Safe Use of Automated Lane Keeping Systems (ALKS): call for evidence

RAC Foundation response, October 2020

The RAC Foundation is a transport policy and research organisation which explores the economic, mobility, safety and environmental issues relating to roads and their users. The Foundation publishes independent and authoritative research with which it promotes informed debate and advocates policy in the interest of the responsible motorist.

The responses to this consultation draws from material in two reports published by the RAC Foundation in collaboration with Nottingham University. The first report, *How will drivers interact with vehicles of the future?* can be found here: https://www.racfoundation.org/wp-content/uploads/Automated_Driver_Simulator_Report_July_2019.pdf.
The second report is soon to be published, *Driver Training for Future Automated Vehicles Introducing CHAT (CHeck, Assess and Takeover).*

2. Overview of ALKS

2.21: Do you foresee any legal barriers to accessing data for incident investigation? If yes, what are those barriers?

Data between manufacturers and authorities needs to be freely shared for incident investigation. There should be a clear, legal obligation on the holders of data generated by and/or held on in-vehicle systems to release that data for police investigations, but short of a police request it would be desirable for the data to be made readily available to investigating authorities for non-injury incidents in order to build a better understanding of how any such incidents have occurred. Not a legal constraint as such, but alongside making the data available so the skills to interrogate it on receipt will also need to be developed.

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?

Our report *How will drivers interact with vehicles of the future?* has highlighted the need for new driver skills when driving level 3 autonomous vehicles. The study showed most drivers developed high level of trust and acceptance of automation, which demonstrates the need to educate drivers on the abilities and limitations of any autonomous system. There is a risk of situations in which drivers over-rely on the automated system, expecting it to deal with events for which it is neither intended nor capable.

Taking learnings from the aviation industry, research shows that pilots have incurred misunderstanding and confusion about new automation systems leading to a decrease in pilot performance and an increase in errors. If training exists for pilots using automated systems, why is there no such training provided for even publicly available level 2 automated vehicles? There would need to be the same continuous vigour for reviewing training needs for cars/vehicles as there is in aviation.

Following on from this first study, we are soon publishing a new report *Driver Training for Future Automated Vehicles Introducing CHAT (CHeck, Assess and Takeover)* that explores the training needs for drivers of automated vehicles. As part of the research two types of training were considered: firstly “behavioural training” which consisted of an interactive PowerPoint along with a short and simple checklist; and secondly “operational training” which was based on a written manual guide. Those people that participated in the behavioural training were better at resuming control of the vehicle. These findings exemplify the problem at hand: without appropriate guidance or training,

people may be unaware of the limitations of automated systems and potential errors in their knowledge (their mental model).

Therefore, training in a form of an interactive guide, with a checklist like CHAT, along with simulation, could be used to educate drivers on ALKS.

That said, we do see challenges in finding a suitable conduit for the training, however minimal, that drivers receive, which is not just an issue for vehicle purchase but also for shorter-term lease hire arrangements. Currently there is very little if any practical training associated with new auto sales, still less in the used car market, other than discretionary schemes such as JLR offer to demonstrate the largely off-road capability of Land Rover and Range Rover vehicles, which suggests some form of in-vehicle information supplied through the vehicle infotainment system might offer a way forward.

2.28 (b): What role do you think manufacturers selling this system should play in providing this education and information?
2.28 (c): What role do you think Government and its agencies should play in providing this education and information?
There should be collaboration between manufacturers and government to provide this education and information. Manufacturers should play a big part in providing the information as they are the ones who know exactly what their vehicles can and cannot do, and should carry some responsibility in ensuring that the drivers of their vehicles are properly equipped to handle them safely. This goes beyond the traditional operating manual to thinking through properly about how drivers might best engage with the information they need to take on board and might include training sales staff to be able to demonstrate advanced systems and warn of their limitations.

The government's role should be to satisfy itself that through vehicle-specific coaching or, potentially, through changes to the driver testing and training regime, drivers are properly equipped to operate their vehicles safely. This could include an obligation being placed on drivers to certify that they have received and understood the relevant material through to creation of a new licence category or certificate specific to the operation of vehicles with level 3 or 4 automation.

3. Ensuring safe use
3.12: 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? If yes, what are those concerns?
In principle any vehicle that meets the criteria under AEVA should be considered an automated vehicle, the consequence being that the human 'driver' is absolved of any responsibility to stay alert or to be ready at all times to resume control. However, with ALKS our concern is that circumstances could arise - e.g. debris falling from a vehicle ahead - where the correct response is to change lanes, which we understand would require human driver intervention. We struggle to see how 'hands-off/eyes-off' operation would be consistent with the risk of such a scenario, given the likelihood that a reaction would be needed in less time than a transition demand would allow.

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?
The criteria for compliance testing for vehicles appear to be comprehensive, but much hangs on the definition of key terms, particularly "5.2.5. The activated system shall detect the risk of collision in particular with another road user ahead or beside the vehicle, due to a decelerating lead vehicle, a

cutting in vehicle or a suddenly appearing obstacle and ***shall automatically perform appropriate manoeuvres to minimize risks to safety of the vehicle occupants and other road users***." – our emphasis added. We cannot see how a system that does not provide for lane change can be judged compatible with this requirement, given the risk of the transition period being too long for the driver to re-take control and react appropriately.

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?
Question for vehicle manufacturers.

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?
The answer to this very much depends on the circumstances and the action that an enforcement vehicle is requiring. We have material concerns with the 10 second threshold.

In particular, we are worried that not all drivers would be in a position properly and safely to resume control and take the appropriate action as swiftly as this envisaged, for example (if this is allowed) if they are engaged in non-driving related activity. Reaction times also depends on age of the driver, experience (and other cognitive variables) and how immersive their activity is. Even observing the passing countryside from a car side-window can be sufficiently immersive to add to the reaction time.

In the report *How will drivers interact with vehicles of the future?*, the researchers explored these issues comparing the differences of having an immediate ten second handover to the driver (top down approach) versus using the ten seconds to check for hazard and having an additional five seconds to resume control (bottom-up approach), both also had a sixty second "prepare to drive" warning before activating takeover request.

Whilst it is the case that over the course of the week drivers usually were able to take control back within the 10 second time frame, performance varied by driver. Melcher, Vivien & Rauh et al (2015) (https://www.researchgate.net/publication/283962593_Take-Over_Requests_for_Automated_Driving) also suggested that 10 seconds seemed to be enough time to take over comfortably. But other research has shown takeover can be up to 15 seconds. https://eprints.soton.ac.uk/403717/1/__soton.ac.uk_ude_PersonalFiles_Users_mh6_mydocuments_TRG_WEB%2520PAGES_HF-16-4889_Take-over%2520time%2520in%2520highly%2520automated%2520vehicles_production_ready.doc

The *average* time for drivers to place their hands on the steering wheel was between 16-20 seconds during the "prepare to drive" phase. Drivers would use this time to dispense their secondary activity, rather than actually preparing to drive (e.g. Improving their awareness of the road situation). Equally concerning is that a significant proportion of drivers continued to engage with the secondary activities e.g. continuing to compose a text.

The range of secondary activities undertaken may have influenced some of the results. For example, participants undertaking activities that involved high visual, manual and cognitive elements (e.g. working on a laptop placed in front of the steering wheel), may have taken considerably longer to detach from their non-driving activities than participants carrying out less demanding activities – for example, those casually glancing at their smartphone at the point of handover. Thus, it is feasible that reaction times might be influenced by the secondary device being used.

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

3.31 (b): Do you foresee any risks should ALKS vehicles not stop for low-energy impacts?
The vehicle should stop in scenarios such as in 3.29. The risk is in part in exacerbating the risk exposure of vehicle occupants who might leave a vehicle in the event of a low-energy impact but still be in amongst live traffic lanes.

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?
Question for vehicle manufacturers.

3.38 (a): Do manufacturers intend to offer automation as an optional package for customers at the point of purchase? Please provide details.
Question for vehicle manufacturers.

3.38 (b): Question: 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? If yes, what are they?
There are two issues here – one is about where the data is stored and the other is about the accuracy of the data. What tests would apply in order to certify that a vehicle had its systems functionally disabled such that they could not be reactivated by the driver? Would some form of certification apply? Whose responsibility would it be to update the system?

4. Fair delegation and residual responsibility
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?
Agreed as the driver should only be held responsible for taking control when the system requests a takeover.

4.12: Do you agree that amending Rule 150 is sufficient to clarify that the driver may rely on the ALKS? If not, why?
It appears so, but we are not in a position to offer a legal opinion.

4.16: Do you agree that not changing the Motorway Traffic Regulations, except for unjustified stops, ensures the driver is suitably incentivised to take back control when requested? If not, why?
We are concerned that in thinking about incentivisation in this way, and without any clear expectation of what training or what enforcement there will be, drivers will behave based on their past experience and their current circumstance – will they be perpetually ready to retake control at 10 seconds notice after 30 minutes of stop-start congested traffic on the south-west quadrant of the M25 on a Friday afternoon, or might they, despite the law, have simply drifted at best into an engrossing daydream and at worst just drifted off to sleep?

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?
4.17 (b): Do you think that amending the Highway Code is sufficient to communicate to drivers their responsibility? Why?
We take these two questions together. The Highway Code would clearly need to be changed consequent on such legal changes are made to road traffic law. But changing the Highway Code changes very little. As of today, there are roughly 38 million qualified drivers in this country who have no plans ever to look at the Highway Code again, and even if they did, they might well consult the hard copy version (i.e. unamended) they bought from HMSO years ago.

5. Performing other activities
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?
5.4 (b): What other activities do you think are safe when the ALKS is activated?
One appeal of using a level 3 automation like ALKS, is that drivers should be able to use their time to do other things. Our report *How will drivers interact with vehicles of the future?* explored what activities drivers would wish to partake in while a vehicle is in charge. Most drivers chose to use the smartphones or to read a book.

However, some activities would require extra time for drivers to re-establish themselves when requested to take over. Reaction times may be influenced by the nature of any secondary device being used. For example, those that are more immersed in an activity such as reading a book may take longer to take over. Those with a broadsheet newspaper spread across the steering wheel longer still.

There are two issues that concern us in trying to answer these two questions. The first is whether ALKS as constituted can safely be viewed as automated driving if it cannot perform a lane change and could require a transfer of control in 10 seconds or less. This we doubt. Second, it is one thing to determine what activities are permissible and quite another to enforce them. Drivers can still routinely be seen using handheld devices whilst driving despite successive increases in penalties, either because they have missed or misunderstood the law or because they judge the chances of being caught are so slim. The government needs to consider very carefully how, in the real world, people will behave and act accordingly.

5.5: Do you think that the driver should be allowed to undertake other activities if ALKS is not listed under AEVA? If not, why? If yes, what other activities could they safely perform?
No, it contravenes Rule 150. If the driver needs to be available in 10 seconds or less then there's not much useful they could do.

5.11 (a): Do you agree that an exception should be added to enable the use of the infotainment system for activities other than driving? If not, why?
5.11 (b): Are there any activities you consider unsafe to perform through the infotainment system? If yes, what are they? Do you agree with this approach? Why?
This depends on whether the system was able to stop activities and inform drivers of any events efficiently. The infotainment system probably should not be used for other activities until this happens. There is a growing view, which we support, that the design of infotainment systems relying on touch screen control is already creating a safety risk in itself, drawing the driver's eyes away from the road.

6. Use of ALKS up to 70mph

6.4 (a): Do you agree with this approach? Why?

No. Driving at 70mph in free-flow is a very different proposition to driving under 37 mph in congestion. Whilst consideration of the latter is of value, considerations about the length of time the ALKS may operate without any form of driver input are different – cruising at 70mph for an extended period would make a driver more prone to succumb to sleep, or to engage in an immersive activity (gaming; answering e-mail etc) that would lengthen their response time. To allow a pure lane-keeping system to operate at 70mph with no lane-change capability looks to us to be a different and riskier-still proposition than the currently envisaged 37mph - a 10 second transition time may work for the slow-moving traffic that ALKS was intended for, but 10 seconds seems too long for faster travelling vehicles.

6.4 (b): Do you have any other comments you'd like to make?

There are so many imponderables and interconnections across the answers this call for evidence raises that sitting back to see how they all fit together is quite hard, but we can envisage circumstances where ALKS could safely be classified as automated under the AEV Act as follows:

- The vehicle is the conduit for informing the driver of what is involved in running the system safely, preferably by voice rather than text, through the vehicle infotainment system, automatically triggered but able to be overridden rather than having to be selected (our preference would still be some mandatory and certified element)
- The driver is permitted only to engage in activity though the vehicle infotainment system, which is, importantly, designed to ensure that the driver's eyes are in line of sight of the road e.g. through a pop-up or heads up display
- The vehicle monitors the driver's behaviour and if it detects non permitted activity it alerts the driver and triggers hand-back of control (e.g. if the driver props a laptop on the steering wheel or opens a newspaper)
- The system is only triggerable in congested motorway conditions where the risk of the driver losing concentration and drifting out of lane is high – higher than the risks of engaging a system that is incapable of automated lane change
- The system monitors the traffic ahead – visually and virtually – and can therefore detect and alert the driver in plenty of time as to the point at which the congestion ahead eases i.e. keeping the driver informed of how much longer they should expect to keep the system running, and how much time they therefore have for their other activity.

This might still not be a comprehensive picture, but it hopefully illustrates how, in combination, a lower risk could be delivered. At present we cannot say whether the elements delivered through the vehicle infotainment system are in train – too many new models appear to us to rely on infotainment that takes the driver's eye away from the road.

RAC Foundation

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