Dear Sir/Madam,

The IET’s response to the Call for Evidence on Safe use of Automated Lane Keeping System on GB motorways.

The Institution of Engineering and Technology (IET) is Europe’s largest professional engineering and technology organisation with 168,000 members drawn from industry, academia and the public sector. The members represent a wide range of expertise, from technical experts to business leaders, encompassing a wealth of professional experience and knowledge. Our primary aims are:

- to provide a global knowledge network, promoting the exchange of ideas between business, academia, governments and professional bodies, and enhancing the positive role of science, engineering and technology
- to address challenges that face society in the future.

We would be happy to discuss our response in more detail and provide examples and evidence from our extensive networks of engineering employers and academic partners. Please feel free to contact us to arrange this by emailing sep@theiet.org.

Recommendations:

- Automated systems need to be designed taking account of human factors rather than being reliant on the user to act in a prescribed manner.
- There should be a creation of a suitable organisational structure to investigate collisions involving automated vehicles (a “Road Accident Investigation Branch”) similar to that of NTSB, in the UK.
- Data should be compiled to create a longer-term evaluation of actual performance with real drivers, including analysis of any near-miss incidents.
- UK regulatory authorities should mandate that the first ALKS will be deterministic until such time as the legal and technical issues concerning the introduction of non-deterministic control systems are well-developed.
- We recommend that ALKS is regarded as a (Level 2) driver assistance system.

Summary of position

ALKS and other vehicle automation technologies have potential to reduce accidents on our roads¹. R&D undertaken in recent years has made impressive progress and systems have been demonstrated that vehicle manufacturers are keen to offer as commercial products.

Our view is that ALKS is still immature and so is the supporting infrastructure (physical, legal, behavioural, safety assurance). For the present, we support the introduction of (suitably safety assured) ALKS as an assistance function requiring driver supervision. Our current view is that it would be unethical to permit unsupervised ALKS operation as we do not know how the benefits and problems will be distributed amongst road users (even if the overall effect is a reduction in collisions) and that there are a number of important issues which have not been sufficiently addressed.

Responses to specific questions

• 2.21(a) Do you foresee any legal barriers to accessing data for incident investigation?
• 2.21 (b) If yes, what are those barriers?

There needs to be a way to manage customers’ and manufacturers’ data within data protection regulation.

We think it is important that manufacturers and the authorities should freely share data within a “no blame” culture so that lessons can be learned from incidents.

• 2.28 (a) How do you think the driver should be educated and informed to understand the abilities and limitations of the system to ensure they use it safely?
• 2.28 (b) What role do you think manufacturers selling this system should play in providing this education and information?

We expect manufacturers to ensure that all vehicle functionality, including ALKS, is intuitive. The safety implications of unintended use and misuse of ALKS (particularly at higher speeds) makes it necessary for drivers who want this new functionality to be trained to use it safely.

Existing arrangements for user training and licencing need to be radically developed.

- Basic education around vehicle automation should be made available and tested within the theory part of the driving test.
- “Graduated Licencing” for non-automated vehicles should improve road safety and has been proposed by several organisations. We support this approach and it would also allow extension to more automated vehicles taking into consideration driver assistance and automation systems.
- Issue licences to allow use for specific automated functions.
- The plethora of terminology, functionality and human-machine interaction design may prompt the need for “conversion courses”.
- Research shows than using a blended approach of written instruction, video and practical experience is most beneficial. Driving simulators would allow more intensive training on challenging and little-experienced use cases.
- Test requirements should be appropriate and proportionate.

Training could also become the seller’s responsibility. Good practice should include asking questions and for the client to demonstrate the automated functionality.

• 3.12 (a) Subject to the outcome of this call for evidence and subsequent consultation, would you have concerns about a scenario where any vehicle approved to the ALKS regulation would be automatically considered to be an automated vehicle under AEVA?
• 3.12 (b) If yes, what are those concerns?

The term ALKS is used by different organisations and developers to refer to systems with a range of capabilities including those with SAE Level 2 capabilities (requiring driver supervision at all times) and which would not be regarded as an AV.

Our understanding is that the consequences of a vehicle being considered as an automated vehicle under AEVA is that vehicle owners/drivers and motor insurers have a statutory liability for any damage caused by an automated vehicle when being operated in driverless mode, but in turn those owners/drivers and insurers may be able to recover damages from the manufacturer if the technology is found to be at fault.
3.15 (a) Do you agree that the criteria set out in the Monitoring and Control Tests provide a reasonable framework for testing compliance with the AEVA definition of automation? Why?

3.15 (b) Do you agree with our preliminary assessment of how ALKS meets the criteria set out in Annex A? Why?

In summary, our answer to both questions is “no”. We believe that driver behaviour is a key factor in overall safety.

Experience suggests that some drivers will want to use systems in inappropriate places or conditions, so some form of geo-fencing may be required to stop this.

Automated systems need to be designed taking account of human factors rather than being reliant on the user to act in a prescribed manner.

NTSB in the US has investigated five “Level 2” AV collisions. Each had a strong contributory factor of the drivers’ over-reliance on automation. We recommend the creation of a suitable organisational structure to investigate collisions involving automated vehicles (a “Road Accident Investigation Branch”) similar to that of NTSB, in the UK.

The procedure proposed in Annex A lacks detail in the evidence and assessment methods, and the level to which they are applied are open to interpretation. A key missing item is longer-term evaluation of actual performance with real drivers including analysis of any near-miss incidents. Also, recalling cars for safety fixes is far from uncommon after they have entered production.

Many of the AI/DS technologies that contribute to autonomy rely on advances made within the last decade. Consequently, the field of verification and validation - providing systems assurance - has to catch up.

We recommend that the UK regulatory authorities mandate that the first ALKS will be deterministic until such time as the legal and technical issues concerning the introduction of non-deterministic control systems are well-developed.

3.27 How do you think ALKS will detect and respond to a police or other enforcement vehicle approaching from behind signalling for the vehicle to pull over?

Regarding ALKS as providing SAE Level 2 functionality would mean that the driver is responsible for supervising its operation at all times; thus, the driver is responsible for detecting and responding to police and other enforcement vehicles.

This question is only relevant if ALKS is determined to provide SAE Level 3 functionality: A driver has to be aware of his/her surroundings at all times and, therefore, any automatic system that takes over from the driver must be able to do the same.

3.28 Do you think that 10 seconds is fast enough in the foreseeable circumstances to comply with the rules on responding to enforcement vehicles? If not, why?

No.

This question is only relevant to an SAE Level 3 system.

A driver of an SAE L3 system may have to go from a dis-engaged state to a fully in-control state in a very short time. The time taken depends on the driver’s state and personal characteristics and on how the take-over request is presented to him/her.
There is no consensus in the human factors community on how much time is needed for the driver to take over vehicle control following dis-engagement with the driving task (the literature reports findings from around 2 seconds to over 30 seconds).

There are circumstances where an alert driver would change lanes in order to minimise risk. Without lane change as an automated option, the vehicle may request a driver takeover but in order to make the lane change, a response time considerably shorter than 10s would be required.

3.31 (a) How will ALKS detect a minor or low-energy collision, in order to come to a stop and alert the driver?

Low-energy needs to be defined but it probably needs multiple detector approaches and sensor fusion to eliminate false alarms from potholes, debris, etc.

Current technology is unlikely to reliably detect low energy collisions and identify them as a collision.

For the vehicle manufacturers to demonstrate that their systems work sufficiently well requires testing and assurance methods which do not currently exist.

3.31 (b) Do you foresee any risks should ALKS vehicles not stop for low-energy impacts?

Yes

3.31 c) If yes, what are these risks?

The driver of the other vehicle will take some action which will depend on the circumstances of the collision. The legal requirement to stop and report an accident which may not be met.

The ALKS car may continue its journey with potentially dangerous damage and the driver not necessarily being aware either of the damage or the necessity to stop.

3.34 How will manufacturers ensure that ALKS vehicles deployed in Great Britain are able to recognise signage located above the road that may be unique to Great Britain?

This is an important and more general question if vehicles are allowed to travel from NI to Ireland (mph to kph, for instance), let alone across to mainland Europe or vice versa.

Current technology is unable to reliably recognise a variety of signage. We note that the development of “digital Traffic Regulation Orders” (which would also support Intelligent Speed Advice systems) is likely to be helpful here.

Ultimately, it is for the vehicle manufacturers to demonstrate that their systems work sufficiently well.

3.38 (b) Do you have concerns about vehicles that are registered as AVs on the DVLA database but the keeper has chosen to have the functionality disabled so they are not capable of operating as an AV?

3.38 c) If yes, what are they?

Manufacturers do not generally provide mechanisms to “permanently” disable automation so new procedures would be needed. If the disabled features are such that they can be re-enabled there are concerns about illegal re-enabling/hacking.
It is important that proper records are kept of the status and equipment of all vehicles, including safety modifications. For AV the status of software also needs to be recorded and not just at the time of annual inspections.

• 4.9 Do you agree that it is appropriate to exempt the driver from prosecution – if the vehicle comes to an unjustified stop when ALKS is engaged – by creating a further exception in the Motorway Traffic Regulations? If not, why?

No, not with the current state of technology and whilst regarding ALKS as a driver support function.

ALKS may not have sufficient built in redundancy to always find and reach “safe harbour” (e.g. an Emergency Refuge Area) by itself if a part of the system fails. Similarly, it might not be capable of dealing with all driving circumstances.

What is an appropriate Minimum Risk Manoeuvre (MRM) is problematic particularly at 70 mph. In the case of the proposed ALKS, this appears to be a simple stop in lane. The risk of collision from behind is clear when other traffic is accelerating. It would seem necessary that ALKS has a lane change capability as well as stop-in-lane.

We do not believe hazard flashers are a sufficient warning for other road users after MRM. There should be additional warning systems such as extra lights and audible warnings and road authorities should be alerted.

For AVs that provide Level 2 automation it is the driver’s responsibility to take back control within a safe time - certainly less than 10 seconds - and the only exemption from prosecution might be in the case of non self-induced incapacity (e.g. medical emergency). If ALKS is permitted on GB roads and classified as an automated vehicle Level 3, then an unjustified stop whilst under automated driving is the responsibility of the manufacturer. For the present, we recommend that ALKS is regarded as a (Level 2) driver assistance system.

• 4.12 Do you agree that amending Rule 150 is sufficient to clarify that the driver may rely on the ALKS? If not, why?

Assuming that the car’s ALKS passes the AEVA test, amendment to Rule 150 would be adequate but it needs to be ‘rescinded’ at the instance of a transition demand.

• 4.17 (a) Do you agree that the Highway Code should be changed so that drivers of ALKS must be alert to a transition demand? If not, why?

Yes, with caveats:

- Wording needs to be robust in the face of evolving technology so that loopholes are not inadvertently created, requiring updates as new technology is introduced.
- Amending the Highway Code may not reach experienced drivers.
- It is questionable if inexperienced drivers should be licensed to drive with ALKS and other automated driving aids.

• 4.17 (b) Do you think that amending the Highway Code is sufficient to communicate to drivers their responsibility? Why?

No.
Drivers with access to AV functionality may have had their licence for many years and may not be aware of changes.

We recognise that vehicle manufacturers go to great lengths through system design to help drivers with no knowledge of the system use it successfully.

• 5.4 (a) Do you think the driver should be allowed to perform other activities when ALKS is activated if they must only be ready to respond to a transition demand, with particular reference to any implications for road safety? If not, why?

We are not convinced that the ALKS and its Minimum Risk Manoeuvre are sufficiently robust for the driver unaware. Therefore, the driver should not be allowed to perform other activities and should treat the ALKS as providing driver assistance with Level 2 automation functionality.

• 5.4 (b) What other activities do you think are safe when the ALKS is activated?

None

• 5.5 (a) Do you think that the driver should be allowed to undertake other activities if ALKS is not listed under AEVA? If not, why?

No, it contravenes Rule 150.

• 6.4 (a) Do you agree with this approach? Why? Up to 70mph

In short, no, but this question requires a more elaborated response.

This is an important issue as the ALKS Regulation significantly limits use of the system. The European ALKS Regulation limits system use to roads that are divided by a physical separation from vehicles travelling in the opposite direction and with a prohibition of cyclists and pedestrians. ALKS is limited to 60km/h (37 mph).

So, the system can only be used on motorways, when there are prolonged slower speeds (e.g. caused by traffic congestion). This is very limited and raises the issue of whether users will fully understand these limitations and will appreciate such a system.

The issue of speed of operation should not just be left to the manufacturers. We believe that it requires independent expert oversight providing certification/assurance and ongoing monitoring. The 737 Max issue has illustrated the dangers of handing full control of safety declaration to a manufacturer.

The Consultation notes that some of the complexities of motorway driving including temporary signage and lane markings, negotiating road works, smart motorway variable speed limits, Red X lanes and variable weather. All of these “use cases” become more difficult as speed is increased and we have not seen sufficient evidence of the safety performance of ALKS in these circumstances.

• 6.4 (b) Do you have any other comments you’d like to make?

We have several remarks relating to automated driving which can be grouped under a heading of “Systems Thinking”. Further points are made below:

ALKS is a waypoint on the journey to full automation and self-driving vehicles. We support this endeavour and do not want to see improper products providing little consumer benefit that could lead to delays in level 5 vehicles being available. ALKS systems from different
manufacturers vary in the degree of authority and do not all provide exactly the same capability. It is useful to consider their level of automation defined by the Society of Automotive Engineers. This is widely used and accepted.

Further consideration needs to be given as to whether other road users should be informed that a vehicle is under automated control. A self-driving vehicle may have different ways of coping with situations that may not be readily understood by human drivers.

A systems approach to vehicle automation would include the necessary road and communications infrastructure. Such infrastructure could:

- Ensure automation is only activated in certain geographic areas (e.g. on the inside lane)
- Ensure vehicles take full account of static and dynamic speed limits
- Ensure that emergency commands and messages are conveyed to the vehicle

Whilst appreciating that the Government is principally concerned with vehicle automation in the UK, we note the truly international aspects of passenger road vehicles. There is a need for work on international standards for automated vehicles.