicle. Investigations by the Vereinigung für die Technische Prüfung von Kraftfahrzeugen (International Motor Vehicle Inspection Committee (CIT)) have shown that electronically controlled systems in vehicles display, by way of comparison, the same fault rates as mechanical systems. The fault rates of electronic systems increase with both the age and the mileage of the vehicle. Each and every vehicle owner must, however, be able to rely on a vehicle's electronics working properly, not only for three or four years, but over the entire lifetime of the vehicle.

The issues sketched out above show that, when people and technology interact on the roads, they create an environment that is beset with challenges. This will be examined in more detail in the following sections of this report.

People and technology in road traffic

Jean-Luc Névache, Interministerial Delegate for Road Safety in France

"Although the new technologies can be of valuable assistance to drivers, it should not be forgotten that technology cannot entirely replace people. In 2011, 3,970 people lost their lives and 80,945 people were injured (provisional figures) in road traffic accidents in France. Even though there has been a sharp fall in the fatality rate In the last ten years, these figures could still be improved significantly.

It should be remembered, however, that the behaviour of the driver is often at fault as, in nine out of ten fatal accidents, there has been a breach of road traffic legislation. Prevention, awareness-raising, education and control measures can be taken to make individual drivers behave more responsibly. Vehicle safety is also an important factor in preventing accidents or minimising their consequences.

The development of electronic assistance systems that support the driver while driving, such as the anti-lock brake system (ABS), the electronic stability programme (ESP) and the lane departure warning system, is running at full speed. There are also other technologies with which certain factors giving rise to accidents, such as drink driving, can be combated effectively. An example is the breathalyser with immobiliser. This system is already mandatory for new buses for the transportation of children and will soon become mandatory for all buses. This safety system may also be prescribed by the courts in the near future for vehicles driven by people who have come to their attention for drink driving on more than one occasion.

The LAVIA speed limit system facilitates efficient driving within the speed limit through automatic adjustment to the permissible speed. The driver can speed up at any time in an emergency and therefore remains fully responsible for his or her vehicle. The French President believes that France will be the world leader in this area. In this context, a working group made up of drivers, representatives of insurance companies and legal experts among others has been set up to prepare the road map for development in this area.

Although much is to be expected from the new technologies, it is still incumbent on drivers to drive attentively and to operate their vehicle safely. They must comply with the rules of the road, keep to the speed limits, fasten their seat belts and drive attentively so that they can react appropriately to any unforeseen event that may occur."

2001: From 1st February mobile phones can only be used with a hands-free set in Germany.

2001: First series-production model with lane guard system (Nissan Cima).

2004: From 1st April infringements of the mobile phone ban behind the wheel are punishable by a fine of EUR 40 and a penalty point in Flensburg.

2005: A draft law amending the German Road Traffic Act and other regulations is introduced in the federal parliament, paving the way for a Germany-wide "accompanied driving at 17" regulation.

2005

2006: First motorcycle airbag in production (Honda Gold Wing).

2011: From 1st November all new vehicle models put onto the market in Europe must be fitted with the electronic stability programme (ESP) as standard. This will be mandatory for all new vehicles from November 2014.

2010

Systematically reducing the risks of accidents

An accident often has several causes. The majority of accidents can be attributed to excessive speed, the influence of alcohol and errors when overtaking.

As already mentioned in the introduction of this road safety report, in only eight of 27 countries has the EU objective of halving the annual number of road deaths been achieved. Germany narrowly failed achieving this objective. The number of road deaths fell by 3,329 persons, or 48 per cent, from 6,977 in 2001 to 3,648 in 2010. In this period, a total of 53,952 people died on the roads in Germany alone. If the number of people killed each year between 2001 and 2010 had remained constant, there would have been 69,770 deaths. As a result, because of the favourable development 15,818 road users have been "saved" since 2002 (Figure 5).

Due to the dominance of absolute figures, the main reason for the fall in the total number of road deaths was the favourable trend in relation to car passengers. In 2010, 2,183 fewer people were killed than in 2001. This equates to a drop of 54 per cent (Figure 6). The other types of road use exhibited falls that were, in some cases, much less in relative terms: 47 per cent among pedestrians, 46 per cent among motorised bicycle and moped users, 40 per cent among cyclists, 34 per cent among motorcycle users, 30 per cent among goods vehicles, and 8 per cent among other road users (including bus occupants and users of agricultural tractors).

Although the 48 per cent drop in the number of road deaths between 2001 and 2010 can be seen as a further major success of efforts to increase vehicle and road safety in Germany, the number of deaths, even at the current level, is still unacceptable and needs to be reduced further. That is why the current guidelines for Europe for the period

Historic low

Doris Bures,
Transport Minister,
Austria

"Greater road safety in Austria has been a focal point of my activity as Transport Minister from the outset. Road rage and drink driving are the most common causes of serious road accidents. That is why, following intensive talks with experts, I have taken action at three levels. First, penalties for speeding and for drink driving have been increased significantly – both the fines and the duration of the withdrawal of driving licences. Second, roadside checks have been intensified and, third, we have raised the awareness of road users through a nationwide road safety campaign. This three-pronged action plan and investment in road safety infrastructure have had the desired effect. Last year, the number of road accident fatalities, which stood at 521, fell to a historic low. For me, this positive development is an incentive for further, targeted measures for increasing road safety. Every fatality is one too many."

5 Change in the number of people killed on the roads and "saved" in Germany

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001–2010	2011*	2001–2011
People killed	6,977	6,842	6,613	5,842	5,361	5,091	4,949	4,477	4,152	3,648	53,952	3,991	57,943
"Saved"	0	135	364	1,135	1,616	1,886	2,028	2,500	2,825	3,329	15,818	2,986	18,804

Source: Federal Office for Statistics *provisional figures

from 2011 to 2020 have once again set the goal of halving the number of road deaths.

There are no valid figures for 2011. According to the provisional figures of the Federal Office of Statistics, the total number of road deaths in Germany has risen again, from 3,648 in 2010 to 3,991. This is an increase of over nine per cent (Figures 5 and 7). In France, by contrast, the positive trend continued in 2011 – albeit by only 0.6 per cent compared to 2010 (2011: 3,970 road deaths; 2010: 3,992 road deaths). In 2011, Austria managed to reduce road deaths by 5.6 per cent to 521 (2010: 552 road deaths).

Returning to Germany, with 3,648 road deaths, in 2010 a historically low level was reached. Given that there are a total of 52.9 million motor vehicles on the roads, this is less than one death per 10,000 vehicles. According to the figures of the Federal Office of Statistics, road deaths reached their peak in 1970 at 21,332; the number of motor vehicles on the roads at that time was 20.8 million. For every 10,000 vehicles, therefore, there were approximately ten deaths.

6 Number of people killed on the roads in Germany between 2001 and 2010 with the corresponding changes in individual types of road use

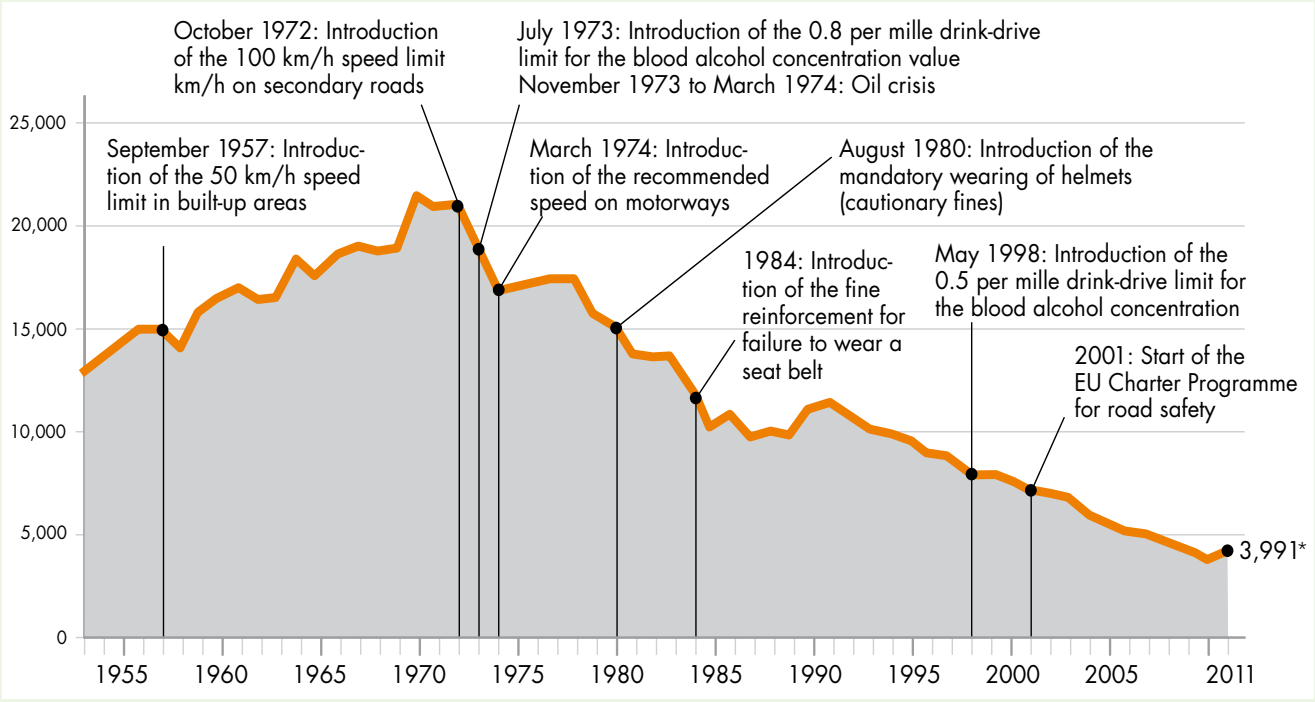
Type of road use	Car occupants	Motor-cycle users	Pedestri-ans	Cyclists	Occupants of goods road transport vehicles	Motorised bicycle and moped users	Other
Fatalities 2001	4,023	964	900	635	230	138	87
Fatalities 2010	1,840	635	476	381	162	74	80
Change	-54%	-34%	-47%	-40%	-30%	-46%	-8%

Source: Federal Office for Statistics

REDUCING THE NUMBER OF ROAD DEATHS BY MORE THAN 50 PER CENT IN SOME CASES

Experts believe that there are many reasons why Germany has developed positively for almost 40 years. Traffic regulations as well as the introduction of the compulsory use of helmets and seat belts have made a contribution, as has the constant improvement of vehicle safety and of technical vehicle equipment. Road construction measures, enhanced traffic management, more roadside checks, measures such as "accompanied driving at 17" as well as the creation of pedestrian zones and bicycle paths separating protected from unprotected road users, all contributed to this positive development. More traffic and road safety education, progress in driver training as well as improved emergency medical care in Germany should not be forgotten. Despite this, in 2010 an accident still occurred, on average, every 13 seconds. One person was

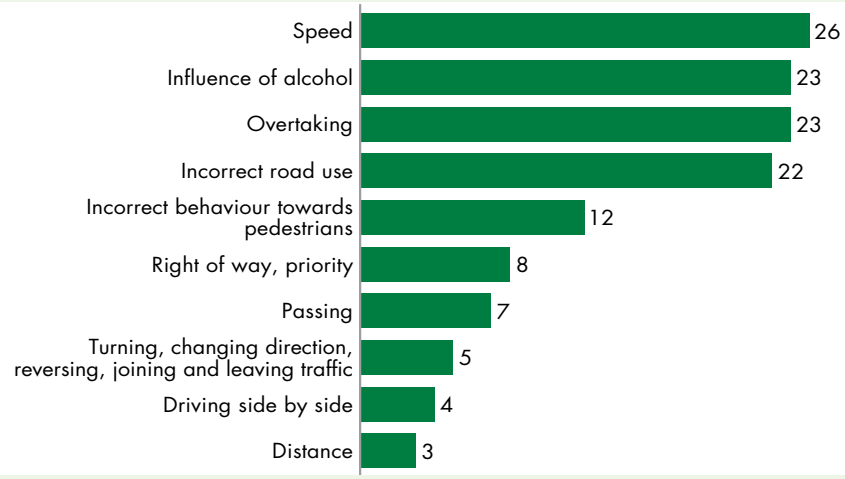
7 Change in the number of people killed on the roads in Germany between 1953 and 2011



Source: Federal Office for Statistics, 2011 *provisional figures

8

Number of people killed per 1,000 accidents resulting in personal injury by cause of accident

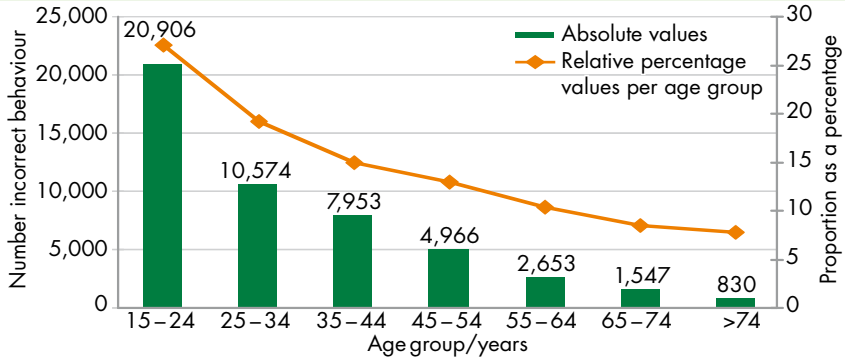


Source: Federal Office for Statistics

9

Inappropriate speed – passenger car

Absolute frequencies of inappropriate speed as the cause of accidents distributed over age groups (as the average value for the period 2001 to 2010) and the percentages of this cause per age group.

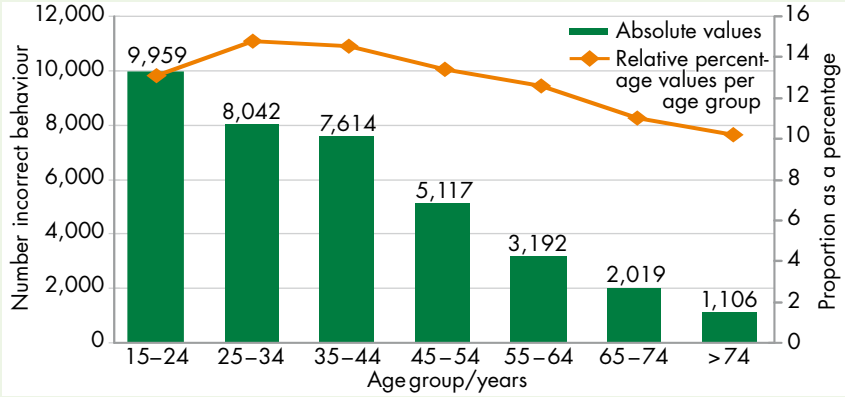


Source: Federal Office for Statistics, DEKRA

10

Distance – passenger car

Absolute frequencies of inappropriate distance as the cause of accidents distributed over age groups (as the average value for the period 2001 to 2010) and the percentages of this cause per age group.



Source: Federal Office for Statistics, DEKRA

injured in a road accident almost every minute and one person died on the roads. This is an indication that the need for action is as great as ever.

A closer look at the incidence of accidents in Germany reveals that, between 2001 and 2010, the number of road users fatally injured each year fell by 50 per cent or more in some areas, including

- accidents in the new federal states (down 56 per cent),
- passenger car occupants (down 54 per cent),
- driver-related accidents (down 52 per cent),
- accidents between a pedestrian crossing the road and a motor vehicle (down 53 per cent),
- accidents that take place at night (down 56 per cent) and during twilight hours (down 58 per cent),
- accidents involving impacts with trees (down 56 per cent), posts (down 50 per cent) and obstacles at the side of the road (down 51 per cent),
- accidents outside built-up areas without motorways (down 50 per cent), accidents on district roads inside and outside built-up areas (down 52 per cent),
- accidents resulting in the death of children under 15 (down 55 per cent), young people between the ages of 15 and 17 (down 65 per cent) and young adults between the ages of 18 and 24 (down 57 per cent).

TRAFFIC TELEMATICS FOR BETTER SPEED MANAGEMENT

According to information provided by the Federal Office of Statistics, in 2010 in Germany "inappropriate speed" was not only the biggest cause of accidents, it also led to the worst consequences of accidents. While 13 people were fatally injured and 217 seriously injured for every 1,000 accidents involving personal injury, in the case of "speed accidents" 26 people were fatally injured and 309 seriously injured for every 1,000 accidents (Figure 8). In accidents in which at least one of the drivers involved was charged by the police with driving at an inappropriate speed, 54,776 in all, 1,441 people died and a further 74,842 were injured. Put differently, in 2010 three out of every five killed on the roads lost their lives as a result of "speeding". The statistical evidence shows that, in 2010, the majority of car drivers involved in accidents as a result of speeding were below the age of 24 (Figure 9). More than one in five novice drivers involved in accidents in which people were injured were charged with driving at an "inappropriate speed". By contrast, insufficient distance, which often accompanies excessive speed, as the cause of accidents is

Faulty lights and inappropriate speed are common causes of accidents.

particularly pronounced amongst 25 to 44 year-old drivers (Figure 10).

A similar picture in terms of speed emerges in France, where "inappropriate speed" was also the main cause of accidents resulting in personal injury. According to information provided by the National Interministerial Observatory for Road Safety (ONISR) in 2010 in France 717 road deaths (= 18 per cent of 3,992 road deaths) could have been prevented, if the drivers involved in the accidents had kept to the speed limit.

As well as training and awareness-raising, the introduction of heavier penalties for infringements and the use of technical solutions, infrastructure improvements are seen by the EU as making a major contribution to reducing road casualties, with infrastructure measures going well beyond the design of traffic space. Against the background of excessive speed as a common cause of accidents, infrastructure measures also include, crucially, the targeted management of traffic flows and adapted speed management.

Variable speed limits, warnings of weather hazards and traffic jams, suggestions regarding public transport or the wide selection of alternative routes are examples of the many options offered by traffic management and control systems. Future interactions between vehicles and traffic computers will then go far beyond the current status quo.

The advantages are obvious: speed limits and warnings can be activated in response to a given situation, with only relevant information actually being transmitted promptly to drivers without them having to select or evaluate it. Static displays such as 80 km/h in wet conditions, 100 km/h between 22:00 and 06:00 can therefore be usefully replaced. It is also possible to prevent congestion through the targeted specification of maximum speeds.

If there is heavy traffic on the road ahead, increasing the risk of congestion, adequately reducing the maximum speed can prevent other vehicles from adding to the congestion. Not all traffic jams can be entirely prevented, but the best possible flow of traffic can be established for the particular density – provided that all road users comply. Experience shows, however, that variable speed limits are better accepted than static speed limits.

FURTHER POTENTIAL FOR A HIGHER RATE OF SEAT BELT USE

Irrespective of the speed at which a vehicle travels and in spite of ever new safety technologies and driver assistance systems, the use of the seat belt remains the most important measure for significantly reducing the risk of vehicle occupants being seriously injured. The positive trend in the use of the seat belt in Germany has been a success story spanning decades. According to a survey conducted by the Federal High-

Causes of traffic accidents in Poland

Inspector Marek Konkolewski, Road Traffic Office at Police Headquarters in Warsaw

"Road safety is influenced by three factors: the human being, the vehicle and the infrastructure. The human factor plays the leading role in this safety triangle. It should not be forgotten that driving is primarily a continuous, mentally challenging process. On average, a driver has to make between eight and twelve decisions per kilometre, with often only half a second available for each decision. That is a real challenge, even for experienced drivers.

In 2010, car drivers in Poland caused 23,559 traffic accidents, in which 1,933 people lost their lives and 32,342 sustained injuries. Current data show that there will be even more fatalities in 2011 than in the previous year. Almost 75 per cent of all people killed in traffic accidents lose their lives in accidents involving passenger cars. The prominent role of people in the safety chain also determines other influencing factors such as the technical condition of the vehicles and road infrastructure. The driver of a vehicle with safety-related technical faults can therefore suddenly lose control of the vehicle, which can lead to an accident with serious consequences. An average driver in Poland drives a car that is around ten years old, which does not automatically have to mean that it is in a poor technical condition. Quite the contrary, as a result of mandatory regular technical inspection and inspection by authorised garages the condition of the vehicle is kept at a generally good technical safety level.

Finally, as regards the roads, which we in Poland so often complain about, Poland has been a fully entitled Member of the European Union since 2004, which has entailed major investment in the construction and upgrading of Poland's roads. There are, therefore, an increasing number of roads available, which compensates, at least partially, for pedestrian and driver errors. That is a good prognosis for the future.

To conclude, responsible, always attentive and considerate road users – whether travelling on foot, by bicycle or by motorised vehicle – help to guarantee safety on the roads. Safer vehicles and vehicles increasingly equipped in the future with electronic assistance systems, as well as modern, user-friendly road infrastructure, make an increasingly important contribution."

When leaving a roundabout in Germany: indicate!

way Research Institute (BASt), the introduction of cautionary fines for failure to use a seat belt on 1st August 1984 resulted in the rate of seat belt use by passengers sitting in the front seats shooting up to over 90 per cent. In 2010, the proportion of adult car passengers (driver, front and rear passengers) correctly restrained in cars was, on average, for all roads, 98 per cent and, in built-up areas, 97 per cent of all adult car passengers were secured with a seat belt.

The federal government refers to this issue in its road safety programme for 2011, which supports the further improvement of seat belts and occupant restraint systems and argues in favour of "seat belt reminders".

However, the question arises as to whether the rate of belt use, which, according to statistics, is already high, is a true reflection of reality. Those who speak to students and teachers on a daily basis are increasingly concerned, as many young people feel that they are being over-regulated and want to feel free, especially at the wheel of their own car or of that of their parents. Wearing a seat belt is often perceived as being shackled and is therefore "mega out". The latest reports on police checks (Figure 11) also give cause for concern. Although such figures are not representative and are the result of a certain pre-selection of vehicles checked by the police, they nonetheless show that there is clear potential for further improvement of road safety through the systematic wearing of seat belts.

SEAT BELTS SAVE LIVES

This potential can be seen even more clearly in the accident data. For example, an analysis of the GIDAS database (German In-Depth Accident Data Base) carried out in December 2006 on the basis of 21,260 car occupants involved in accidents showed a clear trend: the greater the severity of the injuries the lower the rate of seat belt use (Figure 12). Approximately 35 per cent of those seriously injured or killed, with a classification of MAIS 5+ (AIS = 5 and 6), were not wearing a seat belt. MAIS represents the maximum value of the injuries of a single person according to the internationally applied Injury Scale AIS, which goes from AIS = 0 for "uninjured" to AIS = 5 for "critically injured" and AIS = 6 for "maximum" (= "untreatable"). In relation to all car occupants involved in accidents the rate of seat belt use was less than 85 per cent. This result can be seen as representative for the Federal Republic of Germany.

The results of a survey conducted in the German federal states and published by the German Road Safety Council (DVR) in December 2011 (DVR series of papers on road safety No 15) are just as alarming. For ten states for which relevant data were available, an average of 19.8 per cent of car occupants killed in road accidents were not wearing a seat belt.

All this information points to a clear need for action: the use of seat belts must continue to be heavily promoted. The "success story" of the high rate of seat belt use in Germany, which appears not to have changed since the mid-1980s, should not hide the fact that there is considerable potential for greater road safety simply through increasing this rate. The fact remains that roughly 50 per cent of people killed in road accidents in Germany are car occupants. For car drivers the seat belt is still the number one life-saver. It constitutes the basic safety mechanism in a stable passenger compartment and is a prerequisite for the effectiveness of other occupant restraint systems such as the belt tensioner, belt force limiter and various airbags.

One can also speculate on the proportionality of the penalties imposed for failure to use a seat belt. People found not to be wearing a seat belt during road side checks are required, according to the catalogue of fines, to pay a cautionary fine of EUR 30. Anyone caught using a mobile phone without a hands-free set while driving must pay a cautionary fine of EUR 40 and incurs a penalty point in the Central Register of Traffic Offenders in Flensburg.

11 Small selection of reports on police checks

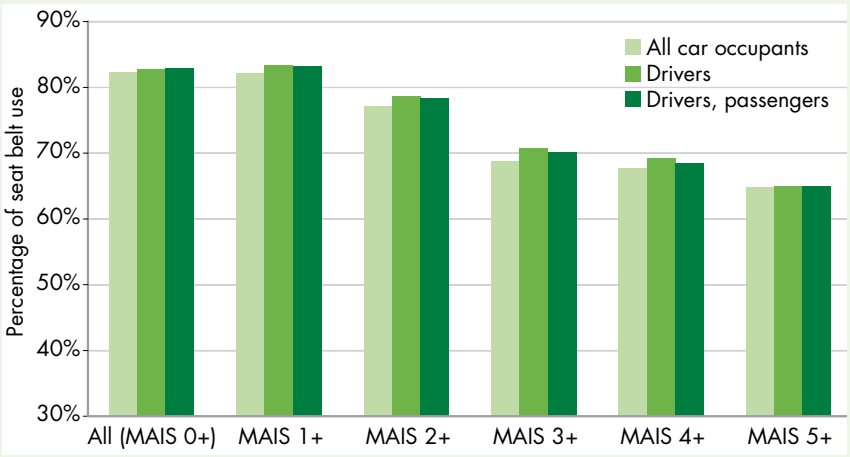
Source	Date	Findings
Information from the police in Karlsruhe	14.12.2011	Seat belt checks of 28 cars and lorries stopped on the slip road to the A5 motorway resulted in a rate of seat belt use* of just over 60 per cent.
Press release from the police in Münster	16.11.2011	During seat belt checks on the A1 and A30 motorways of 215 vehicles and 298 people between 09:00 and 15:00 a cautionary fine for "non-use of seat belts" had to be imposed 49 times, corresponding to a rate of seat belt use* of 84 per cent.
Press portal	3.11.2011	40 drivers were checked during seat belt checks in Wolfsburg between 10:50 and 11:50 and between 16:00 and 19:00. 15 drivers were not wearing seat belts, corresponding to a rate of seat belt use* of 63 per cent.

*In contrast to the rates of seat belt use among all vehicle occupants published by the Federal Highway Research Institute the findings here relate to rates of seat belt use among checked vehicle occupants.

Many people who refuse to wear a seat belt are not aware that not only are they at greater risk of being injured or even killed in an accident but they can also be held responsible for the consequences of their failure to wear a seat belt. Case law is clear on this point: drivers who do not wear a seat belt are complicit in their own injuries, even if they are not otherwise responsible for the accident. As far as financial compensation and damages for pain and suffering are concerned, they face financial deductions. In addition, people who refuse to wear a seat belt must, under certain circumstances, pay part of any hospital costs themselves.

Failure to wear a seat belt is not a problem just in Germany. In the French road accident report for 2010, for example, it was established that 22 per cent of car occupants killed in road accidents were not wearing a seat belt. More than 341 people could still be alive today if they had been wearing a seat belt – especially those on the rear seats.

12 Seat belt use among 21,260 car occupants involved in road accidents calculated on the basis of the maximum severity of the injuries (MAIS)



Source: GIDAS, data analysis in December 2006

DRINK DRIVING

Alongside "inappropriate speed" driving under the influence of alcohol is one of the greatest safety risks in road traffic. Figures provided by the Federal Office for Statistics for 2010 leave no doubt in that respect: 23 killed (Figure 8) and 332 seriously injured per 1,000 accidents involving personal injury can be attributed to the influence of alcohol. In 2010 in Germany a total of 342 road users were killed and 18,874 people were injured in alcohol-related road accidents. Although, compared to the previous year, the number of alcohol-related accidents leading to personal injury fell by 14 per cent, with the number of fatalities even falling by 22 per cent and the number of those injured by 13 per cent, almost one in eleven road deaths resulted from an alcohol-related accident.

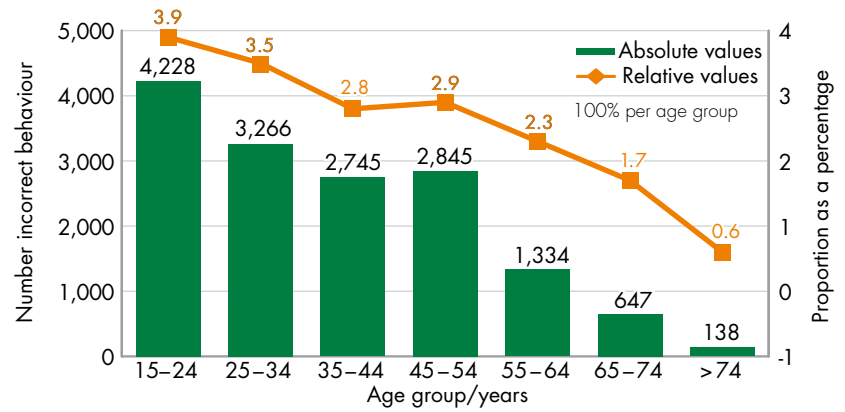
The proportion and the number of people involved in accidents the cause of which is attributed to alcohol decrease significantly with increasing age (Figure 13). Among car

Safety of children in road traffic as passengers

According to figures published by the Federal Office for Statistics, in 2010 in Germany a child under 15 was injured in a road accident every 18 minutes. A total of 28,629 children were injured on the roads in Germany. More children under 15 died for the first time since 2005. 104 children died in road accidents – 16 per cent more than in 2009. Of these, 49 (hence almost half) lost their lives as passengers in a car. Compared to the previous year, more children died in a car (up 32 per cent). Particularly affected were children under nine (up 67 per cent). These figures show that securing children correctly in cars is still being neglected. The following suggestions are a first step towards increasing safety for children under 15 in road traffic:

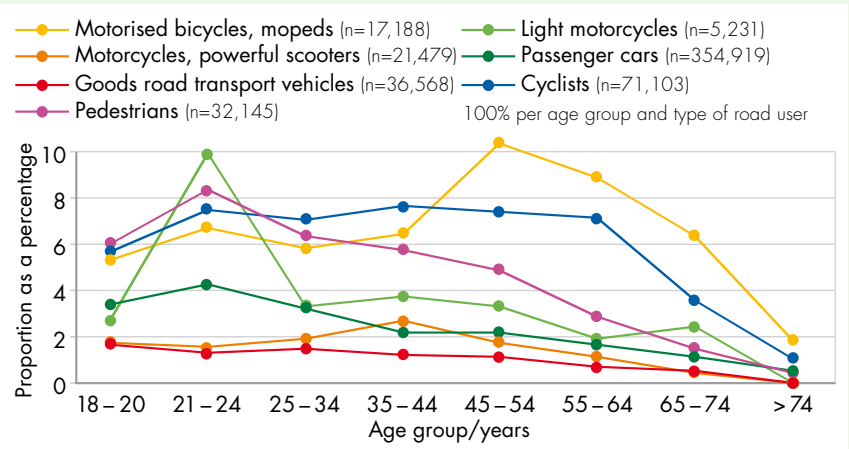
- Section 21 of the Road Traffic Act (StVO) requires that children under 12 who are shorter than 150 cm can only be transported in approved restraint systems for children (referred to colloquially as child seats).
- The basis for the approval of child seats is ECE Regulation 44/04, which prescribes comprehensive crash tests, among other things.
- Under this Regulation, child seats are recognised by the numbers 04 at the beginning of the approval number. If used as intended, these child seats provide a minimum level of protection.
- So that their protective potential can be exploited, child seats must be fitted correctly and the directions for use must be followed exactly.
- It is important that the child seat is appropriate for the car. So, when buying a child seat, test it by installing it in the vehicle, or use the child seat recommended by the vehicle manufacturer or offered as an accessory.
- If the vehicle contains ISOFIX anchorage points it is recommended to use child seats with ISOFIX. This can significantly reduce the risk of faulty installation, and the child is better protected. In addition, child seats secured with ISOFIX are well secured in the car even without a child.
- Child seats are often acquired second-hand or handed down in the family. In such case, care must be taken to ensure that only child seats that come from a trustworthy source are used, so that pre-existing damage can be excluded. The seat must be checked against the directions for use to ensure that it is complete. The use of old child seats (approved to the 01 or 02 series of amendments of ECE Regulation 44/04) is strongly discouraged, as they no longer correspond to the state of the art. These seats can be recognised, as their approval numbers begin with 01 or 02.

13
Proportion of drink drivers involved in accidents in 2010 in Germany



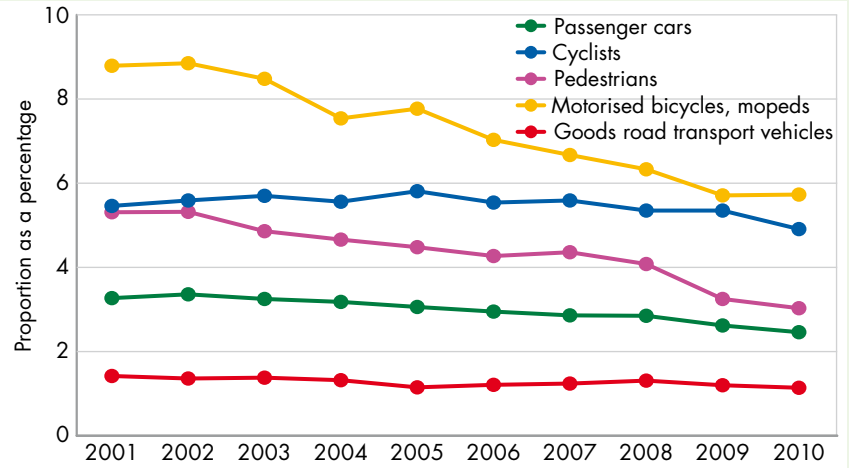
Source: Federal Office for Statistics, DEKRA

14
Proportion of drink-drivers involved in accidents in 2010 in Germany



Source: Federal Office for Statistics, DEKRA

15
Level of alcohol in the blood of those involved in accidents resulting in personal injury 2001–2010 in Germany



Motorised bicycles, mopeds without light motorcycles and motorcycles → only motorised two-wheel vehicles with insurance sticker; goods road transport vehicles include all weight classes → heavy goods vehicles + transporters

Source: Federal Office for Statistics, DEKRA

drivers more than five per cent of whom are involved in accidents leading to personal injury, alcohol as the cause of the accident is to be found most frequently in the 18 to 24 age group (Figure 14). Drink driving as the cause of the accident is, in general, attributed to women less frequently than to men. The 45 to 55 age group, in which the proportion of women and men is equally high (approx. 1.4 per cent), is an exception.

The proportion of road users involved in accidents leading to personal injury has fallen in the past decade among all road users, with the sharpest fall being recorded among drivers of mopeds and powered bicycles (from 8.8 to 5.7 per cent = approx. 2/3 of the initial figure). A similar fall can be observed among pedestrians (from 5.3 to 3.0 per cent = less than 60 per cent of the initial figure). The smallest decrease (approx. 90 per cent of the initial figure) is to be found among cyclists (Figure 15). According to official statistics, the level of drink driving is lowest among drivers of goods road transport vehicles involved in accidents (1.2 to 1.4 per cent).

A measure aimed at preventing driving under the influence of alcohol, which has been widely discussed throughout the EU in recent times, concerns a breath alcohol ignition interlock system, also known as an alcohol interlock for short or alcolock. It is a breath alcohol measuring instrument with a vehicle immobiliser. Before setting out on a journey the driver must take a breath test. If the instrument detects alcohol the vehicle will not start. All the test requirements, results of the breath test, operator errors and attempts at tampering are stored in the

The Swedish experience

"In Sweden the number of fatal road traffic accidents has fallen by 52 per cent since 2001. This means that, on the one hand, the EU-wide target of halving the annual number of road deaths between 2001 and 2010 has been achieved while, on the other hand, with just 28 deaths per million inhabitants, the death rate among Swedish road users is the lowest in the world. Sweden has adopted 'Vision Zero' as its road safety objective. 'Vision Zero' is an ethical undertaking not to accept people dying or being serious injured on the roads. The strengths of this vision lie in setting interest groups a common objective, even though there is a variety of ways of achieving it.

Sweden focussed primarily on speed and roads. In the late 1990s many secondary roads had high speed limits but not enough traffic to

Rehabilitation of seriously and slightly injured patients

Prof. Dr med.
Axel Ekkernkamp,
Unfallkrankenhaus
Berlin

"According to WHO forecasts, in 2020 road accidents will be third on the list of causes of death. The Decade of Action for Road Safety 2011–2020 is an attempt to prevent this. Given that 300 million new vehicles are expected to have been registered worldwide by then, especially in China, India, Brazil, Russia and Vietnam, is this realistic? The Federal Minister of Transport is proud of, and delighted at, the official accident statistics for the Federal Republic of Germany: in 2010 'only' 3,648 were killed. For the first time this was below the current maximum of 4,000 road deaths. As a trauma surgeon, I focus on the fate and rehabilitation of seriously injured patients, as well as on prevention. Professional Association clinics play a special role in this. Under the German Social Code, Part VII, those injured in accidents at or on the way to or from work are to be cared for using all appropriate means. In addition, the principles of 'rehabilitation before pension' and 'everything from a single source', introduced more than 100 years ago, still apply today. This knowledge and experience are being transferred to other road users. With great commitment and meticulousness, trauma doctors have set up trauma registers and trauma networks, which now operate extremely well and attract attention well beyond Germany's borders. The federal government and states, statutory and private health insurers, as well as scientific professional associations and professional associations of trauma doctors, note with pride that seriously injured patients in Germany receive the best possible care. Ostensibly or actually slightly injured patients are pushed somewhat into the background. The moderate neck pain immediately after the accident, the not uncommon tinnitus combined with vertigo attacks, hearing loss and headache cause high diagnostic expense and long periods of incapacity for work. Complaints often become chronic and lead to retirement. That is why strengthening the prevention of road traffic accidents and improving the diagnosis of ostensibly slightly injured patients will become even more important in the future."

instrument's memory and can be read and assessed by a special program. Alcolocks are primarily used as a rehabilitation measure for drivers who have committed alcohol-related offences (secondary prevention), but they are also regarded as a general, preventive road safety measure for professional drivers (primary prevention). Such systems are widespread in Scandinavia in particular. There is no doubt, however, that the fight against driving under the influence of alcohol is a major challenge for anyone in Europe who is committed to improving road safety.

Catharina Elmsäter-Svärd,
Swedish Infrastructure
Minister

justify their expansion. Instead, we introduced separate secondary roads, the so-called 2+1 lane motorways with a central barrier. This was very successful. Up to 80 per cent fewer fatal accidents occurred on these roads. Since 2000 we have invested in more than 4,000 kilometres of roads with separate lanes and, in so doing, saved over 50 lives. In addition, we have also installed 1,100 road safety cameras. We have also re-examined all speed limits and adapted them to the road safety standards. These are the most important factors explaining Sweden's historically low figures.

For the future I have a great deal of confidence in the further technical development of vehicles. The automotive industry continues to do a good job and is developing safety systems that support drivers even more. Better alcolocks, driver fatigue detectors and accident prevention systems are being fitted into mass-produced vehicles. To support this development of assistance technologies, future road networks must be equipped for modern cars, for example with lines and signs that cars can detect themselves.

Young, inexperienced drivers are increasingly emerging as the group to which the legislator needs to pay special attention. That is why Sweden has included the area of risk education in the curriculum of driving schools, and we have driving licences for mopeds. Many young drivers take enormous risks and believe that they are immortal. Sweden recently experienced a spate of accidents involving young drivers who did not abide by any of the laws: high doses of alcohol and drugs in their blood, extremely high speed and non-use of the seat belt. I hope that the technical development of vehicles will help us to solve some of the problems using assistance technologies which help drivers to prevent accidents. But we must also support the good work of the police as well as good training and respect for risk. And we must focus our attention on civil courage. It is important to say no if an inebriated friend wants to drive."

Striking examples of accidents in detail

1 Course of the road and speed limit

2-4 Final resting position of the car following the rollover

Example 1 – Speeding

SINGLE-VEHICLE ACCIDENT WITH ROLLOVER

Sequence of events leading up to the accident:
The driver of a passenger car was driving along a secondary road in rainy weather. The speed limit of 80 km/h in the wet was being exceeded. On a bend in the road the vehicle became unstable and began to skid out of control. After veering from the lane of traffic the vehicle overturned and ended up lying on its roof.

Vehicles involved:
Passenger car

Consequences of the accident/injuries:
All five occupants were injured in the accident.

Cause/problem:
The vehicle did not have any technical faults that might have caused the accident. The initial speed of the vehicle was reconstructed and found to be approximately 100 km/h; the weather-related permissible speed was 80 km/h.

The accident was caused by excessive speed for the road surface conditions.

Accident prevention options/ approach to road safety measures:

Compliance with the speed limit.

Potential for accident prevention/minimising the severity of the accident through ESP is indicated.

Example 2 – Speeding and drink driving

SINGLE-VEHICLE ACCIDENT IN WHICH A CAR COLLIDES WITH A TREE

Sequence of events leading up to the accident:
The inebriated driver of a passenger car left the carriageway to the right at very high speed in a rural area after coming out of a slight right bend. As a result of excessive countersteering, the vehicle skidded on the wet carriageway and collided laterally with a tree.

Vehicles involved:
Passenger car

Consequences of the accident/injuries:
The passenger was killed as a result of the collision; the driver sustained serious injuries.

Cause/problem:
The vehicle did not have any technical faults that might have caused the accident. The initial speed of the vehicle was reconstructed and found to be approximately 160 km/h; the speed limit was 100 km/h.

The accident was caused by drink driving and speeding.

Accident prevention options/ approach to road safety measures:

Accident prevention options/approach to road safety measures:

Driving without alcohol.

Compliance with the speed limit.

Not planting trees along rural roads and constructing protective devices around existing trees.

1

2

3

4

1 Vehicle in its final resting position

2 Extreme deformation caused by deep penetration of the tree

3 The tree involved in the collision

4 Speedometer after the collision

1 Skid marks

2 Final resting position of the vehicle

3 The stable passenger compartment offers good chances of survival for restrained occupants

4 Door opening possible without the fire brigade

5 Deep penetration by the lamppost into the engine compartment

Example 3 – Speeding, technical faults of the vehicle, non-use of seat belts

SINGLE-VEHICLE ACCIDENT IN WHICH A CAR COLLIDES WITH A LAMPPOST

Sequence of events leading up to the accident:
The young drivers of two passenger cars were racing each other in an inner-city area, significantly exceeding the speed limit. On a bend, due to faulty brakes and excessive speed one of the vehicles skidded and collided with a lamppost.

Vehicles involved:
Passenger car

Consequences of the accident/injuries:
The driver, who was not wearing a seat belt, and the occupants of the rear seats were seriously injured in the accident. The front-seat passenger, who was not wearing a seat belt, suffered fatal injuries.

Cause/problem:
When the vehicle was checked for roadworthiness the braking device was found to be extremely faulty. This became noticeable to the driver when driving through the late onset of the braking effect. It was also indicated by a warning light. The reconstruction of the initial speed resulted in a lower speed limit of 81 km/h; it may have been much higher.

Accident prevention options/
approach to road safety measures:

The fatal injuries of the passenger could have been avoided had he been wearing his seat belt correctly and the severity of the driver's injuries would have been significantly less.

The accident could probably have been prevented if the braking device had been intact; an effective ESP would also have had a positive effect.

Compliance with the speed limit.

Example 4 – Speeding and faulty vehicle

SINGLE-VEHICLE ACCIDENT IN WHICH A CAR COLLIDES WITH A TREE

Sequence of events leading up to the accident:
The driver of a passenger car left the carriageway to the right at very high speed in a rural area after coming out of a right bend. As a result of excessive countersteering, the vehicle skidded and left the carriageway to the left, just missing a vehicle coming in the opposite direction. After leaving the carriageway the vehicle collided with a tree and ended up in a flood ditch.

Vehicles involved:
Passenger car

Consequences of the accident/injuries:
The driver and the passenger were seriously injured as a result of the collision. Both occupants were not wearing seat belts.

Cause/problem:
When the vehicle was checked for roadworthiness, the braking device and the tyres were found to be extremely faulty. The body was weakened by rust. Considering the specific accident sequence, these faults did not cause the accident, but they increased the consequences of the accident. When the initial speed was reconstructed it was found to be 171 km/h, while the speed limit was 100 km/h.

The cause of the accident was excessively high speed. An ESP system may have had a positive impact on the accident. Because of the poor overall condition of the vehicle, the stable passenger compartment was not as effective as it should have been, and this led to higher forces being exerted on the occupants.

Accident prevention options/
approach to road safety measures:

Accident prevention options/approach to road safety measures:

Compliance with the speed limit.

Repair of safety-relevant vehicle faults.

1 View in the direction the car came from

2 Final resting position of the vehicle

3 Hardly any deformation on the passenger side

4 Deep penetration of the tree into the rust-weakened passenger compartment

Minimising risk through a greater sense of responsibility

An increasing amount of technology is integrated in vehicles, both passenger cars and lorries, to support drivers in critical situations and to prevent accidents as far as possible. Greater market penetration of such assistance systems appears crucial, as incorrect behaviour on the part of drivers is still by far the most common cause of accidents. In addition to the growing need for age-appropriate mobility guidance and road safety education, it is also important to increase the acceptance of rules.

Road traffic presents people with many challenges, with certain minimum requirements having to be met for participation in road traffic. Nevertheless, certain restrictions, such as illness, for example, can have a critical impact on vehicle handling. The ability and aptitude to take part in road traffic depends on the resources a person has to solve problems and the possibilities a person is able to demonstrate to compensate for the stresses and strains of driving. Restriction on the grounds of health or behaviour does not necessarily mean having to give up driving; it can be compensated for with available resources.

Behaviour in road traffic is also social behaviour. All road users act as a social system. To prevent accidents, those involved must have a common knowledge of rules and standards. Road users must be able to predict, to anticipate the actions of another – whether in a car, on a bicycle or as a pedestrian. This ability enables people not only to put themselves in the position of another person but also to identify all options for action and to recognise which are most likely.

In such a complex system as road traffic, which is constantly changing, the coordinated actions of many individuals are decisive. Therefore, road users who disrupt or interrupt the smooth functioning of the "traffic" system – through illness, impairment or intentionally inappropriate behaviour, for example among aggressive drivers – are of special interest. For here lies huge potential for improving road safety and preventing accidents. Whatever means of transport you use, road accidents always have several causes, first and foremost excessive speed, carelessness or alcohol, not forgetting external conditions and possible technical faults. In short, a person behind a wheel is and remains a major risk factor.

YOUNG ADULTS – ASPECTS OF DEVELOPMENTAL PSYCHOLOGY

If we now take a somewhat closer look at selected groups of road users, it is noticeable that more young adults between the ages of 18 and 24 die in road accidents than people in other age groups. This

finding is also supported by figures from the Federal Office of Statistics showing the trend in accidents on German roads. In 2010, their number was 73,172, with 73 per cent travelling in a car, even though the average across all age groups is just 53 per cent. Despite positive developments in this age group, it is still the most vulnerable group. Even though they make up just 8.3 per cent of the population, 19 per cent of those killed and one in five of those injured come from the 18 to 24 age group. One in three of young adults killed in 2010 died in a road accident. The risk of dying in a road accident is twice as high in this age group as the average risk of all age groups. For every one million inhabitants in their age group, with 102 killed young adults were the most vulnerable age group, followed by the elderly, with 54 fatalities, and the young, with 41 fatalities (Figure 16).

Young drivers in particular often underestimate the risk of distraction.

What circumstances lead to young adults being particularly vulnerable in road traffic? The special mix of inexperience, appetite for risk, inflated self-esteem, the search for kicks and exhibitionism certainly play a role. A closer analysis of the data shows that inappropriate speed and insufficient distance were the most common causes of accidents. But alcohol and drug consumption are also common in this age group.

Appetite for risk among the young plays a special role. Young people tend to have a riskier lifestyle than adults, while being unaware that they are endangering their own health. The reason for this lies in "youthful egocentricity". Young people are inward-oriented and self-referential and are therefore unable to realistically assess the events in the "external world".

Other processes, described by Limbourg and Reiter, which make it difficult for young drivers to assess risk realistically are perceiving the self as unique, inflated self-esteem ("I can react very quickly") accompanied by big ideas ("I am a great driver") and presuming that they are invulnerable ("It won't happen to me"). At this age, young adults judge others by their own standards ("Everybody drinks alcohol in discos") and therefore justify their actions in this way. Such requirements as tests of courage or delinquent behaviour are especially important in peer groups to set themselves apart from adults. Transgressing standards and overstepping boundaries also serve as a protest against the adult world. For these reasons, awareness campaigns in the media only have a limited effect. Young drivers are not, or are hardly, in a position to relate risks to themselves, and it is therefore difficult for them to influence their own behaviour.

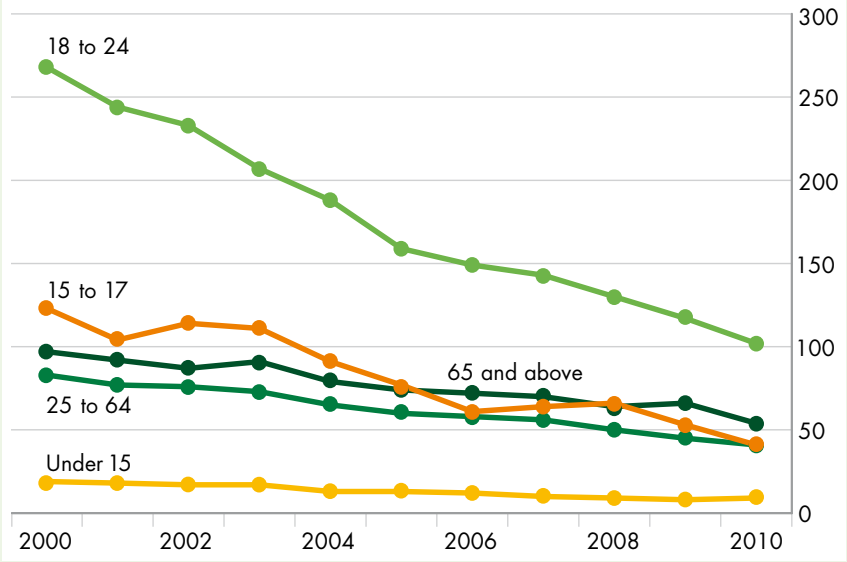
In his article "On the acceptance of road infrastructure charging" the traffic psychologist Bernhard Schlag names four possibilities for influencing behaviour in traffic:

- Regulatory measures (requirements and prohibitions: "enforcement"),
- Training, public awareness-raising and information ("education"),
- Offer structure (traffic routes and modes of transport: "engineering") as well as
- Incentive systems or variation of the cost-benefit calculation of the road user ("encouragement" or "economy").

In this context, Lars Rößger and colleagues composed backgrounds for specific driving offences (Figure 17).

A further preventive approach for young drivers is improved training for novice drivers, which is also promoted by the federal government in the Road Safety Programme 2011. The model project "Accompanied driving from 17" was able to demonstrate initial positive experience in the area of the risk of offences and accidents. The "Framework Strategy for Pre-test Driver Training in Germany" is currently being prepared to bring further improvements.

16 Road traffic fatalities broken down by age group per 1 million inhabitants



Source: Federal Office for Statistics

17 Backgrounds of specific traffic violations

Influencing factors		Situation favouring violations	Social norms	
			Expected consequences	Perceived risk, informal standards, social acceptance, signals of illegitimacy
Type of offence	Speeding	Misunderstanding of the situation, false cues. Situational behavioural demands (vehicle, road).	(Subjective) probability of detection low, severity of punishment mostly low. Presumed gain appears more assured and more important.	Perceived risk low, informal norms weak, social acceptance of violations high, few signals of illegitimacy.
	Drink driving	Rarely indicated (possibly alcohol in discotheques, etc.)	Probability of detection low, severity of punishment high.	Perceived risk? Informal norms now strong. Social acceptance of violations low, signals of illegitimacy strong.
	Red-light offence	Misunderstanding of the situation, transitions not clear enough („amber"), poor prior management (increases probability of error).	Probability of detection high, severity of punishment quite high.	Perceived risk strong, informal norms quite strong, social acceptance of violations low, signals of illegitimacy strong.

Source: Modified according to: L. Rößger, J. Schade, B. Schlag, T. Gehlert (2011): Verkehrsregelakzeptanz und Enforcement (Acceptance of Traffic Rules and Enforcement).

PRESSURE FROM OTHER ROAD USERS

It is, of course, also the behaviour of "experienced" road users towards young, novice drivers that frequently leads, first, to uncertainty and, then, to errors, often with a tragic outcome. In the theoretical part of driver training, young people are provided with traffic rules while, during practical training, they practice implementing them in road traffic. If a young, novice driver then gets into his or her own vehicle, there is no longer the protection generally afforded by a driving school vehicle. If a novice driver drives along a secondary road with a speed limit of 60 km/h at the prescribed speed, other car drivers react by driving tool close to the vehicle in front and executing passing manoeuvres. If a novice driver slows down when the traffic lights are at amber, this is greeted with a cacophony of car horns from following drivers, as is stopping at the green filter arrow or waiting too long for a "safe" gap before turning. Insecure novice drivers are made even more insecure through such behaviour, which violates the regulations but which is, unfortunately, practised by many drivers, and lay the blame on themselves.

"Attacks" from other drivers can be avoided by driving faster, going through traffic lights on amber, and by adopting a more aggressive driving style. If there are friends sitting in the car, being pilloried as a hindrance to traffic is definitely not desirable. How much pressure is really exerted by other road users can be easily checked simply by complying with the rules of the road, especially speed limits. After such an experience one might also change one's own behaviour towards others who actually do everything right.

THE ELDERLY IN ROAD TRAFFIC

In contrast to young drivers, elderly drivers currently feature much less in traffic accident statistics because they do not clock up as many miles. However, demographic trends and the mobility patterns of future elderly people will lead to fundamental changes in this regard. A sharp rise in the number of elderly drivers is already evident in the medium term. In Germany alone, the 12th coordinated population projection (Figure 18) underpins this trend with the following facts:

- By 2060 the population of Germany will have fallen from 82 million today to between 65 and 70 million.
- In 2030 almost 30 per cent of the population will be over 65 years of age.
- In 2060 there will be almost as many 80 year-olds as under 20 year-olds.
- Today, one in five is 65 or older – in 2060 it will be one in three.
- By 2060 the life expectancy of women will have risen to approximately 89 (currently 82.5), and that of men will have risen to 85 (currently approximately 77).

These facts make it abundantly clear that older people will in the future play a greater role in road safety. Mobility is crucial for the elderly, it safeguards their quality of life and it is also a resource for society as a whole. Meeting the basic need for mobility must also be promoted and guaranteed, as must road safety and the protection of the public in general, which is closely associated with it.

The elderly are particularly vulnerable road users.

Personal factors		Dominant problem and approaches to change
Motivation for violations	Error rate and experienced controllability	
Various personal characteristics (age, gender, quest for change, etc.), influences indicated by the situation (haste, etc.). Lack of negative consequences and perceived advantages cause habituation.	Mental model including expected consequences unfavourable. Violations are experienced as controllable.	Problem of violation: Motivation for and social acceptance of speeding with weak social control of false gain.
Strong habituation up to dependency, weak self-control (inc. risk of re-offending).	Lack of control in the problem group, otherwise generally indicated. Misjudgement of individual problems.	Subgroup problem: lack of separation of alcohol and driver in the problem group. Selection and change of behaviour. General: strengthen social control, set clear boundaries (e.g. alcohol ban).
Haste, willingness to transgress, etc.	Situation favouring breaking the rules to some extent. Age and/or specific problems. Experienced control: yes. Sometimes indirectly intentional: advantages expected.	Judgement error with existing willingness to transgress. Make violation limits clear and proactively manage them, reduce the probability of error technically and educationally.

Berlin: GDV, Research Report W 06, p. 44.

THE PHYSICAL AGING PROCESS: LIMITATIONS, RESOURCES AND COMPENSATION

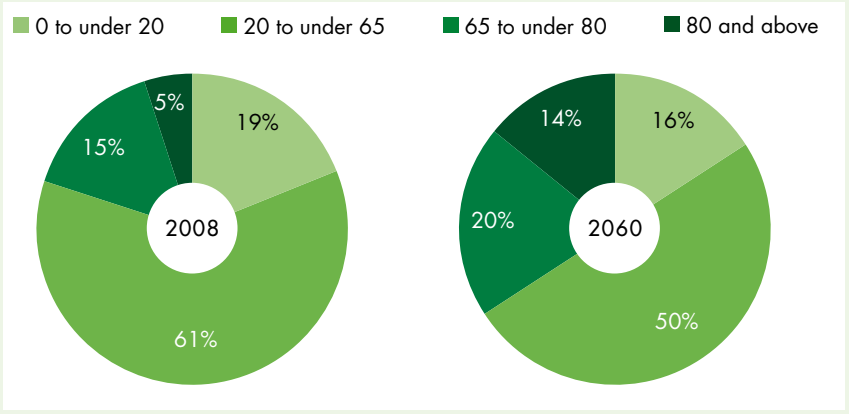
When it comes to road safety, it is important to realise that older drivers are affected by the physical aging process and associated age-related structural and functional changes. For example, visual acuity and hearing ability change with advancing age. Cognitive functions (psycho-functional level) such as attentional performance and aspects of memory are impaired. Selective attention, that is to say the filtering out of relevant information, requires greater effort in old age, which means that older people get tired more easily. Divided attention, that is to say the ability to process several bits of information in parallel, is also affected by the aging process. Generally speaking, the speed at which information is processed decreases with increasing age.

Age-related restrictions also occur in the psycho-motor area. For example, the reaction and orientation time becomes longer. Although a person's personality is a stable variable, changes take place. Older people tend to be increasingly anxious and unwilling to be self-critical.

In physiological terms, not only do specific illnesses occur with increasing age (for example, cardiovascular diseases, diabetes mellitus or locomotor system diseases), but, most significantly, older people tend to suffer from co- and multimorbidity, that is to say several diseases occurring together. However, a comparison between the risk of accident associated with specific illnesses which mainly occur later in life and other risks such as the consumption of alcohol shows that these illnesses entail a similarly high risk as driving with a blood alcohol concentration of 0.5 per mille (Figure 19). However, a comparison between the 75+ age group and young men under 25, who are well known to be at risk, makes it clear that young drivers face a much higher risk of accident than older drivers.

18

Population by age group



12th coordinated population projection
Source: Federal Office of Statistics

A SELF-CRITICAL LOOK AT THE AGING PROCESS AND PERFORMANCE

When listing illnesses that appear to be caused by old age alone, it should be borne in mind that the calendar age of a person is not the only determinant of the aging process. The so-called biofunctional age of a person, which is heavily influenced by socio-cultural factors and depends on living conditions and everyday behaviour, is far more important and can be positively or negatively influenced throughout life.

It cannot be denied, however, that, due to age-related physical changes, there are traffic situations that are more difficult for older people to control than when they were younger. Such situations include changing lanes when overtaking, complex situations at intersections, reversing and turning manoeuvres, conflicts in traffic and situations in which interaction with other road users is necessary.

The portrayed performance losses do not necessarily have to have an adverse impact on driving behaviour but can be compensated for through the avoidance of risky situations or the adoption of a more defensive and hence safety-enhancing driv-

The "Gulliver cars" of DEKRA show adults from what perspective children perceive cars and what risks this perspective entails.

ing style. According to John A. Michon, a Dutch psychologist, three different levels of road use can be distinguished: the strategic, the tactical and the operational level. On the strategic level, decisions are often made before the journey begins (route, etc.). Older people who are no longer part of the workforce can make such decisions without any rush and are therefore able to plan better. On the tactical level, the focus is on seeking to minimise risk. This can best be achieved through anticipating road incidents, and it is here that older people are helped by their wealth of experience in road traffic. On the operational level, the focus is on the selection and execution of driving manoeuvres. On this level, in particular, older people are often overwhelmed because of their performance losses. However, driver training for older drivers can lead to improvements.

However, the greatest potential for compensating for age-related limitations lies in the first two levels, as most older drivers have enough time to plan their route adequately (strategic level). They can still go on holiday by car, for example, just not the customary long distances. Alternatively, they can maintain their mobility target – the city centre for example – and choose another form of transport (tactical level) such as the bus for example, if city traffic can lead to situations they find difficult to cope with. It is also possible for older road users to compensate for performance losses such as decreasing reaction speed through other psycho-physiological resources – in this case increased attention.

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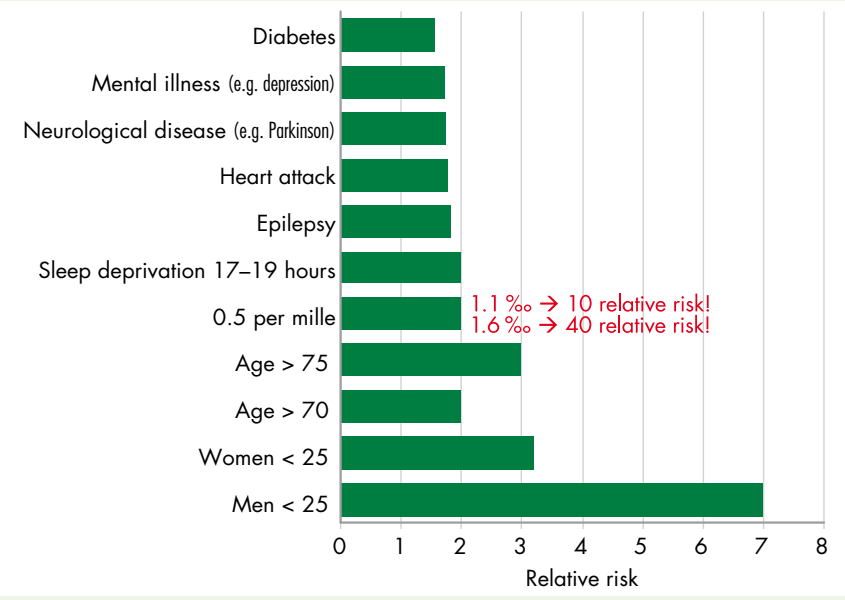
The risk of accidents based on various risk factors

The graph shows that, for example, with an alcohol level of 0.5 per mille, the risk of accidents is twice as high as if the driver was sober. At 1.1 per mille, the risk of accidents is 10 times higher and at 1.6 per mille the risk of accidents is 40 times higher. Male drivers under 25 are at much greater risk of accident.



Source: Epilepsy and driving in Europe. Final report of the Working Group on Epilepsy. EU Project IMMORTAL Deliverables R1.1 and R1.2

INCREASING NEED FOR MOBILITY-RELATED COUNSELLING

It is therefore clear that older road users are "unfit to drive" not simply on account of their age-related performance losses. Furthermore, calendar age is not, on its

Voluntary DEKRA mobility check

In order to maintain quality of life in old age the preservation of individual mobility is vital. However, it is precisely in the later stages of life that drivers ask themselves: am I up to the challenge? Answering such a question objectively is especially important when, for example, illness and medication are already part of everyday life.

The driving aptitude assessment units employ competent traffic psychologists and traffic-specialised doctors who can advise on matters of performance and state of health in relation to the use of a vehicle. As part of driving-related psychological mobility guidance diagnostic processes are used to provide information on performance (attention, concentration, reaction speed, the ability to criticise oneself, etc.) to those seeking advice. The driving-related medical check and counselling creates clarity as to the physical prerequisites for driving a vehicle. The driving-related psychological observation of driving behaviour provides additional information on driving behaviour under real-life conditions.

Participation in the counselling programme is voluntary. At the end a certificate is issued, which may also contain individual recommendations (for example, "no driving at night", "only drive along known routes", etc.). Each person seeking advice can then decide what conclusions to draw. Apart from this person, no one – not even the driving license authorities – is given information about the conduct and the results of the mobility check.

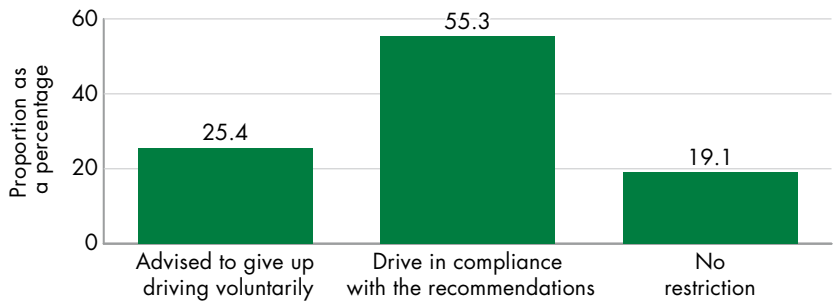
This is a purely preventive approach (possibly supported in the future by an incentive or reward system), which enables citizens to comply with their duty of self-assessment under Section 2(1), sentence 1 of the Driving Licence Regulation (FeV).

An analysis of 101 mobility checks carried out by DEKRA showed that the average age of participants was 70 and that ages ranged from 27 to 89, with the majority of people seeking advice being men. There was a special need for driving-related psychological counselling followed by driving-related medical counselling and observation of driving behaviour.

Results of the DEKRA mobility check

Around half of all participants were encouraged to drive a vehicle only if they followed certain recommendations. Some examples of these recommendations are:

- Assess your wellbeing before setting off (duty of self-assessment under Section 2(1), sentence 1 FeV);
- Adjust your driving to your capabilities (proactive, defensive);
- Avoid situations which will place excessive demands on you (rush hours, traffic junctions);
- Avoid additional burdens (illness, tiredness, stress, etc.);
- Consult a specialist (e.g. cardiologist, ophthalmologist, diabetologist);
- Limit the duration of the journey (e.g. not longer than 2 hours) or the driving distance (e.g. only within a radius of 20 km, only known routes);
- Discuss the effect of medicines on driving ability with your doctor;
- Get regular medical care;
- Avoid driving at night and in twilight conditions;
- Take advantage of training opportunities for older drivers (e.g. knowledge of traffic rules).



Source: DEKRA

The important thing with regard to the recommendations and the consultation is that there are no administrative consequences in terms of driving licence restrictions and conditions. The results and their possible effects on driving behaviour are discussed with the client. In this discussion the client is advised either to give up driving, to continue to drive only in compliance with the recommendations, or to continue to drive without restrictions. The content of the discussion is not passed on to the driving licence authorities. The client can decide independently whether he or she will follow the advice and recommendations or not.

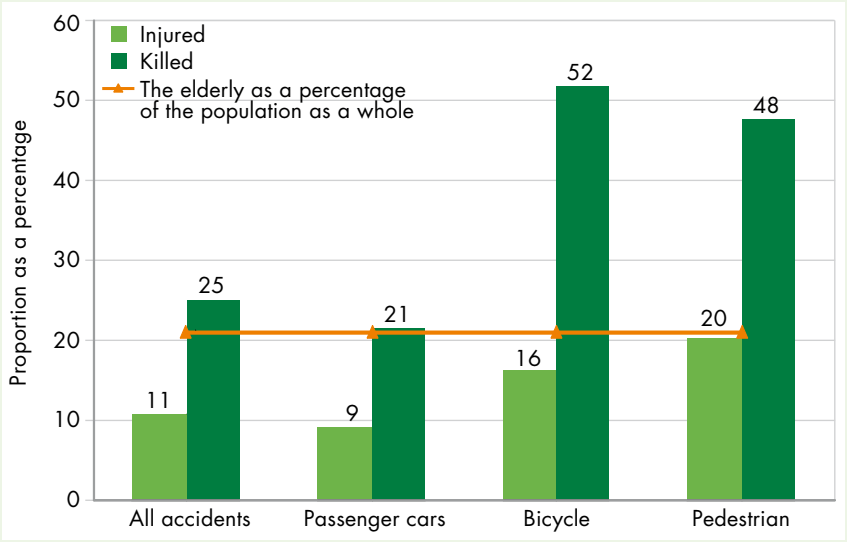
own, a valid criterion for identifying a person's actual physiological and psychological performance. However, for older road users, it is important for their own safety that they monitor their aging process and performance so that appropriate measures and compensation strategies can be adopted.

There is, therefore, an increasing need for individual mobility-related counselling (for example the "DEKRA Mobility Check", see box page 29), diagnostics and assistance. It is important to note that mobility counselling should be interdisciplinary, with doctors and psychologists from officially recognised assessment and course centres being particularly suitable for mobility counselling due to their specialist experience. The quality of such counselling must be assured, as it is not the illness of the person concerned that is important but how the illness is dealt with. This is a predominantly psychological evaluation and cannot, for example, be tackled by a general practitioner without special traffic-specific training. What is more, because of the current shortage of doctors – especially in rural regions – the need for mobility counselling cannot be covered by GPs. There are currently no statistics on medical counselling. Therefore, a first step must be to identify which illnesses predominate in which age groups and what impact they have on a person's fitness to drive.

Advisory services must be technically and conceptually developed and unified. Such mobility advisory services can be supported by insurers through a system of rewards and can therefore also promote the use of elderly volunteers to give advice. Examining fitness to driver on the basis of calendar age alone is not appropriate. For

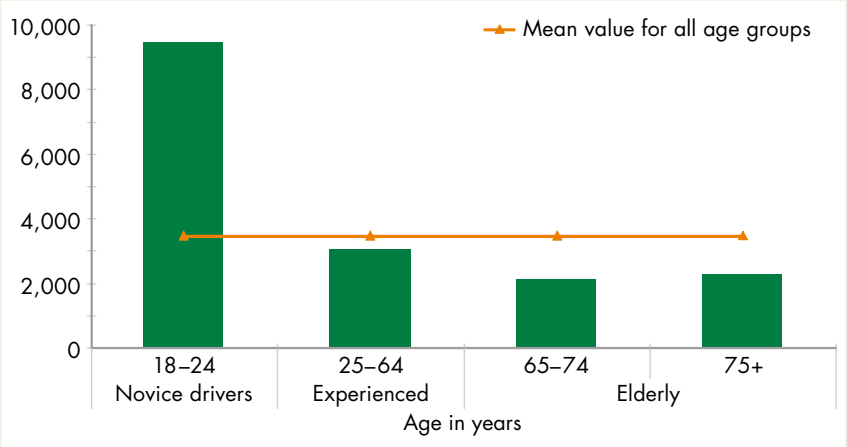
Tiredness at the wheel is a common cause of accidents.

20
The elderly as a percentage of those killed/injured by means of transport 2010



Source: Federal Office of Statistics

21
The car as the main cause of accidents resulting in personal injury per 1 million driving licence holders



Sources: Results report "Mobility in Germany 2008", Federal Office of Statistics, Klaus Rompe: "Unfallrisiken der Senioren am Steuer und Möglichkeiten zur Reduzierung durch intelligente Fahrzeugtechnik" (The risk of accidents caused by the elderly and possibilities for reducing this risk through intelligent vehicle technology)

one thing, the biofunctional age of a person is crucial in determining a person's performance. For another, in Germany the requirement of the cause-related approach is crucial in determining driver fitness.

OLDER DRIVERS: DANGEROUS OR VULNERABLE?

In the public perception, older drivers are not only a growing group, they also represent a special risk for road safety. Increasingly, there are reports in the media about the elderly who are involved in road accidents in a special way. There are also public debates about special tests or appraisals for older drivers. But does this kind of reporting reflect statistical reality?

The fact is that some figures rise with increasing age. According to figures provided by the Federal Office for Statistics, per one million inhabitants killed in road accidents in 2010 54 persons were senior citizens – looking at the population of Germany as a whole the average was 45 fatalities per million inhabitants. This is also confirmed by the percentage change (Figure 20). The elderly have the second highest risk of dying in road traffic behind young adults under 25. The percentage of the elderly as the main cause of car accidents rises with increasing age (66 per cent amongst 65 to 74 year-olds, 76 per cent amongst the over 75s). If these values are put into another system of reference the first impression broadens. Older road users make up only a small proportion of all accidents (11 per cent), but an increased proportion of fatalities. They make up 21 per cent of the population.

The elderly are therefore involved less than average in accidents, but they are more frequently killed in an accident. This is particularly true of older pedestrians and cyclists. It can therefore be concluded that the elderly endanger themselves more than other road users. If other reference systems are used for these absolute accident figures a different picture emerges. For example, Figure 21 shows the number of car drivers causing accidents resulting in personal injury per 1 million licence holders over all age groups.

Looked at in this way, it is clear that the elderly with a driving licence cause far fewer accidents than all other age groups. They have the lowest annual number of entries in the central traffic register. In addition, the elderly use their cars less and less as they get older, which means that their annual mileage falls. This more than compensates for their higher risk of accident (Figure 22).

Drowsiness in road traffic

Prof. Dr rer. nat. Wolfgang Schubert, President of Deutsche Gesellschaft für Verkehrspsychologie e.V. (German Association for Traffic Psychology)

"Most drivers have already experienced tiredness at the wheel, caused by illness or behaviour (too little sleep for example,) or as a result of sustained monotonous activity such as motorway driving (exceeding driving periods). The resulting risk for road safety is often trivialised, although, according to information available today, tiredness and drowsiness often lead to road accidents.

In contrast to causes of accidents such as alcohol and drugs there are currently no objective limit values available for drowsiness. There are no validations distinguishing between acceptable and imperilling drowsiness. There is therefore a lack of equality before the law and legal security for the appraisal of drivers during roadside checks, following accidents or when producing reports, Better legislation is also called for by the EU.

Introducing driver drowsiness into the Appraisal Guidelines for Driver Fitness is justified on the grounds of risk potential alone. The aim must be to work towards a coherent and scientifically well-founded approach. This requires further development of methods as well as reliable empirical knowledge."

A Swedish investigation even established that the risk of accident rises in all age groups if mileage decreases (Langford, Methorst & Hakamies-Blomqvist, 2006). If mileage is very low, the risk of accident rises dramatically. A Danish study also examined the consequences of the periodic testing of older drivers. The background to the study was the introduction of a cognitive performance test for older drivers in Denmark. Fatal road crash statistics before and after the implementation of the cognitive test were compared. It emerged that there was no difference between the number of older drivers who were involved in fatal accidents. In other words, this monitoring measure had no impact on the safety of older road users. On the other hand, however, the number of unprotected older (but not of unprotected younger) road users killed during the two-year observation period increased significantly. The authors interpret this trend as showing that older road users have given up travelling by car and have gone over to unprotected, significantly less safe forms of mobility.

Conclusion: The elderly are particularly at risk in traffic. This is especially true when they go somewhere on foot or by bicycle. For the elderly – depending on the number of miles travelled – travelling the same distance by bicycle is 10 times, and on foot is 7 times, more dangerous than by car. It is, therefore, not sensible to persuade the elderly to give up driving and to switch to cycling on the basis of undemonstrated safety concerns. Instead, public local and long-distance transport, especially in rural areas, must be expanded and improved in order to guarantee those older people who no longer trust themselves to drive a car their individual mobility.

DRIVER ASSISTANCE SYSTEMS: A COST-BENEFIT ANALYSIS FROM A TRAFFIC-PSYCHOLOGICAL PERSPECTIVE

In the literature and the current statistics it is repeatedly stated that driver are the greatest source of error in road accidents. According to figures provided by the Federal Office for Statistics, in 2010, 84 per cent of all accidents were caused by driver error. To the question of what psychological causes an accident has Udo Undeutsch gave the following answers:

- breach of natural behavioural tendencies,
- indirect assessment of the situation,
- false expectations of other road users,
- incorrect assessments,
- distraction,
- entrenched behaviour and
- age-related driving incompetence.

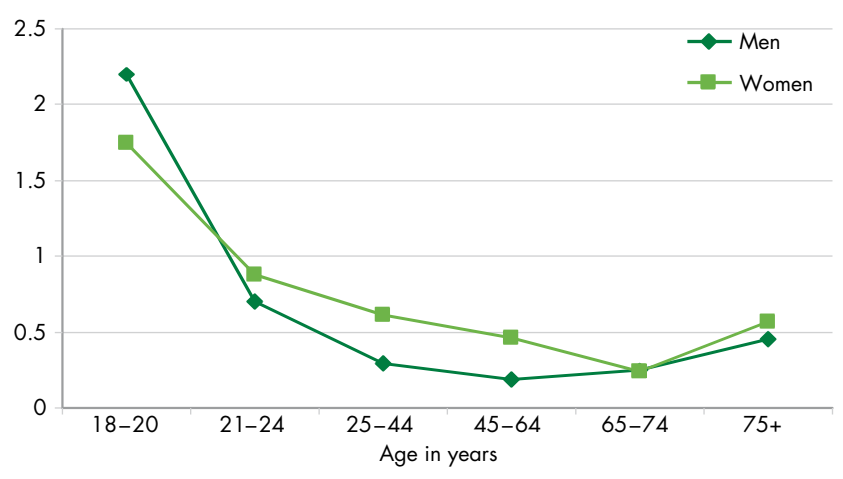
A study on errors in accidents carried out by Prof. Mark Vollrath at the Institute for Psychology, Cognitive and Engineering Psychology at the Technical University of Braunschweig produced the following picture:

	All accidents	Serious accidents
Collision with road users having priority	33.0	36.4
Turning into/crossing intersection	16.5	21.8
Turning against	3.1	5.0
Turning bicycle right	0.5	1.3
Parking/changing direction	6.4	4.8
Changing lane	6.5	3.4
Tailgating	27.7	18.8
Longitudinal traffic	23.3	15.8
Turning off	4.5	2.9
Leaving the road	13.3	21.3
Speed: course of the road	11.0	18.6
Lane holding road	1.5	2.1
Total	**74.0**	**76.4**

Figures given as percentages

22

Injured drivers per 1 million kilometres by age



Source: Hautzinger, H., Tassaut-Becker, B., Hamacher, R. (1996): Verkehrsunfallrisiko in Deutschland, Berichte der Bundesanstalt für Straßenwesen M 58, Bundesanstalt für Straßenwesen. (The risk of road accidents in Germany. Report by the Federal Highway Research Institute M 58, Federal Office for Statistics

On the basis of this analysis, a conclusion can be made as to which driver assistance systems (DAS) are particularly suitable when the cause of an accident is the human factor. These would therefore be an intersection assistant, an assistant to prevent collisions with situation-dependent cruise control, and also a system to support lateral control. The strategy a DAS would have to follow can also be determined on the basis of the type of error.

Type of error	DAS Strategy
Lack of information or lack of perception	Inform
… and excessive demands/distraction	Warn
Misinterpretation	Warn
… und little time for intervention	Active support
Wrong decision	Active support
… and consciously willing to take risks	Intervention
Defective execution	Intervention

Such information signs show the actual speed at which a vehicle is travelling.

SCIENTIFIC EVALUATION OF DRIVER ASSISTANCE SYSTEMS

A distinction can also be made, however, between comfort systems and relief and safety systems. Driver assistance systems such as cruise control, adaptive cruise control (ACC) and lane keeping assistance, for example, have the task of relieving the driver. Safety systems include intelligent speed adaption (ISA), brake assistance and lane departure warning.

It is well know from studies of airline pilots that those who frequently fly with autopilot fail in situations in which piloting skills are required. From this, the question arises whether and to what extent an operator actually needs relief. In a BASt study carried out in 2011, Prof. Vollrath and his colleagues were able to demonstrate that drivers who drive with DAS – in this case ACC and cruise control – reacted more slowly to changing situations (bends etc.) than drivers who drive without an (activated) system. It also became clear that the average speed for journeys made in fog by drivers using ACC increased.

The "ironies of automation" of Lisanne Bainbridge, which are well known from psychology, also play a role in these processes. In order to be able to make quick, good decisions in complicated situations people must be alert. However, the more a vehicle performs automatically, the less attentive people are. They tend to do other things. In addition, people are rarely compelled to intervene in the process the better automation – in this case the DAS – becomes.

Drivers must then take quick and effective action if the complexity of the situation exceeds the intervention limits of the DAS. However, these situations are very difficult for drivers to bring under control, as they rely on DAS. Two processes play a role. On the one hand, drivers are deprived of the opportunity to acquire the necessary skills to deal with difficult driving situations. On the other hand, drivers rely on DAS to intervene in critical situations and are therefore more willing to take risks when driving. Making things easier for drivers does not therefore make sense from a psychological point of view.

The situation is different with DASs that are intended to inform and warn, such as FCW+, a brake assistant that first gives a warning and only intervenes in an emergency. In simulation studies, it in fact prevented more accidents and reacted more quickly than the driver alone. The same is true of the use of ESP, while, in a Norwegian study, the increased number of accidents involving pedestrians, cyclists and animals can be primarily attributed to a lack of information on the part of the driver, due to lack of experience with the system. A detailed explanation of this phenomenon does not yet exist.

In a Swedish study, respondents stated that they would drive less carefully if the vehicle were fitted with ESP, the aforementioned processes reflecting the driver's increased willingness to take risks. Thirty five per cent of respondents believed that the vehicle was fitted with ESP even though that was not the case. As a result, providing drivers with target information on a vehicle's equipment and the advantages and disadvantages of their assistance systems and the associated psychological processes (assumption of reliability) is absolutely necessary. An indispensable prerequisite for the widespread use of DASs is their scientific evaluation, which should be supported not only by technical but also by engineering psychological criteria.

NOT EVERYTHING THAT IS TECHNICALLY FEASIBLE IS APPROPRIATE

The information provided by DAS must be structured from a psychological perspective. The information should therefore be presented in an unambiguous and comprehensible way. Especially important safety enhancing information must be delivered in a striking manner. The type of information that is necessary must be carefully chosen on the basis of modality (optical/acoustic) and amount, assessed in terms of consequences and relevance to behaviour and structured accordingly. Technical progress may, in extreme cases, make things worse for drivers. It is therefore necessary to seek consensus about ethics to ensure that this does not happen. Limits must also be set in the implementation of fashion trends; a bright interior, for example, impairs vision through glare.

The following aspects must be taken into account in the development of driver assistance systems:

- the driver's actual information requirement,
- possible distraction effects,
- quality of the (ergonomic) presentation of the information,
- management of the wide range of information,
- transparency of the system functions,
- acceptance by the driver,
- reactive behavioural adaptations and
- motivation of the driver.

It is also very important that the systems are included in vehicle type approvals

Younger drivers in particular consume alcohol and drugs at the disco – a lethal hazard!

and in regular technical monitoring. The ergonomic quality of the systems is currently not, or only infrequently, checked. The potential benefit for the driver should, however, be demonstrated and subsequently checked as well (evaluation of DAS) and expertise in human sciences must also be taken into consideration. An evaluation system for vehicles, comparable to the star system for the Euro-NCAP crash test, must also be developed from a human sciences perspective (traffic psychology and medicine) and introduced. Not everything that is technically feasible is appropriate.

Higher acceptance of rules for greater road safety

Prof. Dr Bernhard Schlag, Technical University of Dresden, Transport Psychology

"Most road traffic violations are routine violations and are committed in pursuance of individually more highly valued objectives. They belong to the repertoire of behaviour and are often committed as a matter of habit – for example, speeding, driving tool close to the vehicle in front, dangerous overtaking or incorrect behaviour on the part of cyclists and pedestrians. Habits regularly develop when behaviour frequently turns out to be advantageous and is therefore strengthened. The lessons learned from the perceived consequences of behaviour frequently go in the wrong direction in traffic. Breaking the rules frequently brings benefits in everyday life. Those who abide by the rules, on the other hand, suffer comparative disadvantages; they see, for example, others succeed more quickly. Withdrawing the advantages of rule violations is at least just as effective as prosecuting violations.

External control through the (anticipated) consequences of action, for example through expectations of reward and threats of punishment, has become more established in road traffic than in any other area of life. Of pivotal importance here are the (subjective) probability of detection and the (subjective) severity of the punishment. On the other hand, motivation to follow the rules can arise internally, with road users acting out of conviction and internalised norms. Motivation through internalised norms and not simply through external incentives such as the fear of retribution and the hope of reward has a longer lasting effect, as road users observe the rules not only in expectation of unfavourable consequences. That is also the reason why greater acceptance of the rules of the road is a highly effective step towards greater road safety. Lack of acceptance cannot be replaced entirely by greater repression. Conversely, sanctions have a stronger effect if they are consistent with the norms and values of road users and are seen as justified."

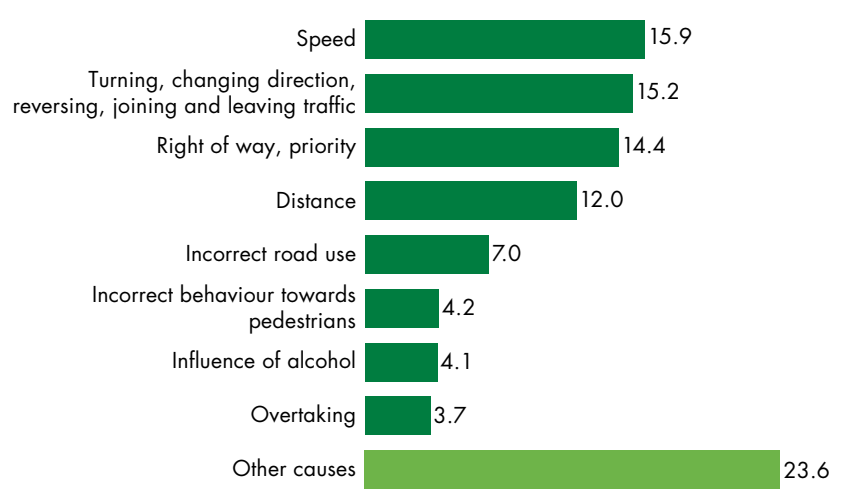
RULE ACCEPTANCE IN ROAD TRAFFIC

Accident statistics from the Federal Office for Statistics for 2010 show that almost 90 per cent of accidents can be attributed to human error. In order to approach these errors and their causes systematically, the levels of human action will first be considered. According to Rasmussen three levels can be distinguished:

- the knowledge-based level, which comprises actions that are consciously controlled and based on analytical procedures,
- the rule-based level, on which actions based on the knowledge of rules (the IF-THEN rule for example) are displayed and
- the skill-based level, which reflects actions based on automated routine operations with no recourse to conscious attention processes.

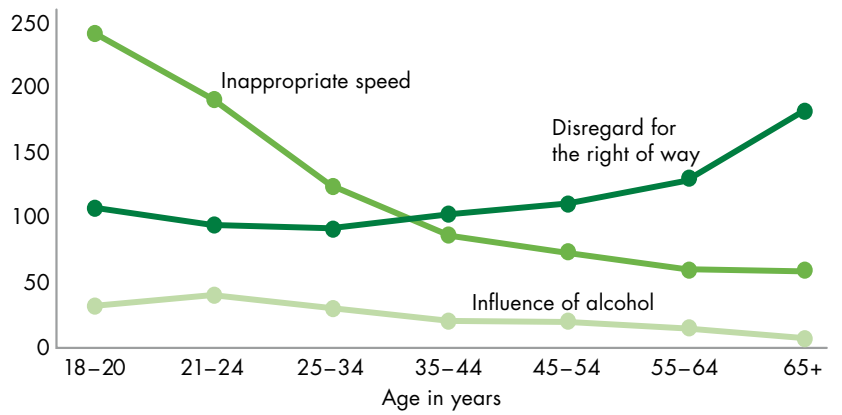
Reason (1994) divides types of errors into unintentional actions (slips or mistakes) and intentional actions (violations).

23
Incorrect behaviour of drivers in road traffic accidents resulting in personal injury in 2010



Proportions as percentages. Source: Federal Office for Statistics

24
Incorrect behaviour per 1,000 drivers by age group



Source: Federal Office for Statistics

Accidents with rail vehicles mostly disadvantage other road users.

Assuming the classification of the levels of action, the types of errors can be broken down as follows:

- knowledge-based level → knowledge-based errors,
- rule-based level → rule-based errors,
- skill-based level → gaffes, blunders, slips.

Driving as an action can also be subdivided into three levels:

- the navigation level (knowledge-based), which comprises route planning before and during the journey, traffic jam and construction site detours, or navigating through unknown regions;
- the management level (rule-based), which relates to driving as a matter of observing the rules of the road, following the course of the road and the planned route;
- the stabilisation level (skill-based), which means adapting to the traffic and environmental conditions in order to remain in the flow of traffic (for example through steering, acceleration and braking, etc.).

OBSERVING THE RULES DEPENDS ON MANY FACTORS

Errors based on violations during driving, that is to say errors that can be attributed to the rule-based management level, are mainly responsible for the accident figures. These include offences in relation to non-observance of the rules of the road, for example excessive speed, driving too close to the vehicle in front, or driving under the influence of alcohol or drugs (Figures 23 and 24). The most common violations are, however, routine violations characterised by the fact that, although they are committed intentionally and often habitually, they are not committed in order to consciously damage the system. They are committed in pursuance of higher-level objectives ("functional infringement").

Whether a rule is complied with depends on the rule itself, the situation in which it arises, and the person intended to apply the rule in a given situation. Studies indicate a higher probability of violations in certain situations such as speeding on wide roads. A wide road gives a driver the impression that it is safe to drive at 100 km/h. However, if the speed is limited to 70 km/h, speeding violations happen more frequently and can even be socially accepted. For a traffic rule to be observed, it must be accepted. Road users must be aware of a rule and they must also be motivated to comply with it. If a rule is not accepted, it will not be complied with and will be resisted. As

Driving too closely to the vehicle in front and non-observance of the requirement to keep as far to the right as possible are frequently encountered – not just on German roads.

a result, its subsequent enforcement will require greater monitoring.

GREATER ATTENTION TO CHANGES TO TRAFFIC RULES NECESSARY

How can observance of the rules be improved? One possibility is to create objectives that are important for society as a whole out of existing measures ("vision zero"). The probability of being caught as a result of violating the rules influences their observance; in other words, anyone expecting a check to be carried out will obey the rules. The probability of detection can therefore be influenced by checks, police presence and technical surveillance. The extent of the penalty (fine, driving ban, etc.) has an impact on compliance with a rule, as it conveys to the road user the value of the rule ("trivial offences"). A violation must be punished immediately so as to ensure that the actual consequences of the action are conveyed. It also makes sense, however, to reward, and hence reinforce, positive behaviour, for example through bonus systems for accident-free and compliant driving. The media play a central role in raising awareness of problems and in justifying certain measures among the public at large.

Before rules are accepted and followed drivers must be aware of them. Despite all attempts at harmonisation, traffic

The driving fitness assessment at a glance

The initiator of a driving fitness assessment, i.e. a medical opinion or a medical-psychological assessment (MPU), is the authority that has reasonable doubts concerning the fitness of the person concerned to drive (for example, through illness or behavioural difficulties).

The examination is to be carried out using the documents relating to the person concerned sent by the Driver and Vehicle Licensing Agency. The assessor cannot be the treating physician or psychologist. The examination may only be carried out on the basis of recognised scientific principles.

Prior to the examination, the assessor must explain the subject matter and purpose of the examination to the person concerned. The assessor must stick to the question(s) posed by the Driver and Vehicle Licensing Agency. The subject matter of the examination is not the whole personality of the person concerned but such characteristics, abilities and behaviour as are important for the ability to drive a car.

On the day of the examination, which may take place, for example, in an officially recognised assessment centre for driving fitness, records must be kept on all the examinations (medical, psychological, toxicological etc.). A central method in the driving fitness assessment is the diagnostic interview. This interview forms the guidelines for data collection, evaluation, interpretation and integration into the overall assessment of the findings. Objective psychometric tests (performance and personality tests), which test the factors of relevance for driving fitness, are also central components.

As the driving fitness assessment is always discharge- and resource-oriented, compensation possibilities are also investigated – for example by means of the psychological observation of driving behaviour. Therefore, recommendations can be made to the Driver and Vehicle Licensing Agency with constraints and limitations (technical, medical, behavioural). The assessment is used by the administrative authority for the preparation of its decision.

The assessment is concluded by means of a written document, the report. The person concerned has the opportunity to decide whether to submit the report to the Driver and Vehicle Licensing Agency to dispel official doubts about his or her fitness to drive. The report must be written in plain language that the reader can readily understand. It must be clear, verifiable and complete in all essential points, especially with regard to the questions posed. The people concerned must pay the costs of the driving fitness assessment themselves.

Using a navigation device can lead to inattentiveness. The safe distance behind the lorry is much too short. The way the navigation device is mounted does not comply with the recommendations of the EU Commission on safe and efficient information and communication systems, which state that no part of the system should obstruct the driver's vision.

rules within the European Union are far from constituting a unified regulatory framework. The different specifications for the same traffic signs make it very difficult for road users to comply with the rules in international traffic.
A crucial example of this is zebra crossings. The rights and obligations of the individual road users differ considerably from one Member State to the next, which is not exactly a positive example of a safety-oriented transport policy.

Nevertheless, traffic rules that are easy to understand, even for persons outside the legal profession, do exist. The German Road Traffic Act (StVO) was formulated specifically from this perspective. However, it is read by very few road users – after all, they have their driving licence. The rude awakening comes when the driver knocks over the pedestrian when turning, collides with the road user coming from the left when leaving a traffic-calmed area (street forming a designated play area) or collides with the cyclist coming in the opposite direction along a one-way street and is then arrested by the police for having caused the accident. Acceptance of the rules starts with keeping up to date with changes to traffic rules and regularly brushing up on existing regulations throughout the driver's life.

RISK REDUCTION THROUGH COMPLIANCE WITH TRAFFIC RULES

Motivation to follow the rules also depends heavily on how one assesses the relevance of a rule in a given situation. Why stop at a stop sign or a green arrow when there is no other car in sight? Why indicate when there is no one around who could benefit from this information? Why wait at a red pedestrian stoplight when it is possible to cross the lane without any problem? Such selective observance of the

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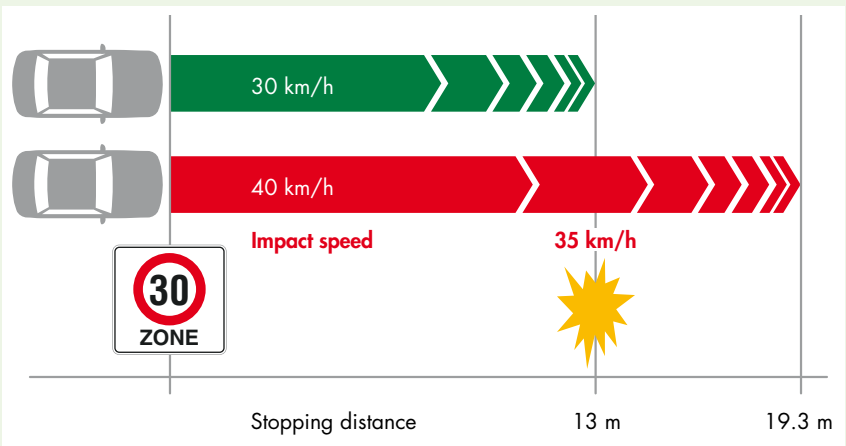
Lethal hazard through a seemingly insignificant breach of the rules

10 km/h too fast: trivial offence or extreme danger for others, especially pedestrians and cyclists?



Source: DEKRA

rules shows that road users themselves set a framework in which they interpret the rules in their favour or consciously violate them. Social acceptance and a low risk of punishment for breaking the rules lead to habituation to such violations and to what are dismissed as trivial offences becoming more widespread. At some point, however, we fail to stop at a red pedestrian stoplight when there are children standing and waiting, indicating becomes a hit-or-miss affair, and if we drive fast enough we can still get into the gap in front of the preceding vehicle, the stop point would simply be a hindrance. But heaven help us if another person interprets the traffic rules in his or her favour and violates them and we have to slow down.

The more a rule makes sense the better it is accepted. Braking to 60 km/h while going downhill on a well constructed road for reasons of air pollution control is harder than slowing down to the specified speed before a sharp bend. It should not be forgotten, however, that the reason for the regulations and restrictions is often not obvious when simply "driving past" and that the rules must guarantee a minimum level of safety for all road users alike. If the 40 km/h speed limit before a bend is cursed as a party pooper by the driver of a sports car, it is seen as still too high by the driver of a sport utility vehicle. The same speed limit will be seen exactly the other way round on a construction site, if the road surface is worn or there are big potholes.

Very rarely do drivers consider the consequences that breaking the rules can have. At most, they work out what a possible cautionary fine or fine would be. Driving at 40 km/h through a 30 km/h zone costs EUR 15 in Germany and EUR 20 in Switzerland; in Austria the offence costs between EUR 20 and EUR 42. What drivers do not realise is the fact that a collision that could be avoided at 30 km/h leads, with a starting speed of 40 km/h, to a collision speed of 35 km/h (Figure 25). If pedestrians are involved, such a collision ends with them sustaining for the most part very serious or fatal injuries.

This underestimation of the dangers resulting from breaking the rules can be found in many areas. Whether it is about using a mobile phone without an appropriate hands-free set, driving too close to the car in front, or having a beer before setting out, the rules are justified and are designed to ensure swift progress for all while at the same time maintaining a high level of safety. But it is also clear that over-regulation does nothing to help increase acceptance of the rules. The clearing of the forest of signs, which has started in many places in the last few years, is a good start. A restrictive implementation of the remaining, well-founded rules will then be accepted by the majority of road users.

Developments in driving licence procedures

Mathias Rüdel,
Managing Director
of TÜV | DEKRA
arge tp 21

"In order to systematically increase road safety among young novice drivers in particular, technical test centres have been working for many years on developing the theoretical and practical driving test. The aim is to address the problems that are typical of young novice drivers and to place them at the centre of the driving test and hence driver training. This will be done under the constantly changing reality of driving. The driving test is extremely important for the entire system of preparing novice drivers. On the one hand, only novice drivers who are competent to drive are allowed on the roads. On the other hand, the content of the test, the assessment criteria and the test assume important control functions for the orientation of driver training and the individual learning processes of novice drivers.

The federal state of Brandenburg was the first federal state to introduce, along with DEKRA, the state-wide PC-based theory test back in 2008. When the nationwide introduction of the computer-supported test was completed on 1 January 2010, a special quality management system was introduced, which continuously evaluated and optimised the quality of the theoretical driving licence test. This system is based on the scientific analysis of all test results and proposed revisions. Potential for optimisation has so far been identified especially with regard to reducing the necessary reading skills for task processing and reducing the information provided for answering the questions and alternative answers. A further step was to begin to vary the sequence of the answer choices relating to a particular task as well as the sequence of the tasks in the question paper. This can effectively prevent manipulations based on knowledge of the solution pattern of individual question papers and tasks. Expanding the instruction formats through new visual illustration possibilities is the next step in the optimisation of the theoretical driving licence test. Following a decision from the relevant authorities, tasks with a dynamic presentation of a particular situation will be gradually introduced, starting in 2012, thereby implementing the long-awaited change to the methodical design of the tasks, especially the themes of hazard identification and prevention. Trial tests had to take place before this new task format could be introduced. The initial results of these necessary empirical investigations were obtained in Saxony in cooperation with DEKRA by the regional driving instructors' association as early as 2010. Efforts are also under way to optimise the practical driving licence test, which, as a monitor of behaviour in the context of real traffic situations, has a high potential for the analysis of driving skills in the context of the preparation of novice drivers.

On the basis of the development results of the last few years, further steps are now being introduced, which include, for example, the development of an updated catalogue of driving tasks for the practical driving licence test. Building on this, specific requirements of an electronic test report are being identified, which will support the experts when carrying out the test and enable the transparent documentation of the candidate's test performance. At the same time, this will improve the feedback system to driving licence applicants and driving instructors."

Age-related road safety programmes of individual EU countries

With the exception of small, local particularities, the problem areas to be tackled in road traffic in the EU are very similar. Examples of such areas are the special protection of children, the high risk of accidents for novice drivers and the mobility problems of the elderly.

However, the solutions adopted by the individual countries are, in some cases, very different. It is also striking that many countries have thus far only formulate statistical objectives but have not specified how these objectives can be achieved. Basically, the road safety programme contains three broad solution strategies:

- Education and training of the population,
- Introduction of higher penalties for violations and
- Use of technical solutions.

Concrete measures

CHILDREN UNDER 15

Children are seen as particularly worthy of protection by all EU Member States, as they have very little experience in road traffic. A central element in almost all EU Member States for keeping children safe on the roads is the earliest possible road safety education – when they are still in primary school.

Germany

- "Move it": promotion of the safe movement of children.
- "Achtung Auto!": raising awareness of the stopping distance of a vehicle and correct securing in the vehicle.

UK

- Provision of material for road safety education. Better education and training in schools and better driver training.

Ireland

- Special programmes in primary schools (for example, crossing roads safely, behaving correctly on the way to school and in buses, getting into and out of vehicles safely, cycling safely).

Netherlands

- Education programmes for children, including practical experience.
- Measures to reduce speed in areas in which children often linger, as the speed of impact has a very significant effect on the severity of injuries.
- Increasing the use of cycle helmets.
- Better separation of fast and slow traffic (for example, cyclists and freight traffic).
- Guidance for children on how to behave at crossings in freight traffic ("blind spot").

Spain

- Creation of a safe school environment and safe routes to school to counteract the high accident figures before and after school. For reasons of sustainability the use of private transport, especially the car, should be minimised.
- Improving the effective use of restraint systems for children (child seat). In Spain, only around 50 per cent of children aged between 5 and 12 who are involved in accidents sit in a suitable child seat.
- Expanding road safety education in schools. Children will be given training in acting responsibly when they first come into contact with traffic.

Czech Republic

Measures having the following objectives, among others:

- At least 99 per cent of children will sit in a suitable restraint system in vehicles.
- At least 95 per cent of children who get around as pedestrians or cyclists will have reflectors.
- At least 95 per cent of children who ride a bicycle will wear a helmet.

YOUNG PEOPLE BETWEEN 18 AND 24

This age group causes the most accidents EU-wide. There are, however, many different reasons for these high accident figures, each of which must be tackled individually so as to reduce the number of accidents in a sustained manner. In this view, this group has been allocated the measures for novice drivers in particular. More general measures such as measures against speeding or alcohol and drugs at the wheel are not taken into consideration here, as they also relate to the older groups.

Germany
- "Alles im Griff?": event at which young people and young adults under the guidance of a moderator reflect on their experiences in road traffic, analyse the causes of road accidents and develop strategies for safe road use.
- "Aktion junge Fahrer": the programme is intended to provide young people and young adults with material on road safety. Dropping a car from ten metres simulates an impact at 50 km/h with a stationary obstacle. On the seat belt simulator young people feel with what force their bodies are hurled against the seat belt during an impact. In drive simulators young drivers experience how quickly they overestimate their own ability and react incorrectly or too late.

UK
- Better education and training in schools and better driver training.

Netherlands
- Simulator test drives for practicing dangerous situations.
- More lessons after obtaining a driving licence.
- Accompanied driving.
- Restrictions on the use of the mobile phone while driving.
- Alcolock, so that the vehicle does not start if the driver has drunk alcohol.
- Similar penalty point system as in Germany.
- Reward system, through which, for example, the voluntary fitting of a tachograph and compliance with the rules of the road are rewarded.

Spain
- Improvement of training and raising the awareness of young drivers of the dangers of road traffic.
- Introduction of measures against the most important risk factors at night and at the weekend.

THE OVER 65S

The elderly are becoming increasingly relevant in accidents, as the proportion of older people increases. This group of people have two fundamental problems in road traffic. For one thing, the ability to drive can become increasingly impaired with advancing age. However, as this happens very insidiously and it is also highly individual, this process is difficult to assess. The second problem is that the body's resistance diminishes as people get older and so minor accidents can lead to serious injuries.

Denmark
- Training, better planning of traffic or changes to infrastructure.

Germany
- "Sicher mobil": Transfer of knowledge and skills to help the elderly remain mobile as long as possible and as safely as possible (route planning, choice of transport, performance, health, the vehicle's technical features, etc.).
- "Mobil bleiben, aber sicher!": practice-oriented forms of learning, tests and practical exercises, sight tests and reaction tests as well as discussions on how to drive more safely in twilight conditions, how to adapt to the growing volume of traffic, how, as a cyclist, to get oneself and one's bicycle back into shape after the winter break, and also how to operate the automatic machines of local public transport correctly.

UK
- Special training programmes to support older people in road traffic.

Netherlands
- Special training programmes to support older people in road traffic.
- Inclusion of the needs of the elderly in infrastructure planning. New designs should follow old principles so that existing experience can be built on. Also important are good lighting and clear lane markings.
- Technical adjustment to the needs of the elderly (servo motors for example).
- Offers of alternative means of transport.
- Offers for further training and to test skills.

Spain
- Better monitoring of the driving ability of older people. Families and GPs will help to create awareness of the loss of those skills that are necessary for safe driving.
- Creation of areas that are safe for the individual locomotion of the elderly (in Spain 43.8 per cent of fatally injured pedestrians are over 64).
- Improvement of knowledge about the accident rate of the elderly and their locomotor behaviour.

Technology in the service of mankind

Assistance and information systems that increase safety and comfort are an essential component of modern vehicles. The interface between these systems and humans should always be designed so as to ensure that the signals coming from the vehicle can be understood intuitively by people of all ages at all times. The correct and safe functioning of the vehicle throughout its entire life are just as important. Against this background, and also in view of the risk that electronic vehicle systems can be tampered with, the periodic main inspection is becoming increasingly important.

ABS und ESP, adaptive cruise control and lane departure warning, collision warning and prevention systems, and many other electronic systems are currently offered as standard equipment to support the driver or are already provided as standard. Automatic dipped beam and high beam with gliding headlight range or glare-free high beam as well as adaptive light distribution and blend lighting, rain sensors to control windscreen wipers and parking assistants will reduce the driver's burden. Infrared night vision systems act as extra eyes if the sight of the human driver is significantly restricted at night under dimmed headlight conditions. The driver can then – so the theory goes – focus even better on his or her driving task. In the future, vehicles will communicate with each other and with the relevant environment. Experts agree that this can make driving much safer. From there, it is not far to the autonomous operation of vehicles – at least in certain situations, such as driving in convoy on motorways. At the end of the development stands a visionary goal: zero deaths and serious injuries in road traffic.

Without question, all these systems have their justification. Among drivers, their names and descriptions have a relatively high degree of recognition, even though the share of vehicles equipped with many systems – with the exclusion of ABS and ESP – is not likely to increase significantly until well into the future (Figures 26, 27 and 28). However, driver assistance systems can overwhelm and irritate driv-

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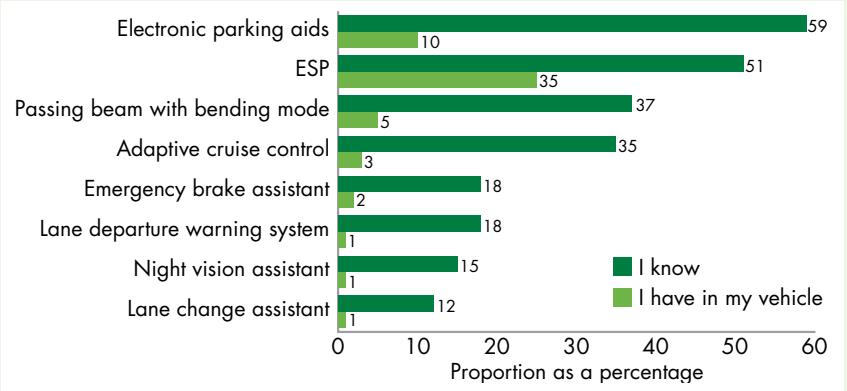
Driver assistance systems – known, but not readily available



Source: DVR

ers or lull them into a false sense of security. This can have fatal consequences in an accident, in which they and other road users can be injured or even killed. The responsibility always lies with the driver and cannot be taken away by any system or any manufacturer.

Many electronic safety and comfort systems work "behind the scenes". In extreme situations requiring intervention the driver is generally happy for the support, if he or she even notices it. Other systems give targeted warnings of critical situations in order to direct the driver's full attention to what is happening on the road. By directly linking an automatic intervention or a haptic, acoustic or optical warning to a hazardous situation, these systems are very effective.

It is crucial that the driver understands the functions and the information intuitively and perceives them to be logical and supportive in the circumstances. Success requires adapting the technology to the human being, that is to say optimising the human-machine interface. In view of the individual variety of human sensations and human behaviour – especially in critical situations – system developers and vehicle manufacturers face enormous challenges.

OVERLOADING THE DRIVER WITH WARNINGS

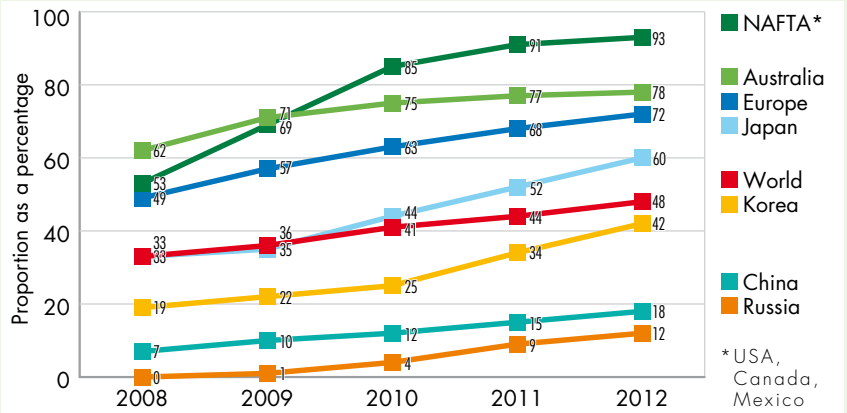
The excessive number of acoustic signals emitted by some vehicles quickly leads to numbness on the part of regular users. The parking assistant, a light left on, a closing tailgate or the key in the ignition when the driver's door is open – everything is accompanied by signal tones in a wide range of variations and pitches. No wonder then that the light stays on. Finally, a beep is emitted whenever the vehicle stops. The tone indicating that the fuel is about to run out can guard against an unplanned stop. But whether this important signal can be recognised as such among all the other tones indicating that external temperatures are low, that the prescribed speeding limit has been reached, or that the vehicle is due for a service is a moot point.

But it is not only the acoustic signals that, though well intentioned, do not always have the desired effect. What driver used to lights turning on and off automatically would think of manually switching on dipped headlights in foggy conditions? The automatic system does not always adequately detect adverse weather conditions and leaves the daytime running lights on – the rear lights remain dark. The high beam assistant ensures optimal illumination in front of the vehicle. As the high beam switches on automatically and the gliding headlight range or the glare-free high beam only reacts to oncoming vehicles or vehicles in front with their lights on, a driver is unlikely to think of switching it off manually if cyclists or pedestrians who are not recognised by the system are dazzled.

Faith in technology, indifference, apathy, coupled with ignorance of the limits of the systems used and the handing over of tasks for which the driver was originally responsible to safety and comfort systems can create new hazards. Overloading the driver with warnings and variously important information can be just as counterproductive as the non-functional distribution of tasks between driver and electronic assistant.

The issue of functional interfaces between humans and technology in vehicles has also been taken up by the EU. In 1999 a series of recommendations for designing a user interface was compiled and published by the Commission as the ESoP (European Statement of Principles) on HMI (Human Machine Interface). These recommendations were updated in 2006. In the meantime there have been many developments affecting vehicles. Not only are there many new functions in the vehicle itself – the whole series of assistance systems is the best example – new forms of feedback have been installed in vehicles. These include head-up displays and tactile (haptic) signals sent to the driver via the seat or the steering wheel.

27 Percentage of new cars equipped with ESP



Based on the production of passenger cars and light commercial vehicles <6t

Source: Bosch

28 Percentage of cars equipped with assistance systems – a look to the future

Without addition incentives	Proportion of new cars with system on board		
	2010	2015	2020
ESP	high	very high	very high
Obstacle and collision warning	very low	low	average
Emergency brake assistant	very low	low	average
Blind spot assistant	very low	low	low
Adaptive headlamps	low	average	average
Lane departure warning system	very low	low	average
With addition incentives	**Proportion of new cars with system on board**		
	2010	2015	2020
ESP	high	very high	very high
Obstacle and collision warning	very low	average	high
Emergency brake assistant	very low	average	high
Blind spot assistant	very low	low	average
Adaptive headlamps	low	average	high
Lane departure warning system	very low	average	very high

Latest estimate based on expert analysis

Source: Report of the working group "Implementation Road Map", Brussels, 2011

Functional, easy-to-understand control elements in vehicles that are, as far as possible, similar are indispensable for safe driving. A new class of systems – so-called "nomadic devices" – is appearing on the horizon. These are devices that are not installed permanently in the vehicle. Navigation systems fitted with additional functions or the development of special applications for smart phones (Apps) are just some examples. It is clear that issues relating to the user interface and its integration into the vehicle will have to be re-evaluated: updating and supplementing the existing recommendations on the human-machine interface could be of great help.

A selection of driver assistance systems

As the population knows very little about the function of driver assistance systems, the DVR has committed itself to disseminating information on driver assistance systems and to provide an explanation of systems that have already been developed. On the website www.bester-beifahrer.de the DVR provides extensive information on new driver assistance systems. There, car buyers can also find the first nationwide query database on the type-specific availability of driver assistance systems. It should be noted that the systems differ to a certain degree from one manufacturer to the next. The following description is therefore only intended to be used as a rough guide. More information on the various systems can be found on the websites of the car manufacturers.

Electronic Stability Program (ESP): ESP acts on the braking or power systems of a vehicle to assist the driver in maintaining control of the vehicle in a critical situation. ESP constantly monitors the dynamic state of the vehicle with its sensors and, if there is a risk of skidding or tipping, intervenes in brake management and, if necessary, in engine management. The system is thus able to identify dangerous situations quickly and reliably and to keep the vehicle under control within the physical limits. Typical accident scenarios such as the vehicle sliding during cornering, slippery road surfaces, emergency braking on a road with variable skid resistance and hectic evasion manoeuvres can be defused and the risk of accidents can be greatly reduced.

Adaptive Cruise Control (ACC): The continuous transition between braking and acceleration as well as frequent lane changing are, today, a common occurrence on the roads because of traffic congestion. The "half of the speed indicator" – the rule of thumb for a safe distance – is therefore not often complied with. There is a risk of rear-end collisions. As an intelligent speed-limiter, adaptive cruise control automatically adjusts the speed of the vehicle to the flow of traffic in such a way that the safety distance is maintained. In congestion and slow-moving traffic, the ACC Stop & Go function also takes over the tiresome braking and acceleration operations. If the vehicle in front stops, the ACC Stop & Go function applies the brakes until the vehicle comes to a standstill. If the vehicle in front moves off again, the slightest pressure on the accelerator is enough and the car moves off. ACC without Stop & Go can be used at speeds of 25 km/h and above, but it is mainly used during journeys on dual carriageways and motorways.

Adaptive Cruise Control Active Brake Assist (ABA): The emergency brake assist system is based on the radar system of the adaptive cruise control system and is intended to contribute to preventing rear-end collisions or, at the very least, to reducing the speed of collisions. Not without good reason, as accident investigations have shown that more than half of drivers in Germany apply the brakes too late or even not at all in rear-end collisions. In the event of an impending collision with a vehicle in front the driver is first warned by an optical and acoustic signal. If the driver does not react, as a first stage partial braking will be automatically triggered. If the driver still does not react, as a second stage emergency braking is automatically initiated. Some passive safety systems are automatically activated in the vehicle to ensure that the occupants are protected in the best possible way, by a pretensioned seat belt for example.

Lane Guard System (LGS) and **Lane Change Assist** (LCA): LGS and LCA can warn drivers on secondary roads and motorways if they inadvertently leave their lane. On long and monotonous stretches of road in particular, when a driver's attentiveness can wane, this provides valuable support. A video camera in the vehicle records the course of the lane ahead and digitally analyses the existing lane markings. If the system detects an unintentional deviation from the lane without the indicator having been activated, an acoustic signal sounds or the steering wheel becomes tactilely noticeable and the driver can therefore correct his or her course in good time.

Blind Spot Monitoring: Vehicles approaching from behind are seen immediately, even in the blind spot. The blind spot loses its horror and the driver gains a greater sense of security.

Driver Fatigue Detector: The system continually analyses the driver's behaviour, when steering for example. Proven signs of waning concentration and growing fatigue are, for example, phases in which the driver briefly stops steering and then abruptly makes a correction.

PREVENTING ACCIDENTS WITH DRIVER ASSISTANCE SYSTEMS

That the use of driver assistance systems contribute to road safety is regularly demonstrated by broad-based studies. The German "AKTIV" (Adaptive and Cooperative Technologies for Intelligent Traffic) research project carried out between September 2006 and August 2010 by 28 partners from the automotive industry, the electronics and telecommunications industry, as well as software companies and research institutes investigated four driver assistance systems for cars and lorries for their effectiveness. The research work was carried out in five subprojects: "active emergency brake", "integrated transverse control", "intersection assistant", "safety for pedestrians and cyclists" and "driving safety and attentiveness". The stated aim was to determine the potential effectiveness of new driver assistance systems by analysing real accident data. For this purpose, the Allianz Centre for Technology (AZT) had created its own accident database containing more than 2,000 serious road traffic accidents on the basis of insurance documents for detailed analysis.

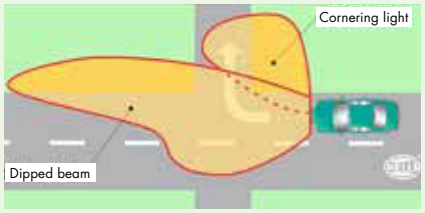
The greatest accident prevention potential is shown by the "active emergency brake" for cars, the use of which is expected to reduce accidents resulting in personal injury by 44.6 per cent (41 per cent in the case of lorries). The following also show accident prevention potential: "intersection assistant" by 33.3 per cent (16 per cent in the case of lorries), "safety for pedestrians and cyclists" (anticipatory sensors) by 14,4 per cent (3 per cent in the case of lorries) and "integrated transverse control" by 6.4 per cent (22 per cent in the case of lorries). In addition to preventing human suffering this would, according to the AZT, correspond to a reduction in the consequential cost of accidents to the economy of EUR 7 billion per annum.

It is hoped that systems through which vehicles communicate with one another (V2V – vehicle to vehicle) or exchange in-

The system can combine the frequency of this reaction with other data, such as the speed of the vehicle, the time of day, or blink behaviour, and calculate a level of fatigue. If the system detects that the driver is tired, the driver is warned of the danger of becoming fatigued and of the risk of nodding off by means of an optical, acoustic, or haptic signal and is recommended to take a break.

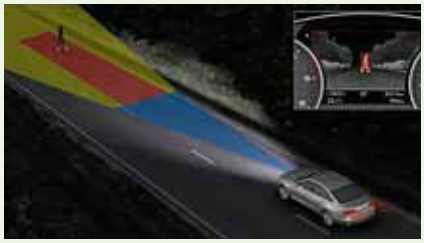
Head-up Display: This is a display system that projects information that is important for the user as a virtual image via a small display within the driver's field of vision. This means that drivers no longer have to take their eyes off the road in order to read the speedometer or to read the information provided by road sign recognition, or of pedestrians and cyclists detected by the night vision system in the displays of the instrument cluster.

Camera-based active light systems (adaptive cut-off): At night, on a secondary road, a shadow suddenly appears before a bend – evasive manoeuvres are executed at the last minute. Approximately one third of all fatal accidents happen in the dark. Xenon lighting, adaptive forward lighting, as well as automatic high beam with gliding headlight range or glare-free high beam improve vision and help reduce the risk of accidents at night. With dynamic bend lighting, the headlights automatically align themselves with the road ahead. Drivers are then able to see the curve of the bend and any obstacles in good time and



adapt their driving style accordingly. If the bends are particularly tight or if the driver wants to turn, static bend ensures better vision. The light of Adaptive Front Lighting Systems (AFS) replaces the conventional functions of the dipped beam and the main beam. The light is automatically adjusted to urban traffic, secondary roads, motorways and bad weather, depending on the speed.

Night vision assistant: In the night, vision is significantly restricted, especially if the main beam cannot be switched on. If it is also raining, the road can hardly be seen at all. Pedestrians or unlit cyclists at the edge of the road are often noticed too late by drivers. Wild animals that suddenly materialise are not seen until it is too late. The night vision assistant helps to reduce these risks significantly. It uses an infrared camera to observe the road and displays what is happening in front of the car on a screen. People and animals stand out in sharp contrast against the background in the electronically processed image. The night vision image can be used like a rear-view mirror or a speedometer. With an occasional brief glance, the driver can see where possible dangers are lying in wait in front of the vehicle. The night vision assistant can always see, even in the glaring light of an oncoming vehicle. Second generation systems can even recognise people and cyclists, highlight them on the screen and send out a warning if a collision appears to be imminent. Such warnings can also be displayed via the head-up display. The latest development is the marking light, whereby pedestrians detected by the night vision assistant are illuminated several times for a short time in a targeted manner by the headlights (spotlight function). As a result, the driver does not have to adapt to what is displayed scaled down or two-dimensionally on the screen but spots the danger directly in the danger area in front of the vehicle.



Automatic emergency call system (eCall – emergency call): In the event of a car accident, the appropriate local public service answering point is automatically informed over the mobile phone network. The system recognises a serious accident by means of, among other things, the airbag activation signals. The position data of the accident vehicle are transmitted and – if possible – a voice connection is established with the accident vehicle. Necessary rescue measures can therefore be introduced quickly. But if a voice connection cannot be established, the public service answering point can arrange for assistance. The emergency number 112, which is valid throughout Europe, can be used for the eCall. The geographical data are transmitted using satellite navigation systems, which guarantees that the place where the accident occurred can be ascertained quickly. In addition, an employee of the public service answering point can be contacted by telephone. A transnational trial has shown that, in 90 per cent of all cases, a connection to the public service answering point was established within 25 seconds and, in 97 per cent of cases, within 45 seconds. eCall is expected to be mandatory for newly homologated vehicles from 2015.

29 Overview of effective solutions for driver assistance systems to improve road safe

Features of the traffic situation	Type of accident	Driver assistance systems			
		Infrastructure-independent	Vehicle-independent	V2V	V2I
Intersection	Accidents caused by right-of-way errors	❍	●	●	●
	Accidents with the LSA switched on	❍	●	●	●
	Accidents involving pedestrians and cyclists	●	●	●	●
Open road	Dynamic accidents on bends	●	●	❍	●
	Dynamic accidents on straight roads	❍	●	❍	❍
	Accidents in traffic jams	❍	●	●	❍
	Accidents by overtaking vehicles	❍	●	●	❍
	Accidents by passing vehicles	❍	●	●	❍
	Accidents by turning vehicles	❍	●	●	❍
	Accidents involving pedestrians and cyclists	❍	●		❍
	Accidents involving animals	●	●		●
	Accidents involving temporary obstacles	❍	●	❍	❍
Environmental conditions	Accidents caused by rain, ice, wetness, etc.	●	●	●	❍
Other	Accidents involving inebriated parties	❍	●	❍	❍

Source: UDV compact 17 C21 ● Recommended solution ● Alternative solution ❍ Not very effective

formation with the road environment (V2I – vehicle to infrastructure) will contribute further to safety. Such systems are designed to identify and communicate hazards in good time so as to enable the driver or the vehicle to react at the appropriate time. It is therefore necessary to know how and where the relevant accidents happen, what elements they have in common and what information is needed to inform the driver of the impending hazard. To find out, the UDV (German Insurers Accident Research Group) commissioned an investigation into the extent to which V2I-based driver assistance systems are appropriate for improving road safety on secondary roads. The vehicle's own systems and V2V-based systems were taken into consideration in the investigation.

The investigation showed that the advantages of V2I-based systems, especially in complex, spatially restricted traffic situations such as, for example, major junctions can be used in a target-oriented way. Events that occur suddenly and locally such as, for example, the loss of a load or turning vehicles can best be covered by means of purely vehicle-based systems (Figure 29). For road safety reasons, the UDV recommends developing those systems that are effective against accidents that occur frequently and have serious consequences such as, for example, accidents on straight stretches and on bends resulting from excessive speed, accidents caused by distraction or accidents caused by inebriated drivers.

FUTURE DEVELOPMENT OF ELECTRONIC SYSTEMS

Current assistance systems are effective, essentially, in dynamic operation on the road. By contrast, however, in the everyday flow of traffic there are many constantly recurring situations in which vehicles are travelling at low speeds or are even at a standstill and which can give rise to dangerous moments of the most diverse kind. The presence of static and dynamic obstacles alone places constantly high demands on the attentiveness and reactive capacity of all road users. Cyclists, for example, are at serious risk from a carelessly opened car door. Expanding the functionality of these systems in this area promises additional safety.

For a number of years now, car manufacturers, the supply industry and accident researchers have also been working, in particular, on active safety systems to improve pedestrian and impact protection. These systems warn the driver if there is a risk of collision. If the driver is no longer able to prevent an accident by reacting independently, automatic braking interventions are activated with the aim of reducing the consequences of an accident. Against this background, a working group was set up to develop proposals for test procedures for anticipatory front protection systems (vFSS). The Allianz Centre for Technology, the German Insurance Association (GDV) and the Federal Highway Research Institute (BASt) cooperate alongside nine vehicle manufacturers, Audi, BMW, Ford, Honda, Mercedes, Opel, Porsche, Toyota and VW, in the vFSS group. The Automotive Technical Institute (KTI) and DEKRA chair the group. The direct aim is to propose technology-independent test procedures on the basis of accident scene investigations.

The vFSS group is pursuing a sustainable and realistic philosophy towards a future vision of vehicle safety. The guiding principle is to measure a safety system in the complete vehicle on the basis of its effectiveness in a real traffic environment and in a real accident. It would therefore be inappropriate to develop active and passive vehicle safety separately and to extol the virtues of individual, isolated measures to users. Rather, future protection can only be achieved through the intelligent and effective integration of active and passive safety elements. The development of an integrated safety system is therefore based on the following premises:

- Integrated safety: integration of active and passive safety systems in terms of overall vehicle safety, taking into account real accident black spots in a traffic environment.
- Driver in the loop: exploiting potential to prevent accidents through the timely warning of an inattentive driver and through measures that increase the sovereignty of the driver in dangerous situations.
- Collision mitigation: automatic intervention in the braking system can occur if the driver no longer has any options at his or her disposal for taking action to prevent an accident.
- Fail-safe: guaranteeing basic protection up to the limits of the functionality of anticipatory protection systems through passive safety measures, especially if the driver fails to detect an accident situation.

RELIABILITY AND PERFORMANCE MUST BE GUARANTEED

Existing applications have shown that the available electronics currently make completely new dimensions of vehicle

safety possible. However, electronics are subject to a certain amount of aging, they are not free from system errors, they can be tampered with, switched off and removed from the vehicle. Investigations by the Internationale Vereinigung für die Technische Prüfung von Kraftfahrzeugen (International Motor Vehicle Inspection Committee (CITA)) have shown that electronically controlled systems display, by way of comparison, the same failure rates as mechanical systems. Failure rates increase both with the age of the vehicle and the distance travelled.

To determine which electronically supported systems are integrated in a vehicle and whether they work correctly, experts in Germany have had access to an extensive system database since January 2006. Specifically to create this database, in October 2004 13 technical test centres and monitoring organisations – including DEKRA – founded FSD Fahrzeugsystemdaten GmbH in Dresden. The system database was created primarily on the basis of information provided by vehicle manufacturers and importers on the systems fitted in their vehicles and the test procedures needed for this. Using the information provided by the system database, test engineers will, at the same time, also be able to determine whether the vehicle's prescribed level of safety has been inadmissibly reduced by modifications or upgrades.

The periodic technical inspection of vehicles has now become established throughout Europe. However, there are major national differences. The harmonisation of periodic vehicle monitoring planned by the EU Commission should bring about substantial progress in this area. Germany has a key role to play in this regard, especially in the development of test content and test methods (see the statement in the box). Germany was the first country worldwide to introduce the testing of safety electronics in the main inspection (HU) in 2006 and a nationwide field trial with a specially developed test system, the HU adapter, is planned for 2012. This test tool will make it possible to test safety-relevant electronic systems, such as driver assistance systems for example, even more efficiently during the main inspection.

Better test procedures for the testing of assistance systems

Prof. Andre Seeck, Head of the Department of Vehicle Technology at the Federal Highway Research Institute (BASt) and President of Euro NCAP

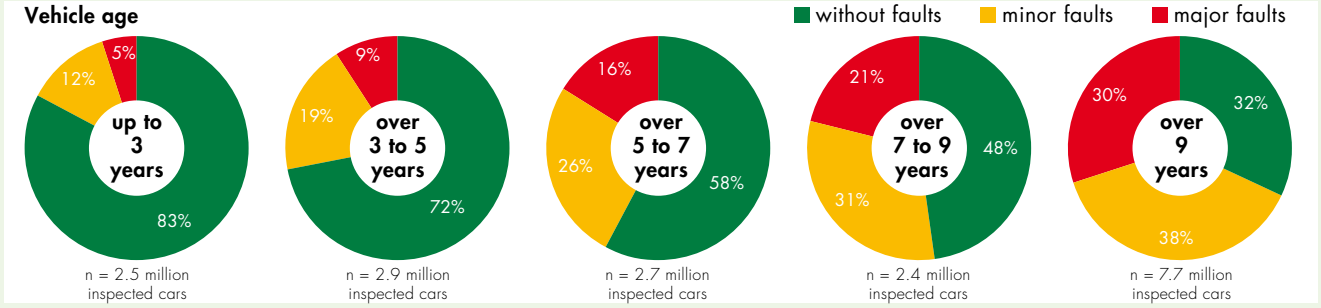
"With regard to the future development of driver assistance systems it is necessary to be able to reproducibly assess the effectiveness of systems for preventive pedestrian protection and for the preventive protection of traffic flowing in the same direction – including under the Euro NCAP (European New Car Assessment Programme), the manufacture-independent assessment programme for vehicle safety in Europe. That is the reason why, in recent years, various working groups have been formed and projects have been implemented which, independently of each other, identify relevant traffic accident scenarios and develop test and assessment methods from them. There is a risk that a contest will develop between these groups which may lead to inhomogeneous assessment. The implementation of a standardised and targeted assessment basis would, as a result, be impossible. The working group for anticipatory front protection systems (vFSS) has set itself the goal of paving the way for joint collaboration – also in terms of global harmonisation beyond the borders of Europe. The fundamental factor for the successful, sustainable impact of anticipatory front protection systems in a real accident situation is market penetration. Comprehensive serial deployment in all vehicle classes is necessary and must be demanded and encouraged. What is more, test and assessment criteria must take account of all available technologies. The challenge is to demand a realistic level of technological complexity on the basis of the test and assessment criteria, without limiting the variety of technical concepts. Instead, what is needed is to positively encourage implementation and future development in the interest of road safety for all road users."

FAILURE RATE OF MECHANICAL SYSTEMS STILL TOO HIGH

Despite the further development of electronic components, mechanical systems continue to play a central role in road safety of course. In the main inspection, therefore, braking and steering systems are scrutinised just as closely as lights, axles, wheels and tyres, suspensions, chassis, frames and bodies, and visibility, to name just a few examples. A look at the results of the main inspections carried out in Germany in 2010 makes it clear just how important periodic testing is. Statistics from the German Federal Department of Motor Vehicles (KBA) show that, all cars combined, faults were established in 49 per cent of vehicles: 29 per cent of vehicles had minor faults and 20 per cent had major faults.

A breakdown of the results by age of vehicle understandably produces a quite different picture (Figure 30). Approximately 17 per cent of vehicles up to three years of age have faults and 42 per cent

30 Results of car inspections 2010



Source: KBA

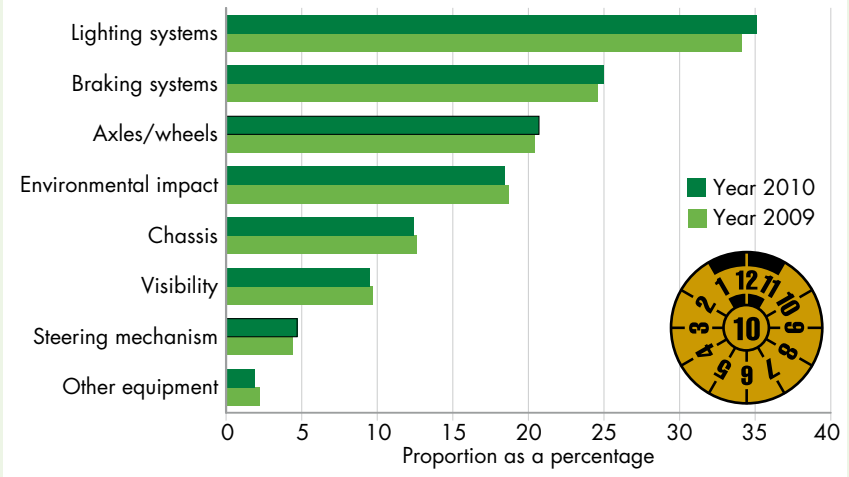
of vehicles aged between five and seven have faults. Vehicles over nine years of age have a failure rate of 68 per cent and 30 per cent of vehicles in this group have major faults. Ultimately, the actual failure rate of vehicles in circulation is undoubtedly much higher than the different fault statistics show. The reason for this is that main inspections frequently take place in garages after vehicles have been serviced, with the result that the vehicles are prepared for them.

A close examination of the faults identified shows that lights (35 per cent) and brakes (just short of 25 per cent) are in first and second place. Defective axles, together with wheels and tyres (over 20 per cent) are also well up in the negative rankings (Figure 31). While experts identified faults in the lighting equipment of approximately nine per cent of vehicles up to three years old, this percentage rose to 48 per cent in the case of vehicles over nine years of age. This sharp rise runs through all assemblies and shows that the older a vehicle is the more faults it has on average. An assessment by the aforementioned FSD shows that the number of cars with major faults in selected safety functions such as the airbag and the automatic anti-lock system also increases year on year in the context of the main inspection.

Planned changes in the context of HU reform

- **Fault report:** In the future car drivers will be entitled to a detailed fault report which, in the event of a fault, will not only indicate the assembly, the braking system for example, but will also state exactly where the fault is, for example "front left brake disc worn". This has long been standard practice in the inspection reports issued by DEKRA.
- **Checking compliance with specifications** such as, for example, system data and other test data. This affects all vehicle assemblies. This process also includes the phased deployment of electronic testers (HU adapter) as well checking for upgrades, retrofitting or upgrade of safety or environmentally relevant systems.
- **Braking performance:** increasing the required minimum braking performance of vehicles.
- **Test drive:** To make the vehicle fit for the inspection and to activate electronic controls for individual vehicle systems, a test drive will become mandatory.

31 Result of the car inspections 2010 – car by fault type



Source: KBA

DEKRA "SAFETY CHECK", GERMAN TRAFFIC WATCH AND DVR

As almost all statistical assessments show, there is one age group that is involved more frequently than average in serious road traffic accidents: young drivers. The reasons for this are, first, that novice drivers have inadequate driving experience and, second, for financial reasons younger drivers very often drive older vehicles. Aging, wear and tear, lack of awareness of technical faults as well as skimping on maintenance and repair mean that older cars have major faults much more frequently and therefore present a much greater accident risk than younger vehicles.

That the cars of younger drivers continue to be driven on the roads often with, in some cases very serious, safety defects is demonstrated impressively by the voluntary and free road safety campaign "Safety Check" by DEKRA, German Traffic Watch and the German Traffic Safety Council (DVR). Over the last five years, the experts checked more than 73,000 cars belonging to young drivers (2011: 16,000 vehicles). The average age of the vehicles has increased since 2007 from 10.8 to 11.2 years. Currently, the cars examined here are, on average, 2.9 years older than the average German car (8.3 years). The average mileage of the vehicles checked rose from 115,000 km to 130,000 km between 2007 and 2011.

Over the last five years, the failure rate also remained at a high level, with more

than three faults per defective vehicle. In the case of vehicles aged "over seven to nine years", the failure rate was almost 80 per cent (Figure 32). Risks for road safety arise in particular from the poor condition of brakes, tyres and electronics. During the "Safety Check" 2011, 41 per cent of all vehicles checked had defective brakes, 53 per cent had a defective chassis, tyres, or body and, in 48 per cent of vehicles, the lights, electrics or electronics were faulty – 35 per cent of faults related to safety and the environment. The failure rate rises sharply with the increasing age of the vehicle (Figure 33).

By way of comparison, in 2011 DEKRA also carried out the "Safety Check" in Poland, where 72 per cent of vehicles were faulty and each vehicle found to be defective had just under two faults. Most faults were found in the chassis and tyre assemblies, followed by lights and brakes.

Returning to the "Safety Check" in Germany, an increased hazard potential arises as a result of the lack of safety assistance systems in older vehicles driven by novice drivers. There has been a pleasing positive development in the rate at which these systems are now fitted. An increasing number of older cars are now equipped with ABS, an airbag and ESP/ASR. The proportion of cars without one of these three systems fell from 47 to 24 per cent between 2007 and 2011. However, drivers of older cars cannot always rely on the protection of these systems. In 2011 one in eight ESP/ASR (12 per cent) and three per cent of airbags and anti-lock systems were found not to be working in the safety check. The facts given above are a clear indication that there is still a lot of potential in the technical condition of vehicles for increasing road safety.

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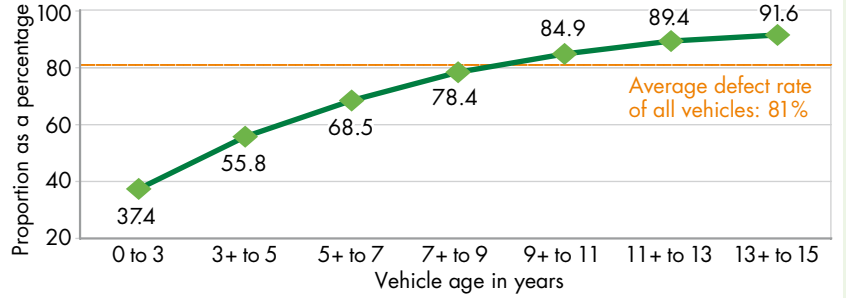
Change in failure rates in relation to the age of the vehicle



Source: Final SafetyCheck Report 2011

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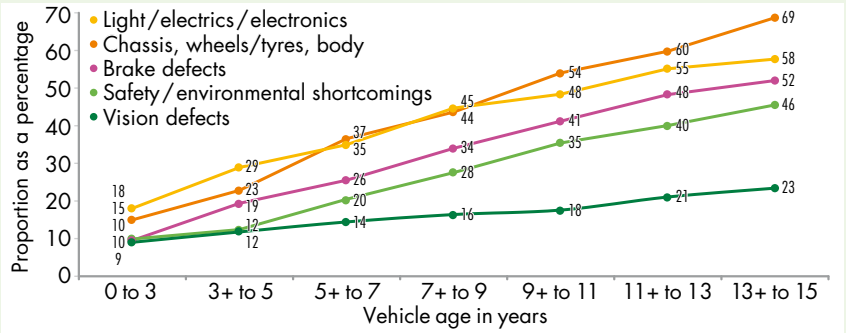
Failure rates in the assemblies of the vehicles inspected



Source: Final SafetyCheck Report 2011

HU Adaptor ensures even greater efficiency in the main inspection

Jürgen Bönninger, Managing Director of FSD Fahrzeugsystemdaten GmbH

"The vision of safer mobility for all road users is becoming reality. Up to 40 per cent of all serious car accidents could already be influenced positively by the available electronic safety systems such as emergency braking systems, adaptive cruise control, or lane departure warning systems, if all vehicles were fitted with these systems. So that the 'invisible helpers' in the vehicle can achieve their potential for mitigating the consequences of accidents or preventing them over the entire lifetime of the vehicle, an important step was taken in Germany in 2006, when these systems were integrated into the main inspection.

Without the HU as a tool for maintaining safety functions, the number of people killed on the roads would, according to an internal FSD calculation made as part of a study on accident prevention and HU potential from November 2011, be up to 10 per cent higher. In relation to accident figures from 2010, this corresponds to around 300 human lives which could be saved if these functions were continuously checked in the HU!

To maintain the effectiveness and efficiency of the main inspection even with the rapidly rising rates at which safety functions are installed in vehicles, a generic inspection tool, the so-called main inspection adapter, has been developed by experts for experts. It is being used in a nationwide field trial.

With the adaptor, the execution of the installed safety systems can be queried automatically, current sensor data can be monitored and the function, effect and condition of a vehicle's safety-relevant systems can be checked by means of programmed check routines. The adaptor is connected to the on-board diagnostic system (OBD) outlet in the vehicle. The vehicle's safety functions can already be tested during a short test drive.

The expert or test engineer controls these routines by means of a display and operating unit via a WLAN or Bluetooth connection. This universal test device makes the inspection of electronically controlled safety systems more effective for all types of vehicles and for all models, or makes it possible for the first time. The support of the expert during the main inspection via the vehicle interface will be gradually introduced in the coming years."

Exploiting existing safety potential more effectively

There is a whole range of approaches for further increasing safety on the roads of Europe. Much could be achieved simply through the systematic use of seat belts, compliance with the rules of the road, constantly refreshing one's own knowledge of the rules, mutual respect among road users and focussing on what is happening on the road. Greater market penetration of driver assistance systems is also clearly desirable.

The trend in the number of road deaths in the EU observed in recent years can readily be considered a success. In 2001 around 54,300 lost their lives on the roads of the EU; according to the available figures, in 2010 31,100 road users died. The European Commission is still some way from achieving its stated objective of halving the annual number of road fatalities by 2010. The fall to 30,700 road fatalities means a reduction of "only" 43 per cent. Therefore, in July 2010, the Commission presented new, ambitious plans, aiming once more to reduce by half the annual number of fatalities on the roads of Europe. This is clear from the new Road Safety Guidelines 2011–2020 published in March 2011. Several EU Member States have underpinned these objectives with their own national road safety programmes.

25 000 LIVES TO SAVE
European Road Safety Charter

GREATER ROAD SAFETY THROUGH MORE EFFICIENT VEHICLE TECHNOLOGY

It is a fact that vehicle safety and, in particular, the constant improvement of the safety of new vehicles is one of the main driving forces behind the positive trend in the number of road fatalities in recent years. For example, the equipping of newly registered passenger cars in Germany with driver and front-seat passenger airbags rose from a rate of around 40 per cent in 2001 to over 90 per cent in 2010. Almost 100 per cent of passenger cars are now equipped with them. The percentage of passenger cars equipped with ABS has risen almost in parallel. In the entire stock of passenger cars, in 2010 values of approximately 85 per cent were achieved, with 99 per cent of new passenger cars equipped with ABS. Additional safety effects can be expected from systems such as side airbags and ESP, if the percentage of passenger cars equipped with them increases. Equipping passenger cars with new headlight systems also shows great potential for improving road safety.

HIGH DEGREE OF EFFECTIVENESS OF DRIVER ASSISTANCE SYSTEMS

Looking at the percentage of new vehicles equipped with assistance systems, it can be seen that, aside from ABS and ESP – the latter will be mandatory for all newly registered vehicles in the EU from 2014 – many other safety-enhancing systems are only coming onto the road in very small quantities. Especially with cheaper vehicles, this is certainly related to the addition costs associated with such systems. Alternatively, it can be attributed to the fact that these systems are not offered by the manufacturer. In the EU, programmes and projects to promote equipping vehicles with assistance systems have been ongoing for years. There is no doubt that initial subsidies or discounts are instruments for increasing the rates at which manufacturers

offer them as standard equipment and hence for generating effects of scale. But it would be too one-sided simply to consider the financial incentives. It is often the case that buyers simply do not have the necessary information on the benefits of an available option for the safety of the vehicle offered.

The functional interfaces between humans and technology in a vehicle are an important issue. The recommendations already elaborated by the EU in this regard – ESoP (European Statement of Principles) on HMI (Human-Machine Interface) – in 2007 certainly need to be revised and supplemented to take account of technological progress (for example head-up displays or haptic feedback for the driver). Updating and supplementing the existing recommendations on the human-machine interface is also a good idea with regard to mobile systems for information and assistance functions (so-called "nomadic devices", which are not permanently installed in vehicles).

PERIODIC VEHICLE MONITORING ACQUIRES EVEN MORE IMPORTANCE

A further objective must be to guarantee that every safety-relevant system functions reliably over the vehicle's entire lifetime. Maintaining and servicing the systems concerned must therefore not be neglected and all warnings and error messages in the car must be taken seriously by users. Experience has shown, however, that many older vehicles are no longer maintained in accordance with the manufacturer's instructions and so periodic monitoring takes on greater importance. The importance of electronic systems for the safety of vehicles has now been taken up by the European Commission and included in the frameworks for Europe-wide vehicle monitoring.

NEVER FORGET TO BUCKLE UP

Although there are many new occupant protection systems and systems to protect pedestrians and cyclists for example, there is still considerable potential in the consistent use of existing systems, tried and tested for decades, such as the seat belt. According to the results of a survey carried out by the German Road Safety Council in April 2011, on average almost 20 per cent of passenger car occupants killed on German roads were not wearing a seat belt. Against the background of 98 per cent of all passenger car occupants wearing a seat belt in 2010, this once again confirms that car occupants who do not wear a seat belt are at a much increased risk of being killed. At the same time, the potential benefit of further increasing seat belt use is clear. In this connection, it would be of great educational value if, in the event of serious accidents in which vehicle occupants were injured or hurled out of the car, the fact that the occupants were not wearing a seat belt, which is often the cause, was made more explicit in the reports issued by the police and the media.

TRAFFIC RULES MUST BE COMPLIED WITH

Many accidents can be prevented if all road users behave in accordance with the rules of the road. The German Road Traffic Act says, among other things, that every change of direction or change of lane must be clearly indicated in good time. A study carried out by Auto Club Europe in 2008 found that, in Germany, almost one in three car drivers did not indicate when changing lane or turning. There are also many "signalling slouches" that flick the indicator only very briefly and therefore generate just a single flash impulse. In this regard, too, many vehicle manufacturers have now reacted with a simple driver assistance system: when the indicator is touched, this generates a flash cycle of, as a rule, three flash impulses (light-dark phases), corresponding to the required "clear indication" of an intention to change direction.

Activating the indicator is a very simple example of what, in addition to all the technical systems, could make road traffic still safer: greater knowledge and acceptance of the rules and mutual consideration. Whether it is about using a mobile phone without an appropriate hands-free set, driving too close to the car in front, or having a beer before setting out, the rules are justified and must be complied with. However, before a rule can be accepted and followed, road users must know what the rules are. Every road user should therefore find out about changes to the traffic rules and refresh their knowledge. Despite all attempts at harmonisation, many traffic rules within the European Union are, admittedly, far from constituting a unified regulatory framework, which, in turn, makes it very difficult to know and follow the rules abroad.

The necessary measures to achieve harmonisation must be implemented at all political levels in the medium and long term.

Achieving the goal of once again halving the annual number of road fatalities in the EU by 2020 will require substantial efforts on the part of the parties involved. Of importance in this regard are vehicle technology, infrastructure, road construction, vehicle monitoring, the emergency services, road safety education and other measures in the area of prevention. Last but not least is the human being, who, through his or her behaviour, makes a significant contribution to road safety.

DEKRA claims in brief

- Earliest possible road safety education of primary school-age children.
- Further improvement of novice driver training.
- Greater rule acceptance, regular refreshing of knowledge about current traffic rules and greater mutual consideration.
- Self-critical observation of age-related restrictions and of the performance of road users.
- Increasing the rate of seat belt use to 100 per cent.
- Greater market penetration of safety-enhancing driver assistance systems.
- Ensuring the operationality of mechanical and electronic components of vehicle safety over the entire lifetime of the vehicle.
- Shortening the test intervals for older vehicles.
- More systematic focusing of traffic checks on demonstrable effects for improving road safety.
- EU-wide harmonisation of all traffic rules.

Any questions?

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