VIAVISION

VOLKSWAGEN SHAPING THE FUTURE OF MOBILITY

Assistance Systems

Small Helpers, Big Effects

Contents

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Edited by
Volkswagen Aktiengesellschaft
Konzernkommunikation
Brieffach 1972, 38436 Wolfsburg
Phone: +49 (0)5361/9-26922
Fax: +49 (0)5361/9-21952

V.i.S.d.P. (Person responsible according to the German press law)
Stephan Grühsem,
Leiter Konzernkommunikation;
Pietro Zollino,
Leiter Produktkommunikation
Marke Volkswagen

Editorial staff
Susanne van den Bergh, Stefanie Huland,
Carina Reez,
Volkswagen: Michael Franke,
Tonio Vakalopoulos
Contact: redaktion@viavision.org

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Modern Assistance Sys Driving More Comfort

Dr. Heinz-Jakob Neußer on the future of assis

Cars are becoming safer and safer. How is it possible that accidents and traffic jams are still part of everyday life on our motorways and streets?

In general, it must be said that accidents, and their resulting consequences, have steadily declined over recent years. Modern driving assistance systems and safety systems have certainly played their part in this positive development. This is why it is worth our while to invest in developing these small, invisible helpers. Thanks to both refined and new systems, as well as car-to-car or car-to-x interconnection, we expect further improvements in the future. Important road and traffic information can be sent to the car via an online connection. This could help improve drivers' awareness of unexpected situations. But, of course, every road user is obliged to help avoid accidents by behaving responsibly and considerately. Modern assistance systems can help the driver do this.

Does it make sense to equip the driver with so many assistance systems? Is the driver not being distracted by them?

Most assistance systems, like the Dynamic Light Assist or the Proactive Passanger Protection System, just to name a few, basically work in the background and do their job unobtrusively. Other systems like Fatigue Detection, for example, always warn the driver when they detect a certain situation. The City Emergency Braking System, on the other hand, actively intervenes when danger is imminent. The driver can always manually override them, and stays in control. Park Assist is an example for a system that the driver deliberately activates when he wants support. During the development of these systems, we take special care to ensure that they do not distract the driver.

With so much help, is driving still fun?

Of course driving can still be fun with assistance systems. Assistance systems should not be viewed as a constraint. They support the driver, within their respective limits, and actively intervene when it is not humanly possible to react fast enough. They can also facilitate tasks, during traffic congestion say, making driving more comfortable and safer.

> "We create innovations so that our cars offer our customers even more safety, comfort and fun."
>
> **Dr. Heinz-Jakob Neußer**

What is your target group for driver assistance systems and safety systems?

We have made it our goal to democratise driver assistance and safety systems, and so bring them to as many customers as possible. This is why some systems have been introduced as standard in all Volkswagen vehicles, for instance the anti-lock braking system or

TEMS SUPPORT THE DRIVER AND MAKE ABLE

tance systems and their importance

Dr. Heinz-Jakob Neußer is the new Member of the Board of Management for the Volkswagen brand with responsibility for Development.

the electronic stabilisation program, to name just a couple. Of course, our customers have their own preferences about which assistance systems they want installed in their vehicle or which of the standard assistants in the vehicle should be activated, depending on the situation. This is why so many systems are optional when buying a car, or can be deactivated in the car. Above all, the systems are targeted at people that want plenty of safety and assistance in their vehicle, and also enjoy a comfortable ride.

How far away are we from the automated car?

Automated driving is already possible today, technically speaking. But before the automobile industry actually starts to offer cars that participate independently in traffic, many questions regarding vehicle communication, interconnection and infrastructure, as well as legal issues, need to be resolved.

Some systems require a WLAN infrastructure which the cars use to transmit information. When do you think such infrastructure will exist and why is Volkswagen developing systems that cannot yet be fully employed?

The problem is that installing such infrastructure is very sophisticated and expensive. The German Ministry of Transport is trying very hard to create such an environment: the usefulness of this system was confirmed last year during a six month field test in which Volkswagen participated, involving 100 vehicles. Unfortunately, at present the necessary requirements for comprehensive implementation are still absent. Nevertheless it is important to continually refine those systems in order to keep pace with the rapid development of communications technology. At Volkswagen, we are always interested in developing innovative technologies that give more safety, comfort and driving pleasure to our customers. Even though a WLAN structure for car-to-x communication is not installed yet, our cars will soon be able to exchange information between each other via car-to-car communication.

Helpers in All Circumstances

See More, Know More, Arrive Safely

As traffic on German roads grows, the challenges and pressures on each car driver also grows. The amount of kilometres driven on German motorways and federal roads has increased by almost 50 billion kilometres between 1993 and 2010. Humans have been moving at maximum speeds of 20 to 30 kilometres per hour for millennia. This is what our motor functions, as well as our coordination, perception and information processing, are designed to handle. Anything faster is stressful and increases the risk of accidents – and also the need for the reduction of stress.

In order to minimise this risk, Volkswagen has been researching and developing more and more effective driver and safety assistance systems. They are designed to protect against accidents, without taking away the fun of driving. Automobile manufacturers, authorities and associations have been following the 'vision zero' strategy for years. Its goal is to ensure no more people are fatally injured or damaged for life by traffic. In order to achieve this, roads and vehicles need to adapt more to human needs and drivers require better support. Because about 90 percent of all accidents are caused by human error, it makes logical sense to support the human senses with the most modern technologies and thus improve the flow of information.

With the development of innovative driver assistance systems, Volkswagen is systematically pursuing this vision of unlimited and accident-free mobility. Here the company is focusing on research and development: the driver should improve his perception of the car's surroundings, and thus of traffic, and be supported in difficult situations.

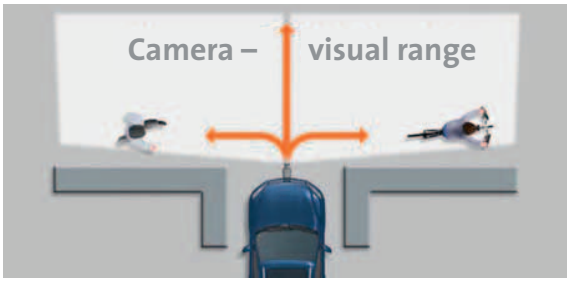
In this context, the installation of these driver assistance systems, as well as elements of integral safety (see glossary), has the highest priority; not only in luxury segment vehicles but particularly in smaller and more economical cars. Volkswagen has a name for this: 'the democratisation of safety and comfort'. Thus for the first time, in the new Golf, assistance systems – Adaptive Cruise Control ACC, the Ambient Traffic Monitoring "Front Assist" and "Lane Assist" – that have previously only been available in larger and more expensive vehicles are integrated into a compact class car. The Automatic Post-Collision Braking System has premiered globally in the Golf Mk7. Using this, a car in an accident situation brakes automatically – even if the driver is no longer applying the brakes. It is one of the most important innovations of the last decade, according to leading road safety experts. Furthermore, the multi-collision brake has been awarded the 'yellow angel' by the German automobile club ADAC in the 'innovation and environment' category.

Now, a new generation of assistance systems is in the starting blocks and will take us one step closer to 'vision zero'. Whether Emergency Assist, Area View or Road Works Assistant – they all are important steps towards accident-free driving. Innovations by Volkswagen that will ensure safety and assist all traffic participants are detailed on the following pages.

Mileage on German motorways and federal roads per year:
(in billion kilometres)

The total mileage per year on German motorways and federal roads has increased by almost 50 billion between 1993 and 2010. This number consists of the accumulated mileage of all vehicles during a whole year. Over 1,460 permanently installed counters are collecting the data all over Germany. The 324.7 billion kilometres covered in 2010 have been driven on 44,517 kilometres of motorways and federal roads.

"Area View"



The wide angle camera aperture allows the driver to see on the display people and vehicles that lie outside of his field of view. So he can virtually look 'around the corner'.

Whether sports cars or SUVs, many cars have a rather large blind spot. When parking or leaving a courtyard, it is therefore difficult for the driver to completely see the entire surroundings of his car. Since 2010, the Volkswagen Touareg has offered a solution to this problem: Area View.

The surroundings' monitoring system has four cameras that are installed in the rear of the car, the exterior mirrors and radiator grille. Each camera has an aperture angle of 190 degrees so that the system can detect the entire surroundings of the vehicle. For comparison, the visual field of a person given a steady, straight view is about 175 degrees.

The image of each camera is displayed on the monitor of the radio or navigation device, all four images can be displayed at the same time. In addition, the control unit can calculate and display a bird's-eye view of the vehicle from the information collected. In addition, static and dynamic auxiliary lines appear in the image, making it easier to assess distance.The surroundings' monitoring system also allows the driver to look 'around the corner' because the camera in the grille is located much further forward than the driver himself, and therefore observes the areas to the left and right earlier and better. The second generation of Area View is currently being developed by Volkswagen. Like its predecessor, the system is turned on with the parking assist button or by switching into reverse gear. Each image can then be shown individually or in parallel on a split screen.The assistant deactivates at speeds over 15 kilometres per hour, it is switched off manually using the park button or the parking brake.

The cameras of the second generation of Area View have a higher resolution and can therefore represent the surroundings in much more detail. In addition, the system can detect obstacles and warn the driver if he approaches them. Therefore the assistant expands the function of the ultrasonic parking sensors, that do not scan the entire environment of the vehicle.

The bird's-eye view, calculated by Area View using the data gathered from all cameras, provides a view of all surrounding objects, and thus also an assessment of distance.

Road Works Assistant

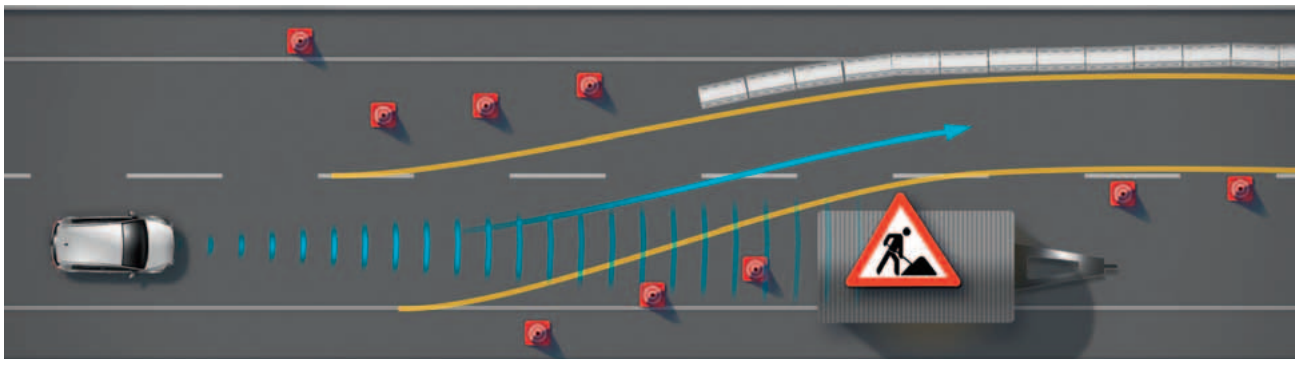
Construction sites have it all: the narrow lanes intimidate drivers, the lanes often change and traffic density is very high. The short distance between vehicles is perceived as dangerous by many drivers.

The reason for this feeling is usually that the width of your own vehicle can be hard to assess. Construction sites, where the lanes are only 2.5 metres wide, the speed limit is at 80 kilometres per hour and the lane is shifted by ten percent to the right or the left, have the highest risk of accidents. Road Works assistant is a further development of "Lane Assist" and can contribute to avoiding accidents. The system calculates a travel corridor using the monitored data. The direction of motion of the vehicle is predicted here and the desired direction of travel of the vehicle determined.

In addition to lane markings, with the help of a camera, Road Works assistant also recognises other physical limita-

tions, such as crash barriers, traffic cones and objects on the adjacent lanes such as lorries. Supported by the Brake Assistant, as well as the Adaptive Cruise Control, the Road Works Assistant can adjust steering correctively.

As well as lane markings, Road Works Assistant detects other lane limitations and calculates the ideal route through roadworks.



City Emergency Braking System with Pedestrian Monitoring

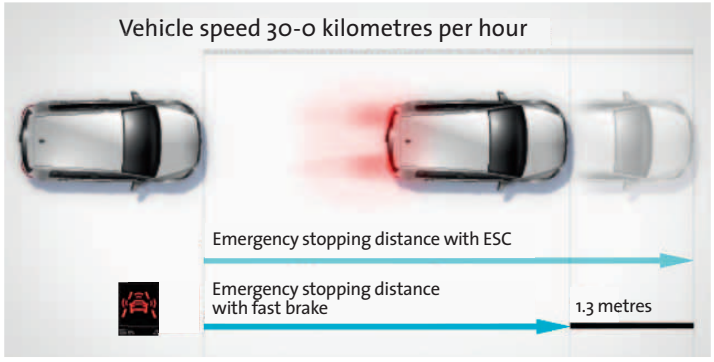
Almost every driver has already experienced this situation: driving in the inner city and a pedestrian suddenly steps into the road. A collision is only prevented by a fast reaction.

From now on, such situations will be defused for the driver by an assistance system: the City Emergency Braking System with Pedestrian Monitoring. A camera, in combination with radar sensors on the front of the vehicle, detects, within the system's limits, pedestrians on the side of the road and on the road. Given the pedestrian's position, his direction of movement and his speed, the system calculates the probability of a collision.

If there is a risk of colliding with the pedestrian, the system first warns optically and acoustically and then with a short jolt of the brake. In addition, brake pressure is increased slightly, ready for possible emergency braking. If the driver does not react to these warnings, the system initiates automatic emergency braking. This way, collisions can be avoided at speeds of up to 30 kilometres per hour. At higher speeds, the vehicle does not come to a stop but the force of the impact is reduced by braking. The system operates at speeds up to 65 kilometres per hour.

To this end, a 'fast brake' is currently being developed by Volkswagen. It builds up the required braking pressure needed for a timely stop of the car much faster.

The system warns the driver when the sensors recognise a pedestrian. The system brakes fully automatically, if the driver does not react to this warning or reacts too late.



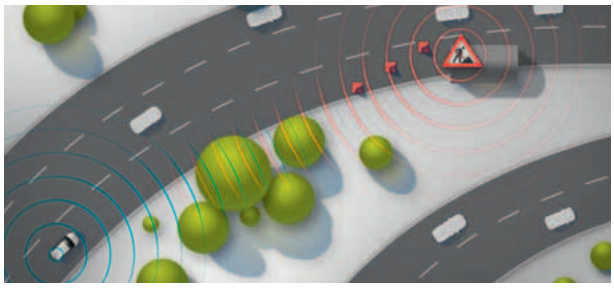
The electromechanical brake booster 'fast brake' shortens the stopping distance at a speed of 30 kilometres per hour by 1.3 metres.

Car-to-x Communication

Assistance systems can assist the driver in many ways and increase his driving comfort. However, there is a limit to it: the systems can only react to objects that are in the detection area of the environment sensors. Bends, houses, trees or other visual obstructions could blind previous assistants. In the future, car-to-x communication will enable them to 'look around the corner'.

Car-to-x communication is the exchange of information between vehicles (car-to-car) and with the surrounding infrastructure (car-to-infrastructure). The cross-manufacturer developed WLAN standard ETSI ITS G5 (see glossary on page 11) is used for this.This local network includes all transmitters and receivers within a radius of several hundred metres. Unlike server-based systems, communication only takes place between vehicles and the infrastructure in the immediate environment. The communication partners remain anonymous and safe.

Ideally, in the future, all vehicles will be equipped with the appropriate technology. This way, the driver is warned of approaching emergency vehicles, bottlenecks due to road works and the dangerous ends of tailbacks, through the engagement of active safety systems. Likewise, their own vehicle can pass on information about breakdowns, accidents and critical road conditions to the immediate surroundings so that all road participants can adapt in anticipation of the situation; making driving behaviour safer. In addition, traffic lights, road works and other suitably equipped infrastructure elements transmit further useful information to the driver and sustainably improve traffic flow.



Car-to-x communication can warn the driver of roadworks before they are visible.

A future advantage will come from the information advanced by car-to-car communication. Automated cars can pass on information, for example when driving through a bend, to other cars in the area. This look into the future allows drivers and vehicles in the area to drive more appropriately and cooperatively, and thus forms the basis for automated functions.

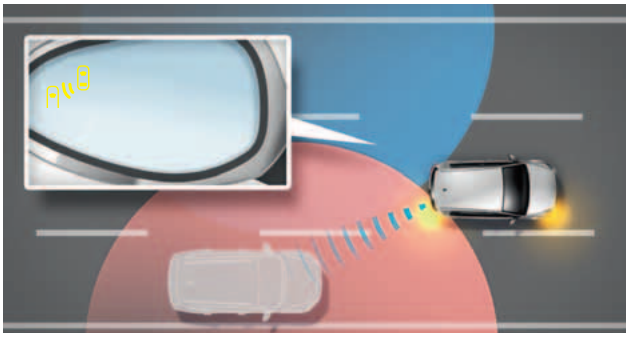
"Blind Spot" Monitor Including Rear Traffic Alert

Changing lanes in heavy traffic and reversing out of parking spaces, especially from perpendicular parking spaces, poses a particular challenge for motorists. The remedy is the Blind Spot Monitor with Rear Traffic Alert.

Radar sensors that monitor the area behind and besides the vehicle are installed in the rear of the vehicle.

The Rear Traffic Alert, detects traffic that moves at a right angle to the vehicle, within its limitations. Given the threat of a collision the system warns. If the driver does not react, a braking intervention is initiated that can reduce the damage resulting from accidents.

The Rear Traffic Alert alerts the driver to traffic that might not be visible to him. If the driver does not react to this, it can initiate emergency braking.



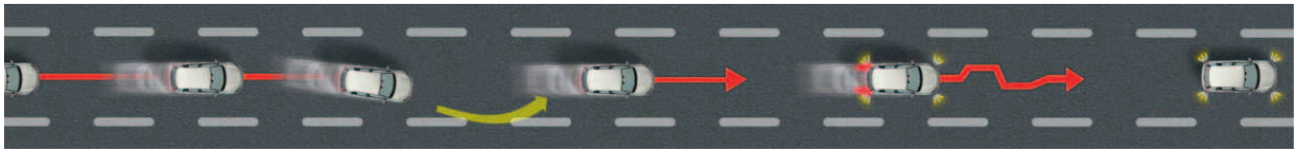
The sensors of the vehicle in front detect the second car and also display this to the driver.

“Emergency Assist” – Partial car control in medical emergencies

‘Cause of accident: heart attack at the wheel. Five people injured.‘ These headlines are common in newspapers. The problem: the driver loses control of his car and drives full speed into the oncoming traffic.

Emergency Assist is intended precisely to avoid these situations or reduce the consequences of accidents. If the system detects that the driver is no longer steering, braking or accelerating, it prompts the driver, first with a quiet signal and a display on the screen, to assume control of the vehicle. If this does not happen, a loud signal is sounded. If the driver still does not respond, there is a short braking jolt to which overtired or inattentive drivers would react at the last. If there is still no reaction, the system concludes that the driver is no longer fit to drive.

Using active Lane Assist and ACC, the system keeps the car within the lane. In addition, the hazard warning lights are automatically activated to alert surrounding traffic. The vehicle is slowly but steadily decelerated to a complete stop in the same lane, as long as the driver does not intervene.



After multiple warnings the Emergency Assist takes over control of the car, keeps it in lane and takes into account the distances ahead. If the driver does not react, it activates the hazard warning lights and slowly but continually decelerates the car to a complete stop within the lane.

Remote Parking

Parking spaces are often in short supply. If you have finally found an empty space in the inner city or in the car park, it is often too narrow. The doors cannot be opened and getting out is impossible. Using a remote control or a smartphone app, the driver can make his car drive into the gap or out of the gap.

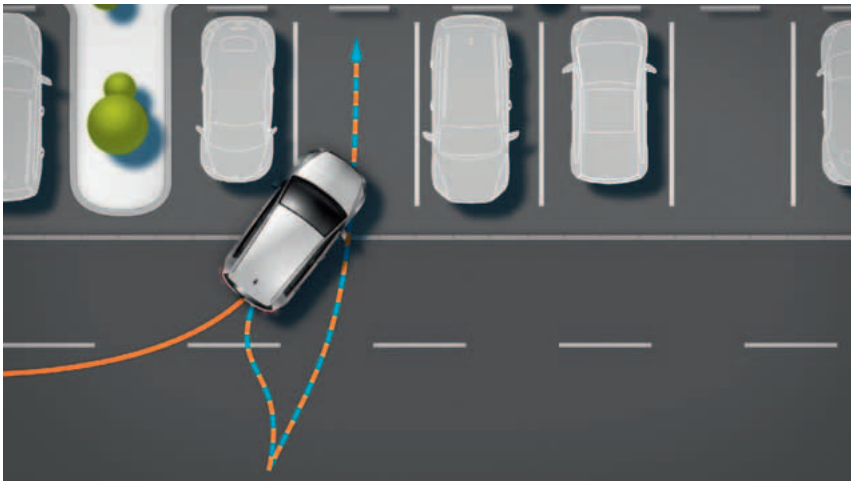
To park remotely, the driver places the vehicle just in front of the desired gap. He then gets out and activates ‘drive forward’ or ‚reverse‘ using his remote control or smartphone. The assistant then disengages the parking brake, and the transmission park lock, and selects the appropriate gear. The vehicle rolls into the gap at a maximum of five kilometres per hour. Higher speeds are not possible. As soon as the driver releases the drive button, the system locks the parking brake and activates the transmission park lock. The motor can be switched off and the steering column locked with the remote control. Locking the doors takes place in a separate step.

If the doors are blocked, the driver can start the parking assistant with the remote control or the smartphone when he is close to the vehicle. When the ‚reverse‘ function is selected, the system unlocks the steering column and disengages the transmission park lock, then starts the engine and drives the car slowly out the gap. The vehicle will stop if an obstacle is in the way, the driver releases the button or if the vehicle has travelled the maximum permitted distance of one car length to the front or back.

The vehicle can be driven in and out of narrow parking spaces using a remote control or a smartphone app. However, it is not possible to steer the vehicle in this way.

“Park Assist 3.0” – Steering Guide

Parking can confront the driver with a variety of challenges, regardless of whether one is parking in perpendicular or parallel spaces. Therefore, as early as 2007 Volkswagen introduced Park Assist in the Touran. It recognises suitable parallel parking spaces for the vehicle at speeds of up to 40 kilometres per hour, by means of sideways ultrasonic sensors, and assists during parking. Additionally, further development of the assistant from 2010 added support for reverse parking into perpendicular parking spaces and reversing out of parallel parking spaces. It can also detect perpendicular parking spaces and enable parking on curbs, amongst other things. When parking, the driver only needs to accelerate and brake, steering is done by the assistant.

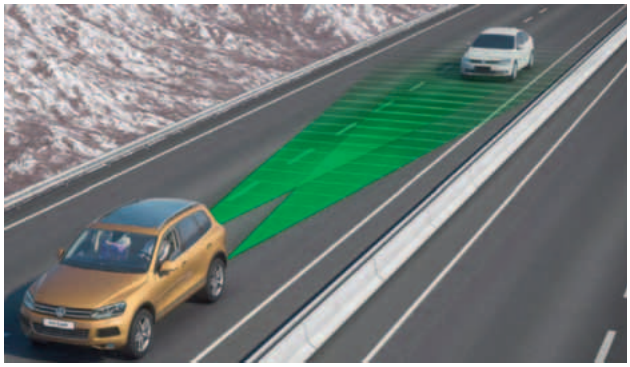


The further development of Park Assist detects perpendicular parking spaces and supports the driver when parking in them. In this case, the driver only accelerates and brakes.

Now Volkswagen is even further developing Park Assist: in the future, the system will also enable driving into perpendicular parking spaces. Therefore, the assistant will support the driver in almost all parking scenarios. It detects suitable parking spaces and displays them to the driver, who then chooses in which parking space to park and how. He then only accelerates and brakes, the system does everything else.

Proactive Passanger Protection System

In the future, the Proactive Passanger Protection System will use the Side Assist information too. It usually helps the driver when changing lanes by detecting the traffic behind your own vehicle with radar sensors, warning the driver when a vehicle is in his blind spot and is approaching fast from behind. The Proactive Passanger protection system uses this data to evaluate, based on the current position of both vehicles and their speeds, whether the car following poses a threat.



Given the threat of a collision by a car from behind, the Proactive Passanger Protection System is activated. This assistance system closes all windows except for a narrow gap, initiates the automatic tightening of driver and passenger seat belts and sets the electrically adjustable seats to an optimal position.

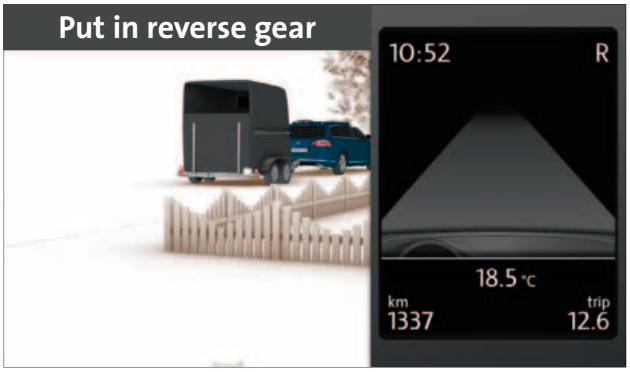
The system detects a vehicle approaching from the rear and calculates its speed. From the difference in velocities, it deduces the probability of a collision. If a critical situation is detected, the Proactive Passanger Protection System is activated.

“Trailer Assist” – Manoeuvring Guide

Driving with a trailer is a special challenge even for experienced drivers. Manoeuvring backwards is especially complicated. In the future, this will be be facilitated by Trailer Assist.

The system takes over the steering. For this, the driver puts the car in reverse and activates the system by pushing the park button. After that, he only accelerates or brakes, the system does the steering. The driver can adjust the desired angle in which the trailer moves with a control knob. Once the trailer is in the right direction, the driver can instruct the system to follow the current alignment of the trailer.

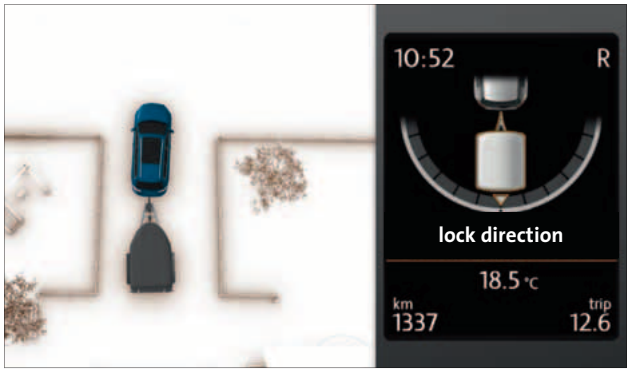
To disable the system, the driver again presses the park button or touches the steering wheel.



In order to activate Trailer Assist, the driver puts the car in reverse and pushes the park button. Subsequently the car takes over the steering, the driver has only to accelerate and brake.

The driver can set the angle he wishes the trailer to take using the correspondent control element, pictured here in the exterior mirror adjuster.

In the next step, the driver carefully accelerates in reverse gear and can monitor the trailer angle on the display. If he touches the steering wheel, the assistant deactivates.



As soon as the trailer is parallel to the entrance, or rather faces in the right direction, the driver can prompt the assistant to lock the alignment. The driver accelerates an brakes. “Trailer Assist” is ensuring that the trailer is reversing in a straight line.

Glossary

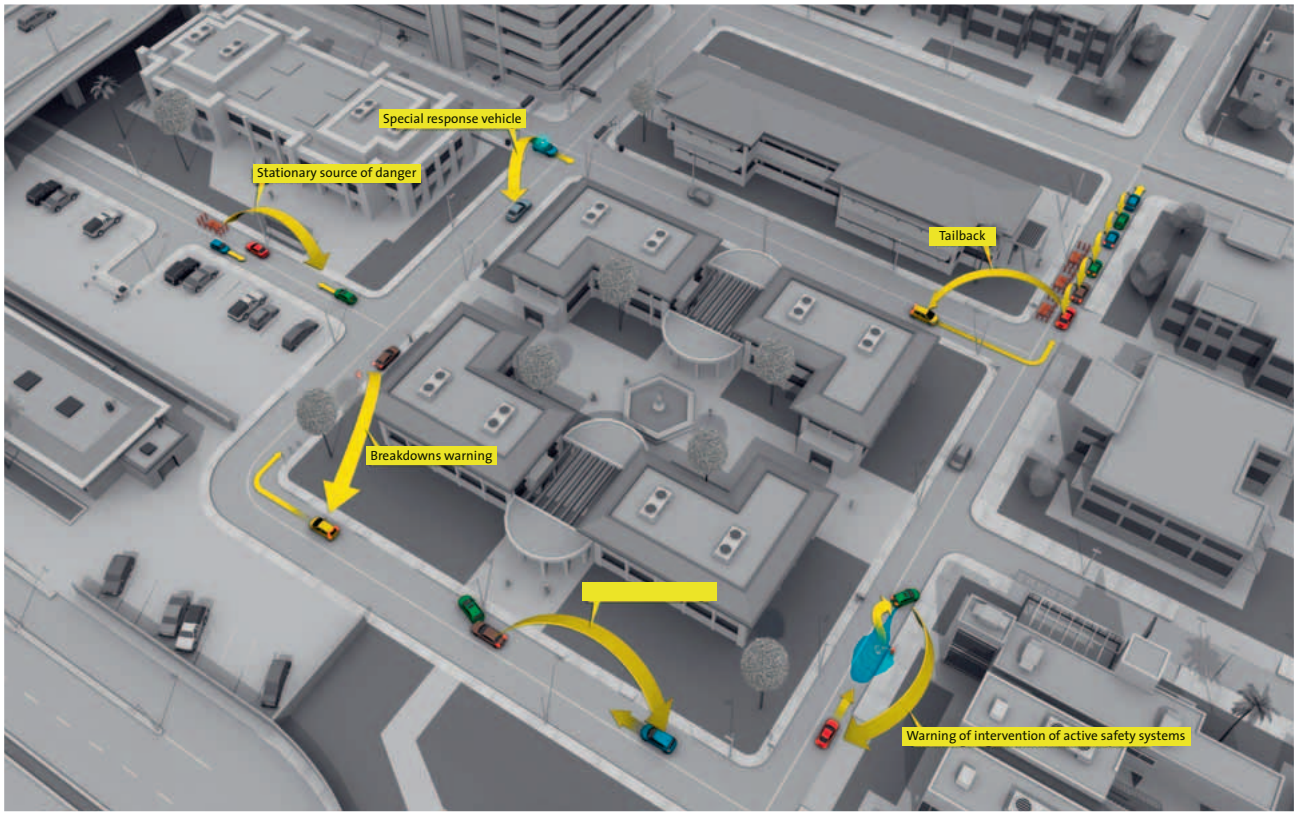
Integral Safety: Integral safety means interconnecting active and passive safety systems. An example is Volkswagen's Proactive Passanger Protection. Seat belts are part of the car's passive safety system. The active assistant detects impending accidents and, among other functions, tightens the seat belts. In addition, it closes the car's windows and sliding roof.

Passive Safety: While active safety systems above all help to avoid accidents, by intervening before something happens, elements of passive safety decrease the consequences of an accident. First of all comes the seat belt system: wearing a seat belt has been mandatory in Germany since 1976 and new cars had to be equipped with them since 1974. The seat belts hold the passengers more closely to their seats, which can decrease accident injuries. In addition, airbags further decrease the the risk of sustaining heavy head or chest injuries, because the upper body and head of the passengers impact on a larger and softer area. The occupant cell is also part of passive safety. It forms a safety cage with its stiff structure and improves the occupants' survival space.

WLAN: In order to be able to use the full range of car-to-x communication functions in the future, above all a working automotive WLAN is required. WLAN stand for wireless local area network. It is a wireless network that is limited locally. The wireless technology ETSI ITS G5, developed especially for the requirements of automobiles, is employed here. The networks are only established in certain areas and only include participants within a radius of a few hundred metres.

Radar: Radar is short for "Radio Detection and Ranging", originally "Radio Aircraft Detection and Ranging". The radar sensor sends out bundled electromagnetic waves at almost light speed. Objects in the surrounding area reflect these waves back to the sensor. Using this data, it can now calculate the distance and direction of the object in relation to the sensor. A series of readings allows for the calculation of speed and distance covered. A high-resolution radar can also recognise the contours of an object. Some of the assistance systems rely on the data gathered by radar sensors.

Ultrasonics: Ultrasonics are sound waves with frequencies above the spectrum of human hearing. These waves are emitted, similarly to the radar, and reflected by the surrounding objects. The distance to the object can be calculated by the time passed between emitting and receiving these waves.



A future goal is a complete connection of all motorists within a limited area through car-to-x communication.

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Assistance Systems

The amount of kilometres driven on German motorways and federal roads has increased by almost 50 billion kilometres since 1993.

A new generation of assistance systems is in the starting blocks that will increase the safety of all traffic participants.