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Background Paper for Senate Transportation Committee INFORMATIONAL HEARING

AUTONOMOUS VEHICLES IN CALIFORNIA: AN OVERVIEW

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Introduction

The purpose of this hearing is to provide an overview of the state of autonomous vehicle (AV) technology in the state of California. Panelists will discuss the current technologies, services, and regulations being employed around the state, as well as highlight safety, cybersecurity, and various distinctions within the AV industry. The first panel will be composed of members of the AV industry as well as members of safety groups. The second panel will include first responders including police and fire representatives. The final panel will include representatives from the Department of Motor Vehicles (DMV) and Public Utilities Commission (PUC) who will discuss the current and future state of AV regulation in California.

Overview of AV Regulation

Under California law, AVs are defined as being vehicles that meet the Society of Automotive Engineers (SAE) Level 3, 4, or 5 standards. This includes any vehicle that, at a minimum, can conduct most driving tasks by itself under certain environmental conditions without human intervention. Importantly, Level 3, 4, and 5 vehicles do not include common vehicle safety features such as automatic braking, lane keep assist, or adaptive cruise control. Vehicles with these systems are considered Level 2 vehicles under the SAE standards, and thus do not qualify as AVs. This extends to what are commonly referred to as “Level 2+” or “Level 2 ADAS” vehicles, that package many of these features together to offer AV-like services.

AVs are currently regulated by two government entities. DMV regulates the testing, operation, and deployment of AVs, while PUC regulates commercial robotaxi services. In order for any AV manufacturer to apply for PUC robotaxi permits, they must first have full DMV permits.

DMV Permits: DMV offers two different types of AV permits. The first type is a testing permit, which allows manufacturers to test AVs on California roads for internal research purposes. These permits were created following the passage of SB 1298 (Chapter 750, Statutes of 2012), which allowed DMV to offer their first round of AV regulations. Testing permits can be given for vehicles with or without safety driver. These

are individuals who ride in the car and monitor the AV system. The second type of permits are deployment permits, that allow manufacturers to deploy AVs on California roads more broadly for both private and commercial use. These permits were created in 2018 following the DMV's second major round of AV rulemaking.

Under existing rules, DMV must approve permit applicants for any manufacturer that has demonstrated they have met the proper safety requirements. However, DMV can place additional constraints on permit holders, such as the locations, times, and conditions under which they can use their AVs. DMV also requires the reporting of all crash data. Testing permit holders are further required to report all disengagements, or instances when the AV system had to be disengaged and a human had to step in. As of right now, AV permits are also limited to so called "light-duty vehicles", with a gross weight of under 10,001 pounds.

Currently, DMV is undergoing their third major round of AV rulemaking. This set of proposed regulations is aimed at authorizing new permit types and tackling existing safety concerns. Primarily, these rules will add a new permit type for heavy-duty vehicles, over 10,000 pounds in gross weight, for commercial purposes. The rules are also focused on expanding data reporting, especially for deployment permits, improving law enforcement interactions with AVs, and requiring proper licensure for safety drivers. These rules would also extend to remote operators. These are individuals who monitor AVs remotely and can provide the vehicle with additional guidance when it finds itself in a situation it cannot resolve on its own.

PUC Permits: Like DMV, PUC currently offers two different permit types. The Pilot Program allows for non-commercial service for testing purposes, while the Phase I Program is what permits full, commercial robotaxi service. In general, acquiring the permits to operate under these programs requires the manufacturer to obtain both DMV testing and deployment permits, Charter-Party Carrier authority, and direct permission to operate from PUC under the "Tier 3 Advice Letter" process. As part of acquiring these various authorities, a manufacturer is generally required to demonstrate 30 days of AV operation on California roads, provide a detailed service map and plan, and an in-depth passenger safety plan.

Recently, PUC also began a new round of rulemaking for robotaxi services. This round is focused on resolving a number of issues left unaddressed by the initial programs described above. Specifically, the new rules will address the regulation of partnerships between AV manufacturers and regulated passenger carriers, the use of personal AVs in regulated passenger carrier service, appropriate regulations for Level 2 vehicles, and broader issues of passenger safety, including unaccompanied minors in AVs and shared passenger service.

Federal Legislation: Currently, the SELF Drive Act (HR 7390) is under consideration in Congress. There are three provisions of this bill that would have immediate and wide-reaching effect on AV operations in California. First, this legislation would permit SAE Level 4 and 5 AVs to not have controls for human drivers, such as steering wheels and pedals. Second, the bill would create a national database for AV crash and disengagement reports. Third, and most consequentially, the bill would pre-empt all state and local AV regulations, effectively nullifying the current rules put in place by DMV and PUC.

Current Challenges with AVs

As the use of AVs in California has grown more widespread, various challenges have arisen regarding their deployment. These challenges broadly fall into two categories: those surrounding worker displacement and those surrounding safety.

Worker Displacement: Labor concerns around AVs have been focused on the displacement of current human drivers, of which there are potentially millions in California. Concerns also surround the use of remote operators who may be based outside of California and thus not have the proper licenses and training to conform with California's rules of the road.

Safety: One safety challenge in the AV space has to do with the so-called "Level 2+ Loophole." This loophole refers to Level 2+ vehicles that market themselves as fully autonomous vehicles, without actually meeting the SAE Level 3, 4, or 5 standards. Thus, these vehicles are able to operate as "autonomous" vehicles without facing the full regulatory scrutiny that usually accompanies that distinction.

A separate AV safety challenge is related to the fact that AVs are often highly interconnected to other vehicles and the broader internet, prompting cybersecurity concerns about these vehicles being potentially hackable by bad actors. This is intertwined with a related issue around transparency from AV manufacturers with regards to operating data and computational bug fixes. Namely, are manufacturers disclosing sufficient information to foster trust in their AV software?

Finally, AV concerns have been raised by emergency responders who are often at the frontlines of dealing with AVs when they go awry. Many first responders are concerned about their ability to properly work with AVs in the event of emergencies. For example, emergency responders have reported difficulties directing AV traffic in emergency situations. Concerns have also arisen around their ability to relocate malfunctioning AVs, especially if those AVs are not equipped with manual controls.

AV Operations in California Today

Today a number of AV manufacturers operate in California, performing both testing and commercial robotaxi operations. According to DMV, 30 companies hold drivered testing permits, 6 hold driverless testing permits, and 3 hold deployment permits. Meanwhile, according to PUC, 5 companies hold testing permits for robotaxi services, and 1 holds full commercial service permits.

Exact safety records differ widely across these companies. However, DMV does collect and report data on so-called "disengagement" events, or events when an AV system disengages and a human must take over. According to the most recent report, there were 9,315 reported disengagement events across 9 million miles of driving in 2025 in the state. This means there was a disengagement for roughly every 1,000 miles of driving by AVs. Notably, disengagement events can happen for a wide variety of reasons, ranging from the vehicle stopping because it detected a foreign object in the roadway, to a safety driver taking manual control to

prevent a collision with another vehicle. DMV's data does not distinguish between these different triggering events.

However, a clearer picture of AV operations and AV safety in California can be seen by looking at individual companies. Of the 30 companies that hold some form of AV permit with the DMV, only a handful are currently major commercial players. The robotaxi market in particular is dominated by Waymo, with emerging competition from players such as Nuro, Zoox, and Tesla. Numerous other companies, such as WeRide and Tensor hold DMV and/or PUC permits but have not begun any form of large-scale operations in California.

Waymo: Waymo, a subsidiary of Alphabet, Google's parent company, is the first company to offer widespread, publicly available robotaxi service in California. Waymo has been providing this service in limited areas of San Francisco and Los Angeles since 2024. Recently, Waymo has been given approval by DMV to expand their service areas in these two regions. This expanded service, along with service in San Diego and Sacramento, is expected to launch sometime in 2026.

In addition to restricted service areas, Waymo is also limited in the types of service it can offer. Currently, Waymo can only operate on surface streets at speeds of under 35 miles per hour, and cannot operate in and around airports. However, even with these limitations Waymo has amassed over 127 million miles of driving experience nationally, including over 64 million miles here in California as of September 2025.

According to Waymo, their vehicles are substantially safer than human drivers, being involved in 80% fewer injury-causing crashes, and 90% fewer serious injury or worse crashes. These statistics rest primarily on the fact that the vast proportion of reported Waymo involved incidents have been found to not be the fault of the Waymo AV system. Outside sources though have highlighted that the two recorded fatalities across Waymo's 127 million miles is nearly double the average fatality rate per mile driven for human drivers. However, the numbers involved are still too small to be statistically significant at this time to definitively state whether or not Waymo is safer than a human driver on average.

Furthermore, Waymo has been involved in a number of high profile incidents both in California and across the country. Namely, in December 2025 a power outage in San Francisco caused a large number of Waymo vehicles to freeze, mainly due to issues navigating intersections where traffic signals lost power. Additionally, in October 2025, a Waymo vehicle struck and killed a local bodega cat in the mission district of San Francisco. Waymo has also come under increasing scrutiny over recent months for reports that their vehicles are routinely passing stopped school buses.

Tesla: Although Tesla is not technically an AV manufacturer, they play an outsized role in the space given their large public presence. Tesla's so-called Full Self-Driving (Supervised) Mode is not truly an AV system as it is only SAE Level 2. However, Tesla has still been heavily involved in advertising their vehicles as AVs and trying to enter the robotaxi space, taking advantage of the Level 2+ loophole.

Currently, Tesla only holds a DMV permit for AV testing with a safety driver in California. This means they are not authorized for widespread AV deployment and cannot operate a commercial robotaxi service. Because Tesla does not hold a DMV-issued AV deployment permit, they have faced legal action from DMV for advertising their vehicles as being fully autonomous. Specifically, in 2022, DMV filed a complaint with the Office of Administrative Hearings claiming that in advertising its driver assistance program as “Full Self-Driving” Tesla was misleading consumers. DMV alleged that Tesla was effectively claiming their vehicles were full AVs, capable of driving without human supervision (i.e. SAE Level 3 and above) when their vehicles were only SAE Level 2. In late 2025 a judge ruled in DMV’s favor, leading to DMV giving Tesla a 60-day window to take corrective action or have their licenses revoked that permits them to sell and manufacture vehicles in California. Tesla has since rebranded their service as “Full Self-Driving (Supervised)” and DMV has accepted this corrective action. However, Tesla is currently suing DMV to get the initial ruling overturned.

Nuro: Nuro, although a long player in the AV space, has recently shifted operations away from full vehicle manufacturing to focus solely on AV software design. The Nuro Driver software is an SAE Level 4 AV system, and Nuro currently holds full testing and deployment permits with DMV, as well as Pilot Program permits with PUC. Moving forward, the company’s new focus is on a recently announced partnership with electric vehicle manufacturer Lucid and ridehailing service Uber. Under this arrangement, Lucid Gravity vehicles will be equipped with Nuro Driver software and used in robotaxi service on the Uber platform. The partnership aims to start services in San Francisco this year.

Zoox: Zoox is an Amazon subsidiary that currently holds driverless testing permits and drivered deployment permits with the DMV. While they have started full robotaxi service in Las Vegas, in California they are currently operating a free, wait-listed public beta in San Francisco. Zoox aims to begin full commercial service in limited areas of San Francisco this year.