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Automated Vehicles Team, Law Commission
1st Floor, Tower, 52 Queen Anne's Gate
London SW1H 9AG
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Re: Automated vehicles: Consultation Paper 3 - a regulatory framework for automated vehicles

Dear members of the Law Commission,

Waymo respectfully submits these views in response to the third and final consultation paper: *A regulatory framework for automated vehicles*, issued on 18 December 2020. Please note that we do so solely on behalf of Waymo and not on behalf of Google or any other entity that is also part of Alphabet Inc.

We recognise the opportunity for the UK to be a leader in autonomous vehicle (AV) technology and policy, and that this consultation represents a positive step towards fulfilling that ambition. While the majority of our technology development has been in the United States, we recently completed building Waymo UK, based in Oxford - our first European engineering centre. Furthermore, a significant proportion of Waymo's fleet today are cars manufactured in the UK by Jaguar Land Rover. We continue to look for opportunities to grow the team in the UK, and partner with other leading automotive manufacturers.

About Waymo

Waymo is an AV technology company with a mission to make it safe and easy for people and things to get where they're going. Every year, 1.2 million lives are lost to traffic collisions around the world. Ninety percent (90%) of all collisions on European roads are caused by human error and a large proportion are linked to drowsiness, distraction, and drunk driving. Waymo's automated driving system¹ ("ADS") - which we call the *Waymo Driver* - operates without a human driver today on the streets of several cities in the greater Metropolitan Phoenix area of Arizona, powering the world's only fully autonomous commercial ride hail service. This is unlike technologies sold in cars today such as adaptive cruise-control or lane-keeping systems which require constant monitoring by the driver.

From our start as the Google Self-driving Car Project in 2009 and since becoming a standalone company under Alphabet Inc. in January 2017, Waymo has been focused on improving transportation for all people by building the world's most experienced driver. To date, Waymo has driven over 20 million miles autonomously on public roads across 25 U.S. cities and completed over 20 billion miles of simulation testing in our fleet. The equivalent of 20,000 vehicles are driving 24-hours a day in simulation in order to develop, test and validate our technology.

¹ A vehicle operated by the Waymo ADS is equivalent to a "highly automated vehicle" as per the *Code of Practice: Automated vehicle trialling*: <https://www.gov.uk/government/publications/trialling-automated-vehicle-technologies-in-public/code-of-practice-automated-vehicle-trialling#annex-b-definitions>

While Waymo is building an automated driving system, the Waymo Driver, we are not currently a vehicle manufacturer. We work with several leading European automotive partners for vehicle supply and to enable key use cases. The vehicles in Waymo's fleet today are US homologated vehicles and trucks from the FCA Group and Jaguar Land Rover.

Our Level 4 Autonomous Driving Technology

SAE International, the standards development organisation, has set out six levels of vehicle automation², as noted in the consultation paper. To meet the definition of Level 4, an automated driving system must be able to perform the entire dynamic driving task and bring a vehicle to a condition of reduced risk in the event of a system failure without the need for human intervention.

Waymo's technology is being designed to work across a number of use cases, such as ride hailing, heavy-duty trucking, and local delivery, all of which have been deployed fully on the streets in the US. We conducted the world's first fully autonomous SAE Level 4 ride in 2015 without a human driver. In October 2017, we extended this testing to the greater Metropolitan Phoenix Area. In 2019, members of the public in the Metro Phoenix area who are part of our Early Rider Program began to be matched with fully driverless cars when they hail a Waymo vehicle using our mobile app. In October 2020, we opened this service, called *Waymo One*, to members of the general public in Metro Phoenix, Arizona - the world's first fully autonomous ride hailing service.

Waymo Safety Framework

Safety is the core of Waymo's mission. In 2017, we became the first company to submit a detailed autonomous driving safety report to the US Government. Last year, Waymo published an updated overview of the safety methodologies³ that govern the testing and commercial deployment of our fully autonomous vehicles - the first time a company has publicly released such a framework guiding fully autonomous operations. Earlier this month, Waymo published an important new study⁴ looking at how a simulated version of the Waymo Driver performs in reconstructions of real-life fatal crashes that took place in our Chandler operating domain in Metro Phoenix. We found enormous safety improvements when the Waymo Driver replaced the initiator and the responder in the crash, avoiding collisions or dramatically reducing the likelihood of a severe injury, at a minimum, in almost all of the crashes that happened there over a 10 year span.

Waymo's extensive experience in designing, validating and operating our SAE Level 4 systems and these safety analyses have been key to informing our response to the consultation paper, which is detailed below.

² The SAE defines 6 levels of vehicle automation, starting with Level 0 (no automation). See [J3016, Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-road Motor Vehicles](#) (June 2018). To meet the definition of Level 3, the automated driving system must be capable of performing the entire dynamic driving task within its design limitations (known as the system's "operational design domain") but is dependent on a human driver for intervention in the event of a system failure. By contrast, a Level 4 system is also capable of performing the entire dynamic driving task within its design limitations but must also be capable of achieving--without human intervention--a condition of minimal risk in the event of a failure of the automation system or major vehicle system that prevents continued self-driving. The Commission's *EU Strategy for Mobility of the Future* (section 2 and f.n. 11) relies on these SAE definitions.

³ Waymo 'Safety Methodologies and Safety Readiness Determinations': <https://waymo.com/safety/>

⁴ 'Waymo Simulated Driving Behavior in Reconstructed Fatal Crashes within an Autonomous Vehicle Operating Domain': <https://storage.googleapis.com/waymo-uploads/files/documents/Waymo-Simulated-Driving-Behavior-in-Reconstructed-Collisions.pdf>

We appreciate the opportunity to provide our views and look forward to continuing to assist the Law Commission team with any further steps as it prepares to submit its final recommendations to the Government later this year.

Sincerely,



Ben Loewenstein
International Policy Manager, Europe

Response to the Consultation Paper

We commend the Law Commission for its thorough work and see this consultation process as an important step towards creating a robust national framework for the commercial deployment of autonomous vehicles in the UK, building on the 2015 UK Code of Practice: Automated Vehicle Trialling (“Code of Practice”)⁵. While Waymo supports many of the proposed measures, our submission focuses on a number of key areas on which we believe future legislation can provide greater clarity and thus certainty for both the AV industry and policymakers: ADS definitions, the national type approval scheme and the process for making safety determinations.

Waymo’s comments below outline these issues in detail and provide recommendations for their resolution as well as addressing specific questions from the consultation paper in the final section of the submission.

1. ADS definitions on the types of automation should be aligned with the current UK Code of Practice, derived from SAE International.

We agree that an Automated Driving System Entity (“ADSE”) as envisioned under the current proposal should include both technology developers and/or vehicle manufacturers given the breadth of entities testing and deploying ADS-equipped vehicles.

The consultation paper also raises a number of important questions regarding definitions, namely the first chapter, which focuses on terms like “driving itself” and “remote assistance”. Indeed, references are made throughout the diverse pool of sources for these definitions and to the impact that variations in the language can have on the eventual legal framework.

In making these assessments, Waymo urges the Law Commission to use the incumbent Code of Practice terminology, including the definitions of “automated driving system”, “dynamic driving task,” “conditionally”, “highly” and “fully” automated vehicles (which align with SAEJ3016⁶). We also believe the updated SAEJ3016 language (which, as noted in the consultation paper, has been shared with the Law Commission previously by another commenter) should serve as the basis for resolving

⁵ UK Government Code of Practice: Automated Vehicle Trialling:
<https://www.gov.uk/government/publications/trialling-automated-vehicle-technologies-in-public/code-of-practice-automated-vehicle-trialling>

⁶ Specifically, these align with SAE levels 3, 4 and 5 respectively

issues about what constitutes “remote driving” versus “remote assistance.” We also urge the Law Commission to ensure that companies like Waymo that use remote assistance are not required to use remote driving, since the Level 4 ADS is responsible for the entire dynamic driving task rather than a human being.

2. The proposal for a broader national approval scheme for commercial AV operation is a positive step. It must be open to developers and carried out by a specialist regulator rather than a patchwork regime, and avoid imposing undue limits on deployment.

Under a regulatory scheme like the UK’s, which requires pre-approval of vehicles, trials and deployment should be approved by an individual specialist regulator for ADSEs, with or without a user-in-charge, rather than a patchwork of different approval entities. Consistent with this approach, we note that the pending AV deployment ordinance in France (Article 31), envisions a broad national approval process for the commercial AV transport of members of the public conducted by a specialist regulator, separate from vehicle type approval.

In addition, the UK’s national approval framework for commercial deployment should not create limited use cases or inhibit deployment, and the Code of Practice already provides effective relevant criteria for testing. Waymo is concerned that placing limits on deployment, as is suggested in the consultation paper, either by number or geography, would do just this. We believe the need to provide ongoing safety assurance post-deployment is already being addressed through the Law Commission’s recommendations on collecting meaningful data.

3. Safety determinations should be made objectively by the designated regulator and applied consistently from entity to entity.

The consultation paper examines in detail the difficulty involved with assessing what is “safe enough” and provides an overview of the various thresholds set out by different groups. As set out in our own safety framework,⁷ Waymo agrees with the Law Commission’s view that no one methodology provides a definitive, empirical methodology for answering the question of “how safe is safe enough.” Indeed, our own determinations rely on a combination of safety methodologies.

On the question of how a determination is made, we agree that an expert regulator should make a determination to approve or reject deployment. The Law Commission’s conclusion that the ultimate decision to assess acceptable risk is a political one implies that there is a large degree of subjectivity involved in that process. We believe this decision should be made as objectively as possible. While all regulation involves a degree of policy choice, safety should be determined by objective standards that demonstrate an ADS’ capability in its ODD.

Waymo therefore sees this consultation as a key opportunity for the Law Commission to provide greater clarity around the process of providing advice to the Secretary of State for Transport on safety standards. That is, identifying who will provide the relevant advice and what the process will look like.

⁷ Waymo ‘Safety Methodologies and Safety Readiness Determinations’: <https://waymo.com/safety/>

Responses to Specific Consultation Questions

We focus here on selected questions as our general points have been made above.

Question 3: *We provisionally propose that the decision whether a vehicle is sufficiently safe to “safely drive itself” should be made by the Secretary of State (for Transport), as informed by advice from a specialist regulator. Do you agree?*

As we have described above, the determination made by a specialist regulator should be based on objective criteria applied equally to all developers and manufacturers. We urge the Law Commission to specify what the process for providing that advice should look like.

Question 7: *We provisionally propose that: (1) safety assessment should use a variety of techniques; (2) manufacturers/developers should submit a safety case to regulators showing why they believe that the automated driving system is safe; (3) regulators should: (a) provide guidelines for what is in the safety case; (b) audit the safety case; (c) prepare guidance for manufacturers and developers on preferred standards; and (d) carry out at least some independent tests. Do you agree?*

Waymo supports part (1) of the recommendation that a variety of safety assessment methodologies and techniques should continue to be available for the ADSE, which should be able to document its application of its chosen methodologies. If such documentation is required to be submitted, we note that the process should require protection of confidential business information. Moreover, we would urge that the scope of any such required documentation remain consistent with the general requirements of the UK Code of Practice, to maintain consistency between trialling and commercial deployment.

Question 10 : *We provisionally propose that: (1) the Government should establish a domestic scheme to approve automated driving systems (ADSs) for use on roads in Great Britain (a “national ADS approval scheme”); (2) manufacturers should have a free choice to apply for approval under either the UNECE system of international type approvals or through the national scheme; (3) developers should be able to submit an ADS for national approval, even if they are not responsible for manufacturing the whole vehicle. Do you agree?*

Waymo supports these proposals. National timelines for trialling and deployment have tended to be more mature than those set out by UNECE. The UK’s Code of Practice is a good example of this in that the UK has been able to develop a national framework quickly and effectively. While both national and international paths for approval should remain open, one should not foreclose the other.

Question 11: *We provisionally propose that: (1) an ADS approval scheme should be established through regulation under the Road Traffic Act 1988, without further legislative reform; (2) an ADS should be defined as a combination of software, hardware and sensors, which can be installed in a “type” of vehicle; (3) when an ADS is approved, the approval should be accompanied by specifications for: (a) the type of vehicle in which it can be installed; and (b) how the ADS is installed within the vehicle; (4) where an ADS is installed in a pre-registered*

vehicle, an example vehicle should be submitted to the regulator for approval of the installation. Do you agree?

With regard to part (2), as outlined in point 1 of our response, we encourage the Law Commission to use the existing Code of Practice terminology, which stems from the SAE definitions. The current UK Code of Practice defines an ADS as follows:

'An automated driving system (ADS) is a vehicle system that uses both hardware and software to perform all of the dynamic driving tasks (all the activities associated with moving a vehicle, other than strategic tasks like journey scheduling) needed to undertake a journey. When activated, the vehicle enters automated mode ("self-driving mode"), and the driver does not need to monitor the road traffic environment, or the ADS. The ADS may work within specific driving situations (sometimes referred to as an operational design domain), or in any driving situation. Outside of these situations, a driver is needed to control the vehicle.'

With regard to the proposal set out in part (4), Waymo urges the Law Commission to clarify that it would not be approving the installation but rather approving the capabilities of the ADS as installed for the intended use case. Furthermore, we instead propose that the Law Commission recommend that a vehicle be made available for demonstration by the ADSE for testing within its ODD rather than simply submitting it to the regulator or another third party, given that a Level 3 or 4 vehicle cannot be tested at just any facility or directly compared against other vehicles with the same levels of automation that may have a different ODD.

Question 16: We seek views on whether the regulator that classifies vehicles as self-driving should have power to allow their deployment in limited numbers, so as to gather further data on their safety in real world conditions.

As described above in point 2 of our response, we believe a national scheme should allow for broad commercial deployment. Creating limits on numbers would impede this and would be akin to imposing a second pre-deployment trial phase. It would also create an added layer for decision-makers to govern and industry to comply with. We instead urge the Law Commission to place its emphasis on utilising meaningful data from ADSEs and manufacturers' trials in order to satisfy the necessary safety requirements to approve a deployment use case, while relying on existing authorities to request additional data as needed should a safety concern arise.

Question 37: We provisionally propose that:

- **Where an individual is exercising latitudinal and longitudinal control (steering and braking) over a vehicle remotely, that should not be regarded as a form of "self-driving"; and**
- **Where lateral and longitudinal control are exercised by an ADS, all other forms of remote operation should be regulated as "self-driving".**

Do you agree?

We welcome views on whether the current definition of when a vehicle "drives itself" under the Automated and Electric Vehicles Act 2018 should be amended to deal with some forms of remote operation which may involve a degree of "monitoring".

Waymo does not agree with this proposal as currently stated and believes there should be a distinction between these terms as described by the Law Commission in the consultation paper (and as set out by SAE).

We certainly agree that when an individual is exercising longitudinal and latitudinal control over a vehicle remotely (or otherwise), that should not be considered “self-driving.” In addition, remote exercise of either one of those types of control or performance of other functions that constitute the DDT would not be considered self-driving. Whenever a human driver, whether remotely located or in the vehicle, is performing any part of the DDT, the ADS is not controlling “all of the dynamic driving tasks” as contemplated by the UK Code of Practice definition of ADS. If the Commission wishes to bifurcate the DDT in the way suggested by this question, this would deviate substantially from its own construct of what constitutes an ADS. We are not clear on what purpose would be served by such a unique concept of self-driving. Remote control of a vehicle is not vehicle automation and, where combined with vehicle automation, the risks of remote control should be separately assessed and addressed.

Question 40: We provisionally propose that, irrespective of the nature of the vehicle, a licensed operator should be under a duty to:

- ***supervise the vehicle;***
- ***maintain the vehicle;***
- ***insure the vehicle;***
- ***install safety-critical updates and maintain cybersecurity; and***
- ***report accidents and untoward events (as defined by the regulator).***

Do you agree?

Waymo supports the concept that an ADSE should be allowed to serve as the licensed operator and encourages the Law Commission to clarify this when making its final recommendations to the Government. Indeed, we note the Law Commission’s second consultation paper on HARPS which posits that if an ADSE operates a HARPS without a user-in-charge, that the ADSE will need a HARPS operator licence.⁸ While some entity will need to be responsible for matters such as maintenance, obtaining insurance, installing safety-critical updates, and reporting accidents as required, we believe the proposal should clearly permit allocation of those responsibilities among various parties (e.g. the ADSE may partner with other entities for performance of some of these duties).

We also wish to draw attention to the use of the term, “supervision”. In J3016, “supervise” refers to a human driver’s activities in relation to SAE Level 1 or 2 driving automation systems and supervision is not a role assigned to human drivers with regard to ADS systems (L3 through 5). Therefore, if “supervise” as used here is meant to convey a different meaning from the J3016 meaning, that should be clearly explained. If the intent is to require a human operator actually to supervise an ADS-equipped vehicle in the sense of monitoring the ADS, correcting errors by the ADS, or handling parts of the DDT, such a role is inconsistent with the meaning of an ADS.

We also have concerns about the vagueness of the term “untoward events” given it could include a wide range of occurrences, some of which will have no clear link to ADS safety. We understand that

⁸ Automated Vehicles: Consultation Paper 2 on Passenger Services and Public Transport, p.7:
<https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2019/10/Automated-Vehicles-Consultation-Paper-final.pdf>

the definition of the term would be left to the regulator, but we suggest that the Law Commission provide some guidance so that the reporting burden could be reasonably limited to any demonstrated safety need for the information.