



## **AUTOMATED VEHICLE STANDING ADVISORY COMMITTEE**

### **Cross-Industry Automated Vehicle Policy Discussion Report: *Infrastructure, Federal Regulatory Framework, and Societal Goals***

The Intelligent Transportation Society of America (ITS America) Automated Vehicle Standing Advisory Committee ('Committee') Chair, Nat Beuse, Vice President of Safety at Aurora, and Vice Chair, Greg Winfree, Director, Texas A&M Transportation Institute, conducted (February 15-March 2, 2021), more than 10 hours of discussions on the deployment of highly automated vehicles (HAVs). The cross-industry discussions focused on significant issues identified by Committee members.

The questions focused on infrastructure improvements, a federal regulatory framework, and societal goals. The member-developed questions are contained in this report. Participants included automotive, city and county and states, technology-AV and technology-infrastructure, insurance, and research. This report summarizes the key findings. The findings apply to a Highly Automated Vehicles (HAV) with a gross vehicle weight of 10,000 pounds or less equipped with a level 4 or 5 system operated exclusively by automation consistent with the SAE International and the National Highway Traffic Safety Administration (NHTSA) levels of automation.

The Committee is developing policies for legislative and regulatory frameworks to facilitate the safe testing, deployment, and integration of HAVs into the surface transportation system. *Cross-Industry Automated Vehicle Policy Discussion Report: Infrastructure, Federal Regulatory Framework, and Societal Goals* does not necessarily represent the policy positions of ITS America or its member organizations. This report is a timely snapshot of ITS America member opinions on key issues shaping federal policy, legislation, and regulation for development and deployment of HAVs.

ITS America's vision is "A better future transformed by intelligent mobility – one that is safer, greener, and smarter." Its mission is to advance the research and deployment of intelligent transportation technologies and solutions to save lives, improve mobility, promote sustainability, and increase efficiency and productivity. Founded as an official advisory board on road technology to the U.S. Department of Transportation, ITS America represents state and city departments of transportation, transit, metropolitan planning organizations, automotive manufacturers, technology companies, engineering firms, automotive suppliers, insurance companies, and research universities.

## KEY FINDINGS

### Infrastructure

- Participants indicate cross-industry consensus that the definition of surface transportation infrastructure goes beyond roads and bridges to include communications infrastructure.
- Participants strongly support increased digital infrastructure investments, including broadband, 5G, and intelligent transportation systems, to support human drivers and HAVs.
- Participants strongly support prioritizing state of good repair for transportation infrastructure to support a mixed fleet of HAVs and human-driven vehicles.
- Participants generally do not believe AV-specific infrastructure programs are needed, as HAVs are being designed to operate under current nationwide infrastructure standards, not just areas with specific AV infrastructure improvements.
- Participants generally preferred infrastructure improvements within the Manual on Uniform Traffic Control Devices (MUTCD) update as a more prescriptive standard for infrastructure investments that benefits HAVs and human-driven vehicles.
- Participants generally agreed that vehicle-to-everything (V2X) technologies could improve safety for both HAVs and human drivers.
- Participants strongly opposed the Federal Communications Commission (FCC) decision to reallocate spectrum from V2X technologies to unlicensed use.
- Participants generally agreed that regulatory uncertainty caused by the FCC is hampering V2X deployment.

### Federal Regulatory Framework

- While participants shared examples of cross-industry consensus on federal framework policy, there was more disagreement than agreement on it .
- Participants generally supported the use of pilots and temporary exemptions as a vital short-term tool to test HAVs.
- The city/county participants expressed support for geographic consideration with exemptions.
- Participants generally supported a national standard for safety. Participants disagreed over the administration of a certification system:
  - Automotive participants strongly favor self-certification by the manufacturer.
  - Most state participants support self-certification in conjunction with third-party testing, which could be federal or through a private institution.
  - City/county participants support a certification system that falls simultaneously on an outside testing organization, the federal government, and the manufacturer.
  - Research participants support a federally administrated self-certification system and a non-state third-party certification.
  - Insurance participants support a federal certification system.

- Tech participants were split on the certification system based on if they were representing AV tech or infrastructure tech deployment.
- Participants<sup>1</sup> disagreed on who should have access to data generated by automated vehicles:
  - Automotive participants favored providing data to NHTSA.
  - City/county participants did not want AVs tested on city/county roads without the sharing of sufficient data to evaluate the vehicles' safety in the city/county's specific driving conditions.
  - AV tech participants generally supported NHTSA as the main conduit of AV data.
  - Infrastructure tech participants generally believed it was not unreasonable for states to ask AV deployers to provide information on miles, vehicles, disengagements, incidents, and near misses.
  - Insurance participants questioned the extent to which third parties should access private consumer data.
  - State participants said they are not equipped to handle massive amounts of unprocessed AV data.

### Societal Goals

- There is consensus among most participants that current trends undermined the need for an electric vehicle mandate for AVs.
- Tech participants were unanimously against the idea of mandating that all AVs be electric, as they suggest that such a path would ignore the different environmental issues associated with the generation of electricity, the chemical processes in creating batteries, and the disposal of batteries.
- City/county participants said all AVs should be clean vehicles and electrification was a good start.
- Participants indicate broad consensus that significant investment is needed in electric charging infrastructure to support an electric AV fleet.
- There was no clear consensus among participants on policies to ensure equitable access to automated vehicles, particularly for low-income communities and communities of color.

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<sup>1</sup> Participants did not come to a uniform conclusion on what sort of data was specifically required.

## CROSS-INDUSTRY QUESTIONS

### INFRASTRUCTURE

**Question: What are the minimum infrastructure standards and improvements needed by the AV community that will aid in deploying AV technology, including delivery services?**

AV technology is being designed to operate on existing roads, so infrastructure investment should prioritize projects that benefit both AVs and human drivers. Top of the list for those priorities are digital infrastructure to enable general ITS services and road maintenance. The MUTCD update was frequently cited as a vehicle to promote some of this investment, but the state participants indicated they would like it to be more prescriptive to standardize infrastructure requirements across 50 states, an idea which fits within the insurance participant's request for more infrastructure consistency.

#### *State Participants*

States said no new AV-specific infrastructure is needed, as AV technology should be designed to work with current infrastructure. States are hesitant to invest in accommodating new technology that isn't yet ubiquitous. Instead, they prefer investment focuses on infrastructure improvements that would benefit both AV and non-AV vehicles, including telecommunications/communications infrastructure, broadband, 4G/5G cells, EV charging, and paint. They would like the MUTCD to be more of a prescriptive standard to standardize infrastructure that benefits both AV and non-AV vehicles as part of a more general request for stronger requirements on infrastructure investment.

#### *Research Participants*

The research participants similarly indicated the present focus should be on infrastructure improvements that benefit both AVs and human travelers, particularly in communications/cyber-physical infrastructure that can facilitate wide-ranging ITS applications. As AVs become more widely deployed, they believe infrastructure improvements relevant to AVs will naturally evolve alongside this deployment, particularly if the digital infrastructure is already built out for other ITS purposes.

#### *Automotive Participants*

The automotive participants emphasized that AVs were being designed to operate under the current infrastructure standards, as these vehicles are being designed to operate nationwide, not just in particular cities with specific AV infrastructure improvements. Generally, the group was interested in infrastructure improvements within the MUTCD update, such as increased line markings or V2X technologies. They recognized there wasn't a specific timeline for states to invest in these improvements under the MUTCD and pointed out that regular physical maintenance priorities would vary among states.

### *Tech Participants*

The tech participants strongly affirmed that AVs are being designed for operation on today's roads and need the same things all road users need – no potholes, clear markings, and adequate signage. They argued that AVs are also being equipped with technology that allows them to operate in rural areas that have no expectation of additional imminent AV-specific infrastructure. In addition to that, especially when we're thinking about greater automation to the existing vehicles that we're driving, it's going to be a mixed fleet for a long time. The standards will have to match automated vehicles as well as human driven vehicles. They identified flexibility for states and localities to invest in communications infrastructure as an important area of consideration.

### *Insurance Participants*

The insurance participants identified infrastructure consistency as their biggest challenge – as a national industry, variance of infrastructure capabilities among states makes it increasingly challenging to determine risk for a vehicle that would operate in more than one area. They viewed infrastructure in broad terms, including general communications technology, but also noted insufficient striping as a potential area of concern. They questioned if states and localities would be able to keep investing in infrastructure for constantly evolving technologies, given their current significant maintenance burdens. They also named EV charging infrastructure as an area of consideration, particularly given recent grid challenges in Texas. Finally, they discussed liability around these issues and how infrastructure failure could be a decisive factor in determining liability after a crash.

### **Question: How and who should pay for infrastructure improvements for AVs?**

This question was primarily discussed by states and automotive participants. Automakers identified the Surface Transportation Reauthorization and the Advanced Transportation and Congestion Management Technologies Deployment Program as potential sources of funding for infrastructure improvements but recognized that state DOTs would bear the ongoing maintenance costs of those improvements. States were clear they would need additional federal funding for any widespread deployments of new infrastructure projects to prepare for full AV deployment, given the current costs of meeting state performance standards. Additionally, eligibility to spend funds from current federal programs was insufficient, as those funds are already being used for basic performance expenses.

### *State Participants*

States articulated significant concerns regarding where money for AV infrastructure improvements would come from, particularly given the current costs of meeting FHWA and other performance standards. Any funds spent on infrastructure specifically for AV readiness would be likely to come from a pool of money already dedicated to basic performance issues such as pavement or bridges, and DOTs would have to justify the new expenses. In terms of federal assistance, states declared that eligibility and flexibility is not enough – there needs to be specific funding for advanced infrastructure projects for DOTs if states are expected to oversee these projects. There were some concerns with this approach, however – some states were hesitant to support a program in which they would be competing for this

sort of grant funding. They were also concerned that maintenance costs of new infrastructure projects would eventually eclipse the initial cost of the projects.

#### *Automotive Participants*

Automotive participants identified the Surface Transportation Reauthorization as a way to encourage investment in infrastructure that benefits both human drivers and AVs, and that the current MUTCD update would offer an appropriate preliminary guidelines on items that should be considered for funding under those programs. They recognized that these improvements were typically beholden to a lengthy maintenance schedule and would require continued investment even after deployment was complete.

#### **Question: Should AV developers start to talk about the added benefits of V2I to improve traffic flow (at intersections) and safety (at work zones or rail crossings)?**

The two main takeaways of this conversation across participants were a hesitance to rely on V2X technologies from a planning perspective because of the tremendous regulatory uncertainty surrounding the FCC's actions on this topic and a simultaneous agreement that a fully deployed V2X network would be an incredibly effective tool for improving safety and road efficiency. None of the participants supported the FCC's decision to reallocate spectrum away from these technologies but many are waiting to invest in V2X technology or plan for their vehicles to operate without the technology for fear that the requisite spectrum will be taken away.

#### *State Participants*

States were split on this question. Some were going to refrain from investing in these technologies until NHTSA mandated connectivity or they identified funding outside their current funding pools to support deployment. Others intended to continue investing in connectivity as a redundancy to improve human driver and AV safety alike.

#### *Research Participants*

The research participants' conversation on this topic centered around the regulatory uncertainty caused by the FCC's 5.9 GHz spectrum reallocation proposal, which has impacted both state deployment of the technology and academic research involving the topic.

#### *Automotive Participants*

The automotive participants underscored that their vehicles are being built to function with or without V2X but that the technology can be a great tool to improve road safety for both AVs and regular vehicles. They also expressed concern with the FCC's proposed spectrum reallocation.

#### *Tech Participants*

The tech participants were the most enthusiastic about V2X technologies, arguing that they improve safety and road efficiency for AVs and human drivers alike. The clear takeaway from the conversation was that V2X technologies would be a great safety tool for AVs, but the lack of certainty around the

future of the technology is hampering deployment. While some participants highlighted they were designing vehicles to work without V2X due to the FCC's regulatory uncertainty, they maintained they would look at ways to deploy the technology if the V2X spectrum was preserved. At that point, however, it becomes another piece of the infrastructure network deployers would have to pay to maintain.

## **FEDERAL REGULATORY FRAMEWORK**

**Question: Should NHTSA use its authorities versus waiting for Congress to speed up approvals of exemptions and interpretation? Should NHTSA consider pilots to provide a larger number of exemptions?**

No one sees pilots and exemptions as an appropriate long-term tool to deploy AVs, but no one suggests a better way to safely test AVs and deploy them on a small scale before the government establishes formal AV regulations – this was a unanimous opinion among research, automotive, and tech participants. The automotive and tech participants emphasized that the exemption process is their best current tool to test purpose-built AVs. The states were split – some wanted NHTSA to use more of its authority to permit additional exemptions, but others were happy with the speed of the process because the pace ensured that deployments were safe. States were also split on the effectiveness of the AV TEST platform. The research participants raised concerns about how federal exemptions coexist with state and local AV rules, concerns that city and county participants echoed. City/county participants additionally suggested geographic considerations for exemptions to ensure individual cities would not disproportionately receive AV exemptions.

### *State Participants*

The state participants had varying perspectives on this question. Some were eager to see NHTSA staff use more of their power than they do now, particularly in terms of leveraging the NHTSA AV TEST platform. Some states said NHTSA has the authority to move AV readiness forward, but the agency seems to start at the beginning, leaving states without clear guidance. Other states were less convinced that AV TEST was the right platform and said other agencies like FHWA and FTA need additional NHTSA guidance to contribute more fully towards AV deployment. In terms of exemptions, states were again split – some wanted more exemptions to more fully deploy AV technology while others were hesitant to encourage NHTSA to speed up the process because they saw it as vital to ensuring deployments were safe and road-ready.

### *Research Participants*

The research participants view exemptions as a vital short-term tool to try out and test technologies. They are, however, keen on fundamentally standardizing these methods into a larger programmatic vision framework to ensure a patchwork of exemptions doesn't remain the status quo, which they don't see as a helpful regulatory environment. They don't see a better alternative to exemptions in the short-term, as it takes longer to establish standardized AV regulations. They also raised concerns with how states and cities would interpret these exemptions in conjunction with their own rules but noted that

localities more friendly to AV testing would likely be more competitive to AV technology companies – a process that has played out intentionally in states like Arizona.

#### *Automotive Participants*

Automakers see exemptions as an essential tool for deployment in the current regulatory environment, particularly given it is the only option they see now to deploy alternate-design vehicles. They stressed that exemptions are not “get out of jail free cards” but rather mechanisms to share relevant data with agencies tasked with evaluating AV safety. They are happy to comply with state rules in addition to those imposed by the exemptions, but without exemptions, these vehicles will not be tested on roads, particularly purpose-built vehicles aimed at improving accessibility outside of current FMVSS rules.

#### *Tech Participants*

The tech participants argued that pilots and exemptions have afforded AV stakeholders great opportunities to learn and grow the technology but they must also have an end game in mind that includes an implementation strategy because they don’t think pilots are a long-term solution. Rather, they are a steppingstone to deployment, allowing demonstration of the proof of concept of a technology with additional safety constraints when an agency is uncomfortable with full deployment. The participants were most interested in seeing formal regulations established as soon as possible while also providing deployers enough time and warning to react to what is expected in the new rules. In the meantime, some members requested that exemptions authorities be expanded beyond a 2,500 vehicle limit and echoed the importance of these exemptions in allowing alternate designs to be tested, but noted that the short-term authority granted by exemptions adds difficulty to the deployment process, so long-term rulemaking will be required to fully deploy alternative designs.

#### *City/County Participants*

The city/county participants emphasized that exemptions and pilots authorized at the federal level must be sensitive to different local regulatory environments where these vehicles will be deployed. In terms of potentially expanding the number of exemptions, they spoke to the importance of a geographic consideration – in essence, ensuring that one city isn’t disproportionately the testing ground for companies that have been granted exemptions. They suggested a more equal distribution of these exemptions would make cities more comfortable with the federal approach.

**Question(s): Should a national license for AVs upon proving compliance with a national safety standard, confirmed through transparent third-party testing, be considered? Should there be a specific license to operate AVs, separate than that used for human-driven vehicles?**

None of the participants thought state DOTs were equipped to issue AV-specific licenses, preferring federal oversight of safety standards and licensing. The city/county participants were suspicious of self-certification methods, but some states wanted self-certification to remain a component of the certification process to help shield states from liability for an AV company’s software. The city/county, research, and state participants were generally supportive of third-party certification, particularly cities, which wanted a third-party certification to accompany federal oversight and manufacturer liability.



Automotive participants oppose third-party certification - they see it as a move in the direction of type approval, which they argue is incongruous with self-certification. All participants agreed that a standardized AV software license would be preferable to a patchwork of regulations to promote regulatory consistency and to ensure that a vehicle certified as safe in one state would be equally safe in another. However, even with a national license, cities want to retain enforcement authority to ensure that the operation of the AV fits within the locality's rules of the road.

#### *State Participants*

States unanimously agreed they are not equipped to certify the safety of individual company AV software and some suggested that such a certification should be a federal responsibility. Different states spoke in favor of both self-certification and third-party testing, understanding that the third-party should not be a state DOT and could be federal or a private institution. Some states argued that self-certification was harder to verify, particularly if the AV company submits marketing materials. Others indicated that self-certification needed to be part of the process for tort concerns. A third-party certification would help ensure that a vehicle that works in one state would be safe in another. In contrast to their hesitancy to certify the safety of AV software performance, states still want control licensing of a human driver's behavior within an AV – namely, any time a human takes over control of an operational component of an AV, they want that human to be licensed by state processes. For fully autonomous vehicles, they are more comfortable with federal standards being set but would like to see those standards before they commit their support.

#### *Research Participants*

The research participants agreed that while states currently issue driver's licenses for human drivers for what is essentially benchmarking behavioral qualifications, states do not have the capacity to administer behavior performance verification for AV software, nor did they believe it was a good idea to have 50 different behavioral competency guidelines for these vehicles. Instead, they spoke to the benefits of a federally administered self-certification system and non-state third-party certification, which would examine the operations of an AV without publicizing proprietary information. They also noted that humans operating vehicles with automated components like adaptive cruise control or automated braking are still licensed within the state system, even though functions of the vehicle are taken over by the machine. The human is still responsible for the operation of those functions.

#### *Automotive Participants*

The automotive participants were unanimously opposed to mandating third-party certification. They argued that the auto industry is regulated under the framework of self-certification by the manufacturer and that it would be a huge change to bring in type certification. They did not believe it was congruent for third-party certification and self-certification to co-exist. They questioned how to ensure that third party testing is consistent, as well as who would certify the third-party certifiers. They also expressed concerns about the federal government subsidizing the commercial or financial interests of third-party testing institutions by mandating that automakers turn over data for free. Finally, they noted that the committees of jurisdiction in the House of Representatives and Senate have indicated they have no intention of moving away from a self-certification regulatory model.

### *City/County Participants*

The city/county participants argued there should be a national standard for safety that is shared among automakers, accompanied by transparent testing. They preferred any standardized testing to self-certification and agree that testing responsibility should fall simultaneously on an outside testing organizations, the federal government, and the manufacturer. They did not see 50 different standards as being an effective regulatory strategy. However, even with a national license, cities want to retain an enforcement authority to ensure that the operation of the AV fits within the rules of the road established by the locality. If NHTSA were to issue a national AV license, that license should include at a minimum the rules of the road requirements that cities and states have in place today.

### *Insurance Participants*

The worst-case scenario for the insurance participants was 50 states regulating AVs in 50 different ways, with 50 different ways of sharing data. They seek federal direction on certification to introduce additional consistency to testing expectations and road worthiness.

### **Question: Should certain AV data be shared in a readable format with the local jurisdiction?**

Participants are split on this issue. Automotive and some tech participants strongly preferred to exclusively share data with NHTSA and spoke in favor of increasing the flow of data to NHTSA. These participants typically seek to avoid giving AV data to states and localities unless the local jurisdictions were clear on what it was being used for. Other tech participants argued that limited requests for data from states or localities were not unreasonable requests. In terms of the jurisdictions themselves, states primarily argued that they were unequipped to handle unprocessed AV data, but they were interested in obtaining processed data from third-party sources. The city/county participants were firm that companies looking to deploy AVs on their roads should be required to provide data the cities request to ensure that the vehicles are being safely operated and are complying with local regulations. The insurance participants were focused on the liability aspects of data – they wanted AV data to be consistently shared with insurers and first responders when a crash occurs.

### *State Participants*

States ideally want processed data that help them better plan traffic management, maintenance, and crash analysis but mostly agree that state DOTs are not equipped to handle massive amounts of AV data. They spoke to how their IT departments struggle with traditional ITS, suggesting that unprocessed data from vehicles that produce four terabytes of data a day would pose an even greater challenge, particularly given that many states are already sitting on large amounts of data they can't process. There was greater interest in states acquiring data from third-party sources so they can understand what the data is telling them and act on items critical to safety evaluation and crash mitigation. Some states also brought up privacy concerns, particularly when individual trip paths are part of the data acquired. Additionally, some states said they did not want to implement data-intensive regulations, as they were concerned that would unnecessarily hinder the operation and deployment of AVs.

### *Automotive Participants*

Automakers were unanimously in favor of providing data to NHTSA and viewed the federal government as the best entity to determine vehicle safety through data. They described the AV TEST Initiative as a promising tool to improve transparency and provide data with regulators while giving industry the opportunity to demonstrate the safety of their AVs to a general public that may still be unsure about automation. They were in favor of strengthening the AV TEST Initiative's requirements, with some automakers suggesting that it become a mandatory procedure. Others noted that the industry initially resisted NHTSA's push for voluntary safety self-assessments, but the industry now widely embraces it. They also pointed to the pilot and exemption process as another area where data is required by NHTSA – automakers can decide if the exemption is worth providing NHTSA the required data, and NHTSA can decide if the automakers have provided enough data to warrant an exemption. They predicted a similar dynamic would take place if states and localities were not prevented from requiring data for operation on their roads – namely, automakers would decide whether or not deploying in a state or city was worth the additional request of data. While they are very comfortable sharing data with NHTSA, they are uncomfortable sharing data with states and localities without clear indication as to what the data would be used for.

### *Tech Participants*

The tech participants' conversation on this topic took two paths. One participant spoke to the benefits of NHTSA being the main conduit of AV data and was worried about privacy considerations associated with sharing data with states and localities, particularly when vehicles were transporting sensitive materials like prescriptions. That participant suggested that the data exchange associated with exemptions was a fruitful method of providing the data needed to demonstrate vehicle safety. Another participant argued that a state asking AV deployers to provide how many miles, vehicles, disengagements, incidents, and near misses was not an unreasonable request. They were also interested in more collaboration within the industry of non-proprietary technology and data to avoid AV lessons becoming siloed, particularly in terms of safety advances.

### *City/County Participants*

The city/county participants did not want AVs tested on city/county roads without the sharing of sufficient data to evaluate the vehicles' safety in the city/county's specific driving conditions. They advocated for a data ecosystem where government, industry and individuals share and receive data, particularly so that cities can be comfortable that any rules or city laws are being obeyed and that the AVs are responding appropriately to varying safety scenarios. They want sufficient data to make as robust of evaluation of a vehicle's safety as possible. They specified that they were not looking for personal information or anything identifiable in this data. One participant indicated that his/her city officially doesn't want AVs tested on their streets, so companies will need to fully comply with the city's data requests if they are looking to get its approval to deploy.

### *Insurance Participants*

The insurance participants are looking for more consistency in things like data and data acquisition, data ownership, data sharing, and privacy standards surrounding testing and consumers. When crashes

happen, they need to access many data components within an AV to determine appropriate liability and believe that type of data should be shared with insurers, first responders, and law enforcement. Even so, they questioned the extent to which private consumer data should be accessed by third parties.

## **SOCIETAL GOALS**

**Question: What policies should be considered to ensure AVs cut greenhouse gas emissions and help move the nation’s transportation system toward a zero-carbon future? Should there be a mandate to make all AVs electric?**

The main consensus among participants is that significant work is needed on electric charging infrastructure to support making the AV fleet electric. There also is broad consensus among most participants that vehicles are moving towards electrification in the United States as market factors will continue to improve for that technology. The conversation among research participants on this topic was typically along those lines: while the state participants had participants who thought the current trend undermined the need for an EV mandate and participants who spoke to their state’s efforts to ensure that transition takes place. The city/county participants were the most enthusiastic about an AV electrification mandate, while the insurance participants generally supported AVs leading the way on climate initiatives (with a few reservations). The city/county participants suggested that the shift to electrification was something they would support but the environmental benefits of that shift would not be as stark as some would suggest. The tech participants were most adamant about their concerns with an electric AV mandate, listing a number of issues that they saw as impediments to a fully electric fleet. The automotive participants had different perspectives within the group, with some automakers comfortable with a mandate because they are already positioned to comply with it and others expressing concern that states and localities would implement these mandates without any incentives or rebates to help deployers meet the mandate’s goals.

### *Research Participants*

The research participants believe the transition to a more electric vehicle fleet will take place with or without AV mandates, given the economic implications of EVs and the battery technology trajectory. They suggest that policies are adopted that would encourage this trajectory, mostly by incentivizing it. They stressed the importance of considering the readiness of charging infrastructure for this transition, particularly concerning the upcoming need for an intra-state network of charging stations for both light and heavy vehicles.

### *States Participants*

Some state participants questioned if an EV mandate for AVs was needed, given the trajectory of electrification, for similar reasons to those articulated by the research participants. Some participants highlighted the work California has been doing to make all vehicles EVs by 2035 and noted that AV electrification is both a component of their AV plan and part of their efforts to dramatically reduce GHG emission.

### *Automotive Participants*

The automotive participants had mixed perspectives on this issue. Some automakers have already planned on their level 4 AVs being fully electric. Others suggested that EVs were the path forward but mandating that AVs become electric could significantly increase the price of vehicles and questioned if the charging infrastructure was prepared for an all-electric fleet. Another automaker suggested that its main concern was with states mandating all electric by a certain year without offering incentives or rebates and without properly investing in a charging infrastructure network to keep up with the demand generated by such mandates. The two automakers that articulated the more skeptical reading of the EV mandate supported EVs and AVs be considered separately.

### *Tech Participants*

The tech participants were unanimously against the idea of mandating that all AVs be electric. They suggested that such a path would ignore the different environmental issues associated with the generation of electricity, the chemical processes in creating batteries, and the disposal of batteries. They argued that if the current California fleet of passenger vehicles was all electric, the electric production in California would increase about 20% from current levels. They also contended there aren't enough minerals for battery production to scale to the size needed for a fully electric passenger fleet. From an equity standpoint, the tech participants were concerned that low-income communities that could really benefit from AV community vehicles would likely not have the funding to invest in the charging infrastructure required to power an AV mandated to be electric, particularly if they had outstanding costs like bridge maintenance. They suggested the transition to electrification should be gradual rather than an overarching mandate.

### *City/County Participants*

The city/county participants indicated they want all AVs to be clean vehicles and that electrification was a good start. They raised concerns that the deployment of an electric AV might increase traffic congestion and slow down other vehicles not equipped with EV technology and were interested in looking at the ecosystem rather than through a vehicle-by-vehicle lens. They thought an electric fleet might improve the air quality for people living in cities, but electrification doesn't necessarily save carbon pollution while the power generation process is so environmentally taxing. They also raised concerns that electric charging infrastructure might need more work before such a shift could be feasible.

### *Insurance Participants*

The insurance participants thought it could make sense to have AVs lead the way in promoting a greener transportation fleet as long as that would not undermine AV safety or overly slow their advancement. They said consumer buying trends and the continual introduction of more electric models by automakers suggest that electrification will take place naturally. They did express concerns about the readiness of the electrical grid to handle an upswing in EV numbers, particularly given the recent power outage in Texas.

**Question: What policies are needed to ensure equitable access to AVs, particularly for low-income communities and communities of color?**

Many participants spoke to the importance of ensuring that AVs are deployed in a way that benefits low-income communities, both through purposefully identifying equity as the main driver behind deployments and through supporting a shared-ownership model that doesn't relegate AV technology as a tool for only the wealthy. The research, automotive, and tech participants all highlighted accessibility as a top priority while city/county participants were split on whether or not AVs would be a helpful new tool in that effort. The states shared some of their experience with community engagement around AV deployment and argued that robust community engagement should be a requirement for AV deployers. They were skeptical that the AV industry would appropriately prioritize equity issues without intervention by either the federal or state governments. The tech participants touched on land use considerations and food desert mitigation as areas of equity that AVs could address, while the city/county participants stressed the importance of protecting passengers and vulnerable road users when deploying AVs.

*States Participants*

The state participants defined equity as the goal of distributing resources differently to either empower and uplift different communities or reduce barriers. They identified a series of strategies to help accomplish those objectives, including improved community engagement, selective deployment authorizations in favor of projects primarily targeted at equity, and greater federal involvement to ensure equity is prioritized nationally in the deployment of AVs. The states noted that community engagement and outreach was a requirement for federally funded projects, which they supported. They acknowledged that effective engagement can be expensive but noted that many of the states would not approve deployments unless companies were willing to spend serious time on community outreach. They argued that projects were rarely conceived by industry with the specific goal of equity in mind but rather AV deployers would treat equity considerations as a box to check. To solve that, states suggested a series of robust equity goals be a component of the scoping and funding process for any new AV deployment. The states did not trust industry to prioritize low-income or underserved communities on their own, suggesting that supply and demand will never come together to reach an equity goal. They contend that this serves as a rationale for the federal government to lay out equity goals, even if how to achieve those goals are left to the states. They argued that from a federal perspective, it would be preferable for all states to have similar levels of AV deployment. They added they were concerned that states that paid less consideration to equity issues would be disproportionately rewarded by industry, getting too big of a piece of the AV market pie.

*Research Participants*

The research participants' conversation about equity focused on whether AVs will primarily be deployed in a shared or individual ownership model. They thought this question would determine if AVs primarily served wealthy customers as opposed to people who don't have another mode of transportation. They posed the question of how to incentivize equity in AVs, as they saw regulation on that subject to be

unrealistic upon full AV deployment. They saw incentives built into the AV business model as one solution for this issue.

#### *Automotive Participants*

The automotive participants spoke to the accessibility of their purpose-built vehicles, noting they needed continued support from the federal government in the form of exemptions to get vehicles deployed to communities that could benefit from their use.

#### *Tech Participants*

The tech participants took this discussion in three directions. First, they discussed ownership models and how AVs could be deployed to move people who currently have difficulty accessing alternative methods of transportation. They argued that an individual ownership model would drive a wedge between those who can afford the technology and those who especially need it. Part of this question for the tech participants involved considering how AVs would influence land use planning, allowing people to live far away from their jobs and sleep or relax on their way to work. Finally, the participants discussed how delivery AVs could potentially address 70% food desert concerns and identified that as a way AVs could promote equity outside of the discussion of ownership.

#### *City/County Participants*

The biggest concern for the city/county participants was about safety and how AVs are going to be deployed on city streets – not just in protecting the passengers of those vehicles but also ensuring there are adequate safety protections for pedestrians, bicyclists, and all others who use the roads. The cities were somewhat split on the accessibility issue – one participant suggested that AVs presented a once in a lifetime opportunity to make sure this new type of vehicle is accessible to everyone, particularly given the different loading possibilities relative to current vehicles. Another participant challenged whether AVs would serve any specific advantages over traditional paratransit, commenting that attendants would still be required to help disabled passengers in and out of a vehicle and that professional human paratransit drivers are experts at handling accessibility. The participant pointed to a recent Uber pilot that they saw as tremendously successful in proving the concept of on-demand paratransit.

#### *Insurance Participants*

The insurance participants were interested in seeing the direction AV technology focused on whether AVs ultimately serve in more of a delivery role or as an additional component of transit. They believed the transit side had some strong potential to address equity concerns, both in terms of environmental and accessibility challenges. They also focused on ensuring this technology was deployed in underserved communities, rather than simply becoming another tool for the wealthy. They argued that purpose-driven deployment of AVs in low-income communities should be the focus of AV planning.



## **ADDITIONAL QUESTIONS**

### **Question: What concerns do you have about the scope of issues covered in the next AV bill?**

The automotive participants stressed that defining the future of AVs will be a long-term process and that the perfect should not be the enemy of the good in terms of an AV bill in Congress. They had concerns that the AV legislative process turned a bill that started out as a regulatory framework bill into a workforce, infrastructure, and social reform bill. They stressed that each of these issues can and should be addressed but that no progress will be made if they are all addressed at one sitting, and that a desire to litigate these important conversations at one time shouldn't come at the expense of moving forward on a very necessary legal regulatory and safety framework, both in terms of NHTSA and Congress. Until they are presented with a concrete regulatory and safety framework, it becomes increasingly difficult for automakers to devote capital to move AV technology forward, as the regulatory certainty is not sufficient to make such an investment.

### **Question: Who is the AV “driver” of record for enforcement and legal liability purposes?**

The city/county participants argued that tort requires a standard and acceptance of responsibility or an acceptance to risk, and if AVs are governed by self-certification rather than published standardized testing, then the people buying or walking near the car cannot have an informed acceptance of risk, which then leaves that automaker subject to infinite financial risk.

### **Question: What steps can be taken to help accelerate AV research in the United States?**

The research participants see Surface Transportation Reauthorization as a fantastic opportunity to increase long-term research funding to USDOT, especially given the fundamental changes happening in transportation today and particularly on environmental priorities. They argue that the nominal funding for research hasn't changed since 1991. They believe that additional funding for research on topics like mixed traffic fleets will help inform AV frameworks as they are created at the federal and state levels. They are supportive of pilots as a means to help identify some of the data they need for their research but wanted to clarify that pilot funds should not be taken away from traditional research funds.



## INITIAL CROSS-INDUSTRY QUESTIONS

### Infrastructure Related Questions

1. What are the minimum infrastructure standards and improvements needed by the AV community that will aid in deploying AV technology, including delivery services?
2. How and who should pay for infrastructure improvements for AVs?
3. Should AV developers start to talk about the added benefits of V2I to improve traffic flow (at intersections) and safety (at work zones or rail crossings)?

### Federal Framework Related Questions

4. Should NHTSA use its authorities versus waiting for Congress to speed up approvals of exemptions and interpretation?
5. Should NHTSA consider pilots to provide a larger number of exemptions?
6. Should a national license for AVs upon proving compliance with a national safety standard, confirmed through transparent third-party testing, be considered?
7. Should certain AV data be shared in a readable format with the local jurisdiction?
8. Who is the AV “driver” of record for enforcement and legal liability purposes?
9. The USDOT has focused on flexibility in AV guidelines using the word “Should” in lieu of “Shall.” When do you think it will be time for a set of guidelines that will set the framework for the US?

### Societal Questions

10. What policies should be considered to ensure AVs cut greenhouse gas emissions and help move the nation’s transportation system toward a zero-carbon future?
11. What policies are needed to ensure equitable access to AVs, particularly for low-income communities and communities of color?
12. How safe does an AV need to be to be deployed in volume? If an AV is safer than a good human driver, how should it be deployed to secure benefits like improved mobility for the disadvantaged, disabled, and elderly?



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