

# Review of the legislative and regulatory framework for testing driverless cars

## Discussion document and call for evidence

### Introduction

In the Autumn Statement 2013, the Government announced its plan to review the legislative and regulatory framework for developing and **testing driverless cars in the UK**, reporting by the end of 2014.

The advent of connected and 'autonomous' technology in vehicles offers enormous opportunities in terms of safety on the roads, better management of road space to reduce congestion and potentially reducing emissions. This also represents a significant area of interest and investment in the global automotive industry. We have come to rely on many technologies that assist the driver of a vehicle (for example Anti-lock Braking (ABS), cruise control or parking sensors) and as some of these technologies evolve, they are reaching the point where a vehicle is capable of operating for periods of time with reduced, or in some instances without driver input.

Because of the potential benefits the technology offers, manufacturers are carrying out extensive testing on private test tracks, and the next step is to see whether and how it may be possible to carry out carefully controlled testing on public roads. For example, in a number of places around the world, tests are underway that involve the supervision of a driver seated in the vehicle with the normal set of controls at their disposal.

As an important step in facilitating such testing, the Department for Transport (DfT) is undertaking a review of the relevant legislation and regulation to see that there is a clear and appropriate regime to enable cars with advanced autonomous safety systems to be tested on British roads.

This review is part of wider government action that includes a proposal to invest up to £10m in collaborative R&D projects to research this area in the UK.

### About this call for evidence

We would like to hear your comments and views on any regulatory or other issues that may need to be addressed in considering the testing of cars with advanced autonomous safety systems on public roads, and the areas where new regulation may be necessary in order to maintain road safety and provide the appropriate safeguards in the introduction of this novel technology.

For the purposes of this review, we have divided cars with advanced autonomous safety systems into two broad categories:

**High automation** – a car which is capable of operating on the road network without human intervention, but is fitted with a full set of driving controls, and in which a driver must be able and ready to assume control.

**Full automation** – a car which is capable of operating on the road network without human intervention, and in which a driver need not be able and ready to assume control.

The review will focus on the **testing** of driverless **cars** with **high automation**, whilst noting any additional issues relating to the testing of other categories of vehicle. The additional implications for vehicles with **full automation** will be noted and categorised but not analysed in detail, as clearly much more work around this is necessary.

The remainder of this document is set out as follows:

- Section 1 – Why driverless cars?
- Section 2 – What driverless technology are we already using?
- Section 3 – Legislation governing vehicles, drivers and road use.
- Section 4 – The areas of legislation and questions to consider.
- Section 5 – Links to the Highway Code and legislation on the internet

### **How to contribute to the Review**

We would be grateful to receive your comments (in writing) on the issues highlighted in this document. Section 4 contains a list of headings and questions to guide your input. It would be useful to have as much detail of relevant legislation (e.g. section 41 of the Road Traffic Act 1988) as possible, to facilitate discussions with stakeholders and working together to overcome issues. However, this is not essential, as long as you provide sufficient detail to describe a requirement.

Responses should:

- contain your contact details, name of organisation and whether you represent a particular interest group
- be in Word (doc, docx, rtf, txt, ooxml or odt) format, not PDF
- contain as few logos or embedded pictures as possible
- contain no macros
- comprise a single document. If there are any annexes or appendices, these should be included in the same document

We may publish all or some of the comments we receive in response to this call for evidence. If we receive a request from any third party for sight of such comments we may be obliged by law (for example under the Freedom of Information Act 2000) to disclose it.

If there are particular reasons why you would not wish your comments to be disclosed or published, please let us know. Although your wishes may not override any statutory obligations to disclose, they will be taken into account as far as possible.

Please respond by **19th September 2014** to:

(email) [driverlesscars.review@dft.gsi.gov.uk](mailto:driverlesscars.review@dft.gsi.gov.uk)

(post) Driverless Car Review, C/o International Vehicle Standards, Zone 1/34 Great Minster House, Horseferry Road. SW1P 4DR.

## **1. Why Driverless Cars ?**

The advent of connected and 'autonomous' technology in vehicles offers enormous opportunities in terms of safety on the roads, better management of road space to reduce congestion and the potential reduction of emissions. Alongside this, it poses considerable challenges in regulatory and social terms, whilst representing a significant area of interest and investment in the global automotive and high technology industries.

The introduction of autonomous technology leads to the possibility that human error could be reduced or even eliminated, providing road safety benefits, because a significant proportion of accidents are due to human error. There is potential for efficiency gains leading to reduced costs for road users and reductions in energy consumption, with the associated potential of reducing pollution. There is potential for better use of road space, reduced congestion and more consistent journey times. Vehicles with greater levels of autonomy could also improve mobility for those unable or unwilling to take the wheel, enhancing their quality of life. There are also risks, of course – such as the practical considerations of safety, ensuring legal certainty for these different types of vehicle and vehicle use and the matter of social and public attitudes and acceptance - hence the need for thorough testing. We want to progress in this area in such a way as to improve our world leading record on road safety.

But this paper does not seek to analyse the long term outcome. Instead it focuses on a near term objective. Long before the mass roll-out of such technology, exhaustive testing will have been undertaken by the various engineering and technology partnerships involved in this enterprise. Such testing is well underway on the proving grounds and in the laboratories of the global automobile industry and the wider high technology and automation sectors. But this technology must also be tested on the public road, initially under carefully controlled conditions, before it can be given the go-ahead for sale to the public. This is already happening around the world, and testing and developing this innovative technology in the UK will present opportunities for the British automobile industry, for the wider engineering and science sectors, and in the design of towns. Therefore this Review has been convened to ensure that there is a clear and appropriate regime to enable cars with advanced autonomous safety systems to be tested on British roads.

The Government formally set out its intentions for this review in Terms of Reference that are reproduced in Section 7 below.

## **2. What Driverless technology are we already using?**

It is important to recognise that the concept of driverless technology is not new. Almost all new vehicles already use some form of automated technology which makes driving safer and easier. Such technology can, for example, over-ride a driver's demand for acceleration or braking, or maintain a steady cruising speed.

The majority of new cars are fitted with Anti-lock Braking Systems, or ABS. This system operates by allowing sensors in the vehicle to release the brakes momentarily (despite the driver's demand) preventing the wheels from locking and skidding, and enabling the driver to maintain steering control. Many new vehicles are fitted with Electronic Stability Control (ESC), which applies the brakes on one wheel at a time, to permit more stable cornering. Recent developments (e.g. Advanced Emergency Braking System, AEB) give the vehicle the ability to apply the brakes without driver intervention if an obstacle is detected.

Cruise control is a common feature which has been around for many years. This enables the driver to constantly maintain their chosen speed without touching the accelerator or brakes. Adaptive Cruise Control (ACC) is less common. In addition to the abilities of normal cruise control, adaptive cruise control uses sensors to detect other moving vehicles in the same lane as the subject vehicle. The subject vehicle will then automatically decrease its speed to maintain a constant headway to the vehicle in front. If that vehicle ceases to be in the way, for example if the driver chooses to change lane to overtake it, the vehicle will automatically accelerate back up to the chosen speed.

Other technologies and systems available include lane keeping assistance and parking assistance. These enable vehicles to steer themselves in order to stay in lane on motorways, or to steer themselves at low speeds and/or during parking manoeuvres.

As can be seen, there are a multitude of advanced systems (sometimes known as ADAS – Advanced Driver Assistance Systems) already available in new vehicles that automate some of the driving tasks. Often these are fitted in isolation, and even where multiple systems are fitted in a vehicle, great care is taken to ensure that these systems are perceived only as *assisting* the driver (who must remain fully alert) rather than taking over his role. As the number and abilities of these systems increases, the situation will move further along a continuum from *driver assistance* to in effect *driver substitution*, meaning that the driver would no longer be required to be alert and instead the onus would fall on the vehicle to warn the driver when his input was required, bringing him back to a state of full alertness.

Vehicle manufacturers and other technology companies are continuing to develop systems that move further along this continuum. Some have made public pronouncements on the subject, or even demonstrated autonomous systems in carefully controlled conditions. A lot of information about this is in fact publicly available.

The purpose of this Review is not to develop detailed technical standards for these systems, but rather to examine the environment and conditions under which testing and trials could take place, the information from which would help formulate detailed technical standards, which are likely to be agreed at an international level.

### **3. Legislation Governing Vehicles, Drivers and Road Use**

Since the introduction of the motor car around the beginning of the last century, governments have regulated the construction and use of motorised vehicles and their operating environment. This covers the standards relevant to vehicle and infrastructure providers, the equipment that must be carried on vehicles, the behaviour of the driver, the provisions of instructions and information to the driver (road signs) and regimes under which both vehicle and driver must be licensed.

Of course, roads have been in existence for thousands of years and so regulations and informal conventions on their usage have an even longer history. These are not fixed but have been required to evolve over time, with the introduction of new forms of transport, such as animal-drawn vehicles (horse and cart), rider-propelled vehicles (bicycles), steam engines, motor cars, and motor cycles.

Originally of purely domestic origin, in recent years rule-making has increasingly taken place at European and international levels. This is most prevalent for driver licensing, vehicle construction and licensing, and road signs, but also influences driver behaviour (e.g. seat-belt wearing legislation).

There are a number of international conventions covering such things as road signs and use of vehicles in countries other than the one in which they are registered. These are agreements between governments to adopt common practice, and act to assist the free movement of road users participating in traffic in different nations. They have been supplemented in recent years by EU Directives and Regulations which compel national governments to implement EU-wide regimes for such issues as driving licensing and vehicle construction rules, although in both cases an element of national discretion remains.

Additionally, Great Britain has its Highway Code, which is a collection of instructions and guidance to road users, many of which are legal requirements, whilst others are well-established conventions of road use that are essential in governing interactions between different road users and ensuring safety.

It seems likely that the introduction of driverless cars will in due course necessitate changes to regulations, to common practice and to conventions governing the interaction of road users.

#### **4. The areas of legislation and questions to consider**

When considering what is needed for a clear and appropriate regime to enable cars with advanced autonomous safety systems to be tested on British roads, whilst looking ahead to further developments, there is a range of primary and secondary legislation concerning vehicles and road traffic law that could be affected and require change. In terms of legislation this means reference to Acts of Parliament (*primary legislation*, e.g. the Road Traffic Act 1988), and secondary legislation (e.g. the Road Vehicles (Construction and Use) Regulations 1986). There are also EU and international laws and conventions, such as the 1968 Vienna Convention covering road traffic, which may require amendment prior to changes to national rules. In addition, the devolved administrations in Scotland, Wales and Northern Ireland have

to an extent their own devolved powers in these areas which can affect what may be done. Achieving appropriate changes may therefore require careful coordination.

The main areas of legislation involved are expected to fall under the headings given below. We have included two or three questions in each area to help guide thoughts, please provide the reasoning behind your responses and feel free to comment on other matters that we have not covered:

- a. **Driver testing and licensing.** For testing cars with high automation, the driver would have to be the holder of a full licence. Some jurisdictions require a second person as an observer in the vehicle. For full automation, a thorough review would be needed and the law might need to define (and set standards for) the person who is responsible for the vehicle despite not being on board.

*Q1. Should any special training/testing or a minimum number of years of driving experience be specified for drivers involved in testing driverless cars with high automation?*

*Q2. Should a second person be required to be present, as an observer?*

- b. **Driver behaviour.** There are a number of laws around driver behaviour – driving carelessly, using a hand held mobile phone, not wearing a seatbelt, the drink and drug rules. All of these would apply to the person in the driving seat during testing of cars with high automation. So this means that if the car started speeding, the driver would take the penalty points.

There may be some limited exemptions needed. For example, where the driver of a vehicle with high automation is seen with both hands off the steering wheel, it may be they should have a defence against the possibility of being accused of careless driving simply for that reason. However if the vehicle is wandering across the road then they could be liable, and we would not expect such a person to be consuming food or operating a handheld mobile phone, as his prime role is monitoring the vehicle. A more thorough review would be needed, looking at civil and criminal sanctions, in order to assign responsibility for the behaviour of a driverless car with full automation.

*Q3. Do you believe that the normal set of requirements for driver behaviour should still apply or are any exemptions from these required, if so please specify?*

*Q4. Are any new requirements or constraints necessary?*

- c. **Behaviour of other road users.** The introduction of highly autonomous cars represents a considerable change to the current road situation, and is likely to affect the expectations and behaviour of other road users. Other road users may be surprised to encounter a car where the driver is not obviously “driving” and therefore might not react to signals such as hand gestures. Eye contact is a vital part of interaction with other road users,

particularly vulnerable road users, and how to deal with an absence of this needs detailed consideration. Would it be helpful for other road users, during the testing phase or permanently, to be aware that the vehicle is i) capable of autonomous operation, and/or ii) operating in “autopilot” mode?

*Q5 Do you have any suggestions for an indication to other road users that the vehicle is operating autonomously, or capable of autonomous operation? For example, a **warning signal** showing autonomous operation or a **distinguishing sign** (different number plate, sticker on windscreen, etc.) indicating the potential capability of autonomous operation?*

*Q6. Should educational materials be developed to advise other road users about the testing of highly autonomous cars?*

*Q7. Do you have any observations on the possible reactions of other road users, or the risks of interaction with driverless cars, and possible mitigation measures?*

- d. **Product liability.** This issue needs examination, although for cars with high automation, we consider that the situation would not be significantly different to the current situation with technologies such as ABS and ACC, where malfunctioning can cause collisions and injuries, or even existing (non-autonomous) technology such as brake systems. It is anticipated that the regime of strict manufacturer liability would continue to apply. A failure leading to a collision is very rare, and current regulations are intended to minimise this risk for established technology, by requiring that in the case of a failure, the driver is warned and the system reverts to a fail-safe mode of operation. We would require cars with high automation to follow the same philosophy.

Full automation would again present further issues that are not in scope of this Review.

*Q8. Do you see any difficulties with the existing product liability regime, when operating driverless cars with high automation?*

- e. **Vehicle standards.** Vehicles are highly regulated as to the technical standards they must meet to ensure safety, both when new (type approval) and once in service (roadworthiness):

### **1) New vehicles – type approval**

Clearly in the long term, EU or international standards regulating various aspects of these vehicles will need to be developed as part of the vehicle type approval system, but the initial testing of cars with high automation will necessarily take place prior to and during the development of such standards, and may in fact contribute to it. Presently there are special domestic rules to enable the registration and testing of prototype vehicles and these will be examined in the review.



*Q9. Do you have any suggestions for standards to regulate the testing of prototype cars with high automation?*

*Q10. Are there current type approval or construction rules that prototype cars with high automation might not comply with?*

*Q11. Are you able to suggest any specific areas (e.g. braking, steering) or any specific systems/technologies (e.g. ABS, ESC) where regulation needs to be amended or developed, as a priority ?*

## **2) Vehicles in service - roadworthiness**

The cars used for testing will have to be roadworthy. The ongoing maintenance of the car to keep it in good working order will be important, and might involve (for example) compulsory software updates. Special methods for regular roadworthiness testing (MOT, for cars more than 3 years old) will have to be developed in the future, once the type approval standards have been developed, in order to verify continued compliance with them.

A more thorough review would be needed to investigate the implications for vehicle longevity of driverless cars, and to avoid problems as the vehicles age and repair becomes uneconomic. For example, they might need to be designed in a modular fashion, with components and modules that can be swapped out economically when they fail or an upgrade is desired. Alternatively they could be leased, and returned after several years for re-commissioning or recycling.

*Q12. Are any changes to the current roadworthiness regime required to permit the testing of driverless cars, or ensure their safety?*

*Q13. Have you any initial thoughts about any longer term risks and issues as driverless cars age, and possible requirements to address this?*

- f. **Vehicle tax, registering with DVLA.** Cars with high automation would need to be registered. In due course, decisions would be required as to the level of taxation and whether the capability for autonomous operation would be recorded on the DVLA database, in order to provide data on uptake, but that seems to be outside the scope of this initial review.

*Q14. Do you have any comments on this approach?*

- g. **Road and infrastructure standards.** We would anticipate that the testing of driverless cars with high automation would take place largely on existing roads and the vehicle would have to be capable of interacting with the existing infrastructure. However, it would be possible for special areas for testing to be constructed, if necessary, for a more controlled environment. Additional benefits could be realised via active communication between car and roadside units. (This is sometimes known as CVHS: Cooperative Vehicle - Highway System). Any fundamental and widespread changes to signage, road markings or other infrastructure to allow the roll-out of full

automation driverless cars would need to be agreed and planned over the medium and longer term.

*Q15. Do you anticipate a need for special infrastructure to permit the testing of cars with high automation?*

- h. **Insurance.** These vehicles would be required to be insured on the road, in line with the Road Traffic Act. It is anticipated that insurers would offer suitable products, and even if they did not, that manufacturers would be able to 'self-insure' by placing a bond against their liability for third party injuries.

*Q16. What issues would need to be addressed, to enable insurers to offer suitable insurance products?*

*Q17. Are there other insurance-related issues which may affect the introduction and testing of driverless cars?*

- i. **Data and privacy concerns.** Any data collection by an autonomous car would need to comply with existing privacy and data protection laws. This is not anticipated to be an issue during the early testing phase. Longer term, the implications are more complex. The use of vehicle event data recorders ("Black Box") is likely to become more prevalent. There may be a desire for these devices to become compulsory in autonomous cars. This would need a wide debate around the implications for privacy.

*Q18. Do you have any suggestions or concerns over data collection and privacy, when considering the testing of cars with high automation?*

- j. **Overall regime.** The overall regime for the testing of cars with high automation needs consideration. We are investigating the situation in other countries who have implemented special regimes for testing driverless cars. There is a debate as to whether to amend regulations piecemeal to cater for driverless cars, or to introduce a stand-alone regime.

This is made more complex by the fact that different pieces of legislation extend to different parts of the UK – sometimes regulations extend UK-wide, sometimes to England and Wales only, or to England and Northern Ireland only, whilst the relevant Devolved Administrations accordingly have their own legislation. In a sense the Westminster Government can only guarantee to deliver a testing regime for England, although the strong intention and aspiration is to reach agreement UK-wide.

*Q19 Do you (a) support amending diverse current regulations to cater for driverless cars alongside conventional ones, or (b) support creating a special regime via specific regulations to permit the testing of driverless cars under certain circumstances or constraints? (Or does it not matter as long as the regulations are appropriate and clear?)*

*Q20 Do you have any other comments on the need for a special regime to cover the testing of driverless cars with high automation? Do you consider*

*any other regulations or aspects of driving practice would pose a barrier, or do you consider that extra conditions would need to be imposed? Please give full details.*

The headings and questions above are only a starting point, feel free to cover other issues or regulations that are relevant in developing a clear and appropriate regime to enable cars with advanced autonomous safety systems to be tested on British roads.

## **5. Links to the Highway Code and legislation**

Link to the Highway Code:

<https://www.gov.uk/browse/driving/highway-code>

Link to the legislation.gov.uk website:

<http://www.legislation.gov.uk/ukpga>

Link to European legislation on motor vehicle standards:

[http://ec.europa.eu/enterprise/sectors/automotive/documents/directives/motor-vehicles/index\\_en.htm](http://ec.europa.eu/enterprise/sectors/automotive/documents/directives/motor-vehicles/index_en.htm)

Link to other European law:

[http://europa.eu/index\\_en.htm](http://europa.eu/index_en.htm)