

DEKRA  
ROAD SAFETY REPORT 2018  
Transport of Goods

Steps Toward Making  
Vision Zero a Reality.



**Vehicle technology:** Despite the widespread use of electronic systems in commercial vehicles, the potential for avoiding accidents is far from being exhausted

**The human factor:** Training for professional drivers is becoming even more important given increasing automation

**Infrastructure:** New mobility concepts and vehicle combinations pose huge challenges for road construction

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## Utilizing Optimization Potential Even More Effectively

Even though serious accidents receive widespread coverage in the media, the long-term trend is still clear: Commercial vehicles are becoming increasingly safer, and the number of accidents resulting in fatalities, injuries and/or material damage has decreased considerably in Europe. Take Germany as an example: According to the German Federal Statistical Office, the number of accidents involving goods transport vehicles that resulted in personal injury decreased from approximately 36,650 to 29,350 between 2005 and 2016, which equates to a decrease of 20 percent. The number of deaths resulting from accidents involving goods transport vehicles decreased by 35 percent during this period from 1160 to 745. Given the significant increase in the number of goods transport operations, this is remarkable progress. A similarly positive trend can be observed in other EU member states.

But we cannot rest on our laurels, because it is a simple fact that accidents involving trucks weighing in excess of 12 metric tons frequently have particularly serious consequences for everyone involved due to the high masses involved – not only for the truck drivers themselves, but also and above all for car drivers and unprotected road users such as pedestrians and cyclists. The following figures from Germany support this: Of the victims of accidents involving trucks in 2016, almost 9500 were goods transport vehicle occupants and almost 30,800 were other road users. Of the victims who died as a result of the accidents, 133 were goods transport vehicle occupants and 612 were other road users. The risk of being killed in an accident involving a truck is therefore around four and a half times higher for other people involved in the acci-

dent than it is for the goods transport vehicle occupants. Just how serious the consequences can be is made very clear by the rear-end collisions that unfortunately occur time and again at the end of traffic jams.

Thanks to the considerable progress made by manufacturers in terms of driver assistance systems, a lot has been achieved in recent years. It is, however, important to make even more efficient use of the active and passive safety aspects of commercial vehicles – every person who dies or is injured as a result of a road accident is one too many. In addition, accidents not only result in human suffering but also enormous financial burdens for those affected, the economy and society as a whole.

This report uses examples from around the world to demonstrate where action needs to be taken in order to make much more efficient use of the potential for improvement – in terms of both vehicle technology and the people and infrastructure. As such, this report is much more than just a compilation of facts about the current situation. Rather, this publication aims to provide food for thought as well as advice and recommendations for politicians, traffic and infrastructure experts, manufacturers, research institutions and associations and all road users.



*Dipl.-Ing. Clemens Klinke, Member of the Management Board DEKRA SE and Head of the DEKRA Automotive Business Unit*

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<b>Introduction</b>	<b>6</b>	<b>Innovative, Connected and Efficient</b> In view of continuously increasing numbers of goods transport operations, road goods transport vehicles will remain the most significant mode of transport in the foreseeable future. This presents numerous challenges for commercial vehicle manufacturers, the supply industry, the entire transport and logistics sector as well as the fields of politics and science.
<b>Accidents</b>	<b>16</b>	<b>A Positive Trend – But Tragic Accidents Still Occur</b> Accident figures from around the world – including EU member states – show quite clearly that goods transport vehicles are much safer than their reputation would suggest. Compared with cars, the number of people involved in accidents caused by goods transport vehicles is relatively low.
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<b>The Human Factor</b>	<b>34</b>	<b>Being Adaptive, Attentive and Responsible on the Road</b> As is the case with other road user groups, the person behind the steering wheel plays a key role in road traffic accidents involving goods transport vehicles. With this in mind, training in particular is of paramount importance.
<b>Vehicle Technology</b>	<b>52</b>	<b>Better Protection for All Road Users</b> Automated driving systems offer huge potential for enhancing the safety of commercial vehicles, too, by eliminating or mitigating the consequences of human error. But new safety technology concepts cannot hide the importance of one thing: Using a safety belt is still the most important measure for reducing the risk of serious injuries to vehicle occupants.
<b>Infrastructure</b>	<b>64</b>	<b>Safe Roads in Urban and Non-Urban Areas</b> In addition to in-vehicle systems, infrastructure plays a critical role in increasing road safety. Upgrading/maintaining roads is just one of many aspects involved. New mobility concepts such as long trucks, overhead line systems, city logistics vehicles with electric drives and cargo bikes also need to be taken into account to a greater extent in the future.
<b>Summary</b>	<b>72</b>	<b>We Need to Drive Forward This Fundamentally Positive Trend</b> The fact that serious accidents involving goods transport vehicles still occur highlights that there is still much to be done in terms of vehicle safety, infrastructure and, in particular, the human factor.
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## The web portal: [www.dekra-roadsafety.com](http://www.dekra-roadsafety.com)



Since 2008, DEKRA has been publishing the annual European Road Safety Report in printed form in several languages. The [www.dekra-roadsafety.com](http://www.dekra-roadsafety.com) web portal went live with the publication of the DEKRA Road Safety Report 2016. You can use this portal to access additional content supplementing the printed report (e.g. videos, interactive graphics etc.). 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. Scan the code using an ordinary QR code reader and you will be taken directly to the corresponding content.

### IMPRINT

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## Greater Mobility and Fewer Accidents

Mobility is at the center of a free society and the fuel for a thriving economy. Nowhere else is this as clear as it is in our homeland of Germany – the world leader in exports and logistics. This means that we bear a particular responsibility: On the one hand, we must ensure a functional infrastructure and a smooth flow of traffic on our roads; on the other, we have to ensure that these roads are designed as safely as possible.

But we are facing a considerable challenge: the increase in goods transport. According to our traffic projections, goods transport on our roads alone will increase by 19 percent by 2030. It is therefore a matter of priority that we increase the level of mobility while reducing the number of accidents.

To do this, we in the government have launched a comprehensive road safety program. We have already achieved a great deal as part of this program – especially with regard to road goods transport. Since 2000, the number of road users killed in accidents involving goods transport vehicles has more than halved (from 1,417 to 641). But this is not enough. We want to reduce this figure further and move our program forward dynamically. To accomplish this, we are focusing on three key fields of action:

1. People: At the heart of our road safety measures are people, which is why we are investing more than ever in education and information campaigns – including campaigns aimed at truck drivers.

2. Infrastructure: We have given our infrastructure a major upgrade and are investing record sums. After all, the only safe infrastructure is a state-of-the-art infrastructure. Thanks to intelligent and fully digitalized roads, digitalization offers completely new opportunities in this respect. We are already trialling these potential solutions on the Digital Test Track Autobahn on the A9 in Bavaria. In particular, these opportunities include real-time commu-

nication between vehicles and infrastructure as well as “platooning” technology for trucks, whereby individual trucks are digitally linked. The next step entails establishing more digital test tracks in a number of towns in order to trial networking technology in more complex urban traffic scenarios.

3. Vehicle technology: We are improving the road safety of trucks in a very targeted way. We already encourage the integration of assistance systems that protect pedestrians and cyclists more effectively. To prevent serious accidents involving trucks, we now want to make emergency braking systems and cornering assist systems even safer and more effective. We are therefore campaigning at an international level for stricter regulations such as the implementation of measures to ensure that emergency braking systems cannot be disabled.

Furthermore, automated driving technology offers massive safety benefits. Today, more than 90 percent of all accidents can be attributed to human error. Trip computers will relieve drivers of much of the driving workload and significantly reduce critical traffic situations.

I am certain that, together with DEKRA, we can realize our vision of greater mobility and fewer accidents in the future, too. Thanks to its many years of expertise, its road safety campaigns and the vehicle inspections and expert analyses it conducts, DEKRA plays an indispensable role, for which I am enormously grateful. This Road Safety Report on road goods transport is an invaluable resource to us and all of the other players involved. I hope you enjoy reading it!



*Andreas Scheuer (MdB),  
German Federal Minister of Transport and Digital Infrastructure*





## Innovative, Connected and Efficient

According to the most recent World Transport Report published by Prognos AG, goods transport will increase from almost 2 billion ton kilometers today to 2.7 billion ton kilometers by 2040 in the twelve largest EU member states. In the USA, an increase from eight to ten billion is projected; an increase from 15 to 27 billion ton kilometers is projected for China. Road goods transport vehicles remain the most significant mode of transport. This presents numerous challenges for commercial vehicle manufacturers, the supply industry, the entire transport and logistics sector as well as politics and science, not just in terms of efficiency and environmental compatibility but, above all, in terms of road safety.

No pasta in the supermarkets, no beer available in the beverage stores, no clothing available in boutiques or department stores, no material transport for the economy and industrial sectors, no parcels for end consumers, no refuse collection, no fire-fighting operations, no moving house and lots more: The disruption that would occur if there were no commercial vehicles on our roads is almost unimaginable. On certain routes, railroads and ships

are good alternatives, but the current infrastructure in many countries is far from sufficient, even in the medium term, for shifting all goods transport operations from the road to these modes of transport. In most parts of the world, railroads and ships are not a viable alternative for short-haul routes, delivery vehicles, urban distribution transport and critical transport services. Without commercial vehicles, it would be next to impossible to transport any goods.

### Milestones on the Road Toward Greater Mobility and Road Safety



**19th century** Before the invention of cars, horse and cart was the preferred means of transporting goods regionally



1890

**1893** In Paris, Panhard and Lavassor start on the construction of a commercial vehicle



1895

**1896** Gottlieb Daimler sells his first motorized truck constructed by Wilhelm Maybach

**1900** Carl Benz presents his first truck



1900

The strength of commercial vehicles still lies in the high level of flexibility they offer. Compared with trains or ships that rely on rails and waterways, trucks and vans can travel from the sender right up to the loading ramp of the retail outlet or to the front door of the recipient of a delivery. This also makes commercial vehicles indispensable especially for regional transportation. Only on long-haul routes can trains leverage their economic and ecological strengths. In large countries such as China, Russia, Canada and the USA, trains are a much more viable proposition than in, say, the confines of a comparatively small Europe with its borders, national train companies, different train systems and lack of rail networks designed specially for transporting goods. For shorter distances, railroads are simply not viable – goods are transported exclusively by road.

## CONCEPTS FOR THE “LAST MILE” ARE BECOMING INCREASINGLY IMPORTANT

This is particularly important with regard to the “last mile” – i.e. the route taken by most goods ordered online, from a distribution center via a courier, express and parcel service provider to the end customer’s front door. Given the extent of urban traffic problems caused by congestion and exhaust emissions, there are now a variety of issues to consider as well as some concrete approaches that have already been established with regard to covering the “last mile” in as environmentally and traffic-friendly a manner as possible – for example, with alternative drives such as electrically powered distribution trucks and vans or with the help of electric cargo bikes, drones or delivery robots. Nevertheless, even on the “last mile” road goods transport will maintain its dominant role for a while to come.

The challenges associated with the “last mile” are illustrated by the figures of the 2017 Courier,

Express and Package Service Provider Study conducted by the “Bundesverband Paket und Expresslogistik (BIEK)” (Federal Association for Parcel and Express Logistics): In 2016, courier, express and package service providers for the first time transported more than three billion parcels in Germany compared with “just” 1.7 billion in 2000. The continuous growth seen in recent years is also set to continue, with BIEK already forecasting more than four billion parcels for 2021. This increasing number – particularly for parcels – is primarily the result of the significantly stronger growth of online trade in the business-to-consumer segment and the increase in business-to-business shipments. In addition to ever-increasing online trade – be it involving furniture or hobby and leisure items, for example – same-day or even faster delivery (“one-hour delivery”), as is the case with groceries, is becoming increasingly important for the industry globally.

Given the fact that an ever-increasing number of people are living in urban areas and the number

■ *Developing efficient concepts for the “last mile” is a big challenge for everyone involved.*



**1901** A total of 16 manufacturers in Europe build a total of 39 trucks this year

**1903** Heinrich Büssing founds his company in Hanover and launches the mass production of trucks



**1910** Büssing constructs a truck with a trailer attached (articulated truck) for long materials

**1913** Iron tires are banned in the German Reich to limit damage to the road surface; all trucks are fitted with rubber tires




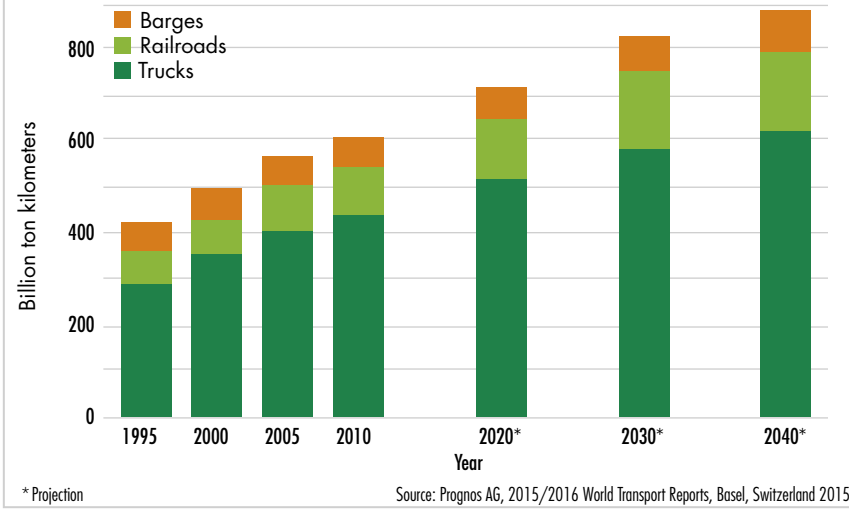
**From 1914** The First World War necessitates high-volume truck manufacture; manufacturers increasingly switch to mass production and replaceable parts

1905

1910

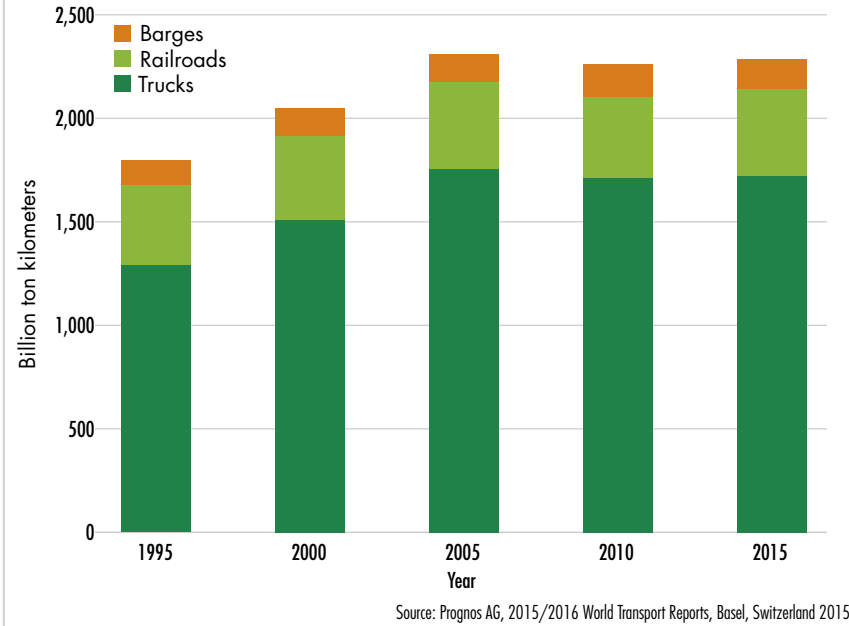
1915

**1** Development perspectives regarding the transport of goods in Germany in terms of means of transport from 1995 to 2040 



of “megacities” with more than ten million inhabitants is increasing, mobility concepts for the “last mile” in particular are unavoidable. According to UN projections, two-thirds of the world’s population will live in cities in 2050 – in 1950, this was just one third. To put this in concrete figures, the planet’s population is expected to number 9.6 billion by 2050, with 6.4 billion people likely to be living in cities. This will inevitably lead to an extremely high volume of traffic – not least due to distribution trucks and vans making “just-in-time” goods deliveries. This, in turn, could have a negative impact on road safety.

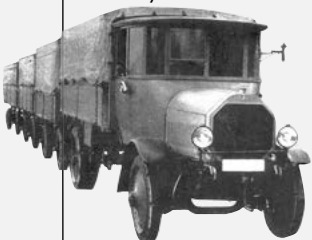
**2** Development in the transport of goods in the EU in terms of means of transport 



**COMMERCIAL VEHICLES ARE WAY AHEAD IN THE MODAL SPLIT COMPARISON**

The significance of road goods transport today quickly becomes very clear in a modal split comparison with other modes of transport. Take Germany as an example: According to the German Federal Statistical Office, almost 4.6 billion metric tons of goods were transported in Germany in 2016, with 3.6 billion metric tons transported by truck. Transportation services totaled almost 660 billion ton kilometers in 2016; the average transportation distance in Germany was 143.5 kilometers.

**1923** Introduction of the four-wheel compressed-air brake by Knorr



**1925** Deutscher Kraftfahrzeug-Überwachungsverein e. V. is founded in Berlin (today: DEKRA)



**1931** The overland transport regulation enters force in Germany; this sets out the legal differences between passenger and goods transport on roads

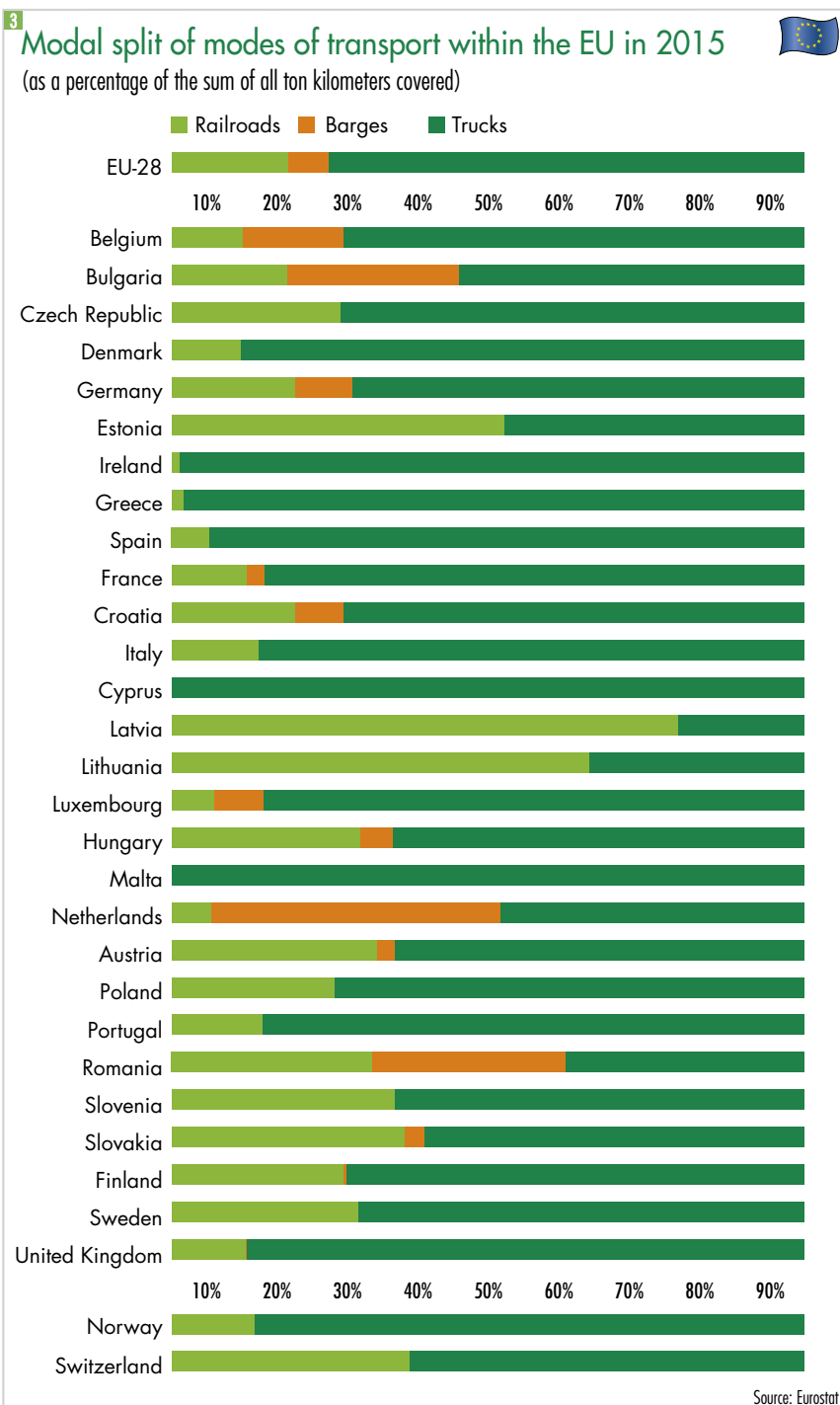




■ Long HGV convoys are very common in many countries.

Covering 472 billion ton kilometers, road goods transport accounted for 71.5 percent of transport operations. Railroads take second place with significantly lower figures: 116 billion ton kilometers – i.e. 17.9 percent – were attributed to trains. The 2015/2016 World Transport Report conducted by Prognos AG projects that road goods transport vehicles will cover 584 billion ton kilometers by 2040 – compared with around 280 billion ton kilometers for trains and barges (Figure 1). In addition, road goods transportation is becoming increasingly international. In 2015, for example, almost 40 percent of transportation services on German roads were provided by foreign companies.

Looking at the expansion of goods transportation in the EU, the dominance of road transport is clear here, too. According to data provided by the European Commission, road goods transportation increased from almost 1.3 to over 1.7 billion ton kilometers from 1995 to 2015 – a rise of more than 33 percent. Over this period, the railways saw growth of just 7.6 percent from 388 to 418 billion ton kilometers (Figure 2). With regard to the modal split of modes of transport within EU domestic traffic in 2015 (Figure 3), road transportation represented 75.3 percent, railways 18.3 percent and waterways



**1949** Series production of the “Unimog” (“Universal-Motor-Gerät” – universal motorized machine) is launched



**1953** The Federal Office for the Long-Distance Carriage of Goods in Germany is established

**1956** Publication of the first version of the UNECE Recommendation on the Transport of Dangerous Goods

**1960s** Certified safety cabs are launched on the market in Sweden

**Hans-Paul Kienzler**

Head of the Mobility & Transport division at Prognos AG



**Road Goods Transport Will Continue to Play a Dominant Role in Goods Transportation in the Future**

Despite all of the successful efforts to shift goods transportation from the road and onto railroads and barges, road goods transport will continue to play a dominant role in the future. The most recent Prognos World Transport Report 2015/2016 projects that Germany will have a 67.5-percent market share of road goods transport in terms of capacity (= the product of metric tons transported and transport distance) by 2040.

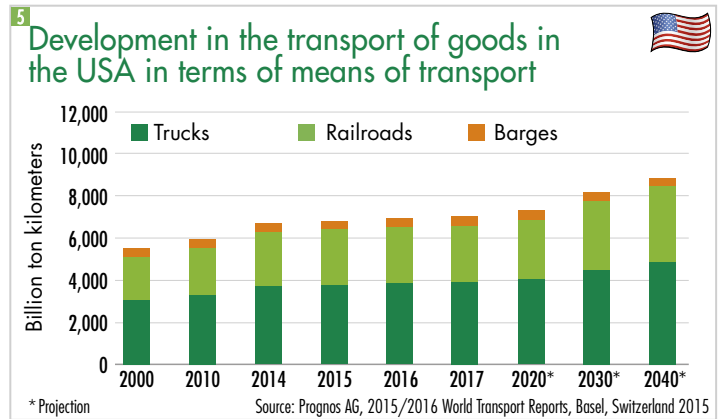
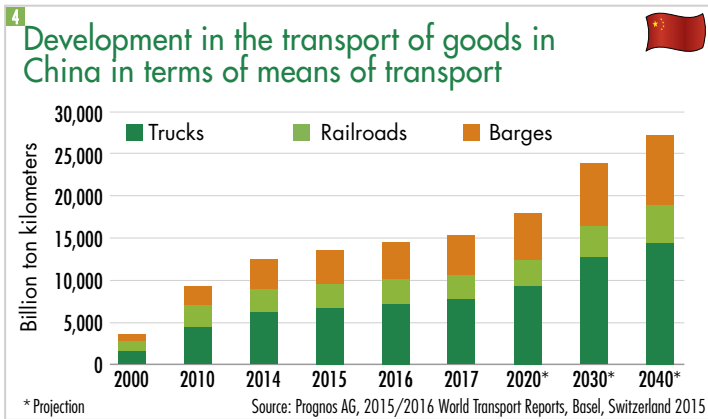
The main driver behind the growing volume of transport services is foreign trade. In 1995, the ratio of national to international transport services was 61 to 39 percent. By 2040, this ratio will change to 52 to 48 percent. This means that around half of all transports in Germany will come from abroad and/or be destined for abroad. Given the growing market shares of foreign transport companies in international traffic, a large pro-

portion of international transport services on German roads will be performed by foreign – especially East European – transport companies.

To logistics specialists, the reasons behind these developments are perfectly clear: Despite increasing hindrances caused by congestion, road goods transportation is still the most flexible means of transporting goods door to door without having to reload them during the process. Ever-decreasing batch sizes are also strengthening this effect. Added to this is the immense growth of small consignments transported by courier, express and parcel service providers in smaller trucks because no alternative means of transport is available for these types of transport operations over medium distances.

If we take into account foreign countries and compare the figures of the

twelve most significant EU member states with those of the USA and China (Figures 4 to 6), then we see things on a whole new magnitude: The World Transport Report projects that the most important EU countries will have a road goods transport capacity of 2.2 billion ton kilometers by 2040. Goods transport capacity is projected to be twice as high in the USA by 2040 (5.4 billion ton kilometers) and more than six times higher in China (around 14 billion ton kilometers). By 2040, the market share of road goods transport will reach around 75 percent in the selected EU countries, 55 percent in the USA and almost 53 percent in China. These differences are due to the fact that considerably longer distances are covered in the USA and China than in the densely populated EU countries, making railroads in particular a more viable solution.



**1966** The first container (sea freight) is put ashore at the overseas port in Bremen

**1981** ABS is used in a truck for the first time



**1989** The Dangerous Goods Advisor Ordinance is introduced in Germany

**From 1990** The THESEUS research project is launched to improve tanker safety

6.4 percent. This distribution has remained more or less the same for a number of years now. In most EU member states, road transportation is well ahead; front runners in 2015 included Spain with 94.1 percent, Italy with 86.5 percent and France with 85.4 percent. In the Baltic states of Estonia, Latvia and Lithuania, however, rail transportation dominated with figures between 52.4 and 79.8 percent. In the Netherlands, goods transportation by ship has accounted for a large share of goods transport for a number of years now. In 2015, this share was 45.5 percent – just slightly below goods transportation by road (48.3 percent).

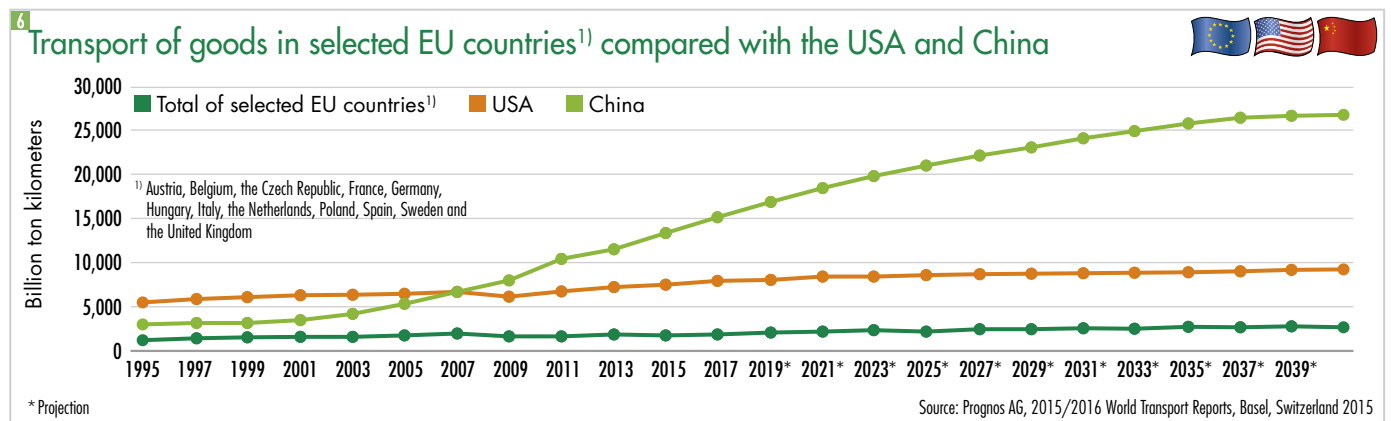
The dominant role of commercial vehicles in the transport of goods also becomes very apparent when one takes a closer look at the development of registration/ownership figures in recent years. Published by the European Commission in 2017, the “Statistical Pocketbook” on transport reports that around 27.5 million vehicles were registered for road goods transportation in the EU in 2000. By 2015, this figure had increased to over 36.5 million – an increase of around 33 percent. States with the highest numbers of commercial vehicles at this time included France (6.56 million), Spain (5.05 million), the United Kingdom (4.24 million), Italy



(4.1 million), Poland (3.43 million) and Germany (almost three million).

Given the considerable growth in the aforementioned courier, express and package service provider sector, it is also interesting that the num-

■ In the modal split comparison of modes of transport, the truck is the clear forerunner ahead of railroads and ships.



**1992** The installation of safety belts in trucks is stipulated in Germany; these must be worn during travel in accordance with Section 21a of the Road Traffic Act

**1993** The BAST (“Bundesanstalt für Straßenwesen” – “Federal Highway Research Institute”) report entitled “Road Traffic Safety Analysis” is published

**1999** The semi-trailer developed by Karl-Heinz Schimelpfennig featuring all-round effective underride protection is launched on the market by Krone with the Safe Liner



ber of goods transport vehicles weighing between 2.8 and 3.5 metric tons in particular has risen significantly across Europe in recent years. According to information provided by the Federal Motor Transport Authority, the number of these vehicles on Germany's roads increased between 2000 and 2015 from under 302,000 to almost 1.2 million. The number of vehicles in this segment has thus almost quadrupled. According to the 2016

Shell Commercial Vehicle Study, the total number of commercial vehicles in Germany is projected to increase to 3.5 million by 2040. Compared with today's figures, this represents further growth of 17 percent.

### A FUNDAMENTALLY POSITIVE TREND REGARDING ACCIDENT STATISTICS

The current situation and various future scenarios present a whole host of road safety challenges – especially when it comes to trucks and vans. With the rise in mileage covered by heavy-duty commercial vehicles in particular, the likelihood of individuals being involved in an accident increases, as does the importance for accidents in general. Nevertheless, the general trend is positive: Thanks to the considerable progress made by manufacturers in developing driver assistance systems, the number of road users killed in accidents involving commercial vehicles has decreased significantly in recent years across the EU. While 7,233 people died in accidents involving commercial vehicles in 2006, by 2015 this figure had fallen by over 47 percent to 3,848 according to latest figures from the European Commission (Figure 7). This figure represents around 15 percent of all deaths caused by road traffic in the EU – a figure that has remained more or less constant over recent years. Over the same period, the USA saw an almost 20-percent decline in road deaths from 5,027 to 4,067. In Germany, such figures have declined by around 34 percent from 1,197 to 787; in 2016, statistics specified 745 deaths in accidents involving goods transport vehicles, which equates to a further decrease of 4 percent.

Overall, the number of people involved in accidents is relatively low, especially when one considers the number of kilometers that vehicles cover. This is illustrated by figures published by the Ger-

**François Bellot**

Minister of Mobility for the Kingdom of Belgium



### People, Infrastructure and Technology: the Three Pillars of Road Safety

All three pillars of road safety – road users, infrastructure and technology – must play a part in reducing the number of accidents involving goods transport vehicles. The progress made and technical innovations concerning road safety certainly give cause for optimism, especially when it comes to commercial vehicles. Such innovations will without a doubt help to reduce the number of accidents and mitigate the consequences of accidents, especially for the most vulnerable road users such as pedestrians and cyclists.

It is nevertheless vital that we monitor the situation closely and continue our endeavors in this area. It is important, for example, to ensure that driver assistance systems function properly over the entire service life of a vehicle so

that the systems are ensured to always operate as required. To guarantee users the independence and objectivity required here, regular technical inspections of vehicle conditions will play an even bigger role in the future.

With regard to infrastructure, efforts must be made to equip roads with the technology necessary for ensuring communication between driver assistance systems, vehicles and the traffic infrastructure.

Training and further education courses for professional drivers also have an important role to play here. The new European regulations enhance the content and level of training. Finally, it is also important that the applicable provisions regarding break and rest periods for professional drivers are implemented systematically.

**2002** DVR launches the "Hats geklickt?" ["all clicked in?"] belt campaign



**2003** Successful pilot test involving rumble strips starts on the A24 in Brandenburg, Germany



**2006** Daimler presents the "Safety Truck" with distance-control system, lane assistant, Stability Control Assist and Active Brake Assist (ABA)

**2007** The ETAC study on the fundamental causes of traffic accidents involving trucks is published

man Federal Statistical Office: In 2016, German police registered 308,145 road accidents resulting in personal injury – 211,460 of these were caused by car drivers, while commercial vehicle drivers were responsible for 19,022 such accidents. According to information provided by the Federal Motor Transport Authority, car drivers in Germany covered 625.5 billion kilometers in 2016, while commercial vehicle drivers covered 80.5 billion kilometers. This means that, in 2016, car drivers were involved in an accident resulting in personal injury every 2.96 million kilometers, while commercial vehicle drivers were involved in such an accident every 4.23 million kilometers.

But whenever goods transport vehicles are involved in accidents causing personal injury, a disproportionate number of these accidents result in fatalities. This can be attributed to the higher mass and lower level of compatibility of goods transport vehicles compared with other road users. Another hazard presented by large and heavy-duty goods transport vehicles is that the vehicle dimensions mean that large areas are hidden from the view of drivers. Pedestrians and cyclists are at especially high risk here.

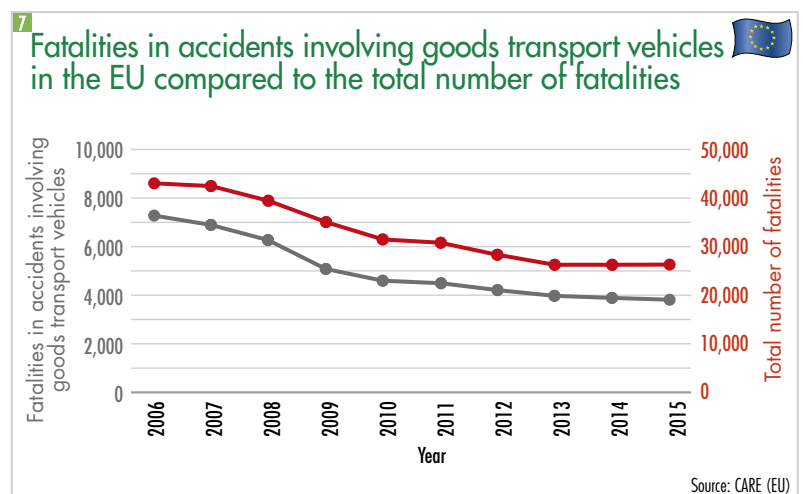


■ *Highways are frequently the scene of serious accidents involving goods transport vehicles.*

nication and Kravag insurance, the Federal Road Haulage Association conducted a field test involving 1000 vehicles and proved that trucks equipped with driver assistance systems are 34 percent less likely to be involved in an accident than similar reference vehicles. However, it is currently possible for

## MAINTAINING AND STRENGTHENING THIS HIGH LEVEL OF SAFETY

The generally positive trend can be attributed to a variety of measures. The aforementioned driver assistance systems play a role in this trend, with commercial vehicles taking the lead here. Technologies such as electronically controlled braking and emergency braking systems were deployed in this vehicle category first before being offered as optional extras in cars. The effectiveness of these systems cannot be disputed. Together with the German Social Accident Insurance Institution for Commercial Transport, Postal Logistics and Telecommu-



**From 2009** New trucks registered in the EU must have retro-reflective contour markings

**2011** Electronic vehicle stability control systems (EVSC) – referred to as “ESP” or “ESC” – become compulsory for all new road vehicles (from cars to heavy buses as well as trucks and their trailers) from November 1, 2014, and from November 1, 2011, for vehicles with a new type approval certificate

**2012** Field tests involving long trucks are launched in Germany under the direction of the Federal Ministry of Transport, Building and Urban Development; the tests address various safety issues

**2012** All new trucks on the market (N2/3) in the EU must be equipped with special daytime running lights; existing trucks do not have to be retrofitted with these lights

**Henrik Hololei**

Director-General for Mobility and Transport,  
European Commission



## Road safety opportunities and challenges of cooperative, connected and automated freight transport

Major investment is now being devoted to developing cooperative, connected and automated mobility solutions. These developments offer tremendous potential in compensating for and eventually eliminating driver errors and distractions, which today play a large role in causing road deaths and serious injuries. But they also create new challenges, such as cyber-security and the coexistence with “traditional” vehicles and other road users.

A particularly interesting application for freight transport combined with traffic management support is platooning. As Digitalization opens new opportunities to ensure interoperability between the different operators of the freight and logistics multimodal supply chain, innovative services aim to improve safety and reliability of operations; platooning is a promising business case that presents the right combination of elements to rapidly advance and showcase outcomes that can be shared to promote a more general deployment of cooperative, connected and automated mobility solutions.

However, a number of road safety issues need to be addressed. Just one example: how can other vehicles safely enter and exit motorways without interfering with a passing platoon? May a car driver get in between platooned trucks? And how will the car driver in fact know that the trucks are part of a platoon?

On the path towards higher levels of automation, other fundamental questions will have to be addressed, such as human-machine interaction and consistency between physical and digital infrastructure, to ensure that vehicles can “read” road markings and signs. This will require a certain degree of harmonization in order to ensure smooth cross-border operation.

In order to “future-proof” road safety activity, the Commission plans to bring forward before the summer a comprehensive framework for road safety policy 2020-2030, complemented by specific considerations on cooperative, connected and automated mobility.

drivers to disable these systems manually. Whether this is in the interests of road safety is rightly the subject of intense discussion. After all, what is the point of a system that is offline in an emergency? This is a question that is explored in detail in the Vehicle Technology section of this report.

The same applies to the ever-increasing level of connectivity among commercial vehicles with not only the surrounding infrastructure but also each other. Connectivity will be a key feature in the vehicles of tomorrow. Linking multiple trucks to form a “platoon” is just one of the pioneering concepts for future goods transportation and marks an important step toward automated driving. The aim of this technology is to make road traffic more efficient and safer and to lighten the burden on professional drivers.

In addition to vehicle technology and the issue of infrastructure covered in this report, commercial vehicle drivers play an absolutely central role in road safety. Given that almost 90 percent of all accidents in Europe can be attributed to human error, it is crucial that professional drivers are made aware of this issue. The European “professional driver” directive 2003/59/EC of July 15, 2003, “on the initial qualification and periodic training of drivers of certain road vehicles for the carriage of goods or passengers” has had an extremely positive impact in this regard. But there is still much work to be done in this area, a fact addressed in a separate section of this report.

**2013** New trucks and buses in the EU must be equipped with “lane departure warning systems” (LDWS) and “advanced emergency braking systems” (AEBS). This ruling initially applies only to commercial vehicles with compressed-air brakes and a permissible overall weight of > 8 t with a compressed-air-assist system for the rear axle(s); from November 1, 2016, for all new commercial vehicles and from November 1, 2018, for all new commercial vehicles with a permissible overall weight of > 3.5 t

**2014** Daimler presents the “Future Truck 2025”, a partially autonomous truck guided by the “Highway Pilot” system

**2016** End of the field test involving long trucks in Germany

**2018** The International Transport Forum (ITF) annual summit is held in Leipzig. This annual summit conference of transport ministers is organized by the ITF of the OECD. The focus of this particular summit was “Transport Safety and Security”





To enhance the road safety of goods transport vehicles in particular, it is ultimately critical for multiple factors to interact efficiently. The potential of a truck or van optimized with vehicle technology and equipped with every driver assistance system available can only be optimally utilized if the infrastructure or road conditions are suitable, networking concepts function and the person behind the wheel performs their task reliably. To relieve the burden on our roads, new approaches are required for dealing with combined traffic. The importance of each of these points forms the focus of this eleventh DEKRA Road Safety Report.

■ *Platooning involves electronically linking multiple trucks so that they can communicate in real time. When the trucks travel in convoy, the leading vehicle can communicate its driving behavior to the other trucks, enabling all of the trucks in the convoy to execute synchronous accelerating and braking, for example.*

## The Facts at a Glance

- In the modal split comparison with other modes of transport, road goods transport is the clear forerunner.
- Sustainable mobility concepts – especially with regard to the “last mile” – are essential.
- Overall, fewer goods transport vehicles are involved in traffic accidents than cars, especially in relation to the number of kilometers that vehicles cover.
- Thanks to the considerable progress made by manufacturers, the number of road users killed in accidents involving commercial vehicles has decreased significantly in recent years across the EU.
- Connectivity will be a key feature in the vehicles of tomorrow. Linking multiple trucks to form a “platoon” can bring about progress depending on the country and traffic conditions.

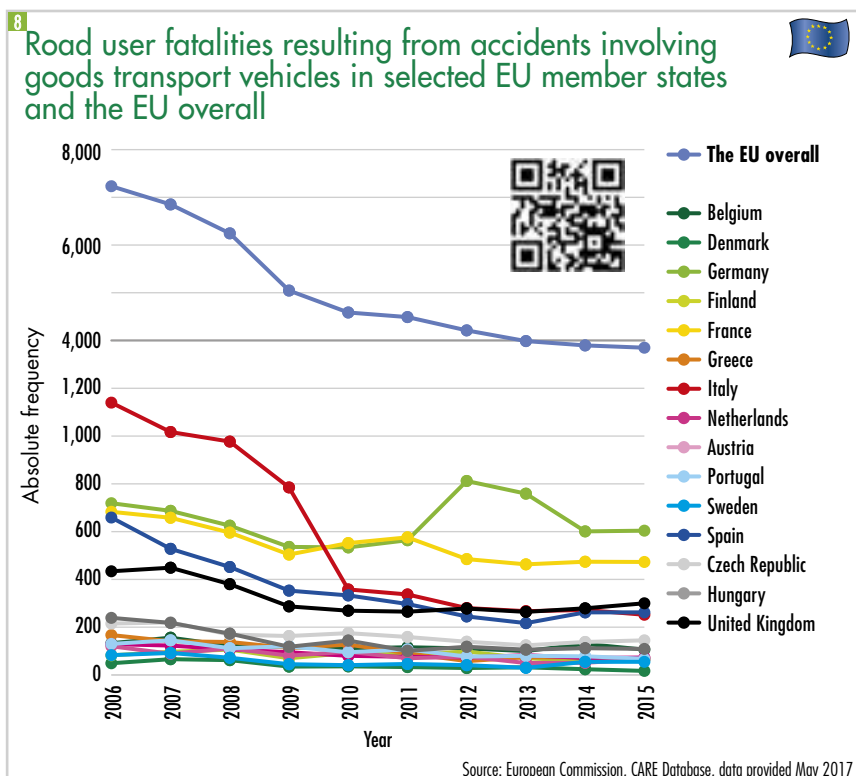


## A Positive Trend – But Tragic Accidents Still Occur

Accident figures from EU member states, among other regions, show quite clearly that goods transport vehicles are much safer than their reputation would suggest. Compared with cars, the number of people involved in accidents caused by goods transport vehicles is relatively low. However, given the number of vehicles on the road, the higher number of kilometers covered and the longer amount of time spent on roads, drivers are six times more likely to be involved in an accident than other road users.

“**M**onster Crash on the Highway” / “Truck Crashes into the Back of a Traffic Jam Without Braking” / “Three Dead After Accident Involving a Truck Driving the Wrong Way” / “Family Crushed Between Two Trucks” are just some examples of the headlines we see in the me-

dia. The media regularly covers accidents involving commercial vehicles in which people are seriously injured or killed. But as tragic as these cases are for everyone involved, we should not lose sight of the fact that, given the number of kilometers they travel, goods transport vehicles are much less likely to be involved in accidents resulting in personal injury than cars.



This is clearly shown, among others, by figures from Germany. According to information provided by the Federal Motor Transport Authority, annual car mileage in Germany in 2016 was around 625 billion kilometers, while goods transport vehicles covered around 82 billion kilometers. In total, approximately 381,000 car drivers and 32,000 goods transport vehicle drivers were involved in an accident resulting in personal injury in 2016. Therefore, according to the statistics, 390 goods transport vehicles were involved in traffic accidents resulting in personal injury per billion vehicle kilometers compared with 610 cars. In 2016, the risk of being involved in an accident resulting in personal injury calculated in relation to the amount of distance traveled was almost double for cars compared with goods transport vehicles. In previous years, the factor was 1.5.

The generally positive development regarding goods transport vehicles is further substantiated by the following figures from Germany: In 2000, around 48,500 goods transport vehicle drivers were involved in accidents resulting in personal injury, but by 2016 this figure had decreased by 33 percent. Over this period, however, vehicle mileage had increased by around 40 percent.

## ACCIDENTS IN THE EU

The accident figures confirm the generally positive trend that has been seen for a number of years in many parts of the world now. The number of fatalities resulting from accidents involving commercial vehicles weighing over 3.5 metric tons in EU member states, for example, fell from 7,233 in 2006 to 3,848 in 2015 (Figures 8 and 9), which equates to a decline of around 47 percent. At the time, the latter figure represented almost 15 percent of all traffic fatalities in the EU – approximately 26,000 in total. Countries leading the way in reducing their fatality figures over this period were Italy (minus 78 percent), Spain (minus 60 percent) and Greece (minus 59 percent).

So we can see that the figures are falling sharply, but the percentage of fatalities resulting from accidents involving commercial vehicles in proportion to all traffic fatalities in the EU has remained more or less constant for a number of years now. The other form of transport most frequently involved in accidents – at a level that has also remained more or less constant for a number of years now – is the car, which is reflected in the fact that, in 2015, 1908 car

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## Improved Accident Prevention in the Transportation Sector

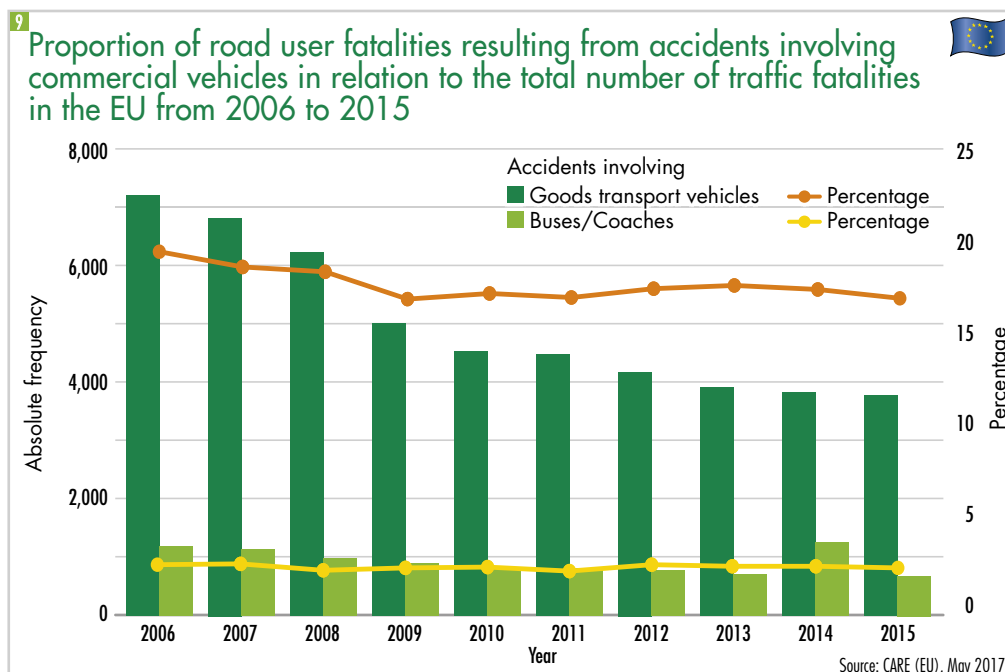
The transport sector is of fundamental and strategic importance to the economy and has a major impact on socio-economic development. Thanks to joint efforts made nationwide, safety in the transport sector in China has continuously increased in recent years and the accident rate has decreased. In particular, the number of fatal traffic accidents resulting in more than ten fatalities has decreased from 55 in 2004 to no more than 11 in 2016.

The Chinese transportation industry is currently undergoing rapid development. However, increasing goods transportation and the significantly increasing number of vehicles on the roads overall are also presenting new challenges. In terms of the complex situation regarding safety, we always have to deal with

any difficulties head-on, move with the times, actively adapt to unfamiliar situations and find solutions to new problems in order to improve accident prevention in the transportation industry and other industrial sectors.

All this is possible by joining forces and putting our heads together to come up with the most ingenious solutions possible. For a number of years now, we have been strengthening our intensive collaborative partnerships with institutions such as the World Health Organization, the International Labor Organization as well as governments, associations and businesses in a variety of countries. We benefit from one another and learn from our experiences, thereby continuously enhancing safety standards.

occupants were killed in accidents involving goods transport vehicles. Pedestrians accounted for 15 percent of fatalities resulting from such accidents in 2015, while goods transport vehicle occupants accounted for 13 percent (Figure 10). The latter figure,



## 10 Fatalities in the EU in 2015 following accidents involving commercial vehicles by type of road user

	Number of fatalities	Percentage
Goods transport vehicle occupant	507	13
Bus/coach occupant	51	1
Car occupant	1,908	50
Van occupant	195	5
Moped driver	64	2
Motorcyclists	199	5
Cyclists	282	7
Pedestrians	579	15
Unknown	63	2
<b>Total in EU</b>	<b>3,848</b>	<b>100</b>

Source: CARE (EU), May 2017





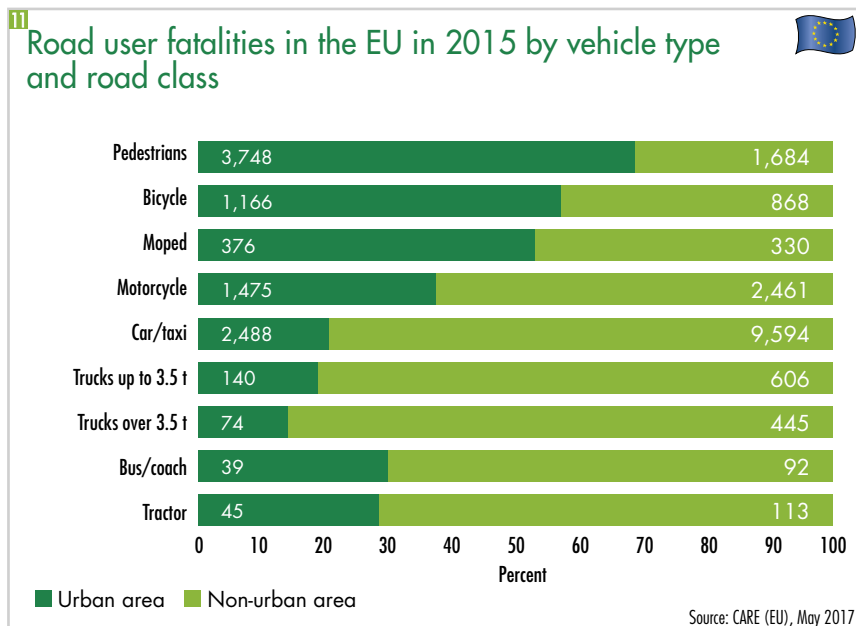
■ Rear-end collisions frequently result in fatal injuries for the vehicle occupants.

in particular, provides food for thought because no other occupational group in the EU suffers as many fatalities in the workplace as professional drivers.

Fifty-five percent of people killed in accidents involving goods transport vehicles died on rural roads, 25 percent in urban areas and 19 percent on highways. It is also notable that the proportion of heavy-duty goods transport vehicle occupants killed in non-urban areas in the EU in 2015 was 86 percent, which is significantly higher than the corresponding figure for other road users (Figure 11).

As far as vans are concerned, most countries see more fatally injured occupants in commercial vehicles weighing up to 3.5 metric tons than in heavy

trucks. The only exceptions here, with figures that differ considerably, are Latvia and Slovakia. In the various countries, occupants of commercial vehicle weighing up to 3.5 metric tons are 1.8 times more likely on average to suffer fatal injuries than heavy-duty goods transport vehicle occupants (based on the figures available). The factor in Denmark – 7.8 – is especially extreme. The higher figures for vans can undoubtedly also be attributed to the higher number of vans on the roads. Overall, the CARE figures available for this detailed analysis for the 2001–2010 period show a decrease in the number of fatally injured occupants. Figures decreased by 41.6 percent for truck occupants and 35.3 percent for van occupants. The gaps in the data for the years since 2010 are too big to make a more detailed statement (Figure 12).



## EUROPEAN STUDIES ON THE CAUSES OF ACCIDENTS

If one wants to go into more detail at an international level regarding accidents involving goods transport vehicles, one quickly realizes that standardized statistics are available only to a very limited extent. Even so, for a number of years now, a range of organizations operating within the framework of eSafety (Heavy-Duty Vehicles work group) have attempted to identify the most common accident scenarios in Europe. Accidents in which the vehicle left the road, collisions with trucks traveling ahead, head-on collisions with oncoming cars, side collisions with cars and collisions with pedestrians or cyclists account for between 40 and 62 percent of all accidents in which people are killed or seriously injured.

Published back in 2007, the ETAC Study (ETAC = European Truck Accident Causation) conducted by the International Road Transport Union (IRU) is still a useful reference and offers interesting insights into the fundamental causes of accidents involving trucks in the EU. According to this study, 27 percent of accidents took place at intersections, around 21 percent were rear-end collisions, 20 percent of accidents were related to vehicles leaving the road and just over 11 percent of accidents were caused by overtaking maneuvers. The primary causes of accidents at intersections were drivers disregarding the right of way or traveling with excessive speed. The primary causes of rear-end collisions were drivers traveling with excessive speed or not keeping a sufficient distance from other vehicles. The primary causes of accidents in which vehicles leave the road were drivers traveling with excessive speed or suffering from fatigue. Finally, the primary causes of accidents caused by overtaking maneuvers were carelessness and fatigue.

## ACCIDENTS IN GERMANY

Several trends seen at EU level are reflected in the number of accidents on German roads. According to the German Federal Statistical Office, a total of 29,353 accidents resulting in personal injury occurred in 2016, with at least one goods transport vehicle being involved. Overall, 32,352 goods transport vehicle drivers were involved in accidents resulting in personal injury in 2016; 48.6 percent of these accidents oc-

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## Periodic technical inspection contributes significantly to road safety for all road users

Transport is at the heart of most modern economies and heavy vehicles are its lifeblood. Millions of people work in road freight transport and millions of others depend on trucks to supply and distribute goods. More than 6,000 billion ton-kilometers of goods are transported each year by road in the EU, USA, CIS, China and Japan alone.

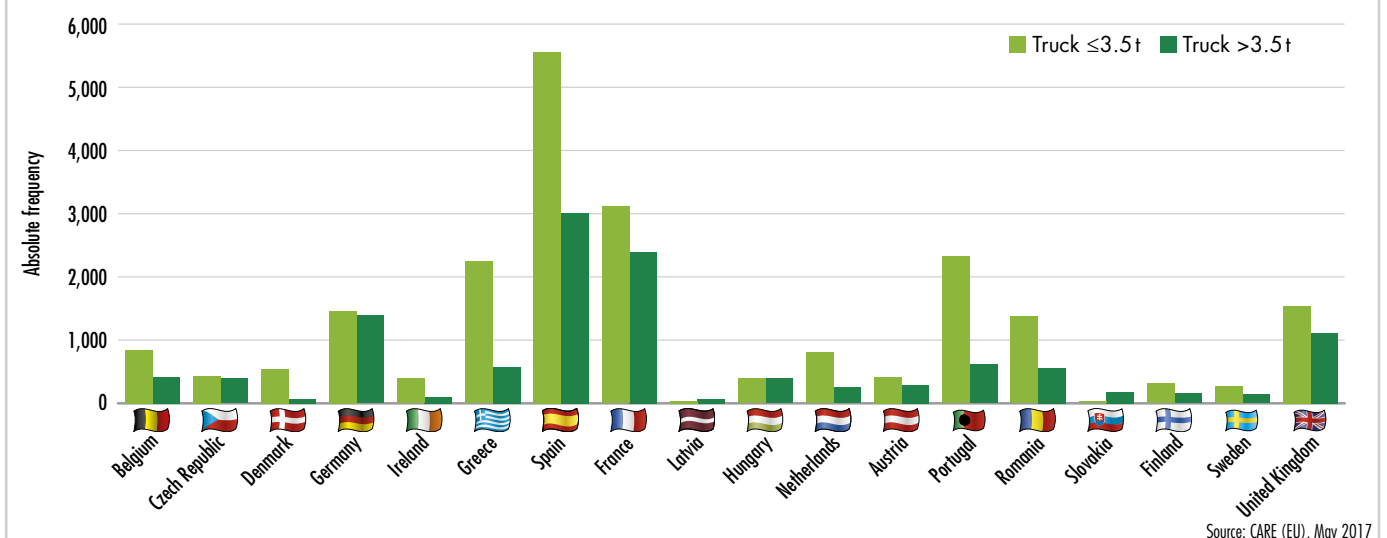
Heavy duty vehicles are a case in point as they are used more intensively and cover longer distances – they also operate in environments that are often highly demanding. Periodic technical inspections (PTI) are the key to ensuring that the vehicles completing these journeys are roadworthy so operators and all road users are kept safe.

By nature of their weight and size, accidents involving these ve-

hicles are also more severe and the social and economic cost from death and injury are enormous. Typical faults for heavy vehicles relate to wear and tear and include brakes, tires, chassis and the results of overloading – independent safety assessment is key to managing those risks and protecting all road users.

Technology, autonomous vehicles and other driver assistance systems are revolutionizing driving – vehicle inspection standards and techniques need to evolve with them to keep everyone safe on the roads. The International Motor Vehicle Inspection Committee CITA helps to ensure that high standards are upheld and has an important role in supporting PTI with consistent standards and continuous improvement of inspections and technology.

12 Total number of light- and heavy-duty truck occupants who suffered fatal injuries in EU states from 1991 to 2015



Source: CARE (EU), May 2017



occurred in urban areas, 26.6 percent occurred on rural roads and 24.8 occurred on highways. As the German Federal Statistical Office explains in its 2016 annual accident report, the different usages of vehicles also become clear when one considers the places where accidents occur. Most accidents – 60 percent – involving small trucks on delivery trips or in the trade sector occur in urban areas; articulated truck drivers, however, were most frequently involved in accidents on highways with a share of almost 50 percent (Figure 13).

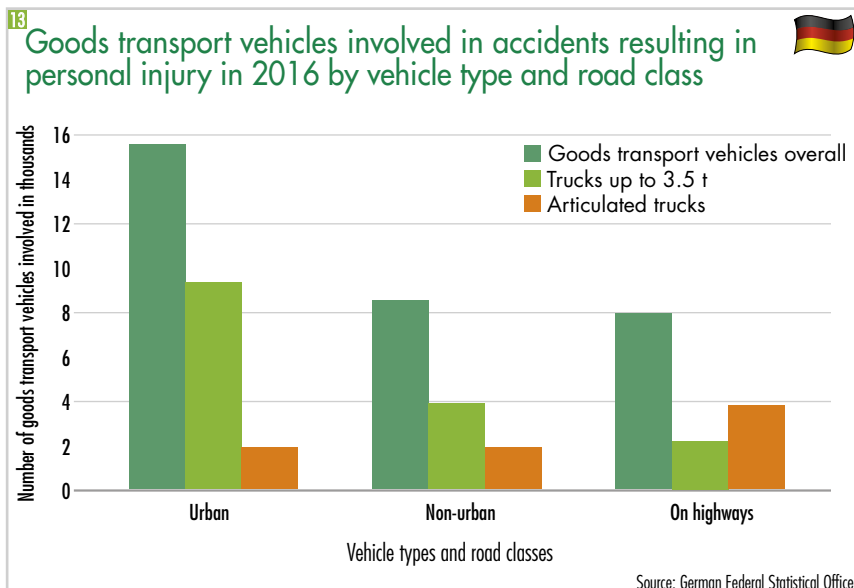
A total of 745 people died in accidents involving goods transport vehicles – that is, around 23 percent

of all traffic fatalities. Compared with the previous year, this was 42 people fewer (or 5.3 percent less). The number of people seriously injured decreased by 0.8 percent to 7,278; in contrast, the number of people suffering minor injuries increased by 0.4 percent to 32,234. Of the 745 fatalities, 355 persons (47.5 percent) died on rural roads, 206 persons (27.5 percent) died on highways and 184 persons (25 percent) died in urban areas. Regarding the distribution of accident victims relative to different types of road use, it becomes apparent that the dimensions and mass of goods transport vehicles mean that the consequences of accidents are usually much more severe for other road users than for the goods transport vehicle occupants. Of the victims of accidents involving trucks in 2016, 9,483 were goods transport vehicle occupants and 30,774 were other road users. Of the victims who died as a result of the accidents, 133 were goods transport vehicle occupants and 612 were other road users. The risk of being killed in an accident involving a truck is therefore more than four times higher for other people involved in the accident – including fellow passengers – than it is for the goods transport vehicle occupants.

### CARS ARE MOST FREQUENTLY THE OTHER ROAD USER INVOLVED IN ACCIDENTS

According to the German Federal Statistical Office, of the total 29,353 accidents resulting in personal injury involving goods transport vehicles, 5.8 percent were single-vehicle accidents resulting in the deaths of 35 goods transport vehicle occupants. In 21,550 of these accidents (73.4 percent), another party was involved; at least three road users were involved in one in five accidents involving a goods transport vehicle. The other road user most frequently involved in accidents involving two parties was a car (13,194), whereby 207 car occupants and 10 goods transport vehicle occupants were killed. In addition, 96 pedestrians, 77 cyclists and 51 motorcyclists died in 2016 in accidents resulting in personal injury involving goods transport vehicles. In 1,268 accidents, the other road user was also a goods transport vehicle, whereby a total of 55 goods transport vehicle occupants died.

In total, almost 60 percent of all goods transport vehicle drivers involved in accidents were considered to be the main cause of an accident resulting in personal injury. But the figures for this cover a broad range: In the case of people driving small trucks, 64.4 percent were the main cause of the accident; with articulated truck drivers, only 50.6





percent were the main cause. The errors attributed most often to goods transport vehicle drivers included the misjudgment of distances (around 20 percent), errors when drivers “turn, perform U-turns, reverse, pull in or drive off” (16.8 percent), failure to observe right of way/priority (11.2 percent) and “excessive speed” (10.4 percent) (Figures 14 and 15).

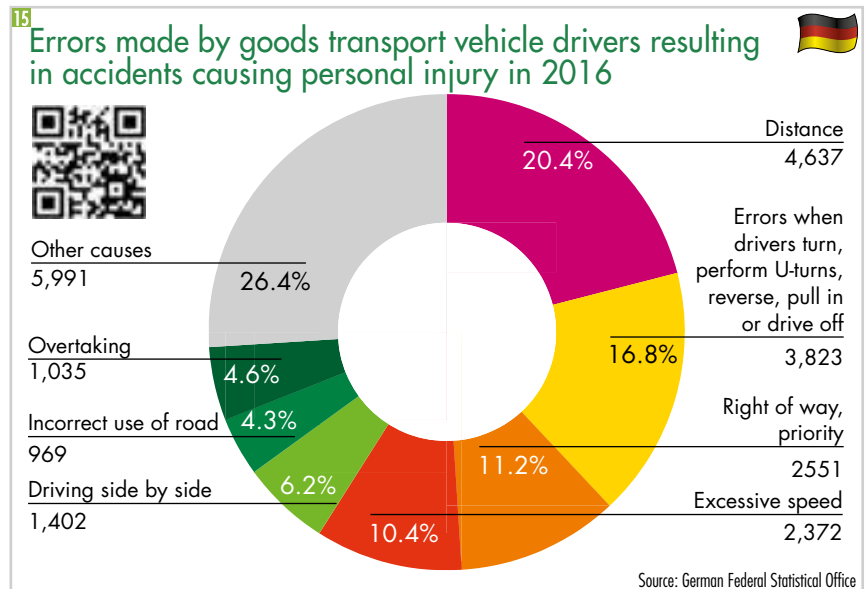
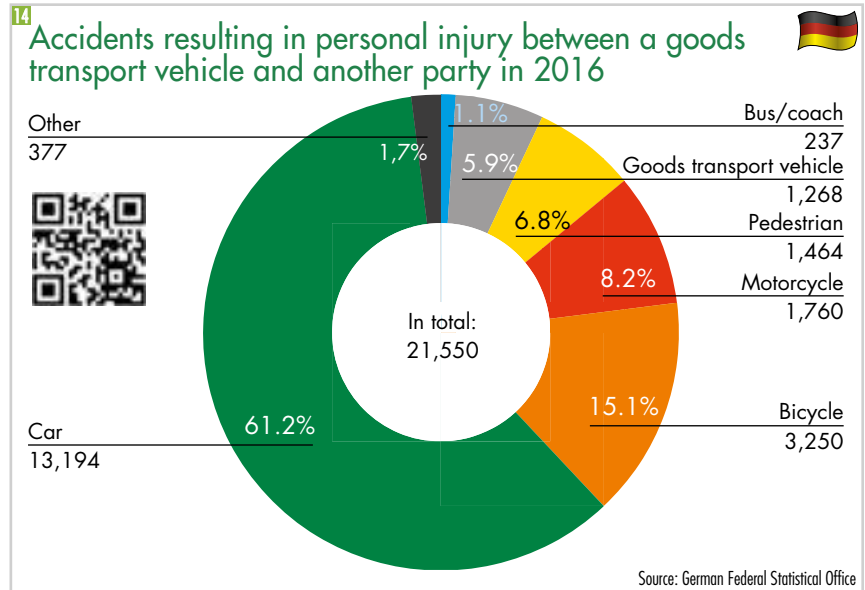
## THE TREND IN GERMANY REGARDING HEAVY-DUTY TRUCKS AND SEMI-TRAILER TRACTORS REMAINS POSITIVE

Looking at the figures for 2017, the provisional accident statistics published by the German Federal Statistical Office show a significant increase in the number of goods transport vehicle occupants suffering fatal injuries, while an overall decline was observed in the number of traffic fatalities. To put this into figures: a total of 168 fatalities – an increase of 35 fatalities or approximately 26 percent compared with the previous year. However, closer examination of the figures shows that the increase primarily concerns the occupants of light-duty commercial vehicles weighing up to 3.5 metric tons (i.e. vans), for which statistics indicate an increase of 32 fatalities. In the case of occupants of trucks weighing over 3.5 tons, the number of fatalities has decreased by three; in the case of semi-trailer tractor occupants, this figure has increased by five.

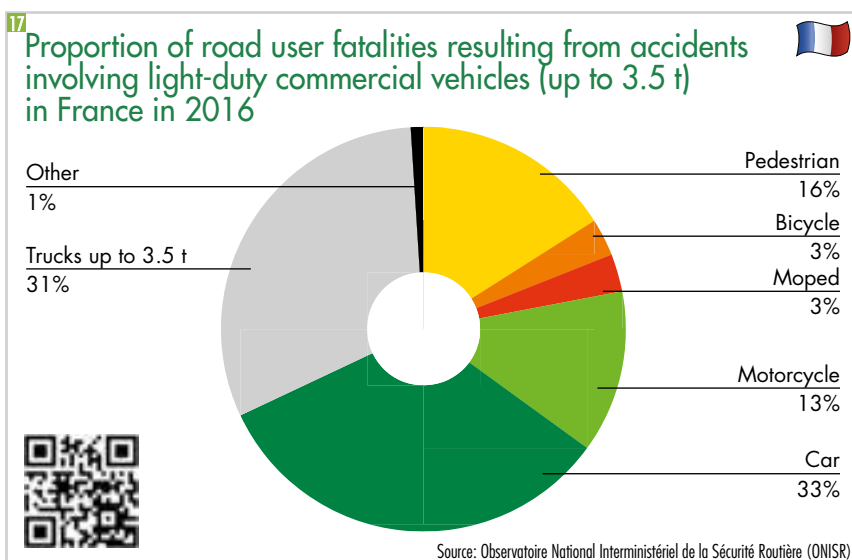
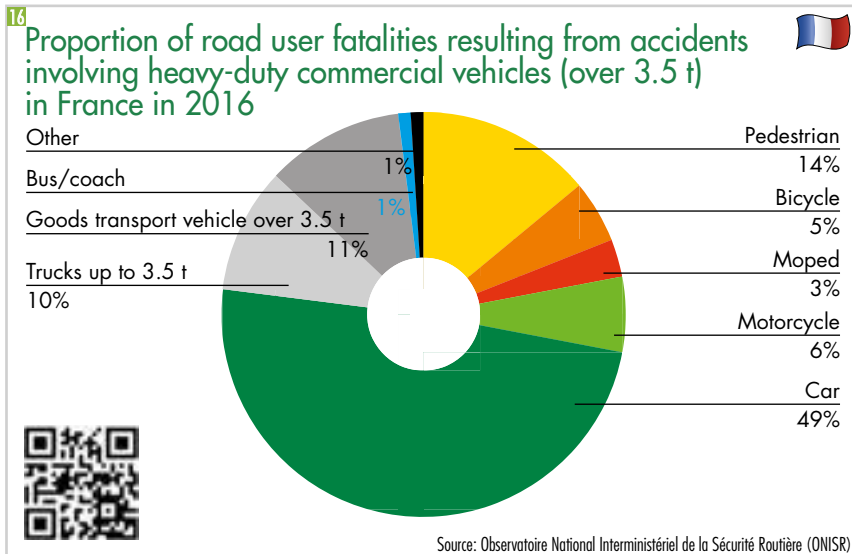
If occupants are not taken into account, but instead the number of fatalities overall in accidents involving light- or heavy-duty commercial vehicles, a similar picture emerges: In 2017, 235 people died in accidents involving vans – a third more than in the previous year. At the same time, a small decrease can be observed in the number of fatalities in accidents involving trucks and articulated trucks. In total, 15 people fewer died in accidents involving both groups of heavy-duty commercial vehicles than in 2016.

## A LOOK AT FRANCE AND THE USA

The long-term trend in other EU member states such as France is also positive. The number of fatalities resulting from accidents involving commercial vehicles weighing over 3.5 metric tons between 2000 and 2010 fell by an average of 6.3 percent per annum in France; from 2010, this figure decreased by around two percent each year. According to information provided by the “Observatoire national interministériel de la sécurité routière (ONISR)”



(French Road Safety Observatory), however, this figure increased by 4.2 percent in 2016 compared with 2015, from 473 to 493 fatalities. Car occupants accounted for around a half of these, unprotected road users – such as pedestrians, cyclists or motorcyclists – accounted for a third, while van drivers accounted for ten percent. 55 of the 493 fatalities were heavy-duty commercial vehicle occupants. 63 percent died in accidents on rural roads, 19 percent died in urban areas and 18 percent died on highways. The trend regarding accidents involving vans weighing up to 3.5 metric tons in 2016 at least is very alarming: The number of fatalities rose by almost 13 percent from 373 to 420 compared with the previous year. After years of this figure decreasing, it was back to the level of 2010. Van occupants accounted for 130 fatalities, which equates to an increase of 8.3 percent compared with the pre-

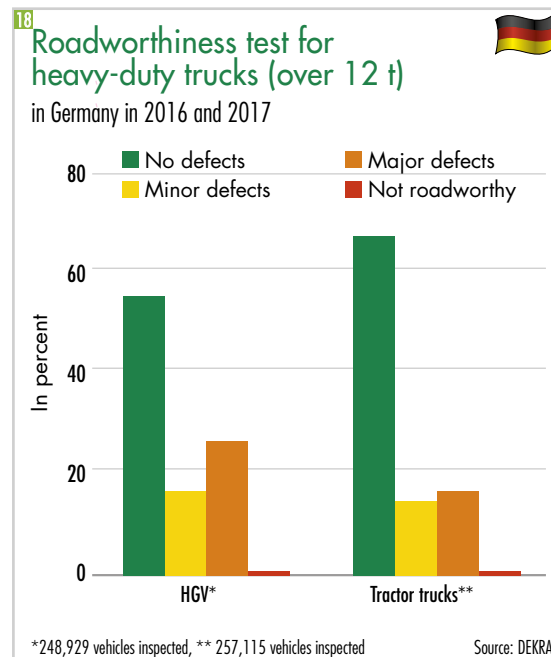


vious year. 67 percent of people killed in accidents involving vans died on rural roads, 23 percent died in urban areas and 10 percent died on highways. According to the preliminary estimates of ONISR, a significant decrease can be observed with respect to the 2017 figures for accidents involving goods transport vehicles weighing over and under 3.5 metric tons (Figures 16 and 17).

The situation has been less positive in the USA for a number of years now. According to information provided by the National Highway Traffic Safety Administration (NHTSA), the number of fatalities resulting from traffic accidents involving goods transport vehicles in the USA dropped by almost 20 percent from 4245 to 3380 from 2008 to 2009. Since then, however, this figure has more or less continuously increased – even going beyond the 2008 level. In 2016, 4317 people died in accidents involving goods transport vehicles in the USA; the increase between 2014 and 2016 alone was around ten percent. Of the 4317 fatalities, 3127 (72 percent) were occupants of other vehicles (an increase of four percent compared with 2015), 722 (17 percent) were goods transport vehicle occupants (an increase of eight percent compared with 2015) and 468 (11 percent) were unprotected road users such as pedestrians or cyclists (an increase of 13 percent compared with 2015).

### TECHNICAL DEFECTS AS A CAUSE OF ACCIDENTS

Various international studies such as the aforementioned ETAC Study prove that technical vehicle defects are responsible for slightly more than five



In 2016, 4317 people died in accidents involving goods transport vehicles in the USA.



■ The HU adapter for electronically controlling the functions of important components has also proved beneficial for heavy-duty commercial vehicles in Germany. Preparations are currently under way to extend the inspection to include trailers.

percent of accidents involving goods transport vehicles. We can also reckon with additional, unreported cases here as well because it is usually very difficult or even impossible to detect vehicle defects on site – in most cases, in-depth technical inspections conducted by an expert do not take place. However, the low rate is certainly also a result of the existing system of vehicle inspections involving professional roadworthiness tests conducted by expert organizations such as DEKRA and other service providers.

As is the case with cars, roadworthiness tests conducted by DEKRA in 2016 and 2017 on trucks and tractor trucks that are registered in Germany and weigh over 12 metric tons show that the rate of defects

## PTI – A Success Story

For decades now, the periodical inspection of vehicles on the road (Periodical Technical Inspection – PTI) has been recognized around the world as an important and integral element of environmental compatibility and road safety. The directive on the harmonization of the laws of the member states relating to technical inspections was developed in 1977 on the basis of standards that had already been proven and tested in individual EU member states; this directive specifies the (minimum) standards for PTI. Against the backdrop of the successful application of the EU PTI directive, which has been updated several times (most recently: 2014/45/EU), the UNECE Convention on uniform prescriptions for periodical technical inspections and mutual recognition of inspection results was adopted in 1997. This laid the foundation for further developing PTI on a harmonized basis beyond the EU framework.

In the same way that the leading role of UNECE with regard to the harmonization regulations for vehicles and vehicle parts is undisputed (1958 Agreement), the EU will be the forerunner in terms of further developing PTI for the foreseeable future. The International PTI institution CITA plays an im-

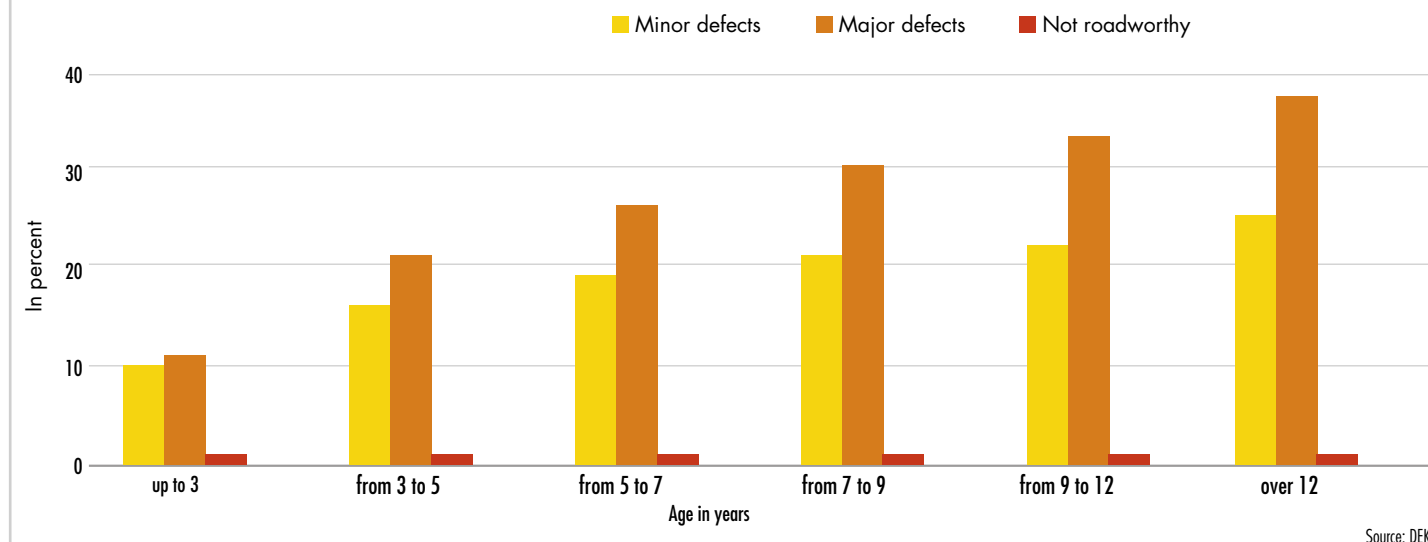
portant role in the process of further developing the content of the regulations.

Updating PTI regulations, as established in the currently applicable EU directive, primarily involves innovative ideas regarding quality management. Following the example of Germany, every EU country is to set up a central supervisory body for quality in vehicle inspections. The use of intelligent driver assistance systems, the increase in electronic components and vehicle–Internet connectivity with simultaneously increasing environmental requirements will have an impact on the future content of PTI. For example, the use of an electronic vehicle interface is explicitly specified; this has already been a part of roadworthiness tests in Germany since 2015 in the form of the HU adapter standard.

The primary objective now should be to harmonize the still-diverging approaches of the EU and UNECE as quickly as possible, with the general progress made with regard to vehicle and inspection technology being taken into account. The global desire for even greater road safety can most likely be fulfilled by further updating the UNECE agreement of 1997.

## 19 Defect rates in roadworthiness tests for trucks and tractor trucks (over 12 t)

in Germany by vehicle age, 2016 and 2017



Source: DEKRA



**Martin Farář**

Former Head of the Department of Transport at BESIP at the Ministry of Transportation of the Czech Republic



### Cooperation primarily with neighboring countries is very important

Freight transport represents a huge part of the whole volume of transportation and truly has some different characteristics apart from passenger transport. It is not only the dimensions of a vehicle. Even technical condition, storage, storage of cargo or eventual overload of a vehicle also plays a huge role. Drivers of freight transport are obliged to follow established times of driving and resting within the so-called social regulations. Transportation of dangerous goods by the ADR is also specific. That is why the freight transportation is realized within the extended legal framework.

The fact is that an ever-growing intensity of traffic brings with it a bigger amount of accidents. The truck category statistics register for the Czech Republic 11,811 accidents in 2017, which is 634 accidents more compared to 2016. The number of people killed decreased year-on-year. In 2016, 80 people died in correlation with truck accidents, whereas 74 people died in 2017. The biggest faults discovered during police checks are consistently in the area of social regulations – drivers are not taking safety breaks and ordered rest. Attempts to influence the function of tachographs are not rare either. In those cases, it is not just about the violation of regulations or cheating. There is a real risk of having an accident caused by fatigue, monotony or microsleep. Besides serious defects, there are also dangerous defects frequently found during

the road checks concerning technical condition. Incorrect storage and insufficient cargo security is a potential hazard not only for the vehicle passengers, but also for other road users. Also, the problem of overloaded vehicles is still there as well. Drawn tracks on the road are also dangerous because there is a higher chance of aquaplaning during heavy rainfall in those places.

As the freight transportation and problems connected to it exceed the borders of the Czech Republic, cooperation primarily with neighboring countries is very important. Since 2010, the Czech Republic is an active observer in the organization known as ECR (Euro Contrôle Route), which associates European control bodies in freight transportation on the road. One of the main goals of this organization is cooperation in the area of increasing the safety of road traffic.

Throughout the year, traffic safety events are being organized. They focus on controls, but simultaneously on accident prevention. Police attend those events in cooperation with regional coordinators from BESIP and mobile control units. The Ministry of Transportation uses those units through the Road Transport Services Center, which is their funded organization. Furthermore, there is every year in the Usti nad Labem Region a traffic-preventive event called “The day for trucks,” which is prepared and realized also by BESIP.

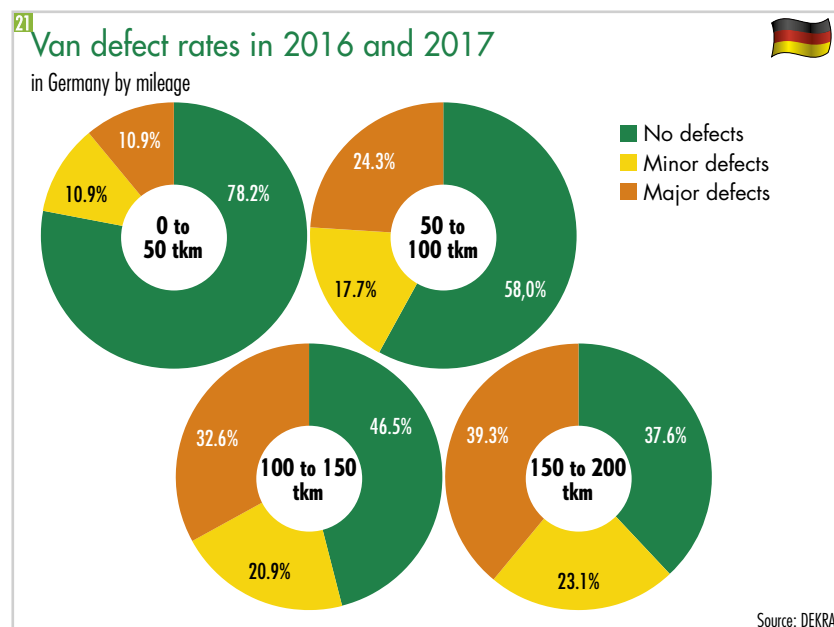
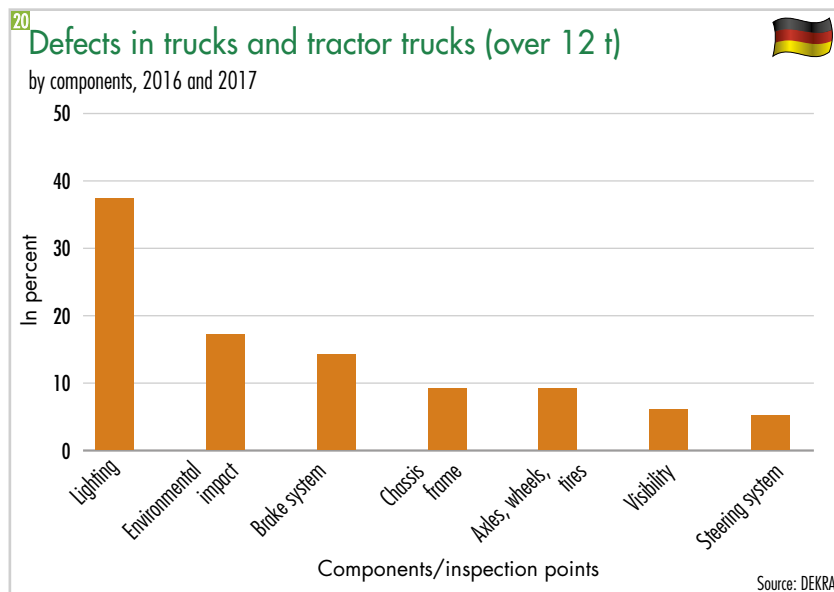
increases as the vehicles age (Figures 18 and 19). While under 22 percent of vehicles up to three years old are found to have defects, this figure is over 50 percent for vehicles over seven years old and over 60 percent for vehicles over 12 years old. The situation is better for trailers weighing over 12 tons, with 20 percent of trailers up to three years old presenting defects and 44 percent of trailers over 12 years old presenting defects. In terms of defective components in trucks and tractor trucks, the electrical system and lights were the components that showed the most defects by far (Figure 20). The reason for this is that a huge number of lights are installed in these vehicles, eventually resulting in a high number of defects with this equipment. In the case of trailers, the braking system and lighting devices were the components that suffered the most defects. As a general rule, the rate of defects increases across all components as the respective parts age – and this applies to trucks and tractor trucks as well as trailers.

A similar development can be observed with vans, as an analysis of DEKRA data from 2016 and 2017 shows (Figure 21). While 78.3 percent of vehicles inspected with a mileage of up to 50,000 kilometers did not present defects, this proportion decreased to 37.6 percent for vehicles with a mileage of 150,000 to 200,000 kilometers. The number of major defects in the mileage categories specified increased from 10.9 to 39.2 percent. Defects relating to the electrical system and lights were the most frequent defects in this case too, followed by the brakes and engine.

■ It is not uncommon for accident sites involving heavy-duty commercial vehicles to be scenes of total devastation.



In addition to the results from DEKRA vehicle inspections, the analyses of trucks involved in accidents provide interesting insights into the defects seen in heavy-duty commercial vehicles. In terms of technical condition, there are clear differences between younger and older trucks. An analysis of the defects in commercial vehicles weighing over 3.5 metric tons found by police directly at the scene of the accident revealed that, from 2007 to 2016, approximately 41 percent of accident-related defects in Germany occurred in vehicles up to five years old. Vehicles over five years old accounted for 59 percent of accident-related defects. The fact is that police can detect defects that are noticeable from the outside directly at the scene of an accident. A detailed inspection in a workshop conducted by independent experts generally reveals many more defects. From 2006 to 2017, for example, the police classified defects with tires detected directly at the scene of an accident as the cause of accidents in 36.5 percent of cases. A detailed analysis conducted by DEKRA experts taking into account all accident-causing defects found the brakes to be the cause of accidents in 50 percent of cases. Overall, defects with tires and brakes in commercial vehicles weighing over 3.5 metric tons are the defects that most frequently cause accidents. It is a similar situation for vans weighing up to 3.5 tons. The figures underline the importance of regular maintenance and servicing as well as roadworthiness tests for vehicle safety.

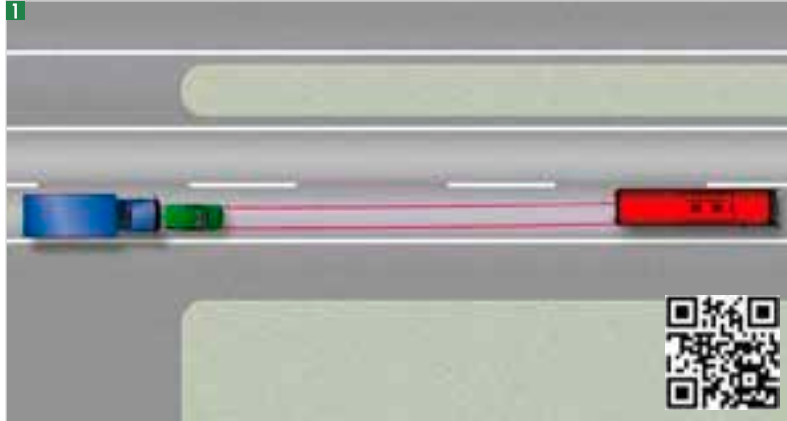


## The Facts at a Glance

- Across the EU, the number of fatalities resulting from accidents involving goods transport vehicles is falling sharply; however, the proportion in relation to all traffic fatalities has remained at more or less the same level of around 15 percent for a number of years now.
- In Germany in 2016, the risk of being involved in an accident resulting in personal injury was half as high for goods transport vehicles than for cars.
- The other vehicle type most frequently involved in accidents with goods transport vehicles is the car – in 2015, 1908 car occupants died in the EU in such accidents.
- The proportion of goods transport vehicle occupants killed in non-urban areas in the EU in 2015 was 86 percent, which is significantly higher than the corresponding figure for other road users.
- From 2009 to 2016, the number of fatalities resulting from accidents involving goods transport vehicles increased by 28 percent in the USA.



# Compelling Examples of Accidents in Detail



- 1 Accident illustration
- 2 Rear end of the coach after the accident
- 3+4 Final positions of the truck and car



End of traffic jam

## TRUCK COLLIDES WITH REAR OF CAR

### Sequence of events:

While driving on the highway during daylight at a speed of 90 km/h, a truck driver crashed into the back of the car ahead in the center of the right-hand lane at approximately 30 to 50 km/h. Around 34 meters after this initial collision, the car, which had become wedged by the truck, was shunted into a coach. In response to an upcoming traffic jam, the coach and car drivers had reduced their speeds at the right time; the brake lights, which were verifiably functional at the time of the collision, would likely have been clearly visible to the following traffic. A technical inspection of the truck gave no indication that the vehicle's braking system had a defect prior to the collision with the car. Visibility was good; the road surface was dry.

### Vehicles:

Truck, car, coach

### Consequences/injuries:

Two car occupants were killed and several passengers in the coach suffered minor injuries.

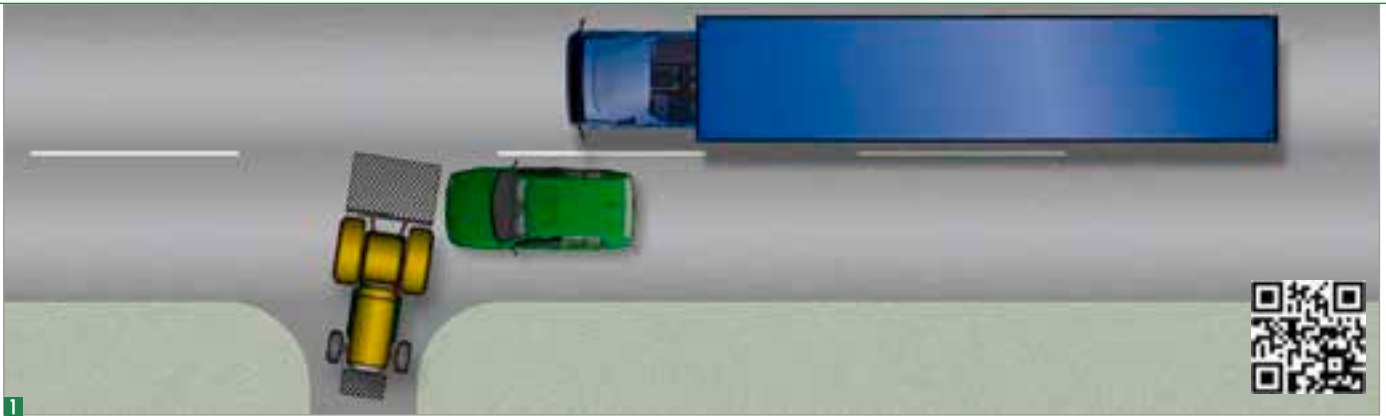
### Cause/problem:

According to the accident analyst, the cause of the accident can be attributed exclusively to the fact that the truck was traveling with excessive speed and the driver did not react to avoid colliding with the back of the car.

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

The truck driver would have been able to react to the traffic slowing down ahead of their vehicle or the brake lights of the coach being illuminated by braking slightly; he could have reacted to the later clear proximity to the car by braking hard or executing an evasive maneuver into the left-hand lane or hard shoulder, thereby avoiding the collision. The accident could also have been avoided or at least the severity of the consequences for the car occupants could have been diminished had the truck been equipped with an automatic emergency braking assistance system. Lives could have been saved if the truck driver had been attentive and focused.





1 Overtaking maneuver

## CAR COLLIDES WITH TRACTOR

### Sequence of events:

On a rural road, a car driver overtook a slow-moving articulated truck. A tractor was driving directly in front of the articulated truck. The tractor driver turned left onto a dirt track when the overtaking car was just behind the tractor, resulting in both vehicles colliding in the lane of oncoming traffic. After colliding with the car, the tractor was thrown onto its side and rolled over. The car came to a stop in the lane of oncoming traffic.

### Vehicles:

Tractor with implement (fertilizer spreader), car, articulated truck

### Consequences/injuries:

The passenger in the car was killed in the accident. The car and tractor drivers suffered serious injuries.

### Cause/problem:

The articulated truck significantly hindered the car driver's view of the tractor and the tractor driver's view of the car.

Due to the high differential speed during an overtaking maneuver, the car was likely still in its original lane as the tractor driver started to turn the tractor.

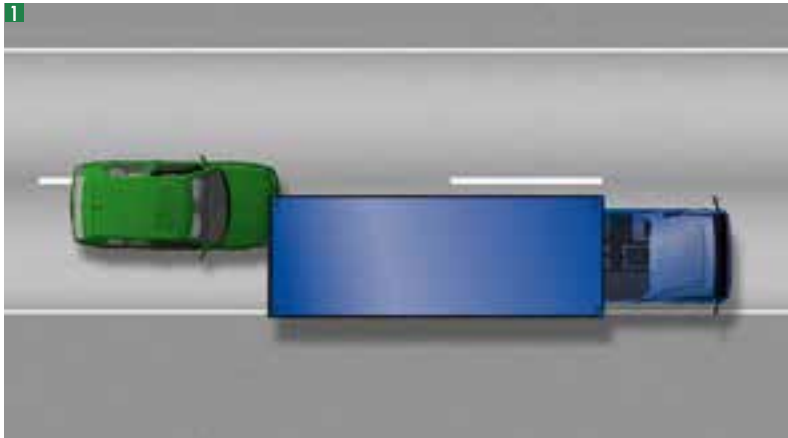
### Avoidance measures, mitigation of consequences/strategy for road safety measures:

This accident could have been avoided had the car driver fully and accurately assessed the traffic situation prior to overtaking, started the overtaking maneuver at an appropriate speed and aborted the maneuver as soon as he had seen the tractor. The accident would have been avoidable had both drivers been more attentive.



1 Accident illustration  
2 Accident site

3-5 Final positions of the vehicles



Sliding underneath the rear end of a truck

## CAR COLLIDES WITH TRUCK

### Sequence of events:

A car driver was driving in the right-hand lane of a highway and crashed into the back of a truck, which was driving ahead in accordance with regulations, at a very high speed (approximately 160 km/h) without applying the brakes. In doing so, the car slid under the truck as far as up to the front seats. Signs indicating that the car driver had attempted an evasive maneuver before crashing into the back of the truck were not found at the scene of the accident. Inspections of the truck's rear lights showed that the equipment was functional and switched on at the time of the accident. The truck rear also had red and yellow reflective panels.

### Vehicles:

Car, truck

### Consequences/injuries:

The car driver was killed after the rear of the truck penetrated deeply into the passenger cell.

### Cause/problem:

According to the accident analyst, the cause of the accident can be attributed exclusively to the fact that the car driver did not react to avoid crashing into the back of the truck, which was clearly visible from behind. The severe consequences are due to the lack of compatibility between a car and truck as well as the huge difference in speed. Both of these factors rendered the car's crumple zone ineffective.

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

This accident could have been avoided or at least the severity of the consequences for the car driver could have been diminished by means of an automatic emergency braking assistance system. The fatal accident could have been avoided had the car driver been more attentive and focused. The high speed of the car contributed to the severity of injuries. For trucks, more effective rear underrun protection systems hold great potential.



1 Accident illustration

2-5 Final positions of the vehicles



Truck turning right

## TRUCK HITS CYCLIST

### Sequence of events:

A truck driver turned right at an intersection and, in doing so, hit a cyclist with the front right part of the vehicle. According to the truck driver, the traffic lights were on green. Since no separate traffic lights are provided for the cycle path running alongside the road, the green light also applied to the cyclist traveling straight ahead on the cycle path. According to the tachograph disc, the truck approached the intersection, slowed to a stop and then accelerated before braking to stop the vehicle again.

### Vehicles:

Cyclist, truck

### Consequences/injuries:

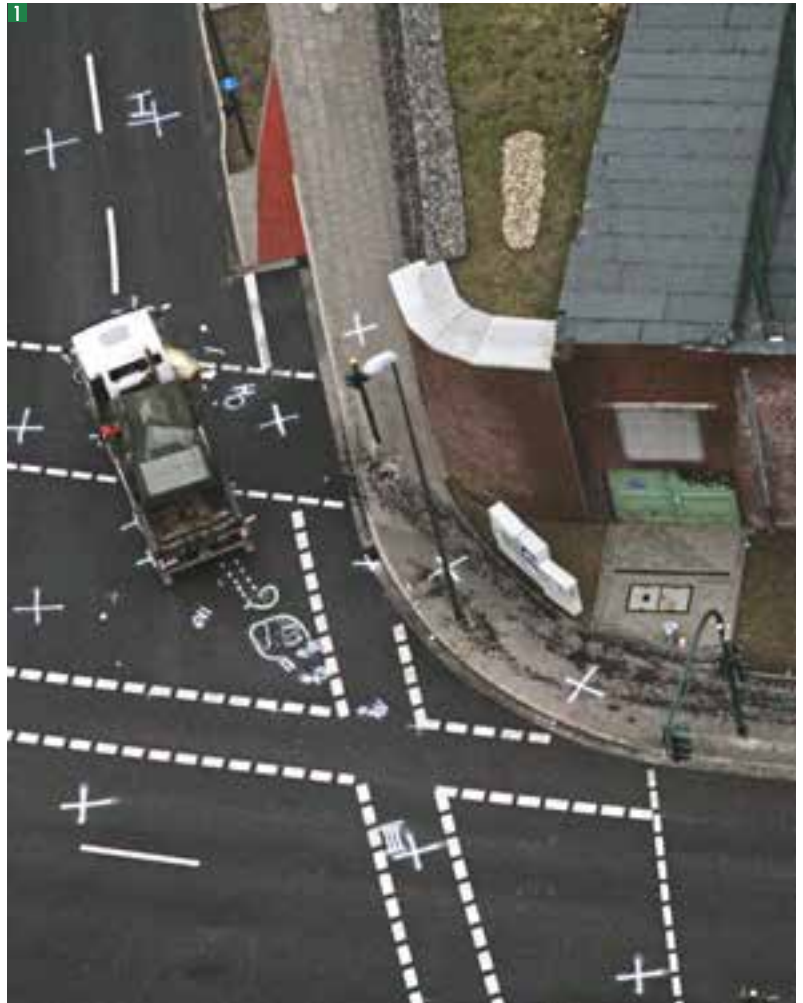
The cyclist was killed.

### Cause/problem:

Despite extensive mirror systems, there are large areas of space that cannot be seen either directly or indirectly from a truck via a mirror (blind spot). Even if something is visible in one of the mirrors briefly, this is not enough to ensure the driver detects it while performing the complex maneuver of turning a truck.

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

Had the truck been equipped with a turning assistance system and camera or radar systems for detecting cyclists or pedestrians on the right-hand side of the vehicle, the fatal collision could have been avoided. Whenever possible, cyclists should make eye contact with truck drivers. Above all, cyclists and pedestrians must be aware of the problem of the blind spot. Particular caution must be exercised whenever a vehicle indicates to turn right.



1 Accident site seen from above

2+3 Final position





Technical defect

## FRONTAL COLLISION WITH ONCOMING TRAFFIC

### Sequence of events:

A truck driver was driving an articulated truck on a rural road. While negotiating around a right-hand curve, the driver applied the vehicle's brakes. By doing so, the wheels of the first and third axle became locked on the right-hand side of the semi-trailer, meaning that the cornering forces needed to travel around the curve could no longer be applied. The semi-trailer traveled left onto the lane of oncoming traffic, where the side of it collided with the front of an oncoming articulated truck. Its driver became trapped in the driver's cab and had to be rescued by the fire brigade.

### Vehicles:

Two articulated trucks

### Consequences/injuries:

A trucker suffered serious injuries.

### Cause/problem:

A technical inspection of the semi-trailer of the party responsible for the accident determined that there were considerable defects with the braking system of the vehicle that contributed to the accident, alongside the behavior of the driver.

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

The driver responsible for the accident could have avoided the accident if they had taken into account the course of the road and the weather conditions and had braked their vehicle to a maximum speed of 40 km/h before entering the curve in order to negotiate it using the full cornering forces without further braking. With regard to the victim who suffered serious injuries, the accident was unavoidable because he had no opportunity to swerve out of the way due to the layout of the road and the slope profile. If the braking system had been in good working order, the semi-trailer probably would not have left its lane. Regularly checking the technical condition of a vehicle is essential, and any defects identified must be rectified immediately.



- 1 Accident illustration
- 2+3 Damage to the oncoming truck
- 4 Damage to the semi-trailer of the vehicle that caused the accident
- 5 Course of the road at the site of the accident seen from opposite the direction in which the vehicle that caused the accident was traveling

Frontal collision with tree

## VAN SWERVES OFF ROAD

### Sequence of events:

At the end of a long left-hand curve on a highway, a van driver swerved off the road to the left. The driver then went through a grass strip for approximately 120 meters. According to the marks, the driver applied the brakes only partially, not fully. No counter-steering movements were made either. The vehicle followed the course of the grass strip until reaching an embankment; the vehicle traveled down the embankment and grazed a tree before colliding head-on with another tree. The road surface was dry at the time of the accident.

### Vehicles:

Van

### Consequences/injuries:

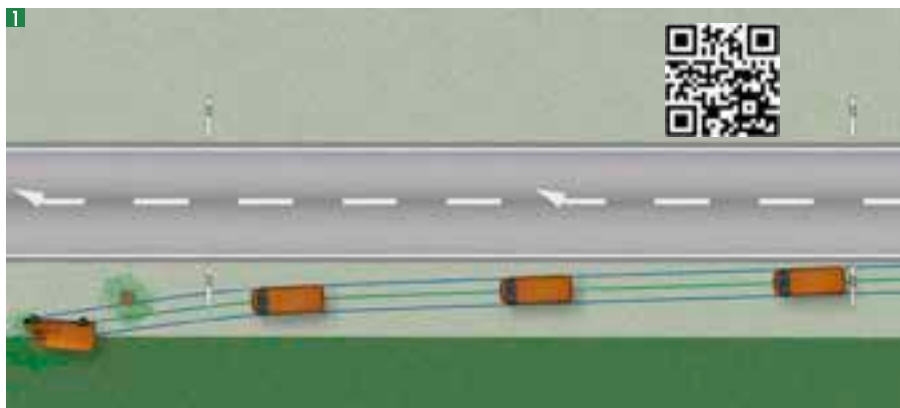
Two occupants suffered serious injuries.

### Cause/problem:

The vehicle was in good working order. The steering and braking systems were functional. The maximum permissible speed at the site of the accident was 100 km/h. At the verified driving speed of maximum 86 km/h, the road at this point would not have presented any problems. The accident therefore has no technical cause, but occurred because the driver did not steer the vehicle to follow the straight stretch of road at the end of the curve.

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

Swerving off the road could have been avoided had the van driver been attentive and focused. Instead of just applying the brakes partially, it would have been sensible to apply the brakes fully after leaving the road. Swerving from the lane could have been avoided had the van been equipped with a lane assist system or lane departure warning system.



1 Accident illustration

2 Final position at the site of the accident

3+4 View from the opposite direction of travel

5 Damage to the van caused by the collision





Into the lane of oncoming traffic

## TRUCK SMASHES THROUGH GUARDRAILS

### Sequence of events:

A truck driver was driving a silo truck on the highway when he swerved off the road to the left and smashed through the guardrails. The vehicle then toppled onto its left side and collided with an oncoming articulated truck in the lane of oncoming traffic. Its driver became trapped in the driver's cab. At the site of the accident, the highway is almost level and straight; the road surface was wet at the time of the accident.

### Vehicles:

Two articulated trucks

### Consequences/injuries:

A driver became trapped and died.

### Cause/problem:

An inspection of the vehicles conducted by the accident analyst found no technical defects that caused or contributed to the accident. The accident can therefore be attributed to inattention or human error.

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

Under some circumstances, the accident could have been avoided or at least the severity of the consequences mitigated if the silo truck had been equipped with a driver assistance system (lane assist system/driver fatigue detection system). The accident would not have happened if the party responsible for the accident had been more attentive and focused while driving and had reacted sooner. With regard to infrastructure, the installation of stronger, more resistant guardrails on highways is to be considered.

1-3 Accident site seen from above

4 End position of the party that caused the accident in detail

5+6 Breached guardrails



Load securing

## POORLY SECURED BOILER END FALLS OFF TRUCK

### Sequence of events:

Two boiler ends were loaded upright in a metal frame on a trailer attached to a truck. During the journey, the left-hand boiler end tipped over from the vehicle and damaged two oncoming coaches. The first coach swerved from the lane and collided with a car. The coach then tipped over onto its right and collided with another car.

### Vehicles:

Truck, two coaches, two cars

### Consequences/injuries:

One coach driver was killed and one suffered serious injuries. Had there still been passengers in the two coaches, the consequences might have been even more devastating.

### Cause/problem:

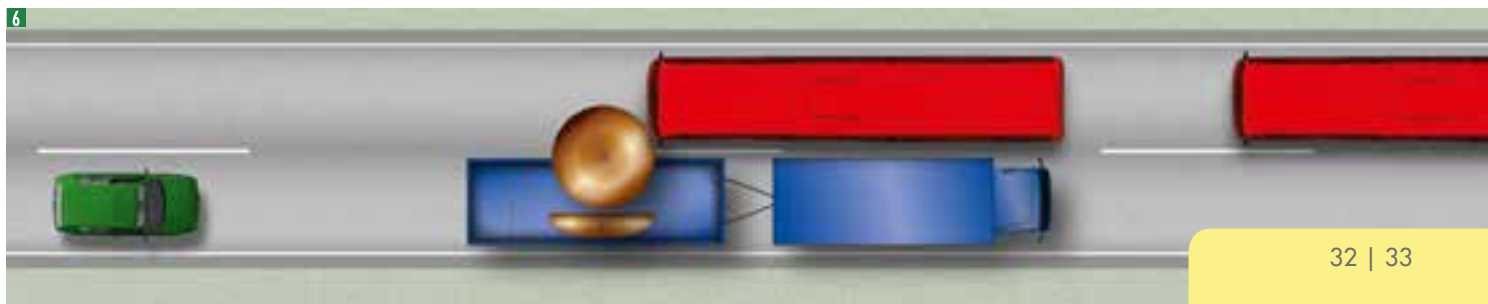
Only one of the boiler ends was properly secured using lashing chains so that it had a positive-locking fit with the frame. The other boiler end, however, was secured with securing straps such that the straps had no effect on the lower section of the boiler end. Soft anti-slip mats were attached to the edges of the boiler end. Because the boiler end was able to move, the sharp edges cut through the anti-slip mats and securing straps, causing the boiler end to fall from the vehicle.

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

If the left boiler end had been secured in the same way as the right-hand boiler end, the accident would have been avoidable. Lashing material should have been attached in a way that a positive-locking fit between the boiler end and transportation frame would have been guaranteed. In addition, stable edge protectors would have had to be used to protect the lashing straps. Against this backdrop, providing professional drivers with training on safely securing loads is essential.



- 1 Rigged-up coach
- 2 Simulated load securing with lashing chain and lashing strap
- 3 Anti-slip mats not resistant to cuts used as edge protection
- 4 Frayed lashing straps
- 5 Simulated load securing with lashing chain and lashing strap
- 6 Illustration





## Being Adaptive, Attentive and Responsible on the Road

As is the case with other road user groups, the person behind the steering wheel plays a key role in road traffic accidents involving goods transport vehicles. Driver assistance systems offer tremendous potential for preventing accidents. For this to actually be the case, however, drivers need to know exactly what the systems can and cannot do. In view of the numerous requirements, strains and dangers, training for professional drivers is extremely important.

Whether a driver is at the wheel of a truck, in the driver's cab of a locomotive, the cockpit of a cargo plane or on the bridge of a container ship – when it comes to the “human factor,” reliability plays a key role. Experts refer to “behavioral reliability” in the context of human-machine interaction – in this case, interaction with the means of transport. Behavioral reliability depends on the design of the technical system and the performance requirements of the person in question.

As a general rule, behavioral reliability is particularly high when the respective system is optimally adjusted to the capabilities of the person. If errors occur, they are considered to be the consequence of an incompatibility between the individual and the task of driving the means of transport. The problem is that human error can have

fatal consequences on the road, so it is important to maintain or, where necessary, increase one's level of behavioral reliability. To do this, one has to be or become aware of influencing factors.

When a driver is at the wheel of a motor vehicle, influencing variables relating to the human factor primarily include acquired skills in handling the vehicle system (competency), the mental and physical requirements of driving a vehicle (fitness to drive) and the current physical and mental state (capability). With truck cabs featuring an increasing number of automation functions, the requirements regarding the required level of competency, fitness to drive and, where applicable, capability need to be modified or even completely redefined.

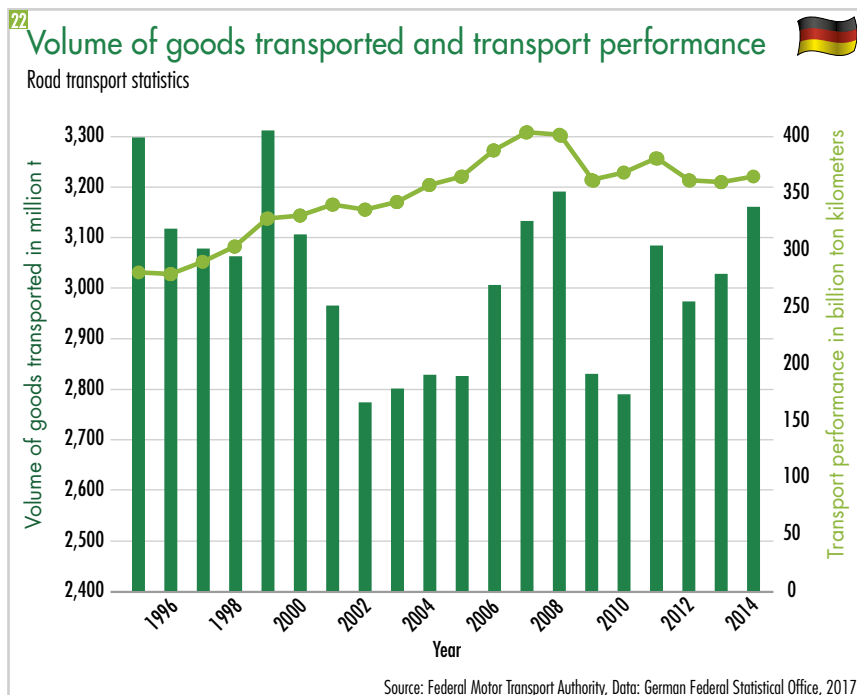


## TRAINING FOR PROFESSIONAL DRIVERS

Given increasing goods transportation (Figure 22) by road, the demand for professional drivers has increased. Against this backdrop, questions regarding the safety of truck and bus transport operations are coming to the fore. Professional drivers in particular have to fulfill very specific requirements due to the complexity of their driving task. Professional drivers face difficult conditions – including driving along unfamiliar routes, on poor roads or in challenging weather conditions – more often than car drivers. Technical equipment in goods transport and passenger transport vehicles is often on a higher level; while this is much better in terms of road safety, it also places increased demands on drivers. Truck drivers need to know exactly how driver assistance systems work and how these systems assist them in their job so that they can take the appropriate action in the event of a technical malfunction. Professional drivers also have to adhere to a range of transport regulations regarding the safe securing of loads or the transportation of dangerous goods. When transporting goods long distances across international borders, professional drivers are additionally confronted with a number of country-specific traffic regulations and features that they have to deal with appropriately. In addition to this, there is the emotional and mental stress of constant time pressure and being a long way from one's family. Another particular challenge for truck drivers is the physical stress involved in working long shifts or single-handedly loading and unloading goods.

The main cause of accidents is still driver error. To increase road safety and help professional drivers to maintain good health, ongoing training is essential. In Germany, it is possible to undergo state-approved training to become a professional driver. In 2016, 2,964 training contracts were signed. According to the Chambers of Industry and Commerce, around 2,000 trainees completed their professional driver training over the last three years, although there were over 100 fewer trainees between 2015 and 2016.

Training courses similar to the professional driver training offered in Germany are available in other European countries too. A report compiled by BASt (German Federal Highway Research Institute) in 2008 compared the professional training courses (Table 23).





23 Comparison of training courses for professional drivers across countries



	France	Switzerland	Netherlands	Germany
Type/objective of training	BEP (technical training certificate) CAP (vocational aptitude certificate) CFP (vocational training certificate)	Basic training for truck drivers	Professional driver training	Professional driver training
Target group	Students who have completed level 1 secondary education or above	Students who have completed level 1 secondary education or above	a) From 16 years old b) From 20 years old	a) Students who have completed level 1 secondary education or above b) Drivers with at least four years of professional driving experience c) Retraining for professional drivers with at least one year of professional driving experience
Length of training	One year or two years on a part-time basis CFP: 350 hours	Three years	a) Two-year training course b) One-year training course each course is led by "Vakopleiding Transport en Logistiek"	a) Three-year training course b) Four to six weeks c) 12–21 months
Implementation	(Professional) school education with compulsory practical work placement (CFP): 41 lessons covering: • The driver and their environment • The driver and their vehicle • The driver as road user • Basic training on "dangerous substances"	Practical training within a business, vocational college once per week	a) • Trainees are contractually employed at the training institute • Training within a business, vocational college once per week b) • Trainees are contractually employed at the training enterprise • Training within a business, vocational college once per week	a) • Dual training system: business and vocational college b + c) • Training and lessons at recognized training centers (such as TÜV and DEKRA)

Source: (from Frühauf et al., 2008)

At a European level, Directive 2003/59/EC (EU directive concerning professional drivers) of July 3, 2003, defines the minimum requirements for professional drivers. The directive cites the following as the reason for professional driver training:

“To enable drivers to meet the new demands arising from the development of the road transport market, Community rules should be made applicable to all drivers, whether they drive as self-employed or salaried workers and whether on own account or for hire or reward.

The establishment of new Community rules is aimed at ensuring that, through their qualification, drivers are of a standard to have access to and perform the act of driving.”

The aim is to improve road safety either by making drivers complete an initial qualification over 280 hours or complete a four-hour theory test and a two-hour practical test in addition to regular further training over 35 hours every five years. The compulsory initial qualification is aimed at drivers from 18 to 21 years old with a driving license in classes C1, C1E, C, CE, D, DE, D1 and D1E. Eighteen-year-olds

■ Roadside checks are one important way of increasing road safety.



starting their career in the transport of goods with a driving license in class C1 or C1E and 21-year-olds with a driving license in class C or CE or D, DE, D1 or D1E can complete an accelerated initial qualification involving 140 hours of training and a final test.

The EU defines the minimum requirements to be met for the initial qualification and further training as:

- The safety rules to be observed while driving and while the vehicle is stopped
- The development of defensive driving, anticipating danger and making allowance for other road users
- Rational fuel consumption

Officially approved training facilities are responsible for implementing qualification and training measures, which are completed by students once they have successfully completed the corresponding test.

## SPECIAL DEMANDS REGARDING PROFESSIONAL DRIVERS

Demands regarding professional drivers have changed significantly in recent years. The job of professional drivers used to be defined simply as driving and loading/unloading. The fact that professional drivers in the goods transportation sector have to perform a range of other tasks was detailed by Frühauf and colleagues (2008) (Table 24); the authors distinguished driving-related tasks from non-driving-related tasks.

Various other skills and “soft skills” are also required because drivers are expected to be friendly and willing to compromise when dealing with colleagues and customers.

Due to the strict requirements regarding professional drivers in the goods transportation sector in Germany, other provisions apply in addition to the initial qualification in order to attain the appropriate driving license. According to the regulation on driver’s license (“FeV”), professional drivers must meet certain physical requirements and have no visual impairments. For drivers who transport people professionally, psychophysical capability (ability to withstand stress, sense of orientation, concentration, attention and reaction capability) is also tested.

In 2000, section 2.5 “Anforderungen an die psychische Leistungsfähigkeit” (Requirements re-

### Dr. Walter Eichendorf

President of the German Road Safety Council (DVR)



## Relieving the burden on truck drivers and preventing serious accidents involving trucks are essential

Goods transport vehicles perform an essential role in society by providing people with goods. Accidents involving these vehicles generally entail serious – frequently fatal – consequences. In 2016, 745 people died in accidents involving a goods transport vehicle and 39,512 were injured, some seriously.

To counter this, people predominantly focus on legislation, infrastructure or technology. Making the installation of an automatic emergency braking system or a turning assistance system compulsory would undoubtedly enhance safety, but we need to pay much more attention to the truck drivers themselves and the continuously high levels of stress from which they suffer. Heavy traffic and congestion on the highways, tightly scheduled route plans and long searches for a parking space are daily occurrences. Short loading and unloading stops are particularly stressful. If it is not possible to keep to the schedule of these slots due to the high volume of traffic, drivers often have to wait for long periods of time, which, in turn, intensifies the time pressure for

subsequent journeys. It is also not acceptable that truck drivers are routinely taken for granted in helping load and unload goods.

More flexible loading and unloading times as well as more realistic route and delivery scheduling based on the time needed to drive the routes and time spent in traffic jams. Furthermore, truck drivers must have the option of taking a break when they are acutely tired to avoid falling asleep at the wheel. A recent personal survey involving more than 350 truck drivers conducted on behalf of the German Road Safety Council (DVR) and the German Society for Sleep Research and Sleep Medicine (DGSM) revealed that almost every second person questioned had fallen asleep at the wheel at least once – alarming findings that we must not ignore.

Relieving the burden on truck drivers and preventing serious accidents involving trucks are essential if we are to achieve “Vision Zero.” This is perfectly possible provided that trucking companies and consignors tackle these problems together.

## 24 Job profile for truck drivers

Driving-related tasks	Tasks unrelated to driving	Other skills
Coupling/uncoupling, attaching/removing swap trailers	Pre-journey checks	Nutrition and health
Cross-border transport	Operating technical devices (forklift etc.)	First aid
Driving in convoy	Loading and unloading	EU social regulations, road traffic law
Fuel-efficient driving	Load securing	Vehicle technology, superstructures, accessories
Maneuvering	Operating electronic toll equipment	Language skills in international long-haul transport operations
Conduct in the event of road accidents	Handling dangerous goods, knowledge of regulations on mixed loading	Correspondence, necessary documents
Anticipatory driving	Maintenance/repairs	Route planning, transport geography

Source: (from Frühauf et al., 2008)

garding mental capacity) of the “Begutachtungsleitlinien zur Kraftfahreignung” (Guidelines for assessing fitness to drive) defined limit values for these dimensions, which are still applicable today, whereby the limit value of PR = 16 (group 1) and PR = 33 (group 2) (“PR” means “percentile rank”). This statistical measure indicates the relative position that a person occupies with regard to a particular characteristic in a comparative or reference group.

The notes accompanying the “Guidelines for assessing fitness to drive” specify that these definitions were established “taking empirical values into account.” Regarding the changes in traffic conditions, entailing the need for professional drivers to complete additional tasks while under ever-increasing time pressure, denser traffic and automation technology, we have to consider whether these guidelines are still applicable under these new conditions and what can be done to keep the human reliability factor in the human-vehicle system at the required high level in the long term.

## AUTOMATION IN THE ROAD GOODS TRANSPORT SECTOR

The very act of driving a truck places enormous demands on motor and cognitive skills. The sheer weight of the vehicle and, possibly, the load mean that truck drivers need to drive such that they are always aware of the traffic situation far ahead of them because, say, an emergency braking pro-

cess takes much longer. In addition to a working knowledge of the relevant traffic regulations, professional drivers also need special cognitive skills such as a high level of attention, the ability to process information quickly, a good sense of direction and the ability to see things from different perspectives. So truck drivers need to see things from the perspective of other road users so that they can anticipate potential hazards. Assistance systems can provide drivers with all the support they need here.

In particular, trucks equipped with automation technology are expected to penetrate the market faster and in higher volumes than other vehicle types equipped with automation technology. There are a number of reasons for this including that legislature specifies the mandatory introduction of safety-relevant assistance systems when a vehicle is first registered; systems include the anti-blocking system (1991), the electronic stability program (2014) and emergency brake assist (2015). The estimated market penetration of truck assistance systems is shown in Table 25. With 2.85 percent annually, the rate of introduction of ACC systems is slightly above that for ABS (2.5 percent).

When it comes to the performance requirements of drivers of (highly) automated vehicles, the test for assessing driver alertness should play a central role in the future. Continuous system monitoring, which is necessary when automated systems are used, demands special skills to sustain atten-

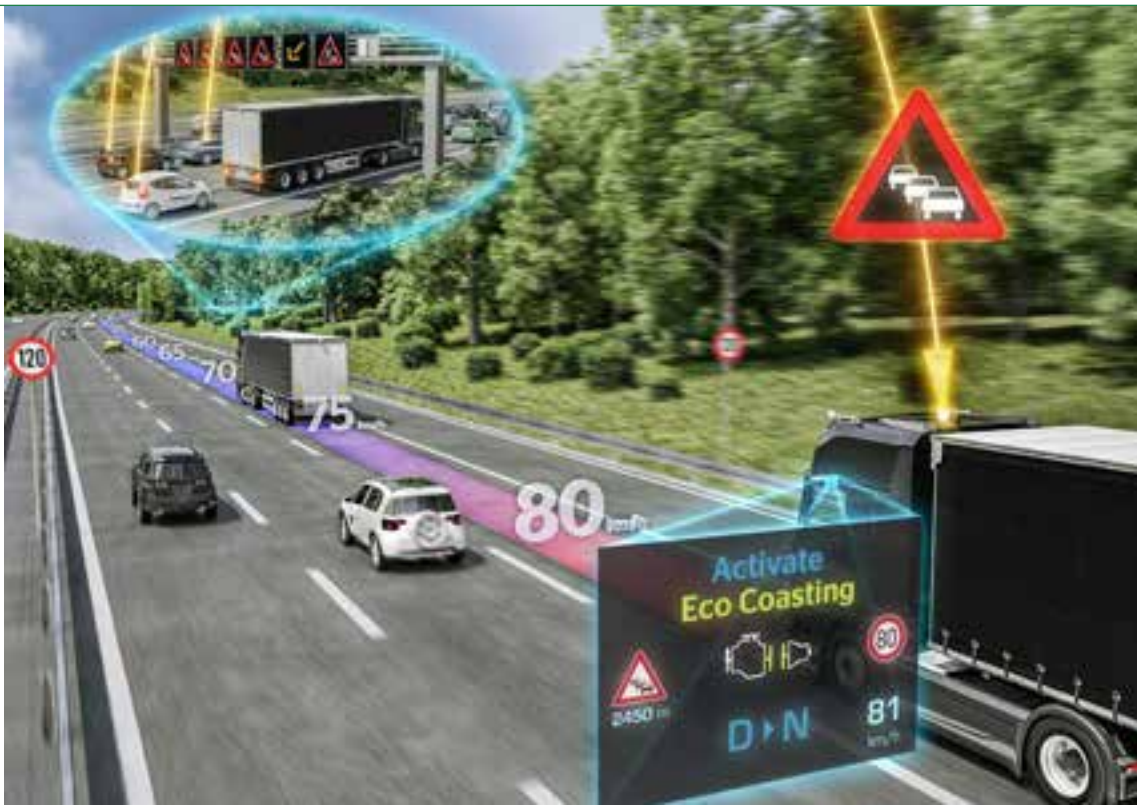
25 Estimated market penetration of truck assistance systems in the truck fleet



Level	Function/segment		Year							
			2015	2020	2025	2030	2035	2040	2045	2050
Normal driver	Penetration of normal driver segment		100%	85%	70%	40%	30%	10%	5%	0%
Partially automated driving function	ACC		5%	20%	40%	70%	80%	90%	95%	100%
	Traffic jam assistant		0%	15%	30%	60%	70%	90%	95%	100%
	Penetration of partially automated driving functions		0%	15%	30%	60%	70%	90%	95%	100%
Highly automated driving function	Highway	ACC	5%	20%	40%	70%	80%	90%	95%	100%
	Chauffeur	Traffic jam assistant	0%	15%	30%	60%	70%	90%	95%	100%
	(reactive)	Lane Change Assist	0%	10%	25%	35%	50%	65%	80%	90%
	Penetration of highly automated driving functions		0%	10%	25%	35%	50%	65%	80%	90%
Communicating highly automated vehicles	Highway	Collaborative convoy operations	0%	5%	10%	15%	25%	35%	60%	75%
	Chauffeur	Lane Change Assist	0%	10%	25%	35%	50%	65%	80%	90%
	Car-to-X communication		5%	15%	25%	35%	60%	80%	95%	95%
Penetration of communicating highly automated vehicles		0%	5%	10%	15%	25%	35%	60%	75%	

Source: from: Busch et al., 2017





■ Dynamic content such as traffic restrictions, road work, traffic flow information, weather information and recommendations is increasingly being displayed for drivers on head-up displays.

tion – a form of alertness, also referred to as “vigilance.” Vigilance, therefore, also needs to be tested, especially among drivers using partially and highly automated support systems in a vehicle.

The ability of a driver to shift their attention from one stimulus to another (“shift of attention”) is also important. In this context, the “working memory” – which has so far not played any role in the assessment of a person’s ability to drive – has taken on a particular significance. According to Baddeley (2012), the working memory consists of four components:

1. the central executive, which undertakes control, organization and monitoring tasks
2. the phonological loop, which processes acoustic and verbal information
3. the visuospatial sketchpad, which is responsible for processing visual information
4. the episodic buffer, which establishes a connection to the semantic and episodic knowledge of the long-term memory

The role of the working memory is to store information for a short period of time and simultaneously manipulate it. The latter differs from the short-term memory, which is used only for storing information. The processes performed by the aforementioned working memory play a role in the executive functions, such as logical thinking, problem-solving and the planning of actions. In view of the higher rates of automation in the goods transportation sector in particular, the definition of ba-

sic (cognitive) requirements for truck drivers and, if applicable, the dimensions to be tested need to be optimized.

It can be anticipated that an increasing number of driving sub-tasks will shift from the driver to the in-vehicle technology. Attempts are already being made in the goods transport sector to transition from partially automated driving – i.e. the use of driver assistance systems – to highly automated driving, which enables drivers to effectively relinquish control of the vehicle, at least in certain situations such as driving in convoy on a highway or rural road. Corresponding research projects have already been successfully completed or are ongoing.

## AUTOMATION IN VEHICLES CAN CAUSE SAFETY ISSUES

But as in-vehicle automation technology becomes more common, the role of the driver is shifting from that of an active operator to a passive supervisor. This shift in roles places new demands on drivers. A passive supervisor rule reduces one’s level of alertness and activity, which in turn can cause safety problems. Drivers can become over-reliant on the in-vehicle technical assistance systems, even if they have been expressly advised that, despite the ongoing technological refinement of these systems, they should not expect their vehicle to master all potential scenarios in active traffic situations in the foreseeable future. It is then very difficult to take over control of the vehicle in the event of an emergency, also known as the “out of the loop” prob-



■ *Increasing automation helps drivers to perform their driving tasks, but does not relieve drivers of their ongoing supervisory role.*

lem. This describes the state in which drivers are in when they are not required to steer the vehicle.

But drivers who can temporarily “switch off” must be able to reliably assume certain driving tasks should the assistance systems be stretched to their limits (i.e. in highly complex situations). The driver must therefore be brought back “into the loop” by the vehicle. But it takes a certain amount of time for drivers to properly understand the situation so that they can retake control of the vehicle without making any errors. A report compiled by the German Insurance Association in 2016 addresses this issue of switching roles. In this report, a review of various studies into the amount of time required for the switchover from (highly) automated driving to manual control shows that anywhere between 2 to 20 seconds can elapse until drivers are in a position to perform their task. However – and as the authors of the report expressly emphasize – the studies are comparable only to a very limited extent due to the varying test conditions.

Furthermore, in the long term, vehicle automation will result in drivers either forgetting the skills they have acquired or not even acquiring these skills in the first place. This effect becomes

particularly pronounced if a driver has to control a vehicle manually because, for example, an automated function fails or if a driver hires a vehicle equipped with only limited automation technology. These are critical or demanding situations in which the driver would have to fall back on patterns of behavior based on little training. The associated decrease in active driving practice means that drivers in the future will have fewer driving-related skills to draw on than drivers today who possess at least a certain level of expertise.

The lesson is clear: Driving (highly) automated vehicles does in principle have the potential to prevent accidents, but the users of these systems must meet certain requirements especially regarding cognitive performance, which today is not tested. In addition, the regular use of “auto-pilot” functions in vehicles, for example, could mean that drivers risk losing their “standard” driving skills. The time required for drivers to retake control of their vehicle also needs to be considered.

### **PARTICULAR DANGERS FOR TRUCK DRIVERS: ALCOHOL, DRUGS AND FATIGUE**

On analysis of the German accident figures regarding goods transport vehicles, it is striking that the majority of accidents here too can be attributed to human error (Figure 26). In addition to driving-related factors such as failing to keep an adequate distance from the vehicle ahead or driving with excessive speed, alcohol and fatigue are key factors that affect a person’s capability to drive.

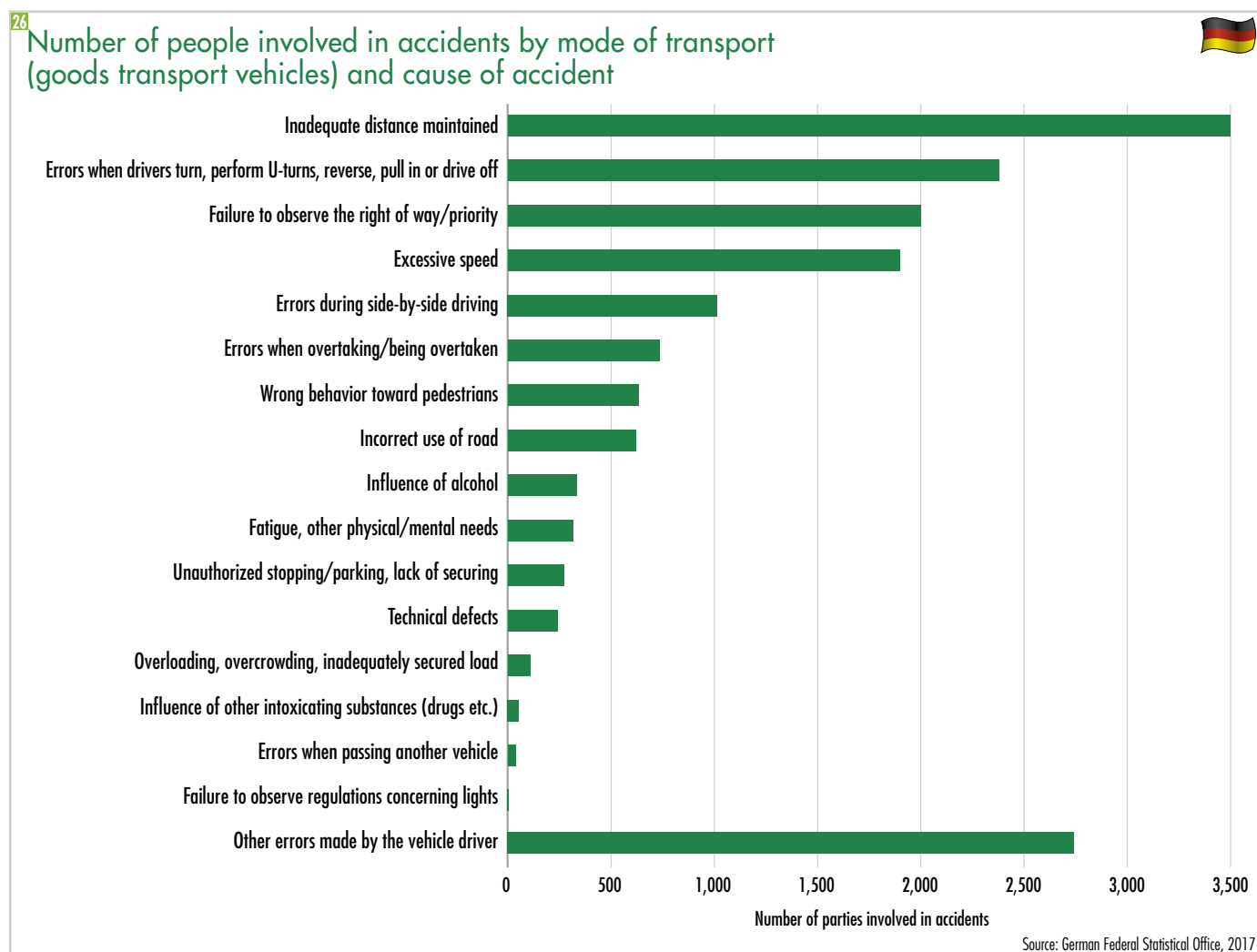
As a systematic analysis conducted by Giroto and colleagues in 2013 shows, major differences exist regarding the consumption of alcohol and drugs among truck drivers in the road goods transport sector. This meta-analysis evaluated studies in which drivers personally provided data on their alcohol and drug consumption as well as studies in which biological samples from drivers were tested for alcohol and drugs. In 18 of 23 evaluated questionnaires, drivers most commonly confirmed drinking alcohol.

The 15 studies that analyzed biological samples found that amphetamines, cannabis and cocaine were the most common drugs taken. On average, drivers admitted to consuming alcohol in 54.3 percent of cases, with the range spanning from 9.9

percent (Pakistan) all the way to 91 percent (Brazil). On average, alcohol was verified in 3.6 percent of the biological samples, ranging from a minimum of 0.1 percent (Australia and Norway) to a maximum of 12.5 percent (USA). The average frequency of self-reported amphetamine usage was 29.5 percent, with the range spanning from 0.9 percent (Italy) to 70 percent (Brazil). On average, amphetamines were verified in 8.5 percent of biological samples (0.2 percent in Norway and 82.5 percent in Thailand). On average, drivers personally reported having consumed cannabis in 19.3 percent of investigated cases; cannabis was toxicologically verified in 4.7 percent of biological samples. In addition, other psychotropic substances were found in some of the analyzed studies, including opioids, phentermine, codeine, caffeine-based medicines, antihistamines and benzodiazepine.

The clear differences in the data can be partly attributed to different survey methods. Depending on patterns of consumption, alcohol and other psychotropic substances can be verified in bodi-

ly fluids only for up to a few hours or days after they are ingested. Such samples are therefore highly specific with regard to verifying substances, but often result in the actual frequency at which drivers ingest the respective substances being underestimated. In this regard, the self-reporting method enables a long-term insight into the working life of drivers and their consumption of psychotropic substances. But this method also has certain limitations: Respondents might misremember things, tend to provide “socially acceptable” answers or purposely withhold information for fear of any legal consequences. The working conditions in the different countries are also different, for example when it comes to loading and unloading processes, the infrastructure and the technical equipment within vehicles. The authors of a study conducted in Thailand, where amphetamines were verified in 82.5 percent of urine samples, attribute this to a number of factors including excessive working hours of 20–22 hours. They conclude that the ingestion of psychotropic substances is higher when working conditions are poor.







■ *Driver distraction can lead to devastating road accidents.*

## STRESS/PRESSURES/DISTRACTIONS

According to the model developed by Matthews, stress occurs when environmental stressors such as poor visibility, poor road conditions, delays and personality factors interact. In subjective terms, stress is experienced as anxiety, anger or tiredness. As part of a survey (Evers, 2010) involving 555 truck drivers, the influence of stress and strains on the way drivers behave in traffic was investigated. The driver survey showed that drivers work for an average of 63.2 hours per week, with 46.6 hours spent driving. In 80.1 percent of cases, the drivers work in the long-distance transportation sector. Approximately one third of the drivers are commonly away from their homes for around one week. Drivers specified traffic conditions as a source of stress particularly frequently – above all, an inadequate number of places to rest, obstructive, risky or aggressive behavior on the part of other road users, poor roads, very dense traffic and traffic jams. Time issues are also sources of stress, however, both with regard to one’s personal life (leisure, family) and logistics (loading delay, poor route planning).

The fact that perceived sources of stress are also associated with a certain accident risk seems clear. This cannot easily be proved on the basis of accident statistics, however, because the cause of accidents is usually assumed to be that which the po-

lice determine when they are called to an accident. On the one hand, it can therefore be assumed that certain causes of accidents cannot be recorded statistically because the accidents are not recorded – for example, if minor damage occurs as a result of a single-vehicle accident. On the other hand, stress-induced situations that cause accidents – such as feeling distracted, anxious or tired – can be determined by police only with difficulty. Unlike for alcohol or drugs in the blood, no instrument for measuring these factors is available.

A survey conducted back in 1995 involving truck drivers who had been involved in a traffic accident gave an indication of the extent to which distraction, stress and fatigue play a role. Of the 55 drivers who had suffered an accident, 15 indicated “fatigue” as the reason for the accident, followed by ten drivers who specified being in a rush or under time pressure as the reason for the accident. Eight drivers also stated that they had become distracted by external stimuli. With regard to their own psycho-physical state immediately prior to the accident, 21 respondents stated that they felt “angry,” 17 said they felt “anxious,” 12 said they felt “tired” and ten said they felt “aggressive.” This clearly indicates that the behavior of drivers at fault in an accident and their frame of mind definitely play a role in the occurrence of accidents, even if these factors are not reflected in accident statistics. In 2013, the British Department for Transport reported that

driver distraction had played a role in 2,995 accidents (three percent of all accidents). In 84 cases, these accidents were fatal (six percent of all accidents resulting in fatalities). Figures relating to accidents caused by driver distraction vary considerably across Europe. This can be attributed to a number of factors, including the fact that no single definition exists for the concept of “distraction” or “inattention.” According to Kinnear and Stevens, four types of distraction can be observed:

1. Cognitive or mental distraction occurs when a driver is mentally occupied with other activities that are not conducive to safe driving. This utilizes mental resources that are actually required for safe driving.
2. Visual distraction occurs when the driver is not looking at the road because they have shifted their attention to the radio, cellphone, advertisements outside, etc.
3. Auditory distraction refers to when a driver turns their attention to a noise. This type of distraction is often associated with another: When a driver tries to follow a conversation, which ties up their cognitive resources. That said, audible warnings emitted by the vehicle can focus the driver’s attention on the vehicle status.
4. Manual distraction refers to removing one or both hands from the steering wheel in order to perform other activities such as eating, drinking or operating devices.

Of course, the different types of distractions are inextricably linked. The extent to which the distraction impacts safe or unsafe driving is also related to the intensity of the distraction, the driving situation (stopping at a red light vs. very dense traffic)

### Alvin Gajadhur

Chief Inspector of Road Transport in Poland



## Contribution to improving safety on Polish roads

The Road Transport Inspection (hereinafter: ITD) was established by the Act of 6th September 2001 on Road Transport. ITD inspectors first started work on roads across Poland in October 2002. The main task of the ITD is to carry out roadside inspections along with inspections at the premises of enterprises, in order to check on compliance with transport regulations by both haulers and drivers.

Over the past 15 years of these controls being in place, ITD inspectors have checked over 2.6 million vehicles and have issued over 370,000 administrative decisions on vehicles, with inspectors withholding the registration documents of over 180,000 unroad-worthy vehicles. Many years of work by ITD employees and their commitment, particularly the work and commitment of the road transport inspectors, have contributed to improving safety on Polish

roads and combating grey areas in road transport.

In 2017, road transport inspectors jointly carried out 192,693 roadside checks of which 52% were inspections of foreign carriers, while 48% were domestic carriers. As a result of the road inspections carried out, road transport inspectors discovered 76,313 violations of regulations based on inspection protocols. The vast majority (over 60%) concerned driver non-compliance with regulations on driving time, mandatory breaks and rest periods. In excess of 28% of these infringements related to the improper use of recording devices while more than 9% related to licensing infringements, certificates of non-commercial carriage and driver documentation. Other violations concerned haulage without the required permits, as well as provisions concerning the transport of individuals by road.

and the time (such as a simultaneous unexpected event). Table 27 presents some examples of common secondary activities in terms of the impact they have on the type of distraction and the duration for which the driver would likely be distracted.

## 27 Examples of distracting secondary activities while driving and their influence on the intensity of the distraction

H = high, M = medium, L = low.

Secondary activity	Cognitive	Visual	Auditory	Manual	Duration
Texting	H	H	L	H	M
Dialing a number on a cellphone	M	H	L	H	L
Talking on a cellphone	H	L	H	L	H
Eating/smoking	L	M	L	H	M
Signals outside the vehicle/advertisements	M	H	L	L	L
Voice control	H	M	M	L	L

Source: Kinnear & Stevens, 2015

## MULTI-TASKING IS A MYTH

The reason why distractions are particularly dangerous for vehicle drivers is that people cannot do different things at the same time. When people attempt to multi-task, the individual activities impede each other. This is because when we multi-task, the brain cannot focus on both tasks simultaneously and instead continuously switches back and forth between the requirements, thereby impairing the performance of both tasks as the mind tries to distribute its attention resources. Since driving is a complex task that in itself requires multiple cognitive processes, performing an additional task while driving means that drivers no longer have the required attention resources to devote to the task of driving. This leads to processing errors and, in turn, loss of control over the actual task of driving, which puts the driver and all other road users at high risk.

Professional drivers in particular often have to deal with integrated vehicle technology. They spend a lot of time in their vehicles and are often under time pressure. A study conducted in 2009 (Olson et al.) reported that in 56.5 percent of safety-related incidents, drivers were engaging in a secondary activity while driving. Furthermore, the likelihood of a critical event occurring while the driver is texting increased 23-fold.

## OPPORTUNITIES TO PROMOTE GOOD HEALTH AMONG PROFESSIONAL DRIVERS

The changes to the job description of professional drivers described above are resulting in a number of specific psychological and physical work pressures and, in turn, an increased risk of health complaints and illnesses. The job profile and associated workplace conditions vary greatly and depend to a great extent on the goods being transported, the transportation route and the organization of work tasks. The fundamental stress factors that affect a large number of workplaces for professional drivers are worth repeating: inconvenient working hours/shift work; long driving times; time pressures; physical environmental stresses such as noise, exhaust gases and lighting conditions; monotony and social isolation in the workplace; long periods away from home; demanding IT-supported assistance systems; long periods of sitting and inactivity; vibrations; load handling; working with dangerous substances. These work stresses can result in sleep disorders, acute and chronic fatigue and, in turn, an increased risk of being involved in an accident.

Professional drivers often have a risky lifestyle in terms of their eating habits and tobacco consumption. A consequence of maintaining a static working posture at the steering wheel and the high physical strain are feelings of discomfort throughout the entire musculoskeletal system, particularly the back. Professional drivers have a significantly higher risk of degenerative disc disease in the lumbar column, cardiovascular disease, being overweight, stomach ulcers and bronchial carcinoma.

It is clear from this that the introduction of an occupational health management system for professional drivers would be very important in terms of maintaining performance and a sense of wellbeing, ultimately preventing an increased risk of accidents. However, the fact that professional drivers are inherently on the move and spend most of their working time away from their business premises makes it extremely difficult to implement conventional methods of promoting occupational health.

What is more, the shipping and transport industry in particular has a high number of small and micro-enterprises, which have so far been generally unwilling to introduce occupational health promotion systems. Occupational health promotion often plays just a minor role compared with occupational health and safety. Intensive education programs and networking with institutions involved in preventive work can help and motivate employers to become active in the field of health promotion. Another option is to initiate company-wide, sector-specific quality and health networks.

Existing concepts for mobile employees can also be applied to professional drivers. Examples of these include an occupational health guide who can be contacted by drivers on tour, targeted use of mobile health apps, contracts with fitness studios along the route an “in-truck gym,” or support with healthy eating on the road (“packed lunch”).

In principle, health-promoting measures should always be based on the sources of stress identified. In a survey conducted by Michaelis, for example, general strategies for preventing tiredness at the wheel and information on healthy eating and reducing tobacco consumption were requested.

Given the special physical and psychological stresses faced by professional drivers, there is a clear need for action in terms of occupational health promotion for this occupational group.



Compared with an office- or factory-bound workforce, more creative ways of communicating with professional drivers need to be found. As a general rule, the amount of time required for measures should be proportionately deducted from the respective working hours. The measure most likely to achieve an improvement might be the introduction of easily accessible services involving few formalities, requirements and little prior knowledge at, for example, rest areas and truck stops.

## TRANSPORTING DANGEROUS GOODS

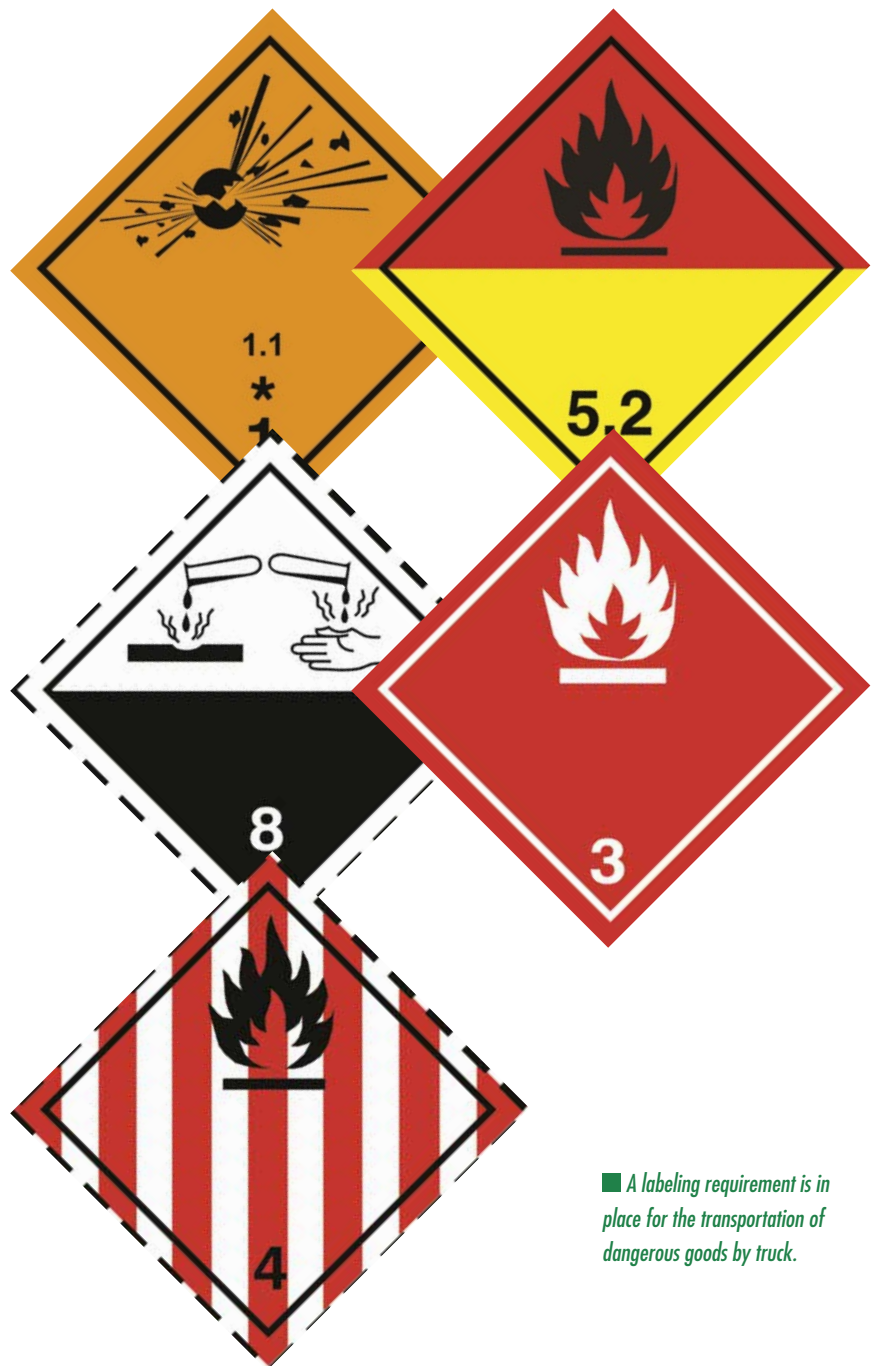
Truck drivers also regularly transport goods with hazardous properties in their vehicles. These include flammable, poisonous or explosive goods – also known as “dangerous goods.” According to the German Carriage of Hazardous Goods Act, “dangerous goods” are substances and objects that due to their nature, properties or state when being transported can pose risks to public safety or order – particularly the general public, important public domains, human life and health as well as animals and property.

Since hazardous goods are frequently transported across national borders, legislation relating to dangerous goods is part of the fields of law that have for many years taken into account the importance of international cooperation. The source of national and international regulations are the Model Regulations on the Transport of Dangerous Goods, which were introduced by the UNECE in 1956 and have since been updated regularly. Serious accidents have also led to these regulations being amended. For example, an accident in the Tauern tunnel in 1999, where a truck loaded with 24,000 highly explosive cans of spray paint caused a catastrophic fire resulting in 12 people dead and 42 injured, led to the introduction of restrictions regarding the transport of dangerous goods through road tunnels.

To deal with the specifics of the respective modes of transport, the following transport-mode-specific regulations are based on the Model Regulations:

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road (Accord européen relatif au transport international des marchandises Dangereuses par Route).

RID: Regulations concerning the International Transport of Dangerous Goods by Rail (Règle-



■ A labeling requirement is in place for the transportation of dangerous goods by truck.

ment concernant le transport international ferroviaire de marchandises dangereuses).

IMDG code: International Maritime Dangerous Goods Code.

ADN: European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (Accord européen relatif au transport international des marchandises dangereuses par voie de navigation intérieure).

IATA-DGR: Regulations concerning the transport of dangerous goods in the air (International Air Transport Association – Dangerous Goods Regulations).



■ Accidents involving dangerous goods necessitate special precautionary measures.

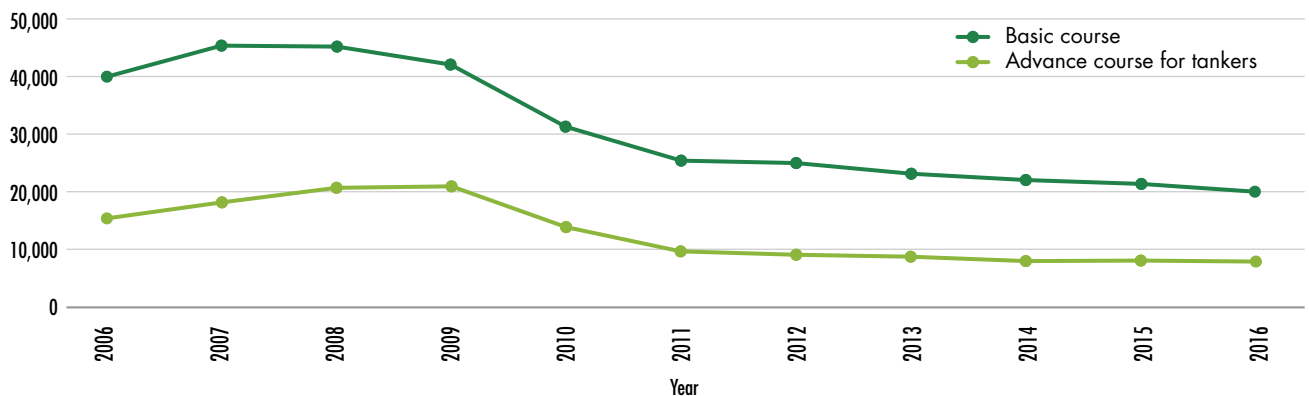
## COMPULSORY TRAINING FOR DRIVERS OF ROAD VEHICLES TRANSPORTING DANGEROUS GOODS

When it comes to safety in transporting dangerous goods, the driver once again plays a key role. Regulations relating to the transport of dangerous goods by road (ADR) therefore stipulate that drivers of transport units subject to labeling must undergo training. In Germany, acquiring an ADR driver training certificate is organized by the Chambers of Industry and Commerce. The training system entails initial and refresher training courses. The basic course serves as a basis. Drivers are then permitted to transport general cargo. Advanced training courses must

be completed so that drivers can transport explosive substances (advance training class 1), radioactive substances (advanced training class 7) and dangerous goods in tankers or vehicles adapted for bulk goods (advanced training for tankers). Drivers must pass a refresher course – including a test – every five years. If a driver wants to possess all of the necessary qualifications, they need to take part in 48 lessons and complete four tests. A failure rate of around 20 percent for the basic course in 2016 shows just how challenging the test is. It should be noted that the number of people taking the test as part of the initial training course has been in decline for a number of years now despite increasing goods transportation (Figure 28).

28

Persons taking part in initial training for dangerous goods transportation



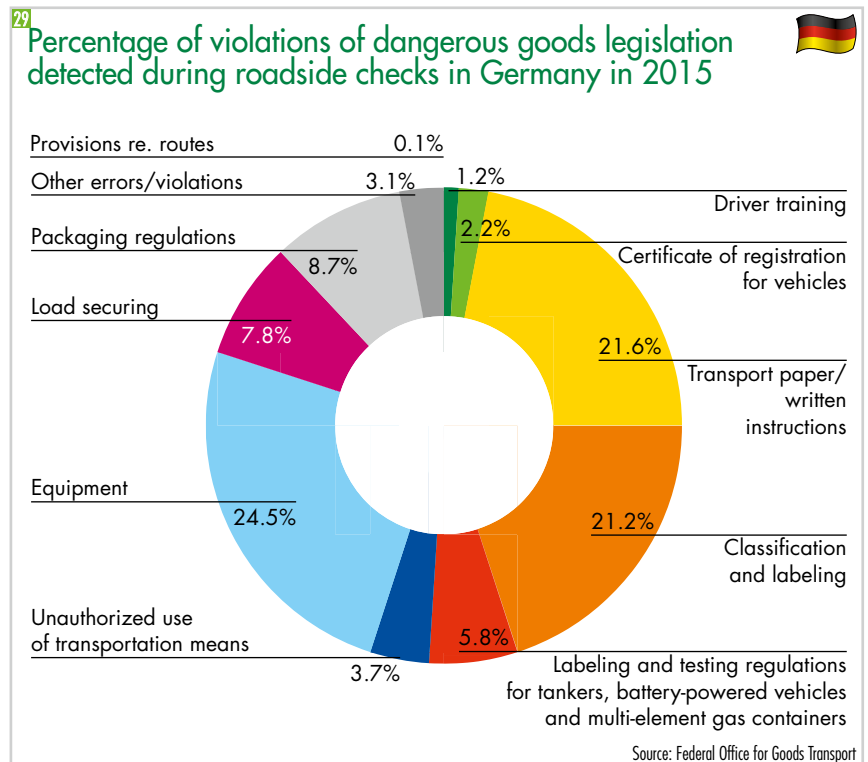
Source: Association of German Chambers of Industry and Commerce

European regulations also stipulate the role of a dangerous goods safety advisor. The safety advisor offers advice for companies and takes preventive measures to ensure that goods are transported safely by, for example, monitoring the packing procedure or ensuring that suitable vehicles are used. The advisor thereby ensures the safety of transports from a central location. As is the case with drivers who transport dangerous goods, training in Germany is managed by the Chambers of Industry and Commerce. The training itself is conducted by companies recognized by the Chambers of Industry and Commerce and is divided into modes of transport (road, sea, inland vessels and rail). If a dangerous goods safety advisor wants to obtain a qualification for all modes of transport, they need to take 60 lessons. Before the advisor can start work, they also need to take an exam. A failure rate of no less than eleven percent shows that thorough preparation is required for this test.

## DANGEROUS GOODS ACCIDENTS AND CONTROLS

As is the case with other specialist officers, the dangerous goods safety advisor can also be appointed externally, which gives many companies the opportunity to work with experienced specialists. With a nationwide network of 120 dangerous goods safety advisors, DEKRA ensures that goods are transported safely. Dangerous goods regulations require all persons involved with the transport of dangerous goods to undergo training. This encompasses a range of persons, including those who pack dangerous goods or load them onto trucks. Special approval is not required to undertake the training, and the qualification of those offering the training is not regulated. However, the only relevant qualification is a training course to become a dangerous goods safety officer.

In Germany, dangerous goods regulations are monitored by the responsible state authorities, the police and the Federal Office for Goods Transport (BAG). BAG publishes a special report once a year. According to this report, 20,171 vehicles were inspected in 2015. Among these, fault was found with 2968 vehicles (Figure 29). Highly skilled, well-trained employees and support from an experienced dangerous goods safety officer help to prevent these faults. In addition to the risk of accidents, the risk of fines and delays in transport operations can also be minimized in this way.



In 2015, the Federal Highway Research Institute recorded 156 accidents involving dangerous goods on German roads. 118 of these accidents resulted in personal injury, with four people killed and 169 injured. These statistics do not state whether there was any leakage of hazardous substances. However, accident figures are falling overall. In 2014, 163 accidents were recorded compared with 206 in 2013. Fortunately, road accidents involving dangerous goods are relatively rare. That said, incidents such as the one that occurred December 19, 2014, when a truck loaded with aluminum phosphide caught fire on German highway A 7 near the city of Göttingen, highlight the dangers inherent in such operations. One person was killed in the accident, and the highway and nearby railtracks had to be closed for several hours.

## PROBLEMS RELATING TO THE SECURING OF LOADS

In trucks, dangers also lurk under tarpaulins and in loading areas because poorly secured or unsecured loads cause numerous accidents every year, many with severe consequences. According to official statistics, in 2016 “an inadequately secured load or vehicle accessories” was cited as the reason for 179 accidents resulting in personal injury and 360 accidents resulting in serious material damage involving goods transport vehicles in Germany.





■ *Securing loads in accordance with applicable regulations is incredibly important in terms of work safety and accident prevention.*

### The TUIS emergency response system



According to the German Federal Statistical Office, 130 accidents resulting in personal injury and involving a dangerous goods vehicle occurred on German roads in 2016. In four of these cases, the dangerous goods were leaked/released. Many more accidents in which goods are leaked/released occur during loading and unloading operations as a result of problems with securing the loads or in transshipment warehouses. Given the huge volumes of dangerous goods being transported, however, these figures are considered low. The regulations relating to dangerous goods are having a positive impact here.

If an accident does occur, however, the rescue forces rushing to provide help can quickly find themselves at their limits. What hazards arise when goods are leaked/released? What risks does the mixing of leaked substances potentially pose? How can fuel be removed from vehicles involved in an accident / how can liquids be pumped out of vehicles involved in an accident prior to recovery?

To assist helpers quickly and efficiently in such cases, the chemicals industry has set up an emergency response system. In Europe, this is the ICE system of the European chemical

association Cefic. ICE stands for "Intervention in Chemical Transport Emergencies" and operates under the umbrella of the international "Responsible Care" program. The transport accident information and emergency response system (TUIS) established by the chemicals industry takes on this role in Germany and Austria. Around 130 companies are affiliated in Germany and around 50 companies are affiliated in Austria. With their fire brigades and additional specialists, an appropriate contact person is available around the clock. As part of post-accident support measures, three escalation levels have been defined. Level 1 entails TUIS specialists providing the head of operations or head of the division with advice on the phone. Level 2 entails a specialist advisor coming to the site of deployment to give advice and clarify the next steps to take. Level 3 entails helping the fire brigade directly at the scene of the accident by providing emergency personnel and resources (special vehicles, equipment, collecting vessels, special extinguishing devices etc.). In Germany alone, the services of TUIS teams are called upon around 1,000 times each year on average.

Source: <https://www.vci.de/vci/downloads/vci/publikation/tuis-broschuere.pdf>

But it is important when interpreting these figures to bear in mind the number of unreported cases.

Inadequately secured loads are not just a concern for road safety though, because accidents often also affect the truck drivers themselves as well as other people in and on the truck performing their duties. Since properly secured loads are extremely important for ensuring occupational safety, the relevant German Social Accident Insurance Institution addressed this subject in the context of accident prevention many years ago. In 1980, they published a brochure entitled "Ladungssicherung auf Fahrzeugen" (Load securing in vehicles), a manual for businesses, resource managers, driving and loading personnel that was one of the first standard references in this field. This helped to improve load securing standards in Germany in subsequent years. Nowadays, there are many comprehensive manuals on load securing available.

With the publication in 2007 of the "Praxisratgebers Ladungssicherung" (Practical guide to load securing), DEKRA played an important role in providing professionals with an overview of the key regulations that apply to them and, in particular, helping these professionals to understand and implement these rules. In addition, experienced trainers at DEKRA offer special training sessions to show shipping agents and drivers how goods are shipped safely and how to avoid accidents. Training courses are also organized for management executives – and not without reason. Just a quick glance at the Straßenverkehrs-Zulassungs-Ordnung (StVZO – German Road Traffic Licensing Regulations) is

enough to see the huge level of responsibility that vehicle owners face. The regulation states in section 31, para. 2: "The owner must not order or permit the operation [of the vehicle], if he knows or should know that ... the vehicle, ... the load or passenger occupancy is contrary to the regulations or that roadworthiness of the vehicle, the load or passenger occupancy suffers." And the accompanying operating regulation states: "If a vehicle or a load does not comply with the regulations, inquiries shall always be made into whether the owner as well as the driver is at fault." In accordance with section 412 of the German Commercial Code, the consignor or the loader, as the case may be, is also responsible for securing the load.

The training courses cover a range of information including the physical fundamentals of load securing, the forces that are exerted on the load in different traffic situations and with different types of use as well as the principles of load securing and

how they are applied. The choice of vehicle is also addressed. Before a vehicle is loaded, it must be clear which vehicle type is most suitable for the respective transport, taking into account the type, weight, height of the center of gravity, dimensions and goods packaging. The various materials for securing loads are also covered in detail, with trainees instructed on the operating principles and how to handle materials such as lashing straps, shoring beams, nets, tarpaulins, air cushions, anti-slip mats and wire ropes. In addition, freight forwarders, haulers, consignors, loaders and drivers are instructed concerning the potential consequences of violations under traffic regulations or criminal law.

The certification of vehicle bodies and parts conducted by DEKRA in accordance with the applicable European and national standards and other regulations has been the basis for load securing in road freight traffic for a number of years now.

## Snow and sheets of ice on trucks with a tarpaulin roof

During the winter months, car drivers should pay special attention to trucks with a tarpaulin roof because snow and sheets of ice can build up on these overnight or during extended periods of downtime. If they become loose or fall while the vehicle is moving, this could entail severe consequences for vehicles behind the truck: a large sheet of ice can easily smash the windshield of a car, resulting in an accident. To prevent such a situation from ever occurring, truck drivers are legally required to remove hazardous roof loads from their vehicles before starting a journey. Various options are available:

- In the case of an empty truck or trailer with a tarpaulin structure, the driver can use a long broom handle or other similar object to push the roof from inside the trailer so that any snow or sheets of ice fall off. One problem with this approach is that the roof may not be cleared completely because the driver cannot actually see onto the roof.
- At company premises or truck stops, high scaffolding is set up, which can easily be accessed by truck drivers. Drivers can therefore climb the scaffolding and use a snow shovel or other similar tool to remove snow or ice from their vehicle roof.
- Some manufacturers offer ladders specially designed for trucks, which drivers can use to clear snow and ice from tarpaulin roofs. These ladders can be folded compactly and also easily stowed and trans-

ported in the truck itself. Folded out and secured to the truck, these ladders enable drivers to easily clear snow from vehicle roofs.

- An inflatable air hose between the roof tarpaulin and roof bow (RSAB = RoofSafetyAirBag) turns a flat tarpaulin roof into a saddle roof, allowing water to run off the roof whenever the vehicle is stationary for an extended period of time or overnight. This prevents any sheets of ice or snow forming on the roof. RSAB can be installed by some trailer manufacturers ex-works. The system can also be retrofitted.

- Various suppliers in America have developed "snow-removal machines." Different models are available: a model fixed to one location, a portable model or an extra-wide model. The machine can be activated manually or automatically. Snow is thrown from the roof laterally via a pushing implement. Like the "snow-removal machine," a "snow-blowing machine" is also available, which blows snow off using blowers installed on the side of the vehicle. The problem with both of these machines is that the snow simply ends up on the ground next to the vehicle.



**Emmanuel Barbe**

Inter-Ministerial Delegate for Road Safety



**Global plan for greater road safety**

The 18 measures adopted on January 9, 2018 within the framework of the “Comité interministériel de la sécurité routière” under the leadership of prime minister Édouard Philippe constitute a balanced and ambitious overall concept. These measures have to fulfill just one criterion: Being highly effective in reducing the number and severity of traffic accidents. Of course, reducing the speed from 90 to 80 km/h on roads with two directions of traffic without a central reservation from July 1, 2018, is a critical measure needed to achieve this requirement. The measure will affect 400,000 road kilometers – almost half of the French road network. It will apply to sections of road on which more than half of all traffic fatalities (1,911 fatalities) were registered in the last year. By considerably reducing the maximum speed by 10 km/h, the government is attempting to reduce the average speed measured, which increased by a whole 4 km/h within five years. According to experts, one life per day can be saved as a result of this measure alone, which equates to 350 to 400 lives a year.

All 18 measures send a very important message to Europe. In addition to general mobilization, the speed reduction will be accompanied by equally significant measures aimed at combating behaviors that affect our European neighbors just as much as they affect us. Such behaviors include drunk-driving, driving under the influence of drugs and even using cellphones at the wheel – a truly global problem! To do this, we are giving law enforcement agencies the option of seizing the driving licenses of those who commit another traffic offense while holding their cellphone, such as failing to indicate before turning.

With regard to drunk-driving, we would like to encourage alcohol tests involving a vehicle immobilizer; unfor-

tunately, we have not yet established this nationwide, although breathalyzers are stipulated by law. In addition, we will enable police officers to make themselves hidden on certain apps used by drivers in order to warn other road users about alcohol or drug checks. In a clearly restricted area, users who are given advice as part of a police alcohol or drug check can still report this using their app, but the forwarding of this information to other users will be completely blocked. The app is blocked within the controlled area by your cellphone provider. This technical measure will not be used for speed checks, but can be very useful for clamping down on criminality. This new and innovative system will be introduced at the end of this year and, as far as I’m aware, will be the first of its kind in Europe.

We are expecting to see great improvement through these measures. After 30 years of continuous progress, we now have seen several successive years in which the number of traffic fatalities increased or at least stayed at the same level. According to European statistics on the number of traffic fatalities per million inhabitants, we rank twelfth. This is a situation that no one can be truly happy with – and many other European countries have shown that we could do much better. This is why we will introduce these measures without delay. The speed reduction on roads with two directions of traffic without a central reservation will be implemented July 1, 2018. The 17 other measures are scheduled to be implemented over the next three years. This applies to the development of an electronic speed measurement device installed in vehicles belonging to drivers who have committed serious speeding violations so that they can better restrain themselves while driving. This technology will also be completely unprecedented.

The certification process involves developing, in close cooperation with the customer from the transport industry, load securing measures that are economical and appropriate and comply with the relevant regulations. The effectiveness of measures demonstrated in static or dynamic tests is documented by the DEKRA load securing seal.

It is a fact that Germany and German freight forwarders are recognized role models in this sector today. When traveling through the rest of Europe, however, you do not have to go far to see that the load securing has still not been properly addressed in some countries. This is resulting in new challenges for transcontinental goods transportation. No compromises can be made when it comes to safety – in particular, competition must not be distorted through cost advantages gained as a result of load securing that is either not performed properly or not even performed at all.

Checks at the roadside and at border crossings are therefore necessary. It is essential that these checks are performed in a standardized manner in order to avoid unnecessary uncertainty and delays, which would ultimately have a negative impact on people’s acceptance of load securing in practice. The strategic objective must be to establish and implement harmonized load securing measures throughout the European Economic Area. In the future, this will take place primarily on the basis of Directive 2014/47/EU with regard to the technical roadside inspection of the roadworthiness and operational safety of commercial vehicles circulating in the European Union.

**ACCIDENT PREVENTION MEASURES IN VEHICLE FLEETS**

An important point with regard to the human factor should be kept in mind: Preventive risk management should be at the very top of the agenda in every commercial vehicle fleet. The implementation of targeted measures helps to avoid problems right from the outset, thereby considerably increasing the safety and economic efficiency of the vehicle fleet. Accidents may ultimately endanger the health or even life of an employee or third party and also entail high consequential costs for the company, which are not covered





■ For a number of years now, training in a driving simulator at the DEKRA Akademie has been an integral element of DEKRA's range of services.

by insurance. In the event of multiple losses or single major losses, this can cost a huge amount and may even have criminal consequences. In extreme cases, the existence of the entire company can be at stake. On top of this, every accident has a negative impact on a company's image.

In this context, it is extremely important to implement measures that are adapted precisely in line with requirements and to resolve the problem areas in the vehicle fleet. With standard solutions and standard training sessions, however, little can be achieved. The first step therefore involves identifying damage areas before implementing measures for improvement, which may be in the form of theoretical and practical training sessions for drivers or driver safety training.

To be effective over the long term, the measures must not be seen as a one-time occurrence – rather, risk management is an ongoing process. Another critical point is actively involving decision-makers in risk management. Management executives in particular must be made aware of the company's damage situation and set a good example. Ultimately, the driver is just one element of the overall structure of each vehicle fleet. Regular controlling is just as important for checking the effectiveness of the implemented measures.

## The Facts at a Glance

- The behavioral reliability of drivers needs to be maintained or, where necessary, increased. To do this, one has to be or become aware of influencing factors.
- Ongoing training for professional drivers is essential if we want to enhance road safety.
- Professional drivers need to be better informed of the potential and risks inherent in assistance systems and automated driving.
- Transport companies need to develop innovative schemes that meet the requirements of occupational health promotion.
- Driver distraction is becoming an ever great danger to road safety. Professional drivers, too, need to be more aware of this problem.
- Better training for properly securing loads and handling dangerous goods is imperative.
- Accident prevention measures must take top priority in every vehicle fleet.



## Better Protection for All Road Users

Whether in rural areas, on rural roads or out on the highway, around 90 percent of all road accidents involving goods transport vehicles can be attributed to human error. This is where driver assistance systems and automated driving functions offer huge potential for enhancing safety by either eliminating or mitigating the consequences of human error. Commercial vehicle experts from a wide range of institutions expect platooning – highly automated driving in a digitally networked convoy – to offer major potential for preventing accidents.

According to the German Federal Statistical Office, a total of 32,352 goods transport vehicle drivers were involved in traffic accidents resulting in personal injury in Germany in 2016 (this is also addressed in the “Accidents” section). Accidents in flowing traffic (15,021) accounted for almost half of these, while ‘turning-into/crossing’ accidents took second place with 5,376 casualties. Of particular note here is that, of the total number of people involved (over 32,000), more than 15,400 of them were involved in accidents involving a van with a permissible overall weight of up to 3.5 tons. Trucks weighing over 3.5 metric tons accounted for almost 8,100 persons involved and semi-trailer tractors accounted for around 7,600. Almost 49 percent of the drivers were involved in accidents in

urban areas, more than 27 percent were involved in accidents on rural roads and nearly 25 percent were involved in accidents on highways.

In urban areas, rear-end collisions and collisions at intersections dominated (together over 50 percent). On rural roads, rear-end collisions and collisions with oncoming vehicles constituted almost 50 percent combined. On highways, rear-end collisions were the most common with over 50 percent. As the German Federal Statistical Office also reports, almost 60 percent of all goods transport vehicle drivers involved in accidents were considered to be the main cause of accidents resulting in personal injury. Among light-duty truck drivers, almost 65 percent were the main cause of the accident; among



articulated truck drivers, around 50 percent were the main cause of the accident. In comparison, approximately 55 percent of car drivers were considered the main cause of the accident.

## PREVENTING ACCIDENTS THROUGH DRIVER ASSISTANCE SYSTEMS

Just these few facts concerning Germany, which are more or less the same in many parts of the world, reinforce the need to make a lasting difference – for example in relation to accidents that occur at the end of traffic jams, which can pose significant risks to vehicle occupants. In particular, accidents involving heavy-duty goods transport vehicles consistently result in occupants suffering severe or fatal injuries. If a truck crashes into the back of a stationary or slowly moving car at a high differential speed, it is highly probable that the car will suffer extreme deformation. Several vehicles are often pushed into each other. If a truck drives into the back of another truck, the occupants of the impacting truck usually suffer the most serious injuries. Even a car crashing into the back of a stationary or relatively slow-moving truck often ends fatally for the car occupants.

Optimization measures aimed at reducing the incompatibility of vehicle structures can certainly help to a degree. However, physical limits are quickly reached as the differences in speed become greater. Given the sheer mass of heavy-duty commercial vehicles, passive safety measures for mitigating the consequences of an accident offer only limited potential. Effective improvements are therefore to be achieved primarily through the use of driver assistance systems that either prevent accidents or reduce their severity. This involves forcing distracted drivers to re-engage with the traffic situation in a speedy and appropriate manner and automatically initiating braking just before a collision becomes unavoidable. The potential benefits of this technology have been investigated many times in recent years. In 2016, commercial vehicle experts at strategy consulting firm

## A visionary truck

In 1989, Mercedes-Benz, AMG and DEKRA presented the concept of the articulated truck of the future – Eurotruck 1. In contrast to other studies on future trends, the vehicle was designed to meet registration requirements and the components were completely functional. For a long time now, many components and systems that were pioneering at the time have found their way into trucks and cars. Nevertheless, when comparing the safety level of Eurotruck 1 with today's standards in mind, there are certainly grounds for criticism. It may have once seemed visionary to position a cellphone and fax machine directly next to the driver, but today we all know that the potential for drivers to become distracted by communication devices presents an enormous safety risk. Another problem that extends to vehicle construction today became apparent back in those days, too: The safety aspect of a good, direct view from a vehicle onto the areas directly surrounding the vehicle was compromised by the futuristic design – the body design in the area of the side windows actually increased the vehicle's blind spot.

By contrast, the full fairing was very advanced; not only did it enhance aerodynamics and, in turn, fuel consumption, but

it also increased protection for cyclists and pedestrians. Drivers were also assisted in their maneuvering operations by a range of cameras and a visual and audible reversing assistant – systems that have only relatively recently found their way into the cockpits of modern vehicles. The integrated navigation system – described as a “device for searching for and finding streets” in a documentary on trucks in 1991 – was pioneering not just from a functional point of view.

The integrated restraint systems were also ahead of their time and, unfortunately, are to this day still not available as standard in trucks. Integration of the seat belt in the air-sprung driver's seat prevented relative movements between the belted driver and the webbing at the B-pillar, a common design in cars back then. To absorb the forces that occur in an accident, the backrest and seat mountings had to be stable. The Eurotruck was also equipped with a driver and passenger airbag. An automatic tire pressure monitoring system increased the level of safety during journeys.

This example shows that it often takes a very long time for new concepts and approaches to find their way into the mainstream despite having already been successfully tested with functional prototypes.





**Dr. Erwin Petersen**

Vice-president of the Lower Saxony regional traffic association



**Optimization potential not yet exhausted**

Collisions in lines of traffic constitute a high proportion of traffic accidents involving goods transport vehicles; these collisions involve a goods transport vehicle crashing into a moving or stationary vehicle in front, usually at the end of a traffic queue, because the driver was distracted or was driving either too close to the vehicle ahead or with excessive speed. This can be seen in the figures collected as part of the “Niedersächsische Werkstatt Autobahn” (Lower Saxony Highway Workshop).

An analysis of 138 serious accidents on highways in Lower Saxony in 2015, in which goods transport vehicles weighing over 7.5 metric tons were the main party involved, showed that a good 50 percent of fatalities – 17 out of a total of 33 – died in 58 rear-end collisions. Over 80 percent of these rear-end collisions – 49 out of 58 – were caused by these types of goods transport vehicle. Of these vehicles, over 80 percent had not (yet) been equipped with an advanced emergency braking system (AEBS).

Around 24 percent of these collisions would have been avoidable had the vehicles been equipped with an AEBS in accordance with the applicable EU provisions. With AEBS that can also prevent collisions with stationary vehicles (which goes above and beyond legal requirements and is already

available as an optional extra at least), more than 80 percent of rear-end collisions and the consequent fatalities would have been avoided.

To leverage the potential for avoiding accidents, all system and vehicle manufacturers should be looking to refine and enhance their emergency braking systems as quickly as possible. Equally, the EU regulation should be adapted to the technical possibilities to support the large-scale introduction of the best systems as standard equipment. This applies primarily to improved object identification for stationary vehicles, a distance warning preceding a collision warning, further development and optimization of override methods as well as measures to prevent drivers disabling these systems.

The latter is always a problem – and often because of a lack of knowledge regarding system terms and functions. Because many drivers are aware of adaptive cruise control (ACC) and confuse this with emergency braking assist (AEBS), they sometimes disable the life-saving emergency braking system completely unnecessarily when disabling adaptive cruise control. Drivers should therefore receive thorough training on the different functions of these systems within the framework of the Professional Driver Qualification Act.

Roland Berger published a study entitled “Automated Trucks – The Next Big Disruptor in the Automotive Industry?”, in which they predicted that intelligent driver assistance systems could reduce the number of rear-end collisions involving trucks by over 70 percent.

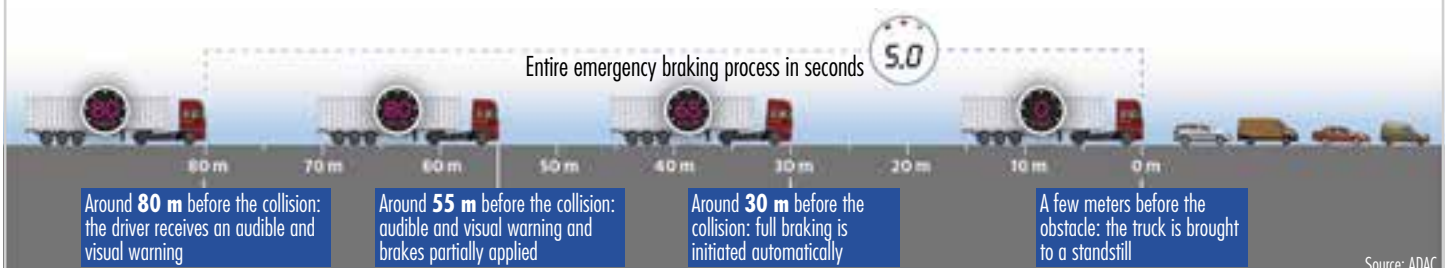
**CURRENT EMERGENCY BRAKING SYSTEMS ARE HIGHLY EFFECTIVE**

To help distribute such systems as quickly as possible, the European Commission stipulated the multi-stage introduction of automated emergency braking systems for goods transport vehicles with a maximum authorized mass of over 3.5 metric tons and buses with more than ten seats. Even though some exceptions are necessary depending on usage (e.g. for off-road vehicles), the regulation fundamentally applies to all of these vehicles. Vehicles with a maximum authorized mass of over eight metric tons first registered in the EU from November 2015 must be equipped with an automatic emergency braking assistance system. The second stage comes into force November 1, 2018. The measure will then be extended to cover vehicles weighing over 3.5 tons. At this point, the requirements regarding the systems will increase again for all of the vehicles concerned. They will include a driver warning function, reduce the speed from 80 km/h to 60 km/h if the respective vehicle approaches a stationary obstacle and ensure that the vehicle completely avoids a collision if the vehicle approaches a vehicle driving at 15 km/h.

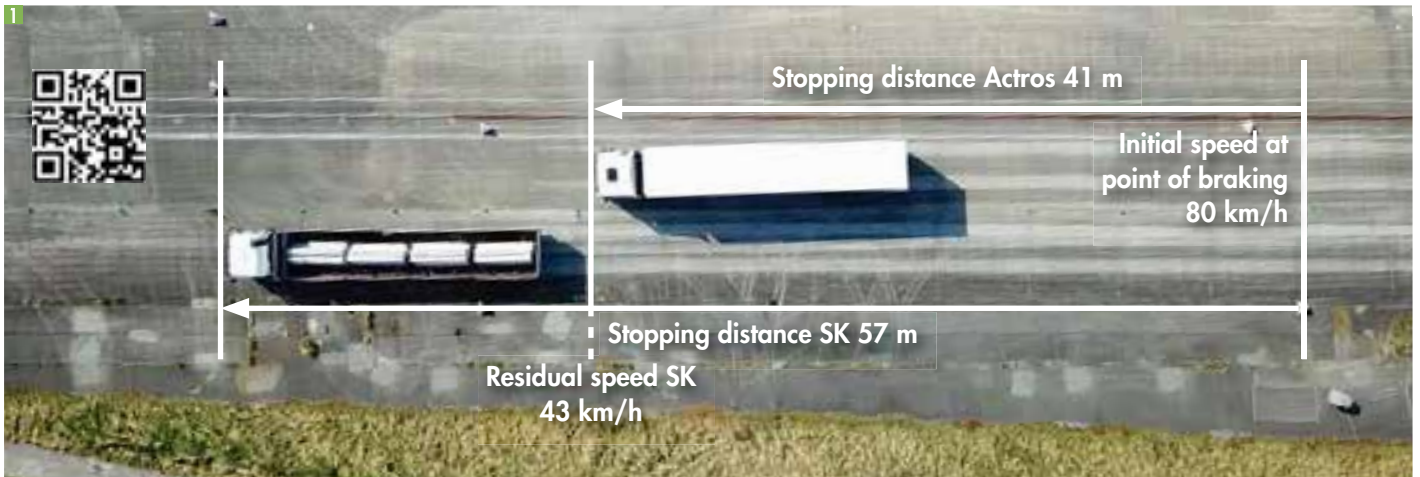
Systems supplied by most manufacturers already far exceed these requirements (Figure 30). This is also one of the findings determined in a test conducted by the “Allgemeiner Deutscher Automobil-Club” (General German Automobile Club) on three current emergency truck braking assist systems. Everyday driving situations were investigated to determine the effectiveness and plausibil-

**30 How modern emergency brake assist systems for trucks work**

Sensors trigger the emergency cascade system, which brings the truck to a complete standstill ahead of an obstacle – without the driver even applying the brakes.



## Comparing old and new braking systems

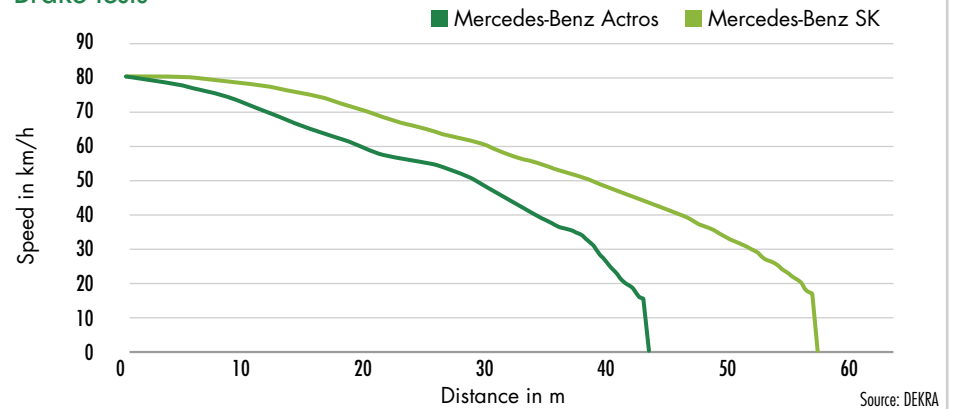


A test conducted by DEKRA Accident Research and Crash Test Center compared the braking performance of a modern articulated truck with that of an articulated truck from the 1990s. Both vehicle combinations were loaded to an overall mass of 38.5 tons. The objective of the tests was to demonstrate the differences in the braking distance from a speed of 80 km/h in identical environmental conditions. Vehicles that are on the road in this form were chosen. The fact that the vehicles had different tires, thereby resulting in slight inaccuracies, is a given but does not alter the core of the results.

The tests showed that the average deceleration of the modern articulated truck from the moment the accelerator was released and full braking was initiated was around  $6 \text{ m/s}^2$ . The braking distance at 80 km/h was approximately 41 meters. In the case of an articulated truck from 1997, the average deceleration was  $4.3 \text{ m/s}^2$ . At 57 meters, the resulting braking distance was 16 meters longer. The residual speed of the older articulated truck was 43 km/h at the point at which the new articulated truck came to a stop (Figure 1–3).

Comparing the braking distance of a modern car with that of a modern articulated truck is also interesting – in a direct comparative test, the car’s braking distance was only slightly shorter (Figure 4). The reaction time of attentive drivers is around one second. In this time, a car moving at a speed of 80 km/h travels over 22 meters. It is therefore essential to maintain an adequate safety distance behind trucks (guideline: half the km/h value in meters).

### Brake tests





■ In spring 2018, DEKRA conducted tests in the Technology Center to determine the potential benefits and limits of modern automatic emergency brake assist systems for trucks. The results will be presented during the course of the year.

ity of the warning behavior of the safety systems and how frequently warnings occurred. The test result showed that warnings occur only when it is absolutely necessary and a situation risks becoming unsafe. The test also showed that the automatic emergency braking system (AEBS) is not noticeable during normal journeys, only adaptive cruise control (ACC).

### MORE AWARENESS OF THE SYSTEM LIMITS

All automatic safety systems must meet high requirements at all times. If the systems activate unnecessarily in a way that irritates or unnerves drivers, drivers will lose confidence in them and, in the worst case, simply disable the systems. Full functionality is necessary in critical situations, while it must also be possible for drivers to override the systems at any time for legal reasons.

Equally as important as drivers understanding the systems' functionalities is the driver being aware of and understanding the full performance range of the systems and, above all, the limits of this technology. After all, these systems cannot override the laws of physics. They cannot boost brake power any more than they can shorten vehicle braking distances on wet or slippery roads. But the technology does ensure that drivers are alerted to critical situations so that they can take countermeasures themselves or, if they fail to do so, the vehicle's brakes are applied automatically.

If the driver reacts by turning the steering wheel to make an evasive maneuver without applying the brakes, for example, the system is generally disabled because the driver has reacted in a way that overrides the system. If the driver does not know enough about how the system works and what its limits are in situations like this, the driver could simply rely on the automatic braking function and steer the vehicle only to make an evasive maneuver without themselves simultaneously applying the brakes – a situation where lack of information can have deadly consequences.

### DISABLING THE SYSTEMS IS A RISKY GAME

Many drivers involved in serious accidents that occur at the end of traffic jams are accused of purposely disabling their automatic emergency brake assist system. Reliable, statistical data on this is not available but would be very desirable for the purposes of accident research. A questionnaire for truck drivers conducted by DEKRA Accident Research suggests that only a very small number of systems are disabled. However, it is striking that the AEBS is often taken to be the same as adaptive cruise control (ACC). While an AEBS brakes only when a collision would otherwise be unavoidable, adaptive cruise control brakes the vehicle as soon as the distance to the vehicle ahead is shorter than the minimum set distance. These braking functions are considered irritating, when an overtaking vehicle pulls in ahead of you. If both systems are



disabled because of lack of knowledge, any safety benefits offered by the AEBS are lost.

There are undoubtedly cases and situations where it is necessary to disable the systems briefly – particularly older AEBS. With the current generation of systems, however, this is rarely necessary because optimized technology has eliminated many sources of error. DEKRA emphatically supports the call for systems to be automatically enabled after a few seconds.

## SEAT BELTS ARE STILL IMPORTANT

Whether Electronic Stability Control, emergency brake assist, a lane departure warning system or lane assist system – in the view of accident researchers, such driver assistance systems undoubtedly and significantly increase the safety of commercial vehicles and help to protect anyone involved in road accidents. However, increasingly advanced safety technology concepts and driver assistance systems cannot hide the importance of one thing: The safety belt is still the most important measure for reducing the risk of serious injuries to vehicle occupants. This applies equally to all vehicle classes and thus, of course, to heavy-duty commercial vehicles too.

In recent years, the rate of seat belt use among truck drivers has certainly increased; but in Germany for example, figures from the Federal Highway Research Institute show that this rate (90 percent) is still below the rate for car occupants (98 percent). A survey conducted by DEKRA revealed a rate of just around 67 percent for occupants of commercial vehicles weighing over 12 metric tons in 2014. Accident researchers estimate that at least half of truck drivers who were not strapped in and suffered fatal injuries in a crash would have survived had they worn their seat belt. Accident research has also established that wearing a seat belt would lessen the severity of or even prevent injuries to commercial vehicle occupants in up to 80 percent of all serious accidents. Considering that the commercial vehicle itself is usually also the driver's workplace, the issue of work safety is of crucial importance here.

## Taking tires seriously

An important aspect of road safety regarding commercial vehicles is the regular maintenance and care of tires. Tires that burst – particularly on the front axle of semi-trailer tractors and trucks – can result in sudden instability and, in turn, skidding, potentially resulting in very severe accidents. But people traveling behind vehicles on which a tire has burst are also at risk due to the tire remnants that have come loose and are lying on the carriageway.

Tires need to be set to the correct pressure in order to function correctly. The statistical assessment of damage to commercial tires by DEKRA has shown for a number of decades now that a large proportion of tire failures can be attributed to a lack of care including insufficient tire pressure or excessive load. Even where the cause cannot be clearly determined, reduced air pressure is involved in a high number of cases. "Cannot be clearly determined" means that, in these cases, multiple overlapping factors have led to tire failure.

Existing damage to the tire in the tread areas, however, which does not lead to an immediate loss of filling pressure, also presents a problem because moisture penetrates up to the steel belt via the channel of damage, causing the belt to corrode and reducing the level of adhesion between the steel cord and rubber. This can result in the protector suddenly detaching from the tire body together with parts of the belt; in these cases, the tire may also burst. Drivers and workshop personnel should therefore check the filling pressure of all tires on a regular basis, adjust the pressure where necessary and check the tires for damage. The gradual loss of filling pressure in

particular can be detected at an early stage by a tire pressure monitoring system.

When deciding which tires to fit on a vehicle, you have to take into account the transport tasks that the vehicle will undertake. Low-section tires certainly offer the advantage of enabling a higher transport volume; however, these dimensions are disadvantageous when it comes to load-bearing capacity. A front axle of a vehicle with tire dimensions of 385/65 R 22.5 for a semi-trailer tractor can bear 3.3 tons, for example, which is almost 50 percent more than tires with dimensions of 295/60 R 22.5. A drive axle equipped with low-section tires with dimensions of 315/45 R 22.5 (dual tires) can bear 11.6 tons, which is significantly less than the load-bearing capacity of 13.4 metric tons offered by tires with dimensions of 315/70 R 22.5. A three-axle trailer equipped with 445/45 R 19.5 tires can bear around three metric tons less compared with when 385/65 R 22.5 tires are fitted. Using the wrong tires for a particular vehicle configuration can result in damage, even if the tires are filled to the correct pressure level.

The process of fitting low-section tires – especially in combination with a tire pressure monitoring system – can present another challenge. Highly skilled personnel are essential for fitting tires correctly and without causing damage. Trade associations BRV (Bundesverband Reifenhandel und Vulkaniseurhandwerk – German tire retailer and vulcanization trade association) and wdk (Wirtschaftsverband der deutschen Kautschukindustrie – association of the German rubber industry) have therefore published fitting instructions in collaboration with DEKRA.



**José Manuel Prieto Barrio**

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**Safety systems and their contribution to reducing the number of accidents in the goods transportation sector**

In 2016, 25,500 people died on European roads. After two years over which the figures remained stagnant, the downward trend in the number of fatalities continued in 2016 – a trend observed over the last six years. With regard to the number of fatalities, a decline of 19 percent was recorded between 2010 and 2016.

The area of focus – “safer vehicles” – is one of the five pillars of road safety alongside these four other fields of action: road safety management; safer roads and mobility; safer road users; response to accidents. The development of new driver assistance systems has resulted in a considerable increase in both active and passive safety.

To take into account technological progress, legislation has been continuously updated at a European level so that the establishment of binding implementation deadlines for new technologies encourages people to adopt the technology. A significant step was the introduction of an obligation to comply with a number of regulations that were issued by the United Nations Economic Commission for Europe (UNECE). This obligation not only increased vehicle safety – including that of goods transport vehicles – but also represents enormous progress in terms of harmonizing regulations from different parts of the world.

Binding technological measures for goods transport vehicles laid down in European legislation include the following modern driver assistance systems: the electronic stability control system and the brake assist system. According to accident research studies, 30 to 63 per-

cent of all accidents could be prevented with the help of these assistance systems. Other systems include the emergency brake assist system, lane assist system and wet grip for tires.

But despite this progress, a great deal of work still has to be done. A number of technical functions are available today that would reduce the number of road accidents if it were mandatory to implement them. In its concluding report published in 2014, the high-level group Cars 2020 advocated extending the measures already implemented to enhance active and passive safety (taking pedestrian and cyclist safety into special account). In this context, the use of the following new safety systems will likely become compulsory for goods transport vehicles: emergency brake assist, intelligent speed assist, a system for identifying when drivers are distracted, alcohol-activated immobilization system, cyclist/pedestrian detection systems and a seat belt warning system for all seats.

According to the concluding report of expert group GEAR 2030 published in October 2017, 94 percent of fatal accidents are still caused by human error. The use of autonomous and networked vehicles would therefore drastically decrease the number of accidents. We need to drive forward the development of automation and networking technology for vehicles and will continue to work with the government in this regard to create an appropriate legal framework for these new approaches, which are highly promising in terms of reducing the number of accidents as well as improving environmental protection.

As an in-vehicle restraining system, seat belts protect vehicle occupants from being flung around inside or even out of the vehicle. Because the seat belt is directly connected to the body of the vehicle, strapped-in occupants benefit fully from the effect of the crumple zone. The combination of the defined extensibility of the webbings with belt tensioner and belt force limiter means that the deceleration values for the occupants wearing a seat belt remain acceptable, even in serious collisions. Other passive safety components such as airbags are also designed for occupants wearing a seat belt and provide optimal protection only when the seat belt is worn.

**VISIBILITY ISSUES IN TRUCKS**

One of the most challenging tasks undertaken by truck drivers is turning the vehicle in the direction opposite from the driver’s seat in city traffic. When doing so, the driver has to look ahead and observe the traffic lights, signs, cross traffic and oncoming traffic at the same time as well as look to their side to check for pedestrians and cyclists. What’s more, the traffic situation can change in a matter of seconds – and cyclists and pedestrians are not always aware that truck drivers may not be able to see them at all because they are in the vehicle’s blind spot.

While a quick glance over one’s shoulder through the driver’s window in a truck gives drivers an extensive view, all drivers can see when they look back over their shoulder is the back wall of the cabin in the cargo area. Of a 360-degree view (in theory), the cargo area alone takes away around a third. The driver therefore generally has to use the exterior mirrors to ascertain the situation in the areas that are not visible. In addition to mirrors, camera monitor systems are becoming increasingly common today, although one has to think carefully about where best to position these systems. For example, can an existing monitor in the dashboard be used? Or would it make more sense to position the monitor close to the mirrors so that drivers glance at the side facing away from them when they need to ascertain the situation from this area? Other questions concern the brightness of the monitor and when the monitor displays which signal.

Due to the numerous collisions between cyclists and trucks that are undertaking turning maneuvers, intensified activities aimed at improving visibility from inside trucks are currently under-

way in the United Kingdom. The aim is to reduce the blind spot from the vehicle itself by moving the lower edges of the windshield much further down. From the point of view of accident researchers at DEKRA, among others, this is to be welcomed in principle. But it is important to remember that these activities relate to a design specification – or, more specifically, “specifications regarding the lower edges of windshields.” A performance requirement would undoubtedly be more constructive. Why is this? A design specification prevents innovative solutions because the design is stipulated. A performance requirement focuses on the end result being achieved – the type of measure selected does not play any role in the process. Generally speaking, one has to first be clear about what the driver must be able to see in front of and next to their vehicle. During the design phase, the lower edges of the windshield can be lowered or another suitable measure can be implemented.

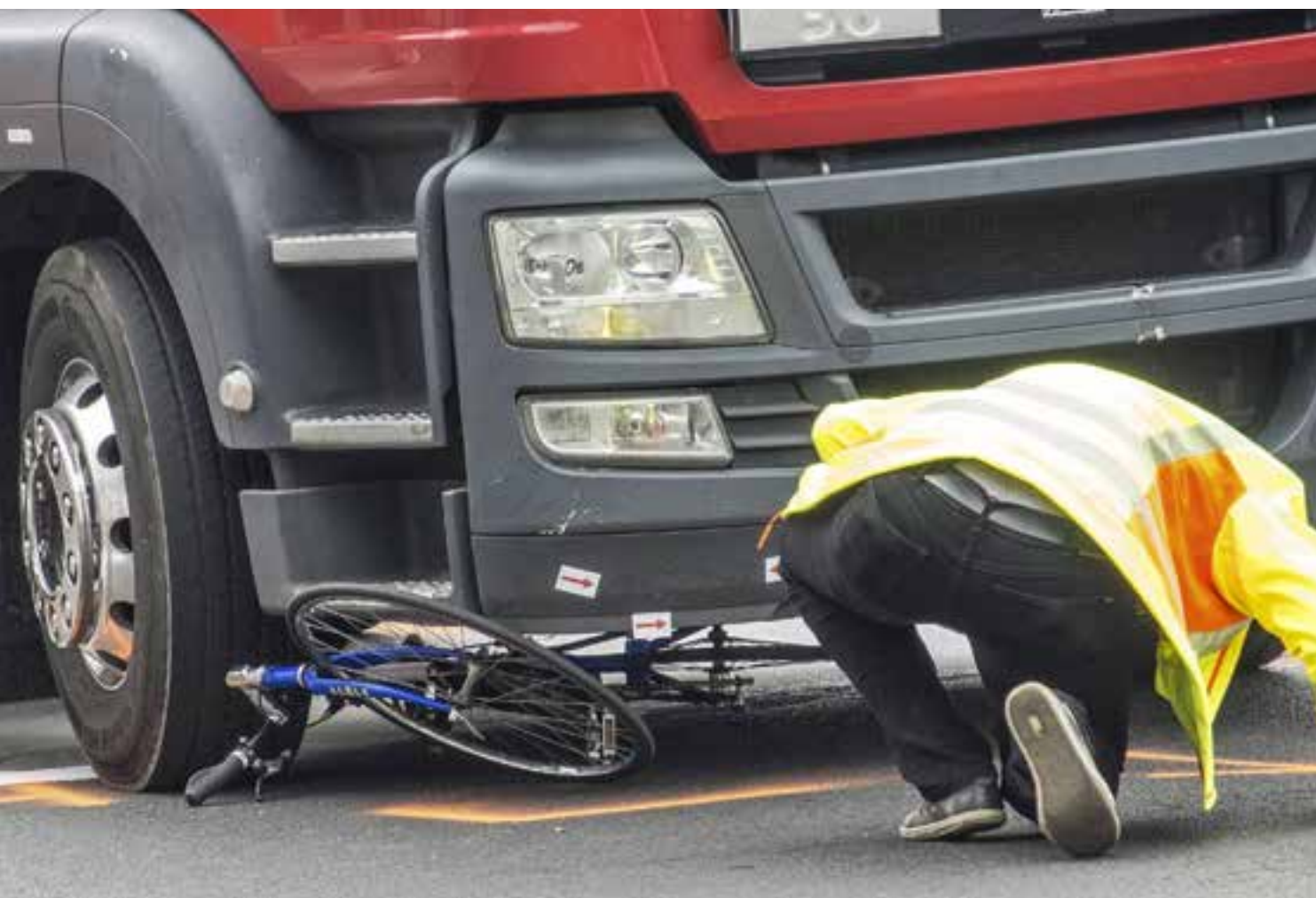
A turning assistance system that detects the presence of people such as that introduced by Mercedes-Benz can also make a significant con-

tribution to preventing accidents when vehicles are turning in the direction of the passenger side. This system is multi-stage: If a cyclist or pedestrian stops in the warning zone, the LEDs in the A-pillar on the passenger side light up yellow in the shape of a triangle. If the system detects a collision risk, the LEDs light up red with a higher luminosity and a warning signal sounds from the right side of the vehicle via a radio system speaker. Furthermore, when the vehicle turns, the sensors can detect a stationary obstacle such as a traffic light or lamp in the trajectory curve of the truck. This prevents collisions not only on public roadways but also when drivers are maneuvering into, for example, parking spaces. This extensive driver assistance is available over the truck’s entire speed range from when it is stationary – at a traffic light, for example – all the way to the maximum authorized speed. This is a system that truly helps to prevent serious accidents.

## DIGITAL CONNECTIVITY

Many of the assistance systems mentioned here and available on the market are good examples of

■ *Collisions involving a truck and a cyclist often lead to fatal injuries on the part of the cyclist.*





**Jean-Michel Mercier**

Director of the Observatoire du Véhicule Industriel (OVI) at BNPPARIBAS RENTAL SOLUTIONS



**The coexistence of humans and machines raises a number of questions**

Road safety for trucks is based on historical principles and is being decisively driven forward today by technological developments that are revolutionizing mobility. The safety of commercial vehicles is also continuously being ensured through the following basic measures: driver training, the implementation of transport regulations, journey planning, keeping vehicles in optimal condition and improving safety and assistance equipment.

In addition to these measures, networked vehicles represent the first of the major developments: With these vehicles, information can be shared with the infrastructure, other vehicles and mobility services and, of course, connections to the ecosystem of the vehicle can be managed (vehicle fleet manager – consignor – customer).

By introducing telematics and processing the information obtained, the company can also map the frequency of incidents and thus respond to the areas of weakness identified in a targeted and efficient manner. This not only cuts costs but also takes account of employee safety as well as societal and environmental requirements.

A real turning point represents the second development: Vehicles that drive autonomously while connected to the Internet, which will truly revolutionize driving as we know it – regardless of whether these are single-group or multi-group vehicles or service or private vehicles. In theory, connected and autonomous vehicles are responding to societal challenges in terms of road safety, mobility and the need to integrate all individual persons into a mobility chain, as well as reducing the influence of the human factor, which is known to be all too frequently responsible for road accidents.

But the coexistence of humans and machines raises many questions of a technical, legal and safety-related nature – after all, the coexistence of conventional, networked and autonomous vehicles will not be without its problems. The spread of these vehicles – as a means of tackling traffic bottlenecks, for example – presents a substantial challenge for all road users.

To ensure the mobility of goods, the optimization of road safety and environmental regulations needs to be considered. But the economic reality of this cannot be ignored because this needs to be taken into account in order to ensure the sustainability of the respective measures.

■ *The turning assistance system enables the driver to monitor the entire truck trailer and detect pedestrians and cyclists.*

the increasing automation of commercial vehicles. In general, automation is a key factor in bringing about long-term change in the commercial vehicle sector as a whole. The study “Delivering Change – The Transformation of the Transport Sector by 2025” published in 2016 by management consulting firm McKinsey & Company sees automation technology as one of the key growth drivers in the logistic sector for vehicle manufacturers and supplies as well as transport companies and freight forwarders. The study identifies autonomous driving as the most significant trend. The study projects that, by 2025, one in three commercial vehicles sold in Europe will be able to drive fully automatically in certain driving situations such as on the highway.

In addition to automation, McKinsey & Company also believes that connectivity will make an impact on the logistics industry over the coming years. Connectivity – that is, the networking of vehicles among each other as well as with the infrastructure – is the key requirement for a technology that almost all players in the commercial vehicle sector expect to bring even greater efficiency and safety in day-to-day business: platooning or, in other words, highly automated convoy driving. The fact that commercial vehicle manufacturers laid the foundations for this technology long ago was demonstrated by the “European Truck Platooning Challenge” in April 2016, in which DAF, Iveco, MAN, Mercedes-Benz, Scania and Volvo all took part.





To test the systems required for automated and connected vehicles in real road traffic, the German Federal Ministry of Transport and Digital Infrastructure set up the “digital highway test field” on the A9 between Munich and Nuremberg back in 2015. Since then, truck platoons have regularly driven along this route. It was also on this roadway in spring 2018 that electronically linked trucks started to be operated as part of regular business operations during the test phase agreed between logistics group DB Schenker and MAN. When does it make sense to form a platoon? What is the best way to form and disband platoons according to the individual situation and traffic conditions? These are just two of many questions that the parties plan to answer in the course of the project.

## PLATOONING PROJECTS AROUND THE WORLD

Of course, it is not only MAN that is making progress in platooning. Daimler Trucks North America, for example, is testing the use of digitally linked trucks with its Freightliner brand on selected highways in the US states of Oregon and Nevada. In the last week of January 2018, Daimler Trucks used its Asian vehicle brand – Fuso – to test the technology on public roads in the metropolitan area of Japan’s capital, Tokyo.

And in another example, Scania launched in January 2017 a multi-annual project, coordinated by the Singapore Ministry of Transport and port authority, involving an autonomous truck convoy on public roads transporting containers from one terminal to another in the port of the Southeast Asian city state. The initiative aims to address the increasing transportation needs and the shortage of land, not to mention of the shortage of drivers. Singapore is therefore used as “virtual test area” for new vehicle concepts designed to enhance productivity and road safety, optimize road capacity and enable new mobility concepts.

Together with German logistics group DHL and other companies, DAF Trucks is currently taking part in a two-year platooning field test in the UK, which is being led by the British Transport Research Laboratory. In this truck platooning test, the British government hopes to gain more experience with this semi-autonomous truck technology, which has the potential to considerably increase the efficiency of road goods transport operations. Driving in an electronically linked network enables the vehicles involved to follow one another closely in a convoy, which has a positive impact on fuel consumption and, in turn, CO<sub>2</sub> emissions, safety and the flow of traffic. The use of advanced driver assistance systems is

■ *Test phase for electronically linked articulated trucks from DB Schenker and MAN on the A9 between Munich and Nuremberg in Germany.*



**Erik Jonnaert**

Secretary General of the European Automobile Manufacturers' Association (ACEA)



**Detailed cost-benefit analysis and an appropriate impact assessment**

Despite a three-fold increase in traffic, EU road fatalities have been reduced by half over less than two decades. Truck manufacturers are also making an important contribution to improving road safety by continuing to invest in the latest technology. Since 2005, the number of fatalities in accidents involving trucks has fallen by almost 50% in the European Union. However, it is concerning that the overall reduction trend has started to slow down in recent years. To give it a fresh impetus, we need an integrated safety strategy, which ensures that safe trucks are driven by safe drivers on safe roads.

In other words, vehicle technology is just one piece of the complex safety puzzle. Other factors include road user behavior, infrastructure, traffic rules and their enforcement, as well as truck fleet age and composition. From our side, truck manufacturers are putting strong focus on active safety measures – in other words, those that can avoid emergency situations or can actively help the driver to manage them properly without having an accident.

Over the past few years, trucks have already been equipped with more than 20 state-of-the-art safety systems. Moreover, connecti-

ty and automation hold great potential to further improve road safety in years to come. In this context, the European Automobile Manufacturers' Association (ACEA) welcomes the European Commission's initiative to revise the General Safety Regulation.

To achieve the greatest impact possible, we will need to invest in the most-effective solutions – especially in the case of trucks. For example, certain safety measures that are currently under discussion, such as low-entry cabs for trucks, can indeed reduce the consequences of an accident but have less impact than active safety measures. The downside of such measures is that they can have a major impact on the transport industry as the overall layout of trucks, including their transport capacity, would be greatly reduced – while CO<sub>2</sub> emissions might increase.

So, in light of this year's update of the EU General Safety Regulation, I would like to underline the need for a detailed cost-benefit analysis and proper impact assessment of all safety measures that are being considered. These should enable the selection of the most cost-effective measures, with the strongest positive impact on improving road safety in the European Union.

also helping to increase road safety, which is the overall aim of the project.

**IDENTIFYING TRUCK PLATOONS**

Even in this early test phase as well as in real-life operation on the roads, there is one extremely important question: How will other road users be able to tell when a truck is part of a platoon? Simple: The trucks will be specially identified. The best method appears to be to attach an electronic display to the rear of the vehicle, a solution not dissimilar to the rear marker panels – required in accordance with UNECE R 70 – that are already a familiar sight on our roads and, in Germany, form the basis for labeling long trucks. This panel would automatically display clear, easy-to-understand information.

The display could state, for example, that a truck platoon comprising three, four or five vehicles is traveling ahead. The display could also state that the truck on which the display is attached is truck 3, 4 or 5 in the platoon. The information displayed







■ Example of information displayed on the electronic rear display on the last vehicle combination of a platoon.

and the remaining distance to the leading truck in the platoon would then need to change accordingly on the truck that is being overtaken. The display would then need to be switched off before a vehicle or a combination of vehicles from the platoon network moves back into a lane or after a vehicle or a combination of vehicles from the platoon leaves a lane. In any case, such a display would need to be discussed and be suitable for use in international transport operations in order to draw enough attention to the particular multi-vehicle combination, provide flowing traffic with the necessary information and ensure that drivers adapt their behavior accordingly.



■ All leading truck manufacturers are currently involved in platooning projects around the world.

## Cora van Nieuwenhuizen

Minister of Infrastructure and Water Management, Netherlands



## Better protection for pedestrians and cyclists

Safe goods transportation is extremely important, especially for a logistics hub such as the Netherlands. Above all, trucks need to be safe. DEKRA, a company offering vehicle inspection services, plays an important role in this. I value the fact that they check and certify

the protective structures of trucks. This makes vehicles safer. Lowered bumpers and buffer beams at the front and rear of trucks are a good example of this; in the event of a collision, these stop pedestrians and cyclists from being pulled underneath a truck.

## The Facts at a Glance

- Driver assistance systems will be used to achieve effective improvements in terms of accident prevention and reducing the severity of accidents.
- The emergency brake assist systems developed by most manufacturers already far exceed statutory requirements.
- In addition to understanding assistance systems' functionalities, drivers must be aware of and understand the performance spectrum offered by the systems and, above all, the limits of this technology.
- In up to 80 percent of all serious accidents, the seat belt helps to lessen the severity or even prevent injuries to commercial vehicle occupants.
- In addition to mirrors and camera monitor systems, a turning assistance system that detects the presence of people can make a significant contribution to preventing accidents when vehicles are turning.
- Platooning has the potential to boost the efficiency of road goods transport operations.



## Safe Roads in Urban and Non-Urban Areas

In addition to vehicle systems, infrastructure plays a critical role in increasing road safety. Upgrading or maintaining roads is only one of many aspects involved. New mobility concepts such as long trucks, overhead-line systems, city logistics vehicles with electric drives and cargo bikes also need to be given greater consideration in the future.

The past and projected increase in the volume of goods transportation by road with the simultaneous increase in the overall volume of traffic, ecological aspects, limitations on the labor market and, last but not least, questions regarding safety make it necessary to further optimize the use of existing infrastructures. This includes better connectivity among different modes of transport. However, new concepts relating to vehicles are also required. The electrification of the power train, overhead-line systems such as the eHighway, improved vehicle-to-vehicle communication through to platooning, approval for longer combination vehicles, higher maximum authorized masses as well as optimization measures for com-

bined transport and loading vehicles onto trains are just a few examples that are being discussed or are already being tested.

Changes to vehicle technology or provisions concerning authorization always need to be considered against the backdrop of whether the infrastructure is even equipped to handle these concepts. Increased mass means higher loads on roads and especially bridges. When braking on bridges, truck platoons generate enormous amounts of energy, while more combined transport operations need to be processed by freight handling stations and railroad companies competitively and in line with requirements.

This also raises a host of new safety questions. What risks are posed by overhead cable posts erected on the roadside to vehicle occupants who leave the road in an accident? What are the limitations of existing safety guards such as guard railings or concrete safety barriers in the event that they are hit by heavier, longer or faster commercial vehicles? What are the consequences of the increased load of a longer combination vehicle in the event of a fire in a tunnel or under a bridge?

## EXTENSIVE STUDIES ON LONGER COMMERCIAL COMBINATION VEHICLES

The topic of heavier or longer combination vehicles is already resulting in some highly controversial discussions in many countries around the world. Longer combination vehicles (LCV) were approved in the Canadian province of Alberta back in 1969. LCVs are vehicles that are longer than 25 meters. The maximum length is 41 meters for vehicles with a generally applicable maximum authorized mass of around 64 metric tons in Canada. Since then, LCVs have been authorized in several other provinces.

In the mid-1980s, the first studies on LCVs were conducted in the USA, with more studies to follow. Today, LCVs are authorized in a number of federal states. Specifications apply to the length of the load carrier and the combination options. Two semi-trailers, a semi-trailer with a trailer and three trailers are authorized. The addition of a tow bar and semi-trailer tractor results in a total length of up to 38 meters and a maximum mass of up to 62.5 tons.

“Road trains” with a total length of up to 53.5 meters and a maximum mass of 132 metric tons (excluding semi-trailer tractor) are used on some long-haul routes in Australia.

The situation in Europe is also far from uniform. The maximum standard length is 18.75 meters. Long truck combinations up to a length of 25.25 meters are authorized in some countries, mostly on a route-by-route basis. Combinations up to 32.5 meters long are permitted in Sweden. Very different regulations also apply to maximum authorized masses of 40 to 90 tons.

The most extensive research work regarding longer truck combinations was conducted by the German federal government under the leadership of the Federal Ministry of Transport from January 1, 2012, to December 31, 2016. The Feder-

al Highway Research Institute provided academic support with regard to the field test. The investigations covered the fields of vehicle technology and the environment, loads on roads, tunnel safety, traffic issues, psychological aspects as well as accidents and other exceptional occurrences.

The field test therefore represents the most comprehensive body of research on this topic. It is a successful example of how insights into “new” concepts can be gained independently. Since no notable problems were identified, it was decided to authorize the operation of long trucks up to a maximum length of 25.25 meters and a maximum authorized mass of 44 metric tons (which was the



**Ana Isabel Blanco Bergareche**

Deputy Director of Traffic in the Ministry of the Interior, General Directorate of Traffic (DGT)

### Safer goods transport for greater competitiveness

In 2016, 102,362 road accidents occurred in Spain. In these accidents, 1810 people died, 9,755 people were taken to hospital and 130,635 people suffered injuries. These figures, which come from one of the EU countries with the lowest road accident rates, mean that we must nonetheless continue working to prevent fatalities and injuries caused by traffic accidents.

With regard to goods transportation, the figures highlight the need to take specific measures for preventing accidents involving trucks and vans. In this context and in view of the fact that global economies have concluded that competitiveness depends on the efficiency and safety of transport, some strategies are presented below:

- A modern and safe vehicle fleet: Half of registered trucks and delivery trucks are 13.5 years old or more. Modernizing the fleet means that vehicles equipped with state-of-the-art active and passive safety equipment and complying with the strictest environmental regulations will be used for transportation purposes. Ensuring that vehicles are

properly maintained as well as smaller-scale measures such as the installation of reflective signs to improve visibility will help improve the existing vehicle fleet.

- Safe roads: Promoting the use of safer roads and improving critical sections of conventional roads, primarily by restricting when vehicles can overtake other vehicles, standardizing vehicle speeds and introducing improved signage.

- Digitalization and connectivity: The transport sector is highly receptive to new technology. Fleet tracking solutions are standard in this field and provide a way of controlling fleets efficiently. Within the context of connected driving, services that can make a significant contribution to road safety are essential.

- Safe behavior: Using police and technological measures to adapt monitoring and checking operations to the specific conditions of unauthorized behavior in the context of speeding and the excessive consumption of drugs and alcohol by the driver.

The challenge is great but together it is possible to ensure safe goods transport that makes us competitive.



**Gustavo Paulo Duarte**

President of the “Associação Nacional de Transportadores Públicos Rodoviários de Mercadorias”



**Road safety: Where is Portugal headed?**

After the trend had declined for a number of decades, the country recorded a slight – yet still worrying – increase in the number of road traffic accidents. Even though this increase can be primarily attributed to an increase in the number of accidents involving motorbikes, additional targeted measures are needed to reverse this trend and ensure that Portugal continues to have some of the safest roads in Europe.

Portugal has a well-developed infrastructure, while the vehicles on the country’s roads are relatively modern and, therefore, safe. But like some other countries in Europe, Portugal is facing the challenge of a continuous increase in the volume of motorized private transport. Drivers and pedestrians therefore need to be made aware of the associated dangers so that stress in everyday traffic, overconfidence and driver distraction (smartphones) do not lead to an increase in the number of accidents. The primary focus is on truck and bus drivers who drive on the roads every day as part of their jobs. This road user group needs special training in order to handle the constant challenges

and changes in their field of work. At a time when environmental pollution, the significance of mobility and, recently, the challenges and risks associated with autonomous or semi-autonomous driving have become central points of focus, should we not concentrate primarily on road safety? Should we not focus even more on developing a strategic plan to make Portugal a road safety pioneer? To ensure that we are ready for the road transport challenges of the future, we need a solid legislative framework.

Portugal now needs to adopt a clear stance on road traffic provisions and new regulation on motorized and stationary vehicles – particularly in cities – as well as a guiding road safety policy. The country meets all of the requirements to continue advancing the successes that have been achieved thus far in this field. We should never be satisfied with a “mid-field position” or the figures achieved so far. As a country, we should strive for nothing less than excellence – especially when it comes to something as important as road safety.

same as previously) on certain routes. A number of conditions apply, including a high safety level for the vehicles involved and the option for vehicles to be used in combined transport.

**INTENSIFYING CONSTRUCTION AND MAINTENANCE MEASURES**

When it comes to optimizing the infrastructure, one issue must not be forgotten: the condition of roads, bridges and tunnels. In this regard, an important role is played by aspects such as the condition of the road surface; predictability of the road design and layout; visibility of the carriageway; design of roadside areas; road markings; design of intersections and junctions; adequate space for evasive and overtaking maneuvers; and, for bridges in particular, the general structural condition.

Back in November 2008, the European Union published “Directive 2008/96/EC on road infrastructure safety management.” The European Commission considers infrastructure to be a fundamental element of its policies for enhancing road safety. These not only concern new building projects, but are also and above all focused on increasing the safety of existing roads. Of course, it is impossible to rebuild every dilapidated road or to renovate it completely, but if all construction and maintenance measures are planned, prioritized and performed with the aim of achieving maximum safety, this can result in significant safety improvements.

Bridges, for example, are one of the major weaknesses in Germany’s road network. One problem here is material fatigue, which can be attributed

■ *Narrow or unsecured shoulders on a rural road can quickly lead to disaster for truck drivers too.*





■ Long truck crash tests conducted by DEKRA on behalf of the Federal Highway Research Institute: the 38-ton long truck did not break through the double-row concrete safety guard of the highest containment level.

on the one hand to the sometimes advanced age of the structures and, on the other hand, to the traffic load, which has been rapidly increasing for a number of years. The enormous increase in heavy goods transportation is having a particularly severe impact on bridges. This is why the structural tests stipulated in accordance with DIN 1076 are an essential element of the measures for improving the road infrastructure. Regular expert inspections ensure that structural faults are detected and countermeasures developed at an early stage, and also are an important component in improving road safety.

## SAFETY HAZARDS ON RURAL ROADS

Alongside highways, rural roads are also an accident hotspot for commercial vehicles. On narrow roads in particular, things can get really tight. If a vehicle leaves the lane in the direction of the roadside, the condition of the edge strip and shoulder often determines the subsequent maneuverability of the vehicle. If there is no edge strip, the wheels leave the road immediately after crossing the margin line. The friction coefficients also change, and, as is often the case, the road shoulder is lower than the road surface, making it hard to steer the vehicle back onto the lane. Inexperienced drivers tend to turn the wheels of the vehicle excessively in an attempt to overcome the differences in height. As soon as the vehicle gets back into the lane and onto the normal road surface, it abruptly heads in the direction of oncoming traffic; all this is combined with a very high risk of skidding. Where space allows, the width of the edge strip should be adapted to the respective speed and lane configuration. The

bordering shoulder should be at the same height as the lane and secured so that it does not subside after heavy rainfall or if a truck drives over it.

### Alessandro Wolf

Chief Operation Officer, Lidl Switzerland



## Visionary electric mobility solutions with clean energy

Efficient logistics has always been one of our core strengths – this reduces costs and the impact on the environment. Critical factors here are a high packing density, optimal route planning and maximum utilization of the vehicles, taking into account the shortest and most direct routes to the branches. No empty or poorly utilized Lidl trucks can be seen on Swiss roads today.

Two purely electric trucks have been in service since autumn 2014 and supply multiple branches with goods twice a day. These vehicles are quiet and release almost no CO<sub>2</sub>, because they are fueled by hydroelectricity. In July 2016, one of these electric trucks even set a Swiss record – it was the first electric truck in the country to cover over 100,000 kilometers. The second electric truck achieved this just shortly after. At the end of 2017, the two trucks had together covered more than 360,000 kilometers.

What's more, Lidl Switzerland provides its customers with electric charging stations at various branches so that customers can charge their electric vehicles for free. When the sun is shining, customers charge their electric vehicles at branches with solar panels so that they can run on solar electricity. If the solar panels do not produce enough electricity for the charging station, hydroelectricity (EU) can be used. In this way, the system promotes visionary electric mobility solutions with clean energy. At the end of April 2016, the first electric charging stations were connected to the grid and, by the end of 2017, 24 charging stations were in service. Overall, in the 2016 fiscal year, our customers charged their vehicles with 26,011 kWh of electricity – an amount that would allow them to travel around the Earth 3.2 times. The network will be continuously developed over the coming years.





■ *The lack of truck parking spaces on highways is a problem facing many European countries today.*

**Dirk Penasse**

General Manager of European Secure Parking Organisation (ESPORG)



**Greater safety through secure rest areas for trucks**

Secure rest areas make an important contribution to road safety. Trucks can be parked securely and drivers can enjoy their time spent outside of their vehicles. This demonstrably decreases traffic accidents and the continuously increasing number of thefts on European highways, as many studies have shown. Furthermore, this corresponds to the more stringent legal requirements in numerous EU member states with regard to driving and rest times for truck drivers.

The occupational profile of truck drivers is also boosted, and women who are interested in this occupation are being targeted with the promise of a secure and professional working environment. We believe that rest areas for trucks as well as security and service concepts tailored to truck drivers need to be a priority.

As a European association for secure rest areas, we work with our partners to establish standards

on the basis of which a five-tiered certification model has been developed for security and services. As part of a study conducted on behalf of the EU, which will be presented at the beginning of November 2018, we are playing a leading role in developing a generally recognized European standard.

From a higher security level, we believe that only a certificate from independent expert organizations can prove, credibly convey and reliably communicate security. A number of rest stops already have a safety certification, which is beneficial in terms of the number of visitors they receive and their business model.

All road users benefit from the certification of demonstrably increased security. As an important part of the logistics chain, secure rest areas also give visitors the option of booking and submitting cashless payments for parking spaces because their trucks are digitally recorded.

**MORE TRUCK PARKING SPACES NEEDED**

A risk regarding road safety that should not be underestimated is the severe lack of parking spaces along highways. For years now, new truck parking spaces have been established in Germany by both the federal government and states. But with the increasing number of goods transport operations, it has not yet been possible to remedy the deficit. According to experts, German highways alone lack thousands of parking spaces for trucks – according to the calculations of the Federal Highway Research Institute, the shortage will reach 26,000 by 2030.

Driving and rest times are one of several significant problems in this regard. Truck drivers are required to adhere to these times, with failure to do so potentially resulting in drivers facing severe penalties. To avoid violating driving times and due to the lack of parking spaces, truck drivers often park their vehicles in the entrance and exit areas of rest stops and service stations as well as on hard shoulders. This presents a high accident risk because the trucks are often inadequately secured and are almost impossible to see by other road users at night due to poor contrast. According to the “Vereinigung Deutscher Autohöfe” (VEDA – association of German truck stops), the resulting fatal accidents have continuously increased in recent years. Prior to 2016, one driver on average died over three years; in 2016, four drivers were killed and in the first half of 2017, six drivers were killed.



A close look at accident black spots

## Road safety screening for greater safety on the roads of Baden-Wuerttemberg

The goal could not be clearer: By 2020, 40 percent fewer people should die on roads in Baden-Wuerttemberg compared with 2010 as part of a major step toward achieving "Vision Zero." To this end, the state ministry of transport has developed a safety concept in which road safety screening plays a key role. This type of screening process is unprecedented in Europe. The process identifies accident blackspots so that efficient optimization measures can be initiated. Road safety screening is also an ideal tool for the 150 accident commissions in Baden-Wuerttemberg that helps them to prepare and follow up visits to the scene of an accident.

On a platform jointly designed with traffic consultancy company DTV-Verkehrsconsult, all information relevant to road safety work is interpreted in a uniform way and the results are displayed on theme-based maps. Relevant

information includes accident data, traffic volumes and vehicle speeds based on regular vehicle monitoring operations at counting stations – of which there are now 5,000 in the state – road geometry, road condition and photos of routes covered. All of the information is gathered to create theme-based fact sheets for short stretches of road, usually 100 meters in length. Depending on the severity of the accident, the road sections are marked in green, yellow or red. The fact sheets form the common basis for the analysis of accident causes and corrective measures and contain up to 700 items of data.

In addition, network evaluations and special inspections that analyze individual accident types or vehicle types separately are conducted to make it easier to establish the content of road safety projects. For example, specific categories

include swerving off the road and colliding with an obstacle, accidents involving trucks, motorbike accidents and accidents in flowing traffic. An online prioritization tool was also developed that enables boundary conditions of accidents to be weighted individually and ranked so that the most critical points relating to a particular matter can be identified and marked in just a few minutes. This ranking system enables the budget available for improving the road infrastructure to be utilized where the need is greatest and so improve road safety over the long term.



■ An example of road safety screening: accidents on highways in Baden-Wuerttemberg, in which articulated trucks were categorized as the primary cause of the accident.

It is important to note that, since 2015, the number of accidents in flowing traffic in relation to all accidents in which articulated trucks were identified as the primary cause has continuously decreased.

This trend is also very clear with regard to the accident consequences: Personal injury and property damage have decreased proportionally.

This development may indicate that the emergency braking assist system compulsory in new trucks from 2015 is having a positive effect.



■ Reflector post with integrated counting technology



■ Cargo bikes are playing an increasing part in inner-city distribution transport.

To remedy the situation, an intelligent parking system was introduced at the highway service station in Montabaur, for example. A display at the service stop lets arriving truck drivers know whether any parking spaces are available. The parking spaces are then assigned to the drivers via a computer system. Parking is organized on the basis of when vehicles will leave – drivers who have to depart early in the morning are assigned parking spaces at the front. This means that the trucks can

be parked in columns, making optimal use of the small number of parking spaces available. According to VEDA, the potential areas “off” the highway could increasingly be considered as an alternative to this solution.

Legislators could also take appropriate action in this regard. Until now, the penalties for exceeding the maximum permitted driving time are much more severe than for parking in an inappropriate place. Making both penalties equally severe could deter drivers from parking their vehicles in hazardous locations. This would just shift the problem, however, because truck drivers would then have to continue driving until they found an available parking space. Fatigued drivers are at an increased risk of being involved in an accident.

### Dennis Isern

Manager Last Mile, Hermes Germany



### Rigorously tested

Hermes has committed to delivering goods to all German cities without producing any emissions by 2025. Our pilot test of the TRIPL e-scooter in Göttingen is a reflection of this commitment. We have rigorously tested the TRIPL here in controlled applications for several months. In addition to the emissions-free drive, other highlights for us include the maneuverability of the vehicle in road traffic and much easier parking – both of which are very important to us, especially in urban areas. At the same time,

the test showed that loading volume is very limited, particularly at times when lots of packages have to be delivered such as around Christmas. We also face the problem of our drivers being exposed to winds, bad weather and traffic without the protection afforded by a crumple zone. We have not yet decided whether to continue using the technology after the test period. Nevertheless, the use of e-scooters on the narrow streets in city centers and historic districts continues to be an interesting project for us.

In addition to the lack of parking spaces, truck drivers have increasingly had to contend with organized crime in recent times. Cargo thefts are increasingly occurring especially in non-secure parking areas. Some truck stops have addressed this problem and are offering the first “completely secure” parking areas with the “premium parking” concept, with 20 truck stops throughout Germany now offering this service. In the Netherlands, parking spaces along two highways are being monitored by a central control center as part of a project. If a vehicle stops at one parking lot after another and thereby arouses suspicion, the control center can send a police patrol to the site. Monitored parking spaces have also been set up in Belgium, England, France and Spain.



## OPTIMIZING THE FIELD OF SMALL-SCALE DISTRIBUTION TRANSPORT VIA CARGO BIKES

In view of increasing traffic problems in densely populated urban areas, innovative concepts are essential here too. One of the fundamental objectives of traffic planners around the world in this regard is rapidly switching small-scale distribution vehicles for retail stores in urban areas over to delivery vehicles with environmentally friendly drives. An equally promising alternative involves optimizing these transport operations by means of cargo bikes with or without additional electric drive.

These bikes have different designs depending on their purpose and area of application. The longest-serving bikes for delivery purposes are bikes used in the postal service. Requirements regarding transport bikes go far beyond the standard for conventional bikes. Due to the high permissible load, the vehicles need to withstand additional stresses, which are further increased through the optional use of an electric auxiliary drive.

Much progress has already been made with regard to drafting a standard that henceforth defines the requirements and test procedures for bikes subject to increased loads compared with DIN EN ISO 4210 and DIN EN 15194 – e.g. company bicycles, bikes for delivery services and rental bikes. Standards give manufacturers a solid foundation on which to build their products, while test centers provide standardized criteria according to which they can test the usability and safety of bicycles used for transporting goods. In addition to this, work on drafting an ISO standard concerning this matter is underway.

Alongside technical issues regarding bicycles for transport/load-carrying purposes, the framework conditions regarding behavior and infrastructure need to be adapted to future requirements. For example, traveling along a cycle path quickly and safely is often difficult, which is why cargo bikes often move onto the road (to avoid blocking the cycle path). Some larger cargo bikes are even too wide for cycle paths. This is not necessarily a problem because many urban areas have zones where the maximum speed is limited to 30 km/h and cargo bikes can be easily accommodated. Larger bikes can now be used to transport packages with the dimensions of European pallets. Today, multi-track cargo bikes have a load capacity of up to 300 kilograms. A proposal has been made to discuss these matters at a European level together with the European Cycle



■ In the future, robots will be an increasingly common sight in urban areas – on sidewalks where possible – to transport packages. Sidewalks were originally a type of protected space for pedestrians. Now, sidewalks are being used for increasingly progressive applications. The question here is whether such applications are actually beneficial or whether they should be limited in certain circumstances.

Logistics Federation (ECLF) in the near future and develop mutually agreeable solutions that will set a solid foundation for the future.

In its resolution of September 27, 2011 on European road safety 2011–2020, the European Parliament strongly recommended the responsible authorities “to introduce speed limits of 30 km/h in residential areas and on all one-lane roads in urban areas which have no separate cycle lane, with a view to protecting vulnerable road users more effectively.” Given that the widespread use of cargo bikes in urban areas is desirable, including among politicians, this recommendation seems more realistic than ever.

## The Facts at a Glance

- Before changes are made to vehicle technology, one has to consider whether the infrastructure is even equipped for these new concepts.
- Various research projects on long trucks show that these modes of transport have not so far had any negative impact on road safety. In general, no relevant changes to maximum structural loads are to be expected.
- The shoulder at the edge of rural roads should be at the same height as the lane and secured so that it does not subside after heavy rainfall or if a truck drives over it.
- The number of truck parking spaces on highways needs to increase significantly.
- Road safety screenings such as those conducted in Baden-Wuerttemberg allow accident blackspots across the state to be identified so that effective measures to improve the situation can be initiated.





## We Need to Drive Forward This Fundamentally Positive Trend

Given the ever-increasing distances covered and ever-growing volume of road goods transport in the EU – a trend observed for a number of years now – as well as the simultaneously decreasing number of fatalities and injuries, primarily in the case of accidents involving heavy-duty commercial vehicles, it is clear that road safety has increased considerably. Nevertheless, the severe accidents that still occur make it clear that a lot of work still needs to be done when it comes to vehicle safety, infrastructure and, above all, the human factor.

Whether it's tightly scheduled route plans, tight deadlines, congestion, stress, fatigue, a lack of parking spaces, distraction by text messages or operating a navigation system, poor weather and road conditions and various other factors, professional drivers have to deal with a whole host of external influences during their day-to-day work. They also need to simultaneously focus on the actual task of driving, which gives them a huge responsibility. Just one moment of distraction or a sudden microsleep can quickly have devastating consequences – for everyone involved.

The fact is that human error is the biggest cause of accidents involving goods transport vehicles. Accident researchers believe that around 90 percent of these accidents across Europe can be attributed to “human error,” although it is of course not only goods transport vehicle drivers who are at fault. Even though goods transport vehicles are

less frequently involved in accidents resulting in personal injury in relation to the number of kilometers they travel, action is still required especially given that the consequences for the other party involved in these accidents are usually much more severe than those for the occupants of goods transport vehicles.

Transport companies and freight forwarders alone can therefore make a significant contribution to improving road safety by making their drivers and any subcontractors even more aware of safety issues. Alongside intelligence, training and further education courses for professional drivers are incredibly important – as already covered in detail in “The Human Factor” section of this report. In addition, efficient occupational health management as well as regular health checks are critical for maintaining efficiency and a sense of wellbeing – and, in turn, minimizing the risk of accidents.

Regarding the vehicles themselves, the potential for optimization is far from exhausted. Heavy-duty trucks in particular are now truly high-tech vehicles. Continuous improvements have been made not only to the structure and equipment of driver cabs but also to the trucks' driving characteristics. In addition to the purely mechanical measures of partner protection to the front, rear and side of the vehicle, modern electronic driver assistance systems further enhance protection for truck occupants and other road users. Regardless of whether vehicle dynamics control systems such as ESC, adaptive cruise control (ACC), emergency braking assist, lane assist or turning assistance systems are used – they all help to prevent accidents or mitigate their consequences.

## DESPITE EFFICIENT ASSISTANCE SYSTEMS, ANTICIPATORY DRIVING IS STILL ESSENTIAL

Equipping vehicles with an ever-increasing number of assistance systems will certainly take us closer toward "Vision Zero," a society in which road accidents do not result in fatalities or serious injuries. But it is crucially important that drivers are fully aware of how the systems work so that they do not disable the "wrong" system – the life-saving emergency brake assist, for example – because they do not know enough about the technology. Drivers must also remember that assistance systems cannot override the laws of physics. They do not increase brake power, for example, and they cannot shorten the braking distance of a vehicle on wet or slippery road surfaces.

Also, it is essential that all such electronic systems function properly throughout the vehicle's service life. Only in this way can they have their desired impact. Regular vehicle inspections will therefore become even more important than they already are, not least because of the growing complexity of the systems and the risk of electronic tampering.

To conclude, however, we must not lose sight of one clear fact, as stated in the previous years' DEKRA road safety reports: To prevent hazardous road situations in the first place, responsible behavior, a proper assessment of one's own capabilities and a high level of acceptance of rules among all road users are – and remain – absolutely essential. In particular, the risk of being involved in a road accident can be decreased on a sustained basis by adopting an anticipatory and defensive driving style.

## DEKRA's Demands

- Assistance systems such as the emergency brake assist that have been "temporarily" disabled by drivers must be automatically enabled after a few seconds.
- The electronic turning assistance system must be mandatory equipment for all commercial vehicles, as is already the case with the emergency brake assist and lane assist system.
- Professional drivers must be informed of the functionality, potential and risks of driver assistance systems and automated driving. This applies to all other road users, too.
- Safe goods transportation cannot be considered and achieved in isolation from other road users. Fewer accidents caused by other road users mean fewer accidents involving goods transportation. This relates not only to in-vehicle safety systems, for example, but also to the problem of drivers and pedestrians not paying attention to what's happening around them on the road.
- The functioning of mechanical and electronic components for vehicle safety systems must be ensured throughout the service life of the vehicle. Inspections of relevant components in the framework of regular roadworthiness checks should be raised to a uniform minimum level across as many countries as possible, especially as technical defects are responsible for many accidents or negatively impact on the course and severity of accidents.
- As the most important life-saving piece of equipment, the safety belt must be worn for all journeys in commercial vehicles.
- Professional drivers need to be made even more aware of the dangers of being distracted at the wheel.
- The required safety standards must already be defined for the testing of the platooning concept. These include individual vehicles with special markings for other road users to distinguish them. This is necessary both in terms of safety and the general acceptance of modern transport technologies.
- Better knowledge regarding how to safely secure loads and how to handle dangerous goods is imperative.
- Road safety screenings such as those introduced by the ministry of transport in Baden-Wuerttemberg for identifying accident blackspots should set an example for similar models so that the budgets available for road infrastructure can be utilized more effectively to enhance road safety.
- Standardized accident statistics that can be compared across countries are essential for introducing targeted measures to increase road safety, such as the implementation of successful "best practice" measures.

# Any Questions?

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