GDV
DIE DEUTSCHEN VERSICHERER

GDV-REPORT

Automated driving

Impact on claims payments up to 2035

Overview

- **Less accidents**
  Assistance systems and automated driving functions make car driving safer, but in practice they prevent less damage than in theory
- **Slow market penetration**
  The new technology is penetrating the vehicle stock with great delay
- **Higher repair costs**
  Additional technology makes damages more expensive

Management Summary

The effects of driver assistance systems and automated driving functions on traffic safety and claims payments are the subject of numerous, partly speculative predictions. For some, all accidents will soon be a thing of the past, while others emphasize the risks of the new technology and doubt the overall superiority of the machine over the driver in highly dynamic and complex road traffic.

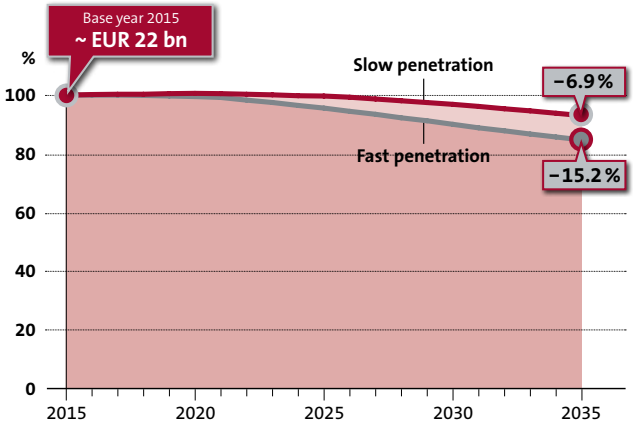
Against this background, the German Insurance Association (GDV) has formed an interdisciplinary project group consisting of engineers, mathematicians, insurance experts, and accident researchers. They were to develop a realistic and in-depth picture of the anticipated effects of assisted and automated driving. The detailed analysis made by the experts and their predictions of the impact on claims development up to the year 2035 shows: Modern driver assistance systems and automated driving functions...

- make car driving safer, in practice, however, they prevent significantly less damage than in theory;
- can be implemented only with delay and therefore reduce losses insignificantly;
- lead to higher repair costs in case of damage, and
- have a greater impact on motor vehicle-related third party liability (MTPL) claims than on motor vehicle own damage losses.

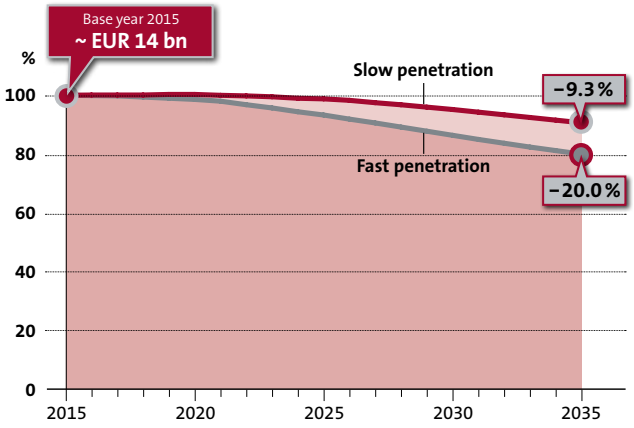
Overall, the study shows two opposing effects: fewer accidents lead, on the one hand, to lower claims payments; on the other hand, the installation of sensitive technology increases the costs of repairs. In terms of figures, the expert group concluded that driver assistance systems and automated driving functions by 2035 could reduce the claims burden by 7 to 15 percent compared to the base year 2015. This total result is composed of reduction in MTPL claims by between 9 and 20 percent and a reduction in motor vehicle own damage losses by between 3 and 7 percent.

Impact of assistance systems and automated driving functions on losses* for all vehicles:

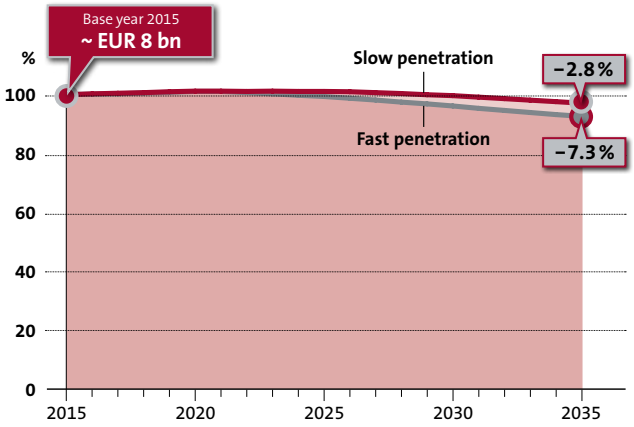
... under motor vehicle insurance in total



... under MTPL insurance



... under motor vehicle own damage insurance



* Reduction in claims payments resulting from driver assistance systems and automated driving functions incl. increase of repair costs due to new systems and innovations in the vehicle stock; base year 2015

Automated Driving – Study on development of claims payments

I. Introduction & problems

For decades, modern technology makes driving more comfortable and safe: power steering, air conditioning, and navigation ensure comfort, ABS and ESP keep the cars on track even in critical situations - and in case of an accident, airbags, belt tensioners, and crumple zones often prevent the worst consequences.

This evolutionary development is now followed by a technological leap. New systems are taking on more and more tasks and are increasingly playing an active role in driving. A good example is the parking assistant: first, the system warned the driver with a beep, then the computer began to take over the steering, and now there are parking assist systems that steer, add speed, or brake - and thus the car can be automatically parked even in a limited space.

This development is made possible thanks to digitalization - using more and more powerful sensors and the rapid processing of information. Cars can now monitor wide areas of their surroundings, evaluate the traffic situation and assess the respective driving situation. Driver assistance systems and automated driving functions use this information to assist the driver and help him in critical situations. Corresponding systems are becoming more and more popular with new vehicles and are now offered, not only in the upper class but in almost the entire product range of automotive manufacturers.

What are the effects of assisted and automated driving?

This technical development can and will have a positive effect on road safety. It is, however, unclear and controversial how and when to deploy the beneficial effects of the new technology and exactly how huge the impact will actually be.

The range of forecasts so far could hardly be any greater: Some point to the fact that 90 percent of accidents are due to human error and therefore expect a rapid decline in the number of accidents. Others emphasize the fact that the human driver, on average, only causes an accident with personal injury every 3 million kilometres - and raise the question of whether assistance systems and automated driving functions can reach the high safety level of human drivers in the foreseeable future.

Against this background, the German Insurance Association (GDV) has set up an interdisciplinary project group consisting of engineers, mathematicians, insurance experts, and accident researchers, and has asked to answer the following question: *How quickly and comprehensively will the technological advances in vehicle control affect the claims payments and motor vehicle insurance in general?*

The result depends on the answers to various sub-questions: Which types of accidents with which claims payments can be avoided with which systems? Can all theoretically avoidable damage really be prevented in practice? How soon will the new systems penetrate the market? How often and with what success are the systems used by drivers in everyday life? What impact has the expensive technology on repair costs? The analysis of GDV has devoted itself to all these questions in detail. The results summarized below provide a sound insight into the effects of technological progress in vehicle control systems and assess the effects from the base year 2015 till 2035.

II. Effects of assistance systems and automated driving up to 2035

Driver assistance systems and automated driving functions are used in various vehicles. The GDV study divides these vehicles into two groups:

1. **Passenger cars** (incl. camping vehicles and light trucks up to 3.5 tonnes of gross vehicle weight)

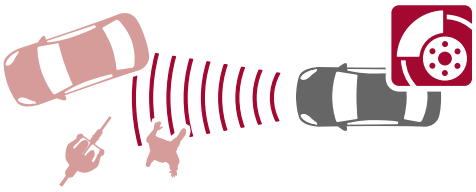
2. **Trucks** (incl. buses and tractors over 3.5 tonnes of gross vehicle weight)

For both groups, the effects of various driver assistance systems were analysed in detail.[1] Since almost 90 percent of the total claims payments (EUR 22 billion) in the base year 2015 were attributable to vehicles of the passenger cars group, the findings for the passenger cars group are considered in more detail below.[2]

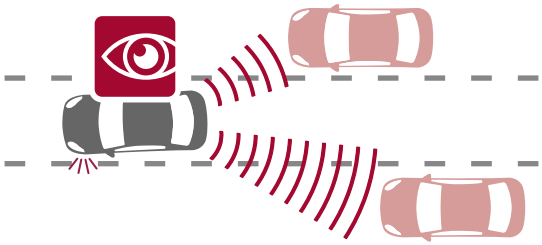
By the year 2035, four **driver assistance systems**[3] and two **automated driving functions**[4] will be relevant for passenger cars:

PARKING & MANOEUVRING ASSISTANT SYSTEM

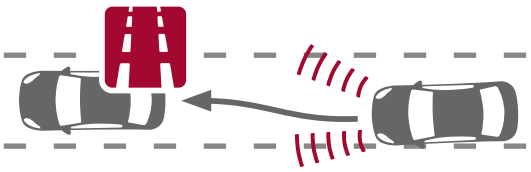
AUTONOMOUS EMERGENCY BRAKING SYSTEM



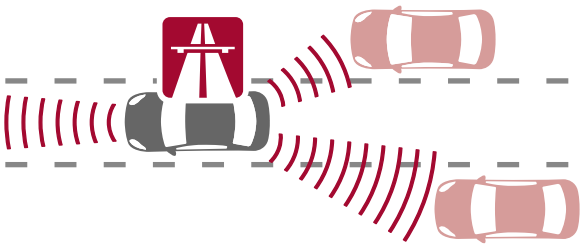
LANE CHANGE ASSISTANT



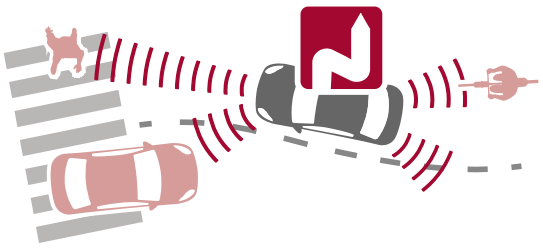
LANE KEEPING SYSTEM



MOTORWAY PILOT



CITY AND RURAL ROAD PILOT



1 For detailed information on the methodology see page 8.
2 In the base year 2015, the trucks group accounted for around EUR 1 billion, or around 5 percent of claims payments.
3 Refer to page 10-14 for definitions and details of the effects of driver assistance systems.
4 Refer to page 15-16 for definitions and details of the effects of automated driving functions.

Insight 1: Assistance systems and automated driving functions can help to avoid some losses and have a greater impact on MTPL claims than on motor vehicle own damage losses

A variety of damages cannot be influenced by the above-mentioned systems. In particular, this applies to the partial motor vehicle own damage losses: Motorway pilot systems do not protect from car thieves, parking assistant does not prevent being hit by a stone, hailstorm, accidents involving animals, or electrical wiring damage by martens . There will still be claims under MTPL insurance - due to carelessly opened doors and the fact that even the best emergency braking system cannot eliminate the physical laws that apply to the braking distance of a car.

In the end, the above-mentioned systems can be relevant in theory for a maximum of 56 percent of claims payments under MTPL insurance and a maximum of 27 percent under motor vehicle insurance. The emergency brake assist achieves the highest relevance for MTPL claims, which could lead to 28 percent fewer losses. On the other hand, parking and manoeuvring assistants will be most relevant for motor vehicle own damage losses, which could lead to a decrease of up to 16 percent.[5]

Insight 2: The systems prevent in practice less damage than in theory

However, on the way to a realistic result, the theoretical maximum can only be the first intermediate step. Therefore, in the course of the study, a further step was taken for each system under consideration to determine which losses could actually be avoided under real traffic conditions (efficiency) and how often the drivers use the available systems at all (utilization).

According to GDV experts, the efficiency increases especially when several driver safety systems are linked (see information box): an efficiency of 90 percent is assumed for motorway, city and rural road pilot systems. Individual driver assistance systems, on the other hand, are generally less efficient. An efficiency of 70 percent is realistic for parking and manoeuvring assistants, whereas the emergency braking assistant, in reality, can actually use the theoretical potential for damage avoidance to a maximum of 40 percent.[6]

The reverse is true in terms of utilization: systems such as emergency braking assistant, and parking and manoeuvring assistant, are generally always active in the background; only a few drivers will switch off the systems. Automated driving functions such as motorway or city and rural road pilots must be activated by the driver. The GDV experts therefore assume that these functions are not continuously used - the level of utilization will also be low during the introduction of this technology to the market, and will only rise in the course of time.

Automated driving functions add value

The automated driving functions are defined by the GDV expert group as a combination of several driver assistance systems.[7] Nevertheless, they are more than the sum of their individual parts. On the one hand, the manufacturers will use only the most advanced technologies; on the other hand, the overall efficiency of systems is increased by linking all available sensors and information of the vehicle's environment. As a result, the loss burden will be further reduced by means of motorway or city and rural road pilots, albeit to a minor extent.

5 For detailed information on the possible effects of the individual driver assistance systems and automated driving functions, see page 10.

6 IIHS: Effectiveness of Forward Collision Warning Systems with and without Autonomous Emergency Braking in Reducing Police-Reported Crash Rates January 2016 Jessica B. Cicchino.

7 See page 14.

Insight 3: The new technology is spreading in the market with delay

The timing was also an important factor for the next step in the analysis: when a new system is introduced to the market, it is not directly used in all manufactured vehicles - rather, it is installed in the larger part of new vehicles and, consequently, spreads relatively slow. It is difficult to predict how fast the new systems will penetrate the market. In the study, two scenarios were calculated for each driver assistance system: the slow scenario is based on the comparatively slow penetration of the ABS system after its introduction in the 1970s; in this scenario, 20 years after introduction the new systems are found in about 40 percent of all vehicles. The fast scenario assumes more rapid penetration of the ESP system from 1995 – in this case, after 20 years the new technology is available in about 80 percent of all vehicles. The assumptions of both scenarios form the upper and lower limit of the predictive model, within which the development will take place until the year 2035.

New risks

Assistance systems and automated driving functions relieve the burden from the human driver by applying programmed algorithms. This paradigm shift in vehicle control can avoid accidents, but also entails new risks: cyber attacks on connected vehicles, misinterpretation of the traffic situation, mixed traffic between automated and conventional vehicles, defective sensors, software errors, or lack of coordination between man and machine are just a few of the numerous risks associated with the new technology. Whether and how these new dangers in road traffic will actually take place is not yet foreseen. The German insurers therefore demand that all new technical solutions for automated driving are only approved for road traffic if they are at least as safe as a human driver.

Intermediate result: Driver assistance systems and automated driving functions can only slowly reduce the damage

For each individual system the actual expected reduction in claims results from such factors as relevance, efficiency, utilization, and market penetration. In case of MTPL claims, the parking and manoeuvring assistant and emergency braking assistant have the greatest influence, but loss reduction by lane-keeping systems is significantly lower. Under motor vehicle own damage insurance, which covers damage to one's own car, the parking and manoeuvring assistant has by far the greatest influence.

As a result, the systems under review show a slow reduction in claims burden. By the end of the twenty-year review period in 2035, claims payments under MTPL claims would decrease by 12-24 percent compared to base year 2015. The effect under motor vehicle own damage losses is even lower and will amount to 6-12 percent, since partial damage is not affected by the driver assistance systems or the automated driving functions.

Insight 4: Driver assistance systems and automated driving make repairs more expensive

Since the new systems not only prevent accidents, but also require the installation of numerous sensors and new technology, the following factors must also be taken into account: In the event of an accident or repair of damaged car glass, cameras and sensors must also be replaced and the systems recalibrated. This makes many repairs more expensive. Under MTPL insurance, the repairs costs will increase by 3 to almost 8 percent by 2035, and under motor vehicle own damage insurance by around 4-10 percent.

Result: By 2035, driver assistance systems and automated driving functions will reduce passenger car damage by 7-16 percent

The combination of both effects-less damage on the one hand and more expensive repairs on the other - shows that the claims payments under the passenger cars group will be gradually reduced by up to 7 percent by 2035, in case of slow penetration of new systems, and by up to 16 percent in the case of fast penetration. This total result consists of a reduction by 10-21 percent in MTPL claims and by 3-7 percent in motor vehicle own damage losses.

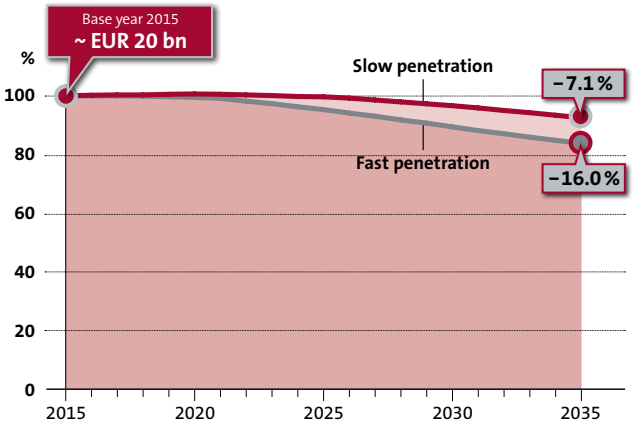
III. Conclusions & outlook

The analysis shows that driver assistance systems and automated driving functions have significant effects on claims payments. With regard to all vehicles, by 2035 the new technology can lead to a reduction in claims payments by between 7 and 15 percent, compared to the base year 2015, but this relief is not achieved in the short term, and will rather build up slowly to the end of the 20-year period. The minor effect is mainly due to consideration of the real potential of new technology and its slow penetration in vehicles.

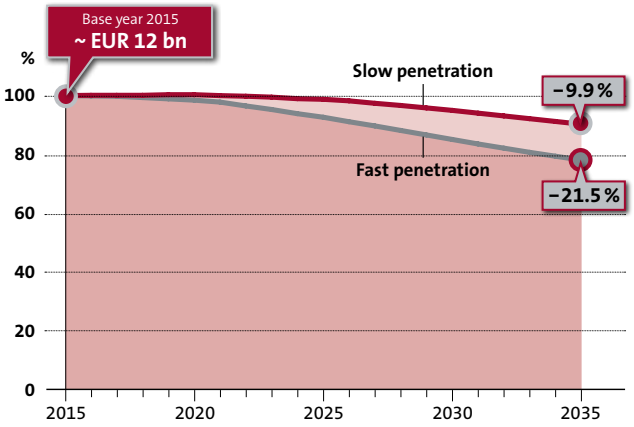
The GDV also sees two developments whose effects for the present analysis cannot be quantified and, therefore, are not taken into account in the figures: On the one hand, the automotive manufacturers and suppliers will continually improve their systems, which will have a positive effect on their efficiency and utilization. On the other hand, the cyber risks are also increasing with the digitization and networking of the vehicles: the social acceptance and market penetration of the new systems will largely depend on whether new accident patterns and losses, e.g. from cyber attacks or software errors, can be successfully avoided.

Impact of driver assistance systems and automated driving functions on losses* for passenger cars:

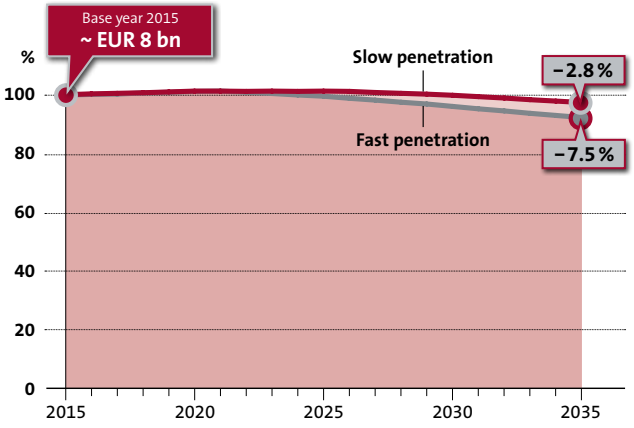
... under motor vehicle insurance in total



... under MTPL insurance



... under motor vehicle own damage insurance



* Reduction in claims payments by driver assistance systems and automated driving functions incl. increase of repair costs due to new systems and innovations in the vehicle stock; base year 2015

The methodology at a glance

Which driver assistance systems and automated driving functions were considered during the study?

For passenger cars (incl. light trucks up to 3.5 tonnes gross vehicle weight and camping vehicles) four driver assistance systems (**emergency braking assistant, parking and manoeuvring assistant, lane change assistant, lane-keeping system**) and two automated driving functions (**motorway pilot and city / rural road pilot**) were considered. Detailed information on the individual systems can be found on page 10 et seq.

As for the trucks, in addition to the above-mentioned systems, the following technologies were considered: **turning assistant system**, **ESP** which still is not widely used in the truck segment, and so-called **"platooning"** (several trucks drive at a small distance behind the leading truck). On the other hand, the introduction of city and rural road pilots for trucks was not considered - since trucks are purchased and operated in purely economic terms, the introduction of such systems is unlikely in the period under consideration, in contrast to the motorway pilots for trucks.

Which influencing factors have been taken into account for the outlook?

The result of the GDV study consists of three factors for the passenger cars:

1. **Claims payments:** Driver assistance systems and automated driving functions considered help avoid accidents and reduce losses.

2. **Repair costs:** The systems require installation of additional technology on vehicles, which cause higher repair costs in the event of damage.

3. **Vehicle stock:** The total number of passenger cars will initially rise slightly by 2025, but will drop by 1.6% by 2035 compared to the base year 2015.

As for trucks and buses, only the effects of systems on claims payments were considered. The question whether and to what extent the repair costs for trucks and buses will increase as a result of new technology, and how the vehicle stock in this group will develop, was not projected because of the lack of valid data. The study did not take into account the price development (inflation), the impact of new mobility concepts (e.g. car sharing) and new causes of accidents that could result from new technology (e.g. cyber attacks on networked vehicles, programming errors, malfunctions of sensors, effects of mixed traffic between automated and conventional vehicles).

How was the loss-preventing impact of individual systems calculated?

Four parameters were determined for each system under consideration:

1. Relevance

The relevance indicates the proportion of the total claims burden that could be maximally avoided in theory by applying the respective system. Research of the German Insurers Accident Research (Unfallforschung der Versicherer, UDV)[8] and the Allianz Centre for Technology (Allianz Zentrum für Technik, ATZ)[9] were the basis for the corresponding assumptions.

Concrete example: If parking and manoeuvring assistants could prevent all parking accidents, this would be equal to a decrease of claims payments under motor vehicle own damage insurance by 16%.

8 Hummel, T., Kühn, M., Bende, J., Lang, A.; Driver assistance systems - Determination of safety potential on the basis of claims payments of the German insurers, research report FS 03 The German Insurers Accident Research, GDV e.V.; Parking and manoeuvring accidents (Accident research No. 61), the German Insurers Accident Research, GDV e.V., October 2016.

9 Gwehenberger J., Behl T., Lauterwasser C., "How effective are driver assistance systems - from minor damage to serious accidents?" VKU - Verkehrsunfall und Fahrzeugtechnik, p. 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, as well as: Gwehenberger, J.; Borrack, M.: Impact of driver assistance systems on insured losses. VKU - Verkehrsunfall und Fahrzeugtechnik, p. 342-350, October 2015.

2. Efficiency

Efficiency leads from theory to practice. It indicates the proportion of the maximum avoidable (= relevant) damage under real conditions in road traffic. Restrictions on efficiency can arise, for example, from missing road markings, weather conditions, or as a result of construction works on motorways, especially in dangerous situations. The basis for assumptions on efficiency and utilization (see below) are the international studies on the effects of individual assistance systems and the assessments of the GDV expert group.

Concrete example: The sensors of parking and manoeuvring assistant can overlook dirty or untypical obstacles. In addition, the interaction between human and machine does not always work out. Therefore, not all theoretically conceivable savings are actually implemented, but only 70 percent of them.

3. Utilization

The degree of utilization indicates how often drivers use an existing system. *Concrete example: Many drivers will continue to park themselves in large parking spaces or in a garage at home, therefore, the parking and manoeuvring assistant is only used in 90 percent of cases.*

4. Market penetration

The new technology is only installed on new vehicles - and not always even there. The data base indicating penetration in the vehicle stock is the annual DAT report[10] (DAT: Information centre for the European automobile industry), which, among other things, documents the equipment of the vehicle stock with driver assistance systems and automated driving functions. On this basis, the study assumes two scenarios of market penetration for each system, under which newly introduced technology is available in the vehicle stock: slow penetration is based on the rate with which the ABS system has penetrated, and fast penetration corresponds to the penetration of ESP-Systems.

Concrete example: The automatic braking parking and manoeuvre assistant will be introduced in 2017. Depending on the scenario, by 2035 the system will be available in 37 or 78 percent of vehicles.

By multiplying these four parameters, we can calculate the actual expectable claims reduction. For example, the calculation for parking and manoeuvring assistant under motor vehicle own damage insurance is as follows:

Relevance	x	Efficiency	x	Utilization	x	Market Penetration	=	**Reduction**
16 %	x	70 %	x	90 %	x	37/78 %	=	**3.7/7.9 %**

How was the development of repair costs estimated?

According to the study supported by the GDV[11], driver assistance systems make the replacement of a windshield about 30 percent more expensive. In addition, the GDV assumes that the systems of appropriately equipped cars will be recalibrated after each damage, and that the radar and lidar sensors must be replaced in 10 to 20 percent of car body damage.

Due to the absence of valid data, no forecast regarding technical increase in repair costs could be given for the trucks group.

How was the passenger cars vehicle stock predicted?

The prediction of passenger car vehicle stock development is based on the study “Shell passenger car scenarios up to 2040”.

As there are no comparable studies for trucks, the vehicle stock for this group was considered as constant.

10 DAT Group: DAT Report 2016 and previous years.
11 KTI - Kraftfahrzeugtechnisches Institut und Karosseriewerkstätte GmbH & Co KG: Study of impact of electronic systems on replacement of windshields, 2015.

Parking and manoeuvring assistant

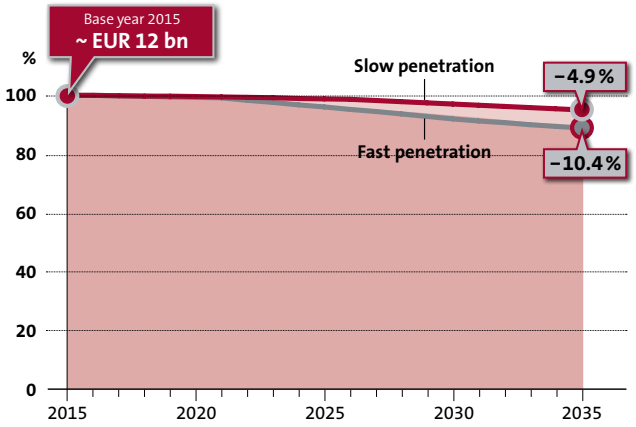
The **Parking and manoeuvring assistant** detects obstacles around the vehicle, including on the vehicle sides, and prevents collision with such obstacles by means of automatic braking. This involves lateral movement of the vehicle during steering. The parking and manoeuvring assistant is designed for use at normal manoeuvring speed; for example in a parking garage, and operates both when driving forward and in reverse.

Parking and manoeuvring assistant with these specifications will be offered for the first time in new vehicles in **2017**. Regarding the previously known and widespread parking assistants with optical and/or acoustic warning, no damage-reducing effect could be detected.[12]

	MTPL insurance	Motor vehicle own damage insurance
Relevance	21 %	16 %
Efficiency	70 %	
Utilization	90 %	
Market penetration up to 2035		
- Slow penetration	37 %	
- Fast penetration	78 %	
Reduction from 2015 to 2035		
- Slow penetration	**4.9 %**	**3.7 %**
- Fast penetration	**10.4 %**	**7.9 %**

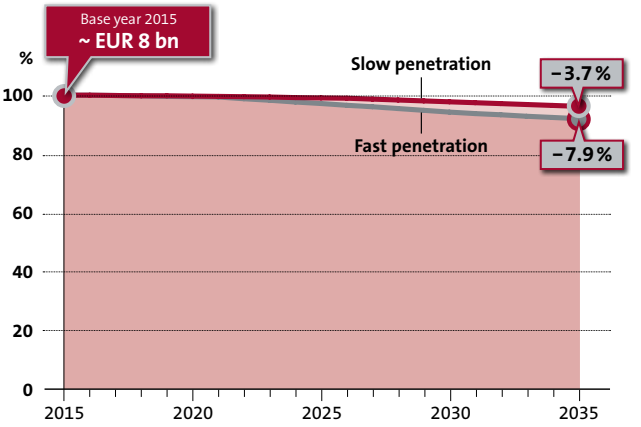
Impact of parking and manoeuvring assistant on MTPL claims, passenger cars

Development of claims payments under MTPL insurance 2015 - 2035, passenger cars only



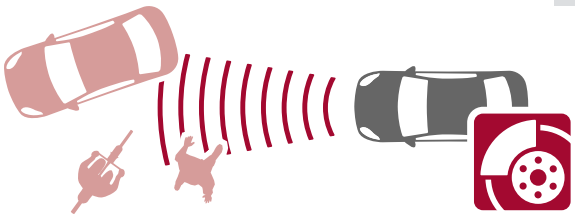
Impact of parking and manoeuvring assistant on motor vehicle own damage losses, passenger cars

Development of claims payments under motor vehicle own damage insurance 2015 - 2035, passenger cars only



12 RCAR: P-Safe Working Group: Position paper about parking and manoeuvring accidents; HUK-Coburg Press release dated April 26, 2017: Parking assistants do not reduce damage.

Emergency braking assistant



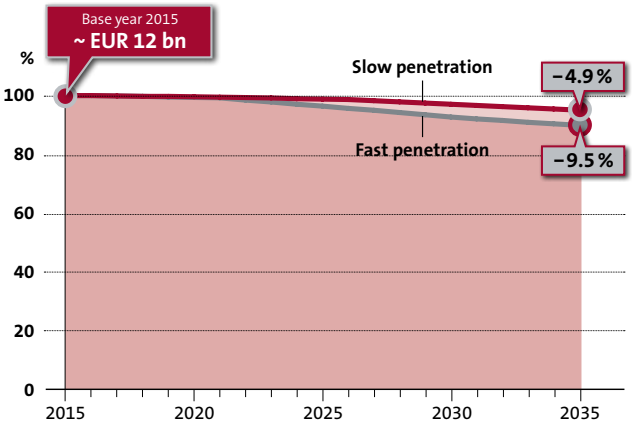
The **Emergency braking assistant** detects moving and stationary vehicles ahead, warns the driver in good time before an imminent collision and, if necessary, initiates partial or full braking to prevent the imminent collision. No limitation of the speed range is assumed. For the first time, emergency braking assistant was offered in new vehicles in 2013.

Since **2015**, installed emergency braking assistants can recognize, not only vehicles, but also pedestrians and cyclists, and react with braking in case of possible collision.

	MTPL insurance	Motor vehicle own damage insurance
Relevance (with pedestrian and cyclist detection additionally)	21 % (7 %)	7 %
Efficiency (with pedestrian and cyclist detection additionally)	40 % (10-30 %[13])	
Utilization	100 %	
Market penetration up to 2035 [14]		
- Slow penetration	49 % (43 %)	
- Fast penetration	95 % (87 %)	
Reduction from 2015 to 2035		
- Slow penetration	**4.9 %**	**1.3 %**
- Fast penetration	**9.5 %**	**2.6 %**

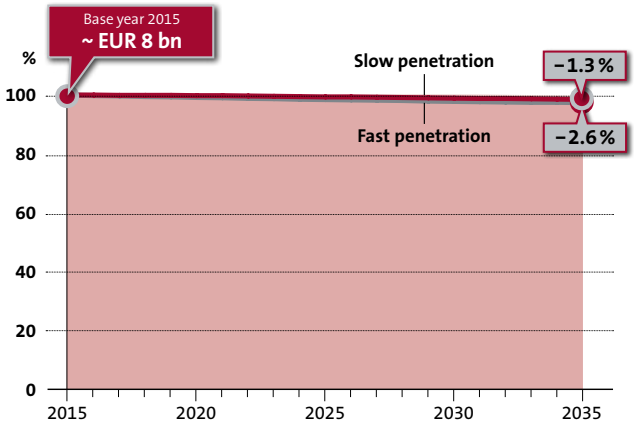
Impact of emergency braking assistant on MTPL claims, passenger cars

Development of claims payments under MTPL insurance 2015 - 2035, passenger cars only



Impact of emergency braking assistant on motor vehicle own damage losses, passenger cars

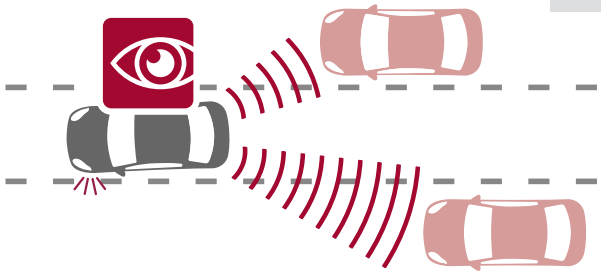
Development of claims payments under motor vehicle own damage insurance 2015 - 2035, passenger cars only



13 Assumption: The efficiency of emergency braking assistant with pedestrian and cyclist detection shall increase with time as a result of technical progress. At the moment of introduction to the market, the efficiency is 10%, and will reach 30% by the year 2030.

14 In brackets: market penetration of emergency braking assistants with pedestrian and cyclist detection.

Lane change assistant

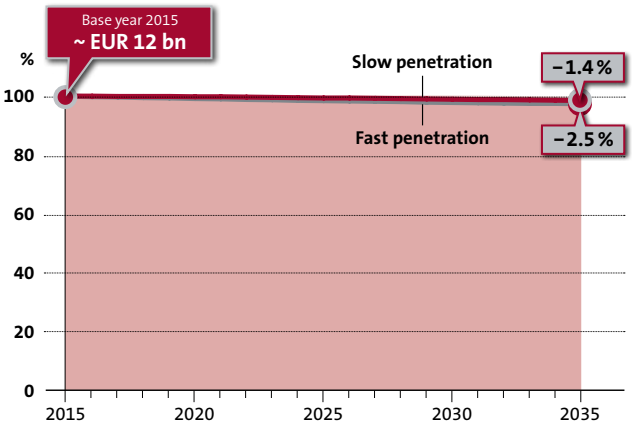


The **lane change assistant**, which was introduced in **2011**, monitors the areas on the sides and behind the vehicle (the so-called blind spots), recognizes vehicles in these areas, and informs the driver in a suitable manner. If the driver initiates a lane change although there is a vehicle in the monitored area, the driver is visually and/or acoustically warned by the lane change assistant.

	MTPL insurance	Motor vehicle own damage insurance
Relevance	4 %	2 %
Efficiency	75 %	
Utilization	90 %	
Market penetration up to 2035		
- Slow penetration	55 %	
- Fast penetration	97 %	
Reduction from 2015 to 2035		
- Slow penetration	**1.4 %**	**0.7 %**
- Fast penetration	**2.5 %**	**1.2 %**

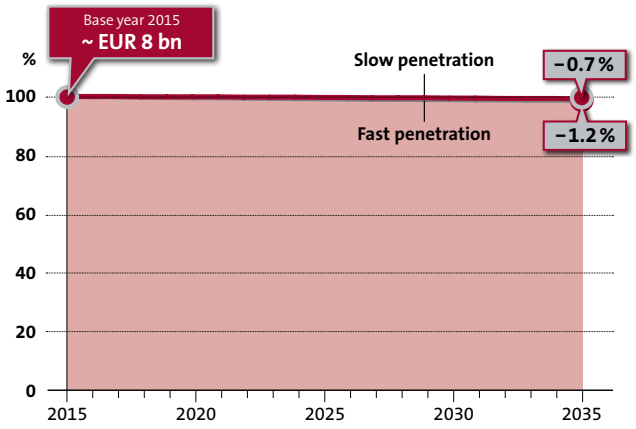
Impact of lane change assistant on MTPL claims, passenger cars

Development of claims payments under MTPL insurance 2015 - 2035, passenger cars only

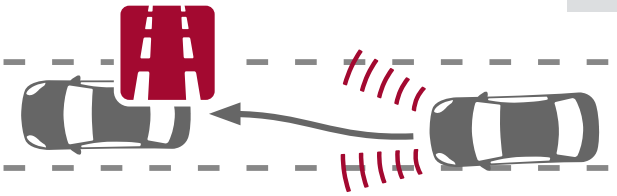


Impact of lane change assistant on motor vehicle own damage losses, passenger cars

Development of claims payments under motor vehicle own damage insurance 2015 - 2035, passenger cars only



Lane-keeping system



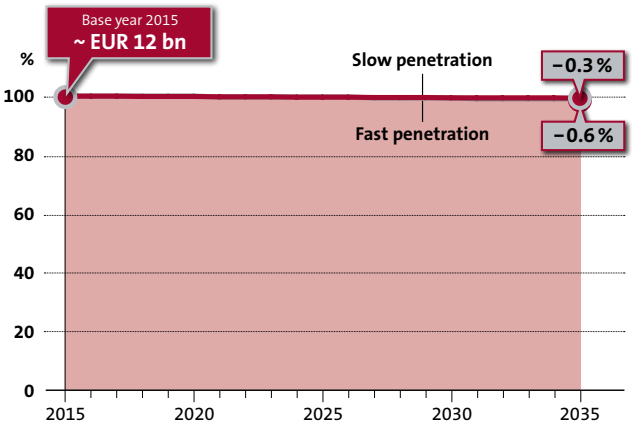
The **lane-keeping system** detects road markings on the right and left side of the vehicle with its sensors and determines the position of the vehicle in its lane. If the vehicle approaches the limits of the lane, or crosses them without turning on the indicator, the driver is first warned visually, and then acoustically or haptically. If the driver continues to approach the limits of the lane despite the warning, the vehicle is placed in the centre of the lane by braking or steering.

Such systems have been available in new vehicles since **2010**. In further configurations, the vehicle is held in its lane by automatic steering intervention so that the driver can take his hands off the steering wheel for a short period of time. In order to ensure that the driver remains responsible, he is asked to take over the steering wheel after a few seconds

	MTPL insurance	Motor vehicle own damage insurance
Relevance	3 %	2 %
Efficiency	20-40 %[15]	
Utilization	50 %	
Market penetration up to 2035		
- Slow penetration	57 %	
- Fast penetration	98 %	
Reduction from 2015 to 2035		
- Slow penetration	**0.3 %**	**0.2 %**
- Fast penetration	**0.6 %**	**0.4 %**

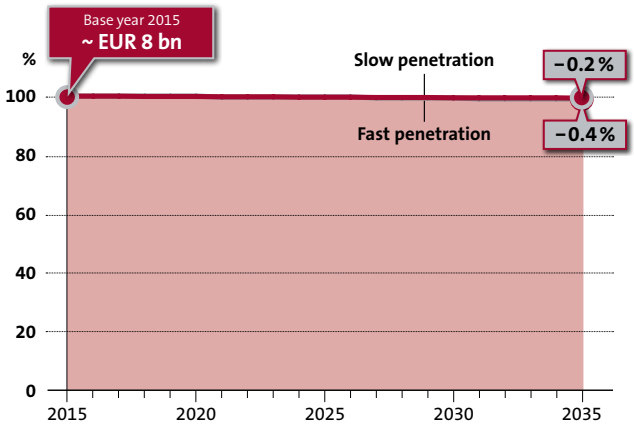
Impact of lane-keeping system on MTPL claims, passenger cars

Development of claims payments under MTPL insurance 2015 - 2035, passenger cars only



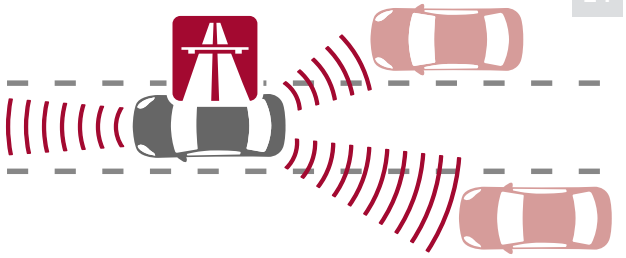
Impact of lane-keeping system on motor vehicle own damage losses, passenger cars

Development of claims payments under motor vehicle own damage insurance 2015 - 2035, passenger cars only



15 Assumption: The efficiency of lane-keeping systems shall increase during the course of time due to technical progress and/or further modifications. In 2015 the efficiency is 20%, and will reach 40% by the year 2030.

Motorway pilot



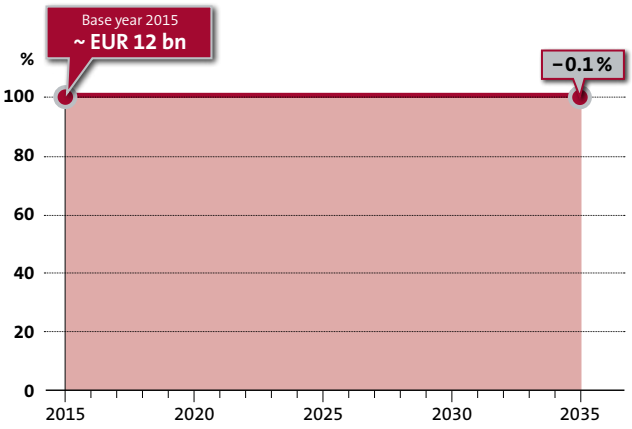
The **motorway pilot** is an automated driving system for motorways or motorway-like roads. Due to restrictions on such roads, control of cross traffic is not required. The first motorway pilot, which is initially designed up to a speed of 60 km/h only, will be introduced in **2017**. The driving task is returned back to the driver with sufficient lead time, for example, before leaving the motorway or near road works.

The motorway pilot is a combination of emergency braking assistant, lane change assistant, and lane-keeping system. In addition, there must be an adaptive cruise control system installed in the vehicle. The low additional damage-reducing effect of the motorway pilot results from an increase in the overall efficiency of the systems up to 90 %.

	MTPL insurance	Motor vehicle own damage insurance
Additional Relevance	–	–
Efficiency	90 %	
Utilization	10-50 %[16]	
Market penetration up to 2035	37 %	
Additional Reduction from 2015 to 2035	**0.1 %**	**0.0 %**

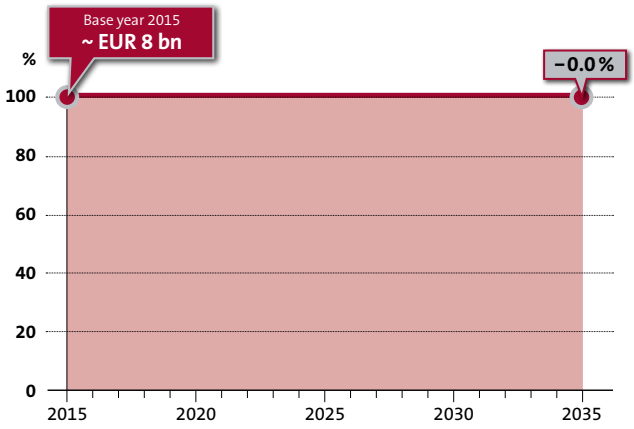
Impact of motorway pilot on MTPL claims, passenger cars

Development of claims payments under MTPL insurance 2015 - 2035, passenger cars only



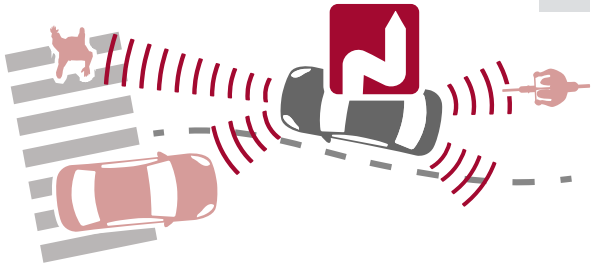
Impact of motorway pilot on motor vehicle own damage losses, passenger cars

Development of claims payments under motor vehicle own damage insurance 2015 - 2035, passenger cars only



16 Assumption: The use of motorway pilot by drivers shall increase in the course of time. At the moment of introduction to the market, the utilization is 10%, and will reach 46% by the year 2035.

City and rural road pilot



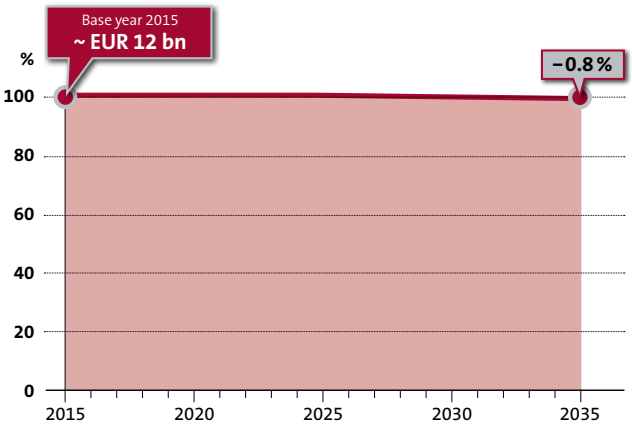
The **city and rural road pilot** is an automated driving function for city and rural roadrural roads. The prerequisite is the safe detection of all other traffic participants (incl. pedestrians and cyclists) in the entire vehicle environment, and all relevant traffic information with the on-board sensors, and, if applicable, exchange of such information with other traffic participants (near field communication) or the infrastructure. The GDV expert group assumes the market introduction of such systems by the year **2025**.

This pilot is a combination of emergency braking assistant, parking and manoeuvring assistant, lane change assistant, and lane-keeping system. In addition, there must be an adaptive cruise control system installed in the vehicle. The low additional damage-reducing effect of the city and rural road pilot results from an increase in the overall efficiency of the systems up to 90 %.

	MTPL insurance	Motor vehicle own damage insurance
Additional Relevance	–	–
Efficiency	90 %	
Utilization	10-50 %[17]	
Market penetration up to 2035	13 %	
Additional Reduction from 2015 to 2035	**0.8 %**	**0.3 %**

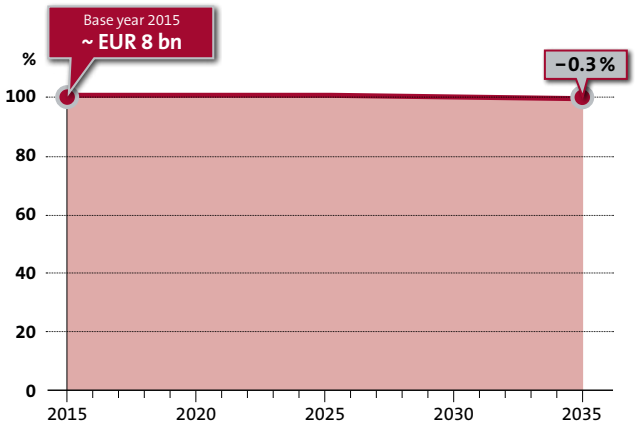
Impact of city and rural road pilot on MTPL claims, passenger cars

Development of claims payments under MTPL insurance 2015 - 2035, passenger cars only



Impact of city and rural road pilot on motor vehicle own damage losses, passenger cars

Development of claims payments under motor vehicle own damage insurance 2015 - 2035, passenger cars only



17 Assumption: The use of city and rural road pilot by drivers shall increase in the course of time. At the moment of introduction to the market, the utilization is 10%, and will reach 30% by the year 2035..