ROAD SAFETY REPORT 2022

Mobility of Young People

DEKRA

Accident Statistics
A clearly positive trend – yet still with considerably higher risk for young people

The Human Factor
High accident potential due to lack of experience and overconfidence

Technology
Passive and active safety systems an efficient means of compensating for risk


DEKRA
Because in your life, you are in the
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The experts from DEKRA check your car to see if it is still safe and environmentally friendly. Get your desired appointment for the vehicle inspection online or just come by our office. dekra.com
DEKRA On the safe side

Young People Are Our Future

Among the worst news that a parent could ever imagine receiving is hearing that their son or daughter has lost their life in a traffic accident. This is naturally so when their children are very young – but no less so when they are novice drivers. According to the Institute for Health Metrics and Evaluation (IHME) at the University of Washington in Seattle, traffic accidents are the most frequent cause of fatalities among young people aged 15 to 24 around the world. This is particularly the case for young men. In 2019 (the year for which there are currently the latest figures from the IHME), an estimated 175,000 people between 15 and 24 years of age died in traffic accidents worldwide. Around 80 percent of these were men. Globally, this age group accounted for around 15 percent of all traffic fatalities in 2019.

These figures alone should already be an unequivocal mandate for all parties involved to take countermeasures using all conceivable means. As we will show in this report, there are plenty of areas where action can be taken – first and foremost in the areas of the human factor and technology. For novice drivers , some of the greatest risk factors include a lack of driving experience, overconfidence, insufficient vehicle control, limited hazard perception, distraction from what is happening on the road, for example through using digital media, and driving under the influence of alcohol or drugs. All of these are problem areas that merit even more focus than has previously been the case, not least in the context of driver training.

To demonstrate how important it is for vehicles to be in good technical condition, we conducted several test drives in our Technology Center at the DEKRA Lausitzring. Once again, it was proven that stable contact between the tires and the road – regardless of the weather or road conditions – is particularly crucial. Only then can it be guaranteed that assistance systems, such as ABS and ESP, will be effective. Given that many young drivers very often drive older vehicles, mainly for financial reasons, periodical technical inspection remains a key aspect of road safety. Aging, wear, and often a lack of awareness about technical faults as well as skimping on repairs and maintenance inevitably mean that older cars usually exhibit significant defects more frequently, and thus present a greater accident risk than newer cars.

Jann Fehlauer, Managing Director, DEKRA Automobil GmbH

In the individual sections of this report, we explain in detail what approaches should be taken, and how, to ensure that young people everywhere are better protected when they are on the road, especially when driving a car or riding a motorbike. As in previous reports, we have analyzed various statistics for this purpose and explored research findings in great depth. And once again, this latest report is far more than just a collection of facts about the current situation, but rather, we want it to get people thinking and provide advice for politicians, traffic and infrastructure experts, manufacturers, scientific institutions, associations, and all road users. The fact that various renowned national and international experts have again agreed to provide statements, in which they report on their respective experiences and any measures taken, underscores how important our report is in specialist circles. DEKRA has been committed to the goal of ensuring maximum road safety for all since it was established almost 100 years ago – and the work continues.

Contents

Wherever the DEKRA Road Safety Report uses terms such as "road user," "pedestrian," "cyclist," etc., these terms should always be assumed to apply to all genders unless explicitly stated otherwise.

Unless explicitly stated otherwise, the terms "bicycle" and "cyclist" always include pedelecs and pedelec riders (up to 25 km/h).

The web portal: www.dekra-roadsafety.com

DEKRA has been publishing its annual Road Safety Report in printed form in several languages since 2008. The www.dekra-roadsafety.com web portal went live with the publication of the DEKRA Road Safety Report for 2016. Here you will find all the reports we have published since 2008, as well as additional content, such as videos, animations, and interactive graphics. The portal also covers a range of other topics and DEKRA activities concerning road safety. If you have a tablet or smartphone, you can link directly from the printed version to the web portal by scanning the QR codes that can be found throughout the report.

LEGAL NOTICE
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We Need to Keep All Young Road Users Safe on Our Roads

DEKRA's continued focus on young people in road safety is most welcome. Indeed, it is essential as globally, road crashes are the leading cause of death of 5-29 year olds. Even in the EU, the 18-24 age-group has the highest road fatality rate (among all age groups), although it has decreased considerably over the past decade and indeed faster than for other age groups.

Your precise focus on young drivers is also very relevant. Research in neuroscience tells us that the part of the brain that encourages risk-taking in the adolescent and young adult develops more quickly than the part that suppresses those impulses. So it is up to us as a society to make sure that that natural urge to take more risk does not end in tragedy for the driver, the passengers, or indeed those outside the vehicle. And motorcycle deaths and serious injuries remain, of course, a significant problem.

Here in the European Union, we are proud of successive waves of legislation in the past decades regarding vehicle safety (safety belts and child restraints; air bag requirements; anti-lock braking; lane assist technologies to name but a few). These have contributed considerably to the much lower death and serious injury rates in the EU over the past 2 or 3 decades. But while we have made driving considerably safer for the occupants of cars, it is still unfortunately the case that 64% of fatalities among 18-24 year olds are car drivers/passengers compared to 44% for the population as a whole.

In other words, road use remains a significant and disproportionate area of risk for young people. They are twice as likely as others to be killed on the roads at night during the weekend. And motorcyclists account for 20% of road fatalities among 18-24 year olds, although they represent only a small proportion of overall road users. These sobering statistics point to the continued need to focus on reducing road deaths and serious injuries among young people, including with reference to driver training and driving behaviour.

In our forthcoming revision of the EU Driving Licences Directive, we are considering whether there is a need for common rules on training and on probation periods, and also whether there is a need to introduce standards for driving instructors and on "accompanying persons" for novice drivers. But it is also clear that enforcement efforts need to be focused on the areas that cause greatest damage, namely excessive speed and drink- or drug-driving. The risk of a road crash following just a single unit of alcohol consumed by a young driver (aged 16-20) is three to five times higher than for the same drink consumed by drivers aged 30 and over. It is also estimated that around 6% of all deaths in road collisions involve drug-driving, so better, more targeted checks on young drivers would save lives. Studies have also shown that lowering the permitted alcohol limit for young drivers leads to a reduction of driving under the influence and consequently to fewer alcohol-related accidents.

Matthew Baldwin, Deputy Director-General of the European Commission's Directorate-General for Transport and Mobility, European Coordinator for Road Safety

Last but not least, I hope DEKRA also remember to look outside the vehicle and at the vulnerable road users (VRU) on our roads. The European Commission recently published data showing clearly that fatalities for pedestrians and cyclists, for example, overwhelmingly stem from collisions involving cars and trucks. So we must do more to protect them too. EU policies are already evolving in this direction with the new mandatory safety measures introduced by the latest update of the General Safety Regulation such as Intelligent Speed Assistance which will be mandatory in all new models by July 2022, and in all new cars from 2024. We also now require that vulnerable users are taken systematically into account by EU countries in applying the Road Infrastructure Safety Management Directive.

As ever, in conclusion, road safety is a complex but vital challenge to our societies. We need to keep all young road users safe on our roads. We know the solutions that will make a difference under the Safe System approach to road safety and we should apply that at all levels – European, national and local. Together we can make a real difference!

Troubling Interplay of Different Risk Factors

Alongside the over 65s and motorcyclists, young people between 18 and 24 are among the high-risk groups in road traffic. The accident rate attributable to young people is comparatively high considering what percentage of the population they make up, and is linked to their inexperience, their higher tendency to take risks, and their underdeveloped ability to recognize potential hazards early on and to react appropriately. In order to – quite literally – "steer" this trend in the opposite direction, it is essential to address various different fields of actions.

Mobility behavior is currently undergoing a rapid transformation in many parts of the world. Traditional car traffic is on the brink of unprecedented changes brought about by the increasing electrification of the driveline and by increasingly higher levels of automation when driving. Car ownership as a status symbol is no longer valued to the same degree as before, and connectivity and flexibility now count for much more than power output and top speed. In Europe, North America, Australia, and New Zealand, the bicycle and its derivatives as well as personal light electric vehicles are gaining in importance for young people in particular (the focus of this report), in part due to a change in environmental awareness.

A survey conducted in fall 2021 by Forsa among 18 to 24-year-olds in Germany (commissioned by DEKRA) revealed some insightful findings about how this age group use different modes of transport in their day-to-day life. Although 46 percent of all respondents stated that they use their own or a private car at least several times a week, a similar number (42 percent) stated that they use public transport, such as the bus or train, at least several times a week. Furthermore, 32 percent said they use a traditional bicycle or pedelec at least several times a week.

CHANGED MOBILITY BEHAVIOR

This trend is being driven firstly thanks to car sharing schemes, electric scooters for hire, and reliable public transport, particularly in urban areas, and secondly, due to a lack of parking spaces, increasing fuel costs, and a growing awareness of sustainable living. This is also evident – at least for Germany – from the above-mentioned Forsa survey. In particular in smaller towns, and communities with fewer than 100,000 inhabitants, people get around by car at least several times

a week. Conversely, in larger towns and cities with over 100,000 inhabitants, residents use public transport or (electric) bicycles more frequently. Another interesting finding was that the reason respondents cited by far most frequently for using a car was that it is the easiest and most convenient solution to get from A to B (84 percent). This applies to a large extent to respondents from more rural regions (towns and communities up to 100,000 inhabitants). Another reason mentioned more frequently by this same subgroup of respondents than those living in towns and cities with over 100,000 inhabitants was that the car was their only means of getting to school or apprenticeship position.

The fact is that with the latest technological possibilities and mobility options, as well as the changing social conditions, the requirements and expectations of modern forms and concepts of mobility are also changing. It is also expected that, along with the described changes in mobility behavior, there will be a concomitant significant change in accident statistics. It is estimated that the biggest changes will apply to older people (the age group addressed in the 2021 Road Safety Report) and younger people – the latter because they are very open to the changes happening in the mobility sector and are willing to try out new things. Thereby, there is an increasing focus on unprotected forms of road use which, for example, do not have a surrounding crumple zone like cars do. For this reason, it is expected that there will be a general increase in casualties in the pedestrians and cyclists segments as well as among micromobility users. There are plans to respond to these changes through making modifications to the legal framework and infrastructure. Over the last years, numerous countries, especially in Europe, have changed their national road traffic acts and implemented measures to make all road users equal.

Dr. Volker Wissing
German Federal Minister for Digital and Transport

Freedom and Safety: a Balancing Act

Becoming an adult, discovering new things, and acquiring a whole new perspective on the world: adolescents and young adults have a whole host of exciting experiences to look forward to, but they will also encounter many challenges. This also applies to the topic of mobility.

Young people in Germany are allowed to have their first driver's license as young as 15. This means they have other ways of getting to school or their apprenticeship position, or to meet with friends than simply cycling or taking public transport; they also have the option of riding a motorized bicycle, moped, or light quadricycles. From the age of 17, young people can start driving with someone accompanying them. Unfortunately however, having more horse power or kilowatts under the hood also means more accidents at this age. This affects 18 to 24-year-olds in particular, who, by far, are most at risk of being involved in a traffic accident. This has got to change.

We want adolescents and young adults to be able to use the roads in a carefree and safe manner at any time. That is why the German Federal Ministry of Transport has been developing special schemes for this target group for many years. We have some strong partners helping us with this, such as the Deutsche Verkehrswacht (German Road Safety Volunteer Organization – DVW) and the Deutscher Verkehrssicherheitsrat (German Road Safety Council – DVR). Together we are working on increasing safety for young people on the road in a way that does not restrict their mobility. Our tools here are: inform, explain, and sensitize.

A real-life example of this is the DVW's campaign "Aktion junge Fahrer" (young drivers campaign), which has been running in schools throughout Germany since 2021 under the slogan "Jung + Sicher + Startklar" (young, safe, and ready to go). The campaign focuses especially on explaining the risks of alcohol and drugs, distraction, and insufficient vehicle safety in road traffic.

The DVR's campaign to improve the quality of young people's driving when accompanied from the age of 17 directly addresses young people's questions on this subject. When am I allowed to start my driving training? How many people can I designate to accompany me? Am I allowed to drive with an accompanying person when I am abroad, too? The aim of providing answers to these and similar questions is to attract as many young people as possible (and their accompanying persons) to take part in the scheme. This is because accompanied driving from the age of 17 increases driving competence and self-confidence among adolescents and young adults, and has proven to decrease their risk of accidents over the long term.

It is for this very reason that we want to lower the legal age of accompanied driving to 16 in future. This would help to sensitize young people to the risks and dangers in road traffic from an early stage. That is why we have asked the European Commission to be able to lower the driver's license age to 16 for a pilot project.

In future, we also want to help prepare adolescents and young people for the mobility of the future. This includes familiarizing them with the opportunities and risks associated with an increasingly digitally networked, automated, and interlinked type of mobility.

The safety of all road users is a national duty, one in which all parties must act in concert. To this effect, the German Federal Government, the federal states, and municipalities founded the "Pakt für Verkehrssicherheit" (pact for road safety) in 2021. It is the first joint strategy that involves all relevant players, and in it we have identified important fields of action and set a common objective: by 2030, we want to have reduced the number of traffic fatalities in Germany by 40 percent and in this way come significantly closer to achieving the "Vision Zero" goal of zero fatalities and serious injuries in road traffic. Children and young people, pedestrians, and cyclists and motorcyclists in particular are to be even safer when they are out and about. Other active campaigners, partners, and participants are very welcome to become involved in the project at any time.

To achieve our objective, there is much more that we have to do in terms of road safety. The DEKRA Road Safety Report provides a reliable guideline and makes an indispensable contribution to protecting all people on the road in Germany. Thank you!

Antonio Avenoso
Executive Director, European Transport Safety Council (ETSC)

Interplay of Inexperience, Immaturity and Lifestyle

According to the latest data available, in 2019, 5,182 young people were killed in road collisions in the 25 EU countries for which figures are available. Road deaths among young people aged 15 to 30 in the EU represent around a fifth of deaths from all causes in that age group.

Around 40% of road deaths in the EU take place in collisions that involve one or more young drivers or powered two-wheeler riders.

Those overall numbers mask a huge gender disparity. ETSC research shows that men represent 81% of all road deaths among young people aged 15-30. Large differences between male and female road mortality remain even after taking into consideration the fact that men drive more than women.

While young people are a high-risk group in themselves, most young people do not deliberately drive unsafely. The risks associated with young drivers and riders stem from inexperience, immaturity and lifestyle linked to their age and gender. Data shows that the younger a person starts unrestricted solo driving, the more likely it is that he or she will have a fatal collision, particularly if under 18 years-old.

Graduated driving licence systems have been assessed by a number of studies that show a reduction in collisions. Such systems put additional restrictions on younger drivers during the first years of driving, allowing them to gain experience while reducing certain high-risk situations.

Young people, especially men, are also over-represented when it comes to road deaths linked to drink-driving and drugs. Enforcing and tightening legal Blood Alcohol Concentration limits and improved help for those living with identified alcohol and other drug issues can therefore help prevent these deaths.

The European Commission is currently reviewing rules on driver licensing, with an updated legal proposal expected in the coming months. ETSC is also calling for the European Commission to recommend a drink-driving limit set effectively at zero (enforced at 0.2 g/l Blood Alcohol Concentration) – a measure that is especially important for younger drivers. Regarding drug driving, ETSC would also like to see a European-wide zero-tolerance limit for illicit psychoactive drugs.

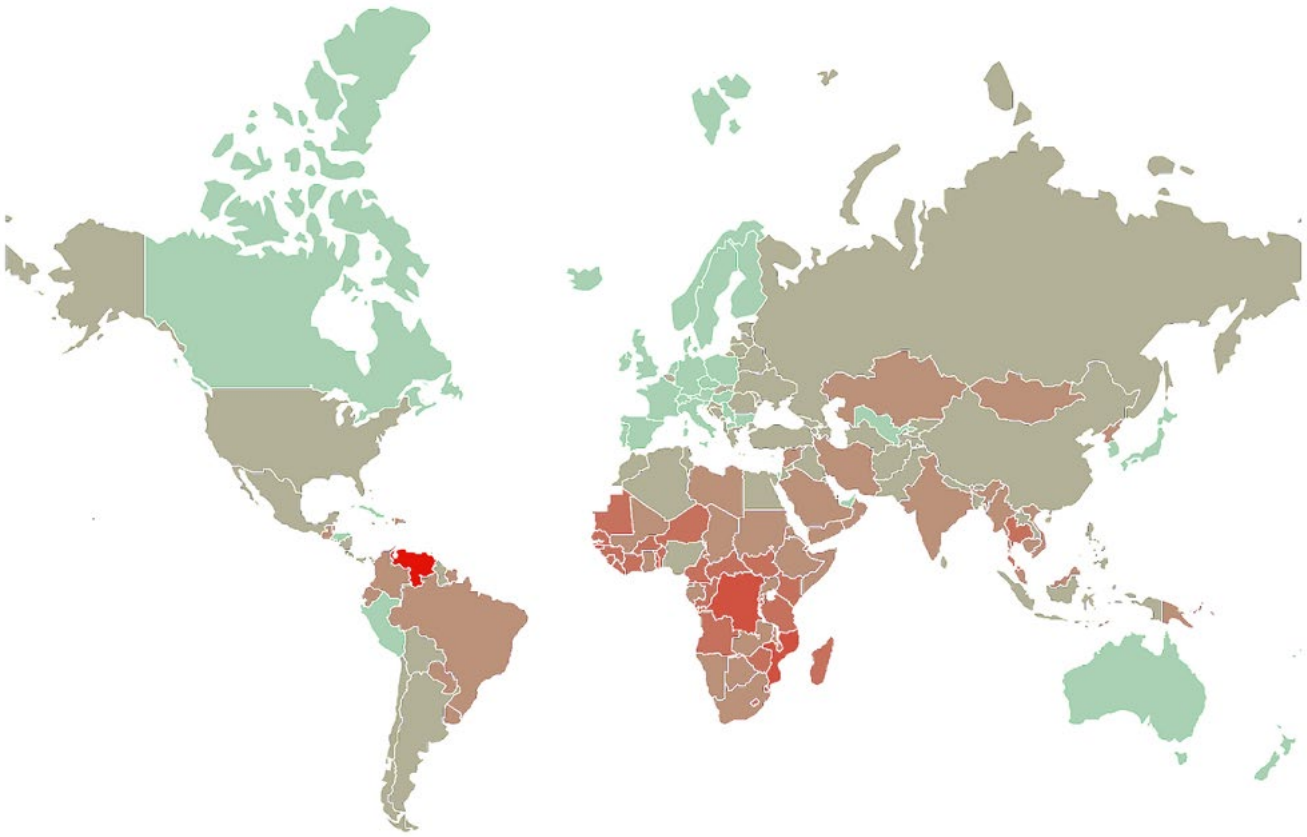
BEING A ROAD USER REQUIRES CAUTION AND CONSIDERATION AT THE SAME TIME

With the overarching goals of Vision Zero, (road traffic without fatalities or serious injuries), ecological, sustainable, and affordable mobility for all, and the creation of a pleasant living environment instead of traffic environment, countries are following the approach of providing the highest level of protection to road users who would be most at risk in a collision. The fact that this important course of action has received little enthusiasm specifically among car drivers can be seen wherever corresponding measures are taken. For example, the revised UK Highway Code introduced in January 2022 resulted in controversial discussions in politics and society.

In Germany too, the changes to the German Road Traffic Act introduced in 2020 to make cyclists equal with pedestrians was met with much opposition. In particular the corresponding changes to the catalog of fines received such heavy criticism, including from lobby associations, that major sections were substantially moderated or even reversed. As such, the expected positive impact on accident statistics has been minimal to non-existent. It is precisely the interplay of different influencing factors that will account for improvements in road safety in general, and road safety for specific road user groups in particular.

In general, there is an acute need to take action when it comes to road safety for young people. As was established years ago by, among others, the United Nations, the World Health Organization (WHO), and the organization YOURS (Youth for Road Safety), which the WHO helped set up in 2009, more young people between 15 and 29 around the world die every year in traffic accidents than from HIV/AIDS, malaria, tuberculosis, or homicide. The average annual rate of young traffic fatalities per 100,000 inhabitants is highest in Africa, South America, and Asia (Figure 1). The conscious or unconscious, often life-threatening risks taken include speeding, being under the influence of alcohol, distraction, not wearing a seat belt, and riding a bicycle/motorbike without a helmet. For this reason, as an official member of the United Nations Road Safety Collaboration, YOURS – like numerous other institutions – is advocating for the inclusion of road safety goals in the 17 Sustainable Development Goals (SDGs) of the United Nations. YOURS is also campaigning on a global level for national strategies to focus even more on road safety for young people – including in March 2022 at the African Youth SDGs Summit, for example.

1 Average Annual Traffic Fatality Rate Among Young People per 100,000 Inhabitants

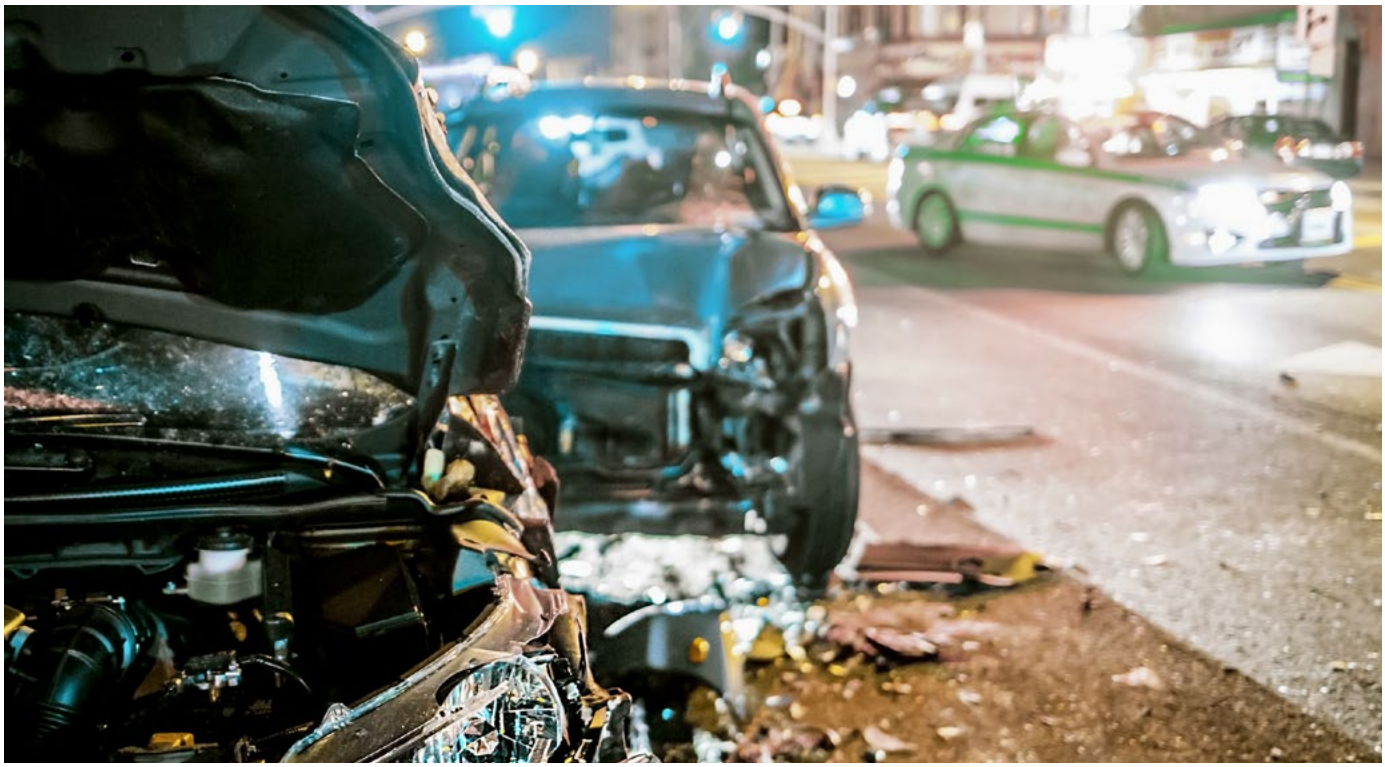


Source: YOURS/WHO

Clearly, the number of young traffic victims cannot be reduced overnight. That is why a strategic approach is required for the effects to last over the long term. This should be an approach that encompasses a stronger focus on sensitizing the public to the problem and the required associated information campaigns, as well as driver training and the test for obtaining a driver's license, the systematic enforcement of regulations, and the targeted use of modern technologies (e.g., driver assistance systems). It is also important to implement appropriate infrastructure measures, for example to ensure that the road infrastructure mitigates any consequences of accidents. The briefly mentioned set of issues shows that young people as road users is a topic where there are many conflicts and challenges. This will be explored in greater detail in the next sections.

The Facts at a Glance

- **Car ownership as a status symbol is no longer valued to the same degree as before, and connectivity and flexibility now count for much more than power output and top speed.**
- **Against the backdrop of Vision Zero (road traffic without fatalities or serious injuries) and sustainable mobility, a large number of countries have been modifying their road traffic acts over the years and have, more than ever before, been following the approach of providing the highest level of protection to road users who would be most at risk in a collision.**
- **Every year, more young people between 15 and 29 around the world die in traffic accidents than from HIV/AIDS, malaria, tuberculosis or homicide.**
- **The conscious or unconscious, often life-threatening risks taken in particular by young people when using the roads include speeding, being under the influence of alcohol or drugs, distraction, not wearing a seat belt, and riding a bicycle/motorbike without a helmet.**



Men Most at Risk

Male, driving a car or motorbike, driving too fast, and potentially under the influence of alcohol: these four factors dominate in the road traffic accident statistics of young people in many countries. Although the number of road users aged 15 to 24 killed or seriously injured in accidents has reduced – in part significantly – over the last ten years, the figures are, for the most part, still considerably above the average for the other age groups, when based on one million inhabitants.

Hardly a day goes by without seeing headlines like "18-year-old crashes into tree," "Drunk 23-year-old veers off road," "Young woman loses control of vehicle" in the media – across the entire globe. According to the Institute for Health Metrics and Evaluation (IHME) of the University of Washington in Seattle, around 175,000 people aged 15 to 24 around the world died in road traffic in 2019 (the year for which there are currently the latest figures from the IHME) (Figures 2 and 3). More than 95,000 of these occurred in Asia, around 40,000 in Africa, more than 25,000 in America, and around 10,000 in Europe. Globally, around 105,000 of the fatalities were 20 to 24-year-olds, and around 70,000 15 to 19-year-olds.

A huge 80 percent of traffic fatalities in both age groups were men – and just 20 percent women. Worldwide, the overall 15 to 24 age group accounted for around 15 percent of all traffic fatalities in 2019. There is an especially high risk of having an accident as a car occupant or motorbike occupant. In these two road user groups, a total of 123,000 people aged 15 to 24 were killed globally in 2019, according to the IHME. That accounts for 70 percent of all traffic fatalities in this age range.

STILL WORK TO DO DESPITE REDUCTION IN ACCIDENT NUMBERS

The quoted figures may not be completely reliable on such a detailed scale, as some of them are merely estimates, as stated in the IHME's GBD Compare online tool. Nevertheless, they show a trend that can be confirmed by examining the

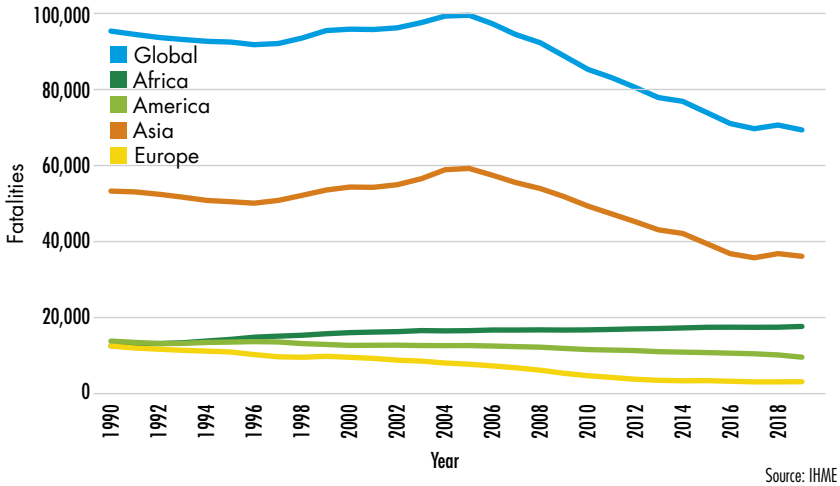
statistics and surveys published by other institutions: young people are at great risk in road traffic – especially as novice drivers.

CLEARLY POSITIVE TREND

When taking an initial look at the general, age-independent trends, analyses from the International Road Traffic and Accident Database (IRTAD) of the International Transport Forum – consisting of various national official accident statistics – show that the number of traffic fatalities has dropped between 2010 and 2019 in most of IRTAD member states listed here. In Switzerland and South Korea, the figures fell very considerably – at 43 percent and 39 percent respectively. But in the USA the reverse was true: the number of traffic fatalities rose from just under 33,000 in 2010 to almost 36,100 in 2019 – an increase of nearly 9.5 percent. And that's not all: while the number of traffic fatalities fell further in almost all IRTAD member states during the start of coronavirus in 2020, in the USA it increased by another 7.2 percent to 38,680.

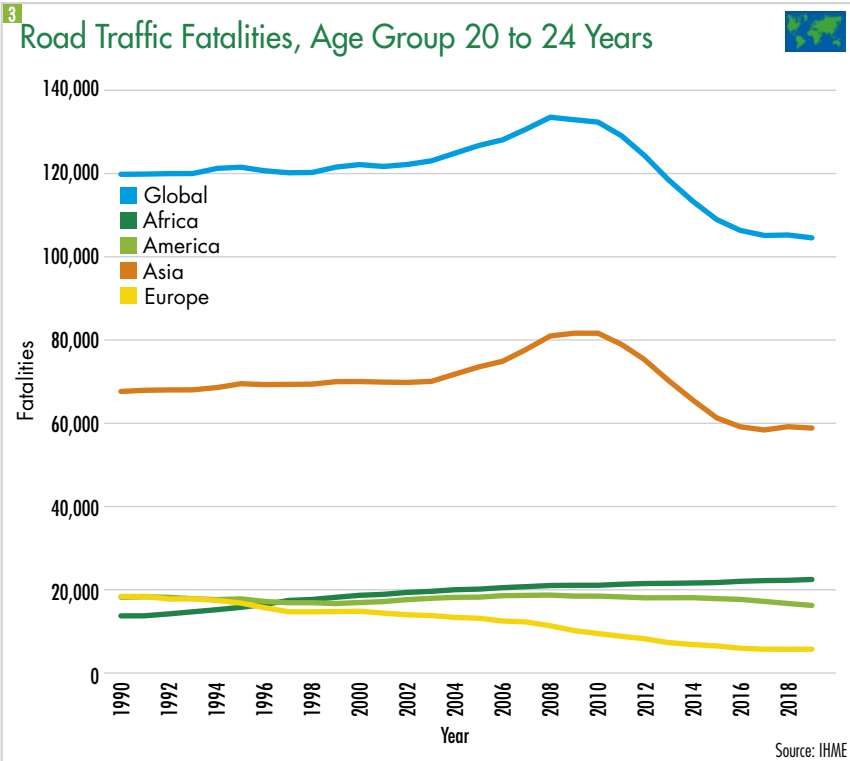
In terms of the 15 to 24 age group, the number of traffic fatalities fell in all IRTAD member states (except for Chile) between 2010 and 2019 – in some countries by more than 60 percent. Furthermore, the reduction in traffic fatalities for this age group is usually significantly greater than the reduction in total traffic fatalities. This also applies with regard to figures per 100,000 inhabitants for the 15 to 24 age group. This suggests that the target-group-focused measures introduced in many countries to protect this age group – who are more at risk on average – were effective. Leading the way in this respect are the countries that, in general, have implemented a successful road safety policy and have been able to reduce traffic fatality numbers in all age groups (Figures 4 and 5).

2 Road Traffic Fatalities, Age Group 15 to 19 Years



Source: IHME

3 Road Traffic Fatalities, Age Group 20 to 24 Years

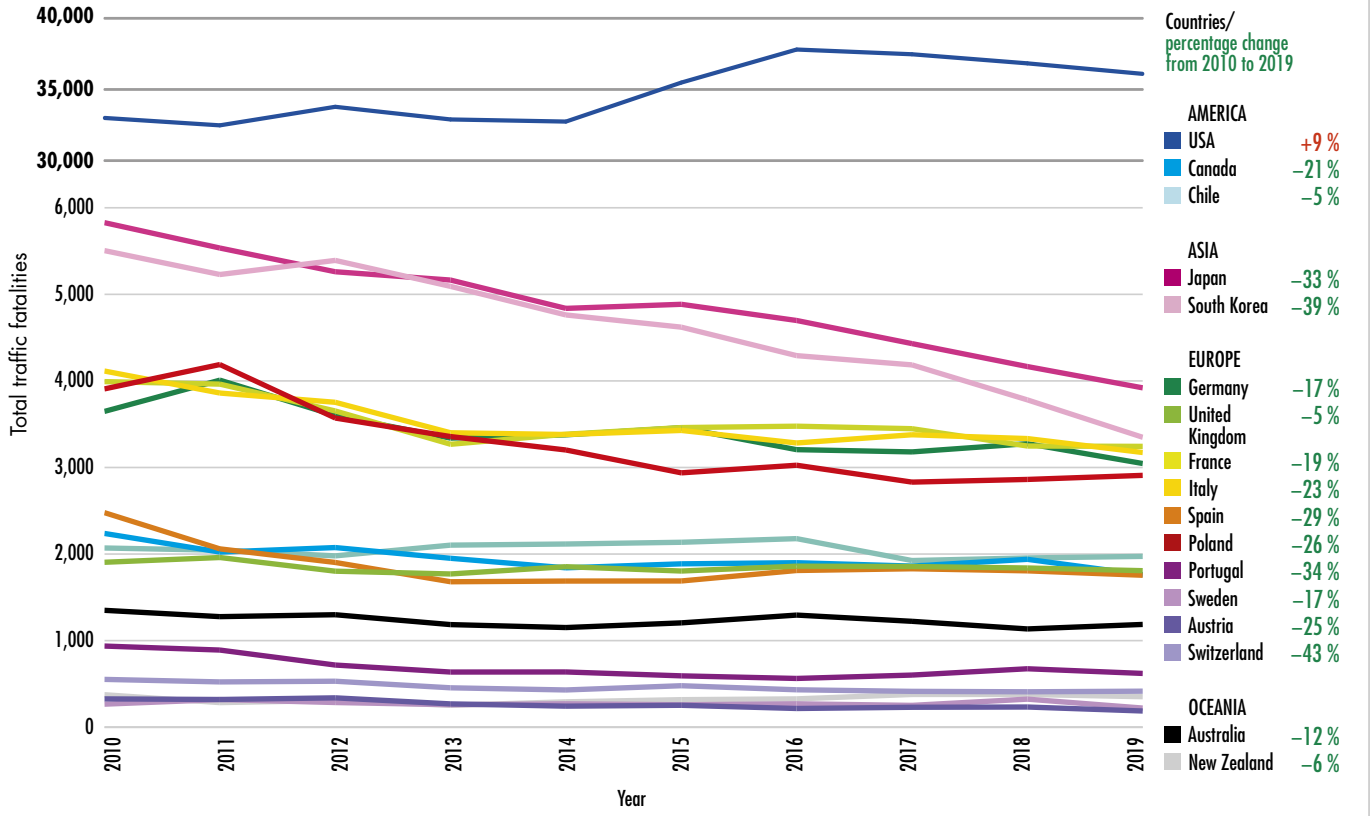


Source: IHME

However, young road users continue to represent a particularly at-risk group in most of the countries analyzed, with the exception of Japan and Korea, where it is senior citizens who are most at risk in road traffic. At the bottom of the rankings is France, although it is worth noting that it has achieved some notable success since 2010. To a greater or lesser extent, the risk factors in most countries include speeding, limited experience, overestimating one's own abilities, underestimating hazards on the roads, alcohol consumption, and driving without a seatbelt. For example, figures from 2019 for the USA show that 45 percent of all drivers aged 15 to 20 who were killed in an accident had not been wearing a seat belt, and 24 percent had consumed alcohol. In 2019 in Canada, a staggering 54 percent of victims from the age group of young drivers between 15 and 24 had not been wearing a seat belt.

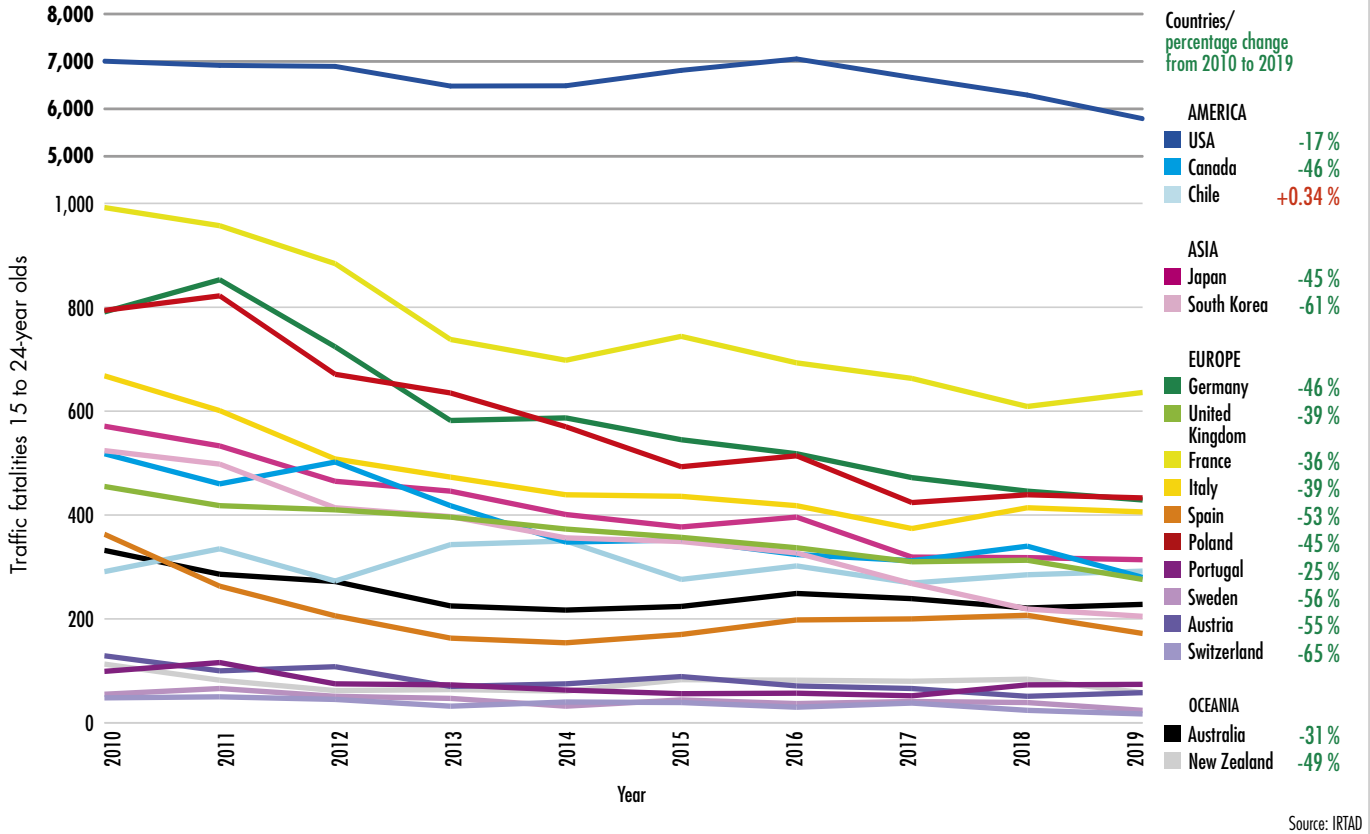
When looking at the number of road users killed per 100,000 inhabitants for the individual age groups compared to the average for all age

4 Trend for Traffic Fatality Numbers



Source: IRTAD

5 Trend for Traffic Fatality Numbers of 15 to 24-Year-Olds



Source: IRTAD

groups, we can see that 15 to 17-year-olds are below the population average in all countries analyzed. In the 18 to 20 age group, the picture is the reverse. South Korea is the only country in which the fatality rates are significantly below the total average; in all of the other countries analyzed, it is above average – in some quite considerably. Poland had the highest rate with 7. This means that the total rate as an average across all age groups, which at 7.7 is already high in Poland, is almost doubled for the 18 to 20 age group.

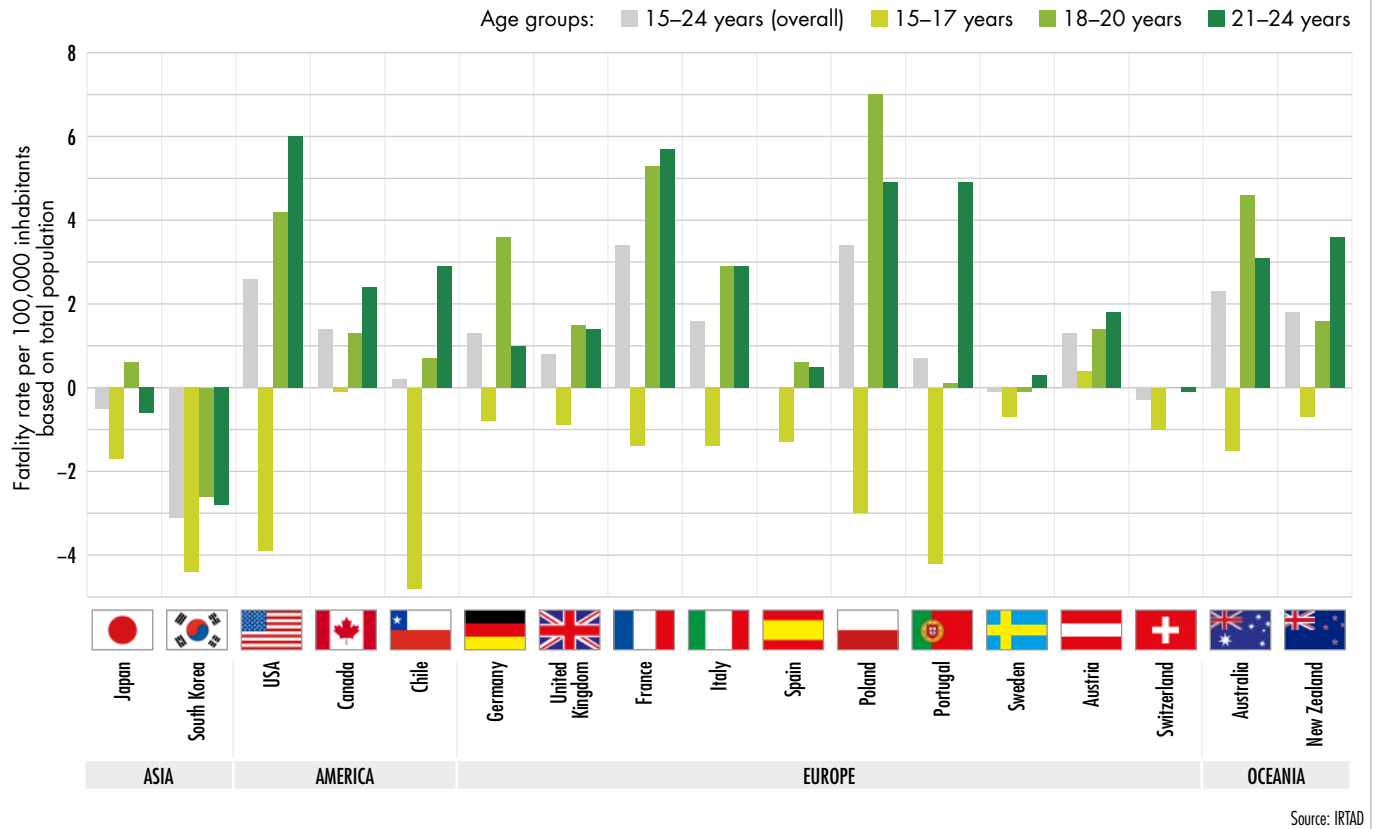
Most of the countries analyzed also have an elevated rate among the 21 to 24-year-olds. The countries with the greatest deviations at the top end of the scale are the USA, France, Poland, and Portugal. It is notable that, in Portugal, the previous age group is only 0.1 over the average, which is fairly positive. The countries below average for 21 to 24-year-olds are South Korea, Japan, and Switzerland.

Analyzing the data in this manner provides a country-by-country picture of the age groups that are at particular risk. Analyzing the different influencing factors in detail makes it possible to compare countries with one another, and thus to identify specific problem areas as well as develop approaches for targeted improvements (Figure 6).

Several road safety campaigns are being launched around the world under the slogan "Drive Safely"

The picture is inconsistent when it comes to the modes of road use that are most risky for young people. For example, in 2019 in Poland, young

6 Fatality Rate per 100,000 Inhabitants in 2019 by Age Group Based on Total Population



Source: IRTAD

Prof. Walter Eichendorf
President of the German
Road Safety Council (DVR)

Accident Risk Among Young People Must Be Reduced Further

For many young people, especially in rural regions, driving a car marks their first step towards independence from their parental home. However, this newly found freedom is concomitant with an increased risk of having an accident. The rate of novice drivers bearing the main responsibility of causing an accident with a car is above average. More than two thirds (68.2 percent) of car drivers involved in an accident aged 18 to 20 were classified by the police as the main person responsible. The reasons for this are limited driving experience and youth – a dangerous combination for risk.

In 2011, to reduce the risk of young people having traffic accidents, accompanied driving from the age of 17 (BF17) was introduced on a permanent basis. The accompanying evaluation proved how successful the initiative was. The rate at which young people who take part in BF17 are involved in traffic accidents during their first year of independent driving is 23 percent lower than those who don't take part in BF17, and they also demonstrate a 22 percent lower propensity to commit significant traffic offenses. The Netherlands have now also adopted this model. However, not all young people take full advantage of the BF17 scheme. The German Road Safety Council (DVR) has declared itself in favor of extending the learning-to-drive phase even further through implementation of BF16 (accompanied driving from 16). This has been adopted by the new German government in the coalition agreement.

The DVR therefore recommends implementing more measures to reduce the risk of accidents even further and increase road safety. The introduction of an options model is one of their measures, which could also be a successful example for other nations. This concerns a general extension of the existing probationary period from two to three years, in order to enable young people to gain more driving experience. Following certain measures, such as professional and standardized feedback drives over the course of the three years or making full use of the BF17 scheme, the probationary period could be reduced again to two years, as the additional measures would help to consolidate what drivers had learned.

To enable young people to benefit from driver assistance systems, such as Adaptive Cruise Control (ACC), the DVR has successfully made the case for basic requirements concerning driver assistance systems to be anchored into the legal framework of driver training and driver's license tests. They will come into effect in 2022.

Due to the coronavirus pandemic, a higher number of online-based lessons were offered for the driving theory part of driver training. To ensure they meet sufficient quality standards, the DVR has requested that the German Federal Ministry of Transport develop a suitable blended learning concept for the near future. It's purpose will be, among other things, to ensure that digital learning programs are high in quality and to define what driving theory content is essential to teach in person and what is not. This concept could then serve as a model for other nations.

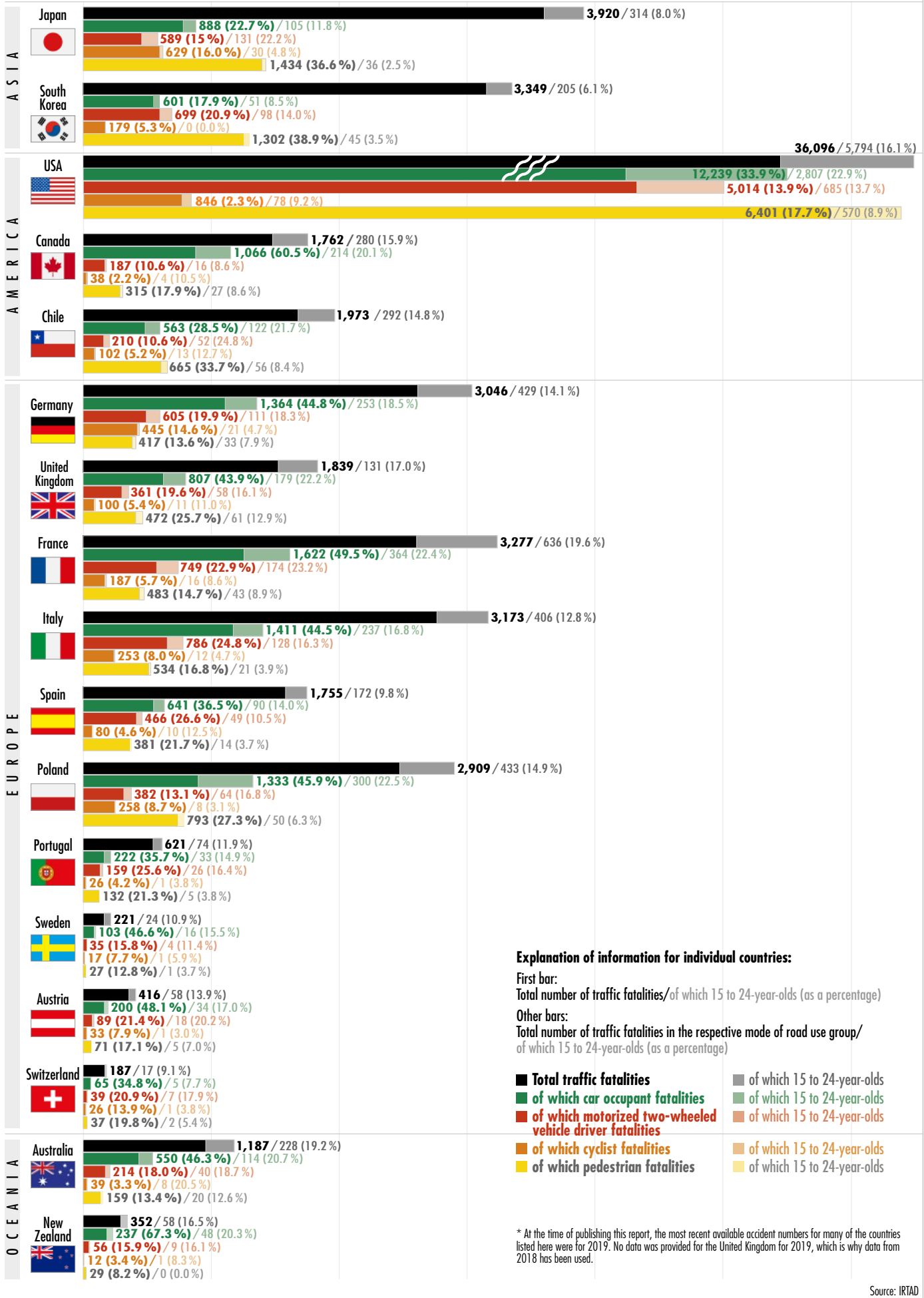
road users accounted for just under 15 percent of traffic fatalities, with car occupants making up 22.5 percent of these and cyclists just 3.1 percent. However, in Australia, although the rate of car occupants killed was similar at 20.7, for cyclists it was a staggering 20.5 percent – the highest value out of all the countries analyzed.

Generally speaking, 15 to 24-year-olds are most at risk when they are car occupants or occupants on motorized two-wheeled vehicles. For example, in 2019 in France, more than 22 percent of road users killed were car occupants, and over 23 percent were occupants on motorized two-wheeled vehicles. In Chile, motorbike occupants even made up almost 25 percent of all traffic fatalities aged 15 to 24. The aspects explored in The Human Factor section, such as increased risk taking and inexperience combined with overconfidence, play a key role here. As pedestrians and cyclists, the risk to this age group is below average – apart from a few exceptions. One of the reasons for this is that younger people are less vulnerable, especially in comparison with senior citizens. However, it is expected that this area will become an increasingly important focus area in future given the changing attitudes to mobility in many countries as well as emerging forms of mobility, especially in terms of personal light electric vehicles (Figure 7).

DRIVING TOO FAST AND DRIVING UNDER THE INFLUENCE OF ALCOHOL ARE CLASSIC PROBLEM AREAS

7

Rate of 15 to 24-Year-Olds Killed Compared With All Traffic Fatalities in 2019 (Selection)*



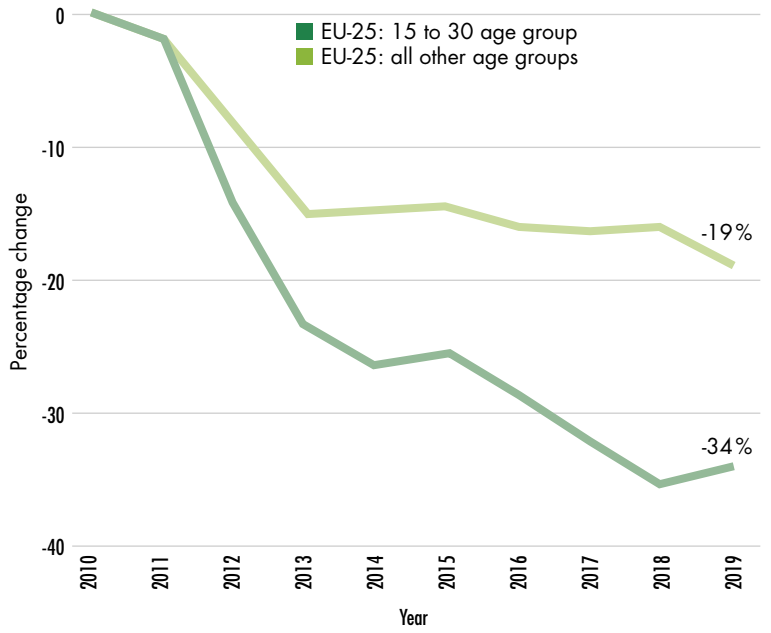
* At the time of publishing this report, the most recent available accident numbers for many of the countries listed here were for 2019. No data was provided for the United Kingdom for 2019, which is why data from 2018 has been used.

Source: IRTAD

THERE IS A PARTICULAR NEED TO FOCUS ON YOUNG MEN IN ORDER TO IMPROVE ROAD SAFETY

8

Trend for Traffic Fatality Numbers in the EU



EU-25 average: EU-27 without Lithuania and Malta, as there is not sufficient data.
Netherlands and Slovakia 15 to 29-year-olds. Ireland preliminary data 2018 to 2019.

Source: ETSC

AVERAGE IN THE EU STILL HIGHER THAN IN OTHER AGE GROUPS

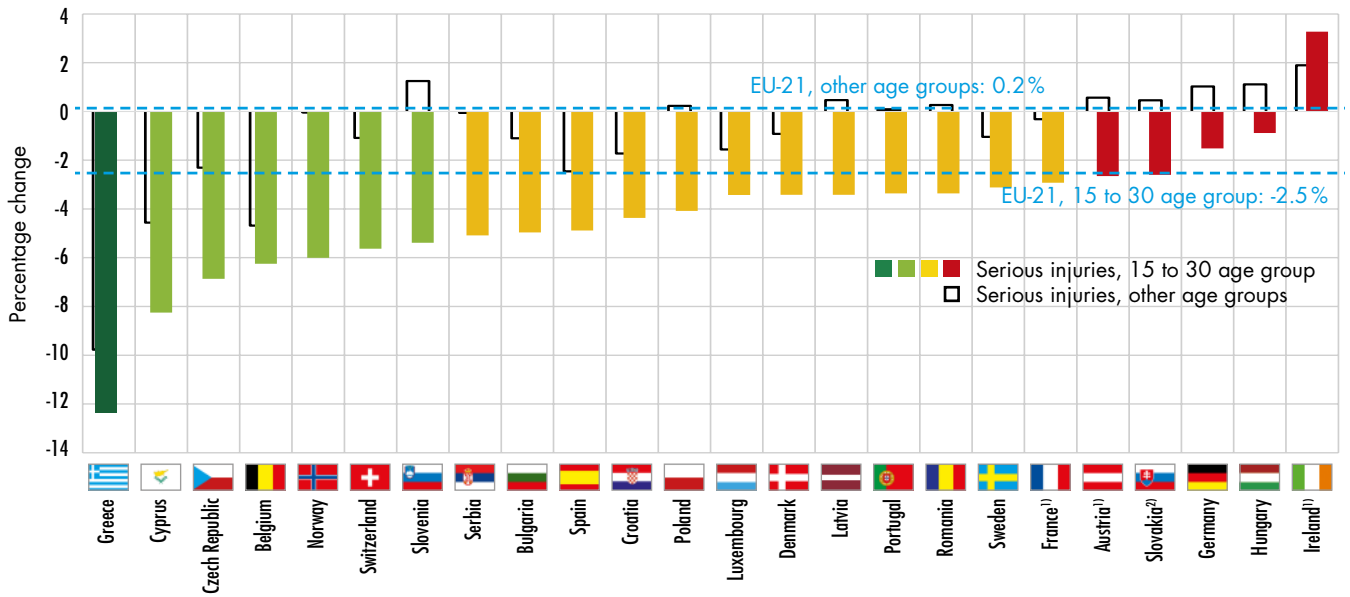
We can see the generally positive trend once again if we consider just the EU member states. As outlined by the European Transport Safety Council (ETSC) in its annual PIN Report, the trend over recent years underscores that there have been huge successes in places where "classic" problem areas, such as speeding or driving under the influence of alcohol, have been addressed and measures taken or campaigns (e.g., concerning putting on a seat belt or how to strap children in correctly) set up to tackle these problems. The introduction of tougher rules, e.g., limiting the speed on inter-urban roads in France to 80 km/h, or to 50 km/h on urban roads in Poland (previously 60 km/h) even at night, combined with stricter controls, higher fines, and better education have had positive effects on these purely behavior-based problem areas.

It is notable that these problem areas are the very areas in which young novice drivers tend to

9

Trend for Number of Seriously Injured 15 to 30-Year-Olds in Europe

Average annual change in the number of serious injuries among young people aged 15 to 30 years (colored bars) and average annual change in the number of serious injuries among the remaining population between 2010 and 2019 (or in the most recently available year) based on the national definition.



[1] Used years vary (France 2010 to 2017, Ireland 2013 to 2019, Austria 2012 to 2019).
[2] 15 to 29-year-olds EU-21 average (excluding Estonia, Finland, Italy, Lithuania, Malta, and the Netherlands due to insufficient data).

Source: ETSC

rank worse compared with the other road user groups. Accordingly, there was also a considerable drop in the number of young people killed on the roads in EU member states. In its PIN Flash Report 41 from October 2021, the ETSC conducted a thorough examination of the age group 15 to 30.

It found that, for the EU-27, the 15 to 30 age group saw an average of 67 traffic fatalities per one million inhabitants, which is still high above the average rate of 49 for the other age groups. However, in 2010, this ratio was even higher at 103 to 61. In Estonia, Romania, and Hungary, the traffic fatality rate among young people is slightly below that for the rest of the population. It seems clear that the ratio is linked not only to the level of traffic safety, but also to factors such as population composition, the ratio of urban to rural population, and the primary modes of road use. Overall, however, the difference is narrowing due to increased safety on the roads (Figure 8).

The number of people seriously injured in traffic accidents between 2010 and 2019 also fell, which is another positive result. While in most of the countries analyzed only very few changes were achieved for the rest of the population, among young people there were improvements – in some areas quite considerable ones. Overall, the average annual change for the 15 to 30 age group across 21 EU countries with sufficient data was a 2.5 percent decline, while for the rest of the population it was a 0.2 increase (Figure 9).

The huge significance of road user behavior, i.e., the human factor, compared with the influencing factors of technology and infrastructure, becomes clear when analyzing the numbers of traffic fatalities by gender. Across the EU as a whole, based on the respective share of the population, more than four times as many young men aged 15 to 30 die in traffic accidents compared to women of the same age. Even if men have a higher road use rate (also behavior related), this is far off the factor of 4. Therefore, to improve road safety for young people, it is essential to concentrate on young men.

ACCIDENT STATISTICS IN THE USA

An analysis of the US figures from 2019 shows that, like in most other countries, cars – including vans, pick-ups, and SUVs – are a dominating factor in fatal road accidents. The considerably

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Measures and Activities Aimed at Young Drivers in Serbia Had Good Effects

Driver behavior is determined by knowledge, attitudes, abilities and skills, as well as the current psychophysical condition of the driver and their attitude towards traffic and the environment. The ability to estimate speed and drive a vehicle at that speed are skills, while the choice of speed at which the driver decided to drive at that moment belongs to the domain of behavior.

Young drivers do not have enough life experience, and especially do not have experience in driving a vehicle. In particular, they have no experience in assessing traffic situations and forecasting, which are very important for safe driving. On the other hand, they easily overestimate their abilities, underestimate risks and are prone to challenges. That is why these drivers are one of the most risky groups of drivers that need special work.

During the first decade of the action for road safety (2011-2020), various activities were implemented in Serbia in order to reduce the number of casualties, and especially in order to reduce the number of people killed in road traffic. Additional measures aimed at young drivers have been implemented: traffic education in primary and secondary schools have been improved, various forms of peer education have been organized, the concept of a probationary driver´s license has been introduced and the presence of a more experienced driver is mandatory in the car with young drivers, training in driving schools is improved, numerous campaigns aimed at young drivers have been implemented, etc.

In the observed 10-year period, the number of drivers killed decreased by about 26%, the number of severely injured drivers decreased by about 18%, and the number of slightly injured drivers increased by about 4%. In the same period, the number of young drivers killed decreased by about 39%, the number of seriously injured young drivers decreased by about 33%, and the number of lightly injured decreased by about 11%. The share of young drivers among the drivers killed decreased from 15.6% to 12.9%, the share of young drivers in the total number of seriously injured drivers decreased from 19.2% to 15.8%, and the share of young drivers among all lightly injured drivers was reduced from about 22% to 18.7%.

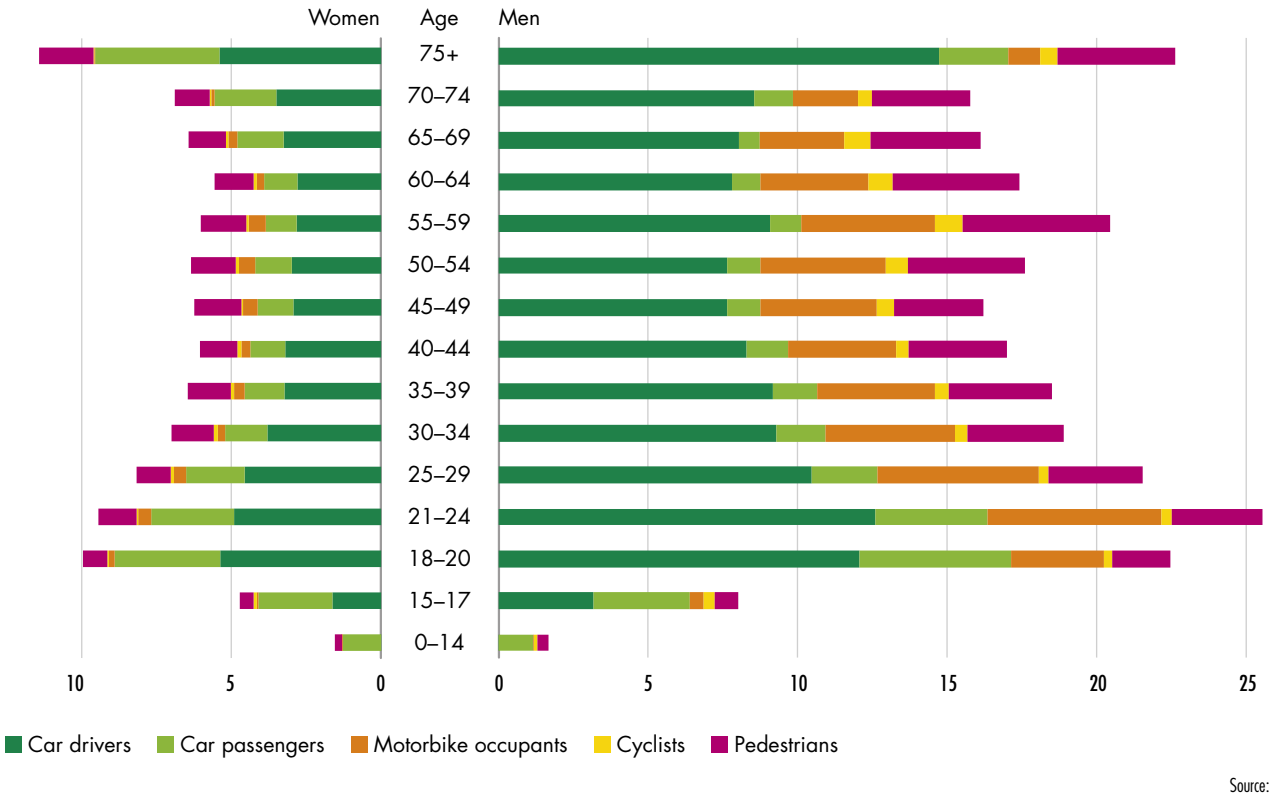
Based on this short analysis, it can be concluded that in the period of the first decade of the action for road safety, the risk of death and serious injuries of all drivers was reduced. However, the risks for young drivers have been reduced more, so the share of young drivers among drivers killed or seriously injured has been significantly reduced. Measures and activities aimed at young drivers had good effects. We should continue to apply similar measures and activities, improve successful measures and activities, but also refresh them with new, proven measures.

Traffic accidents are a shock for all parties involved – especially for inexperienced, young people

higher ratio of men killed compared to women also applies to the USA, but is less pronounced than in Germany, for example. Overall, the number of people killed in traffic accidents per 100,000 inhabitants for each individual age group is at least twice as high as in Germany; the discrepancy is even greater when it comes to women. However, this rate is influenced by a number of factors. As well as differences in infrastructure, vehicle population and condition, driver training, safety-relevant traffic rules, inspection and penalty enforcement, and attitudes to traffic, mileage also plays an important role. In the USA, more than 25 in every 100,000 young men aged 21 to 24 are killed in traffic accidents, which is the highest rate out of all ages groups (Figure 10). For comparison, in Germany the highest rate for men is in the 18 to 20 age group at around 11.

Accidents caused by the influence of alcohol play a key role in this regard. In the Traffic Safety Facts on fatal accidents from 2018, published by the American National Highway Traffic Safety Administration (NHTSA), it was stated that 27 percent of the drivers involved aged 21 to 24 had been under the influence of alcohol (at least 0.08 BAC). However, this extremely high rate should not only be viewed in relation to the number of drivers killed in this age group, as the fatally injured victim can also be a passenger or anoth-

10 Fatalities per 100,000 Inhabitants in 2019 by Age Group and Mode of Road Use



Source: NHTSA

María José Aparicio
Subdirectorate General for Training and Road Safety Education
of the Directorate-General for Traffic (DGT) in Spain

A Message to Our Young People: Don't Ruin Everything!

The current generation of young people is the best there has ever been. No other generation is as prepared as you. In Spain, more than 75 percent of young people currently reach the second level of secondary education, and 50 percent complete a higher education course.

You are digital, innovative, united, and tolerant. Each generation is more dedicated to helping the environment and improving social problems than the last. You are a generation that is campaigning for a fairer, cleaner world, a generation that has given everyone a lesson in generosity by being vaccinated en masse, not for your own sake, but to protect us all.

You have facilitated the most important change in the mobility sector of recent decades by seeking out more environmentally friendly options, such as bicycles and personal mobility vehicles, educated yourselves on the benefits of shared use compared with ownership, and used all alternatives on offer to get around. This has led to you no longer viewing gaining a driver's license upon reaching legal age as a priority. If we look at driver statistics for our country, we can see that, ten years ago, young people between 15 and 24 accounted for 8.4 percent of drivers, and in 2021, it was down to 6.2 percent.

However, this rate increases from six to ten percent if we look at the ratio of young fatalities to total fatalities resulting from traffic accidents. Almost half of all fatalities happen at night and on weekends – accidents in which driving speed and alcohol play a major role. The rate of young fatalities in traffic accidents in Spain has remained constant at around ten percent since 2012. But in summer 2021, the summer of the return to normality, the rate of young people in these terrible statistics was 17 percent, while for the rest of the population, the number of fatalities on non-urban roads during the day and at night declined. The apparent return to normality cost 32 young people in Spain aged 15 to 24 their lives, after being involved in traffic accidents during July and August. That is nine more than in 2019, the year with which we should compare this particular summer, as 2020 was not a normal year and with 39 fatalities had an even worse result.

You are the most educated, the most engaged, the most tolerant, the most united, the most just… Don't ruin everything by losing so many of your lives in road traffic!

er road user. Nevertheless, it is a clear indication that there is a significant problem in this area. For 16 to 20-year-olds, the rate is 15 percent, and for 25 to 34-year-olds it is 25 percent – a quarter of all fatal accidents.

ACCIDENT STATISTICS FOR YOUNG DRIVERS IN GERMANY

Like in many other countries, young drivers aged 18 to 24 are also among the groups most at risk in road traffic in Germany. This is underscored by – among other things – the following figures from the German Federal Statistical Office: while young drivers made up just 7.6 percent of the population at the end of 2018, they accounted for 15.5 percent of all people injured in road traffic in 2019 and just under twelve percent of all people killed. 18 to 24-year olds made up around 15 percent of people involved in an accident, and roughly 13 percent of all people involved in accidents resulting in personal injuries.

Not by chance, young drivers also frequently bear the main responsibility for causing an accident: 65 percent of young drivers involved in accidents in 2019 were classified as the main person responsible for accidents resulting in personal injury. Among men aged 18 to 24, 68 percent were classified as bearing the main responsibility, and among women it was just under 61 percent. The most common behavior-based factors that cause an accident are not changing speed (in 15.7 percent of cases) and not maintaining a sufficient minimum distance (in 15 percent of cases). Another fact that fits this picture is that, according to an analysis of new registration figures published by the German Federal Motor Transport Authority, young registered owners up to the age of 29 have a conspicuously strong preference for vehicles with a powerful engine. In terms of accident statistics, there are also telling figures in the annual reports 2016 through 2020, issued by the German Federal Statistical Office, in relation to cars involved in accidents (not including main responsibility): in nearly 12.5 percent of cases, the driver was between the ages of 18 and 24. Across all driver age groups, the vehicle involved in the accident was twelve years old or more in 30 percent of cases – five percent of which belonged to young drivers of the aforementioned age group.

Telematics Information Provides Valuable Insights Into the Driving Behavior of Young Roads Users

Several motor vehicle insurers have been offering their customers telematics-based tariffs for a few years now. Telematics, which combines telecommunications and computer science, enables data on driving behavior to be recorded, based on which the driver can learn information about their driving behavior. If they demonstrate an anticipatory driving style, they can receive a discount on the amount of motor vehicle insurance they have to pay. To give an example, with the "Telematics Plus" tariff offered by HUK-Coburg, a sensor installed in the vehicle works in combination with the smartphone app "Mein Auto" (my car) to record information on acceleration, braking behavior, speed, and driving behavior in corners.

For the DEKRA road safety report, HUK-Coburg analyzed the anonymized driving data of just under 170,000 vehicles from 2020 and made a comparison between young and experienced drivers. In the "young drivers" category, the insurance holders had a maximum age of 25. In the comparison category "experienced drivers," the insurance holders were between 35 and 65 years of age, with no other driver under the age of 25 being included on the insurance policy.

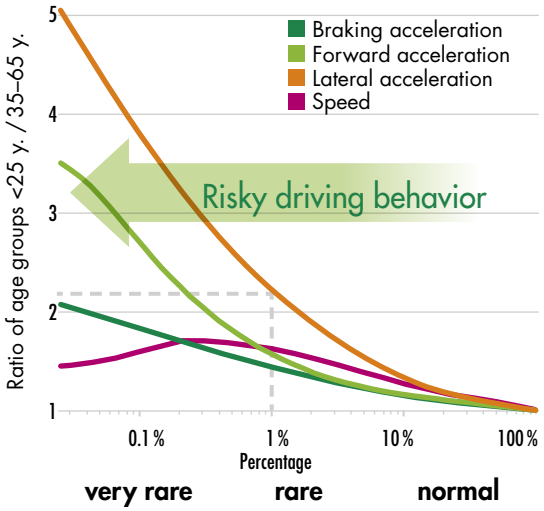
An analysis of vehicle age showed that the young drivers generally drove older cars than the experienced drivers (on average 9.6 and 6.6 years respectively) and cars with less powerful engines (on average 80 kW and 100 kW). The annual driving time was slightly more than 200 hours for both groups. Young drivers were often on the road for longer in the evening than the comparison group, and drove around at night significantly more frequently.

In terms of accident frequency, the rates were considerably higher among young drivers compared to experienced drivers across all cause of damage groups. On average, young drivers caused around 60 to 160 percent more accidents per kilometer driven than experienced drivers. The greatest differences could be seen in dynamic causes of damage, such as excessive speed when turning corners or excessive speed in general, and in collisions with wild animals. Furthermore, particularly speed, turning corners, and braking operations were areas where young drivers demonstrated risky behavior much more frequently compared to experienced drivers – 30 to 400 percent more frequently. And that's not all: If we split the individual categories by severity (for example, minor, moderate, or major speeding), it becomes clear that, the riskier the driving style, the more frequently young drivers demonstrated such driving behavior.

In addition, young drivers used their smartphone while driving roughly three times as often as experienced drivers. HUK-Coburg also used the telematics data to analyze the speed profile on freeways without a speed limit. The findings showed that young drivers drove slightly faster than the reference group of experienced drivers. This tendency increased the higher the speed.

Overall, the findings underpin the official annual accident numbers of the German Federal Statistical Office and at the same time provide important information on potential areas for improvement in terms of road safety, especially that of novice drivers. However, the analyses by HUK-Coburg based on telematics data also show that young drivers who maintain an anticipatory driving style have similarly few or even fewer accidents per kilometer driven than the average experienced driver.

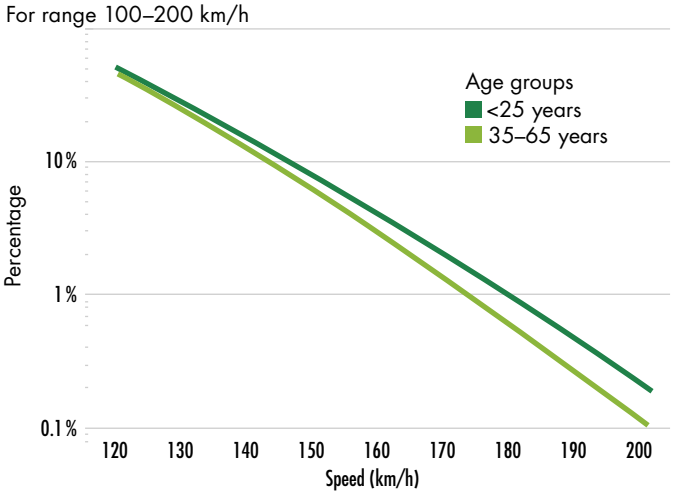
Risky Driving Behavior by Age Group



Explanation: The graph shows the prevalence of a driving style trait for young drivers relative to the experienced drivers reference group in relation to the frequency of that particular driving behavior. The observed driving style traits are braking acceleration, forward acceleration, lateral acceleration in corners, and speeding. The following generally applies to all categories: the more uncommon the trait, the more risky the driving style is. For example, the dotted gray line shows that strong lateral accelerations, which only appear in one percent of the driving data, occur more frequently by a factor of 2.2 with young drivers compared to experienced drivers. Higher lateral accelerations occur most commonly as a result of higher speeds when turning corners and generally indicate a more dynamic style of driving.

Source: HUK-COBURG

Speeds on Freeway Sections Without Speed Limit



Explanation: The graph shows the relative percentage of time spent driving at a particular speed on freeways without a speed limit for both young and experienced drivers. Higher speeds occur less frequently in general, but young drivers have a higher tendency to drive at high speeds than experienced drivers.

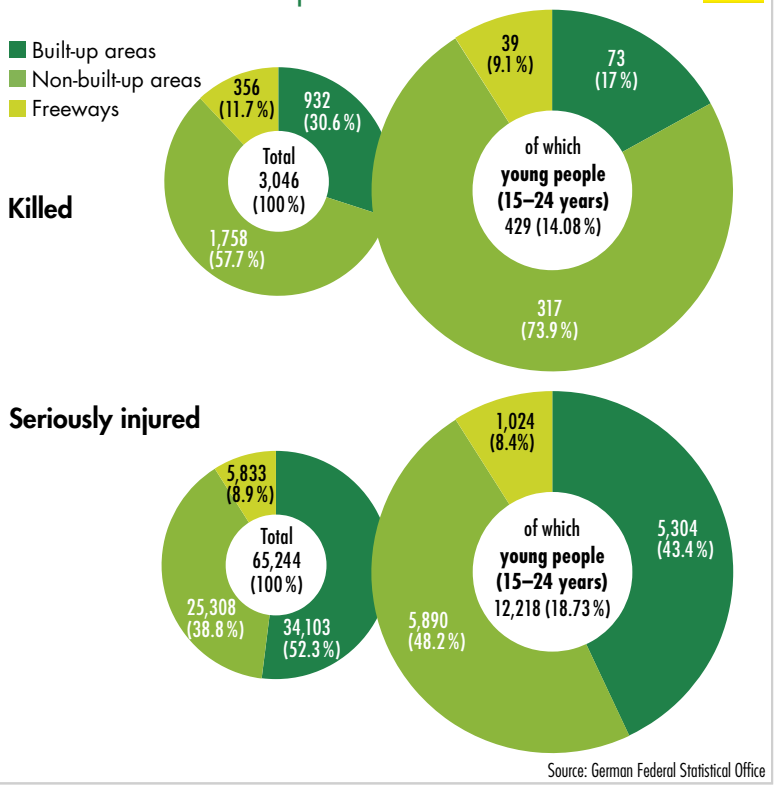
Source: HUK-COBURG

YOUNG MEN IN ROAD TRAFFIC MORE AT RISK THAN WOMAN

Accident statistics for Germany also show that young men aged 15 to 24 lose their lives in three out of four cases when involved in a traffic accident on inter-urban roads. In 2019 for example, this was 317 out of 429. Although the absolute numbers declined slightly in 2020, there was no fundamental change to the ratio just mentioned. Regardless of location, the most frequent way in which young people die in road traffic is as a car occupant, including in Germany – in both 2019 and 2020 it was almost 60 percent. In this age group, the rate of people killed as car passengers is also very high. The only other segment where the rate is similarly high is female senior citizens. Approximately every fourth young person who dies in road traffic is a motorbike occupant (Figures 11 through 13).

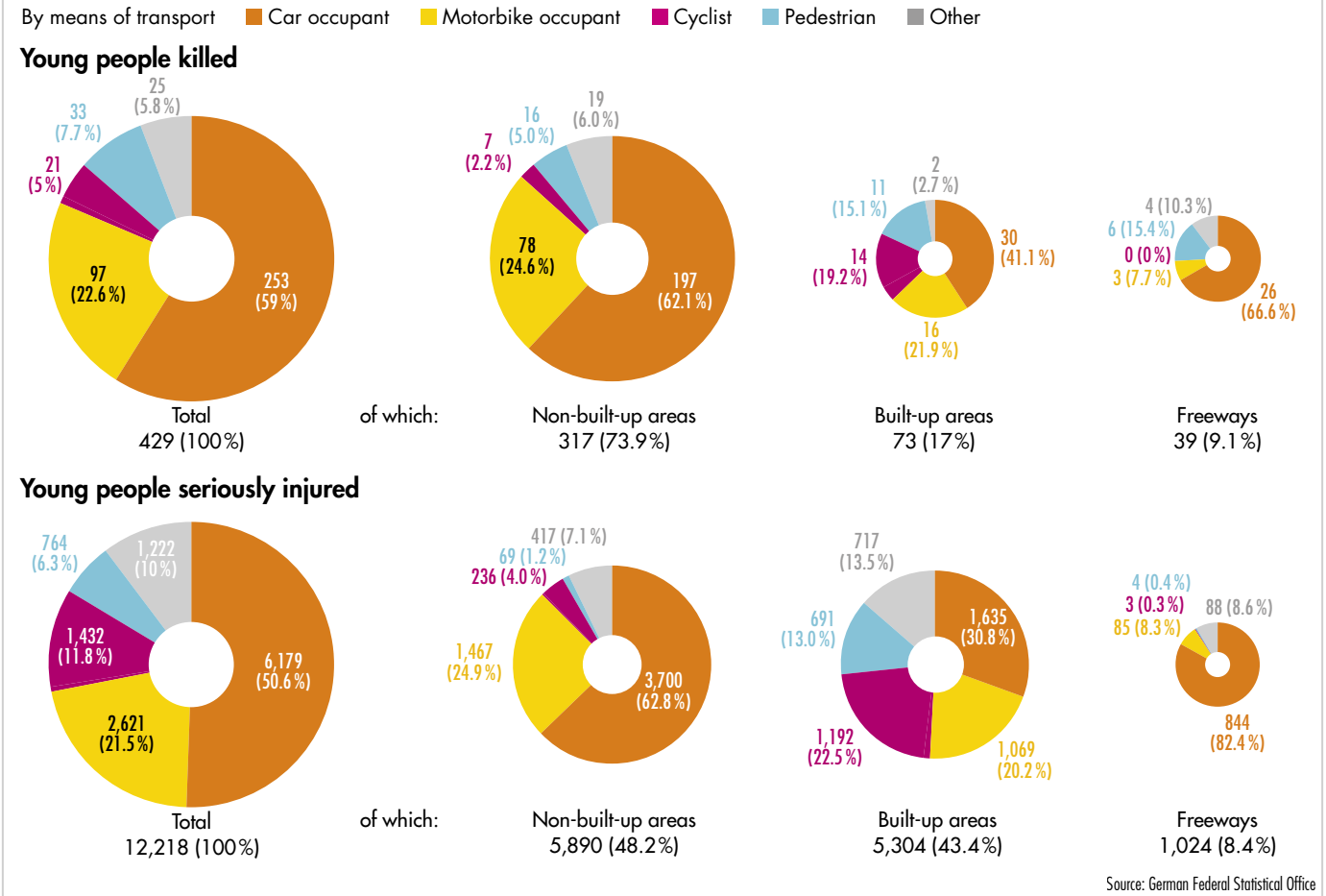
Across all age groups, especially young drivers, significantly more men are killed in traffic accidents than women – similar to findings for

11 Fatalities and serious injuries in 2019



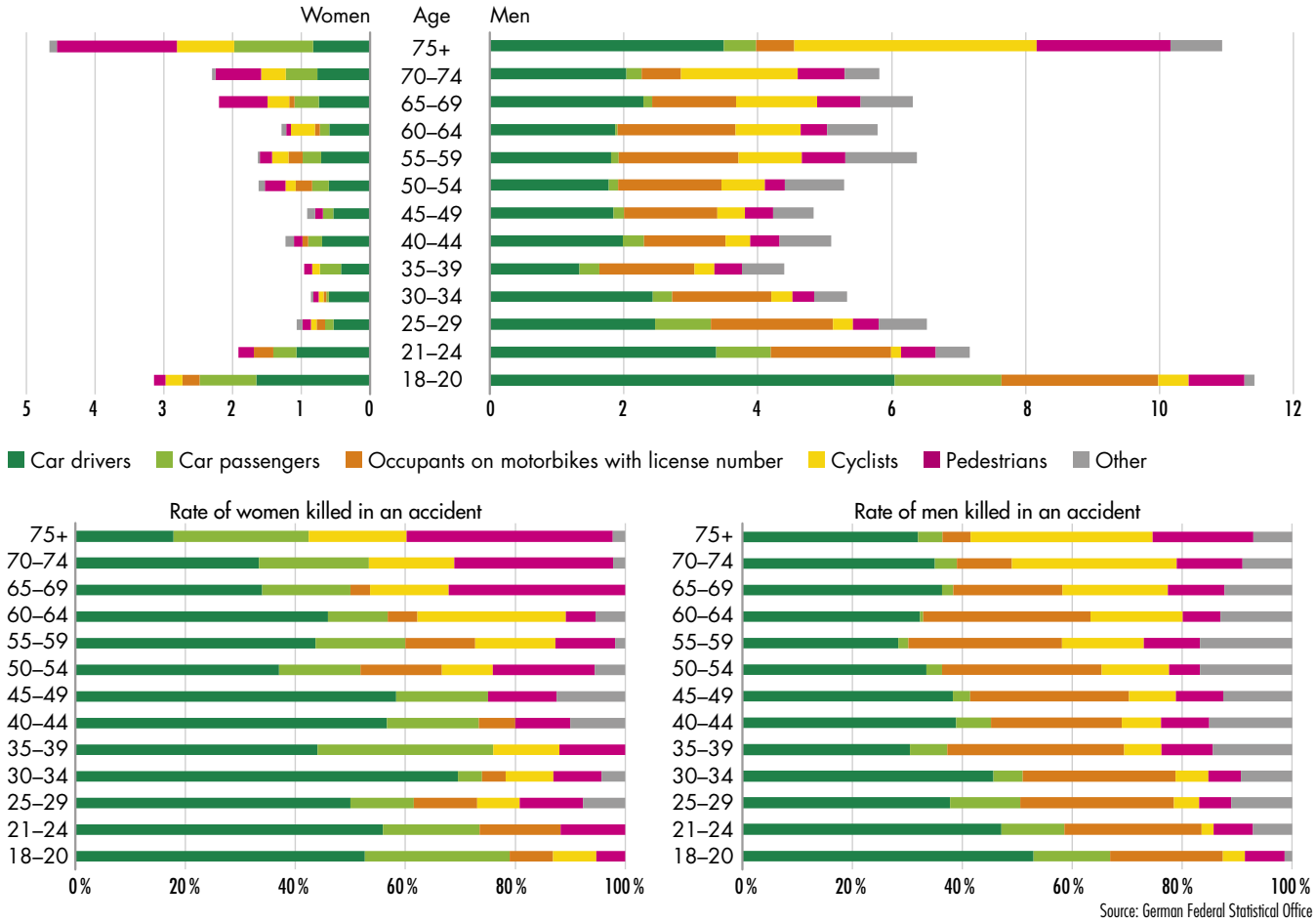
Source: German Federal Statistical Office

12 Killed and Seriously Injured Young People in 2019, by Mode of Road Use



Source: German Federal Statistical Office

13 Fatalities per 100,000 Inhabitants in 2019 by Age Group and Mode of Road Use



Source: German Federal Statistical Office

the EU as a whole (Figure 13). This can partially be attributed to men being more frequent road users, especially as car and motorcycle drivers. The main reason, however, is that men are more likely to take risks and have a considerably less defensive driving style than women. In 2019 in Germany, 11.4 young men aged 18 to 20 per 100,000 lost their lives. For women of the same age group, the rate was 3.1.

Following the car driver category, the second most common mode of road use where men are killed in an accident is as an occupant on a motorbike with a license number. This applies to age groups up to pension age. Fatal accidents on bicycles do not play much of a role among 18 to 24-year-olds, but for men they gradually increase in subsequent age groups. In the 75+ age group, most men killed in traffic accidents lose their lives riding a bicycle. For women, the rate only starts increasing from the age of 50, but never reaches the same level as for men. However, women start to become more and more at risk as pedestrians from the age of 65.

In terms of young people who are seriously injured in accidents, their most frequent mode of road use is also car occupant, followed again by motorcycle occupant. Once more, this applies to more men than women. However, the discrepancy is considerably lower and there is no large increase in the 75+ age group. 18 to 20-year-olds are the most frequently represented age group, with every 216 in 100,000 men of this age group being seriously injured in an accident. This is also the age group most frequently represented among women; the rate is 143 in every 100,000 women of the same age. In the 21 to 24 age group, the respective rates are considerably below this – at 145 (men) and 93 (women) for every 100,000 male/female inhabitants. Among women, the 35 to 39 age group has the lowest rate (47). Among men, the first time the rate is low is for the 40 to 44-year-olds (92), and in the 65 to 74 age group the rate is even lower.

Among women, the rate of seriously injured car drivers falls consistently from over 50 percent for young novice drivers to roughly 20 percent for senior citizens aged 75+. In contrast, the rate of seriously injured female passengers remains relatively constant across almost all age groups, ranging from 11 to 22 percent. Among men, the rate of seriously injured car drivers falls from 46 percent for young novice drivers to 23 percent in the 50 to 54 age group, but then increases again constantly to 39 percent for the over 75s. The rate of seriously injured male motorcyclists is approximately 20 percent across the age groups from young novice drivers through to 69-year-olds. For women, the rate fluctuates between four and eight percent, and from 60 years of age, it becomes completely insignificant. Among men, the bicycle as a mode of road use becomes more significant with each increasing age group – even more clear-cut than among women. The rate increases steadily from 10 percent for young people to over 35 percent for senior citizens. Unlike for women, although the rate of pedestrians also increases, it only plays a minor role.

INFLUENCE OF ALCOHOL AND DRUGS

Alcohol and drugs are also significant in the accident statistics of young novice drivers in Germany. For 2019, official German accident statistics show that 25 in every 1,000 car drivers aged 18 to 20 involved in accidents had been under the influence of alcohol. In the 21 to 24 age group, the rate was 30 in 1,000, which represents the highest rate across all age groups with a driver's license, although in the next age group up – 25 to under 35s – it was almost identical at 29 percent. With continued increasing age, the rate falls considerably. Across all age groups the rate is 20 in 1,000. A fundamentally different picture emerges for riders of motorbikes with an insurance plate. In the 15 to 17 age group, 17 out of 1,000 people were under the influence of alcohol. In the 18 to 20 age group,

Marie Gautier-Melleray
Interministerial Delegate for Road Safety

Targeted and Specific Prevention Messages

In France, 600,000 young people between the ages of 18 and 24 pass their driving test every year. The French Delegation for Road Safety pays particular attention to these newly qualified drivers, who are out and about on the roads without much experience. They may only make up 8 percent of the French population, but they account for 18 percent of traffic fatalities. Novice drivers are more frequently responsible for fatal accidents; in 2019 this rate totaled 19.2 percent. They are also associated with the highest rate of violations (30 percent of 18 to 24-year-olds), which is also evident from the causes of accidents: speeding in 33 percent of fatal accidents among novice drivers, while alcohol and drug consumption play a part in 17 and 16 percent respectively of these accidents.

In order to reduce the accident rate among novice drivers, far-reaching measures have been implemented over the past ten years, and simultaneously action has been taken in terms of driver training and the most frequently encountered risk factors. The most significant measure here must surely be the reduction of the legal drink-drive limit to 0.02 BAC (compared with 0.05 BAC for all other vehicle drivers), which came into effect on July 1, 2015. During the training process, novice drivers who adhere to the German Road Traffic Act can reduce their probationary period by one year by attending advanced classes (additional training that has to be completed six to twelve months after being granted a driver's license), as long as they do not commit any traffic offenses. As part of the General National Service in France, there is a special module designed to help familiarize young people with the dangers of road traffic.

To create relevant awareness among young drivers, further measures were implemented, such as the online program "C'est permis" (That's allowed) with tips for new permit holders. This information campaign uses youth speech to appeal to its target group of road users and features Sam – a well-known character in France – who drives and doesn't drink, to draw attention to the risks of alcohol and narcotics consumption and using a mobile phone while driving.

And because – in contrast to other age groups – so-called "soft mobility" is becoming especially more common among young people (significant increase in bicycle and scooter traffic), they are turning to modes of transport that make them particularly vulnerable, which is why we are giving them targeted and specific prevention messages.

Thanks to all of these very different measures, we have been able to reduce the mortality rate of novice drivers by 5.2 percent every year between 2010 and 2019. We can and must continue with our efforts moving forwards.

AN ANTICIPATORY DRIVING STYLE PAYS OFF IN ANY TRAFFIC SITUATION

DANGEROUS SITUATIONS ON THE ROAD ARE OFTEN NOT NOTICED UNTIL IT IS TOO LATE

the rate increased to 45, and in the 21 to under 25s age group, it was 52. It is evident that alcohol is an issue that must be taken seriously in the context of young novice drivers, and it must be an important focus area in prevention efforts. However, it is also clear that the main issue is from the age of 21 to around 40. One reason for this is the zero BAC limit for young people under 21 and for novice drivers during their probationary period, which was introduced in Germany in 2005.

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Department of Psychology,
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The UK Hazard Perception Test

To improve the hazard skills of new drivers, the UK introduced a hazard perception assessment into the driving test in 2002. This test requires learner drivers to visit a driver testing centre where they watch 14 clips of driving (each about a minute in duration), viewed from the driver's perspective. Whenever they see a hazard, they must press a button as quickly as possible. They are told in advance that 13 clips will each contain 1 hazard, while one clip will contain two hazards.

The first UK hazard test used video clips of driving, filmed from a moving vehicle. All hazards were staged and involved actors. In 2015, the test was updated, and the video clips were replaced with Computer Generated Imagery.

The primary aim of the UK hazard perception test was to reduce collisions, especially those causing injury and death. A summative test can help achieve this in two ways – by encouraging drivers to train in the skill to pass the test, and by keeping the least safe drivers off the road.

A study commissioned by the UK Department of Transport concluded that the introduction of the hazard perception test into the UK licensing procedure significantly reduced non-low speed collisions where the driver accepted some of the blame (by 11.3%). More recent estimates suggest that the hazard perception test provides an annual reduction of over 8500 damage-only collisions and over 1000 injury collisions.

Several countries in Europe are now developing their own hazard tests, modifying the UK model with many of the new techniques that are currently being developed by researchers around the world. As the application of hazard perception testing advances and evolves, it has the potential to save lives across multiple countries.

YOUNG DRIVERS AND SENIOR CITIZENS IN COMPARISON

Some interesting results emerge when comparing the accident statistics of young drivers between 18 and 25 with those of another particularly at-risk group in road traffic: senior citizens from 65 years old. For this purpose, DEKRA Accident Research analyzed several years of data from the German In-Depth Accident Study database (GIDAS), a collaborative project of the German Federal Highway Research Institute (BASt) and the Research Association of Automotive Technology (FAT). A total of 16,845 accidents, involving 23,440 car drivers, were analyzed. Of these, 4,272 drivers were aged 18 to 25, and 2,839 drivers were at least 65 years old.

In terms of location, it was found that in built-up areas more senior citizens have more accidents percentage-wise than young drivers, and on inter-urban roads it is the opposite. In built-up areas, most accidents involving young drivers happen on weekdays during the morning and evening rush-hours; senior citizens mostly meet with accidents in the late morning and early afternoon. Whereas almost no senior citizens have accidents on inter-urban roads late at night or in the early hours of the morning, it is precisely at these times, especially on Friday evenings/Saturday and Sunday mornings, when young drivers have an accident – a clear indication of accidents happening after attending a party or going to a club.

The most common type of accident among young drivers in built-up areas was colliding with a turning or crossing vehicle, or a vehicle in front or waiting vehicle. The most common form of

accidents on inter-urban roads was due to veering off the road to the right or the left. Among senior citizens, the most common form of accident in built-up areas was also colliding with a turning or crossing vehicle, or with a vehicle in front or waiting vehicle. These two types of accidents also occurred most frequently among senior citizens on inter-urban roads. Collisions with an oncoming vehicle also occurred frequently there.

UNDERDEVELOPED HAZARD PERCEPTION

British psychologist David Crundall believes that, in addition to risk factors such as impulsiveness, distraction, and the effects of alcohol and drugs, a lack of hazard perception is another reason why novice drivers in particular are frequently involved in accidents, i.e., there are shortcomings in their ability to recognize dangerous situations on the road in time in order to react appropriately and to prevent an accident. Hazard perception is a multi-layered set of behaviors that only starts to develop with increased driving experience. It starts with the identification of a potential hazard, for example, an oncoming vehicle that wants to turn into a side road and therefore has to cross over the lane, or a vehicle concealing a pedestrian due to its structure or size. If the respective situation seems unlikely to turn into an actual hazard, the driver should ideally continue scanning their surroundings, and over time they develop a priority hierarchy. This mental ranking list is in constant flux, as new elements get added, old elements get removed, and the current elements are reorganized based on the situation dynamics. If a driver fails to identify a potential hazard before there is any real danger, it may already be too late to react appropriately, potentially with fatal consequences.

Following a traffic accident, many accident victims complain of whiplash

The Facts at a Glance

- **Globally, 15 to 24-year-olds accounted for around 15 percent of all traffic fatalities in 2019.**
- **As a young person, there is an especially high risk of having an accident as a car occupant or motorbike occupant.**
- **Young men are at considerably greater risk in road traffic than young women.**
- **In the EU, the number of traffic fatalities per one million inhabitants for the 15 to 30 age group is far above the average of the other age groups.**
- **In the USA, young people are involved in traffic accidents with a comparatively high blood alcohol level conspicuously often.**
- **In 2019 in Germany, around 65 percent of young drivers involved in accidents were classified as the main person responsible when it came to accidents resulting in personal injury.**
- **Three out of four traffic fatalities in the 15 to 24 age group were killed in accidents on inter-urban roads in Germany in 2019.**

Compelling Examples of Accidents in Detail

Not paying attention and speeding

MOTORCYCLE COLLIDES WITH TURNING CAR

Sequence of events:

A 21-year-old motorcyclist was riding along a rural road. At the same time, the driver of a car some way ahead wanted to use a country lane to the right to make a U-turn. After the car driver had brought his vehicle to a standstill on the country lane, allowing the oncoming traffic to pass, he began the turning maneuver without paying attention to the motorcyclist approaching from behind. The motorcyclist tried to evade the car by swerving onto the opposite lane, but still struck the front of the car. The motorbike then veered off the road to the left and the driver fell off with his helmet striking a concrete water course next to the road.

Persons involved in the accident:

A motorcyclist, a car driver

Consequences/injuries:

The motorcyclist sustained serious head injuries when he struck the concrete water course and he died at the scene of the accident. The car driver suffered a shock.

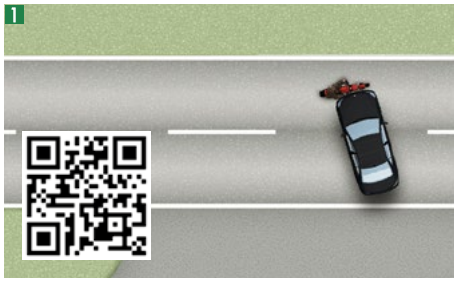
Cause/problem:

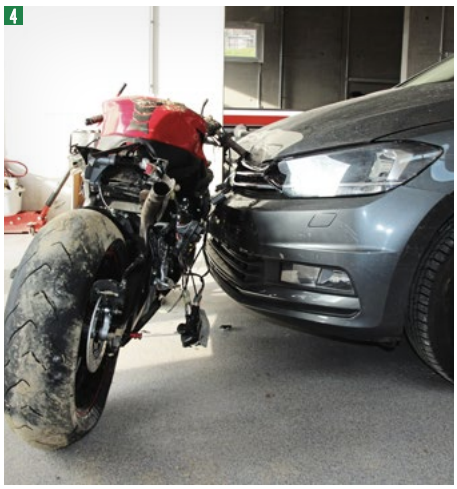
The cause of the accident was that the car driver attempted to perform a turning maneuver in an unsuitable location in one go, without paying sufficient attention to the flow of traffic. Furthermore, the motorcyclist had been exceeding the maximum speed limit by a significant margin.

Avoidance measures, mitigation of consequences/strategy for road safety measures:

The car driver could have avoided the accident by paying sufficient attention to traffic and looking over his shoulder properly. Even if the motorcyclist had been traveling within the maximum speed limit, he could not have avoided the accident. However, the collision speed could have been considerably lower, which might have reduced the severity of the injuries. The motorcyclist could also theoretically have evaded the car by swerving to the right if he had adhered to the maximum speed limit. The motorbike would have reached the collision site at a later point in time, which would have given the rider an opportunity to pass behind the car.

Through regular road safety training, it is possible to directly recreate critical situations and train road users to react appropriately and automatically. Implementing infrastructure that mitigates accident consequences and that does not have sharp-edged and/or hard elements near the side of the road helps to reduce the injury consequences of accidents.





1 Sketch of the collision position
2 Concrete water course
3 Final position of the motorbike
4 Recreated collision position
5 Motorcyclist's perspective

CAR COLLIDES WITH ONCOMING TRAFFIC

Sequence of events:

The 21-year-old driver of a tuned car and a passenger of the same age were driving along a winding, narrow country road with several bends (left, right, left) at a speed verging on the limit for going round bends. To avoid veering off the road, the driver cut across the first left-hand bend. To avoid colliding with an oncoming car, the driver had to perform an evasive maneuver to the right onto their side of the road. The driver then steered to the left again in order to follow the course of the road. Due to the high speed, the vehicle started to drift, which the young driver was unable to maintain control over. The car veered onto the opposite lane and collided there with another oncoming vehicle. The collision caused both cars to be hurled into the wooded area next to the road.

Persons involved in the accident:

Two car drivers, two passengers

Consequences/injuries:

Both drivers and the passenger in the oncoming car were seriously injured. The passenger in the car that caused the accident sustained minor injuries.

Cause/problem:

Due to the speed at which the car that caused the accident was driving, it was only possible for it to navigate the set of bends by cutting across the opposite lane on the first left-hand bend. It would not have been possible for the driver to keep to their own side of the road at his chosen speed when navigating the left-hand bend without the vehicle becoming unstable at the latest upon navigating the next right-hand bend. Due to needing to evade the first oncoming vehicle, it was not possible for the driver to prevent the car from skidding.

When the vehicle was inspected, several permissible modifications to the tires/wheels and chassis were identified. The coilover suspension, however, had been reconfigured in a manner that was not permissible and that caused the tires to skid at the wheel housing liner. Operating the vehicle in this state was not permissible. Defects were also identified in the tires. However, even if the vehicle had been fully intact/conformed to regulations, the accident could not have been prevented due to the excessively high speed.

1 Recreated collision position
2 Overview of winding road layout
3 Winding road layout
4 Scene of accident

Avoidance measures, mitigation of consequences/ strategy for road safety measures:

The driver who caused the accident could have prevented it by selecting a speed that was appropriate for the condition of the road, the road layout, and width of the lane. Young drivers are sometimes attracted to driving along winding roads with different types of bends, as mastering them at excessive speeds supposedly enables them to push their own performance limits, thus giving the driver a thrill or sense of achievement. However, this example clearly shows that there was a serious misjudgment of risk based on an illusion of skill. This issue must be tackled through targeted educational measures. In this particular case, the passenger could also have drawn the driver's attention to his risky behavior. The accident was unavoidable for the driver of the oncoming vehicle.

1 Sketch of the collision position
2 Road layout
3 Course of tire marks
4 Final position of car
5 Damage to car
6 Car after accident

Drunk driver and vehicle defects

CAR VEERS OFF THE ROAD

Sequence of events:

The 23-year-old, heavily drunk driver of a car veered to the right off a rural road while going round a left-hand bend at excessive speed. The right-hand side of the vehicle first struck a tree next to the road, which caused the car to spin round slightly to the right. The left-hand side of the car then struck a second tree. The rest of the accident involved the car striking several other small trees as it was brought to a standstill. The accident happened at night, the road was wet, and the temperature was just above freezing.

Persons involved in the accident:

A car driver

Consequences/injuries:

The car driver was fatally injured.

Cause/problem:

The accident occurred because the vehicle was traveling at a substantially excessive speed, probably due to the driver being very drunk.
What also contributed to the accident was the fact that the vehicle was traveling with summer tires in almost freezing temperatures, the wheels on the front axle were different dimensions, and the tread depth of 1.4 millimeters of one of the tires was under the minimum legal tread depth of 1.6 millimeters. The ESP installed in the vehicle could have been impaired by the different rolling circumferences of the wheels on one axle.

Avoidance measures, mitigation of consequences/strategy for road safety measures:

If the driver had adhered to the speed limit and adjusted his speed and driving style to the road and weather conditions, the accident could have been prevented. If the driver had not been drunk, he probably would not have been driving at such a high speed,

and if he had swapped their summer for winter tires at the right time of year and had a sufficient tread depth and uniform tire dimensions on the front axle, this would also have made the journey safer.

Violation of right of way

CAR COLLIDES WITH TRACTOR TRAILER

Sequence of events:

At dusk, the 21-year-old driver of a tractor with trailer came out of a country lane and wanted to cross an inter-urban road. Simultaneously, two cars approached from the left, from the perspective of the tractor. The driver of the first car (1) had time to react and managed to avoid colliding with the tractor and trailer entering the intersection, by performing an evasive maneuver to the left into a field. For the driver of the second car (2), this was no longer an option. The car crashed into the front left-hand side of the trailer.

Persons involved in the accident:

Driver of a tractor with trailer, two car drivers

Consequences/injuries:

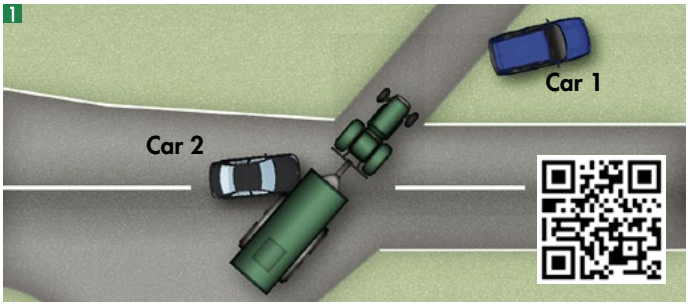
The driver of car 2 was fatally injured through the collision with the trailer. The driver of the tractor with trailer sustained minor injuries.

Cause/problem:

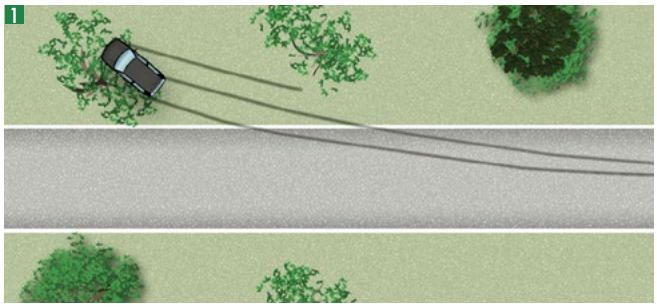
The driver of the tractor caused the accident by violating the cars' right of way. The view was hampered due to the country lane intersecting with the inter-urban road at an approximately 50 degree angle and due to a hedge. The two cars' approach up to the tractor with trailer involved going round a right-hand bend after which there were around 170 meters of straight road until the collision site. Upon reaching the boundary line, this stretch of road was visible to the tractor driver. Both cars were driving with low beam headlights; it was not possible to determine whether there was a violation of the speed limit. The car's crumple zone had no effect due to the difference in height between the car and the trailer.

Avoidance measures, mitigation of consequences/strategy for road safety measures:

The accident could have been prevented if the tractor driver had stopped at the boundary line to the inter-urban road and observed the right of way of the cars approaching from the left. Particular caution should have been taken given the hampered view in the area around the intersection. The car drivers had no possibility of preventing the accident. The site of the accident could be made considerably safer without much effort by reducing the maximum speed limit and improving drivers' line of sight by cutting back the hedge. The speed limit at the site of the accident has since been reduced from 100 km/h to 70 km/h.



1 Sketch of the collision position
2 Car drivers' perspective
3 Tractor driver's perspective
4 Scene of the accident
5+6 Vehicles involved in the accident



Driving error

CAR VEERS OFF ROAD AFTER OVERTAKING

Sequence of events:

The 21-year-old driver of a car attempted to overtake the car in front just before a left-hand bend. Immediately after the overtaking maneuver, the driver clipped the uneven ground by the side of the road with the right-hand wheels as he pulled back into the correct lane. The vehicle then became unsteady due to counter-steering too strongly. This caused the car to completely veer off the road to the right, where it skidded and crashed into a tree on the driver's side. The car snapped off the tree and then overturned into the field behind, where it came to a standstill on its roof.

Persons involved in the accident:

A car driver, a passenger

Consequences/injuries:

The car driver was killed and the 18-year-old passenger was seriously injured.

Cause/problem:

The accident resulted from a driving error of the car driver in combination with not adjusting speed. The row of young trees planted at the side of the road also played a major role in the severity of the consequences of the accident.

Avoidance measures, mitigation of consequences/ strategy for road safety measures:

The accident could have been prevented if the car driver had refrained entirely from overtaking or had adjusted their speed to the road situation and their driving abilities during the overtaking and pulling in maneuvers. The severity of the consequences of the accident could have been prevented if, for example, shrubs had been planted along the roadside instead of a dense row of trees (infrastructure that mitigates accident consequences).

1 Sketch of the collision position
2–4 Final position of the car
5–6 Scene of the accident

Speeding in a built-up area

COLLISION AT AN INTERSECTION

Sequence of events:

A 21-year-old driver of a car (1) was driving through a built-up area in darkness along a rain-drenched road with right of way, and was speeding. At an intersection, the car collided with another car (2) approaching from the left that wanted to cross the road with right of way. The light signal system at the intersection was off at that time of day, and was therefore flashing amber for the road that did not have right of way. As a result of the violent collision, the front of the car with right of way severely penetrated the side of the crossing car. The rest of the accident comprised the two cars also striking a traffic light post and each other.

Persons involved in the accident:

Two car drivers, a passenger

Consequences/injuries:

The driver of car 2 sustained fatal head injuries. The driver and passenger of car 1 sustained minor injuries.

Cause/problem:

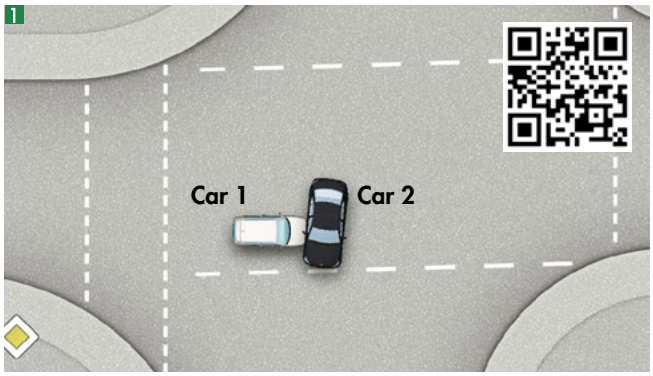
The accident was caused by the slightly drunk driver of car 2 driving into the intersection despite car 1 approaching from the right having right of way. The driver of car 1 was also traveling far above the speed limit, which the driver of car 2 could not have anticipated. It was not possible to deduce how significantly the driver's drunk state impacted his misjudgment of speed. Due to the very high collision speed, the passive safety systems installed in car 2 were ineffective in preventing the driver from sustaining fatal injuries.

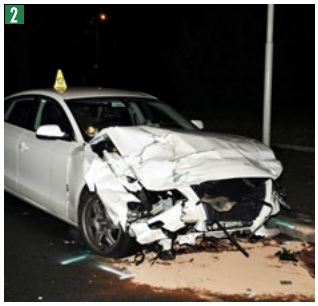
Avoidance measures, mitigation of consequences/ strategy for road safety measures:

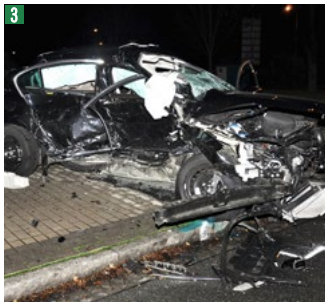
If the driver of car 1 had been keeping to the speed limit when car 2 drove across the intersection, the collision would have, at best, been minimal when the emergency stop was carried out. Instead of the fatal injuries, there would have been no notable physical injuries.

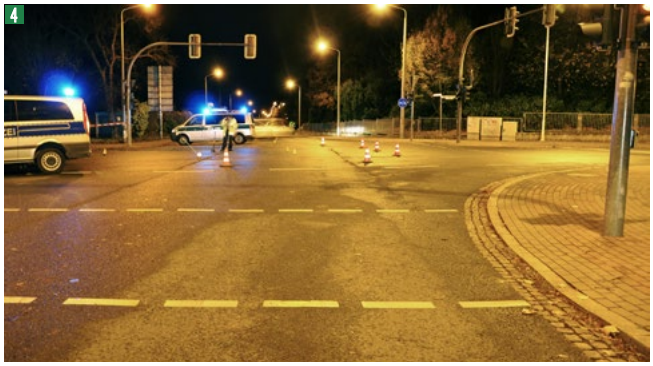
As it is difficult to assess whether a person's character is suitable for driving a car when they complete their driver training, the authorities should be allowed to take further measures earlier on with respect to withdrawing the driver's license off someone who has violated good driving standards.

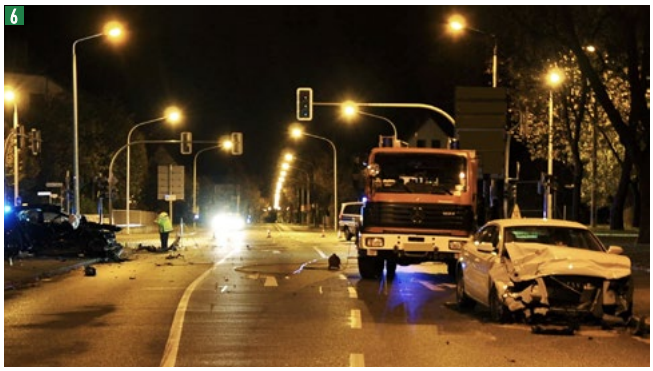
The accident could also have been prevented if the driver of car 2 had acknowledged car 1 with right of way and crossed the intersection at a later point. Even though it is not possible to assess the impact of the low level of alcohol consumed by car driver 2, alcohol should never be consumed before getting behind the wheel.











1 Sketch of the collision position
2 Final position of car 1
3 Final position of car 2
4 Perspective of car 1
5 Perspective of car 2
6 Scene of accident

Fleeing from the police

CAR COLLIDES WITH TREE

Sequence of events:

A drunk 20-year-old without a driver's license was driving a stolen car at night, on the run from the police, along a wet gravel connecting road while speeding. In a right-hand bend, the driver attempted to cut across the bend, and in doing so veered off the road to the right and struck a tree with the front right-hand wheel of the car. The car then collided head-on with a tree on the left-hand side of the road.

Persons involved in the accident:

A car driver, two passengers

Consequences/injuries:

The 20-year-old driver and the 16-year-old front passenger were seriously injured. A 20-year-old rear passenger sustained fatal injuries.

Cause/problem:

The car was traveling at a speed that was much too high for the condition of the road and the radius of the bend. None of the three car occupants were wearing a seat belt, the driver was drunk, and did not have a driver's license. At the time of the accident, the police had already broken off the chase due to safety reasons.

Avoidance measures, mitigation of consequences/strategy for road safety measures:

Wearing a seat belt would have reduced the injury severity for all three car occupants. The rear passenger would not have been flung forward, and fatal injuries would have been unlikely. It is not possible to state what specific impact alcohol consumption had on the driver without an in-depth examination. The disinhibitory effect of the alcohol could have been a contributing cause of the entire incident. Better socio-educational work is required to try and prevent young people showing off from misusing vehicles to satisfy their own ego.

1 Sketch of the collision position
2–4 Final position
5 Marks from where the car collided with the tree
6 Scene of accident

Potential distraction at the wheel

CAR COLLIDES WITH IN ONCOMING TRAFFIC

Sequence of events:

The 22-year-old driver of a small car (1) was driving along a federal highway down into a valley, with one lane going in her direction and two lanes for oncoming traffic. For reasons unknown, car 1 veered out of lane in a left-hand bend, crossed over the double boundary line as well as the left lane of the oncoming traffic and collided head-on with an oncoming top range car (2) in the right lane of the oncoming traffic.

Persons involved in the accident:

Two car drivers, a passenger

Consequences/injuries:

The driver of car 1 sustained life-threatening injuries. Both occupants of car 2 sustained minor injuries.

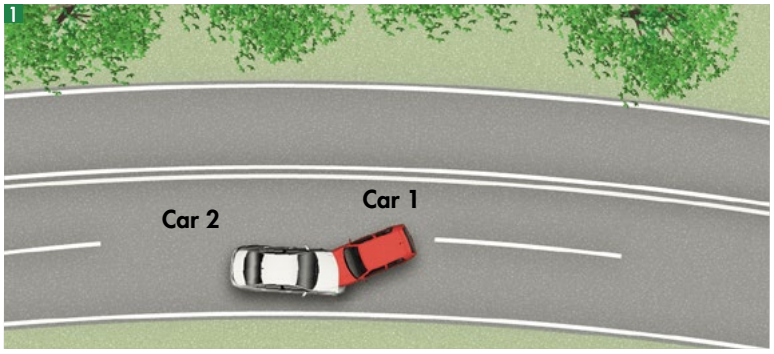
Cause/problem:

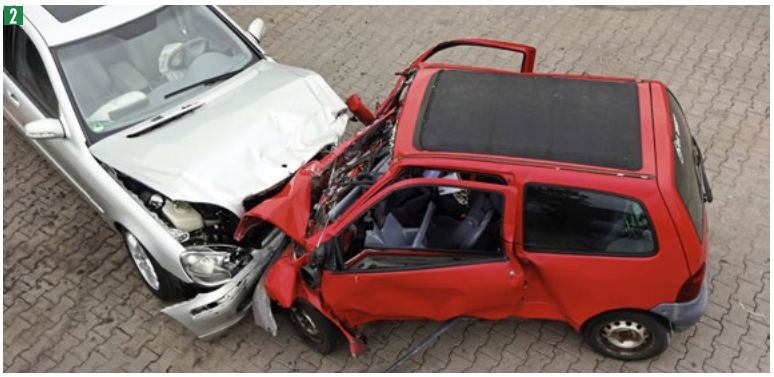
Upon inspection of car 1, neither technical faults nor any other external clues could be found that could potentially explain why the car left its lane. The evidence strongly suggests that the driver who caused the accident was using a cell phone at the time of the accident.

Avoidance measures, mitigation of consequences/ strategy for road safety measures:

The accident could have been prevented by the driver of the small car if she had been paying the requisite amount of attention to the road and had stayed in her lane.

Using a cell phone and taking your eyes off the road to operate in-vehicle infotainment components, such as the radio, navigation system, etc., can lead to dangerous distraction, which, in principle, can be avoided by using ergonomically and psychologically tried-and-tested forms of operation. This also applies on known stretches of road close to home, which was the case in this example. A lane departure warning system would have warned the driver before the car veered out of lane and thus potentially triggered a reaction that could have prevented the accident; had an effective lane guard assistant been functional around the area of the accident, this could have prevented the accident. The accident was not avoidable for the oncoming car.





1 *Sketch of the collision position*
2 *Recreated collision position*
3 *Final position of car 1*
4–6 *Scene of the accident*

Efficiently Minimizing the Potential for Risk

Lack of experience, overconfidence, and an increased willingness to take risks are some of the most dangerous sources of error among novice drivers – sources of error that not infrequently result in serious traffic accidents. This also applies to the same extent to driving under the influence of alcohol and drugs and to distraction while driving, for example due to using a smartphone. This makes it all the more important not to focus solely on vehicle handling and the rule of the road during the driving school training period, but to also instill higher-level competences, such as a regard for safety, self-control, self-monitoring, and an acceptance of traffic regulations.

Having finally obtained his driver's license, Tim is ready to roll! Just a quick trip, nothing major. Tim takes the car for a spin with his friend, they turn the music up loud, and start singing; they are in high spirits. Then Tim receives a text message on his phone. With one hand on the steering wheel, he digs around for it with the other hand. When he finds the phone, it suddenly slips out of his hand and falls onto the floor by his feet. Both the driver and passenger are preoccupied with retrieving the phone, when all of a sudden: the car veers off the road, races down the bank, and comes to a standstill in a field. For young drivers and newly qualified drivers, it is not rare for this kind of euphoria to come to an abrupt disappointing end and they find themselves in danger of losing their driver's license which they spent ages saving for. Young drivers between the ages of 18 and 25 do not have a particularly good reputation. This is because they pose a higher risk of causing an accident, a topic that was already covered in detail in the "Accident Statistics" section using statistical data.

The statistics and the fictitious scenario described at the start illustrate how prone novice driver's license holders are to thoughtless behavior, risky driving maneuvers, and the resulting accident risk. The risk factors that have been extensively researched range from insufficient driving experience and insufficient vehicle control through to conscious risk-taking (for example to experience pushing the limits or to impress friends with one's driving skills), distraction from the road due to using digital media (reading and writing text messages, making phone calls), driving under the influence of alcohol or drugs, and even participating in illegal vehicle races. These types of negative behaviors result from a person's individual disposition, social influence from peers, lifestyle preferences, and leisure activities. Risk factors rarely occur in isolation; most of

the time, several influencing factors are involved simultaneously.

LACK OF DRIVING EXPERIENCE

A lack of experience in handling a vehicle, an insufficient ability to assess danger, and the brain's yet under-developed ability to grasp the connections between human behavior, the vehicle, and the surroundings, are the key traits of a novice driver. The driving skills of experienced drivers do not develop until after drivers have passed their driving test, and are learned over time through constantly navigating demanding situations in road traffic. Passing the theory and practical tests is "only" initial proof that a driver has met the requirements and is competent enough to drive. This includes, among other things, having sufficient knowledge of the relevant legal regulations and familiarity with the dangers of road traffic and the kinds of behaviors that are necessary to avert them, and having both the theoretical and practical knowledge on how to handle a motor vehicle safely.

Similar to when learning a new sport, it is important to be able to combine knowledge of the rules, practical training, and situation-based observation and reaction patterns in daily road traffic, true to the saying: practice makes perfect. This helps drivers to be able to visualize all kinds of traffic situations, link these to the applicable motor programs in the brain through a what-if-rules thought process, and continually improve them when navigating demanding traffic situations. This optimization process is heavily reliant on role models, feedback, and the assessment of suboptimal experiences – for example when the engine stalls when moving off. Step by step, theoretical knowledge is converted into practical behavior patterns. The pivotal point is that drivers can reliably process the relevant information of a situation, in order to develop an immediate understanding of the driving task that has to be solved.

This is also called situational awareness, which, according to the definition coined in 1995 by the US researcher Mica R. Endsley, can be divided into three subsections: First, a hazard has to be identified and then its significance correctly interpreted, so that the driver can predict or grasp the potential consequences of the moments that follow – at worst an accident. In an essay published in 2017, industrial engineer Anuj K. Pradhan and psychologist David Crundall explained that novice drivers do not have sufficient fixation strategies in traffic situation perception and also use inflexible mental search programs that only scan the immediate perimeters in front of the vehicle. The consequence of this is that they do not detect visual cues in time, or misinterpret a situation and therefore do not use the information presented to them correctly. It is generally the case that, compared to experienced drivers with several years of driving practice, novice drivers identify fewer potential hazards and often underestimate the potential danger these pose – while at the same time often overestimating their own driving skills. They frequently take their eyes off the road for longer than 2.5 seconds and are more likely to use a smartphone and other infotainment devices while driving.

It is presumed that the continual process of self-learning in order to improve vehicle control when people first start driving uses up a substantial amount of their attention and concentration, meaning that relevant cues are not detected in time. This "internal struggle" to allocate one's limited cognitive resources has been demonstrated in a 1998 Israeli study. It emerged that novice drivers driving a vehicle with manual gear shifting detected significantly fewer traffic signs than in an automatic vehicle. With experienced drivers, on the other hand, the type of gear shifting had no bearing on traffic sign detection. The authors interpreted these findings to mean that vehicle handling, and therefore gear shifting, is more demanding for novice drivers, and as a result they do not have sufficient mental processing power to scan the roads and traffic for information.

SUSCEPTIBILITY TO RISKY DRIVING BEHAVIOR

It was already established over 20 years ago by traffic psychologist Franz-Dieter Schade that drivers require at least 3,500 kilometers of driving experience to acquire sufficient vehicle control skills and to be able to process in-

Dr. Bettina Schützhofer
Traffic psychologist and CEO of the
"sicher unterwegs" traffic psychology institute

Road Use Maturity of Teenagers

All the skills and abilities required to use the roads safely grow and evolve from childhood and adolescence through to young adulthood. Accident statistics show that adolescent drivers and riders and young adults are clearly overrepresented in accident statistics, while the accident trend for the over 25s, who have usually reached maturity in terms of road use, takes a steep downward turn. So it would seem there is a clear correlation between road use maturity and accident involvement. Data from Austria and Germany shows that 15-year-old moped riders are particularly at risk of having an accident. Based on the number of people who have been granted permission to drive/ride a motor vehicle in Austria, the number of 15-year-old moped riders involved in accidents has been consistently more than twice as high as, for example, among L17 17-year-olds (L17 corresponds to accompanied driving in Germany) for many years.

How can this be explained from a traffic psychology point of view? During puberty, the brain undergoes a significant age-related restructuring process. The areas of the brain most affected by the restructuring are the pre-frontal cortex (hereinafter control center) and the limbic system (hereinafter reward center), with the reward center evolving at a faster pace than the control center. This means that the reward system dominates over the control system for a time. The consequence of this is that, especially in social situations with people of the same age, the ability to control one's behavior through self-control, action control, and impulse control is often not strong enough to ensure sensible and safety-aware behavior. The strong dominance of the reward center in this life stage is what causes people to search for variety, new experiences, and strong emotions, which in the context of road traffic can lead to risky road use behavior.

Average road use personality profiles show that, for 14 and 15-year-olds in particular, complying with rules and standards is not as important to them and they are more easily influenced by the behavior of others than younger or older teenagers. By the age of 16, a large proportion of adolescents have transitioned from the conformist phase to the self-assured phase of their socio-emotional development. Their individuality and tolerance level increases again and they become less concerned about trying to be the same as, or adapt themselves to, their peers.

In terms of performance, it is also evident that adolescents in their early teens are still in the process of developing their road use competencies. When it comes to complex skills, such as hazard perception, it can take young people up to early adulthood to fully develop their competencies. An Austrian study of over 600 adolescent moped riders aged 14 to 16 showed that just under half of participants met the minimum requirements with respect to immediate hazard perception. The study also found that it is possible to positively influence the road use behavior of adolescents through theory-based and age-appropriate road safety education on a knowledge, attitude, and behavioral level. It also came to light, however, that it is not possible to accelerate the actual maturation process of the brain structures using specific measures.

To enable adolescents, especially those of the high risk age of 15, to use motorized vehicles in road traffic, experts suggest implementing risk-minimizing measures, for example a medical and psychological evaluation in the form of a screening to assess road use maturity. On this basis, targeted recommendations could be derived for further risk-minimizing interventions.

formation and navigate traffic. For many drivers, this should be the case after six months of driving experience or a year at the latest. This viewpoint is being corroborated by more recent international studies. Various researchers in different countries have delved deeper into the accident rates of novice drivers and, for example, analyzed the accident rate in relation to the number of kilometers driven or the number of months of having a driver's license. All of the studies show that involvement in an accident is highest during the period immediately after passing one's driving test, after which it drops off significantly.

THE RISK POTENTIAL FOR YOUNG PROFICIENT DRIVERS

An important topic relating to novice drivers is acceptance with respect to following traffic regulations. Whether a motorist adheres to a traffic rule or not depends not only on their driving ability, but also on their willingness to follow the rules when driving in traffic. According to Stefan Siegrist from the Swiss Council for Accident Prevention in Bern and Eva Roskova from the Comenius University in Bratislava, the following factors influence whether a person will follow a traffic rule or not:

1. Knowledge of the rule
2. Subjective evaluation of penalty severity and the likelihood of being caught
3. Social norms (= rules and standards about how one should or should not behave)
4. Perceived behavior control
5. Habits and previous behavior
6. The situational circumstances (for example the traffic situation)
7. Acceptance of the rule.

A driver's unwillingness to follow a rule is strongly linked to their willingness to take risks, which is more pronounced in young people – especially young men. As well as the socialization, hormones like testosterone are also at the root of this phenomenon. Due to the fact that men produce a much higher level of this hormone than women, there is a neuroendocrinological "tsunami" effect in the brain during puberty at the same time as the brain goes through a restructuring stage. The restructuring of the brain is also referred to as the maturing process. The maturing process of the brain commences in the rear part and progresses through to the front part. The first brain structures to become fully mature are the

ones responsible for simple control processes, such as motor skills or sensory skills when processing information. This is followed by the maturation of complex processing structures that are responsible for planning, decision making, evaluation, and execution of plans of action.

The fact that the various brain structures mature at different times means that most young people are relatively willing to take risks. Acting in a spontaneous and impulsive manner is more pronounced in young people than in people who are middle-aged or older. In other words, because the control mechanisms in the front of the brain are still weak, they are not strong enough to suppress surging impulses from the center of desire in the brain. This influences how young people handle risks in road traffic and their willingness to accept risks or to seek them out intentionally in order to relish in their supposed excellent driving skills. The findings from the DEKRA-commissioned Forsa survey mentioned in the introduction of this report are also interesting in this context. 54 percent of the young men surveyed in Germany (18 to 24 years) said they thought they drove much better, or at least slightly better, than all drivers on average. 37 percent of the young women surveyed thought the same.

This phenomenon of overconfidence is displayed when people are of the so-called "subjective age." In a 2021 meta analysis based on 293 international studies involving around 1.5 million study participants between adolescence and old age, the two psychologists Martin Pinquart and Hans-Werner Wahl established that people up to the age of 25 systematically overestimate how old they actually are by up to five years. In other words, young people view themselves subjectively as older than their chronological age. This is linked to an overstated positive self-image with attributes such as experience, maturity, and competence.

In addition to the individual's assessment of their abilities, there are other motives that determine the extent to which a driver accepts risk or perceives hazards. These other motives denote opportunities to satisfy the individual's needs through using a vehicle for more than just mere driving purposes. These include, among others, the motive for showing off to establish a distinct identity, driving pleasure, as well the search for the ultimate thrill when driving. The communication possibilities of social media platforms, such as Facebook or Instagram, provide new ways for young people to satisfy their needs social recognition through the simple posting of photos or videos with their smartphone. Likes, as well as success from participating in a road race or the admiring glances of a passer-by at a tuned car are all forms of positive perception expressed by others. In the DEKRA-commissioned Forsa survey, six percent of young male drivers and two percent of female drivers stated that they drive a car so that they can impress other people. 22 percent of young men and 11 percent of young women checked the "I like driving fast and getting an adrenalin kick" motive.

OVERCONFIDENCE AND CONSCIOUS ACCEPTANCE OF RISK

A wild party atmosphere increases risky behavior in road traffic

The male action type often drives too fast and too aggressively

LIFESTYLE AND SOCIAL BACKGROUND ARE IMPORTANT INFLUENCING FACTORS

Youth often goes hand in hand with certain leisure interests and a lifestyle that centers around pleasure. For this reason, young drivers have accidents particularly frequently on weekends on their way home from meeting friends or from a club or party. In the early hours of the morning, a person's physiological functions are heavily impaired.

A 1999 research project from the German Federal Highway Research Institute (BASt) was able to prove the usefulness of differentiating young risk takers by lifestyle and leisure groups, their fashion, music, and movie preferences, how they spend their leisure time including their alcohol and drug consumption habits, as well as their position on youth and alternative culture groups. Five lifestyle groups were identified that differ in terms of risk-taking in road traffic, as well as by psychological, demographic, and socioeconomic characteristics: the thrill-seeking type, the cultural type, the critical type, the domestic type, the action type, and the fashion type.

The action type is predominantly male (84 percent), enjoys driving cars as a leisure activity, leads an exciting and risk-taking lifestyle involving extreme sports, for example, and is often involved in accidents. They like to drive a lot, have extremely high trust in their own driving ability, as well as an especially positive attitude to driving very fast and aggressive behavior in road traffic. The action type has a high propensity to consume alcohol and drugs, but rarely drives under the influence of substances. The thrill-seeking type predominantly exhibits the following traits: 61 percent male, youngest average age, high participation in trends (sport, leisure, music), differentiating oneself and standing out are important to them, and they have a high propensity to be involved in accidents and have high alcohol and drug consumption (including when driving).

The lifestyle of 18 to 24-year-olds correlates with the use of older vehicles and the presence of members of their peer group – like-minded people of the same age – in the vehicle. A number of international research studies have proven that there is a higher risk of young drivers being involved in a fatal accident if at least one member of their peer group is present, with male passengers increasing the risk more than female passengers. The presence of adult passengers has proven to be a protective factor and reduces the number of near-accidents and risky driving maneuvers. The presence of both young and older passengers curbs drivers from carrying out other tasks, such as using a smartphone. This phenomenon can be explained by the concept of conformity, whereby people with similar attitudes, values, and lifestyle preferences behave in a similar manner, as they adapt to one another more easily and therefore are more susceptible to attempts to influence them.

A further research project from the BASt shows how significant an influence same-aged people have on the driving behavior of this age group in Germany. The conformity concept suggests that people have a desire to be accepted by important figures around them. To obtain this acceptance, personal attitudes and behaviors are often adapted to those of others, with special importance being given to the opinion leader of the group. If a person follows the norms of their peer group, they are accepted, but if they do not behave according to these norms, there is the risk of being rejected or excluded. Thus, one of the ways in which others exert influence is by setting behavior modification processes in motion. If a person's friends are in the

car, there is the desire not to show any weakness, and therefore they meet their friends' expectations without much resistance.

As proven in the BASt study, the influence exerted by peers on the high-risk behavior of young drivers is especially high. Driving at significantly higher speeds as well as driving after consuming alcohol, or using a cell phone while driving are particularly subject to this social influence. Around 30 percent of the respective high-risk behavior can be explained through peer group characteristics. A different observation came to another interesting conclusion: the more often a certain type of high-risk behavior is observed among someone's friends, the higher the likelihood that they will behave in the same way.

ALCOHOL AND DRUGS ARE DANGEROUS "PASSENGERS"

On the topic of high-risk behavior, driving under the influence of alcohol is a major problem. In addition to high speed, alcohol is one of the biggest sources of danger on the roads around the world. Alcohol, without a doubt, makes people feel more relaxed, lifts the mood, and is considered to be a type of "social lubricant" at parties, public celebrations, or in clubs. This is the reason why alcohol is so popular among young drivers. For many young people, having one more drink while enjoying time with friends is just part of socializing. But alcohol also clouds the senses and has a dampening effect on the ability to control and maintain a critical perspective on one's actions, causing one to stay longer at a party than intended, becoming more and more reckless with each glass, and ending up driving the short distance home after all. Drink driving occurs mainly on known stretches of road that are less than ten kilometers long and that one has driven along many times before.

Countless studies and reviews have shown that drivers who have committed alcohol-related offenses differ from drivers who have not in terms of socio-demographics, performance and personality factors, as well as how much importance alcohol has for their individual lifestyle. The risk of drink driving in road traffic increases with regular and especially excessive consumption and correspondingly marked drinking habits, with high acceptance of this kind of drinking culture, with a complaisant attitude to drinking and driving, with a reduced ability to realistically judge what constitutes an illegal blood alcohol concentration level, with a lack of understanding of how alcohol impairs one's performance abilities, and, in particular, with a high alcohol tolerance level.

The latter is characterized through the respective person needing to consume more and more alcohol to achieve the same effects. This means that the person will not register an alcohol level of 0.05 BAC as having an impairing effect, for example. However, it has been proven that alcohol has an effect after 0.02 BAC, which becomes increasingly pronounced the more alcohol is consumed. Alcohol affects almost all cognitive performance areas, such as reaction speed, perception, performance monitoring, executive functions, as well as evaluation processes, including the willingness to take risks. It has been shown, for example, that the basic divided attention skills required for driving a vehicle are already impaired below 0.03 BAC. The risk of having an accident increases exponentially from 0.05 BAC.

ALCOHOL-RELATED EFFECTS PROVEN FROM AN EARLY STAGE

ZERO BAC LIMIT FOR NOVICE DRIVERS

Germany already introduced BAC limits back in 1953, which were supplemented with penalties and, later on, with monitoring and rehabilitation measures. Back then, the German Federal Court set a limit of 0.15 BAC as constituting an administrative offense. This value was lowered in 1973 to 0.08 BAC and in 2001 to 0.05 BAC. Drivers who are caught posing a traffic hazard with a 0.03 BAC or higher blood alcohol level (e.g. an accident) or who are caught driving with a 0.11 BAC or above, even if they do not exhibit any dangerous driving, are considered not fit to drive. This type of criminal offense is penalized through having one's driver's license withdrawn, as well as a fine or a jail sentence. From 0.16 BAC, or with at least two administrative offenses from driving with at least 0.05 BAC, motorists must undergo a medical and psychological evaluation. The aim of this review is to assess whether the driver is likely to continue posing a high risk of drink driving, or will pose such a risk in future.

Alcohol is a bad "passenger"

In 2007, Germany introduced a total ban on drinking before driving for novice drivers. If such an administrative offense is registered for drivers under the age of 21 or novice drivers during the first two years after passing their test, support measures are put in place, for example retraining sessions and penalties, including an extension of the probationary period by a further two years. An evaluation study conducted by the BASt from 2010 was able to show that, during the period after the law was changed, the number of alcohol-related offenses registered for young people under the age of 21 declined above average by 17 percent compared to the period before the change was introduced. For drivers over the age of 21, the decline was just 2.5 percent. The number of young drivers involved in an accident who had a blood alcohol level of at least 0.03 BAC reduced by 15 percent. In the target group of novice drivers, there was also a high acceptance (95 percent) of the zero BAC rule.

The zero BAC rule also applies for novice drivers in several other countries, including almost all states in the USA, as well as in Canada, Australia, Italy, Romania, the Czech Republic, and Switzerland. In many other countries, such as France, Greece, the Netherlands, Poland, Portugal, and Sweden, the limit is set at 0.02 BAC.

A 2020 study from the BASt found that novice drivers who have been affected by the alcohol ban rule since 2007 are also more likely not to get behind the wheel after drinking alcohol in later years. The study analyzed the official accident statistics and fitness to drive register of the German Federal Motor Transport Authority. The study shows that drivers who were subject to a total alcohol ban behind the wheel when they were novice drivers are also less frequently involved in alcohol-related accidents and traffic offenses in later years. Furthermore, compared to the previous survey, the acceptance of the alcohol ban had also further increased, reaching 98.3 percent. This proves that "training" people to accept an alcohol ban from the outset has a positive impact in later years.

In view of the above-outlined consequences of drink driving, many young people now think: "I'll just leave the car and take my bicycle if I want to drink." In a 2008 household survey conducted by the University of Münster in North Rhine-Westphalia, 204 out of 591 people (34.5 percent) stated that they used their bicycle "in order to be able to drink alcohol." Among the 16 to 29-year-olds surveyed, more than half (52.9 percent) agreed with this statement. This suggests that, in particular among young adults, drink driving on a bicycle is not a rarity, and that the dangers of this are underestimated and permissive attitudes encourage such behavior. However, even riding a bicycle on the road after drinking in Germany can constitute an offense. From 0.16 BAC on a bicycle, the rider might have to undergo a fitness-to-drive test in the form of a medical and psychological review, which, if failed, could also result in them losing their driver's license.

ALCOHOL BAN WHILE DRIVING FOR NOVICE DRIVERS HAS A POSITIVE EFFECT

CHRONIC CANNABIS CONSUMPTION IMPAIRS PERFORMANCE ABILITY

In addition to alcohol, the use of drugs such as cannabis when driving is increasingly posing a

problem. International studies show that the extent to which a person consumes cannabis correlates with driving under the influence of this substance and risky driving behavior. There are a number of sociodemographic traits that have been proven to be strongly linked to driving after cannabis consumption – for example young men between the ages of 20 and 25 who had learning difficulties in school (evident from poor academic performance and truancy in school), coming from a single-parent family, or having previously committed several traffic offenses. The main psychosocial factors that can help predict whether someone will drive under the influence of cannabis include a poor state of health, sensation-seeking tendencies, a poor ability to exercise self-control, a personality with a high affinity to risk, as well as aggressive tendencies. All of these are personality traits also exhibited by motorists who commit alcohol-related offenses, unlike those who do not.

For Germany, there are not yet any official statistics on accident numbers, criminal offenses, or administrative offenses in connection with cannabis. For this reason, extracts from available datasets have had to suffice. Out of 1,487 blood samples taken following traffic checks in 2014 in the south and west of Saxony, 39 percent were found to contain cannabis. During the mandated blood tests as part of the medical review for gathering evidence, substance-related behavioral problems and uncertainties could only be established to a limited extent and only rarely. The results are in the low two-figure percentage range – for example problems when walking straight ahead 16.2 percent, turning around 16.5 percent, finger-to-finger test 11.1 percent, finger-to-nose test 10.0 percent, and speech 6.1 percent.

As various studies show, cannabis consumption begins between the ages of 13 and 14 with consumption rates monotonically increasing up to 19 years of age. The highest risk period for first-time consumption, i.e., the age range when most cannabis users start using cannabis, is between 16 and 18. However, starting drug consumption from an early age (under 15) is considered a significant risk factor for causing later health, social, and emotional disorders, as the physical development of teenagers is not complete at this stage and the drugs seriously disrupt the psychosocial maturation process during puberty. The following factors, among others, play a role in causing young people to continue with their drug consumption beyond the initial try-out stage: anticipated effects, encouragement through social ties to peer group, observing positive effects of drug consumption in others, as well as having experienced subjectively positive pharmacological effects of the psychoactive substance. These experiences cause the development of states such as excitation or calm, relaxation, euphoria, or experiences being intoxicated, which can encourage future cannabis consumption and maintain it on a continual basis.

The consequences of chronic cannabis consumption are multifaceted and can affect people's

Patrice Bessone

President of Éducation et Sécurité Routières section (traffic education and road safety) within the automobile industry association Conseil National des Professions de l'Automobile (CNPA)

Knowledge Acquisition, but Especially Know-How…

Traffic education remains an effective long-term solution for reducing the number of traffic accidents. Almost a quarter of all traffic fatalities are young drivers. They pay a high price for the fact that our roads are not safe.

People who drive cars constitute a moving, active part of society. Learning to drive a car is, of course, about acquiring technical skills, but it is also about learning the right kinds of behaviors. There is an imbalance between the 20 compulsory hours of driving, which are essential in order to learn how to control a vehicle safely, and the gap that exists in the regulations with respect to theory training in a group. This theory-based education is just as necessary for learning to behave safely and appropriately in road traffic – in the context of learning to become a car driver and also learning to become a member of society.

Driving schools have adapted with the digital age. They offer prospective drivers tools to help them learn and enable them to test their knowledge online: e-learning classes, online tests in the form of a theory exam, etc. These new technologies make it easier for prospective drivers to acquire the necessary knowledge. However, like with any tool, these technologies also need to be based on a systematic, didactic concept and involve guidance from a teacher.

One does not acquire the knowledge needed to become a socially responsible car driver by sitting alone in isolation front of a screen. This requires the presence of a teacher and a communal setting with other novice drivers, for it is precisely the discussion that this facilitates that is particularly productive. In times when a sense of community and togetherness are already in retreat, the dangers of road traffic and thoughtlessness would only increase if society fell into the trap of conducting traffic education completely digitally due to cost-saving reasons.

Driving schools carry out valuable work on a face-to-face basis. They not only assist driving students with the bureaucracy that comes with acquiring a driver's license, but since their inception have been providing group-based theory lessons in their facilities with official approval from municipal authorities; they focus on knowledge acquisition – especially know-how.

willingness and ability to perform. It can impair all of the same cognitive processes that are affected after acute intoxication: concentration, attention level, response capacity, short-term memory and working memory, psychomotor skills/abilities, as well as perception of time and space. In terms of performance willingness, apathy as well as loss of drive, motivation and interest have a negative impact on a person's cognitive ability to control their actions, and thus on the execution of the driving task.

On the basis of unknown individual genetic dispositions, cannabis can also trigger psychological problems, such as anxiety, depression, or hallucinations, through to fully formed psychiatric disorders, such as mania or a psychotic illness. For this reason, there are certainly good reasons for setting the limit for tetrahydrocannabinol (THC) consumption as low as possible. In Germany for example, the limit is 1.0 nanograms per milliliter of blood serum, which currently constitutes the threshold for an administrative offense. It also marks the point at which a person's fitness to drive a motor vehicle is called into question and requires evaluation, as it is not possible to exclude for certain the possibility of driving safety being impaired.

By way of comparison, in Europe several countries such as France, Great Britain, the Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, and the Czech Republic have also set THC thresholds. These thresholds range quite substantially between 0.0 and 6.0 nanograms per milliliter of blood serum. The limits set in the states of the USA also vary considerably, ranging between 0 nanograms per milliliters of blood serum, such as in Arizona, Georgia, and Virginia, and 10 nanograms in Maine and Washington state.

ILLEGAL CAR RACES AND CAR POSING

Failure to reduce speed, violating speed regulations, and racing compromise road safety in many countries. In Germany for example, almost a third of all fatal traffic accidents are attributed to this particular cause of accident. More than half of all offenses on the German Register of Driver Fitness (FAER) are violations of the speed limit, and the real number – including unrecorded cases – is estimated to be huge. An increasing number of younger drivers in particular are being observed to exhibit the type of extremely fast driving that amounts to speeding. Legislators made a first attempt to counter this trend in October 2017 by reclassifying illegal motor vehicle races as a criminal offense rather than an administrative offense. Competitive driving behavior between two parties is sufficient to use as proof of the offense without the need for it to be agreed beforehand.

Typical cases include the well-known racing off when a traffic light turns green, or the parties involved simultaneously blocking the traffic behind so that they can race each other along the resulting empty stretch of road. Another example is participating in successive racing, which is when the parties involved first drive too fast independently of one another and then decide to compete in a speed race against one another. Drivers who deliberately take part in racing strive to live out their need for achievement in road traffic. They love dangerous driving situations and relish the high speed and the feeling of having mastered dangerous driving maneuvers.

SIGNIFICANT RISE IN SPEEDING OFFENSES, PARTICULARLY IN LARGE CITIES

The growing numbers of racing offenses, especially in cities and conurbations, are an indication of an increasing potential hazard on public roads. In Berlin alone, the number of criminal investigations conducted in relation to illegal motor vehicle races was almost 600 in 2019 and increased to almost 700 in 2020. At 50 percent, 18 to 25-year-olds make up the largest share across all age groups by far. In most cases, the respective driver of the vehicle was not the owner of the vehicle, but rather the vehicles were often rented or entrusted to the driver by a third party. For this reason, the state of Berlin has urged the German government to submit draft legislation under civ-

il law banning entrusting high-performance motor vehicles to novice drivers, in order to prevent these high-risk groups from having access to these types of high-performance vehicles.

Speeders are often car fanatics who define their self-worth and identity through the use of powerful vehicles in spectacular driving scenarios. This is why racing provides an opportunity for showing off in addition to offering intensive driving enjoyment. Similar traits also characterize the phenomenon of car posing. Unlike a driver who wants to use their vehicle to get from A to B, the poser is concerned with "being seen" by an audience and being seen positively on the route between A and B. Posers drive vehicles equipped with features that look flashy and drive around noisily in a way that sets them apart, as this enables them to show off. For this, posers often buy older, used cars from expensive brands and try to restore the high-quality appearance of the vehicle by installing new wheels and rims, lowering the height of the vehicle, tinting the windows, and manipulating the exhaust system. The consequence of this is that many of these vehicles are no longer authorized for road traffic – at least in European countries.

LACK OF SELF-ESTEEM

Drivers who like showing off are fanatic about their cars and want to show this. A car poser's act of showing off represents a compulsive need to present a certain image of themselves. The respective person invests a lot of time and money in this activity and takes a lot of care in seeking out a stage for their performance. Driving in circles around a dense city center with high rectangular housing blocks and street cafés that go right up to the road present the ideal conditions for this. As soon as businesses close for the day and people go home, the poser also ends their public performance, having gloried in repeating their "act" several times an hour. The car poser puts up with unpleasant consequences such as fines, expensive dismantling work to their vehicle, and confrontations with the police, and does not let these stop them from repeating the act.

The strong urge to carry out these kinds of acts and the tendency to prioritize this passion over many other aspects of life as well as the repeated self-inflicted harm through fines and expensive dismantling operations point toward problems with impulse control. It is evident that car posers are intensive users of social media, as this gives them opportunities to present themselves to a wide audience and enjoy affirmation through likes. Posers seek out recognition which increases their feeling of self-worth, suggesting that a lack of self-esteem is a key reason for their inappropriate behavior.

It is not uncommon for illegal car racing in city centers to end in tragedy

In the USA, posing on the roads began more than 40 years ago. As early as the 1970s, low riders, hoppers, and hot rods were known phenomena there. Older luxury sedans were lowered in height and equipped with hydraulic systems which enabled the vehicle to "hop." The drivers of these sometimes highly elaborately painted and stylized vehicles drove around in them deliberately slowly. Low riding very quickly evolved into a trademark of young Mexicans in the USA. In this way, driving these kinds of vehicles represents an act of cultural identification, sets those involved apart from the "foreign" environment, and becomes a counterculture. This is also reflected by these vehicles being increasingly stylized like works of art, with some of them even being displayed in museums. This is a unique way in which a vehicle can have an identity-forming function, i.e., the opportunity for the owner of the vehicle to signal their affiliation with a certain group and their social status.

Manuel Picardi
Vice President and Secretary-General of
European Driving Schools Association

How Driver Training for New Drivers Needs to Change

In the first half of the 20th century private motoring was reserved for two groups: the wealthy (either personally or with a chauffeur) and those who drove vehicles as part of their job, delivery drivers, some trades people and the military. The first driver trainers were car salespeople – it was impossible to sell someone a vehicle if they could not drive it, often the buyer had to be re-taught every time they changed their vehicle because controls were not standardised.

The economic development of the post-war period has meant that since the 1950s many more people have had access to driving licences. Driving schools developed in different ways in different countries and most were forced to concentrate on what the customer wanted; to pass their driving test as quickly and at as low a cost as possible. Training was geared not to best practice but to preparing candidates to pass the test in their country.

History is often cyclical and as frequently happens things change faster than might be expected. Today in European cities traffic factors determine the type of vehicle to use, for different journeys. There are far fewer young people interested in driving a car and technological development complicates the training process.

Today the driving licence is not the symbol of freedom it once was. The higher cultural level and the pressure of time means that the driving licence is now seen as a cost, a tool to get a better job. It is estimated that 90% of pupils go to a driving school to get their driving licence, not to learn how to drive safely. However, driving in traffic is much more complex today than it was twenty years ago which means that training and examination should be much more appropriate to modern times.

For this reason, the European Driving Schools Association seeks to introduce a smarter system, which separates skills from knowledge, and which gives driving schools the opportunity to certify some of the skills necessary for a safer driving style, adapted to the constant changes imposed by technology.

Tomorrow's drivers will have to know what kind of vehicles they will be called upon to drive: hybrid, electric, semi-autonomous vehicles, but sometimes even mechanical ones. The only certain thing in an increasingly uncertain world is that we need thinking drivers, no longer just full of rules. We have five-star cars, we have five-star roads, we need to ensure that drivers are at the same level.

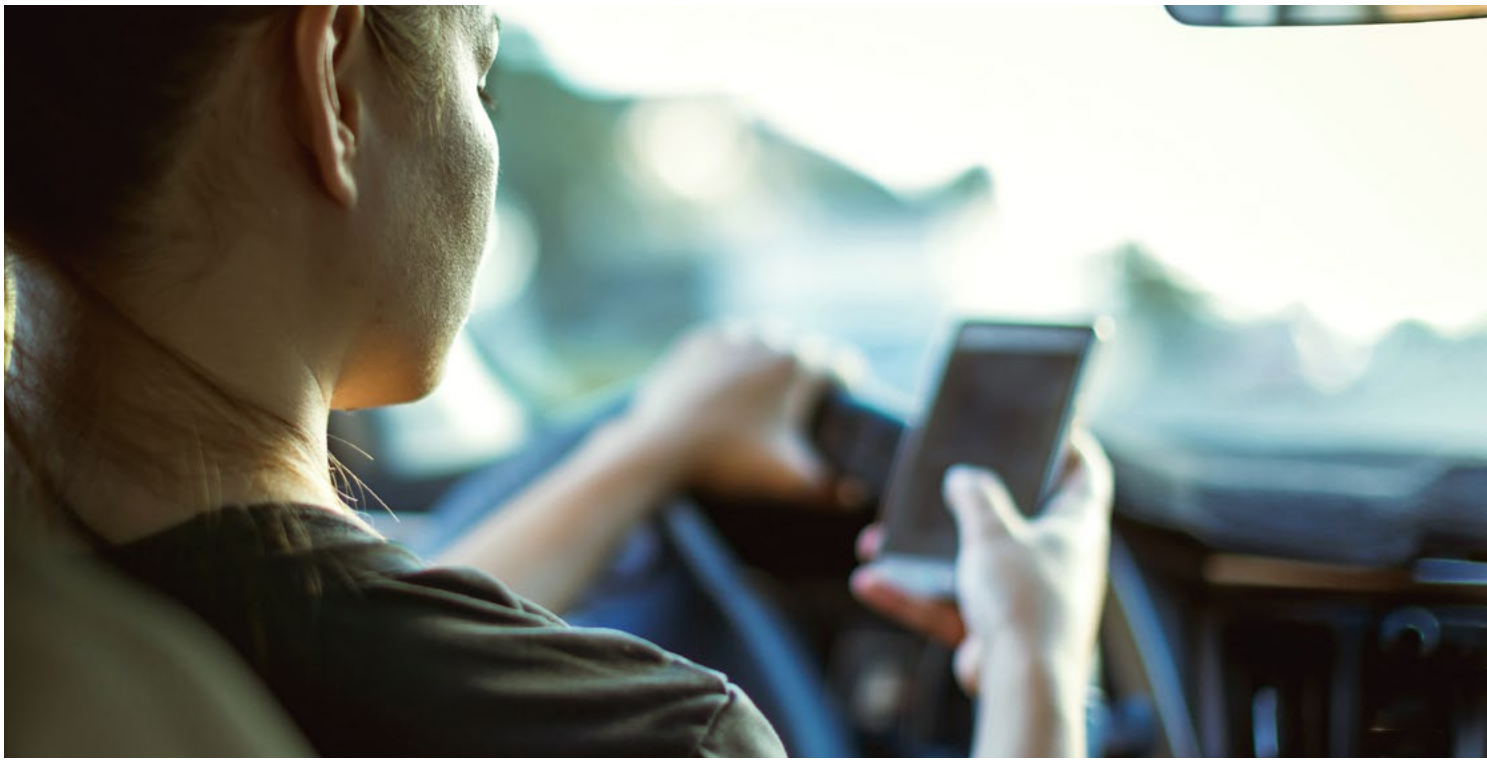
For example, the paintwork on vehicles of the low riders can represent certain residential quarters where Mexicans or Mexican street gangs live. The latest chapter in the history of the low riders is in the music videos of contemporary African-American hip-hop groups, in which it has almost become a cliché that so-called "gangsta rappers" slowly cruise around in souped-up limousines.

DISTRACTION DUE TO USING TECHNOLOGY

Although having a driver's license and a car symbolize a degree of freedom for young people in particular, in many countries the car has lost its meaning as a status symbol among young people and been replaced by the smartphone. Those who can afford it even own several end devices, which serve their need to be an ever-available part of a new, digital community, but also lead to people driving around with a cell phone in their hand. The presence of passengers, conversations, listening to music, and taking part in activities within the vehicle also present other sources of distraction.

The results from a 2018 study conducted by Erez Kita and Gil Luria from the University of Haifa show that the young drivers who took part (17 to 22 years) touched their smartphone 1.71 times per minute while driving. With respect to using a cell phone while driving, several other cell phone functions that young people use in addition to writing text messages or calling have been identified. A 2018 online survey conducted in Australia found that the cell phone function most frequently used by young drivers (in this case 17 to 24 years) was playing music, followed by reading text messages, using GPS navigation apps, and sending text messages.

Results from a survey conducted among young German drivers also show that music-related activities (e.g., changing the music via their smartphone) are the most common reason for using a smartphone while driving. The participants surveyed were between the ages of 18 and 24 and drove at least 1,000 kilometers per year. Almost 65 percent of the participants admitted at least occasionally searching for music while driving. 62 percent of the young drivers admitted to reading text messages while driving, although the majority stated that they rarely did this. 46 percent admitted to reading or writing text messages at least sometimes while driving. Eleven percent of men and seven percent of women said they did this regularly. The results correspond to the results from another survey, in which 62.9 percent of young drivers in Europe aged 18 to 21 stated that they read text messages and e-mails or check social media while driving. Calling using a cell phone is less common among young drivers in Germany: 24 percent of men and 19 percent of women aged 18 to 24 admit to doing this sometimes while driving. A larger proportion (51 percent) state that they send voice messages.



Using a cell phone at the wheel causes dangerous distraction from the road

Young drivers generally report being more frequently distracted while driving than other age groups. The levels of perceived social and personal acceptance of these forms of behavior are also higher in this group. These trends are consistent in Canada, the USA, and in Europe. The additional activities named by the young drivers surveyed in the studies are corroborated in the results of an analysis of driving data of teenagers in the USA. In 58 percent of the randomly selected and analyzed video segments, the young people performed at least one task other than driving. The most common additional activity was interacting with a passenger, which was observed in 33 percent of cases. The probability of performing a secondary task was more than twice as high when driving alone compared to when driving with a passenger.

HOW IS DRIVING BEHAVIOR IMPAIRED?

Distraction while driving occurs when the driver's attention is directed toward something other than the driving. Distractions can comprise visual, acoustic, manual, and/or cognitive elements. As a result, the type of distraction can impair a person's driving in different ways. For example, several different studies show that young drivers (16 to 18 years) who drove with several people and had loud conversations with one another took their eyes off the road for longer than one second twice as often, and their risk of having a serious traffic accident was six times higher. Writing text messages increases the load on a person's motor and cognitive functions (by holding a device and operating it), which leads to significantly longer glances away from the road, an increase in missed lane changing, and a considerably higher variation in lane position and the distance maintained to the vehicle in front. Visual distractions tend to be generally more pronounced than cognitive distractions. Further studies show that visual distractions result in poorer lane keeping, increased reaction times, and speed fluctuations.

DISTRACTION AND ACCIDENT HAZARDS

The driving behavior impairments caused through distraction are concomitant with a higher accident risk. An analysis of the traffic accident trend for young drivers in the USA shows that, in 59 percent of the analyzed cases, the young drivers had been preoccupied with a secondary activity in the seconds before the accident. The most frequently observed distracting behaviors before an accident were interacting with passengers (14.6 percent), using a cell phone (11.9 percent), and performing an action inside the vehicle (10.7 percent). Over the period that was analyzed (2007 to

Fernando Santos
President of the Portuguese driving school association ANIECA

Car Drivers from Generation Z

Most driver's license applicants in driving schools were born after 1990. They belong to Generation Z, who are highly cognitively oriented and have never experienced the world without the Internet or a cell phone. As intensive users of technology and apps, they have the ability to perceive several realities simultaneously and sometimes mix up their virtual and real relationships.

They are completely dependent on devices and their brain is permanently in multitasking mode. They have no problem at all ordering an Uber when they are out, while simultaneously having a discussion with someone, posting a photo on Instagram, and organizing dinner with friends via a WhatsApp group. However, they find it difficult to focus solely on what is being taught in driving theory lessons.

They attach little value to formalities, but they are pragmatic. For them, it is important to reach a goal, irrespective of their place of work, their working times, or clothing conventions. They prefer learning at home and obtaining their information online rather than following a lecture from a driving instructor in driving school.

They are intensive users of social media, are active in different groups, and have huge mobilization potential. They know how to quickly find out any information, meaning that they no longer view teachers as an important factor in the learning process. When communicating, they prefer using memes and emojis instead of formal language. Learning the definition of terms and traffic regulations from books bores and demotivates them. Many of them have spent countless hours behind a games console and are used to letting their thumbs do the driving. Their sense of space, speeds, and distances is distorted. As a result, it is especially difficult to sensitize them to the right speed or suitable braking point.

"Share rather than own": they are more likely to make use of car sharing offers then buy their own vehicle. This presents the driving instructor with the difficult task of preparing them for the use of different vehicles that are equipped with entirely different technologies. Unlike previous generations, they are more likely to value the technological functions and available connectivity of a vehicle than its power output. On the one hand, this could be an indication that they are likely to drive at lower speeds. On the other hand, this also makes it clear that they will find it difficult to focus solely on the task of driving. For example, every time they reach a red light, they will automatically reach for their smartphone.

The entire life of someone from Generation Z revolves around a smartphone. While up to a few years ago, driving instructors had to try and encourage their driving students not to make phone calls when they are behind the wheel, now they have to be taught not to send/check messages (texts, WhatsApp, etc.) with their cell phone, not to use social media, and not to browse for music.

Many even have no intention of applying for a driver's license. It is hard to motivate a student to learn if they were forced by their parents to sign up to driving school.

The driving instructor is faced with the hard task of teaching driver's license applicants to make safe and appropriate decisions at all times. Trying to encourage them to forget their smartphones for a few minutes and only concentrate on driving is harder than one would like to admit. Educating this amazing generation to become safe car drivers requires a change in strategy – one that will require a huge amount of effort. But the driving schools are ready to meet this challenge!

2015), rear-end collisions increased significantly. In accidents that involved the use of a cell phone, there was a shift from speaking/hearing to operating/looking. Both the time for which drivers took their eyes off the road and the longest amount of time for which they did this increased in rear-end collisions for the analyzed period. Consequently, the change in the use of cell phones over recent years could be one of the reasons why young drivers are having more and more rear-end collisions.

The various secondary activities – and thus the associated risks – undertaken by young drivers vary. The results from an observation study conducted in the USA show that, from a large range of secondary activities, reaching for or using objects while driving and manually operating a cell phone are associated with a higher accident risk. Both actions combined increase the risk of having an accident sevenfold. Undertaking a secondary activity while driving correlates with an increase in the total length of time in which the driver takes their eyes off the road. For each additional second that a driver takes their eyes off the road, the risk of having an accident increases by 28 percent. The action of taking one's eyes off the road is the aspect of teenagers' manual use of a cell phone which is connected with their risk of being involved in an accident. 41 percent of the risk associated with using a smartphone can be traced back to drivers not concentrating on what is happening on the road. The remaining 59 percent is associated with the physical and cognitive strain from using a cell phone while driving.

The link between distraction and accident risk while driving has been corroborated in a further US study. It showed that drivers who had near accidents had a significantly lower frequency of performing secondary activities than drivers involved in accidents. It is possible that the absence of a secondary activity increased the chance of successfully performing an evasive maneuver. However, the differences between accidents and near accidents in terms of secondary tasks and evasive maneuvers were not as great as they were believed to be, and are not enough to explain what separates an accident from a near accident.

DRIVING EXPERIENCE DEVELOPS OVER TIME

MEASURES TO IMPROVE ROAD SAFETY: BASICS OF DRIVER TRAINING

The frequent involvement of young drivers in accidents, their occasionally poor regard for traffic regulations, and the inappropriate actions that this might result in can be traced back to two key causes: youth-based risk and novice driver risk. Youth-based risk can be understood to mean the effect of an incomplete maturation process in terms of the brain restructuring itself, individual learning experiences, and social influences. As mentioned above, the consequences of this are the formation of attitudes that impair safety, an increased willingness to take risks, and a tendency to overestimate one's abilities. Novice driver risk refers to the fact that novice drivers' driving skills are not fully developed, as these skills are acquired through driving itself; in other words, they lack driving experience. This process includes the conversion of acquired factual knowledge into mental action programs, which are developed and refined through practice, feedback from other road users, trial-and-error learning, and negative experiences, such as near accidents or fines.

Drivers can build up effective mental action programs by methodically educating themselves on road safety and participating in road traffic through other modes of road use – for example, as a pedestrian, cyclist, or motor vehicle passenger. The importance of professional and educational programs that focus on imparting knowledge in closing the gap between self-evaluation and external evaluation, as well as the limits of human competence in traffic, must not be underestimated. It has also been recognized that the driving school training period should encompass more than just learning about vehicle handling and traffic regulations; driving training must be a time for imparting higher-level skills, such as a regard for safety, self-control, self-monitoring, and the acceptance of traffic rules. The theoretical basis for this is provided by the GDE matrix model.

Driving safety training is also an important element to increase road safety, especially for young people

14 GDE 5SOC Matrix: Important Elements of Driving Behavior

Regulation level		Knowledge and skill	Risk-increasing factors	Self-evaluation
5	Social environment	Culture, monitoring, subcultures, group values and norms	A lack of understanding about the influence of cultural/subcultural matters on driving	How does culture influence my decisions and preconceptions when I am driving?
4	Personal values and attitudes, life goals	Knowledge of and control over how life goals and personal tendencies impact driving behavior; lifestyle, age, group, culture, etc., with respect to driving behavior	Risks and tendencies: a love of adventure, acceptance of risk, group norms and group pressure, willingness to accept responsibility	Introspective competence (self-monitoring), personal preconditions, self-control. What kind of a person am I?
3	Driving motives, purpose of the journey, and driving circumstances	Knowledge and skills with respect to journey necessity, mode of transport choice, time of day choice, motives, route planning	Risks associated with, e.g., social context and wider society, alcohol, tiredness, rush hour traffic, young passengers, speed	Self-critical thinking, motives behind one's personal preferences
2	Driving in traffic, mastery of traffic situations	Traffic rules, cooperative behavior, recognition and perception of hazards, automation	Disobeying rules, driving too close to the vehicle in front, low friction, vulnerable road users	Nuanced assessment of own driving ability and personal driving style
1	Control over the vehicle, vehicle operation	Vehicle functionality and control, safety systems, laws of physics	Not using seat belt, failure of vehicle systems, worn tires	Nuanced assessment of own skills in terms of vehicle control

Source: GDE Matrix from Hatakka et al., 2002

The GDE matrix (Goals for Driver Education) is a competence-based theoretical model for driving behavior. It was introduced as part of the EU-funded research project GADGET, which stands for Guarding Automobile Drivers through Guidance Education and Technology. The basic framework of the GDE matrix (Figure 14) is based on empirical studies that research causes of accidents and describes five different levels of influencing factors on road use behavior. The levels are assumed to be hierarchical, with each level influencing the challenges for, decisions, and behavioral patterns of the driver on the next level down. As such, the following applies (from top to bottom, or from level 5 to level 1):

5. The social environment influences
4. the driver's personal values and attitudes as well as life goals, which influence
3. the goals and context of driving, which in turn condition
2. how the driver masters traffic situations on the road.
1. Vehicle control and maneuvering in a certain traffic situation, i.e., vehicle operation, can be viewed as a synopsis of the higher levels 5 through 2.

The GDE matrix also has three columns in addition to the five levels:

1. Knowledge and skill
2. Risk-increasing factors
3. Self-evaluation

The first column describes what knowledge and skills a driver requires across each of the five levels in order to drive safely. On the lowest level it relates to vehicle control and, with each ascending level, to aspects such as traffic rules, risk-related matters, and motives for driving. The second column contains risk-increasing factors on each level, from worn out tires, disobeying rules, and alcohol consumption through to dangerous driving motives and risky lifestyles. The third column concerns the driver's ability for self-control with the prerequisite of realistic and adequate self-evaluation on each level. This starts with the ability to critically assess one's vehicle control skills, one's driving style, and one's driving motives. The higher levels require the ability for self-reflection.

The GDE matrix can be used to determine training goals and training content in the con-

COMPLYING WITH THE BASIC RULES IS ABSOLUTELY ESSENTIAL IN ROAD TRAFFIC

text of driver training. Driving motives, attitudes, evaluation dispositions, cultural background and lifestyle preferences can be socialized and form homogeneous groups. Depending on one's group affiliation and profile characteristics, this results in either a defensive and safe driving style or a reckless, risky one. The pivotal point is the ability to accurately judge one's personal knowledge and ability on each level and for this to tie in with the desire to drive safely – i.e., the motivation to following basic traffic rules.

EXAMPLE: DRIVER TRAINING IN GERMANY

Driving motor vehicles on public roads is associated with extensive risks. For this reason, in Germany it is illegal to drive a motor vehicle on public roads without a valid driver's license. According to German Road Transport Law, the issuing of a driver's license is dependent on meeting the following seven conditions:

1. Residence in Germany
2. Minimum age
3. Fitness to drive
4. Training (according to driving instructor law)
5. Competence (passing one's driving test)
6. First aid course
7. Not possessing another driver's license from an EU member state or a non-member state which is party to the Agreement on the European Economic Area.

Fitness to drive and competence form the main requirements in the right to have a driver's license, as they have a direct influence on road safety. In the hierarchy of requirements, fitness to drive is conceived as a precondition for training and competence. To this effect, if the respective administrative authority is given information that someone who has applied for a driver's license is not fit to drive, that person is not permitted to take the qualification examination until the deficiencies have been addressed. To be considered fit to drive, a person must meet the necessary physical and cognitive requirements and have not significantly or repeatedly violated traffic regulations or criminal law. Some of the factors that are relevant to someone's fitness to drive include medical conditions or health impairments, which include a poor sense of sight or hearing, heart, vascular, and renal disorders, and issues resulting from alcohol and drug consumption and from taking medication.

Every time a driving license authority receives a first-time application for a driver's license, it must identify whether there are any concerns regarding the applicant's fitness to drive a motor vehicle. If this is the case, the applicant must undergo a medical and psychological evaluation, or medical evaluation. In special cases, such as a physical impairment due to a missing limb, the applicant must also undergo an evaluation from an official-

Accompanied Driving From the Age of 17

Adolescents in Germany have been able to take part in the accompanied driving from 17 scheme (BF17) since April 2004. This scheme has been offered in all German states since 2008, and enables young people to acquire a car driver's license from the age of 17. However, until their 18th birthday, they must be accompanied by a designated person, who themselves must be at least 30 years old, have held a car driver's license for least five consecutive years, and have no more than one point on the Register of Driver Fitness. The purpose of extending the learning period is to help reduce the accident risk of young novice drivers. To evaluate this, the German Federal Highway Research Institute (BASt) conducted a nationwide, survey-based study on people who had participated in the BF17 project and on a control group of people who had not. The results showed that the group that had participated in BF17 had around 19 percent fewer accidents in their first year of independent driving compared to the control group that had not participated in BF17.

The bottom line of the study is that the more time novice drivers spend driving with somebody accompanying them, and the more driving practice they acquire during this time, the greater the effect is on reducing accident numbers. In this respect, the plan to reduce the minimum age for accompanied driving to 16 – as resolved in the coalition agreements of the new German government in office since December 2021 – is definitely a welcome step to increasing road safety.

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Managing Director of DEKRA Akademie GmbH

Educational Guidance Is Also Fundamental During Professional Driver Training

The pandemic has underlined how important the transport industry is for our society. In some countries there were repeated supply shortages, resulting in empty shelves in supermarkets and canceled fuel deliveries to gas stations. At times, even the military had to be called in to help as there were simply not enough drivers available. In view of the demographic change that the industry is currently undergoing and recruitment statistics, it is clear to see that the number of active professional drivers is declining year upon year. In order to prevent similar supply shortages in future, it is therefore more important than ever to enthuse young people for this systemically relevant profession.

This could be achieved through a three-year study program or as part of acquiring a driver's license in combination with a fast-track basic qualification. However, to ensure the industry has a constant flow of new, young, motivated drivers, concepts that offer additional incentives are needed. This includes the prospect of continuous professional development and promotion opportunities. Training to become a professional driver could also, for example, open up the opportunity to gain a qualification as a road transport professional at a more senior level and subsequently to run a fleet. Qualifying early on to operate a forklift truck or a loading crane is a way for someone to significantly improve their prospects in the job market and enable them to gradually qualify in other professional fields. The DEKRA Akademie helps companies and its trainees with these kinds of qualifications, for example as part of cross-company trainee schemes.

However, the training must encompass much more than just teaching driving skills and technical knowledge. Teaching trainees about health aspects must receive an equal amount of focus. For, without a mature understanding of how to maintain one's own wellbeing, the challenges of being a professional driver can lead to risks – not only for the drivers themselves, but also for other road users. Tiredness and stress have repeatedly been the main causes of serious accidents in recent years. Drivers who are informed on what to do in these situations and who look after themselves help to protect others and thereby increase road safety overall.

Continual educational guidance is also fundamental during the training period, as it helps young people to become aware of the importance of soft skills, such as reliability, autonomy, and diligence. These are skills that drivers should internalize from an early stage, as carrying out tasks such as the departure check with the same level of meticulousness each and every day is essential to ensure drivers have a safe journey. Ultimately, everybody benefits from training programs that not only train drivers, but also enhance the people themselves, as well-rounded qualified drivers are fundamental to a reliably functioning and future-proof logistics chain.

ly approved expert or examiner. These evaluations help the driving license authority to make their decision.

If there a no concerns around the applicant's fitness to drive, and the relevant registers, such as the Register of Driver Fitness (FAER) and the German Federal Central Register, do not contain any incriminatory data, the applicant is allowed to proceed with their driving theory and practical training. The core of this is teaching the applicable traffic rules, traffic signs, and traffic regulations. This includes the fundamental obligation to always be cautious and considerate in road traffic, and to avoid posing a hazard and causing damage to, obstructing, and causing disturbance to other road users.

In the driving theory examination, applicants have to answer questions on the risks of driving in traffic, how to behave in traffic, priorities and right of way, traffic signs, and vehicle-class-related material. In order to pass the exam, applicants must score approximately 90 percent. Applicants are only allowed to answer one right of way question incorrectly. The practical driving test for a car driver's license lasts for at least 55 minutes and is then evaluated by the officially approved examiner and expert on the basis of a test report with clear error criteria. In general, the driver training concept practiced in Germany seems to be positively received. In the aforementioned DEKRA-commissioned Forsa survey, 92 percent of people surveyed stated that the training they received in driving school prepared them very well or well for driving in actual road traffic.

KNOWLEDGE-HEAVY TRAINING PROGRAMS OFFER COMPARATIVELY MODEST RESULTS

DIFFERENT COUNTRY-SPECIFIC REGULATIONS

The legal and specialist requirements to be granted a driver's license vary considerably – not only between continents, but between countries within continents, for example in Europe. One way in which countries differ is, for example, in the health checks associated with first-time driver's license applications. Different countries have different methods for determining whether an applicant has any health defects that could impair driving safety. These range from self-declaration by the applicant and health screenings through to an assessment for certain areas of the body, such as the cardiovascular system, and for potential substance addiction (alcohol and/or drugs) conducted by a specialist physician (Luxembourg).

Some countries use certified organizations, whereas others utilize the communication channels within the general health system and empower primary care physicians or the health department doctor to transfer the required health data. In some countries, drivers are obligated to declare whether they have any conditions that could affect driving safety (e.g., Estonia, Finland, Great Britain, Ireland), whereas in other countries they are not obligated to do so (e.g., Denmark, Germany, Switzerland). In some countries (Belgium, Finland, Hungary, Portugal, Sweden), doctors are obligated to report any drivers with conditions that could impair the driving of a vehicle to the driving license authorities. In cases concerning temporary conditions, a medical certificate is usually required by the driver's license office, and some countries withdraw a person's license until further investigations have been carried out. In addition to a health check and a sight test, some countries require people to take a computer-based hazard perception test (Belgium and Great Britain).

Other aspects that vary between countries include the evidence and documents required for processing applications and the legal and technical framework conditions around training, testing, and downstream measures to prevent risks. The driver's license licensing systems differ mainly in terms of the following: minimum age of applicant, type and scope of driver training (for example training curriculum, single-phase or multi-phase training), other parties involved (for example professional driving instructor or non-professional trainers – generally parents), importance of driving tests, and measures to ensure the desired road use behavior is ensured, improved, and remains stable over the long term.

The fundamental traffic regulations are taught in theory lessons

One aspect that is particularly widespread is the concept of an official driving school. The idea behind this is that a fully qualified road traffic expert with the requisite specialist and teaching expertise should be in a better position to impart the relevant knowledge, skills, and capabilities in a manner that ensures they are carried over into driving practice over the long term. Driving school training is often formalized and includes explicit learning goals, learning schedules, and a systematic phase-based structure to the training including a close link between theory and practice. Beyond professional driving school training, Northern European countries in particular except Denmark as well as the Netherlands and Great Britain also use the opportunity to involve non-professional trainers in driver training.

Although drivers put substantial effort into completing their driver training, the results of a knowledge-heavy training course are comparatively modest. Driving tests merely ascertain a person's knowledge about driving a vehicle and to what extent the candidates are able to apply this knowledge during a test drive – an artificial situation of a limited time period. Candidates who lack driving competence are therefore excluded from driving in public, as they do not pass their test and are not granted a driver's license. However, what

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Effective Means of Reducing the Risk of Accidents

New Zealand introduced a Graduated Driver Licence System (GDLS) in 1987. The purpose of the GDLS is to protect young drivers by ensuring that they are introduced to more complex and hazardous driving situations only once they have gained experience, maturity and practice while driving under certain restrictions. The system places a phased set of restrictions on learner and restricted drivers, which gradually reduce, thereby allowing novice drivers to develop safer driving skills while minimising the risks they face. For private car and motorcycle licences, New Zealand's GDLS is divided into three licence stages: learner, restricted and full.

When analysing only road deaths and serious injuries, the NZ GDLS has been shown to be an effective tool in reducing crash risk among young, novice drivers (Lewis-Evans, 2010[1]), (Schiff, 2019[2]), with some research indicating a reduction of the incidence of young driver crashes by at least 8% (Begg, Stephenson, 2003[3]). However, when measuring the effectiveness of a GDLS, there are also broader social wellbeing metrics to consider. For example, the structure, delivery and costs of the GDLS can create barriers for some groups to access and progress through the GDLS, particularly those in higher levels of socioeconomic deprivation, which leads to transport disadvantage and social exclusion (NZIER, 2016[4]). To address the issue of access and equity, while improving road safety, a regulatory review of the GDLS is underway with the Ministry of Transport and Waka Kotahi. The Ministry of Social Development is also leading a cross-government working group review into accessibility and equity to the driver licensing system. Finally, to complement and build on these two reviews, Waka Kotahi is due to develop a five-year strategy for the future of the driver licensing system.

MULTI-STAGE PROCESS HAS PROVED SUCCESSFUL

driving tests do not do is ascertain how a driver will behave in traffic in future, or what their general attitude is to accepting rules and adhering to traffic regulations. Evaluation studies have shown that it has not been possible to reduce the accident risk of novice drivers through driver training. Age and, in particular, driving experience have proven to be the decisive factors in this respect.

BEST PRACTICES IN FRANCE AND AUSTRIA

Some newly qualified drivers interpret passing their driving test as proof that they are already good drivers and have nothing more to learn. In fact, the opposite is true. This insight has brought about new approaches to driver training – approaches that combine a gradual transition to bearing responsibility for the vehicle as the driver with learning from the expertise and driving experience of close family members.

In France, for example, there is a combination of driving school training and accompanied driving. First, trainee drivers attend driving theory classes and complete 20 practical lessons. Then they sit the theory test. After this, they are allowed to practice with a family member who has a certain amount of driving experience. Trainee drivers are allowed to be accompanied by a person who has held a driver's license for at least five consecutive years and has completed a special training course. Accompanied driving runs for at least one year and comprises at least 3,000 kilometers within France. It is also mandatory for trainee drivers to attend two educational seminars (with their accompanying person). Everything has to be documented in a course book. France has also introduced a points system. Beginners who have just received their driver's license receive six points as a form of credit. After three years of driving experience, they receive the full driver's license with twelve points. If they commit any traffic offenses, points are deducted. Once their points credit is used up, their driver's license becomes invalid.

Driver training in Austria is structured into multiple phases. First, trainee drivers complete their theory training with 16 course units, their practical training with 18 hours of driving, including preparing for the test stage, and the theory and practical tests. After being granted permission to drive a subcompact car, for example, trainee drivers have to complete a second training phase. For this, they have to complete three modules within one year after passing their driver's license (sub-

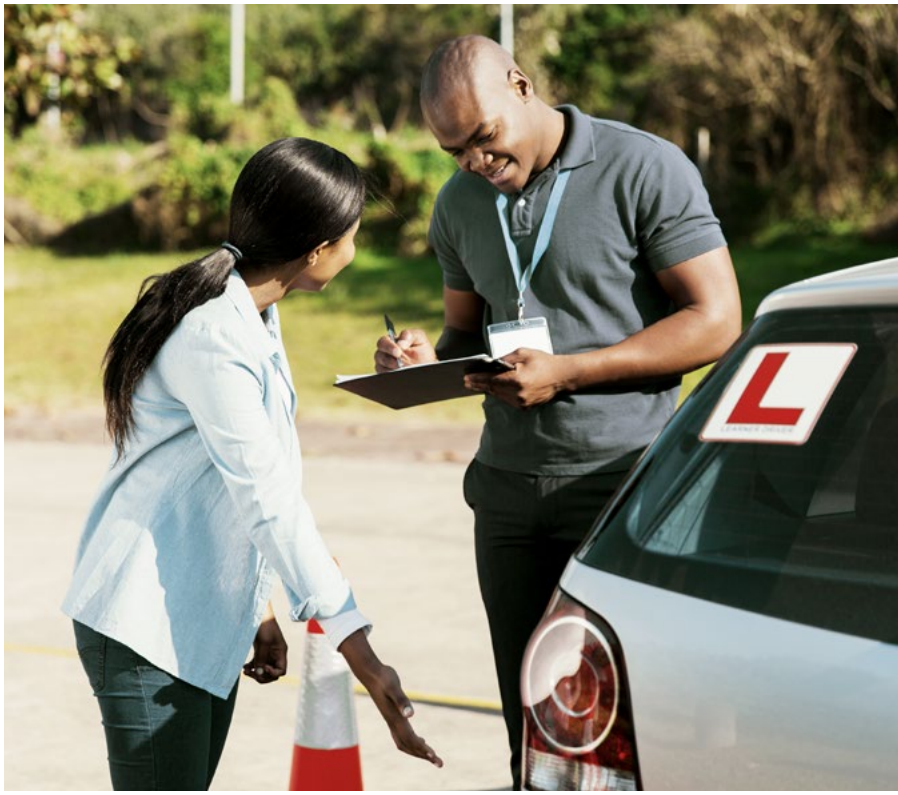
compact): an initial advanced feedback drive with a driving instructor (two to four months after being granted permission to drive), a driving safety training course with a traffic psychology element (three to nine months after being granted permission to drive), and a second advanced feedback drive (six to twelve months after being granted permission to drive).

For the example of the multi-phase training for subcompact cars, in the approximately two-hour advanced feedback drives, which comprise a practical part and a feedback part (50 minutes), particular attention is paid to where the driver directs their eyes, to what extent the driver's driving style is accident-avoiding and defensive, and environmentally conscious and fuel-saving, and to their social behavior toward other road users. The feedback part focuses on the most prominent aspects of the person's driving competence. The second advanced feedback drive focuses on elements relating to an environmentally conscious and fuel-saving driving style, including measuring fuel consumption and drive duration, as well as a discussion of the key points of an environmentally conscious and fuel-saving driving style. The advanced feedback drives can be completed in a driving school of choice and in the person's own vehicle.

The other module comprises a driving safety training course with a traffic psychology element. It focuses on strategies for dealing with hazards (for example, braking exercises and evasive maneuvers). Driving safety training for subcompacts consists of six teaching units in total and is split into a theory part (one teaching unit) and a practical part (five teaching units). This is followed by a traffic psychology group discussion on the same day, in which mainly types of accident and risk factors, such as sensation seeking, are discussed. This group discussion is divided into two lots of 50 minutes.

THE GRADUATED DRIVER LICENSE CONCEPT

The Graduated Driver License (GDL) concept is the idea of gradually extending a person's permission to drive over three phases. It was developed by Waller and Reinfurt in the 1970s. The first time the system was introduced in the USA was in Florida in 1996, but in other countries it appeared earlier than this, for example in 1987 in New Zealand. The aim of the GDL is to support young drivers in learning the necessary skills and capabilities, and for them to benefit from the expertise and feedback of the people accompanying them to help minimize their risk of having an accident. The basic principle of the GDL is that trainee drivers obtain their driver's license over the course of several stages. It combines the concept of accompanied driving with restrictions which include a ban on driving at certain times of the day so that critical driving situations per se are excluded. The individual stages are generally not age-dependent, but are based on the learners' amount of experience.



L plates are stuck to car rear windows in many countries to identify novice drivers during their learning phase

The GDL starts with a mandatory stage of accompanied driving: the Learner License (LL). When they obtain this LL, novice drivers are only allowed to drive a motor vehicle when accompanied by an experienced and officially recognized adult supervisor. This role is usually assumed by the novice driver's parents. The period of time for which an LL is valid is different in the various states in the USA, and is between six and twelve months. Once novice drivers have spent a certain amount of time driving with their supervisor and acquired sufficient driving experience, they are allowed to apply for the second stage of the GDL. The Intermediate License, also called the Provisional or Restricted License, permits a novice driver to drive a car without an accompanying

person, albeit with restrictions. These restrictions include, in particular, the number of other passengers allowed in the vehicle (in addition to the accompanying person) or the exclusion of night time driving. In the USA, car drivers with an Intermediate License are not allowed to drive alone after 10 pm or 12 am, for example. This is grounded in the evidence-based assumption that there is a significantly higher accident risk for young drivers at night. The number of other people of the same age allowed in the car is also often restricted to one.

After successfully completing the second stage, the novice drivers receive their Full License (FL). Holders of Full Licenses are allowed to drive without restrictions, no longer require supervision, are allowed to drive at night, and can have more than one person in the vehicle with them. They are, however, subject to certain age-dependent regulations. For example, in the USA, people up to the age of 21 who have a Full License are not allowed to drive after consuming alcohol. Alcohol consumption itself is still illegal at this age.

Novice drivers in New Zealand also undergo the same GDL process that has just been outlined. Before young people in New Zealand with a Learner License are allowed to drive a car, they must be at least 16 years old. Applicants must also pass a theory exam, in which they are tested on traffic regulations. As described above, they can then drive with certain restrictions. They have to designate a person who will accompany them as supervisor. The supervisor must have been in possession of a Full License for at least two years and must themselves not be subject to any restrictions. Other passengers are allowed in the car, as long as the accompanying person permits this. Novice drivers under 20 are not allowed to drink alcohol. People over 20 are allowed to drive with a maximum of 250 micrograms per liter of breath alcohol concentration, which roughly equates to a blood alcohol level of 0.05 BAC. The LL is mandatory for six months, with the learner being recommended to accumulate 120 hours of driving practice, and is valid for a maximum of five years. After this period, it can either be renewed, or the novice drivers can apply for the next level – Restricted License (RL).

Before novice drivers can receive their RL, they have to pass a practical driving test. They have to be at least 16.5 years old to apply for this. The RL also has a minimum period for which it must be held and a maximum validity period. Novice drivers under 25 must have driven a car with their RL for at least 18 months before they can apply for the FL, although this time frame can be shortened. They can apply for their FL after just twelve months if they have completed an advanced driving course. The minimum time for which novice drivers over 25 have to hold their RL is six months, but can be shortened to three months by taking an advanced driving course. The maximum time novice drivers can drive with their RL is also five years. After this, they have to pass another theory test to extend it, or they can apply for a Full License. Driving with a Restricted License also comes with restrictions. For example, novice drivers who have their RL can drive alone, but only between 5 am and 10 pm. Night time driving is only allowed with the designated supervisors, and only one other passenger is allowed in the car. Although driving with another passenger is only permitted without the presence of the supervisor under certain conditions. In terms of alcohol limit values, the same rules apply as for the LL.

A person must be at least 18 years old to be granted a Full License, or 17.5 if they have completed an advanced driving course, on the condition that they have had their sight tested and passed a practical driving test. The driving test lasts for around 30 minutes with a driving exam-

OFFENSES COMMITTED DURING PROBATIONARY PERIOD MET WITH TIERED SET OF MEASURES

iner, who evaluates the driver's hazard perception ability and asks them to name aloud all of the hazards that they notice during the drive.

PROBATIONARY PERIOD FOR NOVICE DRIVERS – MONITORING AND PREVENTATIVE INTERVENTION MEASURES IN GERMANY

In Germany, there is a hierarchy of measures that are taken if novice drivers commit traffic offenses during their probationary period. If someone goes through all the measures in the hierarchy and then violates the rules again, the person is defined as legally unfit to drive and has their driver's license withdrawn. Offenses are split into serious (category A) and less serious offenses (category B) and the term "erheblichen Auffälligkeit" (significant violation) is defined in more detail. A driver is considered to have committed a "significant" violation if they have been caught committing a category A offense once or committing a category B offense twice. A-category (serious) offenses include driving through a red light or exceeding the speed limit by more than 21 km/h in a car. B-category (less serious) offenses include exceeding the speed limit by up to 20 km/h in a car.

Driver's license holders who are in their probationary period are subject to particular monitoring during this time as part of the aforementioned three-stage system. This encompasses the following corrective measures: the first time a driver's license holder commits a serious or two less serious offenses during their probationary period, the responsible driving license authority orders the driver to attend an advanced course. Drivers who commit alcohol or drugs-related offenses are obligated to attend a special advanced course run by psychologists. As well as fines and a driving ban of up to three months, anyone who demonstrates driving violations during their two-year probationary period is ordered to take part in this preventative measure, as it is well known that early substance-related violations in road traffic indicates that the offender will commit other relevant offenses. If the offender does not take part in the preventative measure, their driver's license is withdrawn, or, if they apply for a new driver's license, their application is rejected. The course programs focus on trying to motivate the participants to permanently change their attitude and behavior toward alcohol and/or drug consumption and on supporting them in changing their behavior. Through the provision of instructions on self-monitoring (for example keeping a drinking log), plugging knowledge gaps around the risks and effects of psychoactive substances, and improving behavior planning, the participants are aided in improving their competence.

Novice drivers in Germany who exceed the speed limit too often during their probationary period could even have their license withdrawn

If, after having attended the advanced course or the special advanced course, an offender commits another serious offense or two further less serious offenses within their probationary period, they enter stage two of the monitoring process and receive a written warning from the driver's license authority. The driving license authority will also advise the offender to attend traffic psychology counseling within two months in order to identify and address any shortcomings in their attitude to road traffic and safe road use. As part of this, offense analyses and an evaluation of the driver's strengths and weaknesses are usually carried out as a starting point for determining the change measures and then used to help them improve their road use behavior.

If, following stage two, the offender commits another serious offense or two further less serious offenses, their driver's license is withdrawn. German law allows for up to three serious and up to six less serious traffic offenses during the probationary period before a novice driver is considered to be unfit to drive and has their driver's license withdrawn. The affected driver is not allowed to drive a motor vehicle for at least six

Vehicle assistance systems can help to warn drivers against tiredness and similar hazards

months and after that and has to undergo a medical and psychological fitness-to-drive evaluation. As part of this evaluation, the driver is assessed for whether the factors that caused their misdemeanor have changed in the meantime or remain a concern.

FEEDBACK SYSTEMS FOR NOVICE DRIVERS – METHODS, ACCEPTANCE, AND SUCCESS OF MEASURES

One way of improving road safety for novice drivers and young drivers is the use of feedback systems in the vehicle. They assist with information processing and help to prevent undesirable and risky driving behavior by monitoring driving style and providing direct feedback on any behavior that relates to safety.

USER-CENTRIC FEEDBACK SYSTEMS

The basic function of feedback systems is to filter for information from the surroundings that could be relevant for the driving task. This supports the driver in the anticipation of emerging hazard situations. Feedback systems are user-centric, provide feedback to the driver in real time, and continuously collect and analyze data. There are two types of feedback systems: attention-activating feedback systems and complete monitoring systems.

The former focus on specific behavior – they work on the basis of prediction and react or warn the driver if certain risks (tiredness, distance to the vehicle ahead, speed) are detected. For example, if there is danger of the driver falling asleep, the system will signal to the driver to take a break. Monitoring systems also monitor the driver's behavior, but only analyze it retrospectively and then provide feedback. These systems also record safety-relevant factors, such as acceleration, speed, driving line, distance to the vehicle ahead, and similar variables.

The raw data is used to analyze situations that could represent (safety-)relevant incidents, for example, braking suddenly or veering out of lane. If certain limit values are exceeded, the system decides in which situation and at what time a risky driving maneuver occurred. This data is recorded, collated, and then fed back to the respective recipients, who could be the drivers, a family member (usually a parent), or the insurance company that provide the vehicle insurance. The latter sometimes use this information to create insurance tariffs, such as pay-as-you-drive tariffs, which are based on driving behavior. One example for Germany is the "Telematik Plus" tariff from HUK-Coburg previously described in the "Accident Statistics" chapter. The "Bonus Drive" telematics tariff from Allianz Insurance works on a similar basis. Drivers on this tariff have a monetary incentive to drive their car with particular caution, which helps to improve road safety overall. Parents can use the feedback to give their children tips on how to improve their driving behavior, as they are usually experienced drivers. The drivers themselves also learn from the feedback about what driving behavior at what point in time was safe and what risks were caused – and can then avoid these risks in future.

Studies have proven that, overall, the use of such feedback systems reduces safety-relevant incidents by up to 50 percent. Although there is still insufficient research into the link between the systems and actual traffic accidents, the data to date suggests the impact of feedback systems on accident risk is positive. It is most effec-

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DEKRA Xpress Course Helps Drivers Get Driver's License Back Following Speeding Offenses During Probationary Period

Young drivers who commit a lot of offenses often have deeply ingrained abnormal developmental issues and attitudes which are resistant to change and closely linked to their personality. This is why offenders undergo interventions that promote fitness to drive before they are assessed in this respect, similar to the present case upon the advice of an attorney. Over the course of three and a half years, Steven committed four offenses, including three serious instances of exceeding the speed limit by more than 44 km/h. He received a total of six points for these offenses, and because he was still in his probationary period, this resulted in the withdrawal of his driver's license. A specialist intervention starts by evaluating the extent to which the offender has a problem in adapting their behavior to be appropriate in traffic.

In this case, the offender was found to display an "insufficient willingness to adapt on the road," based on exhibiting an increased readiness to take risks, reduced hazard perception, and a tendency to form bad habits. A schedule detailing the necessary changes and suitable intervention steps was devised. Consequently, it was recommended that the client take the XS tier/duration of the DEKRA Xpress course (seven sessions over four months).

DEKRA Xpress is a traffic psychology rehabilitation program which, depending on the tier/duration (XS through XXL) focuses on different delinquency types and problems and aims to correct these. It is a multi-component program based on both knowledge-building elements and psychotherapy elements that have proven effective in treating substance consumption or impulse control problems. It also puts an emphasis on participant interaction and on creating a group dynamics effect. The DEKRA Xpress program can be conducted face to face as well as online,

and for this reason it has a modular structure. In each session, the course instructor teaches a psycho-educational element, for example the laws of learning, self-efficacy expectations, the fitness-to-drive rating system, or the physics of calculating stopping distance. Most of the time, participants are also given just under two hours of time to complete individual work on a one-to-one basis with other participants before presenting to the group. Horizontal behavior analyses (offense by offense) with the ABC method, for example, are often drawn on in this case. Another important element is a biographical, vertical behavior analysis. For example, "penalty points in the person's lifeline" in order to demonstrate the function of misconduct and changes over the course of their life.

The last session is an opportunity for participants to take stock and consolidate what they have learned in a final test, similar to a mock exam sat by trainees. Now it is Steven's task to talk about the offenses in terms of their function and to outline the attitude and behavior changes he has committed to making. Furthermore, he has to describe situations and emotional states in which he must be vigilant in order not to fall back into his previous, dysfunctional behaviors. This includes outlining coping strategies. If, following the group sessions in the intervention circle, there is still the need for one-to-one discussions, these can be booked additionally. At the very end of the program, participants receive a certificate of participation, which can be used as evidence in the subsequent medical and psychological evaluation on the assessment day. In this particular case, the course instructor was confident that her client would succeed in demonstrating how he had changed in the medical and psychological evaluation and would receive a positive road use behavior outlook. Steven was granted his driver's license back and now has six months of his probationary period remaining.

tive when feedback is provided to both the drivers and their parents, and providing feedback to the parents tends to be more effective than providing feedback solely to the drivers.

ADDRESSING CONCERNS AROUND THE USE OF FEEDBACK SYSTEMS

People sometimes have negative expectations and fears in terms of using feedback systems, which has prevented uptake of these systems from becoming more widespread. Some of the elements that concern people is data protection and privacy, as well as their independence, a lack of trust, and technological limitations, and so the number of people using these systems is limited. Young people fear that the systems could be used by their parents to monitor and punish them – which is not an unjustifiable fear. They also consider the monitoring aspect as undermining their newly gained independence through driving, and that their relationship with their parents could suffer. Affordability, however, represents the biggest hurdle. Parents who are concerned for their children's safety tend to be more prepared to install the necessary devices.

To address these obstacles and tackle people's concerns around using feedback systems, improving and simplifying the technical requirements for installing and using the systems is recommended. This could include making it possible

Parents have a lot of responsibility in their role accompanying novice drivers

to operate the systems via an app and making the user interface clear and easy to use. Furthermore, monetary incentives, for example in the form of the aforementioned pay-as-you-drive insurance tariffs, could provide a means of increasing people's readiness to use these systems.

It is also important to clarify what the role of the parents is, which should be to improve their children's driving behavior, and not to punish them. Parents, ultimately, also need a motivation to play their part, and they have to be involved in the process in a similar manner to the accompanied driving process. Protecting young car drivers' data and privacy is of particular importance. The data collection process must be clear and transparent for all: what information is collected and what is it used for? Only necessary, exclusively safety-related data should be allowed to be collected. For example, GPS data should be recorded, but not shared with the young drivers' parents, as otherwise there is the risk of it being used for monitoring. Another way of making feedback systems mainstream that should not be underestimated is through legislation. This could provide useful framework conditions, for example the mandatory use of feedback systems as part of driver training, during the probationary period, or as part of the Graduated Driver License model.

LOW EFFECTIVENESS OF PUNISHMENTS

There are very few claims in specialist literature about the clear link between feedback and the laws of the psychology of learning on changes to behavior. It is well known that people learn best through success. If a certain behavior is followed by a pleasant consequence, this is called positive reinforcement. If an unpleasant consequence is removed, this is known as negative reinforcement. Both positive and negative reinforcements have both been proven to promote behavior in that they trigger an increase in the frequency of the behavior that preceded the consequence. Positive reinforcement is experienced as a reward, affirmation, or success and triggers positive emotions, such as joy or pride. Negative reinforcement is perceived as relieving, as it brings an end to an unpleasant state, such as fear or boredom. Conversely, the occurrence of undesirable behavior consequences is referred to as a punishment, which reduces the frequency of certain negative behavior and thus the person learns to avoid that behavior.

Learning psychology research results are unanimous in suggesting that punishments should not

THERE IS STILL A LOT OF DEVELOPMENT POTENTIAL ON A DRIVER-VEHICLE INTERFACE LEVEL

be expected to have much effect, as these suppress the behavior mostly only over the short term but do not completely eliminate the undesirable behavior. It would therefore appear sensible to explicitly reward safe behavior and to use a combination of positive and negative reinforcement. What this might look like is exemplified by the following examples.

If a driver does not maintain a safe distance to the vehicle in front, this could be signaled to the driver acoustically until a safe distance is reestablished. This would be a form of negative reinforcement, as the unpleasant warning signal stops. If a driver overtakes another vehicle without error and without endangering other road users, they could be rewarded for this, which would reinforce behavior that promotes road safety. Apart from verbal feedback, the driver could also collect hypothetical reward chips, which later on they could swap for vouchers or for a reduction in their probationary period. At nightfall, the driver should receive a signal to switch on the lights. If the young driver switches on the lights in time and upon their own initiative, this could be rewarded with reward chips. If the roads are icy or it is snowing, the driver could receive a warning about the road conditions by means of an acoustic signal or a notification on the display. If this causes the driver to reduce speed, this could be rewarded with verbal feedback such as "Good work for paying attention."

These are just a few examples of how situation-based driving behavior can be directly influenced with positive feedback. Other possibilities include providing the driver with a journey feedback summary at the end of a drive. For example, if a person has driven along winding inter-urban road without cutting corners while keeping to the speed limit, they could be rewarded for this. A drive log could be displayed on the display showing what positive and negative situations occurred during the drive.

In summary, to protect lives and prevent physical injuries in road traffic, it is essential to constantly assess the effectiveness of existing road safety regulations in ensuring safety, and to optimize them if necessary. It would appear that, on a driver-vehicle interface level in terms of using technology to help young drivers habitually drive in a road-safety promoting manner, there is still considerable potential for development that must be used moving forward. It is also important to consider that constant preaching on road safety is not enough to turn people who will never be perfect into safe drivers. Lessons can also be learned in this area of behavior through the arduous task of acquiring experience, with a driver making mistakes and learning from these and so improving the behavior that led to the mistakes over the long term. Although it is a tiring method, it can be constructed in a smart, moderated, and target-group-specific manner through the ever-expanding pool of gained experience.

REWARD A SAFE DRIVING STYLE THROUGH NEGATIVE AND POSITIVE REINFORCEMENT

The next chapter "Technology" takes a closer look at how, on a driver-vehicle interface level, in addition to the feedback systems for young drivers, advanced driver assistance systems will become increasingly important in future to the continual improvement of road safety.

The Facts at a Glance

- **The risk factors for novice drivers include insufficient driving experience, insufficient vehicle control, distraction from the traffic situation, using digital media, and driving under the influence of alcohol or illegal drugs – all of which have been the subject of extensive research.**
- **The risk of being involved in an accident peaks during the period immediately after passing one's driving test and then declines significantly.**
- **The fact that the various brain structures mature at different times means that most young people are relatively willing to take risks.**
- **The risk of drink driving in road traffic increases with regular and excessive consumption and correspondingly marked drinking habits.**
- **Speeders are often car fanatics who define their self-worth and identity through the use of powerful vehicles in spectacular driving scenarios.**
- **The driving behavior impairments caused through distraction are concomitant with a higher accident risk.**
- **The use of in-vehicle feedback systems can help to increase road safety for novice drivers and young drivers.**
- **Some newly qualified drivers interpret passing their driving test as proof that they are already good drivers and have nothing more to learn. In fact, usually the opposite is true.**

Technical Safety Saves Lives

The potential for accidents, which is especially high when people first start driving, can be reduced by making use of vehicle technology. One aspect that is crucial to achieving this is the continual advancement in digitalizing vehicle drives in combination with control equipment. Because of this, the systems that are installed should definitely not feature any serious defects or impermissible changes to the design and should be working flawlessly. DEKRA has proven how important this is in several road tests, with striking results. In the future, systems such as the automatic speed limiter could also reduce the risk of accidents. After all, excessive speed, or speed that is not appropriately adapted to the situation at hand, is one of the main causes of accidents for young drivers.

Owning your first car: long yearned for as a symbol of reaching adulthood, the embodiment of achieving autonomous mobility at long last and, in many countries, an outward sign of being of legal age. The needs and desires of young novice drivers are wide-ranging and there are models and equipment variants on offer to satisfy just about everything that can be thought up. That is, were it not for the purchase price, follow-up costs and, often, the ground rules set by parents. It is clear that where the driver lives and the intended use are important factors in the choice of vehicle. Novice drivers in urban areas who mainly travel short distances and do not have their own parking space, may use a different type of vehicle compared to novice drives of the same age who live in rural areas and need the car for their daily 30 kilometer trip to and from their educational institution.

INDIVIDUAL, BUT SAFE

Besides where the driver lives, personal preferences also factor into the decision-making process. Whether it has to be sporty or cute, it's essential that it's red and shiny, or it has to have at least 95 kW and a Bluetooth interface, these issues play just as much of a role as an individual's attitude towards sustainability and safety. Also, only very few young novice drivers can afford a brand new vehicle, and often there is no second car available to borrow from the parents. Because of this, the

choice is often limited to cheaper, older minicompacts or subcompacts. But this exact combination can lead to a number of weak points in terms of safety – even more so for those who took their driving lessons in comparatively new passenger cars of a high technical standard. According to information from the European Driving Schools Association, there are major differences between countries when it comes to this.

MANY PARAMETERS HAVE AN IMPACT ON VEHICLE SAFETY

In keeping with the objective of this report, a few factors should be examined in more detail at this point, which, from the point of view of road safety, must be taken into account when choosing a vehicle, especially for young novice drivers. Good all-round visibility – supplemented when necessary with parking sensors or a vehicle backup camera – can significantly reduce the risk of collisions when parking and pulling out. The smallest possible turning circle with a short vehicle length in total can reduce stress when looking for parking spaces and parking.

Above all, good brakes contribute significantly to avoiding accidents or, at the very least, to mitigating their consequences. Independent vehicle tests show time and time again that there are even significant differences in this regard between new vehicles. The condition of the brakes also plays an important role in used vehicles. Both should be considered when buying a vehicle. However, even the best brakes are useless if you skimp on the tires. Tires that are too old or worn-out, cheap, poor-quality tires, wheel/tire combinations that do not match the vehicle and mixing tires can all have an extremely negative impact on driving dynamics and braking behavior and can also lead to accidents. The same applies to lowering that does not match the vehicle and poorly tuned lowering or other chassis modifications.

If the vehicle has to be personalized, this should be not be at the cost of safety. The reliability of vehicles usually plays an important role in the decision to buy them. Electronic systems are repeatedly mentioned as a source of error, with downtimes and high repair costs. However, this must not lead to a rejection of electronic driver assistance and safety systems. The ESP, or electronic stability program, is a must-have for any novice driver. Blind spot assistants, lane departure warning systems, traffic sign recognition and systems that warn you if you are approaching another vehicle too closely are currently not installed in numerous small cars on the used car market, but are definitely worth considering when buying a vehicle.

It is also worth taking a closer look at the lighting. Xenon and LED headlights have also been available in the small car sector for some time, as have adaptive lighting systems. They offer young novice drivers in particular increased safety, especially if they often travel in rural areas. A high-beam assistant helps ensure that the high beams are always switched on whenever possible. Especially on curved stretches, having to switch to

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Road Safety Topics in "Youth Speak"

The Slovak Republic considers young and novice drivers to be one of the biggest problems in improving road safety, because they are such high-risk road users. It is well known that this trend is mainly due to young drivers being more willing to take risks behind the wheel, not being sufficiently aware of the potentially lethal consequences of their irresponsible driving, and tending to trivialize the imminent danger. Their distorted perception of their own driving abilities often far exceeds their actual competence.

The statistics published by the traffic police of the Slovak Republic for 2020 reveal the following: Of the 7,978 reported traffic accidents in which the driver of the motor vehicle was at fault, 1,051 crashes were caused by a driver of a motor vehicle with between zero and two years of driving experience. As far as the age of the driver is concerned, from the published statistics it can be calculated that about every fifth accident involving a driver is caused by a young driver in the 17 to 24 age group.

Under Slovak law, the police decide whether a motorist who holds a Group B driver's license must complete a rehabilitation program, a refresher course, or a test of technical competence if they commit two serious traffic violations or drive too fast twice within two years of being issued a Group B driver's license or having their motor vehicle license reinstated.

The Road Safety Department of the Ministry of Transport and Construction pays special attention to prevention and the education of young novice drivers. We are aware of the difficulty of this process, as it is not always easy to get young people engaged in preventive measures. For example, we consider experiential education and the use of online forms of communication through working with platforms that are specifically geared towards young users to be good practice. Together with them, we offer road safety topics in "youth speak". Young drivers will of course also be taken into account in the future national strategy for road safety in the Slovak Republic until 2030.

low beams while turning the steering wheel when oncoming traffic suddenly appears can lead to stressful situations or unintended steering motions for inexperienced drivers.

Small dents and scratches cannot always be avoided, but they reduce the price and make these types of vehicles attractive for novice drivers on a tight budget. Caution is advised, however, if the vehicle exhibits considerable rust marks or has damage from an accident that has not been repaired properly. Both of these can have a significant impact on passenger safety in the event of an accident. Repairs that are not carried out professionally can also have a negative impact on driving behavior and thus increase the risk of accidents. If in doubt, it is better to stay away from it or have the vehicle assessed by an independent expert.

Before making their final choice of a model, it is particularly important for young novice drivers to test drive as many different vehicles as possible. This is the only way to find out which vehicle you feel comfortable in and which you do not, which features you find helpful and which control concepts are confusing. Feeling comfortable in a vehicle is more important than the design or preferred brand. Consumer protection tests from the respective regional "New Car Assessment Program" (NCAP) also provide important information about the safety of a vehicle. For many years now, safety-related aspects have been rated in this program with up to five stars. However it is important to note that these programs are also evolving and so the ratings of vehicles which were manufactured in different years are not necessarily comparable. Also, when buying a car, the last vehicle inspection should not have been too long ago.

NCAP TESTS PROVIDE IMPORTANT INDICATIONS

Emergency braking from 160 km/h: with new tires, brakes, and shock absorbers, the braking distance is significantly reduced

DEKRA TEST DRIVES WITH A FOCUS ON BRAKES, TIRES, AND ESP

To shed more light on the influence of vehicle condition and equipment on safety-related driving maneuvers, DEKRA carried out a series of test drives for this report. For test vehicles, the experts at the DEKRA Technology Center at the DEKRA Lausitzring in Brandenburg chose used cars which are very popular with young novice drivers due to their low purchase costs, sporty image, or reputation for being particularly reliable. For the first series of tests, no modifications were made to the vehicles. Only the tire pressure was set according to the manufacturer's specifications. The focus was on the brake units, springs/dampers, and tires. All vehicles had a valid PTI certificate and were in an overall condition which corresponded to their respective mileage. Deliberately, no vehicles were chosen with tires in poor condition. The tread depth is listed individually in the test descpritions. The temperatures during the tests were between three and five degrees Celsius.

Comparative braking tests were carried out on wet, very non-slip asphalt road surfaces for the VW Golf VII. The original tires used were all-season tires from a premium brand with a minimum tread depth of between 4.8 and 4.0 millimeters. With an output speed of 100 km/h, the braking distance was almost constant at 44.4 meters in several tests on wet roads. Tires, brakes, and shock absorbers were then replaced. The tires were replaced with new winter tires from a premium brand. The braking distance was reduced to an average of 38.7 meters.

In the test configuration, the same vehicle was driven at an initial braking speed of 160 km/h. Here the replacements reduced the braking distance from 111.0 to 98.3 meters. The braking distance could thus be reduced by around 11 to 13 percent at both speeds. This corresponds to an enormous gain in safety. This becomes clear in view of the residual speed the vehicle that had not been repaired still had at the point where the one with the replaced parts had already come to a standstill. With an initial speed of 100 km/h this was almost 30 km/h and with an initial speed of 160 km/h it was actually around 55 km/h. On road surfaces with less non-slip coating than that of the test track used, the braking distance is higher and therefore so is the added value of having this maintenance work carried out.

THE CONDITION OF DAMPERS AND SPRINGS HAS A MAJOR IMPACT ON DRIVING SAFETY

The DEKRA experts performed a double lane change with a Honda Jazz. In this process, an evasive reaction to an obstacle suddenly appearing on the roadway and the subsequent steering back to the original lane were simulated. A similar test setup is known colloquially as the "moose test". The driving stability of vehicles is tested while driving through a course marked with traffic cones at higher and higher speeds. No ESP was installed in the test vehicle used. In addition to the condition of the tires – here, in particular, age, tread design, and tread depth – the condition of the dampers and springs is hugely important. They ensure that the contact between tire contact areas and the road surface is maintained, even with rapid load changes.

An area of the test site on which the road surface corresponds to the specifications of the relevant ISO standard served as a test track. The amount of water on the road surface was identical in all test drives. In its original condition, the vehicle was fitted out with all-season tires. The tread depth was at least five millimeters on all tires. Overall, the vehicle handled very pleasantly. The course could be driven through with the unrepaired car at speeds of up to 65 km/h . At higher speeds, the vehicle swerved.

After fitting new brakes, tires, and shock absorbers it was possible to drive through at 70 km/h. New all-season tires from a well-known manufacturer were used. It should be taken into account that these tests were carried out by a professional test driver and that the tires in the first series of tests had a good tread depth. Even for experienced "normal" drivers, driving safely through such a course – or going around the obstacle in a real emergency situation – is barely possible at this speed range. In an emergency, inexperienced novice drivers can be expected to lose control even at much lower speeds. The additional safety that is gained through replacing these parts should not be underestimated.

In its original condition, the test vehicle swerves at 70 km/h during the "moose test", and this is with a professional test driver. For novice drivers, the vehicle would be uncontrollable in such a situation, even at significantly lower speeds

ESP CAN PREVENT SKIDDING ACCIDENTS AND DRIFTING OUT OF LANE

The third test carried out shows the huge importance that condition of the vehicle, particularly in terms of the chassis, brakes, and the correct and good-quality tires, has for the effectiveness of built-in ESP systems. The BMW 1 Series (E87) that was used was equipped with name-brand summer tires. The tread depth was 2.2 and 2.6 millimeters on the front axle and 1.7 and 2.0 millimeters on the rear axle. The car was accelerated up to 130 km/h three times on a wet asphalt surface. A fast so-called sinusoidal steering maneuver with an extended holding time and a steering angle amplitude of 125 degrees was initiated at a predetermined point by a steering robot. In terms of actual driving, this roughly corresponds to a sudden evasive maneuver. Normally it is not a problem to keep the vehicle stable in this situation using ESP. However, even though the ESP was working properly, the vehicle swerved during several test drives. This shows that the ESP control is only effective to the extent to which the chassis, brakes, and tires can transfer the corresponding forces to the road.

THE LIMITS SET BY DRIVING DYNAMICS

For the second series of tests, the brakes and shock absorbers were replaced and the wheels were fitted with new tires of the same type. In each of the three test drives after this repair, there was no loss of traction at any point. The vehicle was consistently caught by the ESP and remained stable. A further series of tests was carried out to illustrate the effectiveness of the ESP. An Audi A3 Sportback was fitted with a steering robot in order to generate a reproducible maneuver, as in the previous tests – this time corresponding to a quick evasive action. The ground was a wet asphalt surface and the driving speed was 80 km/h. With the ESP switched on, the vehicle did tilt slightly, but it was immediately stabilized by the ESP's control intervention and would therefore have remained fully under control. In the same test configuration, but with the ESP switched off, the vehicle spun on its vertical axis in an uncontrolled manner. Countering this would have been impossible, even for the experienced test driver.

The tests strikingly show how important it is for vehicles to be in a technically sound condition. Especially when buying a used car, you should

Steering intervention at 130 km/h: with worn tires, the vehicle swerves and the ESP cannot realize its full potential

therefore hold back part of the budget you have available for any necessary inspection and maintenance measures. Reliable and stable contact between the tires and the road is essential in all road conditions, because only then can it be guaranteed that assistance systems, such as the ABS and ESP, will be effective. In the case of young novice drivers in particular, the idea that older or worn tires are fine to get started with or for low mileage requirements must be rejected. The major potential benefits of ESP for the prevention of skidding accidents or lane departure accidents has been clearly proven in studies. Cars without ESP should therefore not be bought, especially by beginner drivers.

PTI REVEALS SAFETY-RELATED DEFICIENCIES

Given the fact that – as previously mentioned – many young drivers very often drive older vehicles, mainly for financial reasons, periodic monitoring is and will remain a key aspect of road safety. Aging, wear, and often a lack of awareness about technical faults as well as skimping on repairs and maintenance inevitably mean that older cars usually exhibit significant defects more frequently, and thus present a greater accident risk than newer cars. However, a high level of road safety is only possible if the vehicles are in good technical condition and if this is monitored regularly.

One look at the results of the general vehicle inspections carried out by DEKRA in Germany in 2020 makes it clear how important the periodic inspection is (Figure 15). Defects were found in about a third of all vehicles. Almost 12.5 percent of vehicles had minor defects, while around 20.5 percent had significant defects. Dangerous defects were found in 0.5 percent of the vehicles. Fortunately, only around 0.05 percent of the cars were not in a roadworthy condition.

If you split the results according to vehicle age, the following picture emerges: almost 8 percent of vehicles up to three years old had defects, while around 20 percent of vehicles between five and seven years old had them. Vehicles older than nine years had a defect rate of 40 percent. In fact, 25 percent of these had serious defects. Ultimately, however, the true defect rate of vehicles on the road is undoubtedly far higher than that shown in the defect statistics from DEKRA and other testing organizations.

During a steering maneuver on a wet surface, the ESP shows what it is capable of

Background: a lot of repairs and service work do not get dealt with until the general inspection is due. This means that the vehicles often go into the inspection having been prepared beforehand. Amongst other things, this has been shown by the results of the Safety Check DEKRA conducted to-

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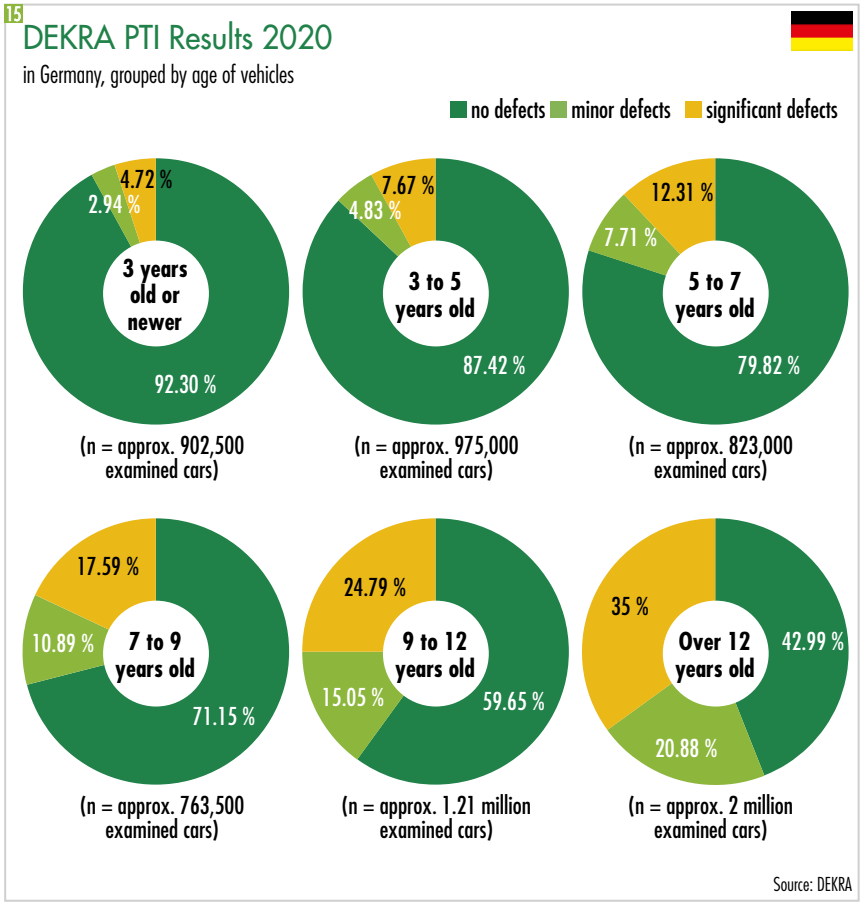

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Young People Often Behave Recklessly

In Brazil, we still have a lot of work to do on certain type of culture: the culture of road safety. We don't talk very much about road safety – whether at home, at school, in the media, or in civil society more broadly. Beyond this, there is a lack of understanding about it among young people. They overdo it when it comes to speed and alcohol consumption. In some countries, young people can officially obtain their driver's license from the age of 16. In Brazil, people under the age of 18 are not allowed to take driving lessons. We still have to address road safety in the early stages of life and during school. We can only really envisage lowering the age to 16 over the next two decades at the earliest, because we are still at the very early stages of this discussion.

The impact of young people on urban mobility in our region is multifaceted and primarily involves safety and relocation in urban areas. Young people aged 15 to 24 use a lot of online driving services when they travel, which increases the CO_2 footprint of private transport. Interest in the national driver's license (CNH) remains low, simply because there is not much need. There are other modes of transportation available, employers usually don't require a driver's license, and working from home is becoming more and more commonplace. Nevertheless, Brazil is currently ranked fifth when it comes to traffic accidents. Each year more than 40,000 people lose their lives in road accidents, incurring costs of about 50 billion real. In the state of Rio Grande do Sul there are 1,500 road deaths every year, 30 percent of which are young motorcyclists. We have found that young people tend to behave recklessly, that there is a culture that does not encourage them to drive, and that safety is an aspect that is neglected. Given the low demand for driver's licenses and the widespread use of public transport, young people may no longer be the main players in traffic accidents in Brazil in the coming years.

As tragic as the public health consequences are, the pandemic is and will continue to be an important driver for changes in a wide range of areas, including urban mobility. Over the course of the crisis we switched from the workplace to working from home and from shops to delivery services, where we can shop for everything from groceries to durable goods without leaving home. In the next few years, autonomous driving will bring about the greatest change. It will increase road safety because the vehicles will be networked with one another. Today, 90 percent of traffic accidents can be put down to human error. Because of this, the number of traffic lights could also be reduced. The future of urban mobility will be shaped by technological developments in the coming years. Soon, electric, autonomous, and driverless cars will be out on the roads and that will undoubtedly have an effect on safety and mobility in cities.

gether with the Deutsche Verkehrswacht (German Road Safety Volunteer Organization) and the Deutscher Verkehrssicherheitsrat (German Road Safety Council) over a number of years. Through this campaign, young adults could have their vehicles checked for safety defects free of charge, outside of the mandatory vehicle inspection. It has shown both that the vehicles in the target group were significantly older than the average of all vehicles and that the proportion of defective vehicles was well above the average for the general inspection. The cars tested in the Safety Check were approximately twelve years old on average, and the total defect rate of the vehicles reached valuesof around 75 percent. Most of the defects were found in the chassis, the wheels/tires, the bodywork, the lighting system, the electrics/electronics, and the braking system.

THE DEFECT RATE INCREASES SIGNIFICANTLY WITH THE AGE OF THE VEHICLES

If you take a closer look at the defects DEKRA found in PTI in Germany in 2020, you can see that the lighting equipment, at about 25 percent, and the brakes, at around 16 percent, were in first and second place. Defects in axles, including wheels and tires, also ranked high at over 14 percent. However, in the case of vehicles up to three years old, the experts only found fault with the lighting equipment in about 4 percent of the cases. This percentage increased to almost 30 percent for vehicles over nine years old and to over 45 percent for vehicles over twelve years old. This sharp increase could be seen across all components, which makes it clear that, on average, the older the vehicle is, the more defects it has.

Clearly, whether passengers reach their destination safely and unharmed crucially depends on

the condition of the brakes, the chassis, the tires, and the lighting system. This applies above all on roads outside of built-up areas which feature risks such as higher driving speeds or differences in speed between road users, varying road surface qualities and oncoming traffic or crossing traffic. The examples of accidents presented in this report make this abundantly clear.

POSSIBILITIES FOR RESTRICTING SPEED AND OTHER FUNCTIONS

The power and speed offered by the vehicles that young people tend to drive create an irresistible desire in some novice drivers to push them to their full potential. Feeling exhilarated because they have a driver's license at last, they just want to drive around, free and "totally autonomous". It is not uncommon, however, for this type of driving to come to a bad end. Sometimes, tragically, this happens during the first few kilometers of the journey.

This risk potential, which is particularly high in the beginner's stage, can definitely be reduced by technical means. The continual advancement in digitalizing vehicle drives in combination with control equipment is crucial for achieving this. A decade ago now, the first automobile manufacturer presented a ready-to-use solution that can be used to limit the maximum speed that can be achieved to a set value by means of a programmable ignition key when it is used by, for example, a novice driver.

However such a restriction on the maximum possible speed offers no guarantee that what is stipulated by, for example, the German Road Traffic Act with regard to speed in all driving situations, is actually being observed. In Section 3 it states: 'A person operating a vehicle may only travel at a speed that allows them to be in constant control of their vehicle. In particular, they must adjust their speed to road, traffic, visibility, and weather conditions as well as to their personal abilities and to the nature of their vehicle and its load.'

Observing traffic regulations plays an especially vital role in ensuring increased safety. On certain sections of road, traffic signs indicate particularly dangerous situations and therefore require compliance with a lower maximum permissible speed. Special protection applies to particularly vulnerable groups of people, for example in front of kindergartens, schools, and retirement homes.

In the future, in order to further ensure compliance with the speed restrictions in force (in addition to traffic controls, which are also effective), there will also be on-board devices that will directly have an impact upon adherence to speed limits.

AUTOMATIC SPEED LIMITERS

These devices include, for example, the Intelligent Speed Assistance (ISA) system. Since the EU expects this to have a positive effect on reducing the number of accidents, it has stipulated that from July 6, 2022, all new vehicle types (cars, vans, trucks, and buses) must be equipped with an ISA system. ISA will then be mandatory in all new vehicles from July 7, 2024. Traffic sign recognition and cruise control (along with speed regulators/speed limiters) are now increasingly standard in passenger car equipment. ISA will connect the systems in order to assist the driver in complying with the current speed limit. ISA is designed to recognize the current speed limit by using a video camera and/or GPS support. The intelligent speed assistant can be overridden by the driver at any time. In order to gain acceptance, it is also possible to switch ISA off, with the system reactivating every time the vehicle is turned back on.

The driver can override the system using the gas pedal, for example when overtaking when the speed limit changes. Whenever this occurs,

Speed limits, among other things in front of schools, make an important contribution to increasing road safety

the driver will receive a visual and acoustic signal until they reach or drop below the maximum permitted speed. Then the ISA will be reactivated. ISA does not control the speed by applying the brakes, but by reducing the engine power. There is a corresponding visual and acoustic warning for this. It can also increase the resistance from the gas pedal. It is still the driver's responsibility to apply the brake. Automatic braking only occurs if the vehicle has an automated emergency braking system or an adaptive cruise control system on board.

At the moment it is still difficult to say what accident avoidance potential ISA has. But if, for example, half of all registered vehicles in Germany were equipped with the system in 2030, 2.8 per cent of fatal accidents (equal to approximately 100 road deaths) could be addressed with the help of the system. However, this would only apply in situations where the accident would not have occurred if the speed limit had been observed, which is not always the case. The system can only be fully effective if it is always functioning and if the driver is aware of the warning system and actually responds to its cues. What is also clear is that ISA is "only" an assistance system. In other words, the driver is and remains responsible for observing and complying with the current speed limit at all times.

A speed limiter can be used to set the speed that should not be exceeded when driving

AUTOMATIC SPEED LIMITATION IN TRAFFIC CALMING ZONES AND PEDESTRIAN ZONES

In the future, the basic principle of automatic speed limiters could also be applied to other means of transport such as e-scooters or pedelecs, as long as the appropriate hardware and software is in place. DEKRA sees this as a prime opportunity to reorganize the current coexistence and confusion in areas primarily reserved for pedestrian traffic, which often leads to conflict and accidents, in a mutually beneficial way and without causing any serious hazards. With an automatic temporary speed reduction for e-scooters and pedelecs from 20/25 km/h to walking speed (7 km/h), the desired model of lively, multimodal inner city areas could be successfully realized in the near future.

The extent to which such solutions could also be applied to certain sections of cycle paths and so-called long-distance cycling routes in the future remains to be seen following successful pilot projects. In any case, DEKRA is in favor of the implementation of such projects. A temporary automatic speed reduction of (appropriately equipped) S-pedelecs (capable of 45 km/h) to a maximum of 25 km/h is also being considered here, as this is the speed limit for electric motors in conventional pedelecs, which are already used on all cycle paths. This would put them on an equal footing with bicycles.

DEKRA SURVEY ON THE LEVEL OF KNOWLEDGE AND THE EVALUATION OF INSTALLED DRIVER ASSISTANCE SYSTEMS

Numerous studies have shown that assistance systems make an important contribution to helping to avoid accidents as far as possible or at least mitigating their consequences and thus reducing the number of fatalities and serious injuries. It is therefore with good reason that the EU Commission has made various safety-relevant driver assistance systems mandatory for new motor vehicles on Europe's roads as part of the General Safety Regulation already adopted in March 2019. For passenger cars, in addition to the intelligent speed assistant, this also includes emergency brake assistance systems, emergency lane guard assistance systems, reversing assistants, driver fatigue and waning attention warning systems, and fixtures to install an alcohol-sensitive immobilizer. In light of this, it would undoubtedly be desirable for the use of automated driving functions and driver

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Light at the End of the Tunnel

In Poland, work on a new system for obtaining a driver's license for motor vehicles began as early as 2001 in the Secretariat of the National Council for Road Safety. One of its premises was the need to implement solutions that would reduce the number of road accidents involving young drivers. After several months of work, which included examining best practices in countries that had succeeded in reducing the risk of accidents for drivers aged 18-27, and after consultations with leading Polish and international research centers, it was possible to develop a complete and definitive system design.

The project came up with an array of innovative solutions, such as, for example, compulsory psychological tests for all prospective drivers, the opportunity to take part in driver training with an accompanying person from the age of 16, probationary driver's licenses with special supervision for young drivers, a second part of the training after the end of the probationary period, with a special focus on recognizing and avoiding dangers, and raising awareness about individual limitations. Another intended part of the new system was educational courses (with the aim of changing behavior behind the wheel) for people who frequently violate traffic rules or drive under the influence of alcohol or substances with similar effects.

Unfortunately, from the very start the legislative proceedings for the bill implementing the Secretariat of the National Council for Traffic Safety's research were strongly influenced by politicians, who feared that the proposed solutions would be poorly received by the public. Among other things, they have ensured that the mandatory psychological tests, driving with an accompanying person, and certain solutions related to restrictions and supervision for young drivers were removed from the project. Due to political turmoil, the Motor Vehicle Drivers Act bill was not passed until 2011, and to date, practically none of the provisions concerning young drivers have entered into force. We wasted 20 years due to this and young drivers in Poland are still dying in accidents and still causing too many accidents.

However, there is light at the end of the tunnel. The Polish Ministry of Infrastructure has publicly stated its willingness to return to the idea of driver training in the form of driving with an accompanying person. We hope that from time to time the solutions contained in the current law on drivers, the entry into force of which has been postponed indefinitely, will also be "relaxed".

assistance systems to be taught as early as during driver training throughout the EU, but also for the limitations of these systems to be made clear. In an ideal situation, confidence in handling these systems would also be part of the driving test.

But what level of knowledge do young drivers have when it comes to the various driver assistance systems that might be installed, and what level of importance do they ascribe to these systems? Important, somewhat important or not important? To find out more about this, DEKRA conducted a random sample survey. A total of 41 students, trainees, and pupils between the ages of 19 and 28 took part, 51 percent of whom were women and 49 percent were men. A total of 14 different vehicle manufacturers were included in the analysis, with Volkswagen accounting for the largest share with over 30 percent. The year of manufacture of the vehicles examined ranged from 1990 to 2021, with just under 80 percent of the vehicles having been registered after 2008. About 40 percent of the vehicles in the study were registered after 2015. The annual mileage ranged from 2,000 to 30,000 kilometers, with an average of 10,000 kilometers. 44 percent were self-owned vehicles and 56 percent were third-party vehicles. In both cases there was a high proportion in the minicompact and subcompact class segments.

First, the participants were asked about the basic details of their car, then they were interviewed about the presence of various driver assistance systems. The focus was on systems such as ABS/ESP/ASR, adaptive cruise control, automated emergency braking, blind spot assistant, lane departure warning assistant, lane guard assistant, driver fatigue detection/attention assistant, high-beam assistant, automatic low beam, tire pressure monitoring device, rain sensor, traffic sign recognition, and the eCall automatic emergency call system.

The survey of the participants was carried out by student employees from DEKRA's accident research department. They had each received a technical briefing before the survey, so that if the par-

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Youth Mobility: Risks and Possible Solutions

Models, fashions, and priorities are changing, including when it comes to mobility. As we have seen in recent years, obtaining a driver's license is becoming less and less important to young people. 45 percent of young people under the age of 34 do not have a driving license (according to the Spanish Directorate-General for Traffic, 2021). There are various reasons for this, but above all, this new trend is due to job insecurity and the emergence of new mobility models (electric bikes and scooters), which can be rented on an as-needed basis at an affordable price.

In addition, the type of causality within this age group has changed. The demographic profile of young fatalities in road accidents is no longer primarily the driver, but the passengers who are on board, even though the driver has consumed drugs or alcohol. In addition, the accident rate for 15 to 24 year olds is very high: in 2019, 172 young people were killed (37 young people per million inhabitants) and 1,223 were seriously injured (many with irreversible, disabling injuries). At AESLEME, we are aware of the risks young people face and the type of personality and attitude that can cause them to be involved in a road accident and we educate them about these in our prevention campaigns. These include a lack of experience, driving older vehicles, driving at night (especially when tired and possibly after consuming alcohol and/or drugs), lower hazard perception, an overestimation of one's own abilities, the need for self-affirmation, showing off due to group dynamics, higher impulsivity, and a lower inhibition threshold for traffic violations and breaking the rules of society in general.

Traffic accidents are avoidable but they are unfortunately still the leading cause of death and disability among young people. It is important to come up with solutions to reduce the risk:

- Information, raising awareness, communication of values from an early age.
- Parents leading by example (as children we learn by imitation).
- Never driving under the influence of alcohol and promoting the idea of the designated driver, the friend who refrains from drinking so they can drive that evening. Taking a taxi/using a ridesharing app (Uber or Cabify) with a group of friends …
- Communicating the importance of being a good friend and not letting friends who have been drinking or using drugs drive off.
- Communicating the importance of following the rules both while driving/riding (whether on a motorbike, car, bicycle, scooter) and as a pedestrian, and the consequences (irreversible injuries) of being unprotected on the road, without a helmet, seat belt, or reflectors.

We must work together to achieve the 2030 goal of reducing fatalities and serious injuries by half in order to move closer to the "zero casualties" goal.

ticipants had any queries about the various drive assistance systems, they were able to provide a brief explanation of how they work. However, the express instruction was to intervene in the survey with as little help as possible in order to gain a more realistic picture. DEKRA's accident research department then checked these answers and compared them with the systems that were actually installed.

RELATIVELY FEW INCORRECT ASSESSMENTS

Overall, the analysis of the answers showed that of all 533 evaluations of the availability of driver assistance systems, incorrect assessments had been made in just over ten percent of the cases (57). This was either because a driver assistance system was declared to be installed when in fact it was not available, or the opposite case turned out to be true. These two results occurred equally often, by the way. The outcome demonstrates a high level of knowledge among the participants surveyed. Interestingly, the proportion of incorrect assessments relating to third-party vehicles at almost 9 percent was almost the same as in the case of the person's own vehicle at around 13 percent. Here, one might have expected the amount of incorrect assessment when it came to third-party vehicles would be significantly higher.

There were marked differences in the incorrect assessment in relation to the individual driver assistance systems. While the participants were almost 100 percent correct when it came to statements for systems such as ABS/ESP/ASR, adaptive cruise control, blind spot assistant, traffic sign recognition, lane departure warning assistant, and lane guard assistant, the proportion of incorrect assessments was significantly higher for other systems. About one in five participants had made an incorrect assessment about the automatic low beam system and the attention assistant. The proportion was even higher for the rain sensor, at just under 22 percent. The tire pressure monitoring system (TPMS) accounted for the most incorrect assessment, at just under 32 per-

cent. Particularly striking here was the high proportion of participants who thought they did not have a TPMS installed, but actually did have the system on board. A possible explanation could be that many of the participants did not know that TPMS systems have been mandatory in new cars since 2014 and they never noticed the system in their vehicle.

When it came to evaluating the importance of the different systems (Figure 16), major differences were revealed. About 70 percent of the participants considered the lane guard assistant to be unimportant. Similarly, more than 60 percent of them did not consider the traffic sign recognition system and the fatigue detection system or the attention assistant to be important. eCall, conversely, was considered important by 66 percent of the participants. ASB/ESP/ASR were considered important by about 61 percent.

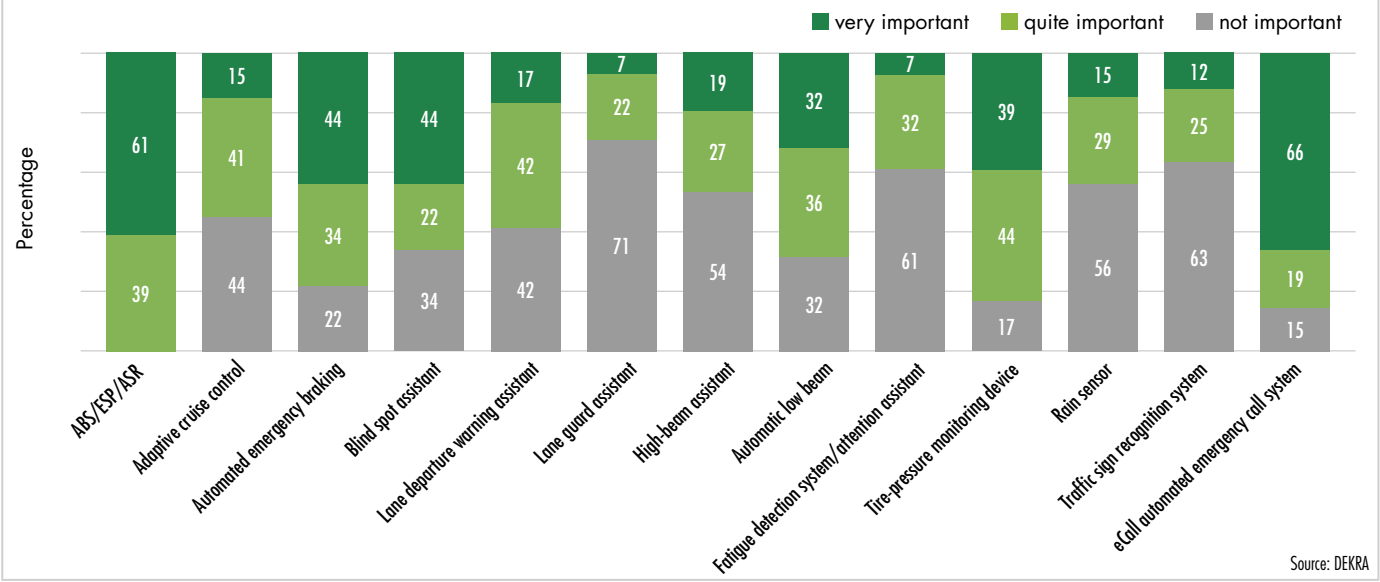
The inflation pressure, which is jointly specified by the vehicle and tire manufacturers for the particular vehicle loading condition, is an important safety factor

THE PROPER SEATING POSITION IS KEY IN A CRITICAL INCIDENT

What happens to the occupants in the event of a road accident depends in no small measure on the question of how well the respective seating position is adapted to the individual's physique, regardless of the passive, active, or integrated safety systems installed. This is because the interaction of the seat, the seatbelt, and the airbag as a whole system can only protect a person as well as possible when the seating position is playing its part. If it is more as though you are lying rather than sitting at the wheel, the seat belt cannot hold you in the event of an emergency stop or an accident. If the front passenger seat is pushed back too far, you cannot realistically expect the airbag to have a protective effect.

Recent crash tests by DEKRA have convincingly shown the impact that the individual adjustment of the seating position to the person's

16 Subjective assessment of the importance of driver assistance systems (DEKRA survey)



Source: DEKRA

physique has on the accident consequences. Three identical vehicles were crashed in three tests, each with three differently sized dummies: the so-called 50th-percentile male with a height of 175 centimeters and a weight of 78 kilograms, the 5th percentile female (154 centimeters, 52 kilograms) and a prototype from the manufacturer Humanetics. This Elderly Dummy (161 centimeters, 73 kilograms) represents an elderly woman with its altered distribution of body mass. In each of the three tests, the three dummies sat alternately on the driver's side, the passenger side, and the back seat. The driver's seat was individually adjusted so that the pedals and steering wheel could be reached easily. The passenger seat, on the other hand, remained in a middle position in all three tests. DEKRA Accident Research had previously determined this to be the most frequently selected setting in passenger cars based on its own survey of real-life cars and an assessment of accident data.

The crash tests revealed considerable differences in accident consequences, especially in the passenger seat. With the middle seat position, the restraint system only exhibited a good interaction for the 50th-percentile male. For the 5th-percentile female, the correct seating position, which would provide the best protection from the seatbelt and the airbag, should be both higher up and much further forward. In the case of the Elderly Dummy, the body's lower center of gravity led to a greater penetration of the dummy into the seat surface, causing it to dip under the lap belt on impact.

MODERN TECHNOLOGY ALSO PROTECTS CYCLISTS AND MOTORCYCLISTS

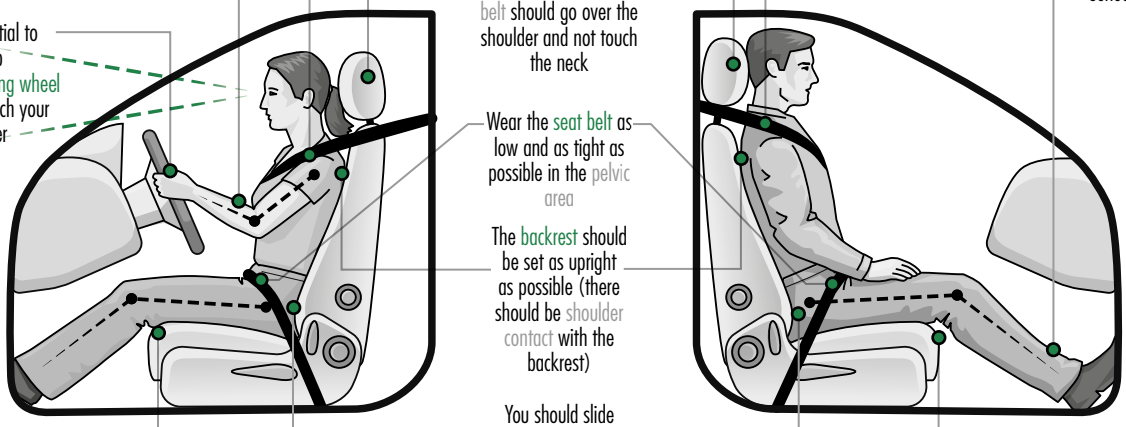
Young people are not only exposed to a high risk of having accidents in road traffic when they are passengers in a car, but also when they are traveling by bicycle or motorbike. The figures cited in

Tips for correct driver and passenger seat adjustment

Adjusting the seat correctly should be given the same priority as a securely fastened seat belt. Even if it is difficult for smaller and/or larger people to get in and out of some vehicle models when the seat is set far forward, seat height, seat surface, backrest, headrest, and seat belt should always be adjusted individually for each driver and passenger. After this, the mirrors should be checked.

Driver's seat

Passenger seat



the "Accident Statistics" chapter clearly illustrate this. Active or integrated safety systems in cars and trucks are therefore becoming even more important as the main forms of protection against accidents. In addition to this, the technology installed on board the two-wheeled vehicles can also contribute towards reducing the number of accident victims. As already presented in detail in the DEKRA Road Safety Report 2020 on the topic of "Mobility on Two Wheels" and convincingly confirmed with driving tests in the DEKRA Technology Center at the DEKRA Lausitzring, the ability to control the brakes on bicycles with front and rear disk brakes is better on both wet and dry roads than other braking systems. With pedelecs, an anti-lock braking system (ABS) provides a significant increase in safety, as it ensures more controlled and stable braking, even under difficult conditions.

The ABS has proved most successful on motorbikes, as it prevents the wheels from locking. Particularly in cases involving emergency braking or heavy deceleration on slippery surfaces, motorbikes come to a stop much more safely and remain easier to control within the limits of driving physics. It also prevents the front wheel from locking, which is dangerous and generally leads to a fall. As a result, they enable motorcyclists to brake at full power. There is now technical further development of ABS technology for motorcycles toward electronic stability control, which is already commonly used in larger vehicles under the name ESP, or electronic stability program.

If an accident that results in injuries occurs, contacting the emergency services quickly could be the difference between life and death, especially in case of severe injuries. While eCall is already a mandatory component for new car models with EU type approval after March 31, 2018, eCall is not yet mandatory for motorbikes. The benefits of this system are obvious, especially in relation to single-vehicle accidents, where other road users who subsequently pass by may not notice the motorbike and its riders and there may not be any outward signs of the accident.

TUNING FOR LIGHT MOTORCYCLES CAN BE DANGEROUS

When it comes to motorized two-wheeled vehicles, small mopeds, scooters and mopeds with kick starters, which are particularly popular with young people, must not be forgotten, as well as electric scooters, which are increasingly widespread. The popularity of these little runabouts definitely has to do with the fact that they are fairly cheap to buy and maintain. They serve as practical and affordable means of transport, with which you can quickly get to school, training position, or university and you are no longer dependent on using your parents as a taxi or taking public transport. In rural areas in particular, small mopeds, scooters and the like represent the point of entry into motorized private transport, the first step in the direction of autonomous and independent mobility.

ABS HAS PROVEN ITSELF ON MOTORBIKES

The desire for independence is an important factor for young people. Within friend groups, owning your own vehicle is seen as cool and is held in high esteem. All this is at odds with the maximum speed limit in Germany, which is 25 km/h for the small moped category and 45 km/h for mopeds. The temptation to increase the maximum speed by technically modifying the vehicles is therefore quite high, as is the pressure to stand out which is specific to this age group. Tuning has therefore been used in this vehicle category for a long time. Then as now, this can be mechanical design modifications involving manipulating the

DEKRA crash tests, including those conducted with the Elderly Dummy prototype, have shown again how important the correct seating position is for passengers

Asia has the highest number of young people involved in motorized two-wheeled vehicle accidents in the world

exhaust system or the transmission. In addition, there has been a rise in illegal modifications to vehicle electronics using so-called tuning kits, which can be purchased cheaply over the Internet.

FREQUENT ILLEGAL DESIGN MODIFICATIONS

Only few drivers, however, think of the consequences that such conversion procedures can lead to. Tuning a two-wheeled vehicle illegally invalidates its type approval, making it illegal to use it on public roads. In addition to this, increasing its top speed means that in certain circumstances a different class of driver's license is required, meaning its user might end up guilty of operating a motor vehicle without a driver's license. In the case of classic small mopeds, there is also the fact that they are built for the maximum speed specified by their design. This can lead to problems. Take braking systems, for example, which are not designed to handle the higher speeds. Since tuning invalidates the type approval, this also gives insurance companies the option of reducing or completely refusing payouts in the event of a claim. But not every instance of tuning poses a safety risk. Professional installation of a sports brake system, for example, can significantly increase the braking power of two-wheeled vehicles, which in turn offers a safety benefit in critical braking situations.

The type of unauthorized design modifications to vehicles is therefore key in the context of traffic checks, and also in the wake of accidents. If the police spot a motor vehicle on the road that seems unusual, regardless of its type, they can have it technically inspected for illegal design modifications by their own specialists or outside experts. DEKRA Accident Research collects the results of technical vehicle inspections carried out by DEKRA experts in its own database. One of the first publications of the analysis results was in the DEKRA technical journal series "Technische Mängel" (Technical Defects), which was first published in 1977.

An analysis between 2016 and 2019 found that there was evidence of design changes on 50.0 percent of the small mopeds investigated after accidents and 26.7 percent of mopeds investigated after accidents (Figure 17). Only 4.2 percent of the cars investigated after accidents within the same period showed signs of illegal design modifications. The percentage of vehicles found to have illegal design modifications during traffic checks was also conspicuously high, especially among two-wheeled vehicles. Illegal design modifications were found in 77.3 percent of the small mopeds that were investigated, 52.0 percent of the mopeds, and 74.5 percent of the motorcycles with registration plates. The figures for traffic checks are naturally higher, since these vehicles were deliberately pulled over by police before being subjected to the additional expert inspection.

TUNING KITS CAN BE DANGEROUS

ACCIDENT-RELEVANT DEFECTS IN A QUARTER OF MOPEDS AND SMALL MOPEDS

Tuning to increase the maximum speed therefore featured heavily each year in the motorized two-wheeled vehicles category, especially in the case of small mopeds, both in investigations after traffic accidents and after traffic checks. In

addition to illegal design modifications, DEKRA experts also examine vehicles if the cause of the accident is unclear or if there has been a serious traffic accident leading to personal injury. The primary focus of these examinations is on whether there was a technical defect and whether this had an impact on the accident statistics.

In this context it is important to consider that the "technical defect" listed in the official statistics is not always connected to the cause of an accident. In a number of cases, the defects mentioned here are those that are directly visible at the scene of the accident, such as a worn tire with a zero millimeter tread depth. If necessary, an expert will also examine the vehicle in a workshop and, if required, dismantle components and/or analyze the software status or the stored data. The expert identifies the fault (e.g. "The brake on the rear axle is inoperative"), determines the effect of the defect on the vehicle characteristics (e.g. "Currently only 70 percent of total braking power is actually available"), and then ascertains the impact of the altered features on the course of the accident, particularly its cause. In individual cases, the DEKRA experts divide accident-relevant vehicle defects into three categories: contributing defect (a defect which did make the occurrence of the accident more likely, but which was not its sole cause), potentially causal defects (where it cannot be proven with absolute certainty whether the accident was due to the defect concerned), and causal defects (a technical defect that clearly caused the accident).

In addition to these, however, technical defects were recorded which did not have a direct or demonstrable effect on the accident but which, for example, would be a minor, significant, dangerous, or unsafe defect in a general inspection. Regardless of whether the defect was accident-relevant, technical defects were found in more than one in two mopeds and small mopeds after a traffic accident in each of the years 2016 to 2019 (Figure 18). If we refer exclusively to accident-relevant defects, a more in-depth analysis of the years 2016 to 2019 revealed that accident-relevant defects were found in around one in four mopeds under 50 km/h and one in five small mopeds. In comparison, this was "only" 6.6 percent in vehicle inspections on a car after an accident, and 12.2 percent in the case of motorcycles with official registration plates. All these figures underline how important periodic technical inspections are, especially for motorized two-wheeled vehicles.

17 Proven design modifications

Technical vehicle inspections 2016 to 2019	Car	Motorbike with official license plate	Moped < 50 km/h	Small moped <25 km/h
After traffic accident, proportion of design modifications	4.2 %	14.0 %	26.7 %	50.0 %
After traffic check, proportion of design modifications	55.4 %	74.5 %	52.0 %	77.3 %

Source: DEKRA

18 Proven technical defects after road accidents

Technical vehicle inspections 2016 to 2019 after road accidents	Car	Motorbike with official license plate	Moped < 50 km/h	Small moped <25 km/h
Percentage of technical defects	22.3 %	28.4 %	57.8 %	61.8 %
Accident-relevant defects	6.6 %	12.2 %	26.7 %	23.5 %

Source: DEKRA

The Facts at a Glance

- **Vehicles that comply with the regulations and are technically sound are a cornerstone of road safety. Periodical technical inspection is therefore essential.**
- **Above all, good brakes contribute significantly to avoiding accidents or, at the very least, to mitigating their consequences.**
- **The ESP electronic stability program is a must-have for any novice driver's vehicle.**
- **Reliable and stable contact between the tires and the road is essential in all road conditions. Only then can it be guaranteed that assistance systems, such as ABS and ESP, will be effective.**
- **Especially when buying a used car, you should hold back part of the budget you have available for any inspection and maintenance measures.**
- **The potential for risk, which is especially high when people first start driving, can be reduced through technological means. The continual advancement in digitalizing vehicle drives in combination with control equipment is crucial for achieving this.**
- **The interaction of the seat, the seatbelt, and the airbag as a whole system can only protect a person as well as possible when the seating position is right.**
- **ABS reduces the risk of accidents, especially on pedelecs and motorbikes.**
- **Illegal design modifications to light motorcycles pose serious safety risks.**

Roads Should Be Self-Explanatory

In addition to vehicle technology and the human factor, a functional and efficient infrastructure is also of crucial importance for road safety, not least for young people. The priority here should be, through road construction and traffic regulation, to eliminate factors that could lead to accidents and also help to mitigate hazard zones in such a way that any consequences would be as minimal as possible in the event of an accident.

Accident statistics from numerous countries show that approximately two thirds of 18-24-year olds who lose their lives in road accidents do so on inter-urban roads. There are many reasons for this. Excessive speed and driving under the influence of alcohol and drugs play just as much of a role as overconfidence and not yet having a particularly well-developed ability to correctly anticipate the course of the road and any possible sharp bends and to adapt the driving style accordingly. A analysis of the data from the road safety screening developed by the Baden-Württemberg Ministry of Transport (a tool that is still the only one of its kind in Europe) paints an interesting picture with regard to the importance of infrastructure for accident statistics, especially when it comes to young drivers. The data analyzed for this report come from the years 2016 to 2020 and concern accident statistics in non-built-up areas without freeways, i.e. on federal, inter-urban, and district roads. According to this report, around 20 percent of the people at the wheel of a car who caused an accident on these roads in Baden-Württemberg were part of the 18 to 24 age group. By way of comparison, in the much larger 25-64 age group, the total was just under 60 percent.

TIGHTER CURVE RADII ARE GENERALLY ASSOCIATED WITH A HIGHER RISK OF ACCIDENTS

If you break down the accident statistics for the given period, it can be seen, among other things, that young people at the wheel of a car were involved in accidents resulting from a loss of control of the vehicle about twice as often as 25 to 64-year-olds (28.6 compared to 14.5 percent). A breakdown by road type shows a significantly

higher proportion of such driving accidents for young people (30.9 as compared to 14.9 percent), in particular for inter-urban and district roads. The reasons for this are obvious: inter-urban and district roads, which make up 22,167 kilometers of the road network in Baden-Württemberg (federal roads account for 4,202 kilometers) contain a higher proportion of roads with narrower lanes which therefore also have tighter curve radii. This means that inexperienced drivers in particular have more problems following the course of the road with their vehicle. Due to their greater importance in the road network and their subsequently higher traffic volume, federal roads are generally of a higher standard.

Young people were involved in accidents with a turning or crossing vehicle in non-built-up areas (excluding freeways) in 25.3 percent of cases (compared to 25 to 64-year-olds in 33.3 percent of cases). Accidents in parallel traffic with vehicles in the same or opposite direction were caused by young people in 26.4 percent of the cases (25 to 64 year olds in 27.5 percent of the cases). Inappropriate speed or breaking the speed limit was attributed from two and a half to five times as often to young people as a proportion as to 25 to 64 year olds, depending on the type of cause of the accident and road category. About one out of three accidents caused by young people took place during the night – for 25 to 64 year olds this was "only" one out of four accidents. The road category had no influence on the value. In a third of the accidents involving young people, the road was either wet or covered in dirt or by snow – for 25 to 64 year olds this was the case for 28 percent of the accidents. Here, too, the road category had no influence on the corresponding value.

Jacobo Díaz Pineda
Director General of the Spanish Road Association

Young Drivers = At-Risk Drivers

Cooperative, nonconformist, open, participative, and ready to face the challenges of education, digitalization, climate change, and the elimination of inequality. These are the qualities that characterize the current generation of young people in our country, according to the "Youth Report in Spain 2020". To these attributes, it is important to add that they are the most educated Spaniards in history. The same goes for being educated about road safety.

This is because those in the age group between 15 and 29 were born at a time meaning they were passengers and pedestrians while the issue of safe driving behavior was being addressed. This is an excellent position to start from, although it does not seem to guarantee safe mobility for this group. Other factors such as the economic crisis, the high youth unemployment rate, and the search for more sustainable means of transport have come into play and led to the emergence and rapid spread of new mobility systems and models, including so-called personal mobility vehicles.

We see them on the sidewalks, in parks, in sports and leisure facilities, and more and more often they are riding on the street or on bike paths. These do not require a driver's license, they can make use of the existing infrastructure, and they do not need too much of an investment – all these factors contribute to the success of these vehicles in cities, above all among young people.

A recent study by the organization MAPFRE reveals that accidents involving e-scooters in Spain increased by 31.6 percent in 2020, with the age range of those affected being between 16 and 35 years. When vehicles of different masses and speeds congregate on the same route, it is the perfect breeding ground for this type of accident, which will not become any less frequent but will probably increase exponentially in the coming years.

The good news is that the solution is relatively simple. It requires the construction of separate lanes or parallel sections for each form of mobility: buses, private vehicles, bicycles, and personal mobility vehicles. However, this requires making investments. Above all, however, there must be an awareness of the problem and the desire to fix it. The safety of our young drivers depends on it.

STRONG SAFETY MANAGEMENT

Even though the data in question is confined to Baden-Württemberg, it is likely to be representative of comparable road accidents in many other countries around the world. It is not without reason, for example, that the EU Commission sees infrastructure as a key policy area for improving road safety. This does not just entail new construction projects, but also, above all, the targeted increase in the safety level of existing roads, as underpinned by EU Directive 2019/1936 of October 23, 2019 amending Directive 2008/96/EC on road infrastructure safety management. Among other things, factors such as the condition of the road surface, the predictability of the road's layout, the ability to see the road clearly, the design of the sides of the road, road markings, the design of intersections and junctions, and the creation of opportunities for evasive maneuvers and overtaking are also of great importance.

In fact, in addition to the condition of the road surface, the ability to see the road ahead and distinguish individual lanes in different light and weather conditions is a key factor for road safety on inter-urban roads. Conventionally, road markings, road reflectors, roadside guide posts and di-

Saul Billingsley
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The Balance of Aspiration and of Need Is Shifting

Children, we are regularly reminded, are the future. So, in a time of climate emergency, what does the future of mobility for young people look like? Will the thousands of teenagers who skipped school on Fridays for Future continue to walk the talk and push pedal power or will they settle, like their once radical soixante-huitard grandparents, for the comfort of an SUV? In the digital age, when a taxi ride or a cycle or scooter hire is a pressed button away, will young people, this first generation to see their earning and home-owning and life-expectancy prospects shrink rather than grow, really sink scarce resources into an expensive car that sits idle for ninety-five per cent of the time?

For the sake of the planet, and for our cities, and for health, and for basic common sense, we have to hope that youthful idealism prevails. It is beyond time that we challenge and correct the prevailing ideology that has ruled streets, destroyed communities, paved highways and fossil-fuelled climate change for one hundred years: that the future belongs to the private car. The 'love affair with the car' was a myth dreamed up by avaricious auto ad-men in the sixties. But there's not much romance in the daily grind of congested commutes and dirty air and fender benders in supermarket car parks.

Generation Z, more than any previous cohort, seems to get this. If there's a love affair today, it is with the smart phone, which is a portal to friends and news and gossip and hook-ups and movies, and can bring private transportation right to your front door and can tell you when the next bus is due and can calculate a walking route and tell you how long it will take to get you where you are going.

Many young people, perhaps the majority, will still want to drive, but the balance of aspiration and of need is shifting. And it is our job, as policymakers and campaigners, to ensure that the shift continues and that the way urban space and public transportation are designed and provided makes it easy for people – not only the young but also that other booming demographic, the elderly (and of course everyone in between) – to make the right mobility choices because they are the obvious choices.

In many fast-growing cities of the Global South, politicians are still catering for a tomorrow dominated by the car, building new urban highways and flyovers; bulldozing homes and chopping leafy, shaded avenues to make way for 'progress'. But their vision isn't the future, and I am confident that young people – like the inspiring youth activists who spoke truth to power at COP26 last year – will take us in a different direction.

rection signs placed in front of bends are used to guide the driver. The roadside area design of inter-urban roads plays an major role both in avoiding accidents and in reducing the consequences of accidents. It serves as an initial guide for the driver as to how the road will continue. At the same time, it creates expectations about the condition of the road ahead and thus has a direct influence on the choice of speed, for example. Discrepancies between the course and condition of the road that are suggested and the actual road must therefore be categorically avoided.

BETTER PROTECTION AGAINST COLLISIONS WITH TREES

Planting trees on the side of the road is a controversial topic that is brought up again and again. When it comes to indicating the course of the road ahead, an avenue is almost unbeatable. However, trees by the side of the road, regardless of whether they are planted in a row, at the edge of a forest, or individually, pose a very high risk to road users in the event of a collision. In addition, they present obstacles to visibility. Wild animals can suddenly run out from behind trees or bushes onto the road, junctions may be seen too late, and the interplay between light and dark means that pedestrians and cyclists, as well as other vehicles that are unlit, only become visible at a much later point in time.

Obviously, cutting down countless trees along inter-urban roads is not possible for a variety of reasons. On the other hand, it makes no sense whatsoever that young trees are still being planted right next to inter-urban roads. Bushes and shrubs are another ecological and safety-sensitive option for road design. When they are present, vehicles are brought to a halt over a large area and relatively gently. Traffic barriers and crash cushions can offer possible solutions at specific points which are known to be potentially dangerous due to trees that cannot be relocated. When drivers lose control of their vehicles, traffic barriers help to keep them on the roadway and thus prevent them from colliding with the obstacles behind. The system's energy absorption and shape all attempt to slow down impacting vehicles with as little stress as possible for the occupants, without allowing them to "bounce off" into oncoming traffic. Special protective measures must be taken for motorcyclists, lower rails, for example.

TRAFFIC CONTROL MEASURES

Another problem associated with accidents on inter-urban roads is that overtaking maneuvers can often end in head-on collisions or skidding off the roadway. Insufficient visibility, misjudging distances and speeds, and impatience are just some of the reasons for the often fatal decision to overtake. Especially on inter-urban roads which see more traffic from trucks, there are significant differences in speed between vehicles and many car drivers want to overtake as quickly as possible. Suitable options need to be created here. The optimal solution would be to widen inter-urban roads to four lanes, with structural separation of the roadways, as has been the practice in Sweden for years now. Road safety on inter-urban roads can also be increased by using overtaking lanes in sections in combination with prohibitions on overtaking and speed limits. However, the mere ordering of maximum permissible speeds does not lead to an increase in safety. The desired effect can only be achieved if road users also obey the rules. There must therefore be a risk that speeding will be identified and punished. In the Netherlands, there is a system in place involving designing the road in such a way that you automatically drive at the speed that is intended there. Intelligent road design can thus reduce the need to monitor the speed limit.

What is clear is that road safety costs money. Measures to improve the infrastructure are often particularly cost-intensive. However, reliable and safe infrastructure is also the backbone of a country's economy, as well as individual mobility and thus quality of life. Long-term planning and a safety-oriented use of funds can help to save money in the long run. If you don't plant the tree right next to the edge of the road today, you won't have to pay for an expensive traffic barrier in front of it tomorrow. If you renovate and freshly mark the road surface over a large area, this is more economical than constantly repairing damage that is penetrating deeper and deeper into the road structure.

In the end, the goal must always be the self-explanatory road that mitigates accident consequences. In other words, the user should intuitively recognize the type of driving behavior and what speed is required of them based on the road design alone. It should be possible to identify dangerous spots. At the same time, the road should offer sufficient safety margins so that a driver can quickly regain control of their vehicle after a mistake and, if possible, no accident would occurs or the consequences of the accident would be less serious.

Trees next to the road pose a high risk for road users in the event of a collision

The Facts at a Glance

- **Rural roads with narrow lanes and small curve radii present particularly high risks for novice drivers.**
- **Potential danger spots should be mitigated as much as possible by means of road construction and traffic control measures.**
- **The roadside area design of inter-urban roads plays an major role both in avoiding accidents and in reducing the consequences of accidents.**
- **Trees should be avoided on inter-urban roads when it comes to the design of the immediate roadside area. Bushes and shrubs are an ecological and safety-sensitive alternative.**
- **For stretches of road with a significant amount of oncoming traffic collisions, it is recommended that they are systematically widened by two lanes with a structural separation of the roadways or that there is an alternation between one and two-lane sections.**
- **The ultimate goal of all infrastructure measures must be a self-explanatory road that mitigates accident consequences.**

Road Safety for Young People Is a Global Challenge

With around 175,000 people between the ages of 15 and 24 killed in road accidents worldwide, this age group is estimated to have accounted for around 15 percent of all road fatalities in 2019. 80 percent of them were young men. In order to lower these figures, there is a need for action on a whole range of issues, as this report has shown. Measures relating to vehicle technology and road infrastructure should take just as high a priority as increased hazard awareness on the part of all road users.

For years, the World Health Organization (WHO), and the organization Youth for Road Safety (YOURS), which the WHO helped set up in 2009, have noted that more young people between 15 and 29 around the world die every year in traffic accidents than from HIV/AIDS, malaria, tuberculosis, or homicide. Hardly anything has changed to this day. Although the total numbers of people in this age group either killed or seriously injured in road traffic have fallen over the years, they are still well above the average for the other age groups per 100,000 or one million inhabitants. Young people are mostly involved in accidents as passengers in cars and on motorcycles.

The risks, whether taken consciously or unconsciously, are well known. Excessive speed, overconfidence, the influence of alcohol and drugs, and distractions are just as important here as not wearing a seat belt and riding a (motor)bike without a helmet. If novice drivers in particular are also driving on smaller roads in non-built-up areas with tighter bend radii – perhaps at the wheel of an older vehicle with technical defects – the risk of an accident is increased many times over.

In order to take effective countermeasures which are sustainable over the long-term, major efforts from the parties concerned are necessary. Vehicle technology, road infrastructure, legislation, traffic controls, road safety education with accompanying campaigns, driving instruction, and further measures when it comes to prevention and minimizing the outcomes of accidents are all crucial factors. The periodic vehicle inspection must also not be forgotten, so as to ensure the good working order of mechanical and electronic components of vehicle safety systems. Despite all these measures, the individual concerned has the greatest influence on the possible occurrence of an accident, and this will remain the case for the foreseeable future.

FAIR COOPERATION

Responsible behavior, paying constant attention to the road, a realistic assessment of one's own

abilities, and a high degree of acceptance of the rules by all road users are essential. It is not without reason, for example, that the German Road Traffic Act states: "A person using the road shall act in such a way as not to harm or endanger or, more than is unavoidable in the circumstances, to hinder or inconvenience any other person."

The fact is that young people lack experience when it comes to road traffic. Their mileage by car, for example, is often only a few thousand kilometers per year. The Forsa survey commissioned by DEKRA, which has already been mentioned several times in this report, showed, for instance, that 40 percent of drivers aged 18 to 24 travel an average of less than 5,000 kilometers per year by car and 25 percent drive around 5,000 to 10,000 kilometers. A lack of driving experience means that in many situations young drivers do not yet react in a way which "experienced" road users would expect. The latter then express their annoyance at this by tailgating or loudly honking their horns in turn. This behavior is not uncommon. It is therefore not surprising that 84 percent of 18 to 24-year-olds in the Forsa survey would like everyone involved in road traffic to be more considerate of one another. 79 percent would like to see less aggressive behavior. Of course, such behavior can also be observed time and time again among young road users. But the vast majority, it should be stressed, are unobtrusive and do follow the rules when they are on the road.

DEKRA's Demands

- **All road users need to be aware of their responsibility to themselves and others on the road and should always behave considerately and in the spirit of cooperation.**
- **Those who have just received their driver's licenses often drive by the book and strictly adhere to speed limits. They find the tailgating and overtaking maneuvers of "experienced" road users unsettling and are then tempted to engage in risky behavior. Novice drivers require particular consideration from others and do benefit from this.**
- **Especially dangerous behaviors such as driving under the influence of alcohol and drugs, being distracted by smartphones, and speeding must be strictly prohibited, monitored, and punished.**
- **The problem of distracted driving should be addressed with an integrated strategy. Educational, technical, and legal options should be exhausted.**
- **Distractions leading to accidents should be included as a separate category in any national road traffic accident statistics.**
- **For novice drivers, there should be an absolute ban on driving under the influence of alcohol. Experiences in different countries have shown how effective this can be.**
- **The distribution and use of telematics-based feedback systems, for example, should be increased.**
- **Thanks to measures geared specifically to this target group, there have been significantly larger reductions in the number of accidents among young novice drivers in most countries than among the rest of the population. These comprehensive measures must be regularly adjusted and extended.**
- **Young male novice drivers represent a significantly above-average risk to themselves and to other drivers. This group must be the focus of road safety efforts, even before driver training begins.**
- **A multi-stage process for acquiring a driver's license has proven its value in many places and should therefore be introduced in other countries.**
- **Only a transparent, standardized, and high-quality theoretical and practical test to obtain a driving license that is independent of driving schools can guarantee the necessary quality standard in driver training.**
- **Anyone who has been convicted of taking part in illegal car races should have their fitness to drive examined medically and psychologically in each individual case.**
- **The seat belt is the number one lifesaver and must be worn in both the front and rear seats every time the vehicle is driven.**
- **Users of motorized and non-motorized two-wheeled vehicles should always wear a suitable helmet, regardless of whether or not they are required to do so by law. Motorcyclists should wear full protective clothing.**
- **How to use driver assistance systems and automated driving functions should be taught during driver training, but the limits of these systems should also be made clear. In an ideal situation, confidence in handling these systems would also be part of the driving test.**
- **The working order of the mechanical and electronic components of vehicle safety systems must be ensured across the entire life of the vehicle. The focus of the periodical technical inspection of motor vehicles should be adjusted accordingly on a regular basis.**
- **In all countries, practical driver training should be as comprehensive as possible with regard to road characteristics (built-up areas, narrow inter-urban roads, freeways) and lighting conditions (driving at night).**
- **In view of the fact that many young people have fatal accidents on inter-urban roads, the primary goal must be self-explanatory roads with a roadside area design that mitigates accident consequences when building new roads or making corresponding changes in road construction.**
- **Damaged or destroyed roadside trees should not be replaced. If they are necessary at all, trees – or even better, shrubs – should be planted a sufficient distance from the side of the road, wherever possible.**

Any Questions?

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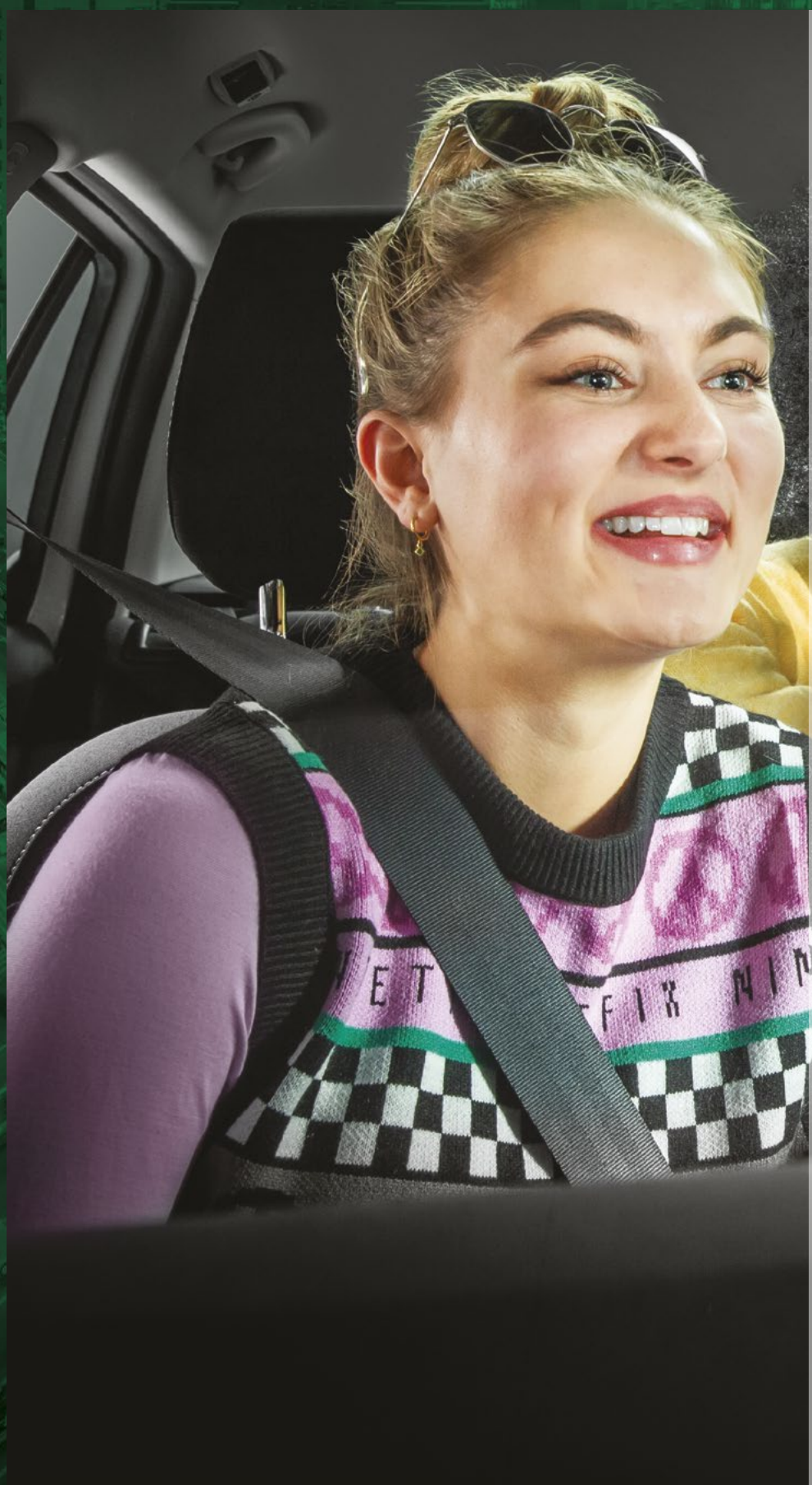

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