

**Law Commission Consultation Paper 3 on Automated Vehicles**  
**Response by Apollo Automobile Group Limited – 31/03/21**

*Special dispensation to file submission by 1<sup>st</sup> April granted by Jessica Uguccioni via email on 16<sup>th</sup> March.*

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**About Apollo Future Mobility Group (AFMG):**

Apollo Future Mobility Group (AFMG) is a Hong Kong listed company (HKEX stock code: 860) with multinational assets focused on revolutionizing the transportation industry. AFMG consists of two operating business units: Apollo Automobil and Apollo Advanced Technologies with international presence spanning across Hong Kong, China, Germany, Japan, United Kingdom and United States.

AFMG are building a world-leading one-stop service platform for “future mobility” through the integration of globally advanced assets and networks. AFMG’s mission is to introduce cleaner, safer, smarter mobility options and technologies to build ecosystems that will connect people, goods and services for generations to come. Mobility, put very simply, is to move someone or something from Point A to Point B. AFMG are taking this concept further to achieve the Ultimate Sustainable Future of Mobility. AFMG feature a world-class team with extensive human capital and proprietary property. With a proven track record, AMFG have successfully executed high profile projects and applications globally.

**Important Submission Note:**

Apollo are currently engineering an infrastructure-based solution that we have termed *Intelligent Road Infrastructure* (IRI). This solution delivers predictive, comprehensive digital mapping of the traffic flows on the Strategic Road Network. This solution solves many of the challenges relating to the effective, safe introduction of Autonomous Vehicles. Our expertise in this area, combined with the expertise of the technical partners we have chosen, means we are well placed to add value to the Law Commission consultation.

At the time of submitting this document, Apollo are still in the process of protecting their Intellectual Property (IP) through patent. Therefore, at this time, Apollo need to be restrictive in some of our answers such that we do not negatively prejudice our ability to secure IP protection.

Apollo expect to have secured IP protection in 3-6 months, and at that point, we would be able to share more detail around the solution we are engineering, and how exactly it resolves a number of

the challenges identified in this consultation. We hope that this is something that the Law Commission will be open to.

### **Executive Summary:**

Apollo are delighted to respond to this key consultation, and we thank you for the opportunity to do so. Our submission responses are focused on three main areas concerning the safe, and effective introduction of self-driving AVs onto the UK roads.

#### **1) Transition control, and specifically the hand back of control from the AV to the driver in charge.**

- Many studies in the public domain have been carried out concerning the time taken to effectively transition back to driver control. A common time conclusion from these studies is in the 6 to 10 second range, allowing a driver to become aware of the transition request from the AV, and to fully refocus their attention.
- At motorway speeds, this transition time is likely to be mean that the distance travelled by the AV during transition, is greater than the effective sensor range of on-car AV technology.
- Apollo strongly believe that comprehensive, external digital traffic flow mapping will be essential to a timely trigger of transition need, allowing safe transition back to the driver.

#### **2) Real time monitoring of AVs, plus all other human piloted vehicles within the immediate operating environment of an AV.**

- Apollo are working together with a world leading autonomous driving software company. A key challenge to the safety of AVs is the effective sensor range which limits reaction time at motorway speeds. This range is further restricted by climatic conditions, and sensor soiling through normal use.
- The range of high - resolution sensors on AVs is not significantly greater than the distance it takes the vehicle to smoothly stop from motorway speeds. This means that hazards only become apparent to AVs at relatively close range, which may require hard braking events, or sudden steering inputs, from AVs. Naturally, there will be ripple effects in the following traffic from such sudden driving actions.
- This technical challenge of sensor range becomes even more important when autonomous Heavy Goods Vehicles (HGVs) are considered. Stopping distances of laden HGVs are longer, and the potential for loss of life in an HGV incident is higher.

#### **3) Post incident review, including near miss incident review.**

- It is clear to Apollo that a set of specialist skills will be required to analyse collisions involving AVs.

- With the provision of comprehensive digital traffic flow mapping, an incident could be re-played digitally, and evidence provided for the behaviour of traffic not directly involved in the incident.
- Monitoring data could help identify the unique set of circumstances that caused this particular incident and could help establish if there is a fundamental weakness in the decision making of the ADSE involved.
- Additionally, the same monitoring combined with specialist knowledge means that the performance of AVs can be continually assessed in-life, allowing for trials, tests, and feedback of safety controls, AV categorisation, and granted approvals.

Please note that we have responded to questions **1, 5, 7, 9, 10, 13, 14, 16 - 18, 22, 25, and 56**. These are the areas where we feel we can add most value to the Law Commission's work.

### **Consultation Questions and Responses:**

#### **The definition of self-driving**

- 1. We provisionally propose that: (1) a vehicle should not be classified as self-driving if, with the ADS engaged, the user-in-charge needs to monitor the driving environment, the vehicle or the way it drives; (2) it is nevertheless compatible with self-driving to require the user-in-charge to respond to a clear and timely transition demand which: (a) cuts out any non-driving related screen use; (b) provides clear visual, audio and haptic signals; and (c) gives sufficient time to gain situational awareness. (3) to be classified as self-driving, the vehicle must be safe enough even if the human user does not intervene in response to any event except a clear and timely transition demand. Do you agree?**

We agree. We would also like to further highlight that many studies in the public domain have been carried out concerning the time taken to effectively transition back to driver control. A common time conclusion from these studies is in the 6 to 10 second range, allowing a driver to become aware of the transition request from the AV, and to fully refocus their attention.

At motorway speeds (70mph, 31 m/s), this transition time equates to between 186 and 310 meters of travel. Combine that with a highway code stopping distance of 96 meters, and this scenario is very close to, if not already greater than, the effective sensor range of on-car AV technology.

Apollo strongly believe that comprehensive, external digital traffic flow mapping will be essential to allowing safe transition back to the driver. This comprehensive flow data, including knowledge of hazards, means that an AV can be warned many minutes before a known incident. The AV can then decide on the appropriate action to take, including a timely request to safely transition back to the driver.

- 5. We welcome observations on how automated vehicles can be made as safe as reasonably practicable.**

Apollo are working together with a world leading autonomous driving software company. A key challenge to the safety of AVs is the effective sensor range which limits vehicle reaction time at motorway speeds. This range is further restricted by climatic conditions, and sensor soiling through normal use.

The range of high - resolution sensors on AVs is not significantly greater than the distance it takes the vehicle to smoothly stop from motorway speeds. This means that hazards only become apparent to the AVs at close range, which may require hard braking or sudden steering inputs. Naturally, there will be ripple effects in the following traffic from such sudden driving actions.

This technical challenge of sensor range becomes even more important when autonomous Heavy Goods Vehicles (HGVs) are considered. Stopping distances of laden HGVs are longer, and the potential for loss of life in an HGV incident is higher.

Apollo intelligence strongly suggests that HGVs will be the first category of AVs on the roads, due mainly to the significant operating cost savings achievable with an autonomous HGV. McKinsey and Company research predicts that 20% of all HGVs will be autonomous by 2030.

Apollo know that to achieve safe AV vehicle fleets on the public roads, the AVs need comprehensive digital traffic flow mapping information to allow them to operate safely. Apollo are delivering this additional, external mapping information that could be used by AVs.

Comprehensive digital traffic flow mapping can be used to inform AVs of relevant safety threats, for example pedestrians and animals in the carriageway, erratic behaviour from other vehicles, and forewarn the AV such that it can take smoother, more timely action.

Additionally, external environment information can be used for complete carriageway monitoring, in real time, to establish how AVs are performing on the road. This same information will also allow post-incident analysis, of both road traffic incidents and near misses.

### **Safety assurance before deployment**

- 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?**

We agree. In addition, we believe that independent information regarding the in-life performance of AVs is critical. AVs are almost certainly going to be on the road network alongside human piloted vehicles, and so there are many potential unexpected events that the AVs may, or may not handle effectively.

Comprehensive digital traffic flow mapping and monitoring is able to provide regulators, and safety bodies with detailed evidence of how AVs are performing in the field, and it has the potential to provide an independent witness. This data can highlight if one manufacturer, or one model of vehicle is consistently handling a scenario sub-optimally, and feed that back to the Automated Driving System Entity (ADSE).

The same comprehensive digital traffic flow mapping can highlight if human behaviour differs from that expected by the ADSE, for example if human pilots learn that they can 'bully' AVs into certain behaviours favouring the human pilot.

- 9. We provisionally propose that: (1) unauthorised automated driving systems should be prohibited; and (2) this should be subject to an exemption procedure by which the Secretary of State may authorise unauthorised systems to be used in tests and trials. Do you agree?**

We agree. In addition, we believe that independent information regarding the in-life performance of AVs is beneficial to the assessment of AVs under test or trial. Comprehensive digital traffic flow mapping will enable regulators, and ADSEs to gain valuable information about the performance of their AVs whilst being trialled.

- 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?**

Whilst we do not have sufficient public policy experience to make a judgement on this question, we do believe that comprehensive digital traffic flow mapping will enable the Government to have an informed feed-back loop on AV performance in life, and thus be continuously informed on the effectiveness of their ADS approvals.

- 13. We provisionally propose that: (1) once an ADS has received type approval at either international or domestic level, an Automated Driving System Entity (ADSE) would need to submit the vehicle to the UK safety regulator for categorisation as able to safely drive itself; (2) the safety regulator should make a recommendation to the Secretary of State for how the vehicle should be classified; (3) it should be open to the safety regulator to recommend that an ADS-enabled vehicle is classified in one of three ways: as not self-driving but driver assistance; as self-driving only with a user-in-charge; or as self-driving without a user-in-charge; (4) the safety regulator should only recommend classification as self-driving (either with or without a user-in-charge) if it is satisfied that: (a) an ADSE is registered as taking responsibility for the system; (b) the ADSE was closely involved in assessing safety and creating the safety case; and (c) the ADSE has sufficient funds accessible to the regulator to respond to improvement notices, to pay fines and to organise a recall.**

We do agree, though we suggest that there is a further possibility to the classifications outlined in Q13, part (3). We believe that with comprehensive digital traffic flow mapping and

the ability to provide AVs with an additional layer of safety critical environment data, it would be possible to categorise an ADS dependent on the road it is using. For example:

- An ADS could be categorised as 'self-driving only with a user in charge' as default.
- The same ADS could be categorised as 'self-driving without a user in charge' on road networks fed by the safety enhancing benefits of comprehensive digital traffic flow mapping.

Additionally, comprehensive digital traffic flow mapping will enable the Government to verify that certified AVs meet the required categorisation, or classification criteria in use.

**14. We provisionally propose that a new legislative framework should provide regulation-making powers to specify: (a) who should assess whether a vehicle is capable of self-driving; (b) the procedure for doing so; and (c) criteria for doing so.**

We agree, and further highlight that comprehensive digital traffic flow mapping will enable the regulation-making powers to have an informed feed-back loop on AV performance in life, and thus be continuously informed on the effectiveness of their assessments and criteria.

**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.**

We believe that whilst sensible when taken at face value, this limited number proposal would be less effective than an alternative option.

For an ADSE and AV to pass the homologation requirements that will be put in place covering AVs, the regulator would have high confidence that the fundamental ADSE system performs well in normalised, and majority traffic conditions.

Given the volumes of testing done by the ADSEs prior to market launch, and the liability implications inherent in the quality of that testing, we submit that the AVs are highly likely to perform well in most normal scenarios.

The risk is in the unplanned, unexpected and untested scenarios that it is simply not pragmatic to expect an ADSE to test for. Restricting the numbers of vehicles deployed on the roads means that statistically, it will take much longer for one of the AVs to encounter such an unplanned event. Small numbers may also mean the event is categorised as minor, and no pattern of AV behaviour found. Additionally, there may be no recording of near misses, nor the consequence to other vehicles by AV manoeuvres.

We suggest that a higher volume of vehicles is beneficial, though it is vital that these deployed vehicles are monitored closely, and comprehensively during their early life, particularly.

This monitoring would be from a range of sources, including comprehensive, external digital traffic flow mapping.

## Assuring safety in use

**17. We provisionally propose that legislation should establish a scheme to assure the safety of automated driving systems following deployment, giving scheme regulators enhanced responsibilities and powers. Do you agree?**

We agree, and further highlight that comprehensive digital traffic flow mapping will enable the regulators to have an informed feed-back loop on AV performance in life, and thus be continuously informed on the effectiveness of their responsibilities and powers.

In addition, such comprehensive monitoring data could be used to inform regulators of near misses, or repeated AV decision making errors. This would mean that the regulator is informed of rare, and unusual issues that may cause a future problem, in addition to actual incident data.

**18. We provisionally propose that the enhanced scheme should give regulators the following responsibilities and powers: (1) scheme regulators should be responsible for comparing the safety of automated and conventional vehicles using a range of measures; (2) to do this the regulator should have power to collect information on: (a) leading measures (instances of bad driving which could have led to harm) and (b) lagging measures (outcomes which led to actual harm); (3) regulators should have power to require an ADSE: (a) to update software where an update is needed to ensure safety and continued compliance with the law; (b) to keep maps up-to-date, where an AV relies on maps to ensure safety and compliance with the law; (c) to communicate information about an ADS to users in a clear and effective way, including where necessary through training.**

We agree, and further highlight that comprehensive digital traffic flow mapping will enable the regulators to assess the performance of all vehicles on the road network. The environment monitoring will mean that human piloted vehicles, and AVs will be monitored, and reported on in an identical way.

This will remove some of the variabilities inherent in broad statistical data, and will allow regulators to directly compare how a human driver, and an AV reacted to the same situation on the same piece of real road.

Over time, the flow mapping data will identify leading measures (outcomes which led to actual harm), informing both the regulators for data collection, and the AVs so that they can avoid such events in future.

The monitoring data will also allow direct understanding of lagging measures (outcomes which led to actual harm). The data will be available to allow an analysis of surrounding traffic, behaviour and decisions taken by all traffic on the road.

It should be possible to access information instantaneously, meaning that the regulators can make recommendations as soon as a systemic concern becomes apparent. The results of software updates could also be rapidly assessed.

System sensors would also be able to provide up to date geographic mapping data of the roads on which they are installed.

- 22. We provisionally propose that a statutory scheme to assure AVs in-use should: (1) investigate safety-related traffic infractions (such as exceeding the speed limit; running red lights; or careless or dangerous driving); (2) investigate other traffic infractions, including those subject to penalty charge notices; (3) if fault lies with the ADSE, apply a flexible range of regulatory sanctions. Do you agree?**

We agree, and further highlight that comprehensive digital traffic flow mapping will enable the independent identification of AVs committing traffic infractions. This would provide unbiased information, independent of what may, or may not be shared by the ADSE.

- 25. We provisionally propose that a specialist collision investigation unit should be established: (1) to analyse data on collisions involving automated vehicles; (2) to investigate the most serious, complex or high-profile collisions; and (3) to make recommendations to improve safety without allocating blame. Do you agree?**

We agree that a different set of specialist skills will be required to analyse collisions involving AVs, though we cannot comment on whether a new unit should be established or not.

We would also like to further highlight the significant benefits to this area provided by comprehensive digital traffic flow mapping. Monitoring data will mean that an incident could be re-played digitally, and evidence provided for the behaviour of traffic not directly involved in the incident.

Monitoring data could help identify the unique set of circumstances that caused this particular incident and could help establish if there is a fundamental weakness in the decision making of the ADSE involved.

### **Access to data**

- 56. We provisionally propose that legislation should impose a duty on those controlling AV data to disclose data to insurers, where the data is necessary to decide claims fairly and accurately. Do you agree?**

We agree. We would also like to further highlight that comprehensive digital traffic flow mapping data could also be very beneficial to insurers deciding claims fairly and accurately by using the system as an independent witness.



**Conclusion:**

We hope that the Law Commission find the above responses useful during the policy development phase of the review into a regulatory framework for automated vehicles. Apollo look forward to remaining a constructive contributor to policy development around Automated Vehicles following this submission, including in greater depth after securing IP protection.