VDA | Verband der Automobilindustrie

Driving tomorrow

Commercial vehicles 2018


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Foreword

Bernhard Mattes, President (VDA)

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Driving tomorrow

The commercial vehicle is the driver of today's world. Its transport performance is the prerequisite for the spatial distribution of labour within our economy and for the increased prosperity and growth we achieve. It not only powers the production process, but also takes over its distribution. It delivers the finished consumer goods we find on store shelves, or brings them to our doorstep. As a bus, it transports us to work and our children to school. It hauls away our refuse, helps us to move to a new home, and protects life and limb as an emergency vehicle.

Over the course of time, the commercial vehicle has also become increasingly cleaner and safer. A truck today emits 40% less CO_2 and 97% less NOx and fine particles than its counterpart from the 1990s. And as it becomes equipped with more and more safety features, the commercial vehicle today is statistically as safe as a passenger car.

And when it comes to the commercial vehicle's core importance in freight haulage, traffic experts all agree that this will not change over the long term. What is going to change, however, is the commercial vehicle itself. Over the course of its more than 100-year history, never did the commercial vehicle fundamentally change as quickly as it has recently. Currently we find ourselves in the midst of a leap to a new level of commercial vehicle development: from pure diesel drive to electric mobility, from assisted driving to automatic driving, and one that is not only networked to its trucking company, but with the entire transport world. This is quasi a three-prong technological advance.

The series production of purely electric vehicles, which we already know from vans, will begin for buses, light duty and heavy duty trucks for distribution transport in the next three years. Only for heavy trucks used for long distance haulage is a purely electric drive, e.g. by fuel cell, still not yet suitable. In play for heavy trucks as a supplement to electric drives are e-fuels, e.g. synthetic fuels produced using electricity from water and carbon dioxide and which are practically climate–neutral. Until that time, the use of CNG and LNG along with the technical reconfiguration of the truck itself offers great potential for providing the transition solution for reducing CO_2 emissions.

At the same time we find ourselves in the middle of the transition from assisted driving to automated driving. Technological refinement here has already been achieved, for example in autobahn trials and platooning that involve the travel of electronically coupled trucks. These innovations increase traffic safety and environmental friendliness, and serve to relieve both the driver and infrastructure. Now it is up to the policymakers to provide the legal framework to allow the use of the technology.

And why should there be ridesharing only within the scope of passenger traffic? The commercial vehicle industry therefore has created telematics solutions which now allow several freight forwarders to combine low-cost freight and thus create profitable trips with the help of an intelligent algorithm. This is another milestone on the way to even better vehicle utilisation, less traffic and fewer emissions.

Just how quickly these opportunities will be put into practice depends ultimately on how quickly the market accepts them. Policymakers should also take this into account, for example in their aim to reduce the CO_2 emissions of commercial vehicles. Unfortunately, the Commission's proposal presented last spring calling for 30% reduction by 2030 lacks any sense of proportion. It is hoped that the EU will come to a more realistic assessment of the possibilities in the future.

Policymakers are also hesitant to promote new technologies. The € 10 million provided by the Federal Government as an annual subsidy for the purchase of trucks with natural gas or electric drives are not enough to bring about any noticeable modernisation to the fleet.

Commercial vehicles will be able to provide the full impetus needed for tomorrow's world only if the political framework conditions are right.

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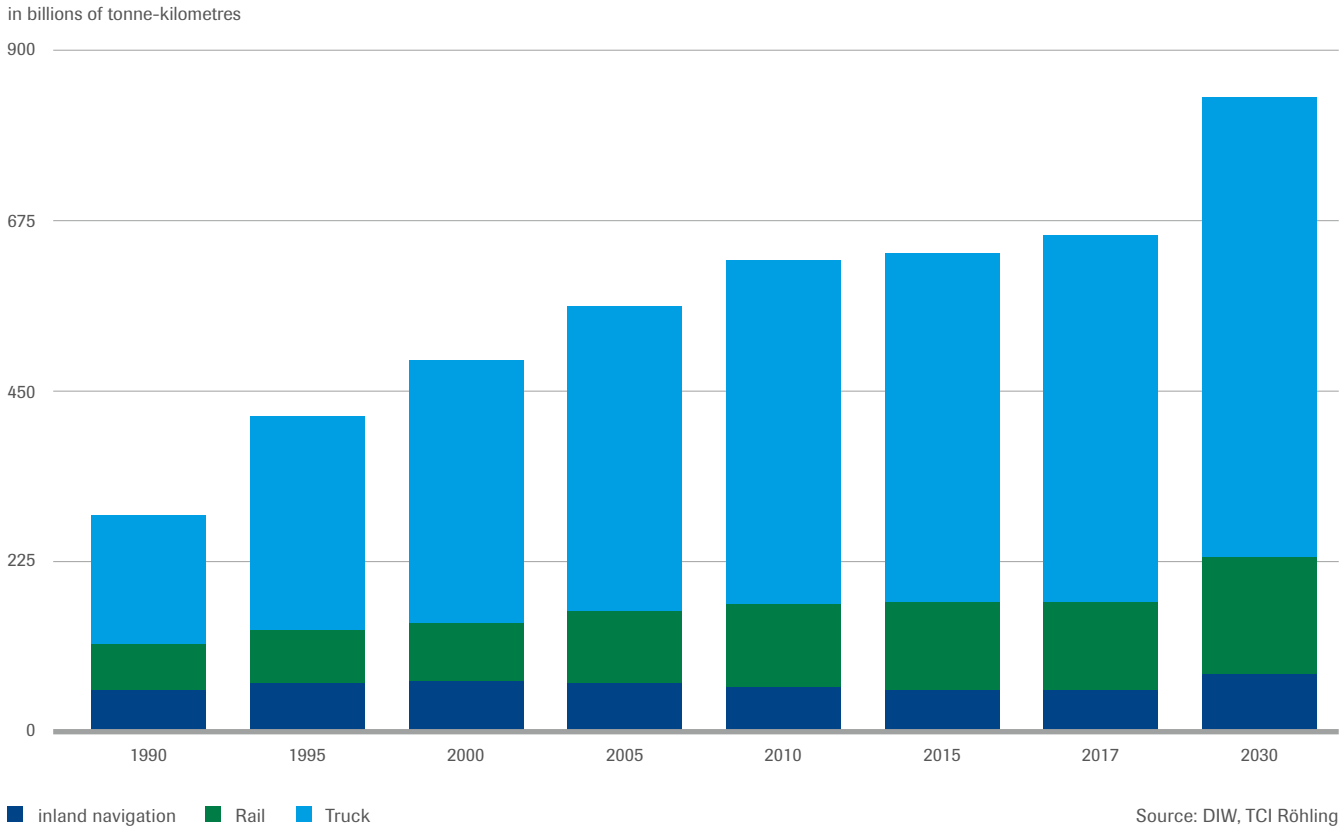
The commercial vehicle is essential for everyone. Every day it transports 120 kilograms for each of us.

Commercial vehicles – the engine of our economy

Without the commercial vehicle we would all be much poorer. It allows us to exchange goods and thus increase our prosperity, which is created from the division of labour. Freight is also carried by waterway and rail. With a share of 74% of all freight transport – which is about the average in the EU – the commercial vehicle is fundamentally the back bone of our freight transport.

The commercial vehicle is not only economically important as a driver of productivity, it also generates jobs directly: The commercial vehicle industry employs approximately 180,000 persons in Germany, which corresponds to about a quarter of all jobs in the automotive industry. In addition, there are jobs that directly depend on the operation, maintenance and use of commercial vehicles. In Germany alone this amounts to some 2.5 million persons.

Freight transport in Germany



Source: DIW, TCI Röhling

Road and rail – a division of work and cooperation

The reason behind the great importance of the commercial vehicle in freight transport is the technological advantages it offers with respect to rail and waterway. Firstly it has an unmatched networking capability, which means it can reach any location – directly to any doorstep or loading dock. Water vessel and trains can be used alone in the rare case that both the consignor and the consignee of the transported freight have access to a seaport or rail terminal connection.

Secondly, the commercial vehicle is also able to economically transport small quantities, which would make no sense for transport by waterway or rail, as due to their own massive weights these are suitable only for hundreds of tonnes of cargo. They offer advantages when the transport of large quantities is involved.

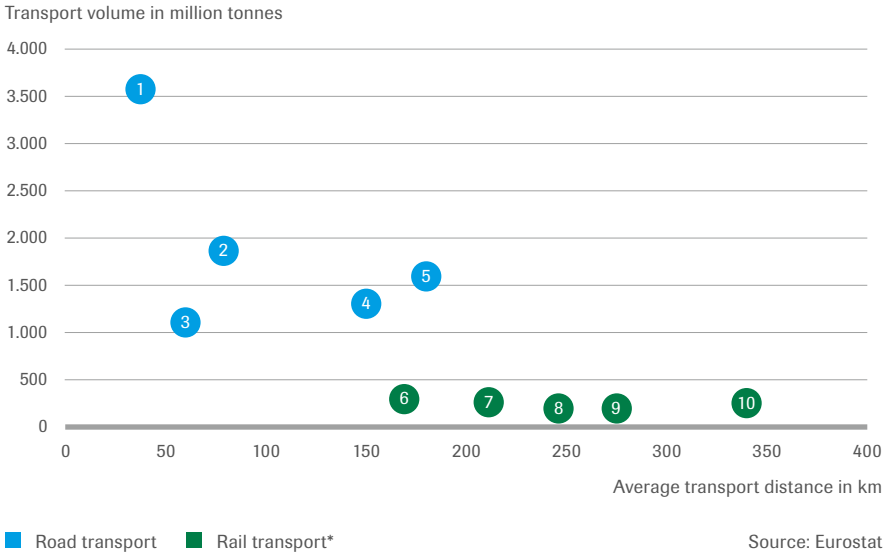
In many cases it is possible to interconnect the strengths of the individual transport means within the scope of combined transport – for example a main transport consisting of rail and a road transport before and after the transhipment hubs. When it comes to combined transports, however, it needs to be considered that transhipment involves time and environmental impact. Moreover, detours and indirect routes arise due to the initial transport, main transport and follow-up transport when compared to direct shipments by pure road shipment. These two drawbacks of combined transport, however, do lose their importance as the transport distance rises. For this reason logistics experts estimate that combined road-rail transport becomes economical when the distances reach 400 kilometres. Depending on the route and transport volume, this could even involve greater distances. Because it comes down to each individual case, blanket requirements for a shift of freight to another mode of transport, such as rail, which has been brought up by transport policymaking, neither makes sense ecologically nor economically. Moreover one has to consider that the average road transport distance in Germany is only 122 kilometres and only a fraction of road freight haulage goes beyond a distance of 400 kilometres, and thus merits consideration for combined transport.

For example, numerous transports of new automobiles are suited for a combination of road with rail. The automobile industry ships more than half of its domestically produced new cars by rail for the main transport distance.

The most important goods transported by rail are raw materials. As a rule these are transported over large distances between the sources and processing plants, which often have their own rail connections.

Foodstuffs, sweets, beverages and building materials are among the commonly carried goods for road transport. What they have in common is that the receivers (supermarkets, home centres) require only relatively small quantities and they can only be reached by road.

The five most important transport goods for trucks and rail in 2015
* Without Italy, Belgium (confidential data); Malta, Cyprus (no rail transport); Denmark, Luxembourg (2013)



Source: Eurostat

- The five largest groups of goods are 3 quarters, and 2 thirds of the transport volume for rail and road respectively.
- One tonne transported by rail travelled on average 256 km, on the road 122 km
- Road transport volume was dominated by construction sites and food supply

1. Ore, stone, earth
2. Cement, gypsum, glass
3. Secondary raw materials
4. Agricultural products
5. Foodstuffs, sweets and beverages
6. Coal, crude oil, natural gas
7. Ore, stone, earth
8. Metals and unfinished goods
9. Coke and petroleum products
10. Not identifiable

The transporter – the transport mode for today's megatrends

E-commerce and the sharing economy don't function without the transporter

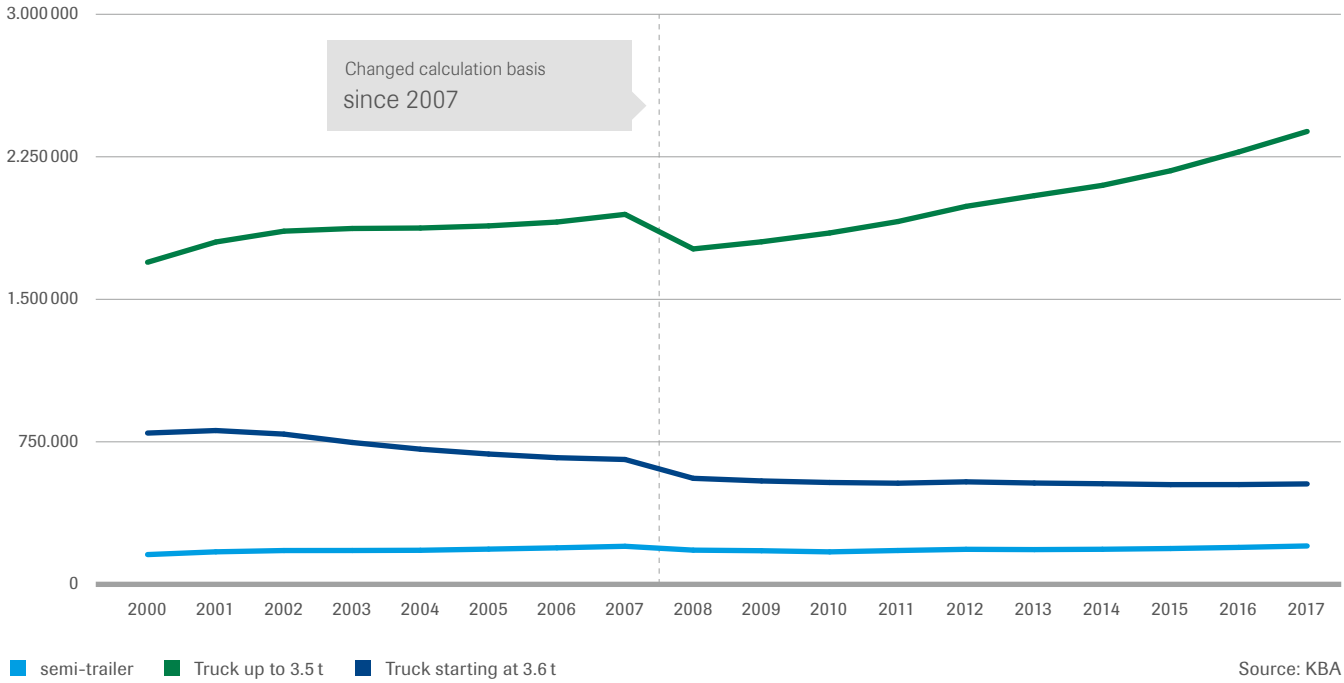
Transporters, commonly known as vans, are by far the most rapidly growing commercial vehicle segment. The number of transporters in Germany has grown by more than 40% since 2000. The reason is the transporter ideally meets the transport challenges and requirements of our time and those of the near-term future, which include e-commerce and the sharing economy.

Currently e-commerce represents already almost 10% of the total turnover in German retail and the trend is projected to continue strongly upward. Commerce analysts anticipate the share of e-commerce could even double to 20% by 2023. It is the transporter that makes it possible for us to have our goods and food products conveniently delivered to our door-step in the shortest time.

Meanwhile the trend towards the sharing economy is leading to the creation of new mobility concepts, e.g. digitally based "public transport on demand", which involves no longer having fixed timetables and routes, but rather routes from providers that can be newly set-up as to the current incoming travel wishes. This high level of public transport individualisation is only possible through the use of small buses or vans with few seats. They are already in use for the first on-demand offered services of German automobile manufacturers in Hanover or Hamburg.

But the importance of the transporter is increasing due to aging demographics. The transporter is the vehicle used for providing homecare to elderly persons in the form of meals and articles of daily use, or for transporting of the ill.

Development of the vehicle fleet in Germany



Source: KBA

A leader in electrification

Transporters are used foremost in urban areas. A special responsibility for an environmentally compatible transport means arises through this proximity to people. Accordingly the manufactures have made sure that the emission of pollutants by lightweight vehicles has fallen by more than 97% since 1990.

Great progress in the reduction of CO_2 emissions has been achieved as well. The intermediate target that the EU placed on light vehicles to reach by 2017 – 175 g CO_2/km – has been clearly exceeded by the EU wide fleet average of 156 g CO_2/km.

Emissions by transporters will continue to fall further over the coming years, for example through the ongoing optimisation of the diesel engine and the growing demand for transporters with electric drives. Transporters are especially predestined for this type of drive owing to their typical travel profile. They are mainly used in metropolitan areas which as a rule can assure adequate charging infrastructure (e.g. depots). Moreover frequent braking in city traffic means electric drive motors can be recuperate energy. It is not for nothing that transporters were the first commercial vehicles to be offered as purely electric series production vehicles.

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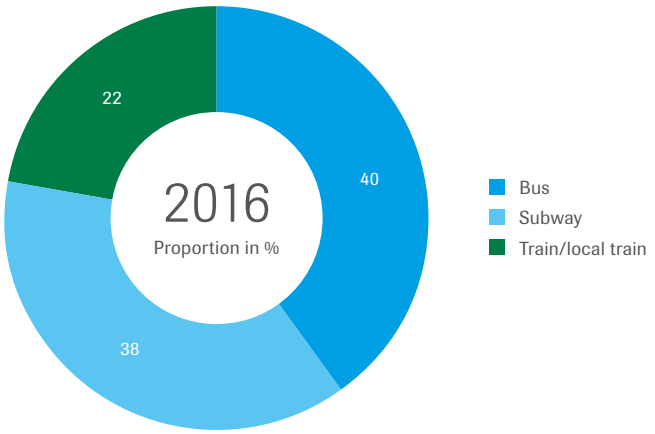
The bus – ecological and economical

The most important transportation means in public transport

In public transport, the most often used means of mobility is the bus. It is used for 40% of all public transport trips while tram and rail make up the remaining 60%. The biggest strength that buses offer is that they can be put on route economically with relatively little investment in places where rail transport would not be worth it. Thus it is often the only means of public transportation in rural areas, and it also offers the most comprehensive transportation network of all three public transportation modes in the city. This is shown by the hard data. The next bus stop on average is only six minutes away on foot while in contrast the next rail stop requires a 27-minute trek. Moreover across Germany there are over 11,300 bus lines in the public transport network and thus double the number of lines found for trams and rail combined. With this supply density the bus serves in many cases as a feeder and sub-distributor to the rail-connected public transportation network and in many cases provides users of public transportation the nearest public transportation connection point.

The bus is also especially economical. And even though it transports more people than tram or rail, it receives only a tenth of the public funding used for financing the operating costs of local public transport.

The backbone of German public transport
(share of traffic (number of persons) in public transport 2016)



Source: VDA

The bus is the future of public transport

It can be assumed that the importance of the bus in public transportation will rise even more in the years and decades ahead as foremost in cities a decisive trend in public transportation is highly individualised transport services that come closer to meeting the quality of motorised individual transport. With this public transport on demand, the providers of public transportation create optimal routes depending on travel demands in-coming via Internet.The waiting time for customers amounts to minutes only and the target is a door-to-door transport for the traveller. This is made possible through the use of minibuses or vans. Corresponding services have recently been offered by start-ups in large cities such as Duisburg, Hanover or Hamburg, but also by established automobile manufacturers who themselves are developing into providers of mobility.

Contribution to air quality in large cities

The bus is not only economical and effective, it is also especially environmentally friendly. In local transport it emits per passenger-kilometre only 76 g of CO_2 on average and thus is well into the performance range we find for rail transport (67 g CO_2).

Also with respect to the nitrogen oxide budget, modern EURO-VI buses fulfil the highest standards. Under real transport conditions, their NOx emissions undercut the values of the EURO-V models by about 80%. The share of EURO-VI buses in the entire fleet of public transport companies is rising continuously. In 2016 the share was only 18.7%. As a result, bus fleet modernisation offers a great potential for reducing the NOx levels in the cities. At the end of 2017 the German federal government included buses in an immediate programme for better air quality in cities. However, instead of procuring EURO-VI buses, only a retrofitting of the older buses with an exhaust treatment system is required. Thus the effect falls short of what is possible. The reason here is that with EURO-VI buses, fuel efficiency could be improved considerably compared to the predecessor models. EURO-VI buses emit not only less NOx than retrofit older buses, but also less CO_2.

Target-wise, on the other hand, it makes sense that the federal government plans to provide support for purchasing buses with electric drives. Currently their share of the total public transport fleet is less than one per cent.

Long distance buses have democratised long distance transport

Since the liberalisation of the long distance transport market in Germany went into effect on January 1, 2013, the use of long distance buses (coaches) has grown rapidly. By 2017 it had already increased in volume by sevenfold to 34 million passengers compared to before liberalisation. This can only be explained by the fact that the long distance coach serves a market segment that had been foremost largely untapped up to 2013 and that the offers by other transportation means since then had been insufficiently exhausted – namely long distance travel for lower income persons. That's why 83% of long distance coach users cite the affordable fares as the reason for their choice of transport means. And that's little wonder because a quarter of all long distance coach users have an income of less than 500 € per month, another quarter have an income of between 500 € and 1000 €. For these people the long distance coach often offers the only affordable means of long distance travel because, thanks to its high capacity utilisation, it costs only 5.7 cents per passenger-kilometre. The competition from the long distance coach has compelled railways to lower their prices noticeably.

Since 2013 the railway has dropped from 14 cents per passenger-kilometre to 11.8 cents per passenger-kilometre today. That's still very far above the cost offered by the coach, but it does show, however, that intermodal competition is good for the market and users of rail are benefitting.

The bus is the only means of traffic to be considered by many long distance travellers because as opposed to rail, it is worthwhile for the bus to adopt into their route networks smaller communities where few people embark and disembark. In the summer of 2017, more than 160 midsize cities with 20,000 – 100,000 inhabitants, 100 small cities with 5000 to 20,000 inhabitants and 40 villages and communities with less than 3000 inhabitants were taken into the long distance coach route-network. Therefore, the long distance coach is of considerable transport policy importance.

The bus is the ecological champion in long distance travel

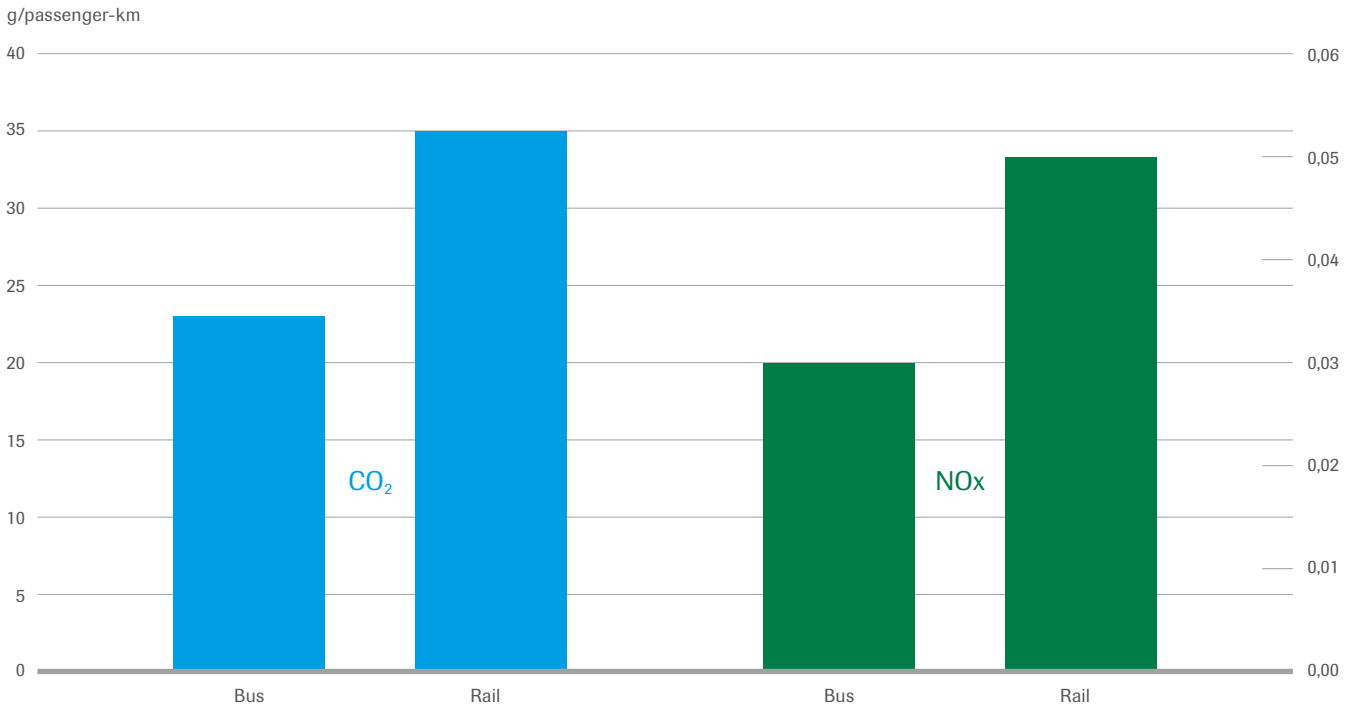
The bus also leads in long distance travel ecologically. This is owing to its high capacity utilisation. As a rule it is replaced by a more modern model after 3 or 4 years due to its high annual travel. Consequently it emits only 23 g of CO_2 per passenger-kilometre and thus significantly less than rail. And when it comes to nitrous oxides, the long distance coach is the clear leader at 0.03 g/passenger-kilometre.

The coach also scores points social-politically and in terms of traffic policy and ecology. For this reason it is difficult to understand why there are calls today to subject it to toll fees, which would make it more expensive. In its spring 2017 proposal for revising the Eurovignette Directive, the EU Commission, among others, called for this for the period beginning in 2020. The above market analysis shows, however, that such a toll on coaches would especially hit low income earners and thus would be socially unjust. Moreover, it also would be counterproductive in terms of traffic and environmental policy. Not least it needs to be pointed out that the coach, through revenue from the vehicle tax and fuel tax, already today more than covers the costs it causes to federal highways. According to figures from the German DIW, buses cover 235 % of their infrastructure costs for the road networks.

The tour bus – a transport and holiday means

The bus is not only a suitable way of bringing someone quickly and inexpensively from A to B, it is also effective for organised holidays. More than 100 million travellers use it each year for holidays, day trips, excursions and round trips. In public transportation it is the only mode of transport which offers its users a customised travel program – and is likely the only one whose use not only offers the function of transport, but also provides a recreational function. Correspondingly, tour bus travellers cite factors such as “getting away from everyday life”, “having fun” and “experiencing nature” as the main reasons for travelling.

CO_2 and NOx-emissions for long distance transport by coach and rail



CO_2 emissions Nitrousoxide (NOx) emissions

Source: ifeu, 2017

Commercial vehicles in times of climate protection

Through the technological development of commercial vehicles, CO_2 emissions from freight transport have approximately remained constant in Germany since the early 2000s, even though the traffic volume has grown by almost 50%. This means that the CO_2 used for each tonne-kliometre has fallen by more than 35%.

There's still more potential for efficiency with conventional drive-train systems

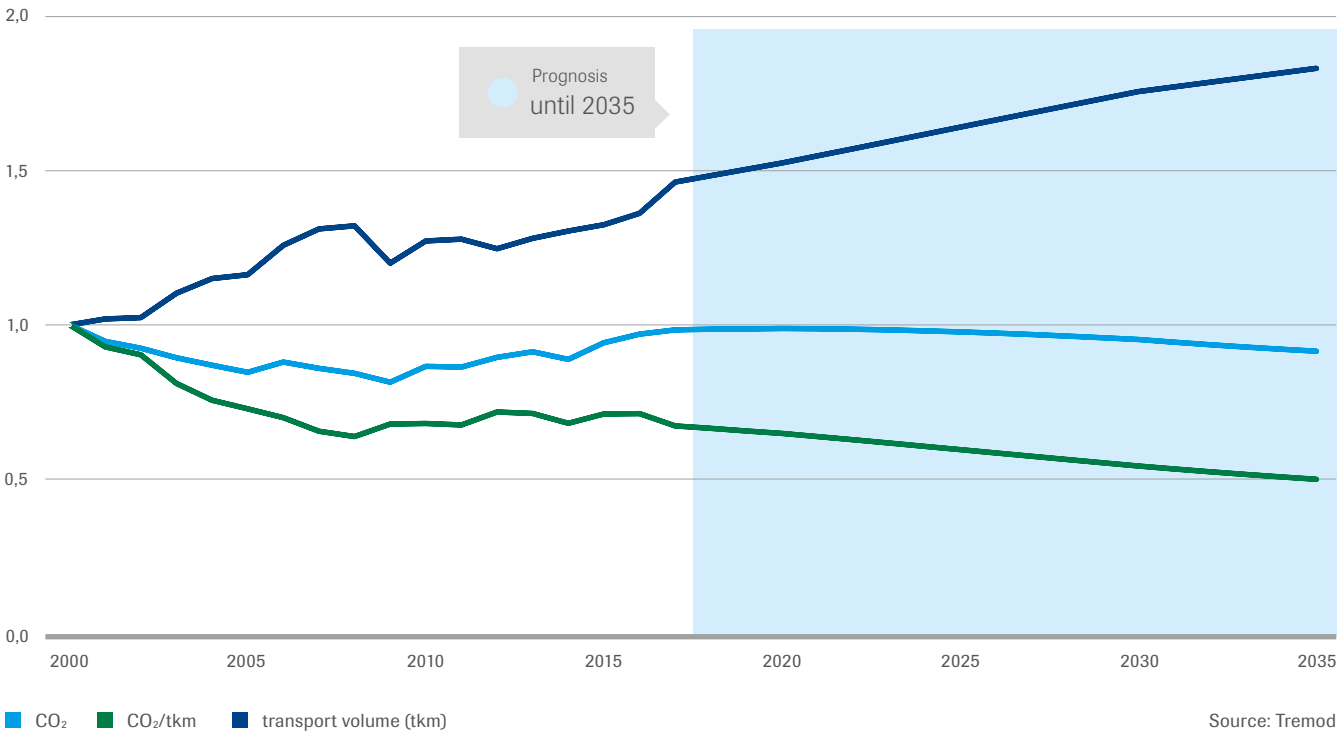
Indeed the potential for greater CO_2-efficiency by commercial vehicles is still far from being exhausted. Environmental experts assume that CO_2-emissions per tonne-kilometre will fall another 18% by the year 2030 compared to today.

Here not only are alternative powertrains and fuels helping, but also the conventional diesel truck still offers potential for greater efficiency. The drive train, tyres and aerodynamics still offer the largest potential for higher efficiency.

Great strides in terms of efficiency for the drive train, meaning the engine and transmission, have been achieved in the past. This has been done for example by reducing inner engine friction, down-speeding, optimising fuel injection pressure, recirculating exhaust gas and optimising combustion temperature. By further developing these measures, the efficiency of the drive train can be further improved. Further fuel savings can also be derived by recovering heat energy (waste heat recovery) that would otherwise escape with the exhaust and using it for powering the vehicle. With this technology, a heat exchanger integrated in the exhaust flow generates electricity, which can be used to propel the vehicle.

By using better rubber compounds and profiles, tyre manufacturers have succeeded in further improving the rolling resistance of their tyres. These are categorised in the fuel efficiency classes of "A" – "G". The tyres that are typically used today are only of Class D efficiency.

The decoupling of CO_2 emissions from transportation performance for commercial vehicles



Source: Tremod

One especially large potential for fuel savings could be achieved through the optimisation of vehicle aerodynamics. This may be achieved through a drop-shaped form instead of today's box-shaped design. In addition to completely enclosing the sides, this would include tapering the driver cab front (soft nose), using an arched-shaped roof and a pyramid shaped rear. If the space of the driver cab and the cargo area were to be maintained, then the cab would need to be extended forward by about 0.5 metres, the rear extended by about 0.4 metres, and a roof of 4.5 metres high would be needed instead of the 4.0 metres permitted today.

Already available today is a driver assistance system which allows a topography-matched driving manner to be integrated with automatic shifting. Through a satellite-assisted tracking unit and a 3D road map, the system detects the course of the road, such as upcoming downgrades and inclines, and thus is able to react accordingly by optimising gear shifting and cruise-control speed anticipatorily. This allows considerable amounts of fuel savings when driving up mountains and down into valleys. Further savings potential could be achieved by having commercial vehicles traveling in convoys under automatic driving (platoon). With the vehicle taking over all driving functions, a safe distance of 15 metres between the vehicles in the convoy could be maintained instead of the usual 50 metres that human drivers need to keep. Here the vehicle travelling in the slipstream can achieve a fuel savings of up to 16%.

Successful pilot tests have been taking place for some years, however the legal framework conditions still need to be created for the use of the technology in public.

Additional savings can be achieved through the electrification of today's mostly mechanical sub-systems, such as oil and water pumps or air compressors, because electrification has a higher efficiency than mechanical drives. Also electric sub-systems can be better matched to the existing performance need.

Today's semitrailers have an empty weight of approximately 14 tonnes (tractor-truck and trailer). Significant weight savings are possible for example by replacing conventional steel with porous steel, aluminium or high quality composite materials. It is expected that the lightweight design would reduce the semitrailer weight to 10.2 tonnes over the long term and thus lead to more CO_2 reductions.

However, all these measures require time for their introduction onto the market. That doesn't always happen instantly – just for cost reasons alone. Ultimately the customers must first also accept the technologies.

Remaining potential for reducing CO_2 emissions
with conventionally powered commercial vehicles

Note: Telematics-supported route optimisation is not shown in this illustration because it reduces the travel performance and not the consumption per tonne-kilometre.

- Efficiency drive train / heat use
- Assistance systems (e.g. ecological gear shifting); platoon driving
- Tyres with low rolling resistance
- Management of auxiliary units
- Aerodynamic optimisation (extending rear and front, rear flaps, side panelling)
- Reducing friction
- Lightweight construction

Source: VDA

Additional CO_2 savings are expected through the comprehensive use of telematic systems and their further development. In the past they already made decisive contributions to commercial vehicles reaching constantly less fuel consumption. Moreover telematic systems provide forwarding companies with an overview as to where each vehicle is located and whether there is available cargo space. This allows the forwarding company to send incoming transport orders immediately to the best positioned vehicle in the fleet. The travel distance of the overall shipping is thus minimised. This telematic application becomes even more efficient when not only the vehicles within the forwarding company are networked to each other, but when all vehicles are networked. This creates an online exchange on which the forwarding companies are able to coordinate the available transport capacities with the actual transport wishes from shippers, even allowingthe spontaneous carriage of goods when there is empty cargo space – quasi a mobile hub for cargo space sharing. Providers of telematic systems have just achieved this. Previously telematics could be used only as a closed system within a forwarding company. But today they are designed as an open platform concept which allows an unhindered data exchange across forwarding companies.

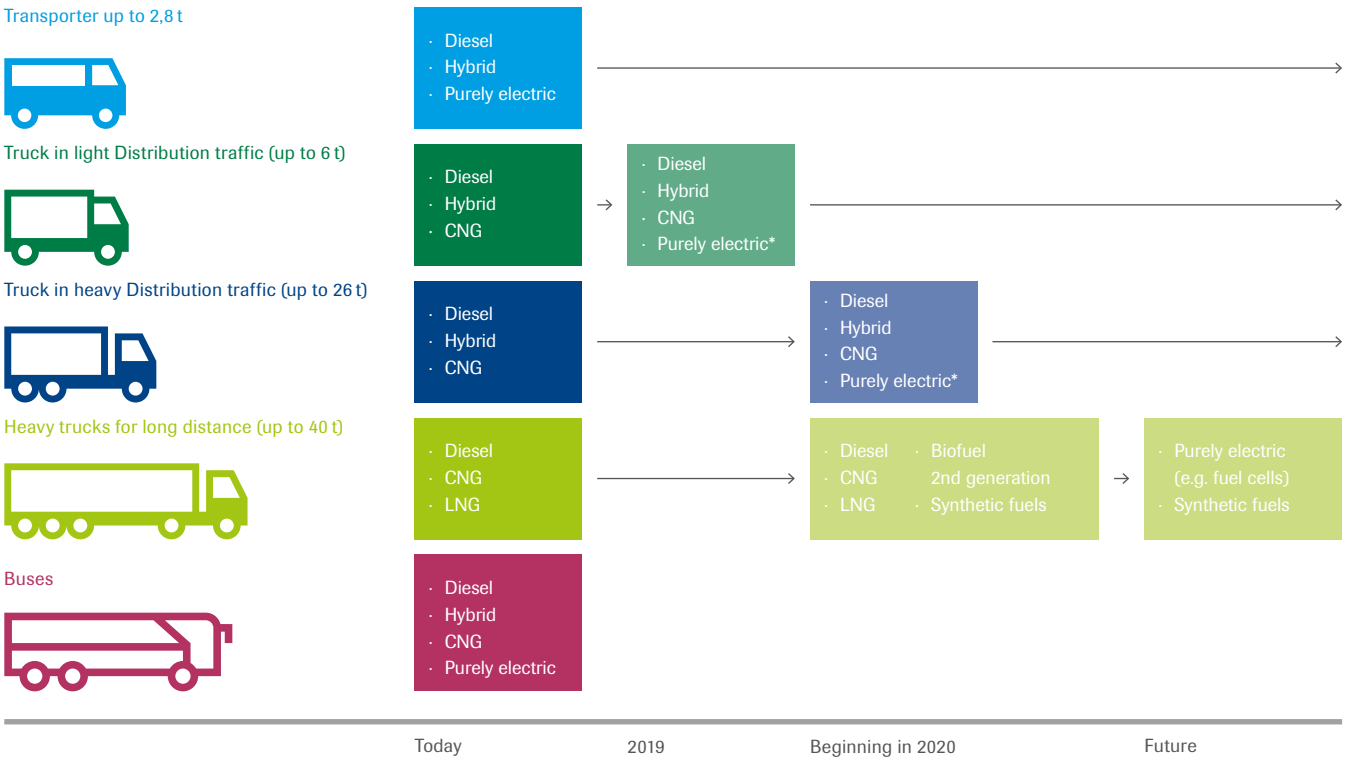
Alternative powertrains and fuels

Further CO_2 savings are achieved through the use of alternative powertrains and fuels. Which drive system and fuel are best suited and when they are economical depends on the commercial vehicle in use and its utilisation profile. Purely electric drives are suitable especially for vehicles performing short trips in urban areas. One reason is the sufficient number of charging stations available (e.g. depots) which ensure no supply bottlenecks. Another reason is that frequent braking helps to recharge the battery through brake energy recapture. Transporters and light to medium weight trucks for smaller distribution areas are predestined for electric drives. But so are also buses in public transport.

Purely electrically driven transporters have been in operation for years in many German cities. Series production of electric buses for public transport also will start at German manufacturers at the end of 2018. Test vehicles in small series production have been successfully put in operation for a number of years in German cities. Also light duty trucks have been extensively tested in small series vehicles for distribution transport. Their series production is planned to begin in 2019. For heavy distribution transport trucks, on the other hand, series production is expected to start in 2021.

Electrifying perspectives

Drive types up to the start of series production of purely electric drive vehicles:



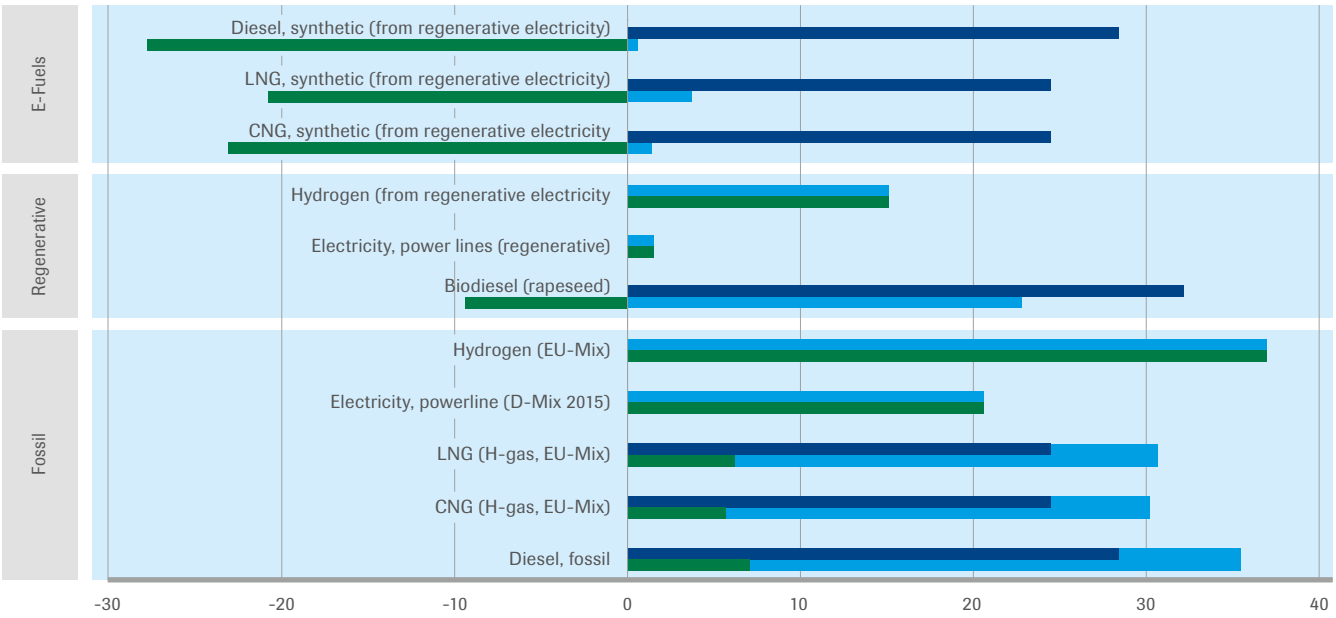
*Start serial production

Source: VDA

The technological limits placed on battery drives are very challenging for heavy commercial vehicles that are used for long distance transport. The size, weight and energy density of today's available batteries are not suitable for the demands of heavy road cargo transport. An alternative here could be the fuel cell drive. Moreover, alternative fuels such as CNG or LNG could be used. Less CO_2 is produced by their combustion compared to diesel fuel. While the existing natural gas network and today's filling stations can be used for the transport, storage and distribution of CNG, LNG requires a new supply and tank infrastructure. Europe has committed itself to build this infrastructure at the important European transportation routes by the middle of the next decade. The decisive advantage of LNG is that it can offer a greater vehicle range than CNG owing to its high energy density.

With regards to CO_2 savings in the entire budget, also the use of synthetic fuels (e-fuels) for heavy trucks promises to be as much as those from electric drives. These fuels are made in power-to-gas (CNG, LNG) or power-to-liquid-processes (diesel) via electricity from water and carbon dioxide. With e-fuels, vehicles can be driven almost in a climate-neutral manner because only as much CO_2 is emitted as what is extracted from the atmosphere to produce the fuel. Moreover e-fuels can also be used in existing fleets and thus achieve rapid reduction effects across the board. Alternative powertrains, on the other hand, are relevant only for new vehicles.

CO_2 emissions by various types of fuels in long distance transport
(40-tonne trucks)



Sum / total in gram CO_2eq / tkm Combustion in g CO_2 / tkm Generation and provision in g CO_2 / tkm Source: VDA

What policymakers can do

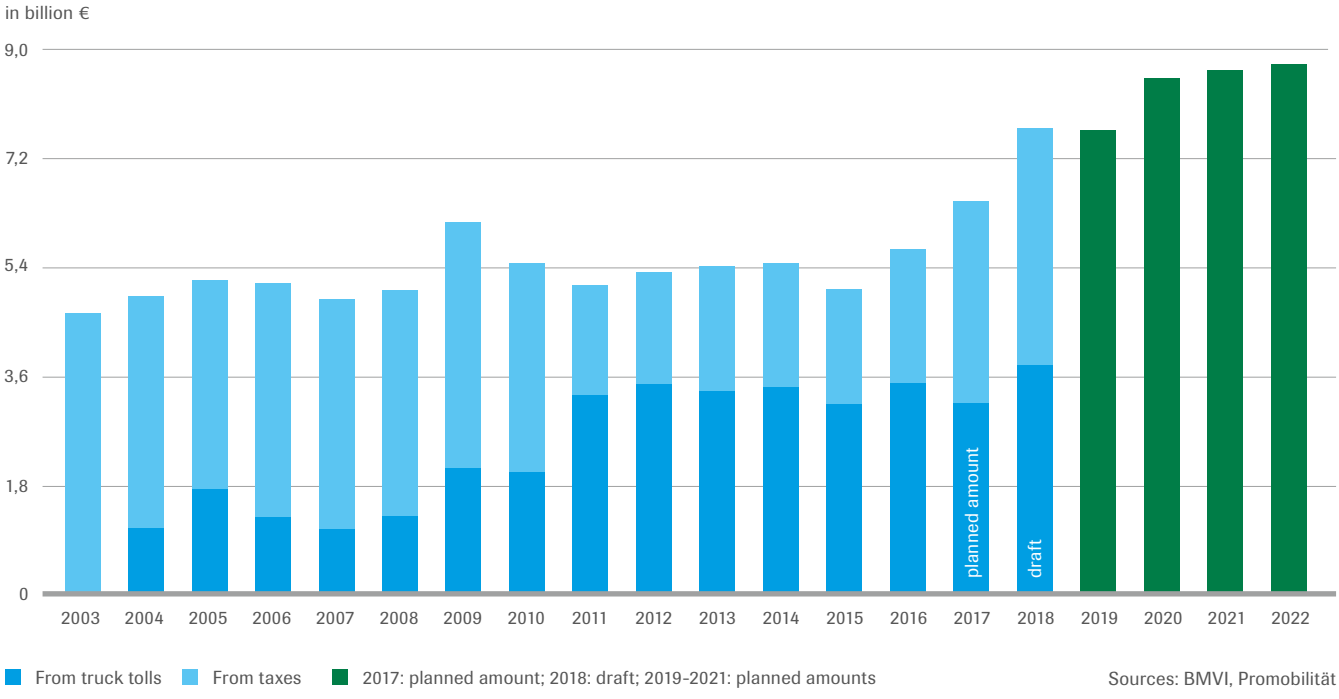
As providers of infrastructure and regulation, policymakers also bear the responsibility of further improving the CO_2 efficiency of road transport. Included here for example are demand-oriented and traffic jam-preventing infrastructures, incentives for modernising truck fleets, readiness to allow aerodynamic vehicle optimisations and implementing the modular system.

Avoiding traffic jams means avoiding CO_2

For years too little was invested in infrastructure. Instead of 8.4 billion euros annually, which traffic experts consider as a demand-oriented investment amount, only an average of 5.2 billion euros flowed into the federal highway network over the 2005 - 2015 period. As a result, expansion capacity lagged far behind demand and thus a number of routes became chronically overloaded. In 2017 traffic jams on the autobahn network totalled 1.4 million kilometres in length. That's bad for the climate because the fuel consumption of a 40-tonne truck can triple when it is forced to brake twice instead of travelling steadily over a 1-kilometre stretch. Added to this were the kilometres-long diversions which thousands of vehicles were forced to make due to run-down bridges that were closed off to trucks. These traffic jams and diversions boosted fuel consumption of the commercial vehicle fleet by millions of litres and added thousands of tonnes of unnecessary CO_2 emissions.

Policymakers have since recognized the problem and thus have been continuously boosting investments in the federal highway system. The investment volume thus rose to 5.7 euros in 2016 and again to 6.5 billion euros in 2017. In its May-2018 budget draft of the midterm financial planning for the years 2018 - 2022, the German federal government earmarked an amount of 7.7 to 8.8 billion euros. As a result, it is now in the investment range that is deemed as demand-based by traffic experts.

German federal highway investment 2003 – 2022



Sources: BMVI, Promobilität

The transport business, economy and consumers, however, are paying a high price for it. The 3 billion euro added investment is to be financed by the government burdening business accordingly more. In mid-2015, the government began expanding the toll system to include more roads and vehicle categories. In July 2015 the truck toll, which had been levied only on a few single federal highways, was expanded to include an additional 1100 kilometres of federal highways. Three months later vehicles with an allowable total weight of 7.5 tonnes were then required to pay (up to that point the toll had applied only to 12 tonnes). Through both of these measures, tax authorities generate extra revenues of 380 million euros annually.

In yet another step, in mid-2018 the truck toll was expanded to include without exception all federal highways. This will lead to an additional 2 billion euros revenue for federal coffers annually. But the expansion of the truck toll on federal highways generates problems: federal highways have an especially strong regional function. They serve as the transport routes for midsized companies in the regions by providing roads for short and intermediate distances that serve to supply the surrounding region. The full-coverage federal highway toll not only hits the midsized businesses, but also negatively impacts the weaker regions that are far away from the autobahns.

Also beginning on January 1, 2019, the toll fees for the federal highways will significantly rise again. However an expansion of and increase in tolls was never necessary for meeting the financing needs of the federal highways because the tax revenue from the excise fuel tax, value added tax, vehicle tax and the truck toll provides some 57 billion euros in federal revenue, but only 21 billion euros flow back into traffic infrastructure. For domestic vehicles that are subject to toll fees in freight transport, the Deutsche Institut für Wirtschaftsforschung (German Institute for Economic Research) calculated more than 10 years ago a level of infrastructure cost coverage of 168%, and 124% for foreign vehicles.

The truck toll needs to be differentiated as to CO_2 emission

Another possible way to further boost the CO_2 efficiency of freight transport even more would be have a revenue-neutral variation of the toll amount according to CO_2 output. This, for example, was recommended by the EU Commission within the scope of its mid-May proposal for modifying the toll directive after 2020. The requirement is that the CO_2 value of the different vehicles types be already determined using the VECTO tool and thus be officially published by the EU Commission. Such a variation of the toll according to CO_2 emissions would provide an additional incentive to invest in correspondingly low consumption and low CO_2 emissions vehicles or technologies. Varying the truck toll according to CO_2 emissions would act in the interest of the transport company so as to compel them to exhaust all possibilities to reduce costs. At 30%, fuel costs make up the greatest share of the total costs for heavy duty vehicles. The demand for the most fuel and CO_2-efficient vehicles would be increased in this way.

CO_2 regulation needs a realistic approach

For the first time in May, 2018, the EU Commission submitted a proposal for a CO_2 regulation of heavy duty commercial vehicles. The industry fundamentally supports a realistic regulation, but the Commission's proposal lacks.

The Commission suggests a CO_2 reduction target of 15 percent by 2025 and 30 percent by 2030. These targets are about double as high as what the industry regards as being already very ambitious, yet achievable.

Moreover the penalties for missing the targets are exorbitantly high and almost arbitrarily selected.

The possibilities of counting multiple times low emission and emission-free vehicles in establishing the average emissions of a manufacturer are too tightly defined because the threshold values are set too demandingly high. Thus the opportunity to create strong incentives to rapidly increase the market share of these environmentally friendly vehicles has been missed. Also the EU Commission's calculation methodology does not reflect important technologies that are available and in use today. Consequently, the technological efforts made by manufacturers to reduce consumption are not always accounted for by the regulation.

The EU Parliament and the Council of Ministers are called on to make course corrections in order to come up with an approach that indeed remains ambitious, but that is realistic and practical. Brussels is taking the easy way out when it wishes to transfer the reduction rates for passenger cars over to the very different commercial vehicle sector.

Promoting the purchase of energy-efficient commercial vehicles

Yet another instrument for accelerating fleet modernization is the subsidisation of the purchase of especially efficient commercial vehicles. Such a support programme was presented by the German federal government in June, 2018. The support period runs until 2020. With it companies receive subsidies when purchasing trucks beginning at 7.5 tonnes of allowable total weight which are powered by natural gas (CNG, LNG), battery-electric or with fuel cells. Other measures for boosting energy efficiency however are not being considered. Also the subsidy amount of only 10 million euros per year is too small to make a noticeable step in fleet modernisation.

Exhaust the ecological potential of the modular system

The modular systemk is a special combination of conventional transport equipment: a regular truck trailer is hitched to a conventional semitrailer or a conventional semitrailer to a truck. The vehicle combination as a result has a length of 25.25 metres instead of the maximum 18.75 metres to which trucks are limited which are not combined into a modular system. Three such truck trips thus can be replaced by two trips with a long truck. Thus, for the same transport performance, the modular system achieves fuel savings of 15 - 25%. This savings was also confirmed by the German Highway Research Institute, which was scientifically involved in multiyear field trials.

The positive experiences from the field trials have led policymakers to permit the modular systemk in regular road transport, effective January 1, 2017. Since then the modular system has been allowed to travel on a precisely defined road network (positive network). The German states are continuously checking stretches for interested companies for suitability and reporting them to the federal government, which then from time to time adds them to the positive network amending the respective regulation. Currently the positive network includes more than half of the entire autobahn network in Germany and about 1 percent of the entire interregional road network without autobahns.

Nevertheless, the CO_2 savings potential of the modular system remains under-utilised. The reason is that some German states have strict requirements for road suitability. In addition sometimes it takes more than a year to go from companies registering the desired routes to their approval via amending the regulation. Moreover, cross-border traffic with countries that also allow the use of the modular system in their domestic traffic, for example the Netherlands or Denmark, is only possible after the conclusion of a bilateral agreement between Germany and these countries. So far there are no political initiatives in this regard even though the logistics industry sees an important field of application for the modular system.

Enabling the aerodynamic optimisation of commercial vehicles

More aerodynamically efficient designs than today's boxy shape already would exist if driver cabs were allowed to be extended forward somewhat to produce a tapered front end and if flaps were allowed to be installed at the rear of the trailer so that air vortices could be reduced. But current EU type-approval does not allow it. Therefore, it is welcome that the EU Commission plans to submit a preliminary draft for an amended type-approval directive at the end of September 2018 with the aim of permitting this aerodynamic optimisation from mid-2019 onwards.

Outfitting the infrastructure with intelligence

Streamlining and smoothing out traffic and avoiding stop-and-go movement is not only an effective way of reducing fuel consumption on federal highways, but in urban traffic as well. For example, the commercial vehicle industry has developed „Green Wave Assistants". Via mobile radio, the vehicle calls up the switching time forecast for the next traffic lights on the planned route. Using the received data, the on-board computer determines an energy-saving strategy for optimally achieving the green phases. Predictive driving, which otherwise a driver can only achieve with the next traffic light in sight, is now provided for the entire city route by the commercial vehicle. However, this is only possible if the infrastructure exists to provide the data to the vehicles, which is not the case today.

What transport companies can do

Transport companies have a decisive impact on their fleets' CO_2 efficiency, for example by encouraging their drivers to drive in a fuel-saving manner, by increasing the capacity utilisation of their vehicles and by closely checking each of their transports to see if the use of the modular system makes sense.

Fuel-saving driving means avoiding sudden speed changes as much as possible and instead driving at a speed that is as constant as possible, by shifting down to the lower gear as early as possible in order to avoid high speeds and, above all, downshifting in time. Environmental experts consider regular driver training as well as equipping the vehicles with tools for evaluating individual driving behaviour to be necessary. In combination, both measures are expected to achieve fuel savings of 5% to 7% in long-haul transport and 7% to 10% in regional distribution transport.

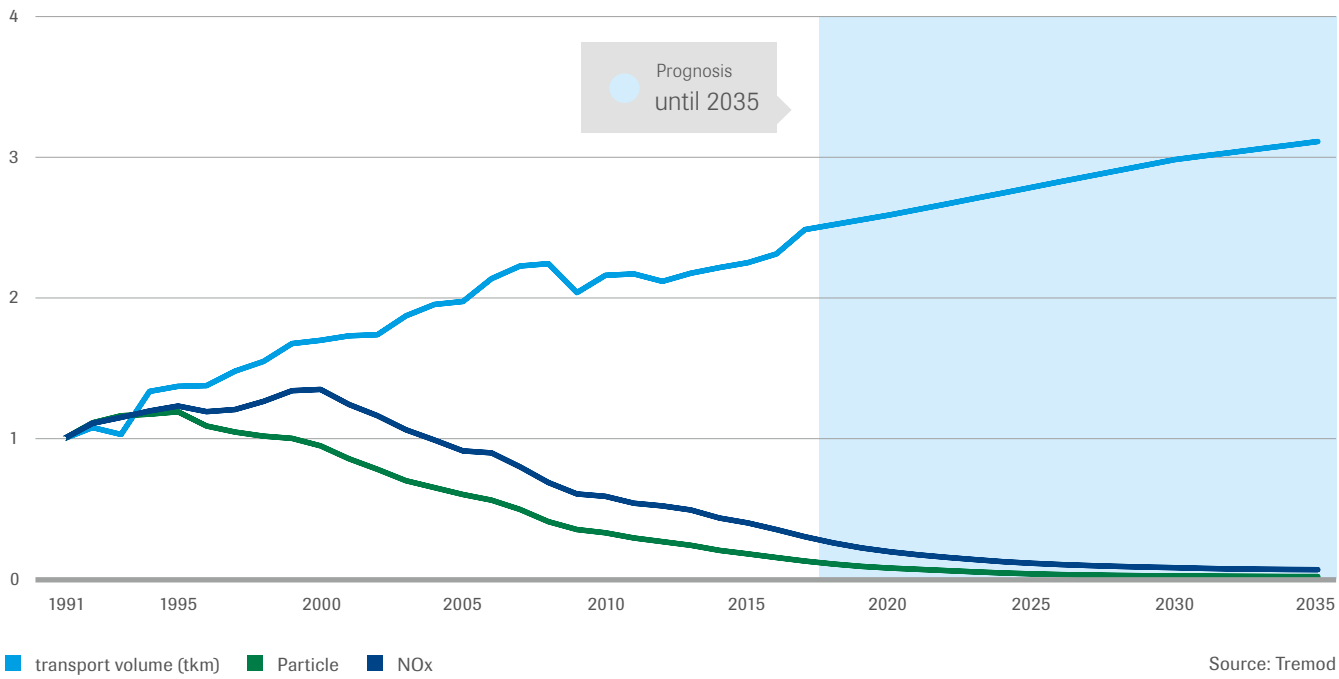
The average vehicle utilisation is estimated by logistics experts to be no more than 75% across the EU in long-distance transport and 50% in regional distribution transport. The most promising measure for increasing capacity utilisation is the cooperation between transport companies (cross-company trade in free transport capacities). Here telematics products for the newest generation of commercial vehicle and component supply industry offer help. They provide an open platform through which carriers can exchange their data. Longer loading times and more generous delivery time windows can also help increase the loading factor. Based on experience from relevant research projects, it is assumed that these measures can increase the load factor by around 5 percent. This would result in fuel savings of over 4% in long-haul transport and almost 8% in regional distribution transport.

Air pollution control - modern commercial vehicles are part of the solution

Since the beginning of the 1990s, pollutant emissions from road transport have fallen by more than 70% (NOx), or almost 90% (particles) even though during the same period transport volume has increased by almost 150%.

This was only made possible through the continuous technological vehicle development. Compared to the early 1990s, today's commercial vehicle emits 97% less NOx and particulate emissions per kilowatt-hour of power. More and more sophisticated technologies have been developed for this. To reduce emissions, internal engine measures were initially used to optimise the combustion process in the engine and thus reduce raw emissions - for example through higher and more targeted pressures during the injection of fuel, through compression of the air and through exhaust gas recirculation. Here part of the exhaust gas is cooled and mixed again with the intake air, whereby the combustion temperature in the cylinder decreases and thus creates less NOx emissions. Later internal engine measures supplemented by exhaust gas purification techniques were added. Diesel Particulate Filters are used for avoiding particle emissions. For avoiding NOx emissions, selective catalytic reduction (SCR) is utilised. Here an aqueous urea solution („Ad Blue") in a separate tank is injected by the engine into the exhaust system. This triggers a chemical reaction that converts nitrogen oxides into non-toxic nitrogen and water. As a positive side effect, in addition to avoiding nitrous oxide, the combustion process is optimised and fuel consumption is reduced by up to 7%.

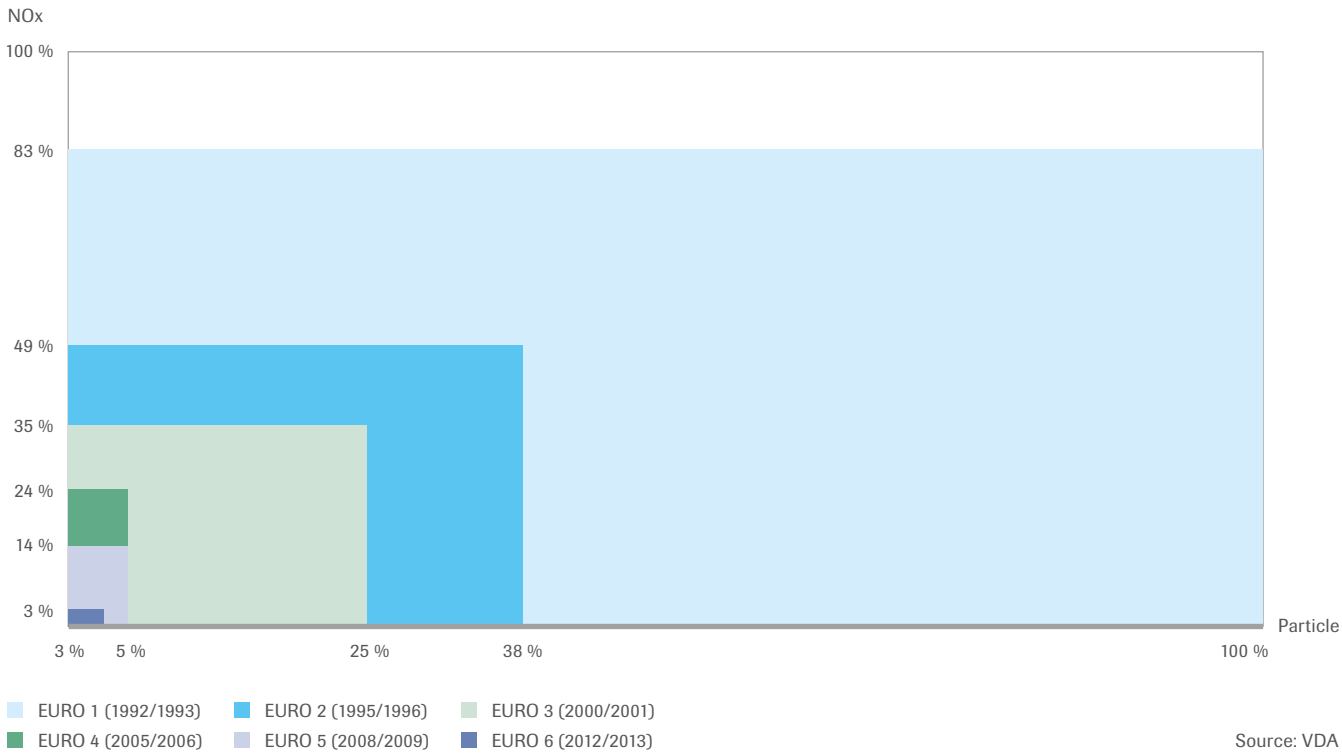
Decoupling pollutant emissions from commercial vehicle traffic performance



Source: Tremod

The strict limits that apply to commercial vehicles today are not only adhered to in laboratory test conditions, but also under real driving conditions. Overall, commercial vehicles must prove to comply with the limit values over a period of up to seven years after being put into operation and traveling a distance of up to 300,000 km (3.5 t - 16 t permissible total weight) or 700,000 km (> 16 t permissible total weight). Here the AdBlue tank content, quality, consumption and NOx values are monitored by sensors while driving. If the ongoing exhaust emission measurements deviate from the required specified values, then three warning stages are included and make further travel of the vehicles with defective exhaust cleaning impossible. Tests in real operation showed that commercial vehicles not only permanently complied with the legally permitted limit values, but even far undercut them – at times by up to 96%. That was the result of random samples from a total of ten different commercial vehicle models whose data were compiled by the Federal Motor Transport Authority and the VTT Finnish Research Institute.

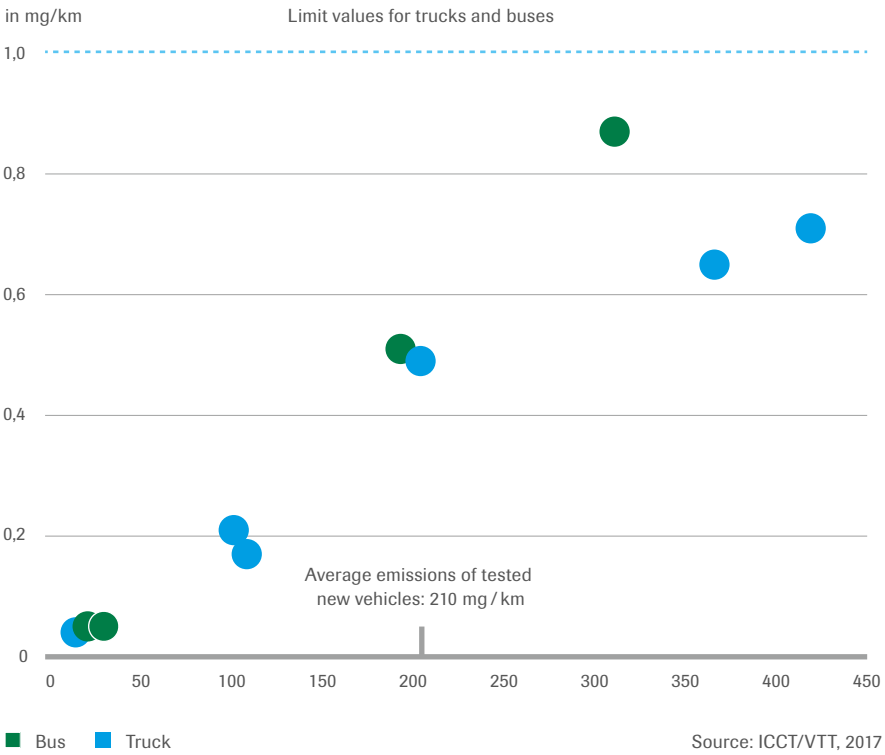
Commercial vehicles are increasingly clean



Source: VDA

Well below the limit values under real driving
(ten randomly selected commercial vehicles)

For example a value of 0.2 on the vertical scale means undercutting the legal NOx limit value by 80 %.



Source: ICCT/VTT, 2017

What policymakers can do

In principle, all measures that reduce fuel consumption also indirectly reduce air pollutant emissions. For policymakers, the most successful strategies here are to create a needs-based, traffic jam-avoiding infrastructure and to ensure smooth traffic flow. They should also provide incentives for truck fleet modernisation and show openness when it comes to the approval of aerodynamic vehicle optimisations and the modular system.

As many German cities at individual measuring stations exceed the EU's annual average NO2 limit of 40 µg / m3, measures for air pollution control are currently being discussed, particularly for metropolitan areas. Against this background, cities are considering imposing driving restrictions for older diesel vehicles on heavily travelled road sections. Should this occur, most cities plan exceptions for freight traffic, as otherwise the supply of goods in the city would be impaired.

It remains questionable, however, whether driving bans are even a suitable means of noticeably reducing NOx emissions. Here as well many more measures to streamline traffic flow are recommended.

Using the city of Ingolstadt as an example, the „Travolution" research project has shown that a grid control system that switches all traffic lights in a city so that traffic flow across the entire city network is optimally smoothed out cuts NOx emissions by 33% over the city road network. Also funding programs for modernising urban taxi and bus fleets are useful.

Safety

Commercial vehicles have never been safer

Already today commercial vehicles are no different from cars in terms of accident frequency. Thanks to continuously improved safety technology, the number of personal injury accidents involving trucks per million miles travelled has fallen by 83% since 1970, to 0.33. This corresponds to the value seen with passenger cars.

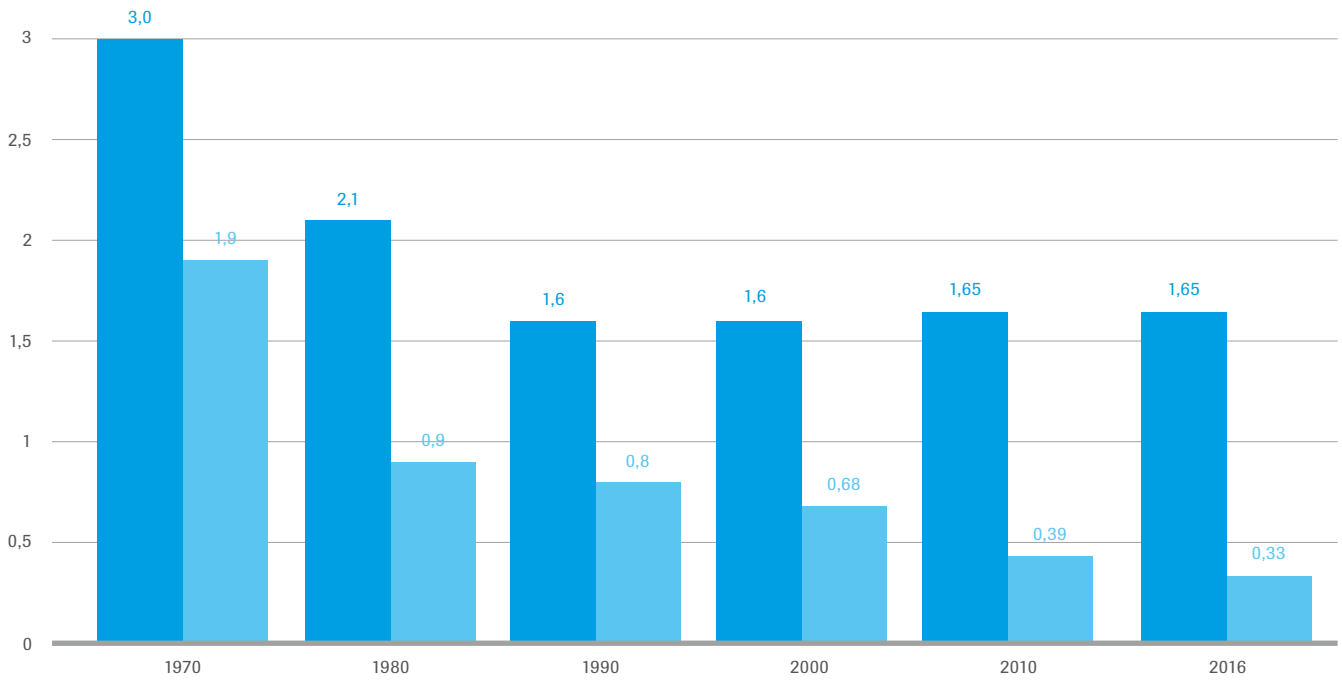
Innovations that have since improved the safety of commercial vehicles include for example crash-optimised driver cabs, underrun protection, antilock braking systems, belt systems and airbags.

In the development of electronic assistance systems, which began around the mid-1990s, commercial vehicle manufacturers initially focused on avoiding the most common accidents involving commercial vehicles. These include, among others, lane departure accidents (19% of all personal injury accidents involving road haulage vehicles) and rear-end collisions (31%). They occur primarily on federal highways in out-of-town traffic.

Electronic Stability Control (ESCP) and lane departure warning systems counteract steering and lane departure accidents. These systems have been available on the market since the mid-1990s. ESCP became mandatory for all vehicles on November 1, 2014. The lane departure warning system has been mandatory since November 1, 2015, for all newly registered trucks with a gross vehicle weight of more than 8 tonnes.

On the other hand, the emergency brake assistant aims to avoid rear-end collisions. In the event of an imminent collision with a vehicle traveling ahead or in a standing position, it first alerts the driver and then independently initiates emergency braking if there is no driver reaction. This feature also became mandatory on November 1, 2015, for all newly registered trucks with a gross vehicle weight of more than 8 tonnes.

Accidents involving personal injury (per 1 million vehicle-km) involving...



Buses Trucks

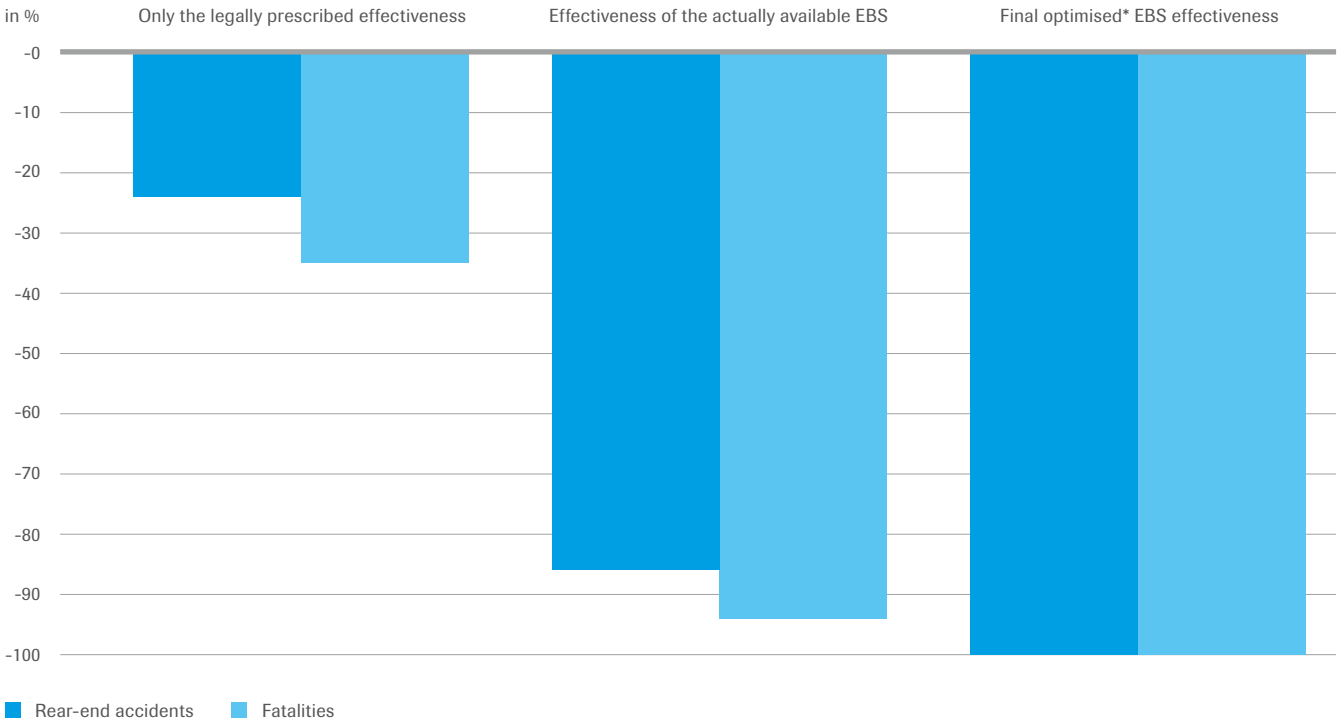
Source: Statistisches Bundesamt

The effectiveness of today's emergency brake assist systems goes beyond the legal requirements

The effectiveness of the emergency brake assist systems available today goes far beyond the legal requirements. According to the regulation, beginning November 1, 2018, an emergency brake assist system must be able to prevent a collision with a vehicle traveling ahead at only 12 km/hr and decelerate to a maximum of 60 km/hr in the event of a collision with a stationary vehicle. This would be equivalent to reducing the impact energy by 45%. However, the emergency brake assistants available today are already considerably more efficient and able to come to a standstill in time in front of a stationary vehicle.

According to calculations from the Landesverkehrswacht in Lower Saxony (State association for the prevention of road accidents), with a system that „only" meets the legal requirements and having 100% market penetration of the truck fleet, 24% of rear-end collisions would be avoided. With today's systems, which go beyond the legal requirements, even a reduction of rear-end collisions by 86% is achieved. For a one hundred percent avoidance of rear-end collisions, the Landesverkehrswacht recommends, among other measures, that the system cannot be switched off by the driver, or only with great difficulty. Unfortunately, numerous rear-end collisions are due to the fact that the system was previously switched off by the driver. Therefore, the commercial vehicle manufacturers are making more and more effort to make a switch-off no longer possible, or at least difficult to shut down (for example by an automatic restart after a short time).

Reduction in the number of truck rear-end collisions, and persons killed, by emergency braking systems (EBS)
Assumption: 100% outfitting of the vehicle fleet



* "Final optimised" means, among other things: a switch-off/override takes place in less than 3 % of the cases.

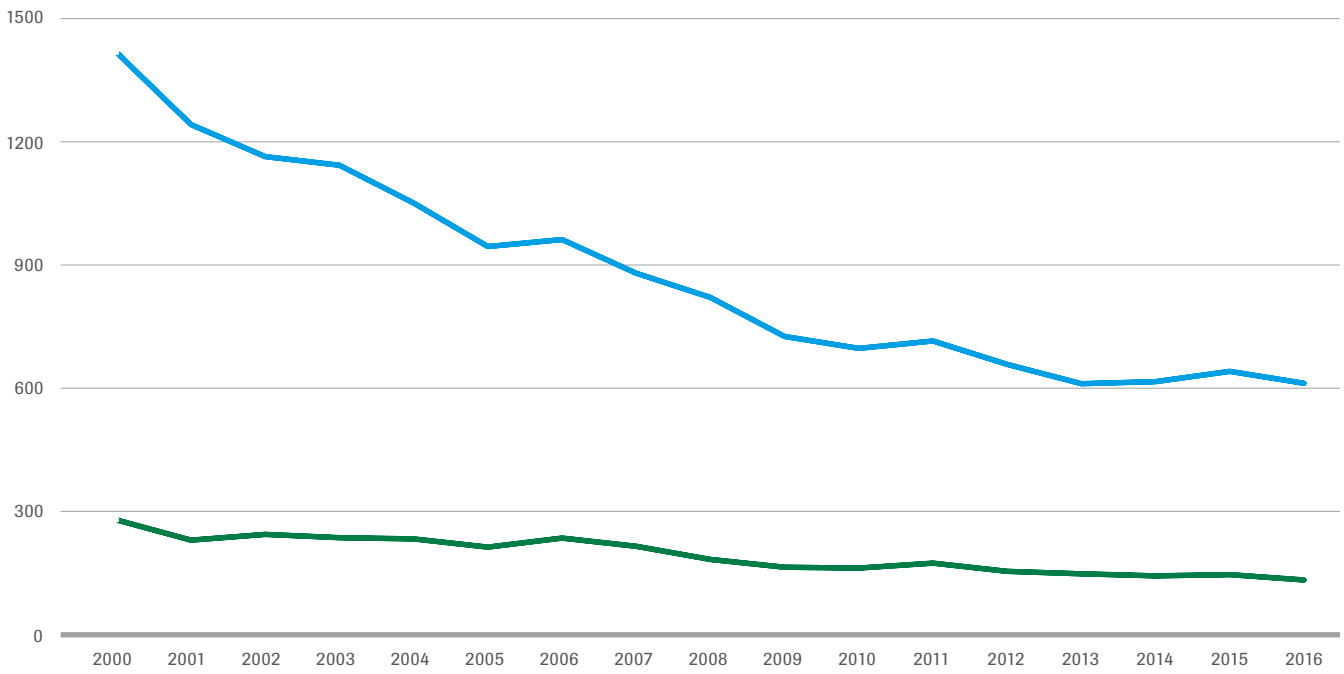
Source: Landesverkehrswacht Niedersachsen

If the current speed of market penetration continues, it is likely that 100% of trucks starting at 12 tonnes will be equipped by 2020. In 2017, the equipment share of the existing fleet in Germany (> 12 t allowable total weight) was 62%.

Incidentally, the obligation to equip trucks less than 8 tonnes with emergency braking systems and lane departure warning systems starts on 1 November 2018.

The commercial vehicle manufacturers have also developed features for city traffic, as 7% of the cases involving personal injury are trucks colliding with pedestrians and with cyclists in 15% of the cases. Therefore manufacturers are already offering emergency brake assistants that not only recognise cars on the road ahead, but also cyclists and pedestrians. Yet, pedestrians and cyclists should not only be „seen“ by the vehicle when they are in front, but also when they are next to it. As a result, manufacturers now offer turning assistants. For example they detect a cyclist to the right of the truck and who is otherwise not visible to the driver. It alerts the driver before he makes the right turn. The German Insurance Association assumes that over 60% of truck accidents involving cyclists could be avoided through this system. Therefore the commercial vehicle industry is calling on the federal government to advocate the obligatory installation of turn assistants at the EU level.

Fatalities in accidents involving cargo transport vehicles



Fatalities, others involved Fatalities, cargo vehicle passengers

Source: Federal Statistics Office

What policymakers can do

Policymakers can contribute to traffic safety in a number of ways.

The road condition has a major impact on traffic safety and has clearly lost quality because of the insufficient investments in the past. According to the Federal Ministry of Transport, the last comprehensive quality measurement in 2013/2014 showed that nearly 20 percent of the distance kilometres on motorways exceed the warning value, i.e. the condition of the road surface warrants intensive observation and an analysis over the causes of the poor condition. If required, planning suitable measures to improve the condition is necessary. For federal highways the proportion of these sections is even 36 percent. This is of concern because bumps reduce the contact level between the tyre and the road surface and thus contribute to loss of vehicle control. This is especially true for commercial vehicles, as they are usually underway as a semitrailer or truck with trailer in long-distance transport.

It is also important to have sufficient truck parking spaces along the motorway so that truck drivers are able to comply with their legal driving and rest times. Although the federal government has massively increased the number of truck parking spaces over the last ten years, expansion has still lagged behind overall freight growth. The most recent needs assessments show a deficit of 31,000 truck parking spaces across Germany.

Last but not least, the approval of longer driver cabs - apart from their improved environmental efficiency - would contribute to greater safety because longer cabs allow the windscreen to be pulled further forward and down, allowing an improved driver‘s view of the road below him. This is helpful at very low speeds, for example in dense city traffic.

In addition, the state can provide financial support for outfitting commercial vehicles with safety systems that are not yet a prescribed standard.

What transport companies can do

Foremost the most effective accident prevention “system” remains the driver. The best prerequisite for driver assistance systems not needing to correctively intervene is the driver himself practicing an attentive, prudent and foresighted driving style and, above all, having the knowledge of what is involved when it comes to moving 40 tonnes of weight, including the dangerous forces that can develop when braking, or the dangerous centrifugal force that develops when cornering. This requires intensive and regular driver training, which is offered to transport companies by various organisations, including the commercial vehicle manufacturers.

Moreover, transport companies can contribute to improving traffic safety by equipping their vehicles with safety systems that are already available on the market but not yet legally required. Of these systems, especially the turn-assistant offers the greatest safety benefit.

Automation

A boost in efficiency for road traffic

Automated driving will further increase road freight transport efficiency in several ways. It increases traffic safety, environmental friendliness and puts fewer burdens on the driver and infrastructure. Its capacity increases over the long term because, for example, the vehicles can travel with shorter distances between them, or because they travel cooperatively and are more oriented to the overall traffic than „human“ drivers are when changing lanes. Transport experts at the Research Association of Automotive Technology (FAT) have found that if all vehicles were automated, infrastructure capacity would be increased by 30% to 43%. This would reduce overall travel times on the motorway network by 6%.

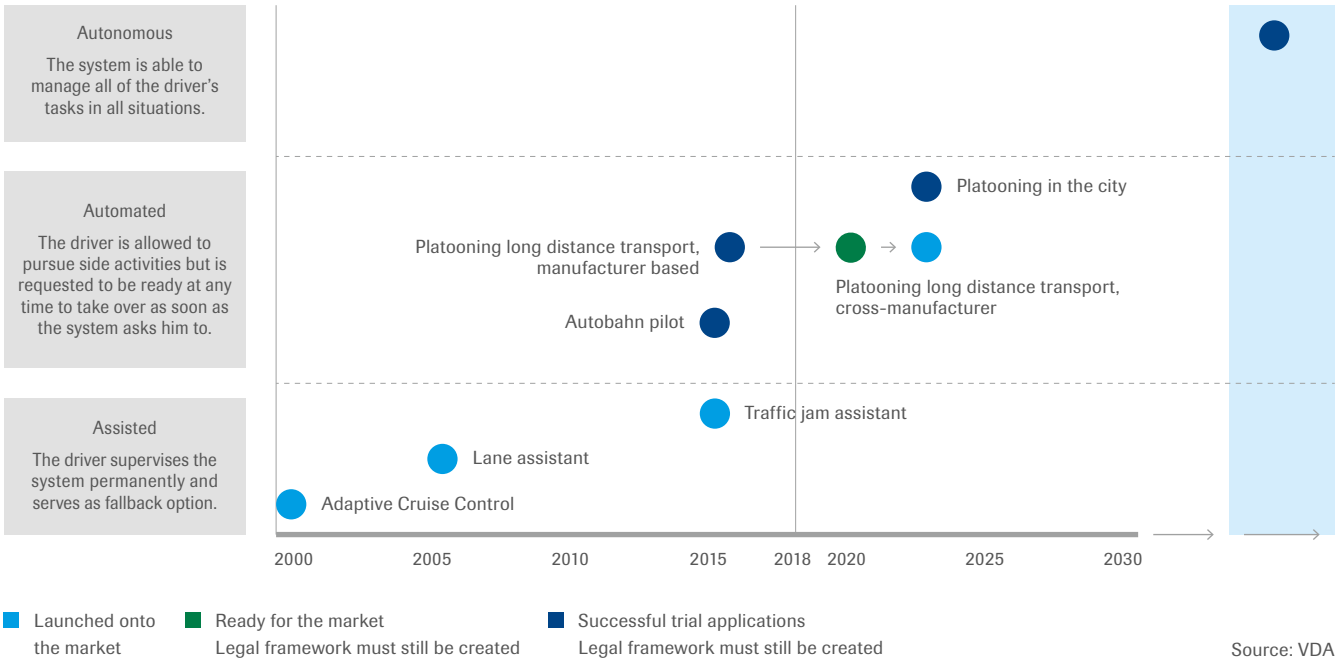
Already today many assistance systems are available for commercial vehicles. That means a system takes over the longitudinal and / or lateral guidance of a vehicle. For example, the traffic jam assistant is already available on the market. It takes over the starting and braking in stop-and-go traffic and keeps the vehicle in the lane. However, the driver must monitor the system continuously and intervene immediately if the system loses control of the situation.

Assistance functions form the technological basis for automated driving. In this case, the system carries out the driving task and requests the driver with a sufficient time buffer to take over the driving task when the system limits are reached. For special applications, such as highway driving, technological maturity has already been achieved. In 2016, as part of the European Truck Platooning Challenge, the European commercial vehicle manufacturers showed that trucks can travel as a platoon. Truck platooning is an approach that can revolutionise transport on highways. Here several trucks are electronically linked to share real-time driving information. The convoy is capable of synchronising manoeuvres such as accelerating and braking. This allows the trucks to drive safely at a distance of a few meters behind each other and to significantly reduce air resistance. However, the formation of platoons had only taken place within the fleet of one manufacturer. Currently it is about developing the technology so that even vehicles from different manufacturers can form a platoon.

It is anticipated that the technology will ready for market in 2021 and ready to be launched a year later if the corresponding legal framework is customised as well.

At about the same time, the first pilot/test applications of platoons on selected routes in the city are expected.

Automated Driving



Source: VDA

Policymakers need to modernise the legal framework

The use of automated driving functions requires the modification of technical regulations for the registration and vehicle operation as well as the rules of conduct governing driver behaviour requirements (e.g. Highway Traffic Code). Regarding cross-border traffic, harmonisation between national regulations needs to be sought. In addition, an ethical framework must be formulated for the interpretation of algorithms. For this purpose, policymakers are currently in an intensive dialogue with the automotive industry and other stakeholders.

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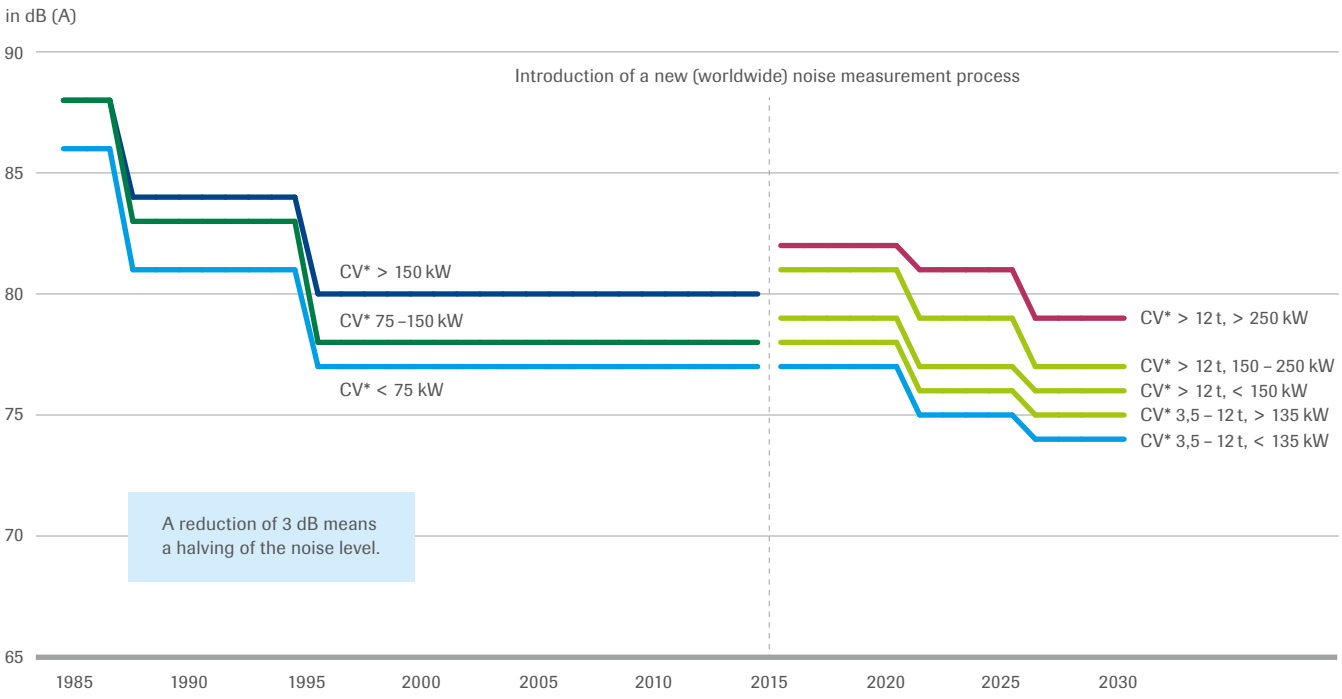
Commercial vehicles are becoming increasingly quiet

Commercial vehicles are not only becoming safer, cleaner and more economical, they are also becoming quieter. Today a commercial vehicle passing by is 90% quieter than one at the end of the 1970s. This has been achieved through low-vibration designs, the encapsulation of the engine and transmission, mufflers on exhaust tailpipes, and driver cabs which provide the least possible wind impact surface. In addition, commercial vehicle manufacturers are working closely with tyre and body manufacturers.

Noise emission is measured in decibels, whereby a reduction of noise emission by 3 decibels is already perceived by humans as halving the volume. In 1978 a truck with more than 150 KW engine power had a noise level of 91 decibels. Today it is only 81 decibels. Incidentally, this is far below the value measured by passing freight trains, which reach around 100 decibels and are thus perceived by humans as being about a hundred times louder.

However, according to the EU regulations, a significant reduction of the noise emission by 1-2 decibels is to take place for all types of commercial vehicles already by 2022, and then a further reduction by the same amount by 2026. The volume as perceived by humans thus will be reduced by up to 75% compared to today.

Noise targets: Noise emissions will be reduced by up to 75%
EU-limit values for vehicle noise emissions



*Commercial vehicle

Source: Institut der deutschen Wirtschaft (German Economic Institute)

Contribution by policymakers

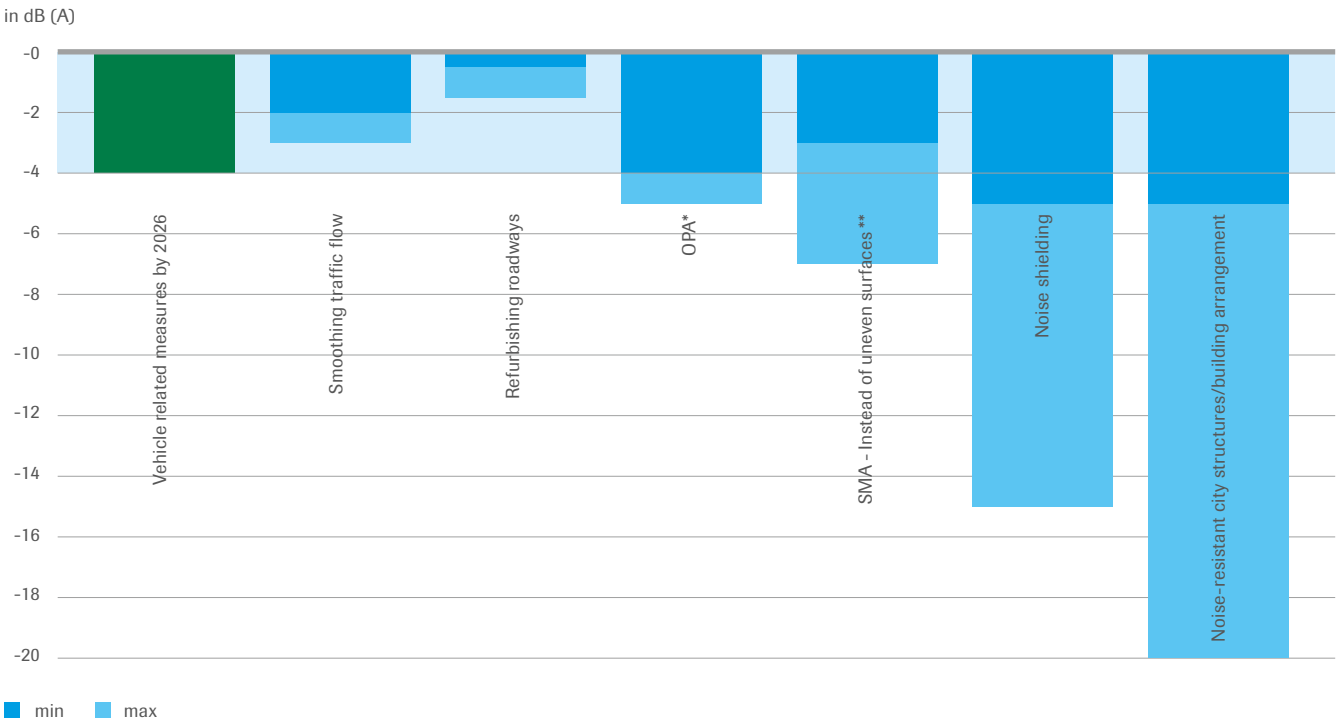
Infrastructure measures can achieve a much greater noise reduction than intensive additional vehicle-side measures.

Smoothing out traffic flow using appropriate traffic light control („green wave"), setting up separate biking lanes or left-turn lanes reduces noise pollution by 2 - 3 dB (A). These measures serve to prevent particularly noise-generating braking and accelerating.

Up to 5 or 7 dB (A) reduction in noise pollution results through the use of low-noise road surfaces, for example open-pored asphalt or split-matrix asphalt. Both types of asphalt are particularly rich in pores, and thus the rolling noise from tires is absorbed instead of being reflected upwards.

Up to -15 dB (A) can be achieved by using sound-shielding measures such as installing soundproof walls, tunnelling or sinking streets into trough structures.

Noise reduction potential of different infrastructure-related measures



* Porous asphalt ** Split matrix asphalt

Source: Own depiction as to UBA (2015)

Nobody lives without trucks

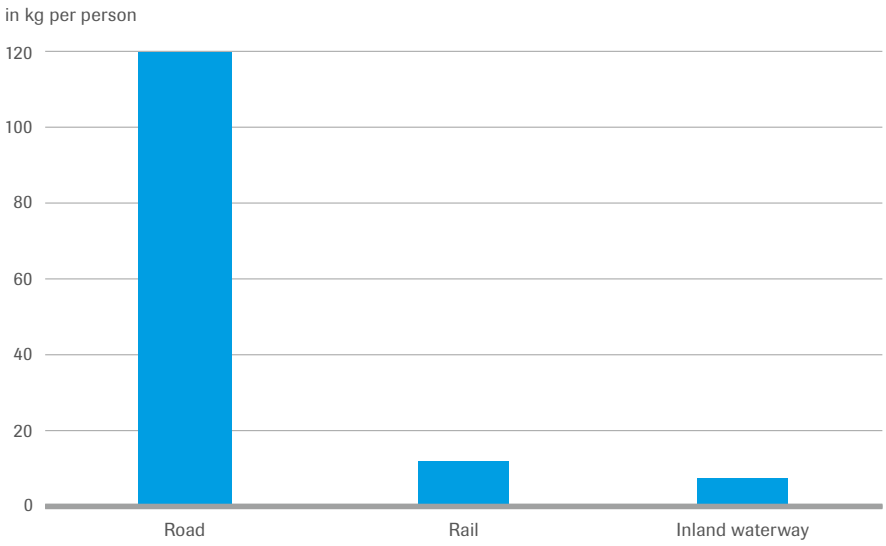
Each of us needs the commercial vehicle several times a day, even if we are not often aware of it. We use its services to have our garbage disposed of or to have something delivered to our home. Whenever we purchase something in a store, the act is preceded by a long transport chain involving the transport of the raw materials and semi-finished products from which our consumer goods are made. On average the commercial vehicle carries around 120 kilograms per day for each of us.

The bus is in operation for more than 15 million trips in daily passenger transport. But we also appreciate the commercial vehicle as a helper when moving to a new home, or as an ambulance or fire truck in times of distress.

Did you know?

- Each year the commercial vehicle performs more than 11.7 million rescue and ambulance trips
- Each year fire trucks extinguish more than 200,000 fires and are used for more than 560,000 technical assistance services, from recovering accident vehicles to pumping out flooded basements
- Each year commercial vehicles assist in carrying out 2 million moves to new homes
- Each day the bus transports 2.7 million children to school and brings them back home
- Each day commercial vehicles deliver over 70 million letters
- Each year commercial vehicles carry out 2.7 billion courier, express and parcel deliveries
- Each year commercial vehicles haul away 44.1 million tonnes of household refuse
- Each year and for each person commercial vehicles transport 99 litres of beer to beverage markets
- Each year and for each person commercial vehicles deliver 65.7 kilogrammes of potatoes to stores
- Each year and for each person commercial vehicles deliver 95.4 kilogrammes of vegetables to the market
- Each year and for each person commercial vehicles transport 90 kilogrammes of meat to consumers
- Each year and for each person commercial vehicles deliver 36.7 kilogrammes of citrus fruit to the supermarkets
- Each year and for each person commercial vehicles bring 12.7 kilogrammes of ready-made meals to the deep-frozen products section of markets. (in Germany)

Daily freight transport volume as to mode of transport 2017



Source: TCI Röhling, BMVI

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