17

Eure!TechFLASH

THE UP-TO-DATE TECHNICAL INSIGHT IN AUTOMOTIVE TECHNOLOGY & INNOVATIONS

EDITION 17

Advanced Driver Assistance Systems

IN THIS ISSUE

EureTechFlash is an AD International publication (www.ad-europe.com)

Download all EureTechFlash editions at www.eurecar.org

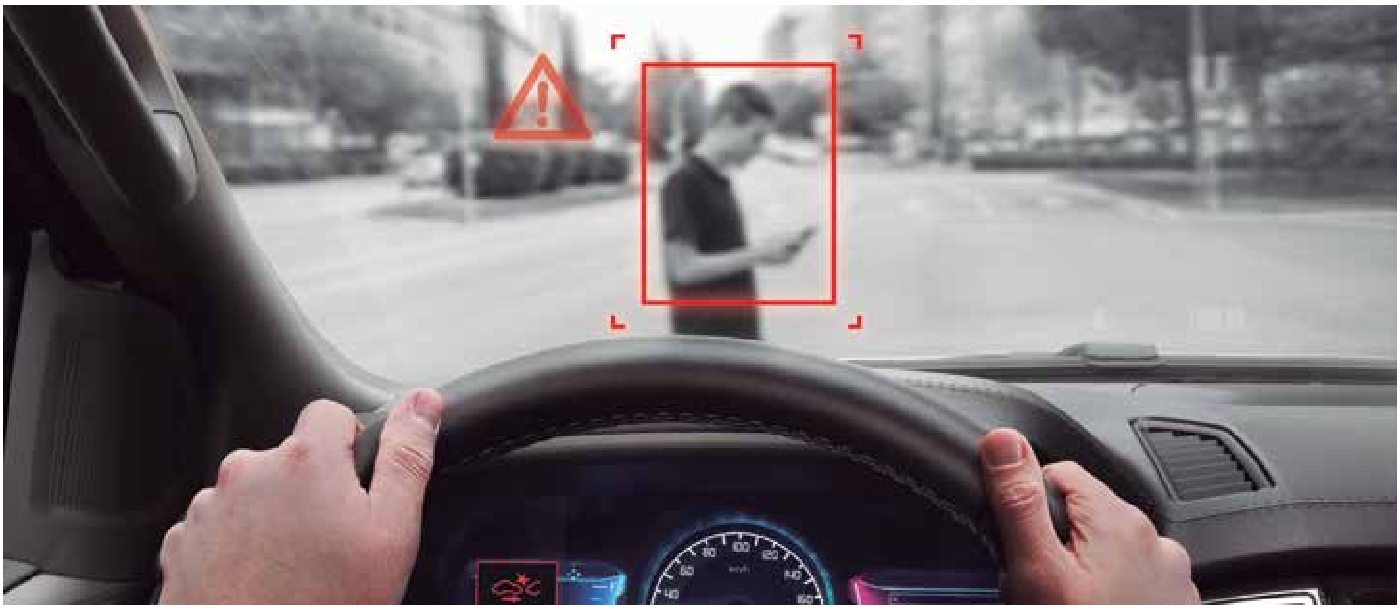
INTRODUCTION

Vehicle sales are increasing year after year worldwide. To get an idea of how much, in the 1990s, a total of 39.2 million vehicles were sold worldwide. In 2016, more than 74 million units were sold. This increase in sales has also resulted in an increase in the number of traffic accidents. The human factor, roads and the vehicles themselves are the key elements that come into play in accidents.

Users are aware of this, so they are showing increasing interest in the different safety systems installed by the different makes when purchasing a vehicle. However, it is important to take into account that these systems have a series of research and development costs that are reflected in the final price of the vehicle. This poses a problem because according to surveys, when evaluating the purchase of a vehicle, the primary determining factor is still price, above aesthetics, fuel consumption and even safety.

The probability of survival of the occupants of a modern vehicle is double compared to that of the vehicles of 10 years ago. Several studies have demonstrated the importance of purchasing a vehicle with the largest possible number of safety elements. By law, some systems are mandatory. These include: **ABS** (Anti-lock Braking System), **SRS** (Supplementary Restraint Systems, or airbags), tyre pressure monitoring or isofix anchorages. There are others that are currently optional, such as: smart speed control, automatic braking systems, pedestrian detection systems, etc.

For this reason, the new safety systems, grouped under the name of **ADAS** (Advanced Driver Assistance Systems) play a vital role in accident prevention and the protection of occupants and road users. This technology is useless if people do not understand how it works or if it is used incorrectly, because it could result in hazardous behaviour behind the wheel. At no time are drivers relieved of their responsibility to drive safely and alertly.



TRAFFIC ACCIDENTS

Every year, approximately 800,000 people die worldwide as a result of traffic accidents, and another 20,000,000 are injured.

The principal causes of accidents are the following:

Overconfidence

Despite the significant improvement in both highways and existing safety systems, as well as the incorporation of new technologies into vehicles, the accident rate has not decreased in proportion to the improvements that have been made. This is due to the fact that there are still many drivers who feel more secure and therefore drive more recklessly.

Deficient driver training

Another problem with the new technologies applied to vehicles is the lag between the technology being installed and the training drivers receive in regard to its operation. A large percentage of drivers is unaware of the advantages that these systems offer and the correct way to use them. The vehicle does not activate the controls automatically on its own; it is the driver who must put them into practice in emergency situations, such as sudden braking so that the ABS is activated, or avoiding an object in the road so that the ESP system corrects the trajectory. If the driver does not know how to react in certain situations, these systems do not activate.

Excessive comfort

New materials and designs have significantly reduced noise and vibration in vehicles, and seats are becoming more and more comfortable, with more ergonomic driving positions. These improvements in comfort make driving safer by reducing driver fatigue. However, excessive comfort makes it difficult to perceive the sensation of speed until it reaches an extreme situation.

Another common problem is that when drivers use more than one vehicle, they do not change the way that they drive when they change vehicles. When a driver stops using a safe vehicle with assistance systems and starts driving another one that lacks these systems, the driver usually feels a dependence on this type of safety technology.

Alcohol and drugs

It has been proven that both alcohol and drugs diminish human capacities when driving. When the body absorbs these intoxicating substances, such as alcohol, the driver's movements are slower and drowsiness and fatigue are generated, making it more difficult to maintain concentration, there are problems with coordination, and sharpness of hearing and vision decreases, making it harder to calculate distances.

There are manufacturers who install breathalysers in some of their vehicles, especially industrial vehicles, which prevent the engine from starting if the breathalyser test is not passed.

ERGONOMICS IN THE DRIVING POSITION

Ergonomics refers to the search for a suitable design of a machine or object in order to achieve better use at the human level.

Driver comfort in the vehicle is vital to prevent fatigue and to prevent reflexes from being altered in emergency situations. For this reason, manufacturer's are placing greater priority on improving the ergonomics in the driving position and not on the performance of the vehicles themselves (power, fuel consumption, etc.)

For a design to be ergonomic, it must offer the following aspects:

- Good seat position, that allows the driver to handle both the steering wheel and pedals optimally.
- Quick access to the vehicle's controls, lights, mirror adjustment, climate control, power windows, etc.
- Intuition and simplicity of systems that do not affect driving directly but do affect the trip, such as audio or navigation systems, opening the boot, gas tank cover, etc.

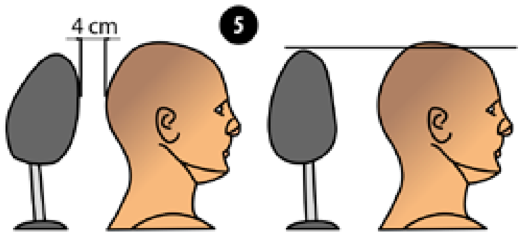
In order to be able to carry out these operations, manufacturers use anthropometric (body measurement) studies so that the driving position can be adapted to the different users. A good position in the driving seat is vital to prevent driver fatigue.

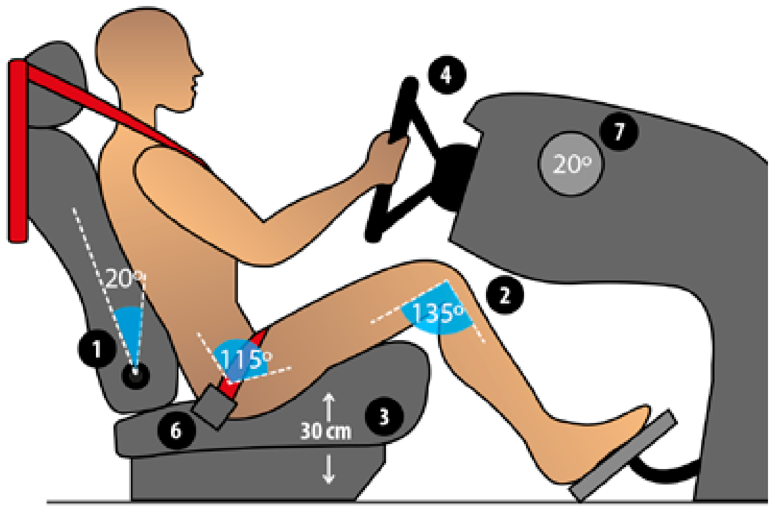
Correct driving position

After the driver sits in the driving seat, they should take the time to make the necessary adjustments. In three-door models, in order to avoid altering the position of the driver's seat, it is recommended that passengers occupy the back seats using the passenger's side door.

The optimum driving position should be:

1. Rear seat tilt of 15° to 25°, in order to allow the legs and hips to form an arc of 110° to 120°.
2. The distance between the floor and the pedals should guarantee a 135° bending of the legs.
3. The distance between the seat and the floor should be approximately 30 centimetres.
4. If the steering wheel is adjustable, the upper arc should be below the wrist, ensuring that the shoulders are in contact with the seat while the arms are relaxed.
5. The top of the headrest should line up with the top of the driver's head, leaving a distance of 4 centimetres between the headrest and the head.
6. In regard to seatbelts, the upper part should rest on the collar bone and chest, without squeezing, and it should be tight over the pelvis to avoid slipping under it in case of a head-on collision.
7. If the vehicle is equipped with climate control, the optimum temperature is 20ºC.





SAFETY IN THE VEHICLE

The race for safety began before ecology or efficiency. Making safer cars is a necessity for all, and there are even certain makes that have made it their most highly-prized icon. Safety does not refer only to the efforts to improve the vehicle's response to impacts. The concept of "Safety" covers a wide range, in addition to minimizing damages in case of impacts.

Generally, there are two types of safety in a vehicle for the purpose of preventing accidents or if they do occur, minimizing the consequent damage. These two types are active safety and passive safety.

Active safety

This refers to a set of mechanisms aimed at preventing, anticipating and avoiding traffic accidents. However, this type of safety does not replace responsible driving or driver skill.

The most popular active security systems are:

Steering system

Guarantees a precise travel direction when driving on highways. The evolution of this system has led to steering with variable stiffness, with softer steering at low speeds, in order to facilitate parking manoeuvres or tight turns, and stiffer steering at high speeds to provide more stable driving. Steering with a variable gear ratio are sometimes also installed.

Some manufacturers equip some of their models with a directional rear axle system. At speeds above 60 km/h, the system makes the rear wheels turn in the same direction as the front wheels to reduce pitching, and at low speed, it turns them in the opposite direction to reduce the vehicle's turning radius and thus facilitate manoeuvres.

Suspension system

The suspension is designed to absorb the irregularities of the ground and control the inclination of the vehicle on curves, preventing it from going off of the road.

There are different types of suspensions, pneumatic or hydraulic, which correct the vehicle's height depending on the needs at any given time. There are also suspensions with adjustable stiffness, which provide comfortable driving on long trips or more aggressive driving by increasing the stiffness of the shock absorbers.

Braking system

The ABS prevents the wheels from locking up, reducing braking distance and maintaining the ability to change direction to avoid obstacles. In the case of a partial failure of the brake system, the ABS system ensures minimal braking, which is achieved by using independent circuits.

Tyres

As with the other systems mentioned, tyres have also evolved enormously. More and more, their composition and treads guarantee optimum traction under any weather conditions. To achieve this goal, they must be in the best possible condition.

Lighting

In terms of safety, it is vital to see and to be seen. Great progress has been made in lighting systems, in terms of range and quality, which now generate a light that is whiter and that imitates daylight, which is an essential aspect, especially for night-time driving. Chronologically, conventional bulbs gave way to halogen bulbs, which in turn gave way to Xenon headlamps. Today, LED lighting is being successfully developed.

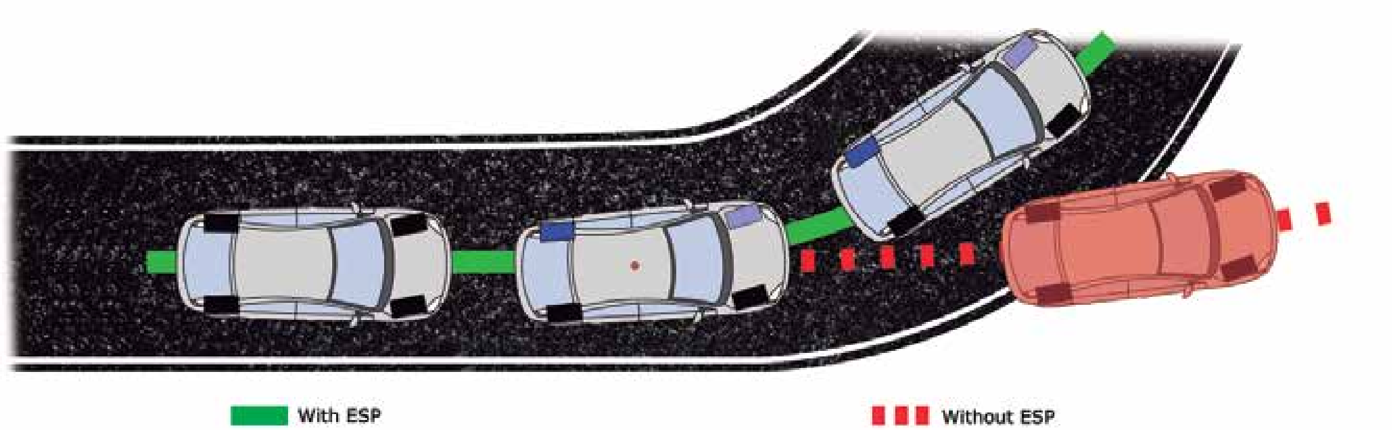
Currently, work is being done to develop laser lighting systems. This system provides light that is much more natural than the other known systems and consumes up to 30% less electricity than an LED lighting system.

Stability control systems

These are especially useful if the driver loses control of the vehicle. The system consists of multiple sensors: wheel speed, body movement, steering wheel and accelerator position. A microprocessor compares the information from the sensors with the vehicle's trajectory, as soon as they do not match, the system goes into operation, braking the necessary wheels so that the vehicle will maintain its trajectory.

The system has certain limits; the laws of physics cannot be broken. The speed of travel through a curve cannot be changed by the ESP, it is set by the weight of the vehicle, the suspension, the coefficient of adhesion between the tyres and the ground, and the correct status of all of these elements.

If the vehicle enters a curve exceeding the maximum speed, the ESP system cannot stop it driving off the road. It is important not to make sudden movements with the steering wheel to correct the path, because the ESP system works to avoid this. The correct and most effective way to obtain the best possible result is to point the wheels where you want to go.



Passive safety

This is a type of safety that is responsible for minimizing the potential injury to the occupants of the vehicle when an accident is inevitable.

The most popular passive security systems are:

Seat belt

In case of an accident, seatbelts prevent occupants who have them buckled from being thrown from the vehicle. They have a locking device that locks the belt if sudden deceleration is experienced. According to statistics, seatbelts prevent 12,000 deaths per year. The seatbelt was invented in 1959 by Nils Bohlin, an engineer for the manufacturer Volvo. Due to this mechanism's great capacity to save lives, he decided not to patent it so that all of the makes could install it in their vehicles.

SRS (Supplementary Restraint System)

This system consists of several "bags or cushions" that are inflated by a pyrotechnic system in case of impact above a certain speed. The objective is to prevent the occupants from directly striking any parts of the vehicle, whether the steering wheel, dashboard, doors, etc. The SRS system is complemented by the seatbelt and the headrest. Currently, there are front, side, head and knee airbags.

Chassis and Body

The vehicle body has zones that absorb energy in case of an impact. In the case of a frontal collision, the body repositions the engine through programmed deformation to prevent it from entering the cabin.

Glass

The composition of the glass of the windscreen is prepared so that if it breaks, shards that could injure the occupants of the car are not generated. However, the glass of the side windows is weaker and can be broken to facilitate the evacuation of the occupants if the vehicle overturns.

Safe fuel system

If fuel is spilled in an accident, a single spark from the electrical system or from metal charged with static electricity could trigger a very complicated situation.
This means that manufacturers design tanks that are impact resistant and the components of the injection system have been improved, because many fires start in the engine compartment. As a complement, systems have been developed to disconnect the electrical circuit, in order to prevent the generation of sparks in case of a short circuit.

Preventive safety

Apart from active and passive safety, there are other systems that indirectly help to prevent accidents and that do not fit under the previous headings. To include these, a third group of safety elements has been created under the name of preventive safety.
This group includes elements such as:

Interior rear-view mirror with automatic darkening

A pair of light sensors compares the amount of light from the front of the vehicle with the amount in the back. If reflections caused by the headlamps of a vehicle travelling behind, the mirror automatically darkens, to reduce the glare for the driver.

Automatic windscreen wiper activation

This system functions with a sensor that checks the transparency of the windscreen; if it detects a change of transparency as a result of the accumulation of water droplets, the windscreen wipers are activated.
The system can vary the intensity of the sweep based on the amount of rain and the speed of the vehicle.

Other technologies

A system for automatic headlamp alignment with automatic light switching, or an auto-adaptive cruise control are examples of how diverse the field of ADASs is. All ADASs that are described in this magazine fall into the preventive safety category. A large number of them are described in the section on "Advanced driver assistance systems".

AUTONOMOUS DRIVING

Autonomous driving can be defined as the mode of driving in which the vehicle is able to travel on a road without the intervention of a driver.
Developing vehicles with systems for autonomous driving is very complex, due to the amount of technology that must be applied, as well as the laws that must be followed depending on the country in which the vehicle will be sold. A vehicle intended for 100% autonomous driving must have an engine, an automatic transmission, a large number of sensors and other devices, in order to have total control over what happens around the vehicle. Some of these devices are: video cameras arranged at different strategic points on the body, parking-assist sensors, one or more radars to monitor the vehicle's surroundings, and a GPS system to verify the readings of the aforementioned sensors, among others.

Vehicles such as the Tesla Model X, Audi A8, Mercedes S Class or BMW series 7 already have semi-autonomous driving.
The organization SAE International is a society of automotive engineers made up of professionals from different sectors, that is focused on standardizing the areas that affect the aerospace engineering sector, auto manufacturing and all the commercial industries specializing in vehicle construction (cars, lorries, ships, aircraft, etc.).
In 2014, this organization standardized automation into 6 levels, in the standard SAE J3016. But this is not a standard to be followed by manufacturers, but rather a guideline that the manufacturers can use to classify their vehicles:

SAE INTERNATIONAL

Level 0: No automation

A system for automatic headlamp alignment with automatic light switching, or an auto-adaptive cruise control are examples of how diverse the field of ADASs is. All ADASs that are described in this magazine fall into the preventive safety category. A large number of them are described in the section on "Advanced driver assistance systems".

Level 1: Driver assistance

This level includes the first assistance systems designed for the purpose of providing a certain degree of comfort in driving. Nevertheless, the driver still has control over the vehicle. Driver assistance is provided through speed control (adaptive or non-adaptive) and by the lane keeping assistant, which centres the automobile in the lane if the vehicle crosses the centre line without activating the directional signal (only in straight stretches or large-radius curves). In both cases, the driver can always cancel the intervention by pressing the brake or clutch in the first case, or by applying slight resistance on the steering wheel in the second.

Level 2: Partial automation

The vehicle is able to act independently in certain specific situations, by carrying out one or several tasks simultaneously with the driver.
This level includes systems such as emergency braking, blind spot detection, allowing the vehicle to remain in the lane on its own at a constant speed for brief periods of time. The driver still needs to pay attention while driving.

Level 3: Controlled autonomous

Starting with this level, the vehicle monitors its surroundings and starts to "think for itself", and is able to stay inside the lane lines, change lanes, brake to avoid colliding with other vehicles or obstacles that cross its path, etc.
The driver begins to be expendable, except in certain situations where the software is unable to act or if there is a fault in the system. For the time being, at the time of this issue, there are no mass produced vehicles that are able to perform this type of driving.

Level 4: Highly automated

The evolution of level 3 leads to vehicles that are able to drive without the need for human intervention, provided that the car has sufficient information. These are vehicles that are capable of evaluating their surroundings and know how to respond to each situation, and will even be able to calculate the best route based on the traffic on the highway. To achieve this, the use of the GPS system is vital so that the vehicle knows in real time what is going on around it.

Level 5: Total automation

This is the highest level of automation; the steering wheel, pedals and any type of control are done away with. The vehicle is able to travel anywhere upon request.

ADVANCED DRIVER ASSISTANCE SYSTEMS

Speed control

This is a very popular system in all automobile makes. It was first marketed in American luxury cars in the 1960s and spread to high-end German cars in the 1980s.
This driver assistance system maintains the speed preset by the driver, regardless of the slope of the ground, without requiring the driver to “modulate” the accelerator pedal. It is especially useful on long trips, by reducing the number of tasks for the driver, also reducing driver fatigue and increasing the capacity to concentrate on other tasks, such as steering control. On the other hand, if the speed control is not adaptive, the driver must be ready to brake if necessary.
The operation of the speed control may vary from one vehicle model to another. The user manual must always be consulted to understand all of the details of how it functions.

Types of speed control

Cruise control
The system’s control unit detects the vehicle’s speed, normally provided by the ABS system. Based on the speed preset by the driver using the controls located on or near the steering wheel, the system takes control of the accelerator to maintain that speed. If the driver accelerates a little more during the operation of the system, it will go into “Hold” mode, going back into operation when the speed drops to the specified value.
In order to offer greater safety, the system deactivates automatically if the driver presses the brake pedal or clutch.
One of the drawbacks of this system is that on downhill stretches, the speed preset by the driver may be exceeded due to the inertia of the vehicle. In this case, the driver must check the current speed and brake if necessary. Some systems generate a visual and/or acoustic signal on the instrument panel when the preset speed is exceeded by 3 km/h, in order to alert the driver.
The use of speed control is recommended on expressways and highways with little traffic and open curves, in other words, when it is possible to drive for several kilometres without having to change the speed.

Speed limiter
This is an evolution of speed control. Unlike speed control, this function does not maintain a speed, but rather avoids exceeding the speed preset by the driver, even if the driver accelerates fully.
To prevent the vehicle from being limited in dangerous situations, for example when overtaking, the accelerator pedal is equipped with a switch at the end of its travel that cancels the system after it is activated.

Adaptive cruise control
Also known by its initials ACC (Adaptive Cruise Control). This is a speed regulator that influences the functioning of the engine and the brakes of the vehicle to maintain a speed and a specific distance from another vehicle that is travelling in front of it. The vehicle can stop and move again automatically with the Stop & Go function of the ACC in combination with an automatic transmission.
When a vehicle is equipped with adaptive cruise control, simple cruise control normally disappears. However, the speed limiter function is maintained. It should be noted that multiple systems cannot function at the same time, that is, either the speed limiter or the adaptive cruise control.
According to the approval regulations, the braking applied by the braking system must not exceed 25%. The rest of the deceleration is provided by decreasing the engine power and varying the gear ratio in the gearbox. If these actions are not sufficient, the system will generate an acoustic signal and the driver will have to act.
This system does not react to unmoving objects, such as a vehicle stopped on the shoulder, or when travelling alone in a lane and stopped traffic is suddenly encountered. The system only functions when it detects vehicles that are already in motion. Other systems (emergency braking, if it is installed) are responsible for stopping the vehicle in these conditions.

The system's principal sensor is a radar located on the front of the vehicle, which makes it possible to detect vehicles travelling in front and determine how far away they are. Depending on the version, the radar may be supplemented by a front view camera or a laser sensor.

In some models, this system allows the driver to select the safety distance to be maintained with respect to the vehicle in front, and regulate the vehicle's acceleration when the distance increases.

Emergency braking

Also known as AEB (Autonomous Emergency Braking), emergency braking is intended to stop the vehicle completely in response to unexpected situations if the driver does not react fast enough. As with adaptive cruise control, the principal sensor is the radar, which in turn also serves as the control unit.

The system acts in two stages: first it **notifies the driver** of the potential proximity of another vehicle with an acoustic and visual signal on the instrument panel so that they can react in time and brake. If the driver does not react, the system **brakes automatically** to avoid or minimize the collision.

There are different versions and action capabilities, with the difference lying in the range of the radar and whether or not it is supplemented with a front camera. The basic version acts at between **5** and **200 km/h**, and is only able to completely stop the vehicle and avoid impact if it is travelling at a speed of between **30** and **60 km/h**. If the vehicle is travelling faster than this, **the impact cannot be avoided**, and the system only reduces its effects, since the group of sensors that is installed does not have sufficient range and when the obstacle is detected at speeds of more than 60 km/h, there is not enough time to stop the vehicle.
If the driver fails to react to the warnings and the **speed** is **more** than **30 km/h** the system initiates braking of the vehicle with a **maximum deceleration of 6 m/s2**, which, depending on the conditions, will not avoid the collision but will reduce its consequences.

If the speed is between **5 km/h** and **30 km/h** the system functions the same way but applies a maximum deceleration of **8 m/s2**. This action is known as city emergency braking.

The emergency braking system only acts if the vehicle is travelling at more or less constant speed.If the driver is accelerating or braking, the system does not intervene because it understands that the driver is performing the pertinent manoeuvres to avoid the collision. The driver's actions always take precedence over this system.

Lane departure assistant

The purpose of this system is to keep the vehicle from driving off the highway. The assistant is especially useful in situations involving drowsiness or distraction, when the driver glances away from the road to adjust the audio system, navigator, etc.

There are many evolutions of this system and it should be noted that even in the case of the most complete system, there is still a lot of room for improvement.

The **most basic version of the system** is known as a Lane Departure Warning (LDW) system. Its functioning is very basic, generally using a camera located on the windscreen focused on the road. When the camera detects that the vehicle is getting too close to the dividing line of the lane without activating the turn signal to indicate a change of direction, an acoustic and/or visual signal is generated on the instrument panel so that the driver can correct the trajectory. Depending on the version, the driver can also be alerted by the vibration of the seat or the steering wheel.
The camera's view provides information such as the radius of curves, whether the lines are solid or discontinuous, waiting longer to react in the latter case as it is a less hazardous situation. This information is compared with the vehicle's speed, the turning of the steering wheel to calculate whether the vehicle is veering from the centre of the lane, and the time that it will take to cross over the dividing lines of the lane.

In the **second generation** of this system, if the vehicle moves out of its lane and the driver does not intervene, the system detects this and automatically corrects the steering in the opposite direction. The electric steering applies a smooth and progressive correction, which may be interrupted at any time by the driver.

The system is operational at **65km/h** and higher (depending on the country) and may be disconnected. Some makes have chosen to replace the front-view camera with multiple infrared sensors installed in the front bumper, but they function in the same way: they detect when the vehicle approaches the lane dividing lines and alert the driver.

Blind spot detection

A blind spot is defined as the lateral zone of the vehicle that the driver cannot see in either the exterior rear-view mirrors or in the interior mirror. This means that when changing lanes or carrying out other manoeuvres, drivers are unable to detect the presence of vehicles, which could cause a collision. This zone is different in each vehicle and depends basically on the positioning and size of the rear-view mirrors.
If the driver activates the turn signal to carry out a lane change or change of direction, and the system detects a vehicle in the blind spot, a light device located on the inside of the door (at the height of the rear-view mirror) or integrated into the mirror itself, will light up. In the dark, the cameras react to the light of the headlamps of vehicles and can function normally, but the system may not detect vehicles that are driving at night with their headlamps turned off. The system also reacts if the driver passes another vehicle with a speed difference of more than 10km/h so that the return to the lane is safe and the driver does not collide with the passed vehicle.
Some weather conditions such as reflections on wet roads, when the sun is low on the horizon and shines into camera and the vehicle's own shadow can generate false warnings. There is a more highly evolved version that replaces the cameras of the rear-view mirrors with RADAR sensors located under the ends of the rear bumper. The principal advantage is that the RADAR is not affected by sunlight reflections or the lights of other vehicles.

Traffic sign detection system

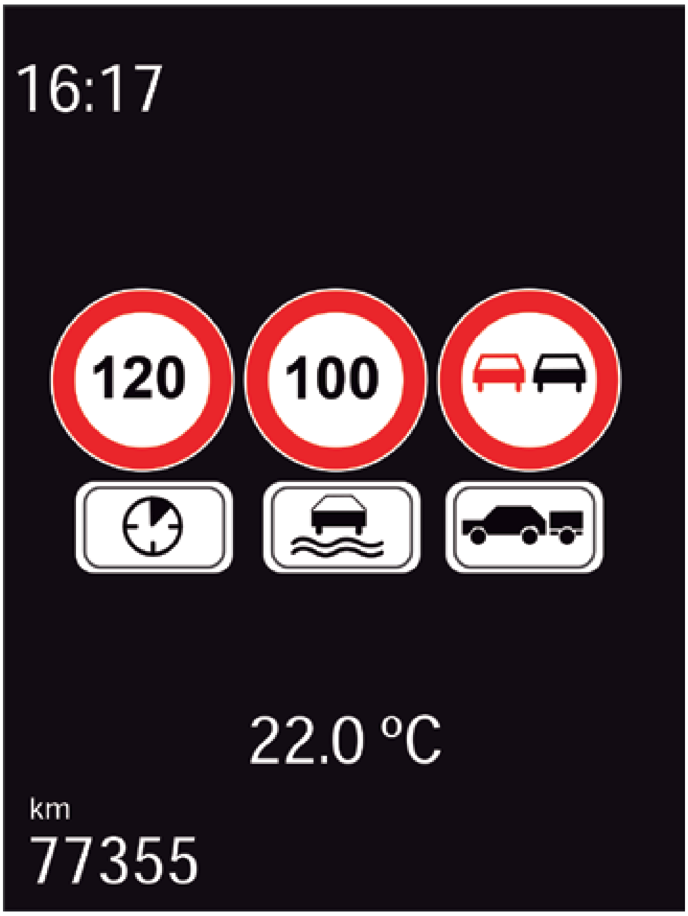
The traffic-sign detection system works by "scanning" the main signs on a road, especially speed limits, to display them on the instrument panel so that the driver can know the driving conditions of the road on which they are travelling in real time.

This is an informational system that under no circumstances regulates the speed limit; the driver remains in control of this function. The system uses the data recorded by a camera that is normally located at the top of the windscreen.

In order to increase the reliability of the system, the camera data is compared with the data from the navigation system, always giving priority to the data recorded by the camera. Some versions use information from the "On-board power supply" unit in order to detect the presence of adverse weather conditions and thus modify the displayed speed limits. This information is:

- Time (day or night)
- Windscreen condition (rain)
- Hitch (presence of a trailer)
- Direction indicator (different speed limit, for example, in an acceleration lane)

The user can activate or deactivate this function on the control panel menu or with a button on the dashboard.



Parking assistant

Also known as Park assist. Its purpose is to facilitate parking manoeuvres for the driver, either in side-by-side or parallel parking.
In this system, the driver is responsible for pressing the pedals and changing gear, and the system turns the steering wheel. This means that the driver is responsible for braking if any anomaly is detected during the manoeuvre. Parking assistant systems are very varied and offer functions that are more or less automated depending on the equipment installed. The principal functions of Park Assist are:

Reverse assist

This function incorporates a camera on the boot lid that provides the image of what is going on behind the vehicle on a screen located on the dashboard. A series of orientation lines are displayed along with the image. Generally, there is a line (normally red) that shows the safety distance, in other words, the maximum distance that must be respected to ensure that the vehicle's bumper does not strike any object, and a pair of lateral lines that show the extension of the vehicle during the manoeuvre.

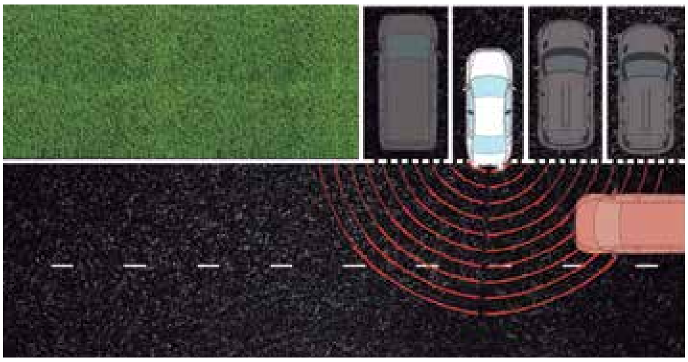
Braking function when manoeuvring

If the sensors detect an obstacle during the reverse manoeuvre and the driver does not brake, the system sends a request to the brake module to stop the vehicle. Depending on the installed equipment, the system may also function during forward manoeuvres. This function is activated along with the parking sensors when reverse is engaged to initiate a manoeuvre and is operational only at speeds of less than **10 km/h**.

Parking exit assistant

The purpose of this system is to monitor the traffic behind the vehicle when backing out of a side-by-side parking space. For greater precision, it uses a series of radar sensors in the rear bumper that are also used for the BLIS blind spot detection system.

It connects automatically when reversing is initiated. If the system detects objects or other vehicles travelling on the road, it emits an acoustic and visual signal on the instrument panel so that the driver can react and stop the vehicle. If the installed equipment allows it, and the driver does not react, the vehicle may brake automatically using the ABS brake module. The parking exit assistant only functions at speeds between 1 and 12 km/h and only keeps the vehicle stopped for a maximum of 2 seconds. The driver can resume movement by pressing firmly on the accelerator pedal or by pressing and releasing the brake pedal.



New developments in parking assist

In more evolved versions and with automatic transmissions, the system allows the vehicle to park automatically, without the need for the driver to press the pedals or move the steering wheel. The driver merely presses the button to activate the system when the Park Assist system has detected a possible parking space; the functions of this system are interrupted at any time when the driver presses the pedals or turns the steering wheel.

The latest trend, although it is only available on high-end vehicles, consists of allowing the driver to park the vehicle/exit a space without even sitting in the driving position. The main advantage of this system is that it allows the vehicle to be parked in very narrow spaces in which the doors cannot be opened after the vehicle has been parked. The vehicle may be controlled using a smartphone or the vehicle's remote control, depending on the model.

Adaptive lights

The adaptive light system is responsible for automatically activating or deactivating different lighting patterns based on the driving conditions, in order to avoid dazzling other vehicles or pedestrians, to adapt better to the driving conditions and to improve driving in adverse weather conditions.
Although the system is highly reliable, the driver can activate or deactivate the conventional low-beam and high-beam lights manually (using the traditional method) if the system does not detect the optimum conditions to do this. The main sensor of this system is a camera that is normally located at the top of the windscreen, which is also used for other systems such as the lane departure assistant and the adaptive cruise control. The brightness sensor is used to determine when the lights should be turned on.
The adaptive lights system may combine the following operating modes:

Static bending lights

This is the most economical and simple system in the field of adaptive lighting. It consists of a series of lights located in the area of the fog lights (which normally also perform this function), at the bottom of the front bumper, or an additional lamp included in the main headlamp, rotated at a certain angle towards the exterior. In both cases, the bulb lights when the turn signal is activated or when the steering wheel is turned at a certain angle, provided that the vehicle is travelling at moderate speed. In order for the driver to have more lighting and consequently improved visibility of the interior part of the curve.
This takes into consideration the information from the vehicle's steering angle and speed. After the manoeuvre has been completed and the steering wheel has been straightened, the static bending light is switched off.

Dynamic bending lights

These represent an evolution of static bending lights. The lights are equipped with an electric motor that can turn the lamp in coordination with the vehicle's steering, allowing the beam to follow the path of the road. In this case, the light that is on the inside of the curve is given a turning angle greater than the exterior light, so that the driver has a complete view of the road.

High beam assistant

Using a camera located at the top of the windscreen, this assistant can recognize the lights of vehicles travelling in the opposite direction, the tail lights of vehicles travelling in front and lighted areas of a town. After processing the information, the assistant automatically activates the low beams or high beams, and tries to maintain them as long as possible.

If the headlamp does not use halogen or Xenon bulbs and uses LED lighting instead, the effect is achieved by turning on different groups of LEDs that are more or less bright.

Predictive lighting assistant

The latest advance in lighting is predictive lighting. Thanks to the navigator installed in the vehicle, the system knows the route of the highway and knows the exact angles of the curves that are coming up. With this information, it can apply the dynamic lighting more precisely.

Fatigue detector

One of the main causes of traffic accidents is drowsiness and fatigue. The fatigue detection system uses the information from different sensors installed in the automobile to create a driving pattern, which is compared with an alert driving pattern. If the two patterns differ excessively, a visual and acoustic alert is generated on the instrument panel, alerting the driver to take a break. The icon used to indicate that fatigue has been detected in the driver is usually a cup of coffee.

The information for creating the driving pattern comes basically from the steering wheel's steering angle sensor in the ESP system, the front-view camera used by other systems such as: active speed control and lane departure warning.

- The system uses the steering angle sensor to detect, on the one hand, the absence of movement of the steering wheel, and on the other, small, rapid and sudden turns.
- The system uses the front-view camera to analyse whether the vehicle is driving in the centre of the lane or is continually "brushing" the lane dividing lines.

Both types of information are compared with parameters such as trip duration, use of turn signals and the time of day to complete the driving pattern.

Another less-widespread system consists of a camera on the dashboard that monitors the driver's facial expressions. The camera focuses on the driver's face and monitors the eyes to see if blinking is normal or indicates drowsiness, along with yawning and other signs of fatigue.

The facial recognition software that is associated with the image captured by the camera goes even further and can also detect whether the driver is watching the road or glances somewhere else, not paying attention to driving, is nervous, stressed or angry. The main problem with this system is that if the driver is wearing sunglasses, the software cannot analyse the eye expressions.

TECHNICAL NOTES

This section describes the most common malfunctions in relation to the driver-assist systems (ADAS). Depending on the manufacturer and the different models, the number of faults occurring over the years may vary.

These faults are selected from the online platform: www.einavts.com. This platform has a series of sections that specify: make, model, line, system affected, and subsystem, which can be selected independently depending on the desired search.

FORD

MONDEO IV, MONDEO IV Sedan, MONDEO IV Turnier	
Symptoms	Fault codes recorded in the headlamp control unit (HCM). The vehicle displays one or more of the aforementioned fault codes. Improper operation of the cornering lights. NOTE: This technical note only affects vehicles that are equipped with adaptive lighting systems and vehicles that are within a specific production date range.
Cause	Software defect of the headlamp control unit (HCM).
Solution	Repair procedure: • Read the fault codes reported by the headlamp control unit (HCM) with the diagnostic tool. • Confirm that one or more of the fault codes mentioned in the symptoms field of this note are recorded. • Check the version of the headlamp control unit (HCM) to confirm that it is in the range of affected units. • Delete the fault codes reported by the headlamp control unit (HCM) with the diagnostic tool. • Re-programme the headlamp control unit (HCM) with updated software. • Calibrate the headlamp control unit (HCM) with the diagnostic tool. IMPORTANT: It is not necessary to replace any unit or component to repair this fault.

FORD

C-MAX, TOURNEO CONNECT, TRANSIT Pickup (FA_ _), TRANSIT CONNECT (P65_, P70_, P80_), FOCUS C-MAX, KUGA, FOCUS II (DA_), GALAXY, MONDEO IV, TRANSIT Pickup	
Symptoms	Improper operation of the parktronic parking assist system camera. The display screen remains blue after the reverse gear is engaged. The system is blocked for about 15 minutes and then a series of incoherences occur related with the following: - The audio system, in the last speaker output source. • The vehicle mobile telephone system, specifically incoming calls, where the "Call screen" message is constantly displayed when the call is ended. • The Ipod/USB connection. - The CD player controller and the buttons on its control panel. • The voice control system. - It is not possible to begin a route assistance during an active call. - The radio and its stations. All these anomalies disappear after a certain waiting time, although we observe a series of TMC (Traffic Messages Channel) messages.
Cause	Software defect of the navigation system control unit.
Solution	• Re-programme the navigation control unit with updated software.

AUDI

A8 (4E_), Q7 (4L)	
Symptoms	Malfunction on the multi-function display (FIS) message when the lane-change system is connected: - Audi side assist: System failure. The following symptom is observed in the workshop: - When reading fault codes on the control unit of the lane-change assistance system (J770) the following fault message is displayed: " Defective local data bus".
Cause	Defect in the software of the control unit (J770) of the lane-change assist.
Solution	Repair procedure: • Read the fault codes reported by the lane-change assist control unit (J770) with the diagnostic tool. • Delete the fault codes reported by the lane-change assist control unit (J770) with the diagnostic tool. • Reprogram the software of the lane-change assist control unit (J770) with updated software. NOTE: The lane-change assist control unit is located in the rear bumper, so every time that its position is changed by an impact or external movement, it must be recalibrated at the original point of sale.

BMW

5 Series	
Symptoms	Cruise control adaptation control function inoperative. No error codes are reported. Improper operation of the ESP system. The vehicle brakes or slows when vehicles are travelling in the opposite direction in the other lane. NOTE: This technical note only affects those vehicles equipped with adaptive cruise control (ACC) systems with front vehicle detection by radar. This symptom is reproduced after body repairs or after frontal collision with an object or in an accident.
Cause	Possible causes: • Power supply or ground defect of one of the units associated with the cruise control system (ACC) with front vehicle detection: • ECM engine control module • Control unit of the vehicle's stability control system in the braking system (ESP). • Steering column control unit • Gearbox control unit. • The front-vehicle detection radar antenna of the ACC system is damaged or defective.
Solution	Repair procedure: • Verify whether it is possible to enter the diagnostics of the cruise control (ACC) control unit to read the fault codes with the diagnostic tool. • Take readings from the remaining units for the cruise control system (ACC). • Check the power supply voltage and ground of the units associated with the ACC system. • Check the condition of the support of the radar of the cruise control system (ACC) located in the front bumper. • Replace the support of the radar of the cruise control system with a new one. • Adjust the radar antenna with the specific tool.

an eye on automotive technology

The Eure!TechFlash newsletter is complementary to ADI's training program Eure!Car and has a straightforward mission :

to provide up-to-date technical insight in innovations within the automotive environment.

With technical assistance of AD Technical Centre (Spain) and assisted by the leading parts manufacturers, Eure!TechFlash aims to demystify new technologies and make them transparent, in order to stimulate professional repairers to keep pace with technology and to motivate them to continuously invest in technical education.

Eure!TechFlash will be issued 3 to 4 times a year.

Eure!Car®
CERTIFIED MASTERCLASSES

The technical competence level of the mechanic is vital, and in the future may be decisive for the continued existence of the professional repairer.

Eure!Car is an initiative by Autodistribution International, with headquarters in Kortenberg, Belgium (www.ad-europe.com). The Eure!Car program contains a comprehensive series of high-profile technical trainings for professional repairers, which are given by the national AD organizations and their parts distributors in 48 countries.

Visit **www.eurecar.org** for more information or to view the training courses.

industrial partners supporting Eure!Car

NEXT

Analysis of 5 gases diesel

Disclaimer : the information featured in this guide is not exhaustive and is provided for information purposes only. Information does not incur the liability of the author.