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Sent by email to: avregulation@infrastructure.gov.au

Waymo submission to the Australian Public Consultation on Automated Vehicle Safety Reforms

Introduction

Waymo respectfully submits these views in response to the Australian Government and National Transport Commission's public consultation. 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.

I. About Waymo

Waymo's mission is to be the world's most trusted driver. We believe our technology can improve the world's access to mobility while saving thousands of lives now lost to traffic crashes. Globally, 1.19 million people are killed in road traffic crashes (1,269 in Australia in 2023) and an estimated 20-50 million injured annually.[1] [2] A large proportion of these crashes are linked to drowsy, distracted, and impaired driving. This is why our highly automated / Society of Automotive Engineers (SAE) Level 4 automated driving system[3] ("ADS") - called the *Waymo Driver* - includes the software and hardware that, when integrated into the vehicle, performs all driving functions.

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. Our system has travelled more than 20 million miles without a human driver and completed more than 40 million miles of testing with an autonomous specialist behind the wheel, across thirteen U.S. states. In simulation, we virtually drive around 20 million miles a day, which is the equivalent of 100 years of driving in the real world, and have driven tens of billion total miles in simulation.

Today, Waymo operates the world's first paid, round-the-clock ride-hail service, called Waymo One[4] in the U.S. cities of Phoenix, San Francisco, and Los Angeles. We provide more than 50,000 paid rides to members of the public every week, and completed more than 700,000 rides in 2023. Our fleet is fully electrified and consists of more than 600 Jaguar I-PACE vehicles, powered with 100% renewable electricity.

II. Waymo's approach to safety

Safety is the core of Waymo's mission. In 2017, we became the first company to submit a detailed ADS safety report to the US Government. In 2020, Waymo published an overview of the safety methodologies[5] that govern the testing and commercial deployment of our SAE Level 4 automated vehicles – the first time a company publicly released such a framework.

[1] WHO road safety data: https://www.who.int/health-topics/road-safety#tab=tab_1
[2] Australia Road Deaths Statistics: https://www.bitre.gov.au/publications/ongoing/road_deaths_australia_monthly_bulletins
[3] SAE J3016 (2021): https://www.sae.org/standards/content/j3016_202104/
[4] Waymo One webpage: https://waymo.com/waymo-one/
[5] Waymo blog: "Sharing our safety framework" (2020): https://waymo.com/blog/2020/10/sharing-our-safety-framework/

Waymo's safety methodologies,[6] which draw on well established engineering processes and address new safety challenges specific to Automated Vehicle technology, provide a firm foundation for safe deployment of Waymo's ADS, Waymo's determination of its readiness to deploy its automated vehicles safely in different settings rests on that firm foundation and on a thorough analysis of risks specific to a particular Operational Design Domain. Waymo's process for making these readiness determinations entails an ordered examination of the relevant outputs from all of its safety methodologies combined with careful safety and engineering judgement focused on the specific facts relevant for a particular determination. This paper explains Waymo's methodologies as applied to the three layers of its technology: hardware, ADS behaviour, and operations, and also explains Waymo's safety governance. Waymo will continue to apply and adapt those methodologies, and to learn from the important contributions of others in the automated vehicle industry, as Waymo continues to build an ever safer and more able ADS.

III. Waymo's safety performance

Our comprehensive research[7] — more than 30 papers that we have published to enhance transparency and understanding of our operations — shows that the Waymo Driver performs safely across a range of evaluations.

The data to date indicates the Waymo Driver is already reducing traffic injuries and fatalities in the places where we currently operate.[8] At Waymo, we aim to reduce traffic injuries and fatalities by driving safely and responsibly, and will carefully manage risk as we scale our operations.

Earlier this month, we published new data showing that the Waymo Driver continues to make roads safer. Over 14.8M rider-only[9] miles (23.8M kilometres) driven through the end of March, it was up to 3.5 times better in avoiding crashes that cause injuries and 2 times better in avoiding police-reported crashes than human drivers in SF and Phoenix.

Comparing AV and human drivers' crash rates is not a trivial task. Last December, we introduced clear human benchmarks for such analysis and showed that the Waymo Driver significantly outperformed them over the first 7.1M rider-only miles (11.4M kilometres).[10] New data provides more evidence for the Waymo Driver's safety benefits (see Figure 1 below).

[6] Waymo Safety Methodologies and Readiness Determinations (2020): https://arxiv.org/abs/2011.00054
[7] Waymo Safety page: https://waymo.com/safety/
[8] Waymo blog: "The Waymo Driver is already improving road safety" (2023): https://waymo.com/blog/2023/07/the-waymo-driver-is-already-improving-road-safety/
[9] Passenger miles with no human safety operator at the wheel
[10] Waymo blog: "Waymo significantly outperforms comparable human benchmarks (2023): https://waymo.com/blog/2023/12/waymo-significantly-outperforms-comparable-human-benchmarks-over-7-million/

Figure 1: Waymo safety data published 18 June, 2024[11]

In September 2023, Waymo and Swiss Re, one of the world's leading reinsurers, published a first-of-its-kind study[12] finding that Waymo's automated vehicles are significantly safer than human-driven ones. Bodily injury claim frequency was reduced to zero and property damage claim frequency reduced by 76% during our first 3.8 million miles of Waymo rider-only operations in San Francisco and Phoenix, when compared against the relevant human driver baselines in those geographies.

In March 2021, we published a cutting-edge paper[13] where we conducted reconstruction simulations of actual fatal crashes involving human drivers that had occurred in Chandler, Arizona (part of the

[11] Waymo Linkedin post (2024): https://www.linkedin.com/posts/waymo_new-data-shows-that-the-waymo-driver-continues-activity-7208861021141176322-j_fW/?utm_source=share&utm_medium=member_desktop
[12] SwissRe Research Study (2023): https://www.swissre.com/reinsurance/property-and-casualty/solutions/automotive-solutions/study-autonomous-vehicles-safety-collaboration-with-waymo.html
[13] Waymo blog: "Replaying Real Life" (2021): https://waymo.com/blog/2021/03/replaying-real-life/

Waymo Driver's ODD) that showed the Waymo Driver would have completely avoided or mitigated 100% of those crashes, except for a few where it would have unavoidably been rear-ended.

In September 2022, we published a study[14] indicating our technology avoids collisions better than always-attentive human drivers. We compared the Waymo Driver's simulated collision avoidance for the Chandler fatal crashes to a non-impaired human with their eyes on the conflict ("NIEON") - a synthetic model of a consistently performing, always attentive driver that does not exist in the human population.

- The Waymo Driver prevented 75% of the crashes and reduced 93% of serious injury risk.
- The NIEON model (i.e., the model of an attentive human driver) prevented 62.5% of the crashes and reduced 84% of serious injury risk.

Response to specific issues raised in the consultation paper

Waymo supports the development of a legal framework to underpin the commercial deployment of automated vehicles in Australia and urges the Australian Government to complete its national framework for the commercial deployment of AVs by the previously stated target date of 2026.[15] Similar moves to legislate have received strong political support in other jurisdictions like the UK, which recently passed the Automated Vehicles Act,[16] [17]supported by both the Labour Party and the Conservatives.

We urge the Government to publish a timeline for when and how it will meet this objective, rather than waiting for the United Nations Economic Commission for Europe (UNECE) to complete its work on autonomous vehicle regulations, which is several years away, and only would address homologation of the automated driving system, rather than a purpose-built national law.

We fully support legal implementation of the concepts agreed to in 2018 by the Australian Government and the state and territory governments, to create a complete framework for the commercial operation of autonomous vehicles in Australia:

- *there should be a uniform approach to driving laws for automated vehicles, and this would be achieved by developing a purpose-built national law*
- *when the ADS is engaged, there must be an entity responsible for complying with driving obligations, referred to as the ADSE.*

The remainder of our submission focuses on Waymo's recommendations in response to key questions raised in the consultation paper.

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[14] Waymo blog: "Benchmarking AV safety" (2022): https://waymo.com/blog/2022/09/benchmarking-av-safety/

[15] NTC Policy Paper: "The Regulatory Framework for Automated Vehicles in Australia" (2022): https://www.ntc.gov.au/sites/default/files/assets/files/NTC%20Policy%20Paper%20-%20regulatory%20framework%20for%20automated%20vehicles%20in%20Australia.pdf

[16] UK Automated Vehicles Act (2024): https://www.legislation.gov.uk/ukpga/2024/10/contents/enacted

[17] Shadow Secretary of State for Transport, Louise Haigh welcomed the legislation and its principles, stating that it is "vital [the UK has] a proper regulatory framework in place" to ensure AVs can contribute positively to the economy. Alongside this, she has welcomed the Act's "efforts to set safety principles for these vehicles". Haigh's Junior Minister for Roads, Bill Esterson has also been vocal on his support for the Act, stating that "Labour welcomes and supports [its] broad principles", as well as emphasising the "enormous opportunity" self-driving vehicles will offer to the UK. He also confirmed that there is a "good degree of consensus on the implementation of the legislation" and should Labour serve in Government in the next election, they will "power ahead and ensure Britain really can lead on this exciting new technology.": https://hansard.parliament.uk/Commons/2024-03-05/debates/AD053D0D-60DD-4C56-A5C1-24A4F37B32E6/AutomatedVehiclesBill(Lords)

Questions 1-5: market entry and localisation

Waymo agrees that an Automated Driving System Entity ("ADSE") as envisioned under the current proposal should include both technology developers (e.g. ADS manufacturers) and/or vehicle manufacturers given the breadth of entities testing and deploying ADS-equipped vehicles, and the broad range of use cases - from personally-owned cars to passenger fleets. This aligns with the approach taken in the UK and EU, creating a flexible regime whereby the organisation that is best placed to present the ADS-equipped vehicle for approval on the Australian market can do so.[18]

With regard to corporate presence requirements, Waymo recommends the Government pursues Options 2 or 3. The proposed Option 1 creates confusion by requiring that a company have an "Australian centre of operations," which could be narrowly interpreted to mean that a company's headquarters must be based in Australia, and could unduly restrict AV operation by companies with headquarters abroad.

Question 3: safety management systems

While Waymo recognises the importance of safety management systems (SMS) to the operation of ADS-equipped vehicles, roles and responsibilities between the ADSE and the manufacturer of the ADS must be defined given they may not be the same entity. We would recommend any differences in roles and responsibilities, between those expected of an ADSE and those of an ADS manufacturer (either of equipment or vehicles) be clearly delineated.

Questions 6-14: ADS safety

Waymo supports a nationally-harmonised approach to ensuring ADS safety and determining eligibility for seeking AV operating licences.

While Australian States and Territories have a considerable role today in the operation of transport services, Waymo's view is that a national determination of ADS safety is a key unifying ingredient in a future Australia framework, critical for both building public trust in the safety of AV technology as well as industry certainty about how the process works. When it comes to making a specific safety determination, one relevant expert federal regulator should be empowered to approve or reject deployment of a highly or fully automated ADS, based on the ADS' demonstrated capability for its ODD. This approach is consistent with the one adopted in the UK's Automated Vehicles Act, which lays the foundations for an operating permit issued by central government, with consent given by the relevant regional/city transport authority.[19] Apportioning responsibility to multiple regulators at different levels of government that may not have the relevant in-house expertise to adjudicate safety risks significant confusion and inconsistent safety determinations, creating commercial and public acceptance challenges.

[18] The UK uses the similar term "Authorised Self-Driving Entity" in the Automated Vehicles Act (2024); the EU adopts a broad definition of "manufacturer" under its Market Surveillance Regulation (EU) 2018/858, which envisions both component and original equipment manufacturers performing the function of the responsible entity.

[19]

Waymo supports a safety case[20] approach, linked to a specific Operational Design Domain (ODD) - akin to the "safety file" under France's AV Decree[21] and the "safety concept" under Germany's Implementing Ordinance[22] and the EU's ADS Regulation[23] - to serve as the basis for vehicle approvals. Waymo supports the EU's requirement for the safety case to entail information "which affirms that the ADS is free from unreasonable risks for the vehicle occupants and other road users". The principle of demonstrating the absence of unreasonable risk is consistent with international best practices.[24] [25] [26] The process should also require protection of confidential business information and intellectual property.

Furthermore, while Australian States' and Territories' authority over operation and licensing of transport systems should be respected and preserved, we do urge a mutual recognition/reciprocity of AV passenger transport permits be considered in order to prevent barriers to scaling and interstate operation in the years ahead.

Question 7: safety risks of repairs, maintenance and modifications

In addressing risks surrounding the repair, maintenance and modification of ADS-equipped vehicles, Waymo urges the Government to respect the right of ADS manufacturers to protect their IP, trade secrets and ability to enter into contractual agreements with specific suppliers. Similar policy proposals, such as the EU's[27], have been the subject of significant controversy, leading to delays in an actual regulatory proposal being put forward as well as strong safety concerns being expressed by the European Automotive Manufacturers Association (ACEA).[28]

Question 11: remote operations

Waymo strongly disagrees with the proposal that all remote functions must be performed within Australia. The consultation paper states that "remote operation is a broad term that can cover a range of activities, including remote driving, remote ADS assistance, and other activities such as vehicle monitoring and passenger support."

This encompasses many different functions involved with running a service like Waymo One such as remote assistance or rider support, during which the SAE Level 4 Waymo Driver performs the entire

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[20] We think the safety concept and associated documentation required by the ADS Regulation is quite similar to a "safety case." NASA defines a safety case as "a structured argument, supported by a body of evidence that provides a compelling, comprehensible and valid case that a system is, or will be, adequately safe for a given application in a given environment." See NASA System Safety Handbook Volume 2: System Safety Concepts, Guidelines, and Implementation Examples at 117, citing U.K. Ministry of Defence, Defence Standard 00-56, "Safety Management Requirements for Defence Systems," London, UK. 2007.2.61.

[21] France's Decree No. 2021-873 of June 29, 2021: https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043729532

[22] Germany's Draft Ordinance implementing the Act amending the Road Traffic Act and the Compulsory Insurance Act, notified to the European Commission (July 2021) https://ec.europa.eu/growth/tools-databases/tris/index.cfm/en/search/?trisaction=search.detail&year=2021&num=344&dLang=EN

[23] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32022R1426

[24] See definition of 'safety' under section 1.103 of ISO26262: https://www.iso.org/obp/ui/#iso:std:iso:26262:-1:ed-1:v1:en

[25] See section 2 ("Definitions) of the United Nations Economic Commission for Europe Regulation 157 regarding Automated Lane Keeping Systems: https://unece.org/sites/default/files/2021-03/R157e.pdf

[26] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:42021X0389&from=EN

[27] European Commission consultation page: Access to vehicle data, functions and resources: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13180-Access-to-vehicle-data-functions-and-resources_en

[28] See ACEA's position paper for example: https://www.acea.auto/video/video-in-vehicle-data-access-creates-major-safety-and-security-risks/

dynamic driving task.[29] This is different from remote driving, which involves a human being performing the entire DDT. The future regulatory framework needs to distinguish between these types of remote functions.

The differences between these are further described in the 2023 AVSC paper.[30] We recommend the Government take the variety of remote functions into account rather than imposing blanket conditions.

Questions 15-17: human user obligations

Question 15: human user obligations

Waymo does not agree with the Consultation Paper's suggestion that a human being should be required to be present in an AV equipped with manual driving controls. Waymo's vehicles operate, with or without, riders in the vehicle. Riders in SAE Level 4 vehicles should not be expected to have to carry driving licences, to ensure this technology can be broadly accessed by people who cannot drive, including those who are legally blind, deaf, have limited mobility, or have been diagnosed with epilepsy.

Waymo instructs riders not to touch the Waymo AV's sensors (e.g. lidar), vehicle controls (e.g. gear shift), or driving mechanisms (e.g. steering wheel). Upon detection that the AV's external sensors have been manipulated, Waymo's security controls will prompt the vehicle to achieve a minimal risk condition — for external tampering, that would typically mean the vehicle was already stationary and would remain so. If internal tampering is detected during a trip, Rider Support will be alerted. Depending on the nature of the event, Rider Support may end the trip, and the rider may have their Waymo account deactivated or be reported to law enforcement authorities.

Waymo also provides a feature for first responders to be remotely authorised by Waymo representatives to disable the autonomous driving mode of a stopped Waymo vehicle and place it into a manual driving mode if needed.[31] [32]

Questions 18-20: aftermarket installation of an ADS

Waymo agrees with the Consultation Paper's intent that unregulated entities should not be able to install an authorised ADS on any vehicle due to the safety risks. However, we have concerns that aftermarket installation of an ADS is being interpreted to mean software updates for ADSs, even those which may not in any way alter the operational design domain for which the system was approved. While amendments to an ADS's driving capabilities or vehicle would likely trigger requests for amendments to an authorisation, these should not be considered aftermarket installations, particularly given the frequency of software updates, such as new driving capabilities and onboard

[29] "*The dynamic driving task includes: • controlling the movement of the vehicle – steering, acceleration and braking • monitoring the environment the vehicle is driving in – noticing the objects and events that are happening around the vehicle, recognising what they are, and planning what to do in response • taking action in response to the objects and events around the vehicle – for example avoiding obstacles, assessing gaps, turning, and overtaking • controlling the vehicle's lights, signals and horn.*"

[30] AVSC standard I-04-2023: https://www.sae.org/standards/content/avsc-i-04-2023/

[31] https://storage.googleapis.com/waymo-uploads/files/documents/first-responders/Waymo%20Emergency%20Response%20Guide%20and%20Law%20Enforcement%20Interaction%20Protocol%20(October%202023)%20-%20240122.pdf

[32] Waymo CPUC Advice Letter (2024): https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/consumer-protection-and-enforcement-division/documents/tlab/av-programs/waymo-llc-cpuc-advice-letter-0002-tier-2--january-2024-passenger-safety-plan-update-january-192024.pdf

maps. We believe this issue is addressed appropriately in the EU's ADS Regulation, which states: "8.2: The ADS shall support software updates. The effectiveness of the software update procedures and processes concerning the ADS shall be demonstrated by compliance with UN Regulation No 156".

Conclusion

Waymo supports the Australian Government's work to develop a national framework for the commercial operation of AVs on public roads and urges it to pass the AVSL and put supporting regulations in place by 2026. We remain at your disposal should you wish to discuss our submission further with us.