Chassis Systems Control

Solutions for increased safety, comfort and agility

BOSCH

Invented for life

Innovations from Bosch have shaped the automobile as we know it today and will continue to do so in the future – a future in which sustainable and low-emission mobility is more important than ever. Although the combustion engine is likely to continue to dominate the industry for many years to come, alternative technologies, such as hybrid and electric drives, are gaining in importance. Regardless what technology powers the vehicles of the future, it must ensure a safe, relaxed and comfortable driving experience. This is another major area of innovation for Bosch. In line with the slogan “Invented for life”, Bosch will continue to supply systems that make personal mobility safer, cleaner and more economical.

Content

Our contribution toward greater safety and comfort in road traffic

Our products have been helping to reduce accidents and the risk of injury for many decades. However, we want to take the already high safety standards to the next level, which is why we are focusing our efforts on the development and intelligent networking of safety and assistance systems.

We aim to implement new functions to reduce the number of accidents, improve the protection available to vehicle occupants, pedestrians and other road users, increase comfort, and improve driving dynamics. Our technology will be utilized to reduce the severity of accidents in the mid-term. Our long-term objective is to see the implementation of technology that reduces accidents caused by driver error.

If we are to reduce the number of accidents by a significant amount, available safety systems need to be included in as many vehicle classes as possible. We not only support technological innovation, but also the development of safety systems that can be made available to everyone. We are continually enhancing systems that have already proven successful. Take ESP®, for example, which now costs just 25 percent of a first-generation system. Thanks to technical innovations, our components and systems are also becoming smaller and lighter, while at the same time more powerful. As a result, we are also helping to reduce the weight of vehicles and therefore lower fuel consumption and vehicle emissions.

Bosch accident research for increased safety

An important starting point for the development of safety systems and functions at Bosch is our central accident research center. Here, we analyze international traffic and accident data to help us calculate the benefits of new functions before they are incorporated in vehicles. By carefully evaluating this information, it is possible to reconstruct the cause and sequence of an accident. This means that new systems can be developed or existing systems optimized to combat potential accident risks, thus considerably improving road safety.

Assistance systems, which aid the driver, and safety systems, which help to prevent accidents or lessen the severity of accidents in critical situations, can significantly reduce the number of injuries and fatalities as a result of road traffic accidents, consequently reducing the financial burden. It is our aim to develop cost-effective solutions for the functions with the greatest expected benefit and to put them into mass production.

Active safety systems **help to prevent accidents**

Active safety systems contribute toward road safety by providing safe, quick and reliable braking actions. As soon as a critical driving condition is detected using data sent by sensors, the active safety systems pinpoint the vehicle dynamics to guide them and restore the stability of the vehicle.

Active safety systems:
- ▶ Brake booster
- ▶ Master cylinder
- ▶ iBooster
- ▶ Antilock braking system
- ▶ Traction control system
- ▶ Electronic stability program*

* Electronic stability program (ESP®) is also known as electronic stability control (ESC)

Active safety systems **enable safe and reliable braking**

The braking system is one of the most important pieces of safety equipment in a vehicle. The components in the braking system convert the brake force applied by the driver into the required braking effect in an optimal way, ensuring the vehicle is decelerated safely and comfortably.

Regenerative braking systems increase the range of electric vehicles and lower the consumption of hybrid vehicles.

Bosch offers products that generate and distribute brake pressure, including brake boosters and master cylinders. What's more, we are also one of Europe's largest suppliers of brake disks.

To make cars more environmentally friendly and efficient, we are working on new braking concepts for current and future drive systems. For hybrid and electric vehicles, we are developing regenerative braking systems that take the energy generated during braking and reuse the stored energy to its maximum possible effect. By using alternative materials, we can reduce the weight of the brake system and brake disks, thereby enhancing the driving dynamics and cutting CO_2 emissions.

Brake boosters: less effort for a more comfortable pedal feel

Vacuum brake boosters amplify the power exerted by the driver's foot when depressing the brake. Amplifying this power reduces the amount of force that needs to be applied by the driver. Bosch offers scalable solutions for brake boosters in single and tandem designs. These solutions not only cover requirements demanded by braking performance and the space available in the vehicle – they also deliver a pedal feel that can be adapted to be in tune with the vehicle's characteristics, thus enhancing the comfort.

In vehicles equipped with antilock braking systems, the mechanical brake assist supports drivers when they need to apply the full brakes, suddenly.

Master cylinders: saving space and enhancing safety

Master cylinders convert the pressure applied by the driver's foot and amplified by the brake booster into hydraulic pressure. The cylinder converts this pressure by feeding brake fluid into the braking circuits and controlling this process. The latest generation of Bosch master cylinders is approximately 30% shorter and around 20% lighter than conventional master cylinders. These reductions mean that the master cylinder not only saves on space, but also helps save fuel thanks to its low weight.

iBooster: dynamics and safety – not just the domain of electric and hybrid vehicles

In contrast to conventional combustion engines, electric motors do not produce a vacuum; however, one is needed for a vacuum brake booster. The electromechanical iBooster works independently from external vacuum generators and is therefore ideal for electric and hybrid vehicles. The iBooster offers great pressure build-up dynamics, a high degree of pressure control accuracy and is extremely quiet. When combined with driver assistance systems, the iBooster is the solution to meet the demands required for braking dynamics, safety and comfort.

Active safety systems **stabilize the vehicle in critical situations**

Bosch's market launch of the antilock braking system (ABS) for cars in 1978 represented a milestone in the development of active safety systems. The technology was groundbreaking and paved the way for all modern brake control systems. The function of ABS has been enhanced over the years: in 1986 the traction control system (TCS) was added and in 1995 the electronic stability program (ESP®). Once again, these systems were innovations from Bosch.

Bosch has been producing antilock braking systems for motorcycles since 1995. The launch of motorcycle stability control (MSC) in 2013 marked an important milestone on the road to improve driving safety for two-wheelers. For the first time, this brake control system is able to provide the best possible stability in all driving situations. MSC supports the rider during braking and accelerating, while driving in a straight line, and while riding in a curve.

The electronic stability program from Bosch counteracts skidding.

Antilock braking system (ABS): braking without wheel lockup

In critical driving situations, such as on wet or slippery surfaces, the wheels may lock during braking. The vehicle can no longer be steered and can become unstable. ABS detects the tendency of one or more wheels to lock at an early stage and adjusts the brake pressure accordingly. This enables the driver to steer around obstacles even during full braking, and to slow down or stop the vehicle quickly and safely.

Particularly in the case of motorcycles, locked wheels can cause dangerous instability. Motorcycle ABS helps the rider to brake safely, thereby reducing the risk of falling.

Traction control system (TCS): acceleration without wheel spinning

The traction control system extends the ABS functions. When setting off and accelerating, TCS prevents the drive wheels from spinning by acting on the engine and, if necessary, by braking the spinning wheel. In this way, the system enables optimum acceleration, even in adverse driving conditions, such as slippery or wet roads. It improves traction and increases vehicle safety by preventing unstable driving conditions.

Electronic stability program (ESP®): prevents skidding

The electronic stability program (ESP®) incorporates the functions of ABS and TCS. In addition, it detects the onset of a skidding risk at an early stage and counteracts it through targeted braking and engine control interventions.

According to international research, ESP® can prevent up to 80% of all skid-related accidents. It is the most important life saver after seatbelts.

Value-added functions expand the potential of ESP®

ESP® also features value-added functions that further increase driving safety and comfort. These include, for example, hill hold control, which makes it easier to start on an incline, or load adaptive control, which adapts the ESP® interventions and the ABS and TCS function to the vehicle load in light commercial vehicles.

When using a towing vehicle and trailer, trailer sway mitigation uses ESP® sensors to detect if the trailer is swaying from side to side. It then brakes the towing vehicle using specific interventions to mitigate this motion.

Passive safety systems
limit the severity of accidents

When a crash cannot be prevented, safety systems, such as airbags and seatbelts, offer the best possible protection for vehicle occupants. They keep the accelerations and forces acting on occupants in the event of an accident as low as possible, thereby reducing the severity of injuries. Passive safety systems also reduce the risk of injury for pedestrians and cyclists in the event of a vehicle collision.

Passive safety systems:

- Occupant protection
- Pedestrian protection
- Electronic pedestrian protection
- Early pole crash detection
- Advanced rollover sensing
- Secondary collision mitigation

Passive safety systems **protect vehicle occupants and pedestrians**

As early as 1980, Bosch became the world's first provider to launch a central sensing electronic occupant protection system for airbag deployment. In the 1990s, this system was expanded to include side impact detection. In 1988, Bosch was the first provider to launch an electronic rollover detection system for convertibles. This technology has now also found its way into hardtop vehicles.

In the event of a collision, the electronic pedestrian protection system offers pedestrians a more effective crumple zone, thereby reducing the risk of injury.

Occupant protection

The occupant protection system from Bosch consists of peripheral acceleration and pressure sensors and an intelligent centerpiece – the airbag control unit. Based on the sensor signals, it detects the strength and direction of a collision and can activate the restraint mechanisms in the vehicle, for example, seat-belt pretensioners and airbags, as required for maximum occupant protection. This optimizes the protection of vehicle occupants against injuries in front, side and rear-end collisions, as well as if the vehicle rolls over.

Pedestrian protection

Pedestrians and cyclists are particularly at risk in traffic, a fact reflected in the high proportion of road deaths among these groups. In order to reduce this figure, legislation for pedestrian protection is planned or already in force in some countries. The aim is to provide a crumple zone to absorb some of the impact in the event of a collision with a pedestrian, so as to minimize the risk of injury.

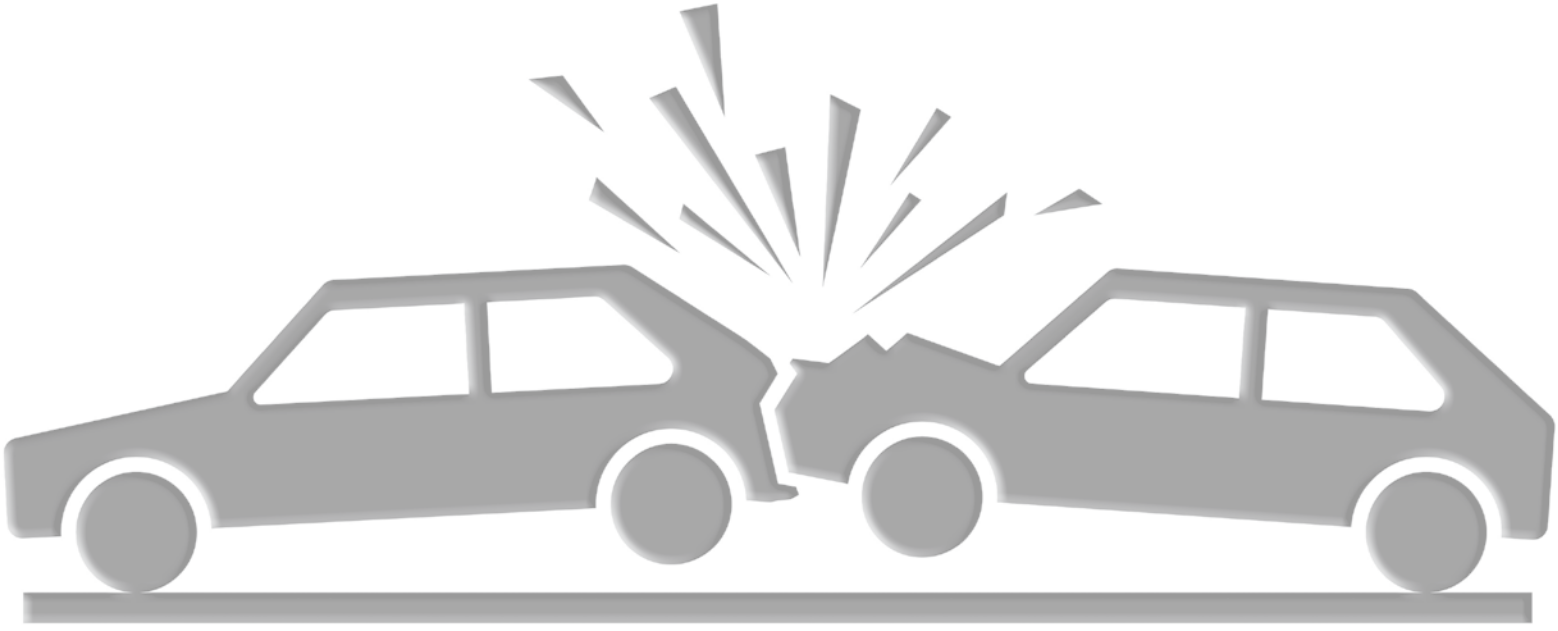
In order to ensure that collisions with pedestrians are not even a possibility, we work with video-based, predictive systems with pedestrian detection and automatic emergency braking. These systems can help prevent collisions with pedestrians or reduce the vehicle speed as much as possible prior to impact, thereby reducing the risk of serious injury.

Electronic pedestrian protection: an electronic guardian angel for pedestrians

Bosch's electronic system for active impact protection for pedestrians is a safe and cost-effective solution, which fulfils the legal requirements for pedestrian protection on vehicles. The system consists of peripheral sensors in the front part of the vehicle and the airbag control unit, which triggers actuators that can, for example, lift the engine hood within a fraction of a second. This allows for the pedestrian to impact against a more effective crumple zone, thereby minimizing the risk of injury.

Passive safety systems
detect imminent accidents earlier

Networking the airbag control unit to the electronic stability program (ESP®) and/or the surround sensors creates new functions that can detect an imminent accident at an earlier stage. As a result, the time required to trigger the restraint systems can be reduced by milliseconds. Protection of vehicle occupants can therefore be optimized – even before the collision occurs.



The advanced rollover sensing function can detect the risk even before the vehicle rolls over and is therefore able to trigger the occupant protection systems earlier.

Early pole crash detection: improves side impact protection

Side crashes expose the occupants to the highest risk of injury, particularly when crashing with a tree or pole. In this case, it is vital to detect the crash as quickly as possible and to deploy the side airbags.

The early pole crash detection function uses sensor signals from ESP® to detect critical lateral motion of the vehicle and to prepare the airbag control unit for possible side impact. Should this actually occur, the side and head airbags can be triggered earlier than previously possible, thereby significantly improving their protective function.

Advanced rollover sensing: protects in the event of vehicle rollover

Many crashes resulting in passenger fatalities involve the vehicle rolling over.

The advanced rollover sensing function not only uses data provided by the rollover sensor in the airbag control unit, but also data from ESP®. By analyzing vehicle movements, the airbag control unit can recognize critical driving situations before a rollover begins. This allows the function to trigger the antiroll bar, seatbelt pretensioners or side and head airbags valuable fractions of a second earlier.

Secondary collision mitigation: decelerating the vehicle after initial collision

In the case of accidents, secondary collisions can often occur after the initial collision because the driver has lost control of the vehicle. This endangers both the vehicle occupants and other road users.

The secondary collision mitigation function is specifically designed for such accidents. In the event of a collision, the airbag control unit forwards this information to the ESP® control unit. ESP® slows down the vehicle through targeted intervention in the brakes or engine, bringing it to a standstill when required. This can help to avoid or reduce the severity of subsequent collisions.

Driver assistance systems **enable safe, relaxed driving**

Driver assistance systems record the vehicle's surroundings using sensors, such as radar, video and ultrasound, and interpret the information. They enhance driving comfort by taking over monotonous and tedious driving tasks from drivers. Additionally, these systems increase comfort and road safety by supporting drivers in complex or critical situations requiring quick and safe action.

Today's and future driver assistance systems combine information from different sensors in the vehicle. By intelligently fusing data from the incoming sensor information, the benefits of various sensor principles are used to optimum effect. This fusion yields more detailed information about the vehicle's surroundings than would be possible with individual sensors.

Driver assistance systems:

- Adaptive cruise control
- Road sign assistant
- Driver drowsiness detection
- Rear cross traffic alert
- Parking aid
- Parking assistant
- Automatic park assist
- Near-range camera
- Valet parking
- Intelligent headlight control
- Lane departure warning
- Lane keeping support
- Lane change assist
- Predictive emergency braking system

Driver assistance systems **increase driving comfort**

Driving long distances, driving in heavy traffic or maintaining a safe distance to the preceding vehicle requires a high level of concentration and can be tiring over prolonged periods of time. Driver assistance systems support drivers with these tasks, thereby enhancing comfort and safety when driving.

Adaptive cruise control (ACC): adapts the speed in line with the flow of traffic

ACC, the adaptive distance and speed control system, actively assists the driver in keeping a safe distance from the vehicle in front.

While driving, ACC maintains the speed set by the driver and can automatically adapt this speed to changing traffic by throttling back, braking or accelerating. The ACC Stop & Go version can bring the vehicle to a standstill and will resume automatically when instructed by the driver.

Road sign assistant: can display road signs in the vehicle dashboard

When the system detects relevant road signs with the help of a video camera, it displays them on the dashboard display.

Additionally, the display can implement warning functions, for situations such as exceeding the speed limit, attempting to pass another

Backing out of a parking space without a clear line of vision is not only stressful, but dangerous. Rear cross traffic alert technology eliminates driver stress by detecting traffic that crosses the vehicle's path and signaling a warning to the driver if a dangerous situation may occur.

vehicle where there are restrictions, and when driving through a stop sign or no entry sign. The road sign assistant works alongside the vehicles navigation system to accurately determine if the recognized road sign is relevant to the driver.

Driver drowsiness detection: can detect the onset of drowsiness

Monotonous driving, for example, on the freeway, is tiring and can quickly lead to a drop in concentration. Based on steering-angle data, the driver drowsiness detection function continuously analyzes the driver's steering behavior to identify phases during which the driver does not steer for a brief moment but then suddenly corrects – often a sign of failing concentration and the onset of tiredness. The function combines the frequency and strength of these reactions with other data such as vehicle speed, time of day and use of blinking patterns to calculate a tiredness index. If this index exceeds a predefined value, the driver is warned by a visual and/or audible signal that he/she is tiring and risks nodding off at the wheel.

When using this system in conjunction with a navigation system, the nearest location can be displayed where the driver can take a break, such as a parking area or roadside stop.

Rear cross traffic alert: warning of vehicles crossing when backing out of a parking space

Backing out of a parking space at right angles to the traffic can sometimes be a challenge – especially if the driver cannot see the crossing vehicles behind his or her own vehicle. Rear cross traffic alert makes backing out of parking spaces set perpendicular to the road easier. If vehicles crossing to the left or right behind the driver's vehicle are detected, the function issues an audible and/or visual warning to alert the driver of any impending risk of collision.

Traffic jam assist: can guide the vehicle automatically in traffic jams

Traffic jam assist helps drivers arrive more relaxed at their destination, even in dense traffic or in traffic jams. The partially automated system allows the vehicle to brake, accelerate, and stay within its lane automatically. The system requires the driver to be ready to take back control of the vehicle at any time. In the future, traffic jam assist will be able to function at higher speeds and in more complex driving situations, including automatically changing lanes. Systems such as traffic jam assist are paving the way, step by step, to fully automated driving.

Driver assistance systems **enable convenient and safe parking and maneuvers**

For many drivers, parking is stressful. There is often restricted vision inside the vehicle, little room to maneuver, tight spaces, and frantic traffic conditions making parking not only a difficult, but dangerous task. Park assist systems relieve driver stress by determining the maneuvers needed in order to park safely and comfortably.

As technology advances, vehicles will be able to park without driver supervision.

Parking aid: can warn of surrounding obstacles while parking
Using ultrasonic sensors integrated into the vehicle's bumper, the system monitors the area immediately ahead of and/or behind the vehicle, and recognizes obstacles in real time. If an object is detected, the system sends a signal to the driver indicating the distance of that object.

Parking assistant: guides the vehicle into a suitable space
An ultrasonic sensor integrated into the side of the front bumper scans the side of the road to detect a suitable parallel or perpendicular space. Once a parking space is detected, the system alerts the driver. If the driver activates the assistant, the system calculates the best possible path into the space as well as the necessary steering maneuver. Once complete, the parking assistant takes control by allowing the driver to let go of the steering wheel and only control the parking maneuver by accelerating and braking.

The automatic parking assistant technology enables automatic parking for pulling into and out of a selected parking space. The driver has the option to remain inside the vehicle as it parts or observe outside the vehicle by remote control.

The assistant also helps with pulling out of the parking space. Parking assistant technology takes control of all steering maneuvers in order to direct the car into a position from which the driver can safely pull out of the space.

Automatic park assist: can automatically move the vehicle into and out of parking spaces

The system enables automatic parking for pulling into and out of selected parking spaces. Drivers have the option to remain in the car or get out ahead of time while the vehicle parks itself. Even spaces so tight that the car doors will barely open will soon be no hindrance. In this case, drivers can get out of their car, in front of the selected space, and start the parking maneuver remotely, by pressing a button on their car key or smartphone. The vehicle then parks and pulls itself out of the space on its own, without the need for anyone at the wheel. The driver remains responsible at all times for monitoring the vehicle's surroundings. The parking maneuver only continues as long as the driver presses the button on the remote key.

Near-range camera: a new perspective on parking and maneuvering

Modern vehicles often offer the driver only a limited view of the car's surroundings. Increasingly smaller side and rear windows, combined with a vehicle shape that is strongly influenced by aerodynamics and pedestrian protection, is making safe and precise maneuvering extremely difficult. A near-range camera located in the back of the vehicle assists drivers reversing by displaying the image onto the vehicles dashboard. The camera in the vehicle's rear is automatically activated when reverse gear is engaged and allows the driver to determine in real time whether the path is clear. Optionally, the vehicle's path can be shown dynamically on the camera image with the help of colored lines. These display the vehicle's trajectory according to the current steering wheel angle and indicate when the steering wheel must be turned.

Valet parking: the vehicle navigates automatically to the desired parking space

In the future, "valet parking" solutions will completely relieve drivers of the search for parking spaces and the tasks of parking and pulling out. The vehicle will receive information on any free parking spaces as it approaches a parking garage. Once a parking space is determined, the driver is able to stop the car at the entrance and get out. After the function has been activated, the vehicle will drive itself to the designated parking space, and when requested by the driver, also drive itself back out to a designated pick-up spot.

Driver assistance systems **improve vision in the dark**

A camera-based headlight controller increases the driver's field of vision without blinding other road users. The improved vision makes driving at night much safer and more comfortable.

Intelligent headlight control: ensures optimum illumination of the road

The intelligent headlight control uses a video camera to measure the ambient brightness and to estimate the distance from vehicles in front and oncoming traffic. This data is used to implement a variety of light functions.

The low beam activation function can automatically activate or deactivate the vehicle's low beam lights in accordance with the current lighting conditions. High beam control improves driver visibility at night by automatically controlling the on/off function of the vehicle high beams through traffic detection.

Intelligent headlight control ensures optimum illumination of the road at all times without distracting other road users.

Using video data, the range of the low beam or high beam lights can also be automatically adjusted. The adaptive low beam control function can constantly adapt the level of the low beam lights to the contours of the road. Particularly in the case of inclines or bumpy road surfaces, this ensures that the road remains well illuminated without blinding other drivers.

The adaptive high beam control not only controls the range or segmentation of the light, but also the width of the beam according to traffic conditions. This can illuminate curves in advance or a wider light cone, which can effectively illuminate the edges of the road in urban areas, ultimately helping the driver to spot any potentially vulnerable pedestrians.

With continuous high beam control, the driver can leave the high beam on continuously without disturbing other vehicles. It uses headlights that are swivel-mounted horizontally and vertically or full LED headlights in which the entire light distribution is controlled in segments so that road users who could potentially be distracted are not exposed to the light cone while the remainder of the area can be optimally illuminated by the high beam. The light distribution from the high beams remain virtually unchanged for opposing vehicles, while the drivers visual range is considerably increased.

Driver assistance systems **help drivers stay in and change lanes**

Even just a momentary lapse in concentration can cause the driver to unintentionally stray from the lane. During overtaking maneuvers and lane changes, vehicles in the driver's blind spot are an especially high-risk factor – even if the driver checks his side mirror.

Lane change assist warns drivers if there are vehicles in an area critical to changing lanes.

Lane departure warning: warns of unintentional straying from the marked lane

The lane departure warning function uses a video camera to detect lane markings ahead of the vehicle and to monitor the vehicle's position within the lane. When the system detects that the vehicle is about to leave its lane unintentionally, it warns the driver by means of an audible, visual and/or tactile signal, for example, through a vibration in the steering wheel. These warnings alert the driver that the vehicle is drifting off course, allowing him/her to countersteer accordingly. When the driver activates the turn signal before a lane change, the function does not issue a warning.

Lane keeping support: actively assists the driver to remain in the marked lane

The lane keeping support function also uses a camera to detect lane markings in front of the vehicle. When the system detects that the vehicle is not maintaining a minimum distance from the lane marking, the system gently but noticeably countersteers to keep the vehicle in the lane. The driver is always responsible for the control of the vehicle and can override the countersteering at any time. When the driver activates the turn signal before a lane change, the function does not intervene.

Lane change assist: warning against impending collisions when changing lane

Lane change assist can prevent critical situations from occurring when changing lanes, thereby reducing the risk of accidents. The system works by using radar sensors that monitor the areas next to and diagonally behind the vehicle. When the lane change assist system detects vehicles in the driver's blind spot or approaching rapidly from the rear, it gives the driver a visual warning, for example, an illuminated symbol in the area of the side mirrors. When the driver activates the turn signal to indicate a lane change, the system can also give an audible and/or tactile warning to make the driver aware of potential hazards.

Driver assistance systems **assist the driver in the event of impending rear-end collisions**

Collisions are typically the result of a moment's inattention or the misjudgment of a critical situation: fumbling for something in the glove compartment or having an animated discussion with a passenger is often enough to distract the driver briefly from what is happening on the road ahead.

Predictive emergency braking system
In critical situations, seconds are critical in determining whether a collision is avoidable. The predictive emergency braking system is based on the networking of surround sensors with the electronic stability program (ESP®) and supports the driver in avoiding an impending collision with a vehicle or any potentially vulnerable road users or, at minimum, reducing the consequences of the accident.

A predictive emergency braking system helps to significantly reduce the risk and consequences of collisions with vehicles or other potentially vulnerable road users.

At speeds above 30 km/h (18 mph)
If the predictive emergency braking system detects that the distance to a relevant obstacle is becoming critically close at a vehicle speed over 30 km/h (18 mph), it prepares the braking system for a potential emergency braking procedure. If the driver fails to react to the critical situation, the system warns the driver by means of a visual and/or audible signal followed by a brief but clearly perceptible brake jerk.

Following the collision warning, the emergency braking system can initiate partial braking in the detected rear-end collision situation. This intervention decelerates the vehicle and gives the driver more time to react.

As soon as the driver presses the brake pedal, the system provides braking support. To do this, the system continuously calculates the degree of vehicle deceleration needed to avoid the collision. When the emergency braking system detects that the driver is not braking hard enough, it increases the braking pressure to the required level so that the driver can attempt to bring the vehicle to a standstill before a collision occurs.

Should the driver fail to react at all to the immediate risk of collision and the system assesses the collision to be unavoidable, it initiates full braking in order to mitigate the consequences of the crash.

At speeds below 30 km/h (18 mph)
Many rear-end collisions occur at speeds below 30 km/h (18 mph), such as while driving in city centers or in slow-moving traffic. Fortunately, the consequences of such crashes are usually limited to bodywork damage, but in some cases, expensive repairs still may be required.

If the predictive emergency braking system detects that the distance to a relevant obstacle is becoming critically close at a vehicle speed under 30 km/h (18 mph), it prepares the braking system for a potential emergency braking procedure. If the driver fails to react to the dangerous situation, the system can automatically trigger full braking to prevent a collision. If the rear-end collision is unavoidable, this action can at least minimize the severity of the collision, reducing the risk of injury to everyone involved.

Protecting potentially vulnerable road users
Consumer protection organizations such as the NCAP (New Car Assessment Program) take accident-prevention systems into account in their vehicle assessments, making these organizations an important driving force behind greater road safety. As of 2016, comprehensive, predictive pedestrian protection is a prerequisite for being awarded Euro NCAP's highest score of five stars.

Perspectives of automated, connected mobility

Vehicles will be facing major changes in coming years. Partially automated systems, which take control of driving tasks, are already available (e.g. traffic jam assist). In the future, even more powerful systems will provide drivers with ever greater support, paving the way, step by step, to fully automated driving.

Being able to reliably locate the vehicle based on digital maps and precise GPS tracking data is a key requirement to achieving this state. The second prerequisite is the interaction of different sensors, such as radar, ultrasound and camera, in order to detect all vehicles and objects in the immediate vicinity. Another essential feature is connecting the vehicle to the outside world – the surroundings, transport infrastructure and internet. By having this connection, future vehicles will be able to communicate with traffic lights and interact with other vehicles, thereby allowing drivers to get up-to-date information about traffic conditions, such as road works, or the end of a traffic jam behind a bend. Drivers can also receive advanced warning of critical weather situations, such as fog or black ice.

New traffic services and systems provide a precise preview of the current traffic situation, accurate information on the course of the road and route topography. The “connected vehicle” makes it possible to provide drivers with enhanced or new services that represent a direct added value.

Experts today agree on one thing: connecting vehicles to each other and to the transport infrastructure will be the driving force to boosting road safety and traffic efficiency over the coming years.

For all the potential there is in such applications, it is also still important to sustainably change the driver’s workplace. Convenient human-machine interfaces (HMI) that can be intuitively operated make it possible to clearly structure and manage the widely diverse range of information available. They take the stress and strain off the driver in accepting and using many different types of information by providing easy-to-use head units and display systems, which are operated using natural gestures and voice control without distracting drivers.

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DECADE OF ACTION FOR ROAD SAFETY 2011-2020

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Road traffic crashes take the lives of nearly 1.3 million people every year, and injure millions more. The goal of the Decade of Action for Road Safety is to stabilize and reduce the number of lives lost by 2020, ensuring that the vision of a world in which mobility is safe for all who use the world's roads becomes a reality.
www.decadeofaction.org