

# Advanced driver-assistance systems (ADAS)

**iam**  
RoadSmart

**Hi-Drive**



## **Introduction**

The motor industry is currently going through one of the biggest transformations in its history. The workhorse of our roads, the internal combustion engine, is being phased out in favour of cleaner alternatives. Alongside this, manufacturers have been steadily increasing the number of driving aids available to owners creating the opportunity for safer roads.

Over the last 20 years, the road safety community has increasingly looked to a 'safe systems approach', acknowledging that you cannot fully eradicate human error but you can have good infrastructure and technology in place to ensure the road environment is as safe as it can be. This is where technology will play its part, making driving safer and more enjoyable and reducing the number of collisions on our network.

IAM RoadSmart is a proud partner of the Hi-Drive project and User Education Campaign led by FIA REGION I Region I and implemented by 11 Mobility Clubs in Europe. This project to raise awareness and education of new technology within vehicles. Through their funding and research, we have worked to create this read-only course for fleet managers and the wider driving community.

We are still some years away from having a self-driving, remote controlled vehicle picking us up from our house to take us to where we need to go without worrying about other drivers, but the level of change in the last decade has already been phenomenal. With this, comes a responsibility to ensure that drivers are well informed of how this technology can help save their lives and embrace it. I hope the content in this course will do just that.

**Nicholas Lyes**  
**IAM Policy and Standards Director**

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## About this content

This read-only course examines the technology installed in motor vehicles to provide an overview of Advanced Driver Assistance Systems (ADAS). There are three key audiences it would be especially beneficial to are:

- **Businesses with fleets**, particularly those where its drivers are covering long annual mileages or those who are part of the delivery sector (often referred to as the 'gig economy'.)
- **Driving for work:** For all drivers that operate a vehicle that they don't own themselves or if the vehicle is owned by a third party.
- **Those selling vehicles:** Dealerships and showrooms are usually the first port of call for people looking at new vehicles or those trading in. Vehicle safety remains a key interest to any vehicle buyer and while there are EuroNCAP ratings available, many drivers do not know nor understand the benefits much of this ADAS technology brings. In some cases, they will switch the technology off.

This read-only course should result in the following understandings:

- Impact of driver error on road safety
- the most relevant technologies used on modern day vehicles and how they are defined
- What each of these technologies do and how they can either assist a driver from a comfort or a safety point-of-view. They should also understand where safety technology can more widely improve overall road safety.
- How these technologies work in vehicles and awareness of when they are engaged
- An understanding of what dashboard warning lights indicate
- Why more training, rather than less training is needed in this area of the automotive sector

*These materials have been developed with the support of the Hi-Drive project. Co-funded by the European Union under the Horizon 2020 programme Grant Agreement No 101006664 (Hi-Drive - Addressing challenges toward the deployment of higher automation).*

## More training needed, not less

There is an assumption that increased technology and driving assistance systems should reduce the need for driver training, however this supposes that every driver understands what every part of their vehicle can do, how to use it and why the technology is useful.

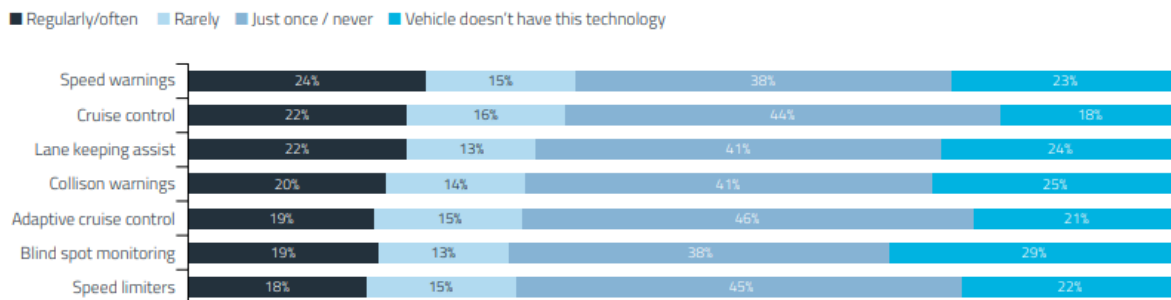
The IAM RoadSmart 2023 'Road Safety Culture Report' is based on a survey of a representative sample of UK drivers. It found that despite the majority of drivers having access to a number of driver aids inside the vehicle, a worrying majority rarely or never use them – see figure 1. This indicates most turn them off or do not engage which is often the sign of being unaware of what they do or of irritation if the system is switched on and is accompanied by an audio alarm.

**Figure 1.**

### Frequency of using driver assistance aids

Q25. Over the last 12 months, how often have you used the following driver assistance aids...?

- Broadly equal proportions indicate they use each of the prompted driver assistance aids; implying that behaviour is to use these aids generally as opposed to specific aids only.
- However, speed warnings and cruise control are the most common driver assistance aids.



In 2020, Nottingham University research which had been commissioned by the RAC Foundation<sup>1</sup> concluded that behavioural training for drivers is paramount for the transition into the next stage of automated vehicles, known as level 3 automation. Researchers studied two groups of experienced drivers in a high-fidelity driving simulator to observe their behaviour while 'driving' the level of automated vehicle. It found that drivers who received behavioural training were more measured in their behaviour and better understood the car's capabilities and limitations, effectively rendering these drivers as far more prepared to assume control of a vehicle when needed.

<sup>1</sup> [More not less training needed for semi-automated cars \(racfoundation.org\)](https://www.racfoundation.org)

IAM RoadSmart believes that equipping drivers of today with an understanding of the skills of tomorrow will make the transition far easier and engaging which is why we have developed this course.

The FIA REGION I Region I Hi-Drive group was established in 2021 to bring together road safety experts to enable a more standardised approach to defining ADAS technologies and how they can be beneficial to fleet owners and drivers. There were 14 automated driving functions covered in the campaign that range between driver support features, advanced driver assistance systems and automated driving functions which belong to levels 0 to 3, of internationally recognized levels of driving automation by the Society of Automotive Engineers (SAE).

We thank the FIA REGION I Region I Hi-Drive team for their assets which are featured throughout this course.

## ROAD SAFETY DATA

### Summary

- In 2023, there were 1,624 fatal collisions on roads in Great Britain
- 29,711 killed or seriously injured (KSI) casualties, similar to 2022
- 132,977 casualties of all severities, a decline of 2% compared to 2022
- 75% of fatalities and 61% of casualties of all severities were male
- In Northern Ireland, there was a total 71 fatalities (an increase on 2022), 880 people seriously injured.

### Reported road fatalities by age group and sex in Great Britain, 2023 compared with 2022 and 2014 [RAS0202](#) (Source: Department for Transport)

Sex	Age group	2014	2022	2023
Male	Under 16	0	0	0
Male	16	0	0	1
Male	17 to 20	36	43	39
Male	21 to 24	54	39	36
Male	25 to 29	49	37	20
Male	30 to 39	53	63	68
Male	40 to 49	51	50	47
Male	50 to 59	46	47	35
Male	60 to 69	52	39	35
Male	70 to 79	36	45	47
Male	80 and over	44	52	37
Male	<b>All ages</b>	<b>421</b>	<b>415</b>	<b>365</b>
Female	Under 16	0	0	0
Female	16	0	0	0
Female	17 to 20	11	8	6
Female	21 to 24	19	11	9
Female	25 to 29	15	13	7
Female	30 to 39	16	15	17
Female	40 to 49	21	13	10
Female	50 to 59	14	10	15
Female	60 to 69	19	11	20
Female	70 to 79	11	24	19
Female	80 and over	21	23	19
Female	<b>All ages</b>	<b>147</b>	<b>128</b>	<b>122</b>

**Reported road fatalities in Great Britain – 2023 contributory factors  
(focusing on driver error)** (Source: Department for Transport)

Contributory factor reported in collision [note 1]	Severity [note 2]	2014	2022	2023
Injudicious action	Fatal	487	462	465
Disobeyed automatic traffic signal	Fatal	14	17	23
Disobeyed 'Give Way' or 'Stop' sign or markings	Fatal	14	14	30
Disobeyed double white lines	Fatal	14	10	10
Disobeyed pedestrian crossing facility	Fatal	7	6	7
Illegal turn or direction of travel	Fatal	13	28	9
Exceeding speed limit	Fatal	282	303	314
Travelling too fast for conditions	Fatal	185	131	122
Following too close	Fatal	27	16	16
Vehicle travelling along pavement	Fatal	5	9	4
Cyclist entering road from pavement	Fatal	6	6	7
<b>Driver or Rider error or reaction</b>	<b>Fatal</b>	<b>1,094</b>	<b>854</b>	<b>849</b>
Junction overshoot	Fatal	24	18	19
Junction restart (moving off at junction)	Fatal	5	6	7
Poor turn or manoeuvre	Fatal	225	159	165
Failed to signal or misleading signal	Fatal	5	3	3
Driver or Rider failed to look properly	Fatal	397	343	308
Driver or Rider failed to judge other person`s path or speed	Fatal	219	164	181
Too close to cyclist, horse rider or pedestrian	Fatal	21	13	9
Sudden braking	Fatal	54	17	15
Swerved	Fatal	127	55	65
Loss of control	Fatal	540	375	347
Impairment or distraction	Fatal	399	458	438
Driver or Rider impaired by alcohol	Fatal	141	160	154
Driver or Rider impaired by drugs (illicit or medicinal)	Fatal	55	97	134
Fatigue	Fatal	56	59	45
Uncorrected, defective eyesight	Fatal	11	5	7
Driver or Rider illness or disability, mental or physical	Fatal	112	126	109
Not displaying lights at night or in poor visibility	Fatal	4	5	11
Rider wearing dark clothing	Fatal	4	4	5
Driver using mobile phone	Fatal	24	22	23
Distraction in vehicle	Fatal	79	85	81
Distraction outside vehicle	Fatal	23	15	15
Behaviour or inexperience	Fatal	447	441	459
Aggressive driving	Fatal	120	127	143
Driver or Rider careless, reckless or in a hurry	Fatal	303	335	320
Driver or Rider nervous, uncertain or panic	Fatal	23	9	6



Contributory factor reported in collision [note 1]	Severity [note 2]	2014	2022	2023
Driving too slow for conditions or slow veh (eg tractor)	Fatal	3	2	2
Learner or inexperienced driver or rider	Fatal	58	44	20
Inexperience of driving on the left	Fatal	6	9	4
Unfamiliar with model of vehicle	Fatal	21	13	6

### Northern Ireland – Principal causation factors 2023 (Source: PSNI)

**Table 2 Most common principal causation factors in injury road traffic collisions, 2023**

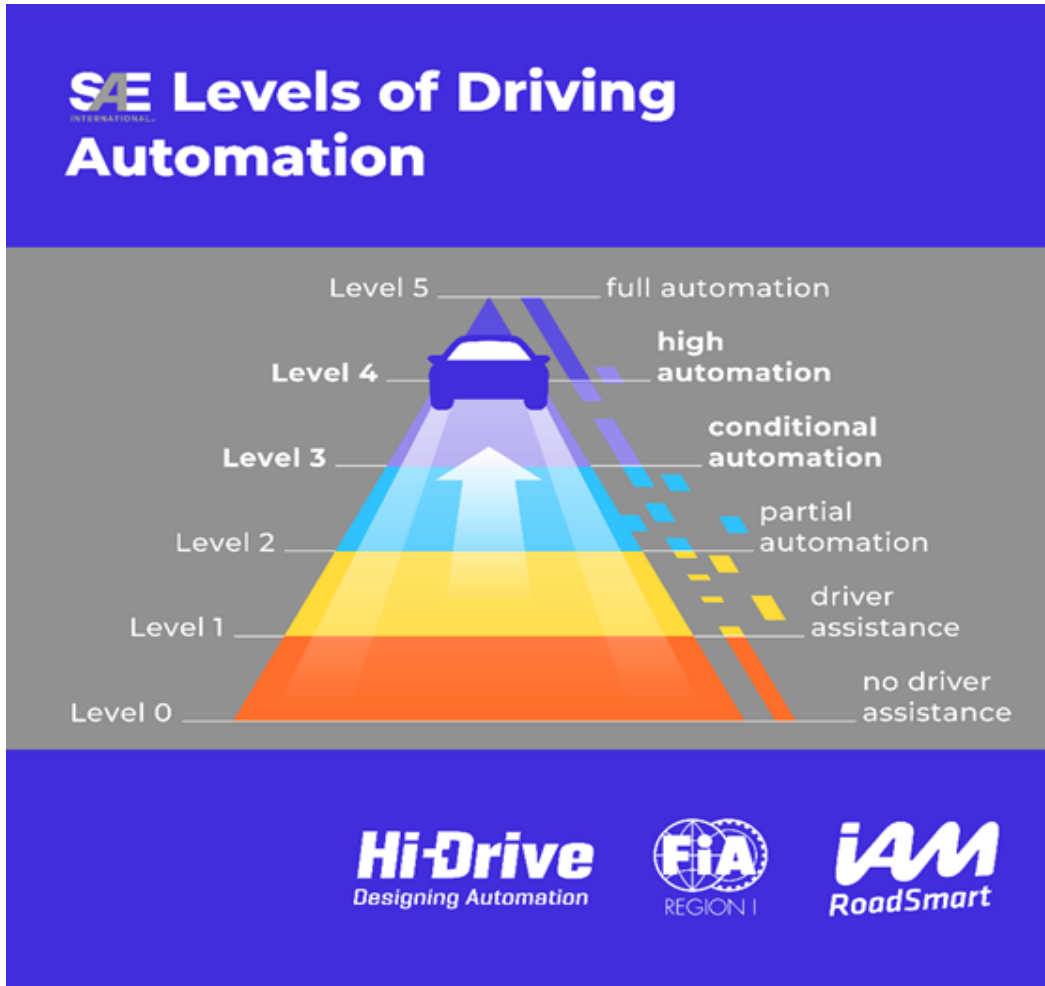
Principal Factor	Number of collisions	KSI <sup>1</sup> casualties	Slight casualties	Total casualties
Inattention or attention diverted	<b>823</b>	135	1,185	<b>1,320</b>
Driving too close	<b>638</b>	17	1,035	<b>1,052</b>
Emerging from minor road without care	<b>378</b>	57	533	<b>590</b>
Impairment by drugs or alcohol - driver/rider	<b>285</b>	84	375	<b>459</b>
Crossing or entering road junction without care	<b>284</b>	55	426	<b>481</b>
Turning right without care	<b>255</b>	58	384	<b>442</b>
Wrong course/position	<b>205</b>	68	331	<b>399</b>
Overtaking on offside without care	<b>187</b>	71	252	<b>323</b>
Changing lane without care	<b>176</b>	15	246	<b>261</b>
Excessive speed having regard to conditions	<b>156</b>	58	250	<b>308</b>

<sup>1</sup> Killed or seriously injured

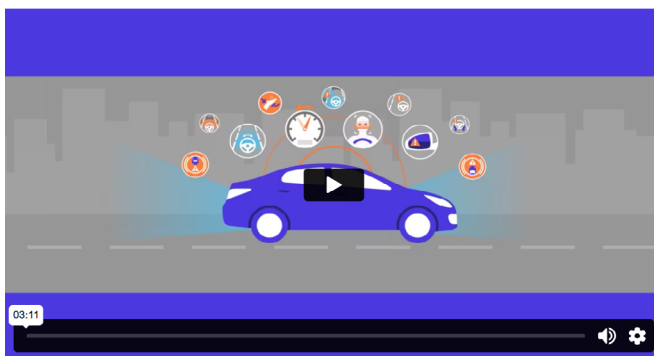
- The most common principal causation factors for all casualties were 'inattention or attention diverted' (1,320 casualties) followed by 'driving too close' (1,052 casualties) and 'emerging from minor road without care' (590 casualties). These 3 causation factors alone accounted for more than a third of all casualties in 2023 (37.1%).
- The most common principal causation factors for KSI casualties during 2023 were 'inattention or attention diverted' (135 KSI casualties), followed by 'impairment by drugs or alcohol - driver/rider' (84 KSI casualties).

## How we define technology

The five levels of automation are defined below:



The video below, presented by Hi-Drive covers the different levels of vehicle automation available



Technologies within this document cover up to Level 3.

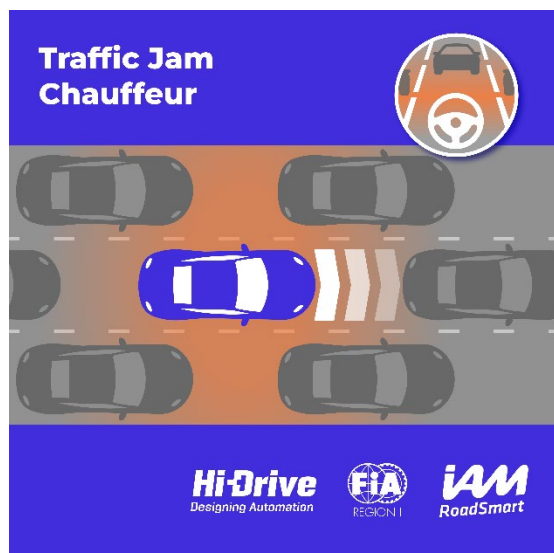
Level 1	This technology has safety benefits but its main purpose is to improve the journey of the driver by increasing the comfort levels by reducing some of the more strenuous driving tasks and providing users with audio and/or visual warnings, thereby improving safety.
Level 2	This level has significant benefits by taking away some driving tasks, though the driver is required to remain in control of the vehicle.
Up to level 3	'Partial or conditional automation' is present in the vehicle and where the driver can effectively hand over all main controls of the vehicle to the system for a period of time before an alarm sounds warning the driver to resume control of the vehicle.

## Automated lane keeping systems (ALKS) – also known as Traffic Jam Chauffeur

### What is it?

ALKS is effectively the closest technology in use which has been approved for use in the UK that allows a driver to disengage with the driving process. As of April 2022, the Centre for Connected Vehicles defines ALKS as *‘vehicle technology designed to control the lateral, left and right, and longitudinal, forward and back, movement of the vehicle for an extended period without further driver command.*

For the user, this effectively means hands-free driving with a warning alarm that notifies the driver that they will be required to take back control of the vehicle. Technology in this area is progressing quickly, with Ford BlueCruise already able to engage at speeds higher than the CCAV definition. BlueCruise is the first hands-free driver assistance technology approved in the UK but is limited to certain pre-mapped sections of the motorway network.



### Chief Examiner summary - how this helps drivers

Lane keeping assist has been fitted to vehicles for some time now and as the technology has progressed it is becoming more accurate. In older systems the vehicle will be prevented from drifting over the lines by an application of a brake forcing the vehicle straight. Systems where servos control the steering have the capability to keep the vehicle in a lane safely and are a useful guardian angel if inattention creeps in. They rely on information from various sensors and if they do not get the required amount of information, they are unable to operate. If a fully autonomous feature is fitted, you must be capable of assuming control immediately should the system decide to hand over. Whilst you may be able to be hands free, at the moment you should not be attention free.

### Classification:

Up to level 3	'Partial or conditional automation' is present in the vehicle and where the driver can effectively hand over all main controls of the vehicle to the system for a period of time before an alarm sounds warning the driver to resume control of the vehicle.
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## **Automatic Emergency Braking (AEB) (sometimes also called autonomous emergency braking)**

### **What is it?**

AEB is a system installed within the vehicle that detects how close you are to the vehicle in front and applies a brake to prevent a collision with a vehicle or object in front. Early designs of the system did this at lower speeds (generally around 20mph), however more modern vehicles with ABS can function even at higher speeds.

The system uses sensors and cameras and will calculate if collision may occur. First, most drivers will see an alert on their dashboard warning them. This may then be followed by an alarm. The vehicle will then apply a sharp brake, effectively reacting if the driver fails to do so.

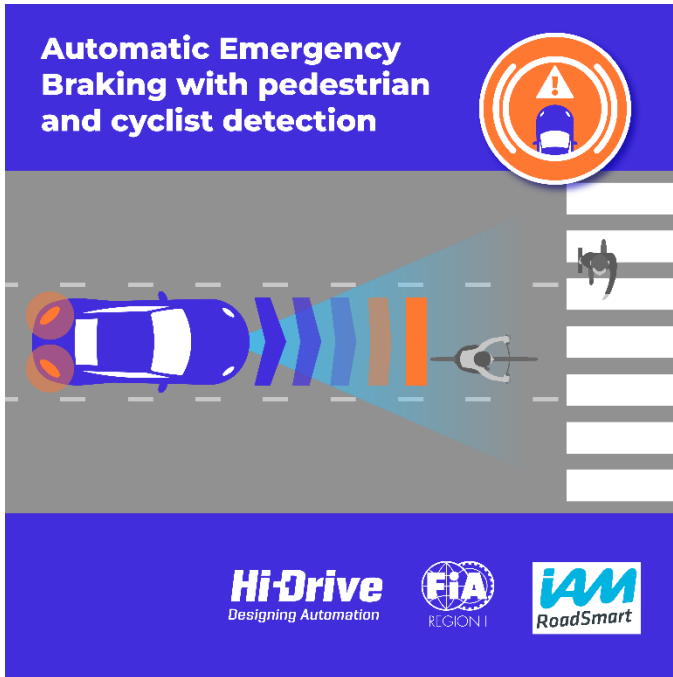
Under European Union legislation, from 2022, it is a requirement that must be fitted with AEB as standard, including AEB with pedestrian and cyclist detection. The UK Government as of 2023 has not committed to the same standards, however given that many vehicles are imported into the UK from Europe, many sold here will be equipped with this.

According to Thatcham, AEB could save an astonishing 1100 lives and 122,860 casualties in the UK over the next 10 years, with some road safety experts believing it to be one of the most important safety features to be introduced since the seatbelt.

### **Automatic Emergency Braking with pedestrian and cyclist detection**

This technology is an evolution of AEB seen in newer vehicles. The system is able to detect objects (such as cyclists and pedestrians) at both the front and rear of the vehicle, helping to prevent collisions. Like AEB, it works at lower speeds better suited for urban roads. It should not be seen as a replacement for drivers paying full attention to the road ahead and on areas surrounding the vehicle. Drivers should be aware that some AEB systems might not include pedestrian and cyclist detection so should familiarise themselves with the capabilities of the system installed on their vehicles.

### **FIA REGION I Hi-Drive visual explainer**



FIA REGION I: AEB is an active safety system that utilises sensors, cameras and radar to detect imminent collision, alerting the driver and applying the brakes if necessary. Various Automatic Emergency Braking systems exist in vehicles today that can detect pedestrians, cyclists and objects near the end of the road. These systems contribute to collision prevention, emphasising the need for drivers to stay focused and maintain good driving habits for overall safety.



**Other & associated button/dashboard/warning images**



**Chief Examiner summary – how this helps drivers**

A useful guardian angel which should be fitted to all vehicles, there are reports of spurious activations causing issues, but these are limited and are far outweighed by the activations that are as a result of driver inattention, if the system is intervening often then something is out of calibration, if the system is checked and correct then you need to re- calibrate yourself to create a safer working space whilst driving. Older systems may not be calibrated for pedestrian activity although the European GSR 2022 has made this mandatory on all new vehicles homologated within the EU, the actual implementation date is set for July 2024 for all newly registered vehicles.

**Classification**

Level 2	This level has significant benefits by taking away some driving tasks, though the driver is required to remain in control of the vehicle
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**Cruise (and Adaptive) control**

**What is it?**

Most drivers are familiar or have heard of cruise control, though its use in vehicles remains fairly weak. According to a survey of drivers conducted by IAM RoadSmart in 2023, 22% say they use it regularly.


Cruise control essentially allows the driver to set the speed at which the vehicle can travel without the need for the driver to continue to have their foot on the gas. Drivers can set the speed they wish to and be confident it won't allow them to go over the speed limit if that is what it is set at. Cruise control systems are disabled when the driver puts their foot on the brake.



**Adaptive Cruise Control** takes it to another level. Using sensors and cameras in the vehicle, the system effectively reads the traffic ahead and will also apply the gently apply brakes to maintain distance between the drivers' vehicle and the vehicle in front.

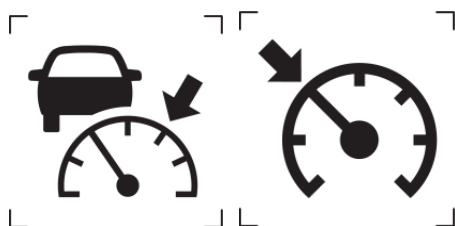
These systems are not mandatory but drivers who use high speed roads and motorways find they can help with leg cramp on long journeys, effectively giving their feet a rest. The systems are also incredibly helpful where average speed cameras operate. Drivers who are concerned about maintaining a speed (e.g 50mph through roadworks on a motorway) can set the cruise control safe in the knowledge they will maintain a steady and safe driving experience, however if the technology is not adaptive, it will not respond to changes in the limit or automatically slow the vehicle down if there is slower traffic ahead.

### FIA REGION I Hi-Drive visual explainer

 <p>The diagram shows a blue car on a road with a sensor beam projecting forward. A clock icon in the top right corner indicates speed adjustment. The bottom of the diagram features logos for Hi-Drive (Designing Automation), FIA REGION I, and iAM RoadSmart.</p>	<p>FIA REGION I Hi-Drive: Adaptive Cruise Control automatically adjusts your vehicle's speed to maintain a safe distance from the car ahead, utilising advanced sensor systems. Driver attention to road conditions is required at all times.</p>
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### Other & Associated button/dashboard/warning light

Adaptive cruise control / cruise control



**Chief Examiner summary – how this helps drivers**

Cruise control is a very useful feature when used in the right way. It is not a substitute for attention although an active system will control your following distance accurately and start to respond in most situations in a subtle way. You still often have more information than the system and your drive may be smoother if you are prepared to intervene and cancel the system where it may be inclined to overreact, it will often brake where you would just lift off the drive. Remember a non-intelligent system when set will disable the AEB feature so you need to be alert when coming up behind slower traffic. Inattention can creep in when using active systems and if you are distracted your speed will adjust to the traffic ahead so you may find yourself travelling at 56mph in lane 1 with lanes to your offside free and clear, but you will be safe.

Level 2	This level has significant benefits by taking away some driving tasks, though the driver is required to remain in control of the vehicle
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## Blind-spot monitor

### What is it?

We all remember during our driving lessons our instructor mentioning the blind-spot. Yes, it's that small area where you can miss something when looking in your mirrors.

Blind-spot monitoring is a system that alerts the driver to an approaching vehicle on its left or right. Sensors on the vehicle detects if it is safe for the driver to change lanes or overtake. The first time most drivers will see this technology in action is when they look in their mirrors and see a flashing warning light, showing it is not safe to change lanes or overtake.

This system is particularly helpful for driving on motorways and high-speed dual carriageways, when changing lanes.

Though not mandatory, an increasing number of manufacturers are fitting this system on vehicles which helps improve the vehicle's EuroNCAP rating.

### FIA REGION I Hi-Drive visual



### Other and associated button/icon/warning light



**Chief Examiner summary – how this helps drivers**

The system will illuminate an icon in the appropriate mirror when an approaching vehicle is detected, the system will change and flash the icon if the vehicle is approaching at speed, a great supplementary system for even an attentive driver, if you glimpse amber then maintain your course. Whilst this system has not been made mandatory for cars in the GSR, it has been mandated on larger vehicles such as minibuses and vans. Some systems have an extension for rear cross flow traffic and will sound an alarm if traffic or pedestrians are approaching or crossing the rear of the vehicle.

Level 1	This technology has safety benefits but its main purpose is to improve the journey of the driver by increasing the comfort levels by reducing some of the more strenuous driving tasks and providing users with audio and/or visual warnings, thereby improving safety
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## **E-call and B-call**

### **What is it?**

Unlike most of the technology covered in this assessment, E-call and B-call aren't driving aids but technology that can help in a post-collision or breakdown incident.

E-call is short for emergency call, and is a system that can be activated either by sensors which can detect the vehicle has been in a collision or through a button. The button is almost always positioned on the ceiling console close to the rear mirror with an SOS symbol.

When eCall is activated automatically by vehicle sensors or manually, it will automatically contact a 999 operator and give the operator the necessary information such as location and direction of travel.

E-call has been mandatory on all new cars post April 2019 and can significantly reduce emergency services' response times.

B-call is short for breakdown call, and drivers can use the button to contact their breakdown provider directly if they suffer a problem with their vehicle. While there is no standardised format, a b-call button might have a spanner icon on it, though further guidance is available in the vehicle handbook.

### **Button/icon/warning light**



### **Chief Examiner summary – how this helps drivers**

Being involved in a road collision is a scary and challenging situation. When there has been a particularly nasty collision, the activation of a system like e-call can save precious time and will save lives. The alternative is relying on another driver to identify the location, or worse, if your vehicle has had a collision in a particularly rural or isolated area where there is nobody on the scene to help.

### **Classification**

This technology does not fall under a standard classification

## Driver drowsiness systems

### What is it?

A driver drowsiness system is technology that monitors patterns of behaviour from the driver to establish alertness. The system will provide a warning to the driver if it believes a rest is required. The technology monitors behaviour in several ways:

- Steering patterns
- The vehicle's positioning within a lane
- Driver and eye monitors a driver's face

Manufacturers have different names for their individual technology. There are also third party operators that can be installed on the vehicle.

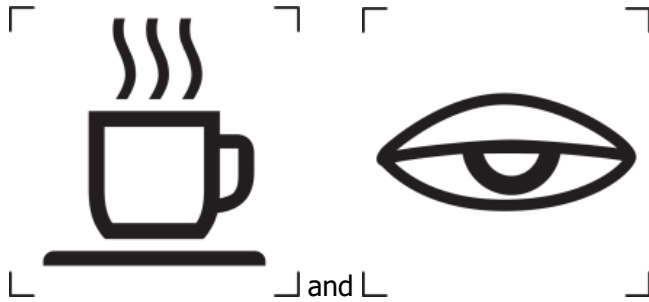
However, within the UK and Europe, this technology is not compulsory, though it is regulated by the EU.

In Great Britain in 2022, there were 53 fatalities on the road attributed directly to fatigue, though fatigue can also slow down a drivers' reaction time, meaning that this probably underestimates the real figure.

### FIA REGION I Hi-Drive visual



### Other & associated button/icon/warning light



**Chief Examiner summary – how this helps drivers**

We should be taking regular breaks in our driving to help us stay alert, the system will encourage a driver to. The technology is clever because it can detect changes in driving pattern and make recommendations on when to pull over and refresh. Drowsy driving costs many lives every year, and with everyone needing to be places quickly, but it’s better to listen to the technology, stop and have a proper break, in extreme cases a short power nap may help. If you are having a caffeine boost, remember it will have a limited effect and will only work once.

**Classification**

Level 1	This technology has safety benefits but its main purpose is to improve the journey of the driver by increasing the comfort levels by reducing some of the more strenuous driving tasks and providing users with audio and/or visual warnings, thereby improving safety
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## Intelligent speed assist (ISA)

### What is it?

ISA is a system which informs and discourages the driver to exceed the maximum local speed limit. More recent types of ISA can prevent the vehicle exceeding the speed limit. The in-vehicle speed limit is set automatically as per the speed signs (through cameras) and GPS allied to digital speed limit maps. There are three types of ISA:

- Informative or advisory ISA gives the driver feedback through a visual or audio signal advising them if they are exceeding the statutory limit
- Supportive or warning ISA: Makes it increasingly more difficult for the driver to use the accelerator pedal. This can be overridden.
- Intervening or mandatory ISA: Actually prevents any speeding by preventing further fuel injection to the engine. Some systems can be overridden, however if the system is adaptive to speed limits it will always need to be capable of being overridden for safety, mandatory speed limiters such as those on coaches or HGVs are not intelligent but a blanket maximum speed so do not need a safety setting.

All new cars sold within the EU since 2022 must have an overridable ISA system fitted. In the UK, this has not been replicated yet.

### Button/icon/warning light



(Polestar example, varies by model)

### Chief Examiner summary – how this helps drivers

While everyone is taught that a speed limit is a maximum and that exceeding a limit is illegal, the reality is that people can drift over the limit even if it is unintentional. Exceeding the limit to overtake is often a deliberate act and should be trained out of a driver. Intelligent Speed Assist can be both a visual reminder to the driver to reduce their speed and a restraint on a driver from exceeding a limit. It means that drivers have one less thing to worry about when using the technology. Nobody wants a fine from speeding, but more importantly, nobody wants to be the



cause of a serious incident. The reality is that police forces see speeding as one of the 'fatal four', therefore this technology has the potential to make a huge difference in terms of saving lives.

Level 1	This technology has safety benefits but its main purpose is to improve the journey of the driver by increasing the comfort levels by reducing some of the more strenuous driving tasks and providing users with audio and/or visual warnings, thereby improving safety
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### Lane departure warning system and lane keeping assist

#### What is it?


This is a system that alerts the driver through an alarm that the vehicle is leaving the identified driving lane. The system can be particularly useful on long drives with straight roads where mundane driving conditions mean drivers pay less attention to the road. Where the driver has engaged the indicator, the system recognises that the manoeuvre is deliberate.

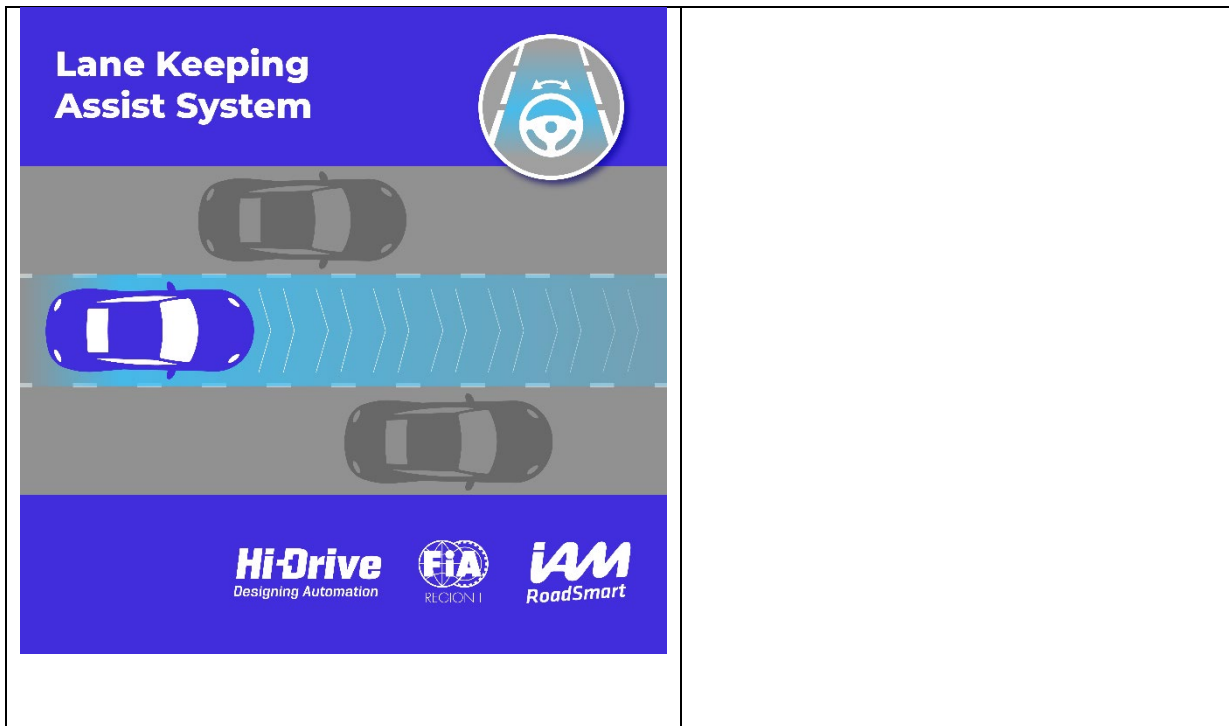
The system is able to pick-up painted markings through a combination of video cameras and sensors on the front of and underneath the vehicle.

The system is similar to lane keeping assist, however lane departure warning systems may not automatically correct the vehicle and only provide audio alerts.

As of 2022, all new car and vans sold in the EU are required to have an emergency lane keeping assist installed. The UK as of yet has not followed suit.

#### FIA REGION I Hi-Drive visual explainer

	<p>FIA REGION I: Lane Departure Warning employs forward-facing cameras near the rear-view mirror to alert drivers as the car approaches lane departure. Despite this assistance, the driver retains responsibility for the driving task and must remain attentive. Lane keeping assist is additional technology that keeps the vehicle in lane if it strays into a neighbouring lane or onto the opposite side of the road.</p>
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### Other & alternative button/icon/warning lights



### Chief Examiner summary – how this helps drivers

On longer journeys or on journeys at anti-social times of the day, there is a heightened risk of driver fatigue. Such systems are not a replacement of being alert but can provide drivers with a warning if the vehicle is veering out of the lane. Some drivers choose to switch such systems off, but this technology is becoming an integral part to modern day driving and we should be encouraged to embrace it.

### Classification

Level 1	This technology has safety benefits but its main purpose is to improve the journey of the driver by increasing the comfort levels by reducing some of the more strenuous driving tasks and providing users with audio and/or visual warnings, thereby improving safety.
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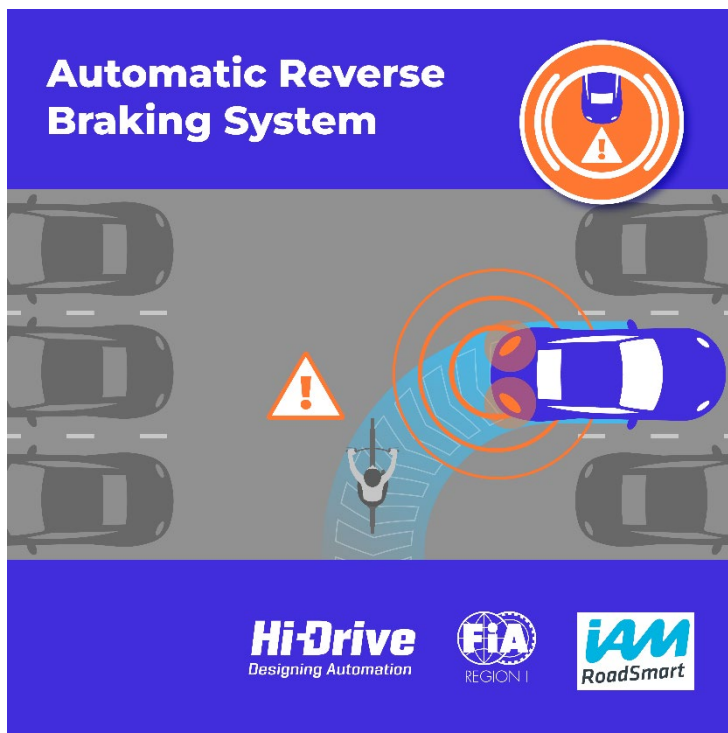
## Parking assist/sensors (including Automatic Reverse Braking System)

### How it works

Automated parking assist will automatically find and steer your vehicle into a parallel or perpendicular parking space. Sensors on the vehicle can detect the space and the surrounding environment to fit the vehicle into the space with minimal steering input from the driver. It can also detect kerbs and vehicles either side to avoid low-speed collisions.

Technology inside the vehicle will instruct the driver what to do with their gearstick (usually instructing to shift into reverse and to release the brakes). Some more advanced technology may automatically position the car to the best fit of the space whereas others will require the driver to brake and accelerate to position the car correctly within the space.

### FIA REGION I Hi-Drive visual



### Other & alternative button/icon/display symbols



**Chief Examiner summary – how this helps drivers**

Ask many drivers the task they like doing the least behind the wheel, parking is often the response. Indeed, many of us sigh at the thought of parallel parking. When a technology comes along which can effectively park the vehicle itself, it can reduce stress levels considerably. Moreover, low-speed collisions when parking can increase insurance premiums so theoretically, reducing the driver-error component should filter down to keeping insurance premiums lower.


**Classification**

Dependent on level of technology

Level 1	This technology has safety benefits but its main purpose is to improve the journey of the driver by increasing the comfort levels by reducing some of the more strenuous driving tasks and providing users with audio and/or visual warnings, thereby improving safety
Level 2	This level has significant benefits by taking away some driving tasks, though the driver is required to remain in control of the vehicle

**Other ADAS systems identified as part of the Hi-Driver project:**

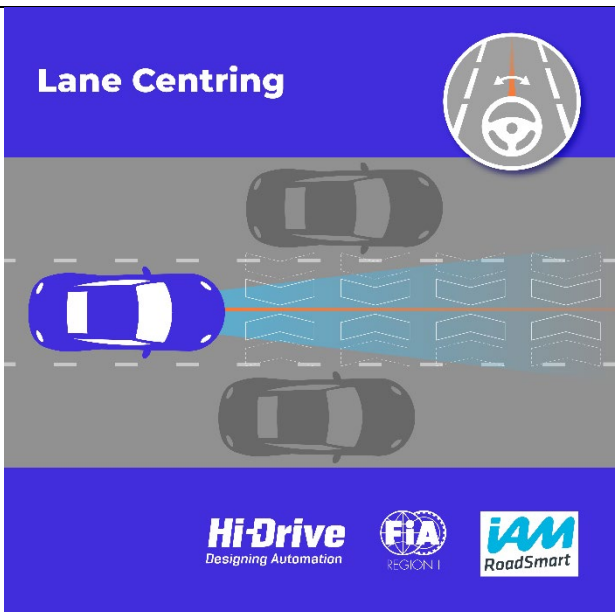
**Motorway Assist:**

	<p>Motorway Assist is an advanced system that can control acceleration, braking and steering, providing a partially automated driving experience. It will also help with lane positioning.</p> <p>It is specifically designed for longer journeys on motorways and highways.</p>
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**Classification:**

<p>Up to level 3</p>	<p>'Partial or conditional automation' is present in the vehicle and where the driver can effectively hand over all main controls of the vehicle to the system for a period of time before an alarm sounds warning the driver to resume control of the vehicle.</p>
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**Lane centering**

	<p>Often confused with lane departure warning and lane keeping assist, lane centering keeps the vehicle as close to the middle of the lane as possible, rather than simply issue a warning (lane departure warning) and correcting the vehicle when it strays into another lane (lane keeping assist)</p>
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**Classification**

Level 2	This level has significant benefits by taking away some driving tasks, though the driver is required to remain in control of the vehicle
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**Hands on wheel detection:**

 <p><b>Hands on wheel detection</b></p> <p>The illustration shows a driver in a car with hands on the steering wheel. A warning icon (exclamation mark in a triangle) is positioned above the driver's hands. A circular inset in the top right corner shows a close-up of hands on a steering wheel with a warning icon. At the bottom of the illustration are logos for Hi-Drive (Designing Automation), FIA REGION 1, and iam RoadSmart.</p>	<p>This technology can detect when a driver takes their hands off the steering wheel and sound a warning to the driver to resume grip of the steering wheel. More advance systems are progressing with the advent on Automated Lane Keeping systems</p>
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**Classification:**

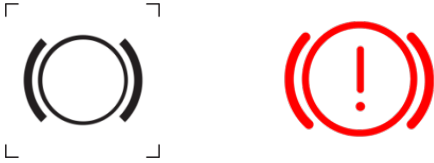


Level 1	This technology has safety benefits but its main purpose is to improve the journey of the driver by increasing the comfort levels by reducing some of the more strenuous driving tasks and providing users with audio and/or visual warnings, thereby improving safety
Level 2	This level has significant benefits by taking away some driving tasks, though the driver is required to remain in control of the vehicle

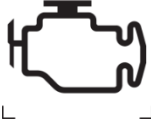











### Dashboard warning indicators

Indicators on a dashboard are designed to alert the driver to any mechanical issue that may be affecting the vehicle. These follow a standardised format and a traffic light colour system – though often green is only used if a device is in use rather than an indicator of a problem.

- Amber lets the driver know that something is not properly functioning and they should look at the handbook for guidance or go to a garage or dealership to have it looked at.
- Red indicates a serious problem which poses a risk to the driver and others on the road and requires immediate attention
- 

Dashboard warning	If a warning sign appears, it may indicate:
	<p><b>Braking (Brake warning light)</b></p> <p>If a warning sign appears, it may indicate:</p> <ul style="list-style-type: none"> <li>- The handbrake or parking brake is active. Drivers should be aware that if the bulb does not illuminate when the handbrake is applied, this may indicate an issue with the sensor of the brakes.</li> <li>- If the light appears when the vehicle is in motion, it may indicate: <ul style="list-style-type: none"> <li>o Brake fluid levels are low</li> <li>o There is an issue with the ABS</li> </ul> </li> </ul>
	<p><b>Diesel particulate filter (Diesels only)</b></p> <p>DPFs are installed into modern vehicles to restrict soot output and reduce pollution. If a warning sign appears, it usually indicates:</p> <ul style="list-style-type: none"> <li>- The particulate filter that captures soot is not working properly</li> <li>- The diesel particulate filter requires a clean. The light may go off after a regenerative clean (usually through taking the vehicle on a 30-minute drive to burn soot off) however if any sign of a light usually indicates the DPF will need a service or a manual clean.</li> <li>- Ignoring the DPF warning light means the vehicle might go into limp mode to protect damage to the engine.</li> </ul>
	<p><b>Oil levels</b></p> <p>If a warning sign appears, it usually indicates:</p> <ul style="list-style-type: none"> <li>- The engine oil level has fallen below the specified level required.</li> <li>- The vehicle keeper should refill with the correct oil for the engine. The oil level cap is under the bonnet</li> </ul>

	<p><b>Engine management light</b></p> <p>If a warning sign appears, it usually indicates:</p> <ul style="list-style-type: none"> <li>- A malfunction of the engine or a problem with the sensor itself</li> <li>- An issue with the emission system or the catalytic converter</li> <li>- Ignoring the problem could cause irreparable damage to the vehicle</li> </ul>
	<p><b>Coolant levels</b></p> <p>If a warning sign appears, it usually indicates:</p> <ul style="list-style-type: none"> <li>- Coolant levels are lower than required</li> <li>- This could be simply down to a gradually natural reduction or because there is a leak</li> <li>- There is a risk of the engine overheating</li> </ul>
	<p><b>Battery warning light</b></p> <p><b>If a warning sign appears, it usually indicates:</b></p> <ul style="list-style-type: none"> <li>- The battery has depleted power</li> <li>- Depleted power can be caused by very cold or hot weather (puts more pressure on the battery), leaving certain things on that use a battery such as lights or the entertainment system or because the alternator needs replacing</li> <li>- The vehicle is unlikely to start or could even shut down while running.</li> <li>- If the warning light appears after a new battery is installed, it could mean a new alternator is required.</li> </ul>
	<p><b>Tyre pressure light</b></p> <p>If a warning sign appears, it usually indicates:</p> <ul style="list-style-type: none"> <li>- The sensor has detected that tyre pressures are not at a safe level</li> <li>- Your vehicle has or will have a puncture unless action is taken</li> </ul>
	<p><b>Anti-lock braking system (ABS)</b></p> <p>There could be many reasons why this light appears on a dashboard:</p> <ul style="list-style-type: none"> <li>- The system might be switched off.</li> <li>- Fluid levels in the reservoir are low.</li> <li>- The sensors might be faulty. ABS sensors which can detect if a wheel is about to lock up and stop moving</li> </ul>

	<p><b>Electronic stability problem (ESP) warning light</b></p> <p>ESP helps maintain traction and grip on the roads. Heavy acceleration might bring the light on momentarily, however if the light remains on it indicates:</p> <ul style="list-style-type: none"> <li>- An issue with your tyres (such as low pressure)</li> <li>- A sensor-related issue or a fault in the ABS system</li> <li>- Incorrect tyre alignment</li> <li>- Faulty brakes</li> </ul>
	<p><b>Brake pad warning light</b></p> <p>If a warning sign appears, it usually indicates:</p> <ul style="list-style-type: none"> <li>- The sensor has detected that brake pads are worn</li> <li>- Braking will become more 'spongy' and could impact on the time taken for the vehicle to stop (stopping distances).</li> </ul>
	<p><b>Wiper screen wash warning light</b></p> <p>This warning light alerts you that your windscreen washer fluid is low.</p> <ul style="list-style-type: none"> <li>- To make this indicator disappear, simply check your washer fluid, and refill the tank if necessary.</li> <li>- Ensure that wiper fluid can withstand cold temperatures.</li> <li>- Failure to top up will result in a dirty windscreen which will impede visibility</li> </ul>
	<p><b>Bulb warning light</b></p> <p>This warning light will appear when one of the vehicle's lamps is no longer working.</p> <p>Even if the bulb is not a main headlight or brake light, non-functioning bulbs will result in an MOT failure so it is important to replace them as soon as possible.</p>
	<p><b>Airbag warning light</b></p> <p>When this warning symbol is showing it may indicate:</p> <ul style="list-style-type: none"> <li>- One or more airbags has a problem and may not inflate in the event of a collision.</li> <li>- You should contact your dealership or a garage as soon as possible for it to be investigated.</li> </ul>

## **Issues with ADAS systems**

### **Re-calibration:**

Although such systems can reduce the chances of collisions, many features will be optional to the driver and can be switched off. Driver error is the primary factor in most collisions and given that many modern vehicles will have cameras and sensors surrounding the vehicle, a collision (even a small one) could mean ADAS systems are unable to operate. For example, faulty sensors detecting rain may no longer automatically engage the windscreen wipers.

Where this occurs, the driver will need to speak to a garage that specialises in recalibration. KwikFit, for example, has selected garages with equipment that is capable of calibrating vehicles fitted with LiDAR/RADAR and Camera detection.

There are two recalibration types – static and dynamic:

- In a static test, a scan tool is connected to the vehicle, and park it in front of a series of targets. With the engine running, the scan tool will aim cameras at specific targets, calibrating it via software.
- In a dynamic test, there is more than one person plus the scan tool. The vehicle is driven on the road, with the tool connected. The tool will target objects along the drive and recalibrate the system.

Re-calibration services are becoming more available to consumers but drivers should speak to their garage to understand the processes used to recalibrate technology systems. The Institute of Motor Industry (IMI) provides training courses on recalibration and perhaps consumers can check if mechanics are IMI-qualified in this area.

Recalibration service costs are usually over £150, which can be costly for consumers.

### **Driver control:**

Drivers should familiarise themselves with the levels of autonomy for individual technologies. As of 2024, most of the technologies people will see in modern vehicles are there to assist with driving rather than being able to hand over control for extended periods. Although ADAS systems like adaptive cruise control and lane keeping assist might feel like the vehicle is effectively driving itself, cars will detect when hands are taken from the steering wheel and alarms will sound. Even with ALKS systems – which at present is the most advanced technology on our roads – drivers should be prepared to retake control when the system is ready to hand back.

Adherence to the Highway Code and every skill you have learnt remains essential.

**Acknowledgements**

**Hi-Drive**



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