GDV German Insurance Association

STUDY

Analysis of trends in motor insurance 2040

Automated driving & Electric mobility

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Design and production
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Photo references
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Status
31st December 2025

Press date for this edition
8th April 2026
2nd fully revised edition

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Executive Summary

Mobility in Germany is undergoing a period of profound change: Vehicles are becoming more digital, more networked and are equipped with advanced driver assistance systems Electric mobility and automated driving functions are no longer some fanciful future prospect, but are already being integrated in today's new models. These developments are bringing about considerable change at the level of damage claims and, consequently, motor insurance. The study "Analysis of trends in motor insurance 2040", which was conducted by the German Insurance Association (GDV), examines how these technical innovations will shape the cost and frequency of claims up to 2040. The analysis is based on claims data and estimates made by experts from the fields of engineering, accident research and insurance.

One key finding is that **technology is making driving safer – but not necessarily more economical.** While advanced driver assistance systems are significantly reducing the number of accidents in the long term, electric mobility, complex technology and inflation are exacerbating the economic pressures at the claims level.

Automated driving & Electric mobility

Analysis of trends in motor insurance 2040

INTRODUCTION AND ISSUES ADDRESSED

For years, road transport has been undergoing a period of technological change. Vehicles are increasingly being equipped with advanced driver assistance systems that support the driver or actively intervene in the driving activity in critical situations. At the same time, we are witnessing the development of assisted and automated driving functions that fully or partially take over certain driving tasks. These developments are closely bound up with the political aims of improving traffic safety, reducing the number of accidents and enhancing transport efficiency.

All of this raises a question of central importance for vehicle insurers: How much will these technological developments actually change the frequency, nature and cost of claims? While public debate often focuses on the considerable improvements in safety brought about by the new technology, the vital economic issue for insurers is whether and to what extent these potentials will materialise under real conditions of use.

The current study carries on from earlier investigations and extends the analysis of the effects of advanced driver assistance systems and automated driving functions on claims costs up to the year 2040. It differs from the preceding studies in that, for the first time, it sheds light on the transformation to electric mobility and also examines some example inflation scenarios.

OVERVIEW OF THE MOST IMPORTANT RESULTS

1. Electric mobility is changing claims profiles and causing a modest increase in costs.

It is more expensive to repair electric vehicles (BEV) than comparable combustion-engine vehicles. By 2040, increased BEV penetration will bring about a 2 % increase in claims costs in the field of motor third party liability insurance and 3 % in that of comprehensive insurance.

2. Inflation is greatly outpacing technical progress.

The continuous increase in spare parts and repair costs is impacting claims costs more strongly than any technological innovation. Even at a rate of 2 % inflation per year, claims costs will increase by 24 % to 32 % by 2040, while at 3.7 %[1] per year they will increase by as much as 64 % to 75 % during the same period when all the considered aspects are taken into account, and in particular the continued widespread take-up of advanced driver assistance systems and BEV. Price rises are therefore the dominant cost driver.

3. Advanced driver assistance systems are noticeably reducing accident rates.

By 2040, the number of accidents will fall by 9 % to 14 % and claims costs will fall by 6 % to 12 % before taking account of inflation. Parking and manoeuvring assists, emergency brake assists and blind spot monitors are having a particularly great effect (see Figure 1).

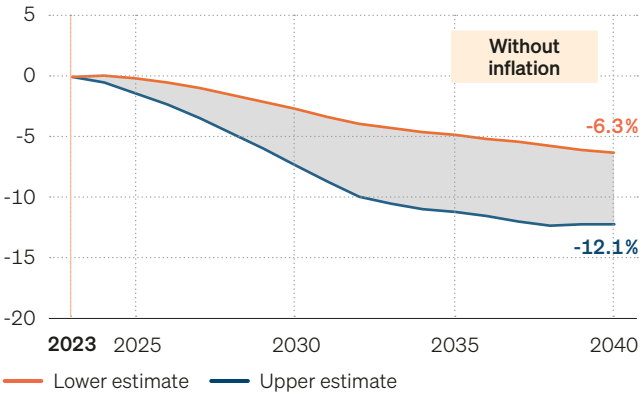
4. Sensors and technology are making repairs more expensive.

Although new advanced driver assistance systems are cutting the number of accidents, they are also making each individual claim more expensive. The cost of sensors and expenses for the additional calibration of cameras and radar/lidar sensors will increase repair costs by up to 5 %.

The figures below show the effect of advanced driver assistance systems (ADAS) and automated driving functions (AF) as well as of the further take-up of BEV on compensation payments for all vehicles – including increased repair costs and changes to the fleet (reference year 2023):

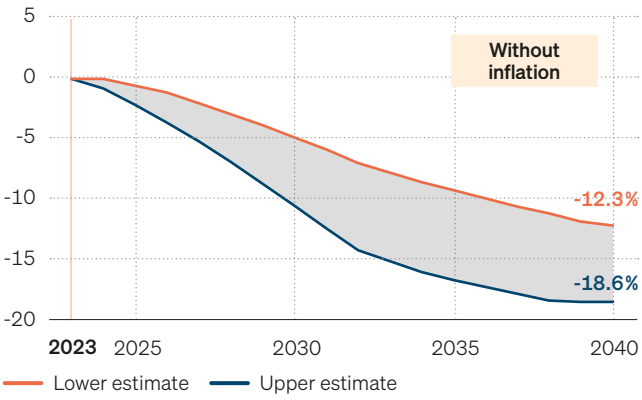
… for motor insurance – all vehicles

Figure 1 · Change in claims costs in percent



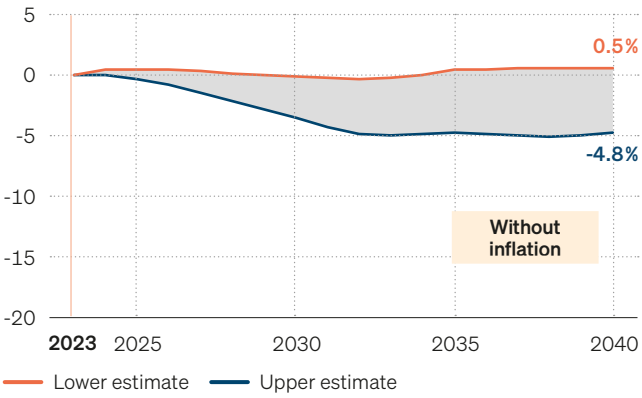
… for motor third party liability insurance – all vehicles

Figure 2 · Change in claims costs in percent



for comprehensive insurance – all vehicles

Figure 3 · Change in claims costs in percent



1 Average increase in prices for spare parts, accessories as well as for servicing and repairs over the last ten years.

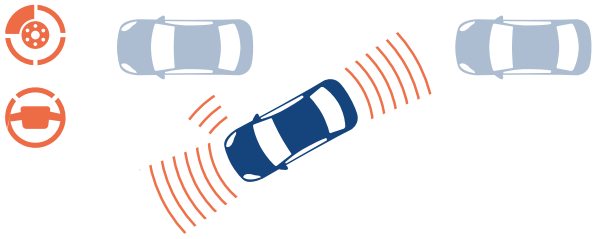
EFFECTS OF ADVANCED DRIVER ASSISTANCE SYSTEMS AND AUTOMATED DRIVING BY 2040

Advanced driver assistance systems are now widely installed in practically every class of vehicle, from passenger cars through to heavy commercial vehicles. Here, the study distinguishes between passenger cars (including camping vehicles, taxis and light commercial vehicles up to 3.5 tonnes) and trucks (including buses and tractor units weighing more than 3.5 tonnes) and analyses the impact of selected advanced driver assistance systems on claims in both groups. This summary of the analysis focuses on passenger cars, because they represent the highest proportion of overall claims costs. The expert group points out that fully automated, driverless cars are currently still restricted to test sites. Autonomous driving is therefore not considered in the current quantitative study since sufficient data is not yet available.

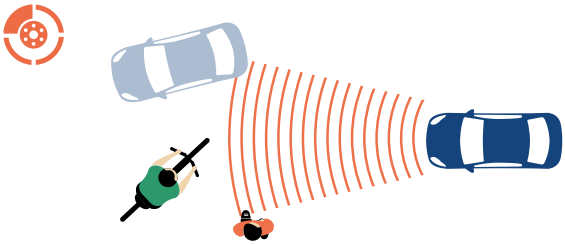
Up until 2040, four advanced driver assistance systems and two automated driving functions will determine developments for cars:

Advanced driver assistance systems

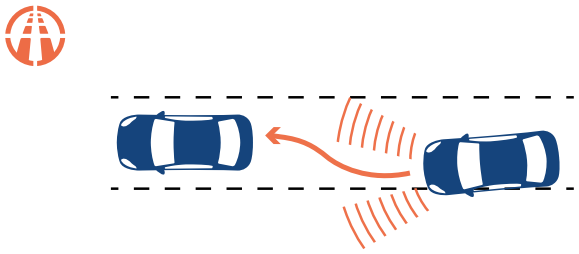
Parking and manoeuvring assist



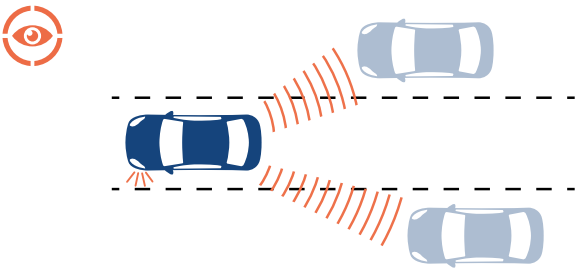
Emergency brake assist



Lane keeping system

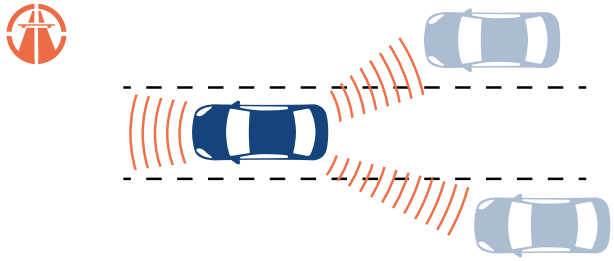


Blind spot monitor

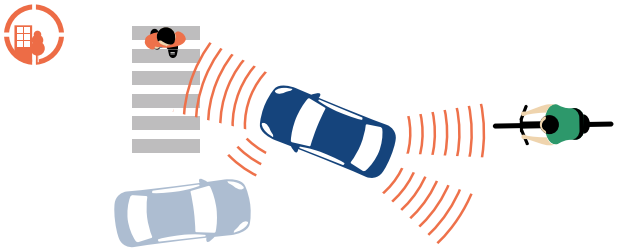


Automated driving functions

Highway pilot



Urban and rural road pilot



Advanced driver assistance systems and automated driving functions prevent only a proportion of claims

Many claims cannot be prevented by advanced driver assistance systems. This applies to comprehensive insurance claims in particular: A highway pilot is no deterrent to car thieves, a parking distance control system provides no protection against flying stones, hail, accidents involving wildlife or damage caused by martens. Claims will also continue in the field of motor third party liability insurance – for example if someone opens a car door without proper attention or because even the most state-of-the-art emergency brake assists cannot overcome the physical limitations governing the braking distance. These systems are therefore theoretically relevant for a maximum of 62 % of claims made and 54 % of compensation paid out under motor third party liability insurance policies. In the field of comprehensive insurance, advanced driver assistance systems address a maximum of 18 % of claims and 26 % of compensation paid.

The practical effect is not as great as predicted by theory

Determining the theoretical maximum is only a first step. The study therefore looks at the real-life efficiency (preventable claims in road traffic) and the utilisation rates for each system. GDV's experts identified the highest efficiency levels (provided the systems have actually been activated): 90 % for highway, urban and rural road pilots; 70 % for parking and manoeuvring assists; 50 % for emergency brake assists. The picture is different when it comes to the utilisation rates: Emergency brake and parking assists usually operate automatically (high utilisation), whereas the various pilots have to be actively enabled. Even though the expert group expects the level of use of pilots to increase, it nevertheless predicts a maximum value of about 45 %.

Market penetration is a decisive factor

When a new system is launched on the market, it is not immediately available in the entire vehicle pool. Instead, it is gradually installed in an increasing number of new vehicles, slowly allowing it to become established. It is very difficult to predict the exact speed at which new systems gain widespread acceptance. The study therefore calculates two scenarios for each advanced driver assistance system: The slow scenario mirrors the sluggish introduction of the ABS system, which took approximately 40 years to achieve market penetration of 90 %. It is therefore expected that new systems will be present in approximately 40 % of all vehicles 20 years after their introduction. The fast scenario is based on the rapid market penetration achieved by ESP: It assumes that new technologies achieve market penetration of approximately 80 % inside 20 years.

Mandatory regulations are another important factor. Since the EU General Safety Regulation (GSR) took effect on 5th January, 2020, certain safety systems must be installed as standard in all new vehicles as of a specified date – for example, emergency brake assists with pedestrian and cyclist detection as of July 2026. This legal obligation to install certain systems as standard primarily speeds up the slow scenario, while the fast scenario generally anticipates this effect due to its intense market dynamic.

Advanced driver assistance systems and automated driving make repairs more expensive

Although modern advanced driver assistance systems help prevent accidents, they nevertheless necessitate the installation of numerous sensors, cameras and additional technology. This causes an effect operating in the opposite direction: Following an accident or when replacing a damaged windscreen, it is often also necessary to replace cameras and sensors and to recalibrate the systems. This makes many repairs significantly more expensive.

Studies conducted by the Institute for Vehicle Technology (KTI) at the Allianz Center for Technology (AZT) and findings by the GDV based on Audatex show that it costs approximately 15 % more to replace the windscreen on vehicles equipped with advanced driver assistance systems than on vehicles without this technology. GDV also assumes that the systems have to be recalibrated on each claim and that they have to be replaced every 10 or 20 claims.

Overall, this results in increased repair costs: By 2040, it is expected that these costs will increase by 3.9 % to 4.8 % for passenger cars covered by motor third party liability insurance and by between 3.3 % and 4.1 % in the case of comprehensive insurance – without taking account of inflation.

The number of passenger cars will only rise slightly by 2040

This projection is based on the "Projection report 2025" (projected greenhouse gas emissions) issued by the German Federal Environment Agency. From this, the expert group concludes that the number of passenger cars in Germany will rise only slightly by 2040. As a result, the expert group assumes that by 2040, the total number of passenger cars will increase by only approximately 2 % compared to the reference year 2023.

Advanced driver assistance systems and automated driving functions are only gradually reducing the number of claims

Even though modern safety technology is preventing accidents, the costs to insurers are coming down only slowly. The question of how much a system lowers costs depends on its technical reliability, the actual use made of it by drivers, and the speed with which the new technology enters into the fleet. In the case of motor third party liability insurance, it is primarily the parking and manoeuvring assists and emergency brake assists that have the greatest positive effect, whereas lane assists tend to have only a moderate effect. In the comprehensive insurance field, which covers damage to the driver's own vehicle, it is the parking and manoeuvring assist that makes far and away the greatest contribution.

Overall, the study shows that technology will only gradually reduce costs.

In the motor third party liability insurance field, total claims costs are expected to fall by 12 % to 19 % by 2040 compared to 2023 (see Figure 2). Although advanced driver assistance systems reduce the accident risk itself by considerably more than this – i.e., by 20 % to 25 % –, these benefits will be partially offset by other developments. The factors driving costs include more expensive repairs (2 % to 4 %), minor growth in the vehicle fleet (approx. 2 %) and the widespread transformation to electric mobility, which will add another 2 % to costs. By contrast, the actual number of motor third party liability insurance claims will fall considerably by 19 % to 28 %.

Savings in the comprehensive insurance field will be significantly lower. Here, claims costs will fall by only 0 % to 5 % by 2040 (see Figure 3). The expert group attributes this to the fact that the accident-prevention effect of the systems (cutting accidents by 9 % to 12 %) will be almost completely balanced out by other factors. Higher repair costs (3 % to 5 %), growth in fleet size (2 %) and the transformation to electric cars (3 %) will all but cancel out the savings. The fall in the number of comprehensive insurance claims will also be comparatively small at 4 % to 6 %, because many typical claims of this type – such as glass breakage or theft – cannot be prevented by advanced driver assistance systems.

TRANSFORMATION TO ELECTRIC MOBILITY

Rapid growth of electric mobility up to 2040

The GDV expert group expects to see strong growth in battery-electric vehicles (BEV). Linear growth is assumed for the purposes of the current study: Whereas the number of electric cars (BEV) as a proportion of new registrations in 2025 was still approximately 20 %, this value should reach 100 % by 2035. However, since it will take time to renew the entire vehicle fleet, the expert group predicts that the proportion of BEV cars on the road in 2040 will be approximately 58 % among cars covered by motor third party liability insurance and some 62 % in the case of comprehensive insurance. The greater proportion of vehicles covered by comprehensive insurance is due to the different age structure: Comprehensive insurance tends to be chosen for more recent vehicles, in which technological change becomes visible more quickly, whereas motor third party liability insurance is found throughout the entire fleet, including older models.

No systematic differences in equipment between electric cars and comparable combustion engine vehicles

One aspect covered by the study was the question of whether electric cars possess more technical safety features than conventional vehicles. The expert group found no systematic difference with regard to the advanced driver assistance systems equipping the two types of vehicle. Even though today's electric cars often feature modern equipment, comparable – usually highly-priced – combustion-engined models nevertheless possess an identical safety level. What is more, statutory requirements such as the "General Safety Regulation" ensure that important safety systems are mandatory for all new cars, meaning that the technical standards are aligned across manufacturers.

Electric mobility will slightly increase actual claims costs

At present, electric cars give rise to comprehensive insurance claims10 % to 15 % less frequently than combustion-engine vehicles. One of the main reasons for this is that claims for glass damage are approximately 30 % lower in this group. However, the expert group expects this advantage to disappear in the long term. As electric cars become increasingly widespread, the driving behaviour of their owners will become more similar to that of current drivers of combustion-engine cars, meaning that the accident rates will converge once more.

The picture is different when it comes to the cost of repairs: Following a crash, it currently costs approximately 10 % more on average to repair an electric car than a conventional one. Among other things, this is due to the higher spare parts prices and more time-consuming workshop processes. Although the expert group expects this cost difference to shrink by 2040 as the procedures become more routine and the number of units increases, it also predicts that an "overhead" of approximately 5 % compared to combustion-engine vehicles will remain. Taken overall, the study concludes that the change over to electric mobility will slightly increase pure repair costs. By 2040, the expert group expects claims costs per policy to increase by approximately 2 % for motor third party liability insurance and by about 3 % in the case of comprehensive insurance.

By 2040, advanced driver assistance systems and automated driving functions will have a measurable impact on the frequency and cost of motor insurance claims. Relative to the reference year 2023 – and including the transformation to electric mobility but without taking account of inflation – there is the potential for a 7 % to 13 % reduction in car insurance claims (see Figure 4). Due to the higher repair costs, the transformation to electric mobility will increase claims costs in the car group by approximately 2 % to 3 %. What is more, the beneficial impacts of the new technology will not be felt in the short term but will instead grow gradually through to the end of the analysis period. The fact that the overall bottom-line effect will remain relatively modest is primarily due to two aspects: On the one hand, the study assumes realistic levels of potential effectiveness for the new technology On the other, the technology will only slowly penetrate the vehicle fleet.

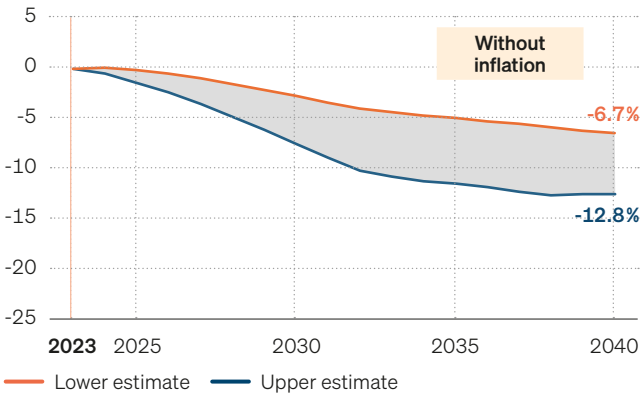
INFLATION SCENARIOS

Even though the basic scenarios covered by the study intentionally exclude inflation, the expert group nevertheless analysed two example scenarios in order to illustrate the effect of price rises. On the one hand, it examined an annual inflation rate of 2.0 % – which is the ECB's long-term inflation target – and, on the other, a more specific value of 3.7 %. The higher rate of 3.7 % is based on the German Federal Statistical Office's Consumer Price Index (CPI) for transport. This value

The figures below show the effect of advanced driver assistance systems (ADAS) and automated driving functions (AF) as well as of the further take-up of BEV on compensation payments for cars – including increased repair costs and changes to the fleet (reference year 2023):

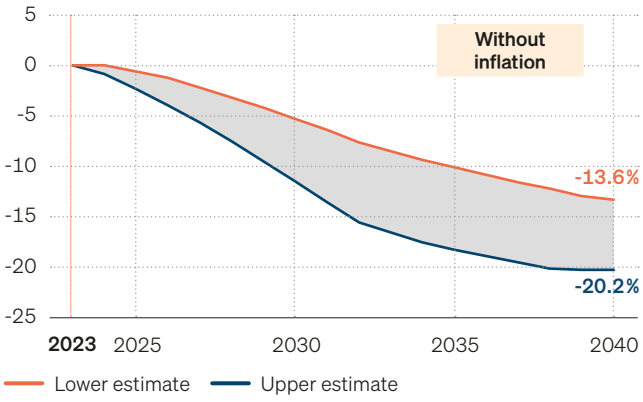
… for motor insurance – cars

Figure 4 · Change in claims costs in percent



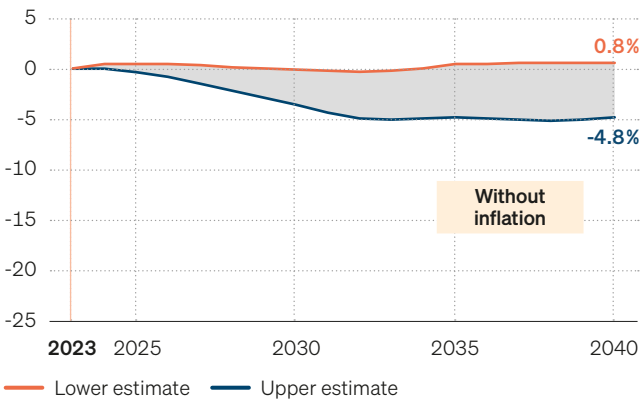
… for motor third party liability insurance – cars

Figure 5 · Change in claims costs in percent



… for comprehensive insurance – cars

Figure 6 · Change in claims costs in percent



corresponds to the average increase in prices for spare parts and accessories as well as for servicing and repairs over the last ten years.

In both scenarios, the cost increases due to inflation far exceed the expected savings resulting from modern assistance systems and automated functions. More specifically, the expert group predicts the following changes in overall claims costs in the motor insurance sector up to 2040 (see Figure 7):

- → At a moderate inflation rate of 2.0 % per year, claims costs would rise by 24 % to 32 % despite the increased vehicle safety.
- → If prices continue to rise as sharply as during the last decade (3.7 % per year), an increase in claims costs of as much as 64 % to 75 % is expected.

NEW RISKS

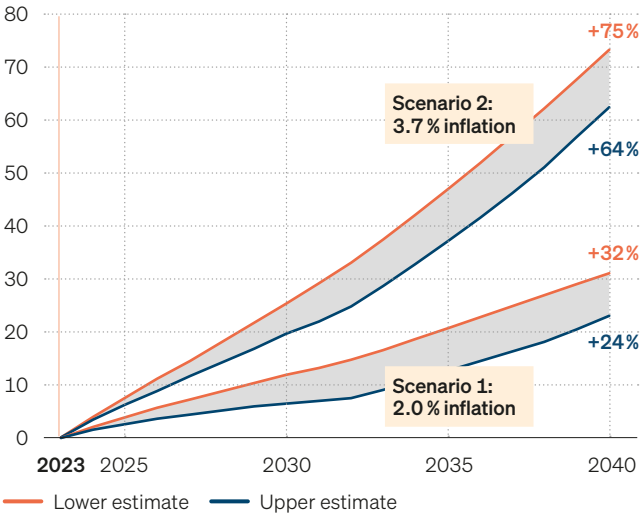
Assistance systems and automated driving functions make driving safer and reduce the burden on drivers. At the same time, new risks that are difficult to measure are emerging. Experienced drivers often intuitively recognise risks faster than programmed systems. At the same time, as the level of automation increases (as of levels 2 and 3), drivers become less attentive because the car itself takes care of ever more tasks. Particular risks arise, above all, when automated vehicles meet conventional cars in mixed traffic and incorrectly assess their behaviour. Technical limitations and operating errors can also lead to accidents – for example when sensors send inaccurate data or the human-system interaction does not function smoothly. The phenomenon known as “mode confusion” is also problematic: If vehicles use different levels of automation, it can sometimes be difficult for drivers to know who is in control at any given time.

With increasing digitalization, the IT-related and cyber-risks are also growing. Automated vehicles depend on a constant exchange of data with manufacturers, digital mapping services or other road users. This is leading to new vulnerabilities: Software errors or incompatibilities can trigger malfunctions and, in the worst case scenario, targeted attacks by hackers might affect entire series of vehicles. One key challenge is to identify IT problems and hardware failures in good time and guard against these – for example in the case of radar or lidar sensors. Since the technology is still in an early phase, it has not yet been possible to reliably quantify these risks.

Motor insurance: Change in claims costs including inflation

Figure 7 · Development when effects of ADAS and AF, change in fleet size, increased repair costs and impact of BEV are taken into account, reference year 2023

Change in claims costs in percent



Conclusion

An example scenario of 3.7 % inflation per year (based on the Consumer Price Index for transport) clearly illustrates the great importance of price changes. In this case, inflation would completely cancel out the technology-related savings and lead to a 75 % increase in costs.

Beyond this, the expert group identifies two other developments whose effects cannot yet be reliably quantified and which are therefore not taken into consideration in the general statistics:

On the one hand, it can be assumed that automotive manufacturers and suppliers will continue to improve the systems, potentially resulting in greater efficiency and utilisation levels. On the other, increasing digitalization and networking will bring new risks. The acceptance and widespread take-up of the systems by society will largely depend on whether new accident profiles and problems potentially affecting entire vehicle series – for example, due to software errors or IT and/or cyber-risks – can be successfully avoided.

Overview of the methodology

Approach and scope of the study

The aim of this trend analysis is to arrive at a quantitative estimate of the effects of selected technological trends on the cost and frequency of claims in the motor insurance field up to the year 2040. It focuses on:

- the increasingly widespread use of advanced driver assistance systems (ADAS),
- the introduction of assisted and automated driving functions (AF), and
- additionally, and for the first time, the transformation to electric mobility.

Other potentially relevant trends such as, for example, changes in mobility-related behaviour (e.g. due to car-sharing or working-from-home policies), regulatory changes regarding the handling of claims, or societal developments, are intentionally not taken into account because there are as yet no reliable, quantifiable datasets for these factors. The analysis therefore focuses on trends whose causal relationships are empirically proven, and which can be methodologically traced and represented.

Considered vehicle groups

The analysis distinguishes between two groups of vehicles:

→ **Car group:** Cars and car-like vehicles (including camping vehicles and commercial vehicles up to a gross vehicle weight (GVW) of 3.5 tonnes),

→ **Trucks/buses and coaches:** Commercial vehicles with a GVW of more than 3.5 tonnes, including buses/coaches and tractor units.

Considered advanced driver assistance systems and automated driving functions

The following advanced driver assistance systems (ADAS) and assisted and/or automated driving functions (AF) were considered:

- Parking and manoeuvring assist
- Emergency brake assist
- Lane keeping system
- Blind spot monitor
- Turn assist (only trucks/buses and coaches)
- Highway pilot
- Urban and rural road pilot (only car group)

The claim-prevention effect is determined individually for each of these systems. This is done on the basis of system-related assumptions regarding relevance, efficiency, utilisation level and penetration in the vehicle fleet. The overall effects are determined by aggregating the effects of the individual systems.

What factors are taken into account for the forecast?

For the car group, the results of the trend analysis consist of four cumulative stages of development relative to the reference year 2023:

- Reduction of the frequency and cost of claims per policy due to ADAS and AF
- Increase in claims costs per policy due to additional repair costs resulting from new technology
- Change in the vehicle fleet up to 2040
- Transformation to electric mobility

In the case of trucks/buses and coaches, some methodological restrictions are necessary because, among other things, there is no reliable data on additional repair costs and changes to the fleet. For this group, therefore, only the accident-prevention effect of ADAS and AF is considered and it is assumed that the fleet will not change compared to 2023.

How is the accident-prevention effect of the individual systems calculated?

The accident-prevention effect of advanced driver assistance systems and automated driving functions is determined individually for the various systems. This is done on the basis of retrospective accident and claim analyses undertaken by the German Insurers Accident Research (UDV[2]), the Allianz Center for Technology (AZT[3]), international studies (IIHS/HLDI) and internal analyses performed by GDV.

2 Hummel, T., Kühn, M., Bende, J., Lang, A.: Fahrerassistenzsysteme – Ermittlung des Sicherheitspotenials auf Basis des Schadengeschehens der Deutschen Versicherer [Advanced driver assistance systems – An investigation of their potential safety benefits based on an analysis of insurance claims in Germany],. research report FS 03, Unfallforschung der Versicherer, GDV e. V., September 2021; Hummel, T., Lindenau, M.: Park- und Rangierunfälle [Parking and manoeuvring accidents], Unfallforschung kompakt No. 61, Unfallforschung der Versicherer, GDV e. V., October 2016

3 Gwehenberger J., Behl T., Lauterwasser C., "Wie wirksam sind Fahrerassistenzsysteme – vom Bagatellschaden bis zum schweren Unfall?" [How effective are advanced driver assistance systems - from minor damage to

Four parameters are determined for each of the considered systems

1. Relevance

Relevance describes the proportion of total claims costs or proportion of the number of claims that can theoretically be impacted by the system in question. Claims that cannot be addressed due to the nature of the system (e.g. theft, hail, accidents involving wildlife) are not taken into account.

Concrete example: If parking and manoeuvring assists were able to fully prevent all the claims that can be addressed by this system, then, in theory, 12 % of comprehensive insurance claims would be affected. These claims are responsible for 16 % of claim costs.

2. Efficiency

Efficiency indicates the proportion of this theoretical potential that can actually be achieved under real-life conditions. Efficiency may be limited, for example, by weather conditions, traffic conditions such as missing carriageway markings, or the limitations of the systems.

Example: The sensors of parking and manoeuvring assists may become dirty or fail to recognise non-typical obstacles. Furthermore, the human-machine interaction does not always function as it should. Consequently, not all the theoretically conceivable savings are actually made: initially, the value is only 20 %, rising to 70 % in 2040.

3. Utilisation level

The utilisation level describes how often an available system is used during actual driving activity. Systems that are permanently active in the background have higher utilisation levels than systems that have to be activated by the driver.

Example: Many drivers will continue to park unassisted in large spaces or in their house garage, meaning that the parking and manoeuvring assist is only used in 90 % of cases.

4. Penetration

New driving assistance systems and automated driving functions are initially only installed in new vehicles and even then, it is not mandatory for them to be offered as standard. They therefore only produce an effect in the vehicle fleet after a certain time has elapsed, and this effect depends primarily on the speed with which the systems become adopted in the fleet.

Two fleet penetration scenarios are considered for each of the systems examined here: a slow and a fast scenario. These scenarios reflect different assumptions regarding market development and the speed of adoption of new technologies in the vehicle fleet.

Both scenarios assume that market penetration remains moderate during the first few years following introduction and becomes more dynamic as the systems become more widely available and are more widely accepted.

Another factor influencing developments is the European General Safety Regulation (GSR), which requires manufacturers to integrate certain advanced driver assistance systems in new vehicles as of a specific date. These regulatory requirements accelerate the take-up of individual systems within the vehicle fleet and reduce the divergence between the slow and fast scenarios.

Example: The automatically-braking parking and manoeuvring assist was introduced in 2017. The system will achieve very different levels of fleet penetration by the year 2040 depending on which scenario is considered. In the fast scenario, most of the vehicles (96 %) in the fleet will be equipped with this system, whereas it will be found in only a smaller proportion (52 %) in the slow scenario.

These four parameters can be multiplied together to give a system's claims-reduction potential. The sum of the individual potentials then gives the overall reduction potential of all the considered assistants.

Example: The calculation for the parking and manoeuvring assist in the comprehensive insurance field in 2040 is as follows:

Relevance	x	Efficiency	x	Utilisation level	x	Penetration	=	Reduction
16 %	x	70 %	x	90 %	x	52 % / 96 %	=	5.2 % / 9.7 %

severe accidents?] VKU – Verkehrsunfall und Fahrzeugtechnik, Rn. 2, p. 60–65, 2012. Gwehenberger, J.; Borrack, M.: Influence of Driver Assistance Systems on Insurance Claims; ATZ – Automobiltechnische Zeitschrift, p. 60-65, October 2015

To some extent, level L2 and L3 assisted and automated driving functions (AF) can be viewed as a combination of advanced driver assistance systems (ADAS), extended by the ACC function (adaptive cruise control), which is not examined here. Vehicles that possess an AF are therefore necessarily equipped with ADAS, meaning that no additional relevance can be attributed to AF.

How are additional repair costs taken into account?

Advanced driver assistance systems and automated driving functions require additional sensors, which are often installed in areas that are at risk in the event of a collision. If damage that gives rise to a claim occurs, there are additional costs due to:

- The replacement of cameras and ultrasound, radar or lidar sensors,
- Calibration costs.

For the car group, these additional repair costs are estimated and then projected onto the claims cost per policy as a function of the level of fleet penetration achieved by the system. This effect is not quantified for trucks/buses and coaches.

How is the development of the vehicle fleet taken into account?

The identified effects refer to the expected development of the vehicle fleet up to 2040 and are calculated in the light of the claims-reduction potentials and the increase in claims costs per policy. For the car group, assumptions regarding the development of the fleet are based on the "Projektionsbericht 2025", a report on projected greenhouse gas emissions in Germany commissioned by the Federal Environment Agency. For trucks, buses and coaches, a vehicle fleet unchanged from the 2023 level is assumed due to the lack of suitable, reliable, long-term forecasts.

How is the transformation to electric mobility incorporated?

For the first time, this study takes account of the influence of electric mobility on claims costs and frequency. This analysis is based on differences in the frequency and value of claims between battery-electric vehicles (BEV) and comparable combustion-engine vehicles (ICE) identified in various studies conducted by GDV[4] and AZT[5]. These differences are taken into account as a function of the proportion of BEV in the overall fleet. The BEV fleet is modelled on the basis of the number of BEV vehicles at the end of 2024 and the number of such vehicles as a proportion of new registrations from 2024 through to the politically stated goal of 100 % BEV new registrations in 2035. It is assumed that the number of newly registered BEV vehicles will follow a linear upward trend. Electric mobility is only taken into account for the car group.

4 Vergleich von Elektro- und Hybrid-Pkw mit baugleichen „Verbrennern" 2021-2023 und Vorjahre [Comparison of electric and hybrid cars with identical "combustion-engine" models 2021-2023 and preceding years] German Insurance Association (GDV), unpublished study

5 Zaviehjigi, Y.A.: Einfluss der Elektromobilität und der zunehmenden Verbreitung von Fahrerassistenzsystemen auf Schadengeschehen, [Influence of electric mobility and the increasing use of advanced driver assistance systems on claims frequency and costs] Deggendorf Institute of Technology, unpublished Master's thesis. Conducted by: AZT Automotive GmbH – Allianz Center for Technology

RESULTS FOR THE INDIVIDUAL ADVANCED DRIVER ASSISTANCE SYSTEMS

Parking and manoeuvring assist

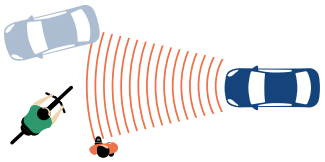
The parking and manoeuvring assist detects obstacles in the vehicle's immediate environment, including the sides of the vehicle, and automatically triggers braking in order to avoid collisions with these objects. It also takes account of sideways vehicle movements due to steering manoeuvres. The system is designed for typical manoeuvring situations at low speeds, of the sort that occur when parking in or leaving multi-storey car parks, for example, and is available for both forwards and reverse travel. A parking and manoeuvring assist with these functional features was offered in new vehicles for the first time in 2017. By contrast, no claims-reduction effect could be demonstrated for the widespread parking distance control systems, which simply output optical and/or acoustic warnings. The efficiency of parking and manoeuvring assists is expected to improve with time due to technological advances.

Emergency brake assist

The emergency brake assist detects leading and stationary vehicles, warns the driver of the risk of a collision in good time and triggers partial or emergency braking if required in order to prevent the impact or reduce its severity. No restriction of the speed range is expected. A system of this sort was introduced for new vehicles for the first time in 2013. Since 2015, emergency brake assists have been available that detect not only vehicles but also pedestrians and cyclists and that automatically trigger braking if there is a risk of colliding with these road users. The claims-reduction effect of pedestrian and cyclist detection has only a limited impact in the field of comprehensive insurance. The efficiency of emergency brake assists with pedestrian and cyclist detection is expected to improve with time due to technological advances.

Parking/manoeuvring assist – claims costs

	Motor third party liability insurance	Comprehensive insurance
Relevance in %	26	16
Efficiency in %	70[6]	70
Utilisation level in %	90	90
Penetration by 2040 in %		
At slow penetration rate	52	52
At fast penetration rate	96	96
Reduction from 2023 to 2040[7] in %		
At slow penetration rate	8.3	5.1
At fast penetration rate	15.8	9.3



Emergency brake assist – claims costs[8]

	Motor third party liability insurance	Comprehensive insurance
Relevance in %	19 (+4)	7 (0)[9]
Efficiency in %	50 (+30)[10]	50 (+30)
Utilisation level in %	100	100
Penetration by 2040 in %		
At slow penetration rate	100 (97)	100 (97)
At fast penetration rate	100 (100)	100 (100)
Reduction from 2023 to 2040[11] in %	8.5 (+1.1)	3.1
At slow penetration rate	5.9 (+1.0)	2.1
At fast penetration rate		

6 Assumption: The efficiency of parking and manoeuvring assists will improve over time due to technological advances. At the time of market launch, the efficiency was 20 % and the efficiency level of 70 % will be achieved as of 2032.

7 Obtained by multiplying relevance, efficiency, utilisation level and penetration, while also taking account of the existing level of market penetration in 2023

8 Values in brackets refer to emergency brake assists with pedestrian and cyclist detection.

9 Pedestrian and cyclist detection will prevent comprehensive insurance claims to only a very limited extent.

10 Assumption: The efficiency of emergency brake assists with pedestrian and cyclist detection will improve over time due to technological advances. At the time of market launch, efficiency was 10 %.

11 Obtained by multiplying relevance, efficiency, utilisation level and penetration, while also taking account of the existing level of market penetration in 2023

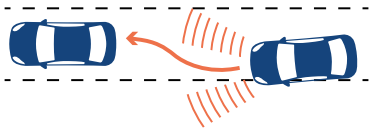
Lane keeping system

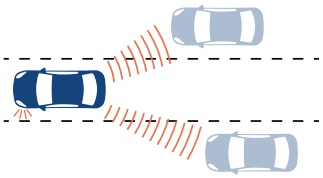
The sensors in the lane keeping system detect the carriageway markings to the right and left of the vehicle and enable the system to calculate the position of the vehicle within the lane. If the vehicle approaches or crosses the lane marking without the driver using the indicator to signal this, then he or she is alerted by means of an optical, acoustic or haptic warning. If the driver continues on this trajectory despite the warning, then the vehicle is actively guided back towards the middle of the lane.

A lane keeping system of this type has been available for new vehicles as of 2010. The efficiency of lane keeping systems is expected to improve with time due to technological advances.

Blind spot monitor

The blind spot monitor oversees the areas to the side and rear side of the vehicle that are commonly known as blind spots. Vehicles located in these areas are detected and displayed to the driver in a suitable form. If the driver attempts to change lane even though another vehicle is present in the monitored area, the blind spot monitor issues an optical and/or acoustic warning.





Lane keeping system – claims costs

	Motor third party liability insurance	Comprehensive insurance
Relevance in %	3	2
Efficiency in %	50[12]	50
Utilisation level in %	50	50
Penetration by 2040 in %		
At slow penetration rate	100	100
At fast penetration rate	100	100
Reduction from 2023 to 2040[13] in %	0.6	0.4
At slow penetration rate	0.4	0.3
At fast penetration rate		

Blind spot monitor – claims costs

	Motor third party liability insurance	Comprehensive insurance
Relevance in %	5	2
Efficiency in %	75	75
Utilisation level in %	90	90
Penetration by 2040 in %		
At slow penetration rate	65	65
At fast penetration rate	100	100
Reduction from 2023 to 2040[14] in %	1.6	0.6
At slow penetration rate	1.7	0.6
At fast penetration rate		

12 Assumption: The efficiency of lane keeping systems will improve with time due to technological advances and/or in future developmental stages. In 2015, efficiency was 20 %.

13 Obtained by multiplying relevance, efficiency, utilisation level and penetration, while also taking account of the existing level of market penetration in 2023

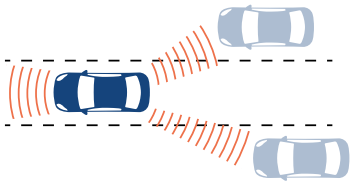
14 Obtained by multiplying relevance, efficiency, utilisation level and penetration, while also taking account of the existing level of market penetration in 2023

Highway pilot

The highway pilot is an automated level 3 driving function for motorways and roads with similar characteristics to motorways. When this driving function is activated, the vehicle maintains its distance from the vehicle in front and is kept in the middle of the lane. The driver is freed to do something else while the system is activated. The task of driving is then taken over by the system. Control is returned to the driver in good time, for example before leaving the motorway or when approaching roadworks;

Urban and rural road pilot

The urban and rural road pilot is a level 3 automated driving function that is used when driving on urban and rural roads. When this driving function is activated, the vehicle maintains its distance from the vehicle in front and is kept in the middle of the lane. The driver is freed to do something else while the system is activated. The task of driving is then taken over by the system. Control is returned to the driver in good time when the system reaches the limit of its capabilities. For it to function properly, it must reliably detect all relevant road users, including pedestrians and cyclists, wherever they are in the vicinity of the vehicle. In addition, all relevant traffic information must be acquired either through the vehicle's own sensor systems or – if necessary – via information transfer with other road users or the traffic infrastructure.



Highway pilot – claims costs

	Motor third party liability insurance	Comprehensive insurance
Relevance in %	–	–
Efficiency in %	90	90
Utilisation level in %	46[15]	46
Penetration by 2040 in %	37	37
Reduction from 2023 to 2040[16] in %	0.1	0.0

Urban and rural road pilot – claims costs

	Motor third party liability insurance	Comprehensive insurance
Relevance in %	–	–
Efficiency in %	90	90
Utilisation level in %	20[17]	20
Penetration by 2040 in %	5	5
Reduction from 2023 to 2040[18] in %	0.2	0.1

15 With time, drivers are making more and more use of highway pilots. At the time of market launch, the utilisation level was 10 % and this will increase to 50 % within 20 years, i.e., it will not reach this value by 2040

16 Obtained by multiplying relevance, efficiency, utilisation level and penetration, while also taking account of the existing level of market penetration in 2023

17 Assumption: The utilisation level of the urban and rural road pilot by drivers will increase with time. At the time of market launch, the utilisation level was 10 percent and this will increase to 50 percent within 20 years, i.e., it will not reach this value by 2040

18 Obtained by multiplying relevance, efficiency, utilisation level and penetration, while also taking account of the existing level of market penetration in 2023

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