

# Autonomous Vehicle Technology



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## Introduction

There is considerable focus on the development and introduction of highly autonomous and fully autonomous vehicles on Great Britain's roads and the legal implications.

The Society of Automotive Engineers International (SAE) has defined six levels of automation.

This includes vehicles with no automation, where a fully qualified driver is required to be alerts at all times, to full autonomy, where a vehicle functions independently without a human driver.

A number of automated technology systems are now available on mainstream vehicles, such as automated parking, adaptive cruise control with lane-keeping assist and motorway assist. However, there has so far been relatively little attention given to educating drivers on their choice and use of these semi-autonomous features.

There are a number of potential safety issues when choosing or using a vehicle fitted with semi-autonomous technology.

With vehicles on the market already featuring 'Level 2 partial-autonomy', it is essential that drivers understand the technology in their vehicles; what it does, how to use it as safely as possible and the potential risks of misuse.

This guide will also supplement the information recently added to the Highway Code relating to motorway assist and remote controlled parking.

### Levels 1 and 2 of Automation

The most basic stage, Level 1, is where one element of driving is supported using sensors and cameras, but the driver is still fully in charge of the vehicle. This includes features such as radar-managed cruise control, lane-keeping assist and autonomous emergency braking (AEB) which have been available for a number of years.

Level 2 autonomy is where the vehicle is capable of controlling multiple functions such as the accelerator, braking and unlike Level 1, the steering function.

With remote controlled parking functions it also possible to park into tight areas without being in the driving seat. In Level 2, the driver continues to remain in control of the vehicle and must always pay attention to the road at all times.

Individual vehicle manufacturers use differing trade names to market what are essentially the same, or very similar, systems. Drivers are advised to consult the handbook of their vehicle before attempting to operate any of these features.

Many features may need to be activated by the driver before use, and some will need to be activated each time the engine or electric motor is switched on, so it is essential that drivers are fully aware of the requirements within their particular vehicle, particularly if they use multiple vehicles.



## Autonomous Emergency Braking

Autonomous Emergency Braking (AEB) systems usually try to avoid an impact by warning the driver at first, although this does not happen on every vehicle fitted with AEB. If no action is taken and a collision is anticipated, the system will apply the brakes.

However, some systems are better at detecting vulnerable road users, such as pedestrians and cyclists, than others. AEB is not a substitute for effective observations and full concentration whilst driving.

Early AEB systems only functioned at low speeds but modern systems can operate up to motorway speeds and can detect pedestrians, cyclists and potential obstacles when reversing.

Some systems can intervene when it is unnecessary, such as when the vehicle is travelling down a steep slope that levels out, so drivers are reminded to remain alert at all times and use the vehicle handbook to find out how to temporarily deactivate the system, or adjust the sensitivity level, if required.

### **Alternative names include:**

Advanced Emergency Braking, Active Emergency Braking, City Safety, City Emergency Braking, Pedestrian Warning with City Brake Activation, Active City Stop, Active Brake Assist, Pre Sense Front, Forward Collision Mitigation.



## Blind-Spot Assistance Systems

Blind-Spot Assistance warns the driver if a vehicle is approaching their blind-spot, usually by a symbol on the corresponding exterior mirror of the vehicle.



Basic systems provide the driver with a visual or audible warning, whereas more advanced systems engage the vehicle brakes or operate the steering where required.

Drivers are advised to always check their blind-spot before changing direction, even if their vehicle is fitted with such technology. There may be an occasion where the system does not detect a vehicle, pedestrian or cyclist and the speeds at which the system is in operation varies depending on the vehicle.

### **Alternative names include:**

Active Blind Spot Assist, Lane Change Warning, Blind-Spot Collision-Avoidance Assist, Blind Spot Warning.

## Adaptive Cruise Control

Adaptive Cruise Control (ACC) is an advanced form of cruise control that allows the vehicle to accelerate and slow down automatically to keep pace with traffic ahead. Some advanced systems use detailed data from the vehicle's satellite navigation to slow down for corners ahead and maintain a set distance from vehicles in front.

Drivers must keep their hands on the steering wheel at all times and be ready to intervene where necessary. Many ACC systems allow the driver to alter the distance between their vehicle and those in front but it is important that a safe distance is always maintained. Poor weather conditions, particularly cold temperatures and condensation, can adversely affect the radar sensors used to operate Adaptive Cruise Control so the system may not always be available to use.

Drivers must ensure they are always in full control of their vehicle. The vehicle can keep a set distance from another vehicle in front but it will not necessarily detect that traffic is slowing or changing lanes due to a lane closure, further along the carriageway. In many circumstances, a good driver would be able to observe what is happening much further ahead and deal with the situation well in advance. It is also worth noting that during heavy rain, fog or icy conditions, the driver should ideally keep full control of the vehicle so that they are able to react to potential hazards ahead.

### **Alternative names include:**

Active Cruise Control, Distronic, Safety Sense, Intelligent Cruise Control, Smart Cruise Control.

## Traffic Jam Assist

Linked with Adaptive Cruise Control, Traffic Jam Assist allows the vehicle to follow those ahead and automatically operate the accelerator and brakes within the limits of the system. However, some manufacturers have developed partially automated systems that also control the steering.

Drivers must ensure their hands are kept on the steering wheel at all times and the same advice for ACC applies, so driver intervention may be preferable in a number of circumstances.

The speeds at which Traffic Jam Assist can be activated varies depending on the vehicle, but commonly operate below 40mph. If the vehicle comes to a halt for a few seconds, it may move off again automatically but on other occasions, the driver will need to depress the accelerator or press a button to continue.

Some systems recognise roadworks and can respond appropriately but this is not always the case. When Traffic Jam Assist reaches its system limits, such as when the traffic is light or there is a sharp bend ahead, the driver must take control. If not, the system will usually warn the driver and as a final measure, the vehicle will come to a stop.

### **Alternative names include:**

Active Cruise Control with Stop & Go, Steering and Lane Control Assistant, Adaptive Cruise Control with Queue Assist, Traffic Jam Pilot, Highway & Traffic Jam Companion.





## Lane Assistance Systems

A camera scans the road ahead to detect lane markings and where the vehicle is in relation to the markings, commonly at speeds above 40mph. Lane assistance systems have numerous different names, often being known as Lane Departure Warning, Lane Keeping Assist and Active Lane Keeping Assist.

Lane assist systems detect that the driver is about to leave their lane and therefore alerts them with an audible warning and, on some models, a vibration through the steering wheel.

Active systems physically intervene and, if the vehicle starts to deviate from its lane, will gently steer the car back into its lane. Some systems use the electronic power steering system to apply a steering input to bring the vehicle back in line whereas other systems use the brakes to steer the car back into its lane.



Drivers must not rely on such systems to take control of the vehicle for them. If lane markings are faded, inconsistent, or the windscreen is not clean the system may not intervene as expected. These systems generally deactivate if they detect that the driver is not holding the steering wheel. Driver fatigue can occur at any time of the day or night so adequate breaks from the wheel should always be planned in to a journey.

The latest systems, such as Active Lane Change Assist, allow the vehicle to change lanes automatically on multi-lane roads when the driver operates the indicator stalk. Sensors determine whether the lane is clear in front, alongside and behind the vehicle, and can take in to account the speed of other vehicles. When there is no other vehicle within the relevant area, the driver is supported in changing lanes.

However, the driver must use effective observations at all times and must not rely on the system to detect vehicles further behind that may be hidden by other approaching traffic. This is particularly important when emergency vehicles may be approaching – a good driver will observe the vehicle in their mirrors and will not overtake at an inappropriate time.

### **Alternative names include:**

Active Lane Assist, Active Lane Keeping, Auto Lane Change, Lane Departure Warning, Lane Change Warning, Lane Keeping System, Lane Following Assist, Lane Positioning Assist.

## Motorway Assistance Systems

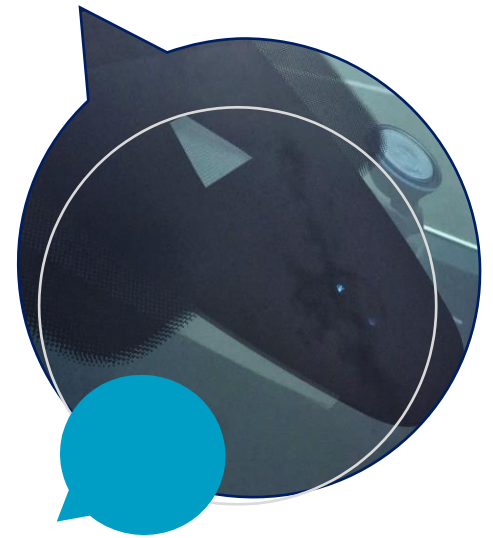
Motorway Assist builds on existing systems such as Adaptive Cruise Control, Advanced Emergency Braking and Active Lane Keep Assist to take full control of a vehicle's position and speed when driving along high-speed roads, such as a motorway.

These systems generally deactivate if they detect that the driver is not holding the steering wheel and the driver must remain in overall control of the vehicle at all times.

These systems may be unable to guide the vehicle and assist the driver when visibility is poor. This could be in bad weather, when driving on hills or sharp curves, when the camera is obstructed or damaged or when a bright light faces the camera.

### **Alternative names include:**

Highway Assist, Highway Driving Assist, Autopilot, Highway & Traffic Jam Companion.



## Speed Assistance Systems

The latest Speed Assistance Systems ensure detected speed limits are automatically adopted as the set speed. Limits are recognised by traffic sign recognition cameras fitted to the vehicle or using information from the vehicle's satellite navigation system. Some systems act as a speed limiter, whereas more advanced systems work with Adaptive Cruise Control to adapt the vehicle's speed to the recognised speed limits automatically.

There could be occasions where camera systems may be unable to detect the sign, perhaps due to overhanging trees, sun glare or where the sign has been struck or moved.

For systems using satellite navigation data, this relies on the device being fully up to date at all times taking in to account any recent speed limit changes.

Additionally, many roads have features such as curves and gradients where the appropriate speed would be much less than the posted maximum speed limit, therefore the driver must continue to remain alert at all times and be able to override the system where necessary.

### **Alternative names include:**

Active Speed Limit Assist, Intelligent Speed Limiter, Safety Sense, Intelligent Speed Adaptation, Intelligent Speed Assistance.



## Park Assistance Systems

Parking Assistance systems can support the driver in searching for a parking space and when entering or exiting parallel or end-on parking spaces. The system can manoeuvre the vehicle automatically into the selected parking space. Some systems can be set to automatically search for parking spaces when the vehicle is travelling at low speed whereas others require a button to be pressed to begin searching.

Certain systems control the steering while the driver controls the accelerator, gears, and brakes. More advanced systems allow the driver to depress a button continuously whilst the vehicle accelerator and brakes are operated automatically.

Drivers must ensure that they provide effective observations throughout the manoeuvre and not rely on the system to fully detect approaching vehicles, pedestrians and cyclists. Depending on the system, the vehicle may not always end up as close to the kerb as if the driver parked it manually, and may not leave enough space for the vehicles in front or behind to exit their space. Additionally, if the manoeuvre is interrupted (for example, if the driver touches the steering wheel or brakes part-way through the manoeuvre), the driver will be expected to take control and complete the exercise.

**Alternative names include:**

Park Assist, Active Parking Assist, Parktronic, Parking Assistant, Easy Park Assist.

## Remote Controlled Parking

Remote Controlled Parking (RCP) enables the driver to perform a parking manoeuvre from outside the vehicle. The device used to do this could either be supplied with the vehicle or a manufacturer-endorsed application installed on a device such as a smartphone.

When the button is held continuously on the device, the vehicle will manoeuvre automatically at low speed while monitoring its surroundings for hazards. If a person or hazard is detected, or if the remote control button is accidentally or intentionally deactivated, the vehicle will stop. The system will not function if the driver is outside a certain range, which is currently 6 metres.

The driver must initially stop in a safe and legal location before exiting their vehicle. It is safer for passengers (especially children) to get out of the vehicle on the side next to the kerb.

Drivers need to be fully aware of their surroundings when operating any device outside of the vehicle, particularly if they are standing in the carriageway, due to the much greater risk of being hit by other vehicles. Drivers must also be mindful of their responsibility to maintain effective observations throughout the manoeuvre and not to rely solely on sensors within the vehicle.

**Alternative names include:**

Remote Parking Assist, Remote Parking Pilot, Remote Control Parking.



## Useful Links

[The Highway Code](#) is essential reading for everyone who uses the road. Knowing its rules could significantly reduce the number of deaths and injuries that occur on our roads every day.

[Driver and Vehicle Standards Agency \(DVSA\)](#) conducts and sets standards for driving tests and recalls of vehicles, parts and accessories.

[RoSPA Road Safety](#) provides guidance, resources and services to help people live healthy, active lives unburdened by fatal and life-changing accidents and injuries.

[Road Safety GB](#) Comprises representatives from groups across the UK, including local government road safety teams. It helps to raise awareness of road safety and safer road user behaviour.

[Road Safety Wales](#) develops co-operation and interaction between key partners and agencies with responsibility for promoting road safety across Wales.

[Road Safety Scotland](#) provides advice, resources and services to promote safer road use in Scotland.

[Think Road Safety](#) provides road safety information for road users and aims to encourage safer behaviour to reduce the number of people killed and injured on our roads every year.

[Driver and Vehicle Licensing Agency \(DVLA\)](#) registers and licenses drivers, motorcyclists and vehicles and maintains the records of over 48 million drivers and over 40 million vehicles.

[Department for Transport](#) sets regulations, laws and guidance for road users, roads and vehicles. Its website is updated regularly.

[Euro NCAP](#) conducts vehicle tests to identify improvements and new technology. The tests go beyond legal requirements and evolve as innovations are introduced.

[Transport for London](#) is committed to ending deaths and serious injuries on London's roads and transport networks by 2041 through its [Vision Zero campaign and action plan](#).

[Highways England](#) operates England's motorways and major A roads, and a uniformed Traffic Officer Service which patrol its network.





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