SCAN TEAM REPORT

NCHRP Project 20-68, Scan 23-02

Recent Experiences in Advancing and Deploying of Automated Vehicle Technologies

Supported by the

National Cooperative Highway Research Program

Acknowledgments

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The purpose of each scan, and of Project 20-68A, is to accelerate beneficial innovation by facilitating information sharing and technology exchange among the states and other transportation agencies and identifying actionable items of common interest. Experience has shown that personal contact with new ideas and their application is a particularly valuable means for such sharing and exchange. A scan entails peer-to-peer discussions between practitioners who have implemented new practices and others who are able to disseminate knowledge of these new practices and their possible benefits to a broad audience of other users. Each scan addresses a single technical topic selected by AASHTO and the NCHRP 20-68A Project Panel. Further information on the NCHRP 20-68A US Domestic Scan program is available at: https://www.trb.org/NCHRP/USDomesticScanProgram.aspx

This report was prepared by the scan team for Scan 23-02, *Recent Experiences in Advancing and Deploying of Automated Vehicle Technologies*, whose members are listed below. Scan planning and logistics were managed by Arora and Associates, P.C.; Harry Capers is the Principal Investigator.

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NINER TRANSIT
BUS STOP 17
SCIENCE BUILDING
This BUS STOP is serviced by the following Routes:
GOLD
SILVER
NINER PARATRANSIT
AUTONOMOUS VEHICLE
STOP
cassi
NINER TRANSIT
beep
nauya
AUTONOMUS

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Scan 23-02

Recent Experiences in Advancing and Deploying of Automated Vehicle Technologies

REQUESTED BY THE

American Association of State Highway and Transportation Officials

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Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ADS	Automated Driving Systems
AV	Automated Vehicles
CASSI	Connected Autonomous Shuttle Supporting Innovation
CoP	Community of Practice
CV	Connected Vehicles
CAV	Connected and Automated Vehicles
DOT	Department of Transportation
FMCSA	Federal Motor Carrier Safety Administration
IOOs	Infrastructure Owner Operators
LIDAR	Light Image Detection And Ranging
OEM	Original Equipment Manufacturer
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
PDD	Personal Delivery Devices
RSU	Roadside Unit
SAE	Society of Automotive Engineers International
TEST	Transparency and Engagement for Safe Testing
TSMO	Transportation Systems Management and Operations
US	United States
USDOT	United States Department of Transportation
V2X	Vehicle-to-Everything

Executive Summary

This National Cooperative Highway Research Program's Domestic Scan 23-02 initiative undertook a detailed exploration of Automated Driving Systems (ADS) and Automated Vehicle (AV) technologies across thirteen US states. This final report consolidates the findings from stakeholders who offered their in-depth perspective on policy frameworks, organizational strategies, pilot projects, and recommendations for next steps. The Domestic Scan sought to better understand how various states have navigated the challenges and opportunities presented by ADS and AV technologies. Findings indicate that state governments are primarily advancing AV technology through policies, organizational champions, pilot projects, and developing or turning to nationally available information to support innovation while addressing public safety and infrastructure challenges. Although each state has a unique approach, many share similar goals, such as enhancing transportation safety, encouraging economic growth, and fostering public-private partnerships.

Policies span from open regulations to state oversight, with a unanimous consensus for federal decisions pertaining to definitions of "driver" and acceptable levels of safety, to name a few, though some participating states noted federal oversight may not always be necessary; simply the act of defining clearly what is federal versus state oversight was the main point of concern. The act of deciding one approach versus another would simply allow states to move forward rather than continue in a state of uncertainty. States like Texas have embraced minimal regulatory environments, fostering innovation by allowing self-certification for safety. Conversely, California's regulatory landscape includes deployments from mandatory safety drivers to driverless testing and deployment permits. This dichotomy highlights the diverse strategies that states employ to balance technological advancement with public safety and economic considerations. In Utah, a permissive regulatory framework allows for deployments of automated vehicles without permits while still fostering safety. Conversely, Pennsylvania's policies emphasize controlled testing environments and detailed safety protocols, reflecting a more cautious approach to public deployment.

Local jurisdictions also play a pivotal role. The City of Seattle's permit system exemplifies localized oversight, allowing municipalities to address community-specific concerns, such as conflicts with first responders and other road users. Many participants advocated for federal guidance and decisions to harmonize state-level policies and reduce regulatory fragmentation, though a point of concern of "preemption" of state responsibilities was raised, without clear resolution.

One finding across all states was that there was no single policy or rule of law that scaled or attracted ADS and AV deployments. States like Utah and Georgia are fully open to AV but see little deployment, while a state like California with state oversight sees significant AV activity. States with high stakeholder engagement like Maryland see a lot of discussions and positive networking but little to no AV deployments. Florida holds an annual meeting with the AV industry but does not necessarily host continuous AV forums for vendors, yet the AV industry is more active in the Sunshine state. These differences highlight the need for more than just changes in law to scale ADS and AV deployments.

Organizational Strategies vary from state to state, with a common thread of "champions" as means for program success. Centralized models, as seen in Ohio, Pennsylvania, and several of the participating states, streamline decision-making and ensure alignment with state objectives. In contrast, grassroots models, such as those in Washington State, empower local jurisdictions to tailor initiatives to specific community needs. The City of Seattle's involvement in AV deployment demonstrates how localized control can address unique community needs. Washington State's approach emphasizes collaboration between state and local agencies, ensuring that local perspectives are integrated into state-level strategies. These approaches underscore the importance of adaptable frameworks that accommodate both state-level oversight and local-level needs.

Staffing and funding are critical components of organizational success. States like Minnesota established dedicated AV units staffed with experts in emerging technologies, data management, and transportation engineering. These teams enable effective program implementation and foster innovation. Florida's integrated Transportation Systems Management and Operations (TSMO) approach, like several other states, leverages existing programs to support AV integration, demonstrating the value of resource optimization. Throughout the states who participated in this scan, the ability to staff and fund projects resulted in higher traction and success of AV pilots led by the state or local Department of Transportation (DOT).

Resulting Projects highlighted difficulties with automated shuttle pilots across multiple states, like Utah, Colorado, Minnesota, North Carolina, and others. While the testing of automated shuttles aimed to serve a need, outcomes frequently did not show the ability to scale, and the added connected vehicle capabilities meant to assist the AV either often failed or resulted in significant delays. Though some pilots, like in Utah, North Carolina, and Minnesota, included the collection of in-depth public perception information, which helped the states to gauge public trust in AV. While these limited pilots show potential for safety and economic benefits, states with experiences in automated shuttle deployments are becoming less inclined to pursue more of these pilots without improvement in the AV and connected vehicle technology. Another common thread from those in attendance was that their responsibilities within the state DOT are primarily for infrastructure and facility operations, not vehicle design; therefore, projects often relate to the infrastructure itself. The discussion around infrastructure "readiness" to support successful deployment continues to be a point of discussion for several Infrastructure Owner Operators (IOOs). Alternatively, more industry-led AV deployments such as AV used for commercial ridesharing ("robotaxis") and Personal Delivery Devices (PDD) have been highlighted as successes, where states do not fund the projects, rather allow the industry to deploy. These types of deployments were out of scope for this Domestic Scan but were important to understand as they are part of the larger ADS and AV world.

Resources of Interest emerged as a valuable topic for states, which were eager to find out more about how other states did or did not succeed with a pilot— especially where and when to find reports publicly to either use as lessons learned or justification for application of a similar AV technology within their own state. For each pilot deployment by a state IOO, several public resources in the form of reports and findings are often available. States are required to provide reports to USDOT when using federal funds, but states have also voluntarily provided reports and findings for others to learn from their experiences in the hopes of assisting with the scaling of ADS and AV technologies across the nation.

Beyond the initial findings, the scan identified several key challenges, including resource constraints, procurement complexities, and regulatory inconsistencies. States grapple with limited funding and skilled personnel, hindering the scalability of AV initiatives. Procurement processes can be ill-suited to accommodate rapidly evolving technologies that may need iterative approaches to successfully deploy, delaying project timelines. Additionally, the absence of a cohesive federal policy framework exacerbates cross-state regulatory disparities, complicating efforts to establish seamless AV operations. Another common thread from those in attendance was that their responsibilities within the state DOT are primarily for infrastructure and facility operations, not vehicle design. The discussion around infrastructure readiness for successful deployment continues to be a point of discussion for several IOO.

Despite these challenges, the scan highlighted numerous success stories that offer valuable lessons. Texas's emphasis on fostering public-private partnerships has accelerated freight-focused AV deployments. Florida's strategic planning and robust legislative support have positioned it as a leader in connected vehicle and AV integration. States' collaborative approach involves frequent outreach to diverse stakeholders, from disability advocates to defense technology partners, which creates a supportive ecosystem for AV innovation. Colorado and New Jersey Transit's (NJ Transit) approach to enhance fleet vehicles demonstrates a clear business case for the adoption of ADS and AV within a state DOT, while states like Utah and Georgia scale connected vehicle technologies to improve safety and efficiency while also providing a groundwork for future ADS and AV solutions.

Recommendations from the scan underscore the need for standardized federal guidelines and decisions to harmonize state-level policies, thus supporting the scaling of AV technologies across the nation. Public engagement initiatives should also be prioritized to ensure community buy-in and address concerns about safety and access, while investing in infrastructure readiness, particularly connected vehicle technologies. Enhanced pavement markings continue to be a point of discussion to create an environment conducive to AV deployment, with some arguing benefits, while others desire an ability from the AV to know how to position themselves without perfect or enhanced pavement markings.

The findings also emphasize the importance of a phased implementation strategy. States are encouraged to begin with pilot projects, gradually scaling up based on data-driven insights as evidenced in North Carolina's gradual and comprehensive pilots of automated shuttles across multiple test sites. Capacity building, including staff training and securing dedicated funding, is essential for sustaining long-term AV programs such as in Ohio and Minnesota. Continuous monitoring and adaptation of strategies will be vital as technologies and regulations evolve.

The Domestic Scan generated a list of recommendations for integrating AV technologies into state and local transportation agencies. By addressing policy gaps, fostering collaboration, and investing in infrastructure and public engagement, states can harness the transformative potential of AV technologies to enhance safety, mobility, and access.

Introduction

1.1. Domestic Scan Background

The US Domestic Scan Program, conducted under the National Cooperative Highway Research Program (NCHRP), is a collaborative effort aimed at enhancing the knowledge and practices of state Departments of Transportation (DOT). It serves as a platform to share and document innovative methods, challenges, and opportunities associated with a specific topic affecting states across the nation. The NCHRP Domestic Scan Program allows participating agencies to exchange insights, develop strategies, and establish a cohesive understanding of an often-fragmented landscape across the United States (US).

1.2. Scan Topic Background

The genesis of this Domestic Scan stemmed from the public sector transportation community, who initiated an opportunity to document Automated Driving Systems (ADS) and Automated Vehicle (AV) experiences from across the United States. Transportation organizations across the nation are exploring the testing and deployment of automated and connected technologies, specifically, ADS and AV. For the purposes of this report, AV and ADS represent Society of Automotive Engineers International (SAE) Levels of Driving Automation Level 3 and above. ADS and AV technologies aim to deliver roadway safety benefits, produce economic and social benefits, and improve efficiency, convenience, and mobility. A popular perspective is that public and private entities can shape the landscape of AV deployment together more effectively than if they were to work independently of each other. However, the learning curve for ADS and AV technologies is steep, risk tolerance in public sector agencies is low, and state and local Infrastructure Owner Operators (IOOs) often face resource constraints in selecting and prioritizing projects. State IOOs must also determine if they will place resources into supporting private sector deployments or focus on their fleet technology improvements only.

This Domestic Scan effort provides information to assist state IOOs interested in incorporating ADS and AV into their operations as well as whether resources should be allocated to manage private entity deployments on public facilities, even when the state IOO is not needed for permitting purposes. The latter will be of importance given over half of the deployments across the nation currently reported on National Highway Traffic Safety Administration (NHTSA)'s Automated Vehicle Transparency and Engagement for Safe Testing (AV TEST) Initiative website are not deployed by state IOOs. According to data reported through AV TEST, there are over eighty ADS pilots under way across the United States. The terms "pilots" and "deployments" are often interchanged, meaning that some may call a "pilot" a "deployment," while others call a "deployment" a "pilot." This overlap demonstrates a need to better define and understand what ADS and AV technologies can do and how state and local IOOs can incorporate them within their business practices.

Given the widespread national experience, there is a substantial opportunity to learn and capture successful practices as well as lessons learned that can be tied to an IOO's core mission to improve and maintain a safe, accessible, and efficient transportation system. However, there are also examples of state IOOs with limited engagement with private entities that see successful deployment of AV and ADS technology.

1.3. Logistics of Scan Event

The goal of this Domestic Scan was to provide valuable insights for state IOOs considering the impacts and adoption of ADS and AV at their facilities and in their communities. As part of the typical process for a Domestic Scan, the team began with a Desk Scan, which identifies a high-level state of the practice. During this phase of the Domestic Scan, the team released an online survey to all states across the United States through multiple platforms, requesting input on questions surrounding their experiences with ADS and AV. These questions, found in Appendix A, helped the scan team better understand who and what topics might be best highlighted for the Domestic Scan.

Following responses from 23 states and the findings from the Desk Scan, the scan team determined that a weeklong virtual meeting with select states would reflect a broad range of state experiences across the nation. The weeklong scan kicked off with a presentation to the American Association of State Highway and Transportation Officials (AASHTO) Connected and Automated Vehicles (CAV) Community of Practice (CoP) to broadly announce the scan's efforts to gather insights and provide visibility on this topic across the nation. The meeting also helped to remind all stakeholders of the scan's survey.

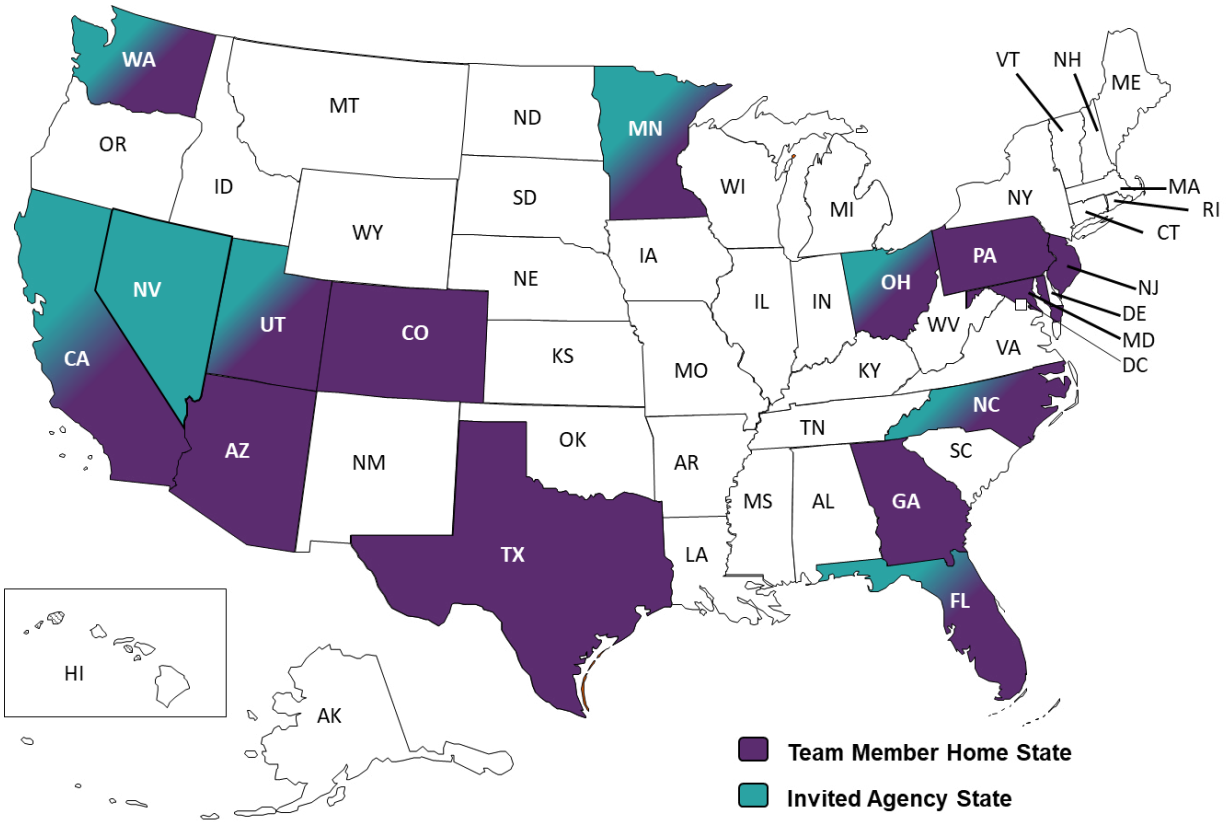

Figure 1: Team Member Home State and Invited Agency State (Source: Arora and Associates)

Following the initial kick-off meeting with the AASHTO CAV CoP, each day of the weeklong event allowed speakers up to two hours to present their state or local jurisdiction's approach to supporting or adopting AV. All speakers and attendees were invited to attend every session to gain cross-state perspectives. Open-ended discussions were facilitated at the end of each state or local jurisdiction's allotted presentation time. Presenters of the weeklong scan event are provided below in alphabetical order by state or agency name.

- Inder Preet Singh, Caltrans
- Hassan Valizadeh, Caltrans
- David Guan, Caltrans
- Stan Slavin, Caltrans
- Miguel Acosta, California Department of Motor Vehicles
- Heather Pickering-Hilgers, Colorado DOT
- Preeti Choudhary, DriveOhio
- Nick Hegemier, DriveOhio
- Breana Badanes, DriveOhio
- Andrew Bremer, DriveOhio
- Andrew Wallace, DriveOhio
- Christine Shafik, Florida DOT
- Jeremy Dilmore, Florida DOT
- JoAnna Hand, Florida DOT
- Jeremy Dilmore, Florida DOT
- Engy Samaan, Florida DOT
- John Hibbard, Georgia DOT
- Victoria Coulter, Georgia DOT
- Alan Davis, Georgia DOT
- Nanette Schieke, Maryland Motor Vehicle Administration
- Michele Gross, Maryland Motor Vehicle Administration
- Roxane Mukai, Maryland Transportation Authority
- Phil Dacey, Maryland Motor Vehicle Administration
- Stephen Miller, Maryland Transit Administration
- Warren Henry, Maryland State Highway Administration
- Parto Mazdeyasni, Maryland Port Administration
- Tara Olds, Minnesota DOT
- Brian Kary, Minnesota DOT
- Thomas Johnson-Kaiser, Minnesota DOT
- Joanna Wadsworth, Regional Transportation Commission of Southern Nevada
- John Dean, NJ Transit
- Sarah Searcy, North Carolina DOT
- Derrick Herrman, Pennsylvania DOT
- Gunnar Rhone, Pennsylvania DOT
- Armand Shahbazian, Seattle DOT
- Bob Frey, Tampa-Hillsborough Expressway Authority
- Darran Anderson, Texas DOT
- Erika Kemp, Texas DOT
- Gus Escobedo, Texas DOT
- Peter Vichitbandha, Texas DOT
- James Choi, Texas DOT
- Blaine D. Leonard, Utah DOT
- Daniela Bremmer, Washington State DOT
- Dongho Chang, Washington State DOT

Policies

Policy development for AV spans federal, state, and local levels, each with a distinctive role and approach to regulation. Below are the findings from discussions with participants according to their jurisdiction's roles and responsibilities.

2.1. Federal Level

While federal partners were not speakers at this event, addressing national policy around AVs frequently became a topic of conversation. The primary agency of influence in the realm of ADS and AV is the United States Department of Transportation (USDOT). Within its roles and responsibilities includes potential for national consensus and approach. USDOT's National Highway Traffic Safety Administration (NHTSA) provides high-level standards and voluntary guidance for AV deployment, focusing on safety protocols, data privacy, and other requirements to protect public welfare. The regulatory oversight of NHTSA includes the design and manufacturing of vehicles, including their components and safety features — such as steering wheels and rear-view mirrors, which have an impact on AV deployments. AVs that omit standard human-driven vehicle safety features, which may not be needed by these specialized vehicles, such as rear-view mirrors or steering wheels, are not permitted to operate on US roadways without explicit permission from NHTSA, presenting a unique constraint on AV development. The national guidance provided to date applies primarily to operational rules, such as speeds and how to respect control devices; however, the guidance is not legally binding and is still voluntary, leaving room for state-level customization and experimentation. This approach affects how AV deployments might or might not proceed forward and provides no clear framework or directive for what is safe enough for our nation's roadways. Establishing consistent rules and legislation to ensure seamless AV travel across state and jurisdictional boundaries would reduce regulatory fragmentation. For example, agencies like the Federal Motor Carrier Safety Administration could play a key role in supporting AV freight movement over long distances. While individual states have developed strong frameworks for AV operation on their roadways, a unified federal approach would enable greater efficiency and safety for interstate travel.

Federal policy in the United States offers guidance but not comprehensive regulation of AV. It also does not offer a decision on whether the AV software that "drives" or "operates" is considered equipment— thus qualifying it directly for Federal oversight— or if the software is a "driver" or "operator," thus placing it directly under state rules. For clarification, states have full oversight of registering and licensing "drivers"; however, they generally do not have oversight over vehicle equipment. This type of ambiguity continues to inhibit the AV industry's ability to scale within the US.

2.2. State Level

At the state level, policies diverge, influenced by individual state priorities, economic ambitions, and local safety concerns. States have taken different approaches, generally falling into three categories:

(1) loose regulations, (2) mandated regulations, or (3) a wait and see approach. States with long histories of testing in their jurisdictions fall within the first two categories. Regardless of approach, states have leaned towards advisory bodies or state-specific AV champions to aid in the discussion.

Some states have adopted permissive regulations to attract technology developers and investment, allowing broad testing and deployment of AV and Connected Vehicle (CV) infrastructure. For example, states such as Utah and Georgia have minimal or no restrictions on AV testing and deployment and rely on private industry self-certification. Texas exemplifies the "minimal regulation" approach while also experiencing high levels of AV interest from the industry. Texas relies on a self-certification process that allows AV companies to operate with few constraints. This model has spurred rapid innovation and investment, particularly in freight and logistics sectors, with projects like the I-45 Innovative Corridor demonstrating how state support can accelerate AV deployment.

Other states, such as California and Pennsylvania, are more conservative, enforcing safety-driver requirements and restricting testing to permitted companies and designated environments, often defined through collaboration with industry prior to approval. While this could be perceived as slowing down the pace of ADS and AV adoption, California remains the state with the highest level of AV industry interest for piloting and deployment of AV technologies. Pennsylvania has also seen several pilot projects and interest from the industry. Other states with more direct oversight can occasionally see high interest from private industry to participate in conversations, without then seeing AV deployments. A correlation might be drawn to AV industry business location and higher levels of AV pilots or deployments in that state, though there is no evidence this always supports more pilots or deployments within the region.

A common thread across the participating states was that some level of economic growth, safety, or innovative mobility solution were drivers for AV regulations and deployment. The digression in implementation occurs within the legal frameworks of that state — who is liable and what is the definition of "driver" were frequent points. When the state legislative body felt AV presented a safety concern, more conservative approaches of mandating a permit process were implemented, such as in California and Pennsylvania. Some states took different approaches like creating an advisory group to help their state prepare for AV that was established by legislation or Executive Order, such as Ohio, North Carolina, and Minnesota. Ultimately, state legislatures and elected officials played a critical role in the development of AV regulations within states — either through prompting by private industry or through proactive interest within the state DOTs. Several speakers noted that strong and frequent relationships across state legislature and the state DOT played a critical role in advancing state legislature for AV in their state.

A key consideration for many states is balancing technological innovation with necessary oversight. States like Colorado implemented specific safety-oriented policies around connected snowplow projects, reflecting a practical use of technology for public utility. Some states have introduced AV-specific task forces or advisory bodies, often involving or led by state DOTs, to regulate, to recommend, or potentially to oversee AV testing and integration. States with significant legislative involvement for AV deployment provide clear frameworks for deployment, encouraging private sector involvement and reducing regulatory uncertainties for companies interested in AV testing; however, no clear connection can be made between different regulatory environments and the scale of AV

deployments. Some states, such as Texas, have seen higher deployments of AV without the restrictions of state-issued regulations. Some states, like California, see high AV activity even with government oversight, while other states with less government oversight, like Utah, see little activity.

While not a written policy, economic growth and the availability of the technology to all are key drivers for state IOOs. States like Texas and Florida view AV technology as an opportunity to attract investment and create jobs, with a focus on freight and logistics sectors. Conversely, states like Maryland, Minnesota, and Pennsylvania emphasize that AV technologies address mobility challenges for underserved populations. All the states noted that economic growth and addressing a public need elevated projects and made them more sustainable than demonstration projects meant to be "wow-factors."

2.3. Local Level

At the local level, municipalities are increasingly involved in regulating AV testing to address specific community concerns and transportation needs. The City of Seattle was a stakeholder in this scan event and discussed their implementation of a permit system that requires companies to obtain permission for AV testing within city limits, emphasizing the local jurisdiction's role in influencing AV activity. This approach allows cities to set unique standards and tailor AV integration to local concerns, such as pedestrian safety, infrastructure readiness, and community perceptions. Some states, however, preempt local authority, ensuring statewide consistency in AV regulations and minimizing potential jurisdictional conflicts.

Across all levels of government, a common challenge is weighing public safety against technological freedom. The absence of binding federal standards means that states and localities must individually decide how to oversee AV deployments, balancing industry support with the need to protect residents and road users. A major point reiterated through the scan was that this variation creates a diverse regulatory landscape, where different levels of permissiveness coexist, and public sector stakeholders-experiment with different degrees of oversight.

Agency Organization

The organization of state DOTs and the availability of resources seemed to play a critical role in the success of AV programs. State priorities resulted in different organizational structures, funding mechanisms, and staffing approaches. Most states present in the scan event use a centralized approach for AV program management, though grassroots models, where local agencies have greater influence, were also represented.

3.1. Top Down vs. Grassroots Approaches

States with top-down structures typically have dedicated AV units within their DOTs to manage all aspects of AV integration. DriveOhio, for example, serves as a hub that aligns emerging technologies efforts, including AV, with state priorities, involving various agencies and academic partners to support program goals. These centralized structures are reflected in various forms across almost all state DOTs and allow for efficient coordination and a unified vision, aligning all related activities under a single, cohesive strategy.

Maryland's approach, where a statewide working group exists to coordinate AV efforts while having no legislative or regulatory requirement to do so, is somewhat unique and provides the state flexibility in what can be pursued, such as topics of interest to the state's stakeholders. In contrast, most presenting states reflected a legislative requirement to oversee or perform studies related to AV. In Washington State, local jurisdictions such as the City of Seattle demonstrate local-level oversight structures. The local jurisdiction established resources and staffing to manage AV deployments, in addition to a basic level of state oversight and management.

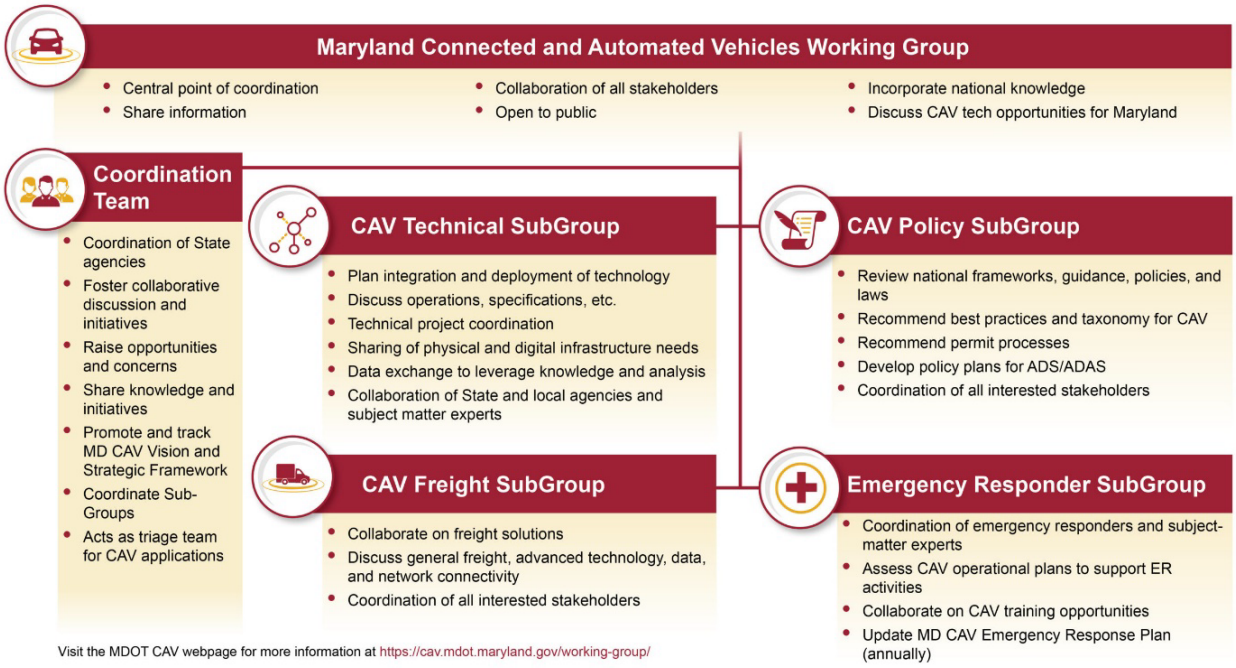

Figure 2: Maryland CAV Working Group Structure (Source: Maryland DOT)

Several of the state DOTs aligned their AV program efforts within other programs such as TSMO, intelligent transportation systems, research, innovation offices, and roadway operations. By leveraging existing programs, these state DOTs use existing funding buckets and resources to further research and adopt AV strategies. Florida's CAV program demonstrates the benefits of integrating AV initiatives with existing infrastructure projects. Programs like the I-4 FRAME and Smart St. Augustine illustrate how targeted outreach and collaboration can enhance innovation. FDOT's focus on developing consistent standards for Advanced Traffic Controllers and communication protocols has been pivotal in overcoming interoperability challenges. Events like the Florida Automated Vehicle (FAV) Summit further underscore the importance of stakeholder engagement.

A common thread from scan stakeholders was their role in understanding the "readiness" of facilities for AV deployments. Most of the scan stakeholders represented IOOs where responsibilities are more aligned with physical roadway infrastructure than vehicle design. As a result, there is uncertainty about how to prepare that infrastructure for AV when AV technologies are still evolving. States like Minnesota, Ohio, and Utah discussed potential approaches to the development of a "readiness score" for AV deployment, which frequently focused on pavement conditions, signage, and data streams. These states continue to evaluate methods of tracking readiness; however, consensus on metrics or even the need for readiness scores continues to be a point of discussion.

3.2. Funding and Staffing

Funding availability is a critical factor influencing the creation, growth, and maintenance of AV programs. Dedicated funding streams, from state or federal sources, are invaluable for states aiming to establish robust, long-term AV initiatives. For example, states that secure dedicated funding for multi-year AV projects often have more comprehensive programs, enabling continuous innovation, testing, and deployment. Ad-hoc or project-specific funding, such as with grants, while helpful for launching pilots, can limit a state's ability to pursue recurring projects, long-term planning, and public buy-in.

Staffing is also central to effective AV program implementation. States with well-established AV units often have specialized personnel with expertise in emerging technologies, transportation engineering, and data management, ensuring that projects are well-supported from a technical and operational perspective. However, many states struggle to recruit and retain such specialized talent due to budget constraints and competitive private-sector opportunities. To address this gap, states like Ohio and Florida have successfully supplemented their internal teams by partnering with universities and leveraging research capabilities. Collaborative arrangements with academic institutions not only provide access to cutting-edge research but also foster innovation hubs that can support AV program goals across multiple entities within a state.

Figure 3: Colorado Autonomous Truck Mounted Attenuator (Source: Colorado DOT)

Moreover, partnerships with private sector companies have proven effective in building capacity. For instance, Utah's collaboration with technology firms and Minnesota's involvement with the microtransit service, May Mobility™, highlight how public-private partnerships can augment staff expertise and drive innovation. These models enable states to address resource limitations while benefiting from industry advancements.

Staffing also expands to offices beyond state IOOs' central divisions or offices. Colorado's efforts to integrate autonomous truck-mounted attenuators and connected snowplow systems showcase the potential of AV to enhance roadway safety. However, difficulties in training field staff and procurement challenges underscore the complexities of adopting these technologies. Ultimately, the state DOT's ability to use existing funding and staffing structures to advance AV within the state has proven to be the most successful at scaling AV, even when the structure is legislatively mandated or issued through Executive Orders.

Resulting Projects

AV projects vary significantly across states, with most initiatives falling into two primary categories: pilot projects and full-scale deployments. Within these categories, AV and CV deployments have emerged as critical testing grounds, enabling states to refine their policies, gain public trust, and generate data to guide future projects.

4.1. Pilot Projects vs. Deployments

Many states begin with demonstration events, where industry partners showcase their technology. From the initial demonstration, states move towards pilot projects to evaluate the technology's effectiveness and safety before pursuing full-scale deployments. Pilot projects are designed as short-term initiatives with limited geographic scope, allowing states to observe the technology in action and adjust parameters based on initial findings. These pilots can be privately or publicly funded, depending on the state and interest of the stakeholders affected. In states like California, private companies proceed through a permit process before deployment, after which they are allowed to charge a fee for their AV services. This approach does not require funding from California and is entirely industry-driven. Regardless, pilot programs serve as valuable tools for generating public buy-in, as they allow communities to experience AV technology firsthand, helping to shift perceptions and build trust. Almost all the presenting states have completed automated shuttle pilots in specific operating design domains (e.g., designated areas and times), demonstrating the potential utility of the vehicles and their safety to the public and generating data to inform longer-term deployments. The scale of pilots can span a few days to a few months and does not have guidance at a federal level for where or how to perform the pilot.

Beyond pilots, full-scale deployments are not clearly defined. Some industry partners might define the use of robotaxis for commercial ridesharing as a full-scale deployment, while states might consider those vehicles and operations to be still in a pilot stage. A consensus from the scan was that no state has achieved a full-scale deployment, sustainable or otherwise, of AV either within their fleets, nor in their communities. Statewide and full-scale deployments would require a significant increase in confidence in and capabilities of AV technologies that participants did not believe has fully been achieved yet. In Texas, for example, privately-led AV deployments for freight and goods movement have been supported by state legislation and executive backing; however, even such deployments include only a handful of physical vehicles.

4.2. AV vs. CV Projects

AV projects are frequently driven by private-sector investment and are more likely to receive executive and legislative support due to their potential economic impact. These projects, while valuable, require careful planning to ensure they meet public expectations and safety standards. In contrast, CV projects are more integrated with existing infrastructure, as they focus on improving communication between vehicles and road networks, which state and local governments directly control. For instance, Georgia, Florida, Utah, and Ohio have installed roadside units (RSUs) in high-traffic corridors to enable CV communication, focusing on

infrastructure enhancements that improve real-time traffic management and road safety. CV projects tend to be less controversial as they align closely with state DOTs' traditional responsibilities as IOOs.

The consensus across the presenting states was that CV technologies support AV adoption indirectly by creating a safer and more efficient network. The belief is that AV can operate with a redundant "safety net," where CV information could confirm or otherwise inform an AV decision. States that emphasize CV implementation help lay the groundwork for AV integration, as connected infrastructure provides AV with critical data on road conditions, traffic, and hazards, making their operation more reliable and safer.

4.3. Example Projects

Provided below are a few examples from the presenting states, with associated publicly available reports documenting lessons learned and potential actionable next steps.

DriveOhio's Rural ADS project was an initiative designed to evaluate the performance, safety, and reliability of AV in rural environments, which present unique challenges compared to urban settings. Over nearly a year, the project collected approximately 60 terabytes of data from automated test vehicles operating across 670 miles of rural Ohio roadways. The study focused on several key factors, including roadway characteristics, infrastructure compatibility, environmental conditions, and AV interaction with human-driven vehicles, pedestrians, and other roadway users. The study found that while AV systems performed well on well-marked highways, they struggled with unmarked or narrow roads, requiring disengagements in certain scenarios. Inclement weather, including fog, rain, and snow, also affected sensor performance, reinforcing the need for further advancements in perception technology. Additionally, rural environments introduced more variable lighting conditions, which impacted the effectiveness of onboard cameras and Light Image Detection And Ranging (LIDAR) systems.

The project also explored connectivity issues, as rural areas often lack robust cellular and high-speed broadband networks that AVs rely on for real-time data processing and vehicle-to-infrastructure (V2I) communication. Limited connectivity led to delays in data transmission and reduced AV responsiveness in some areas, highlighting the need for investment in rural broadband and 5G infrastructure. Furthermore, interactions with human-driven vehicles, particularly those performing unpredictable maneuvers such as slow-moving farm equipment and sudden turns at unmarked intersections, posed additional challenges for AV systems.

Despite these hurdles, the study identified opportunities for AV deployment in rural logistics, freight transportation, and public transit solutions for underserved communities. The research suggested that AV technology could be particularly useful for improving access to essential services in remote areas, such as medical transportation and goods delivery.

- **Report / Summary of Project:**

  Ohio Rural Automated Driving Systems (ADS) Project Final Evaluation Report

In August 2021 and September 2022, the Utah Department of Transportation (UDOT), in partnership

with VSI Labs, conducted an Automated Vehicle Readiness Study to assess the compatibility of Utah's roadways with CAV technologies, particularly focusing on Lane-Keep Assist (LKA) systems. The study involved equipping two vehicles with advanced sensors—including cameras, LIDAR, radar, and positioning systems—and driving them over 1,000 miles across various routes, such as I-15 between St. George and Salt Lake City, and SR-210 in Little Cottonwood Canyon. Findings indicated that most surveyed routes were suitable for automated driving functions, with alternating black and white "tiger tail" lane striping proving highly effective for LKA recognition. However, some deficiencies were noted, including missing lane markings in on-ramp blend areas, gaps due to pavement maintenance, and low-contrast markings. These insights will inform UDOT's maintenance strategies and standard practices to ensure roadway readiness for current and future CAV technologies.

This project highlights one of several states' desire to establish a level of readiness for lane markings, or verification of whether the state should perform lane marking enhancements for AV sensors in the first place. While some states are actively exploring the expansion and improvement of lane markings to support AV technology, others are weighing the financial and maintenance implications of implementing such upgrades. The ability to quantify a state's AV readiness is increasingly viewed as a strategic advantage in attracting AV developers and fostering innovation; however, a standardized methodology or universal metric for measuring this readiness has yet to be established.

- **Report / Summary of Project:**

  Automated Vehicle Readiness Study

The Connected Autonomous Shuttle Supporting Innovation (CASSI) pilot program, launched by NCDOT in collaboration with the University of North Carolina at Charlotte (UNC Charlotte) and Beep, Inc.™, aimed to explore the feasibility of integrating low-speed automated shuttles within a complex campus environment. This 23-week pilot marked NCDOT's most complicated deployment to date, featuring a fixed route that navigated through a dynamic campus setting shared with pedestrians, cyclists, scooter riders, sidewalk delivery robots, and existing transit services. The shuttle, operating alongside UNC Charlotte's Niner Transit system, provided an additional mobility option for faculty, staff, students, and visitors while offering valuable insights into the interaction of emerging automated vehicle technology with traditional transit operations.

The key findings from the pilot indicated several important considerations for future deployments. Findings from the data and analyses indicate that, while some community members appreciated being able to experience and support new technology through the automated shuttle and service, most were choosing other options to reach their destinations on campus, whether due to comfort, convenience, reliability, or some other factor. The shuttle's slow speed, delay from when the onboard attendant needed to troubleshoot problems or manually operate the shuttle and route constraints that resulted in a less direct path between destinations contributed to the lower performance of the shuttle compared to conventional transit options. The most common cause of the shuttle's disengagement from autonomous mode into manual mode was lost connection or miscommunication between the shuttle's Onboard Unit (OBU) and the Roadside Units (RSUs) at the signalized intersections on the route. In addition, the shuttle was out of service for a considerable amount of time due to technology

issues, notably due to Global Navigation Satellite System (GNSS) signal loss and battery insufficiency. These findings suggest that there was no time or connectivity benefit to using the shuttle over other options on campus. Overall, the shuttle's technology needs to advance further to usefully meet the demands of a university campus and the expectations of its community members.

- **Report / Summary of Project:**

  Connected Autonomous Shuttle Supporting Innovation (CASSI) in Cary's Bond Park

Topics and Resources of Interest

In addition to financial and organizational resources, states are leveraging various strategic tools and frameworks from peer agencies to advance AV initiatives. These include strategic and long-term planning documents, public engagement strategies, and lessons-learned reports, all of which help stakeholders refine their approaches, build public trust, and facilitate knowledge-sharing.

5.1. Strategic and Long-Term Plans

Strategic and long-term plans are critical for aligning AV projects with broader transportation goals, ensuring sustainability, and enabling efficient resource allocation. States such as Florida, Maryland, Minnesota, and Pennsylvania have created comprehensive multi-year plans that serve as blueprints for AV deployment, guiding their priorities and outcomes. These strategic plans evolve over time, with some states like Maryland and Minnesota expanding AV recommendations across other strategic plans within the DOT.

Florida's CAV 2.0 Strategic Plan illustrates the importance of evolving strategic frameworks. This plan focuses on mainstreaming CV technology across Florida DOT's business processes, ensuring that CAV initiatives are integrated into statewide transportation systems. FDOT has also developed a CAV Guidelines document that highlights lessons learned from earlier deployments, such as the I-STREET and signal phase and timing projects, emphasizing the need for adaptable strategies that can accommodate new technologies.

The Maryland CAV Strategic Framework outlines the state's vision for integrating CAV technologies to enhance safety, mobility, and economic growth at a state level. Rather than developing a plan for the state DOT alone, this effort highlighted the cross-agency vision for all stakeholders in the state. It emphasizes collaboration among public and private stakeholders, infrastructure readiness, and regulatory alignment to ensure seamless AV deployment. The plan also prioritizes accessibility, cybersecurity, and workforce development.

The Minnesota CAV Strategic Plan provides a roadmap for preparing the state's transportation system for CAV technologies over five years. It focuses on safety, access for all, economic development, and infrastructure readiness while fostering collaboration between government, industry, and communities. The plan includes 65 specific actions and nine to support CAV deployment. These actions are further being refined as a component of the DOT's TSMO Strategic Plan to incorporate actionable recommendations based on lessons learned from the broadness of the original plan.

Similarly, Pennsylvania's CAV Strategic Plan and CAV 2040 Vision demonstrate how strategic documents can drive innovation while addressing community needs. Pennsylvania has incorporated stakeholder feedback into its planning, ensuring that AV initiatives align with public expectations and

improve quality of life. The state's collaboration with Carnegie Mellon University and the Regional Industrial Development Corporation to develop an AV test track highlights how partnerships with research institutions can enhance strategic planning.

The scan also emphasized the value of flexibility in strategic policies. Utah, for example, developed legislation that allows Level 4 and Level 5 ADS to operate under clear regulatory frameworks, addressing safety and insurance requirements. This approach ensures that the state remains prepared for advancements in AV technology while maintaining public safety.

These plans also provide templates for other states to follow. By documenting successes and challenges, states like Texas and Ohio have created resources that others can adapt to their own needs. Strategic and long-term plans are not static; they evolve based on lessons learned, stakeholder input, and technological advancements, ensuring that states remain leaders in AV innovation.

A highlight of publicly-available strategic plans has been provided below:

Florida: FDOT developed the CAV 2.0 Strategic Plan, guiding the state's efforts in integrating CAV technologies to enhance safety, mobility, and economic development is not available online, but the original CAV 1.0 plan has been provided below.

- **Florida's Connected and Automated Vehicles (CAV) Business Plan**

Maryland: The Maryland Department of Transportation released the Maryland CAV Strategic Framework, outlining the state's vision and strategies for implementing CAV technologies.

- **Maryland Connected & Automated Vehicle Strategic Framework**

Minnesota: MnDOT developed a comprehensive CAV strategic plan, outlining 65 actions over the next five years to prepare for advancing technology and mobility trends.

- **MnDot's CAV Strategic Plan**

Pennsylvania: PennDOT released the "Pennsylvania Joint Statewide Connected and Automated Vehicles Strategic Plan," serving as a roadmap for organizational change as CAV technologies evolve.

- **Pennsylvania Joint Statewide Connected and Automated Vehicles Strategic Plan**

5.2. Public Engagement

Public engagement is a cornerstone of successful AV initiatives, fostering public trust, addressing safety concerns, and building confidence in emerging technologies. States increasingly host events where people can interact with AV, allowing them to experience the technology firsthand and gain confidence in its safety and reliability. Presenters throughout the scan event identified that public engagement initiatives occurred for their specific pilot projects.

For instance, Texas DOT's "Welcome to Texas" program exemplifies effective community engagement. By hosting public events, the program educates residents about AV technologies and demonstrates their safety and reliability. Similarly, Florida's annual FAV Summit has become a platform for stakeholder interaction, allowing the public to learn about AV advancements directly from industry and government leaders.

North Carolina's approach to public engagement further highlights the importance of direct community involvement. Through its CASSI program, North Carolina tested automated shuttles in various locations, including Bond Park in Cary and the University of North Carolina at Charlotte (UNC Charlotte). These pilots offered firsthand exposure to AV technologies, allowing community members to experience the technology directly through free rides and engagement events. Ridership and survey data from these pilots revealed varied public perceptions, with locations like Bond Park seeing high usage and positive feedback. The program also emphasized accessibility. North Carolina held events with community members with disabilities and their caregivers so they could view, engage with, and ride the shuttle and provide feedback about the accessibility of the automated shuttle and service, including what works well for them in the shuttle and how the shuttle could work better for them. Feedback was shared in final reports and with the automated shuttle vendor to inform the next generation of vehicles and services. This combination of public demonstrations and community feedback helped address safety concerns, foster trust, and encourage continuous improvement in the developing AV solutions.

Figure 4: CASSI at the Wright Brothers National Memorial in partnership with the National Park Service and EasyMile™ and using an EasyMile EZ10 Generation 3 automated shuttle (source NCDOT)

Minnesota's approach to public engagement emphasizes inclusivity and education. Through initiatives like grassroots demonstrations of AV shuttles, Minnesota DOT has reached over 16,000 riders, providing hands-on experience with automated transportation. The state also prioritizes engaging underserved communities, ensuring that AV solutions address diverse transportation needs. These efforts build trust and ensure that AV projects are viewed as tools for improving quality of life rather than experimental technologies.

States also highlighted the importance of transparency and communication. DriveOhio's Connected Marysville project, which evaluates V2X deployment impacts on driver behavior, relies on community outreach to gain public buy-in. Public Vehicle Technology Days and detailed documentation of project outcomes have proven effective in addressing skepticism and fostering understanding of how AV technologies operate. Example plans are listed in Appendix D.

States have learned that public engagement must be proactive and continuous. Early involvement of communities in planning and testing phases can mitigate resistance and ensure that AV initiatives align with public expectations. By involving local stakeholders, addressing concerns transparently, and demonstrating tangible benefits, states can cultivate a supportive environment for AV adoption. A key point for private industry is understanding that the state DOT can significantly bolster an AV deployment's success, as they are already connected to the communities and have experience in how to do public outreach that often goes beyond what private industry usually performs.

5.3. Public Benefit

Lessons learned from early AV projects have shown that focusing on public benefit strengthens public trust and reinforces the idea that AV technology should ultimately improve quality of life.

NJ Transit exemplifies the emphasis on public benefit through its efforts to address the transportation needs of seniors, individuals with disabilities, and low-income residents. The agency has partnered with Rutgers University and Infratech Solutions to test low-speed automated vehicles. By targeting underserved populations and developing solutions tailored to community needs, NJ Transit demonstrated how AV initiatives can have a direct and meaningful impact on public welfare. These efforts address challenges such as aging populations, driver shortages, and increased service demands, ensuring that AV technologies contribute to more inclusive and accessible transportation systems.

Seattle's approach to public benefit focuses on public need and community collaboration. The city has implemented a local permit program for AV testing, with additional insurance and safety requirements to prioritize public trust and accountability. Seattle's initiatives, such as the Digital Conflict Area Awareness Management Program, aim to improve safety for first responders by providing advanced notice of 911-dispatched events using the Open Mobility Foundation®'s Mobility Data Specification, a machine-readable data format used for connected vehicles. This effort aims to ensure that AV technology contributes to broader transportation goals while reducing conflicts with challenging scenarios such as those involving first responders. These programs are complemented by public engagement strategies, including partnerships with industry stakeholders like Zoox™ and Nvidia™, to pilot innovative solutions that prioritize safety, innovation, and sustainability.

Presenters also emphasized that public benefit extends beyond technological advancements. States like Minnesota and Utah are exploring how AV technologies can enhance mobility for individuals with disabilities and improve access to essential services. Minnesota's emphasis on elevating communities in need through its CAV program showcases the potential of AV projects to address systemic transportation problems.

5.4. Emergency Response

Emergency response teams are almost always integrated into a state DOT's AV initiatives, ensuring that first responders are prepared to handle incidents involving AVs and that safety protocols are in place. All presenters throughout the scan event identified that emergency responders outreach occurred for their specific pilot projects, with some states additionally working with external partners to advocate training across the nation, such as Minnesota and the Governor's Highway Safety Association (GHSA™).

Pennsylvania has made significant strides in incorporating emergency response considerations into its AV strategies. The state has developed a mobile app specifically for emergency responders to enhance incident reporting and management for AV-related situations. This tool ensures that responders have real-time access to crucial information, enabling them to handle AV incidents more effectively. Pennsylvania plans to expand the app statewide, demonstrating its commitment to proactive safety measures. The state also focuses on equipping responders with the training and tools needed to address challenges unique to AV technology, such as vehicle disengagements and interactions with automated systems.

DriveOhio has focused on improving emergency response capabilities through a crash prediction analysis project. This initiative combines real-time data, including vehicle data, to proactively predict roadway specific accident risk and allow for countermeasures to be implemented to reduce the risk. Additionally, DriveOhio's work with original equipment manufacturers' airbag deployment data aims to address incident response challenges, such as accurate vehicle location reporting during emergencies. These efforts highlight how data-driven approaches can enhance safety and coordination among responders.

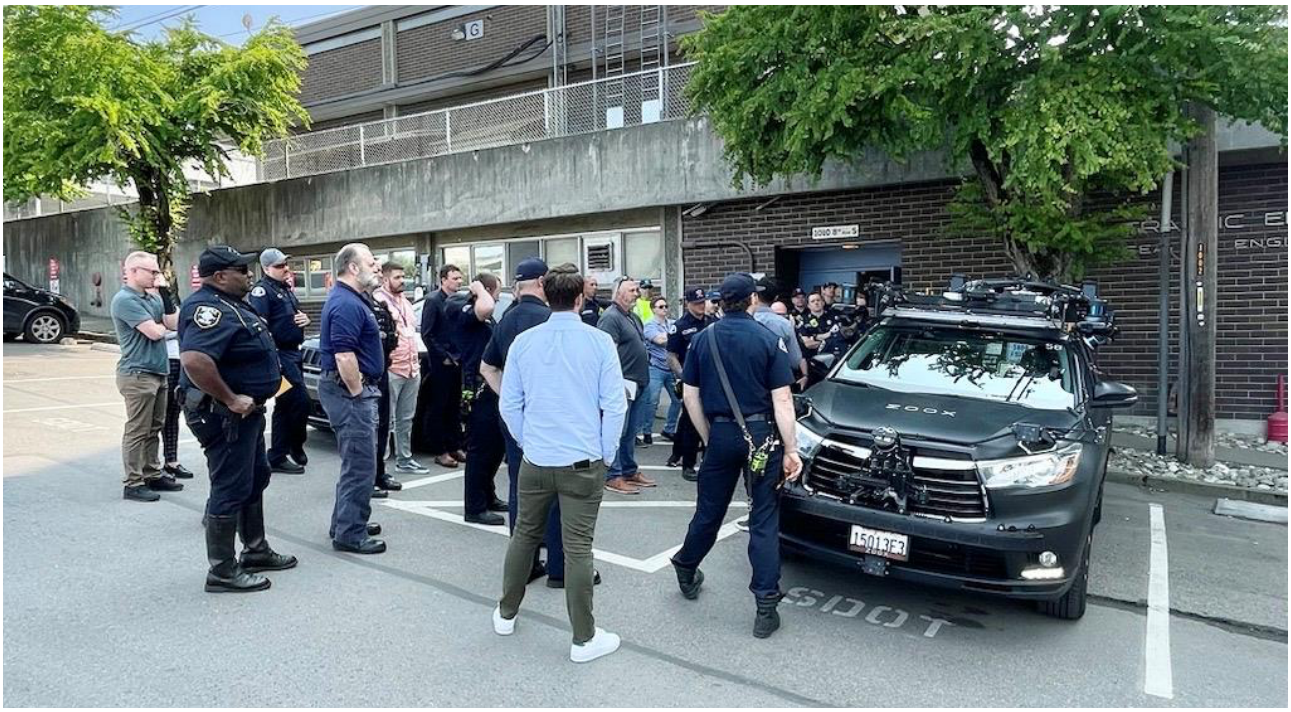

Figure 5: Emergency Response Training with ZOOX AV (source: Seattle DOT)

5.5. Lessons Learned Reports

Documenting lessons learned is critical for advancing AV technologies and fostering knowledge-sharing among states. Many states have embraced this practice, compiling reports that capture insights from AV deployments, including technical challenges, public reactions, and regulatory issues.

DriveOhio, with its multi-million dollars ADS demonstration grant, produced valuable data on rural AV deployment. The project logged over 11,500 miles, revealing challenges such as GPS localization and object detection. These findings are being analyzed by Youngstown State University to inform future AV initiatives. Similarly, Florida regularly shares insights from its numerous CAV projects, such as the I-STREET and FRAME initiatives, during its annual FAV Summit. Utah's Shuttle Pilot Final Report provided insight into the use of an AV shuttle as part of a transit system, including operating costs and operational limitations. These reports provide a roadmap for other states to replicate and scale successful projects.

North Carolina's CASSI program also emphasizes the importance of documenting lessons learned. Pilots conducted in various locations revealed insights into technical issues, accessibility challenges, and public perceptions. The program's detailed reporting informed future projects, particularly regarding the capabilities and limitations of current generation automated shuttle technologies, ADA compliance, and infrastructure requirements.

Minnesota's CAV program similarly prioritized knowledge-sharing. The program generated reports on the disparities between American and European AV infrastructure and the challenges of deploying non-Federal Motor Vehicle Safety Standards-compliant vehicles. These findings helped Minnesota refine its AV policies and improve its pilot projects.

Throughout the scan event, frequent calls were made to presenters to share their available resources as each state had a unique and worthy experience that others could learn from.

5.6. Data Governance

Effective data governance is important for AV programs, especially for states focused on transparency and public accountability. By establishing protocols for data collection, storage, sharing, and analysis, states ensure that AV data supports public benefit rather than serving solely as a proprietary resource for private companies. Data governance also helps state agencies make informed decisions, enabling better policy development and resource allocation.

Florida stands out for its statewide transportation data pipeline and its Advanced Traffic Management Software (SunGuide™), which facilitates data exchange among agencies and supports innovation in traffic management. This centralized approach ensures that AV data is accessible and actionable, promoting collaboration across state and local agencies. Georgia has similarly established an open data portal, allowing stakeholders to access data from roadside units (RSUs) deployed at signalized intersections. This transparency fosters public confidence and supports evidence-based decision-making.

DriveOhio has taken a proactive approach with its Event Streaming Platform, designed to analyze real-time data for crash prediction and incident detection. By combining vehicle data with other sources, DriveOhio ensures that AV data serves public safety and informs policy development. The state's collaboration with Honda™ to evaluate lane quality using original equipment manufacturer (OEM) systems highlights how partnerships can enhance data governance.

Minnesota's focus on V2X technology underscores the importance of consistent data standards. The state is working to improve data-sharing protocols, particularly for rural AV deployments, where infrastructure may differ significantly from urban environments. Insights from Minnesota's pilot projects have informed the development of standardized data collection methods, ensuring that AV systems operate efficiently across diverse regions.

Key Findings

Findings indicate that state governments are primarily advancing AV technology through policies, organizational champions, pilot projects, and developing or turning to nationally available information to support innovation while addressing public safety and infrastructure challenges. Although each state has a unique approach, many share similar goals, such as enhancing transportation safety, encouraging economic growth, and fostering public-private partnerships.

Policies span from open regulations to state oversight, with a unanimous consensus for federal decisions pertaining to definitions of "driver," acceptable levels of safety, to name a few, though some participating states noted federal oversight may not always be necessary; simply the act of defining clearly what is federal versus state oversight was the main point of concern. The act of deciding one approach versus another would simply allow states to move forward rather than continue in a state of uncertainty. States like Texas have embraced minimal regulatory environments, fostering innovation by allowing self-certification for safety. Conversely, California's regulatory landscape includes deployments from mandatory safety drivers to driverless testing and deployment permits. This dichotomy highlights the diverse strategies that states employ to balance technological advancement with public safety and economic considerations. In Utah, a permissive regulatory framework allows for deployments of automated vehicles without permits while still fostering safety. Conversely, Pennsylvania's policies emphasize controlled testing environments and detailed safety protocols, reflecting a more cautious approach to public deployment.

Local jurisdictions also play a pivotal role. The City of Seattle's permit system exemplifies localized oversight, allowing municipalities to address community-specific concerns, conflicts with first responders and other road users. Many participants advocated for federal guidance and decisions to harmonize state-level policies and reduce regulatory fragmentation, though a point of concern of "preemption" of state responsibilities was raised, without clear resolution.

One finding across all states was that there was no single policy or rule of law that scaled or attracted ADS and AV deployments. States like Utah and Georgia are fully open to AV but see little deployment, while a state like California with state oversight sees significant AV activity. States with high stakeholder engagement like Maryland see a lot of discussions and positive networking but little to no AV deployments. Florida holds an annual meeting with the AV industry but does not necessarily host continuous AV forums for vendors, yet the AV industry is more active in the Sunshine state. These differences highlight the need for more than just changes in law to scale ADS and AV deployments.

Organizational Strategies vary from state to state, with a common thread of "champions" as means for program success. Centralized models, as seen in Ohio, Pennsylvania, and several of the participating states, streamline decision-making and ensure alignment with state objectives. In contrast, grassroots models, such as those in Washington State, empower local jurisdictions to tailor initiatives to specific community needs. The City of Seattle's involvement in AV deployment demonstrates how localized control can address unique community needs. Washington State's

approach emphasizes collaboration between state and local agencies, ensuring that local perspectives are integrated into state-level strategies. These approaches underscore the importance of adaptable frameworks that accommodate both state-level oversight and local-level needs.

Staffing and funding are critical components of organizational success. States like Minnesota established dedicated AV units staffed with experts in emerging technologies, data management, and transportation engineering. These teams enable effective program implementation and foster innovation. Florida's integrated Transportation Systems Management and Operations (TSMO) approach, like several other states, leverages existing programs to support AV integration, demonstrating the value of resource optimization. Throughout the states who participated in this scan, the ability to staff and fund projects resulted in higher traction and success of AV pilots led by the state or local DOT.

Resulting Projects highlighted difficulties with automated shuttle pilots across multiple states, ranging from Utah, Colorado, Minnesota, North Carolina, and others. While the testing of automated shuttles aimed to serve a need, outcomes frequently did not show the ability to scale, and the added connected vehicle capabilities meant to assist the AV either often failed or resulted in significant delays. Though some pilots, like in Utah, North Carolina, and Minnesota, included the collection of in-depth public perception information, which helped the states to gauge public trust in AV. While these limited pilots show potential for safety and economic benefits, states with experiences in automated shuttle deployments are becoming less inclined to pursue more of these pilots without improvement in the AV and connected vehicle technology. Another common thread from those in attendance was that their responsibilities within the state DOT are primarily for infrastructure and facility operations, not vehicle design; therefore, projects often relate to the infrastructure itself. The discussion around infrastructure "readiness" to support successful deployment continues to be a point of discussion for several IOOs. Alternatively, more industry-led AV deployments, such as AV used for commercial ridesharing ("robotaxis") and Personal Delivery Devices (PDD), have been highlighted as successes— states do not fund the projects, rather allow the industry to deploy. These types of deployments were out of scope for this Domestic Scan but were important to understand as they are part of the larger ADS and AV world.

Figure 6: Personal Delivery Device

Resources of Interest emerged as a valuable topic for states, which were eager to find out more about how other states did or did not succeed with a pilot —especially where and when to find reports publicly to either use as lessons learned or justification for application of a similar AV technology within their own state. For each pilot deployment by a state Infrastructure Owner Operator (IOO),

several public resources in the form of reports and findings are often available. States are required to provide reports to USDOT when using federal funds, but states have also voluntarily provided reports and findings for others to learn from their experiences in the hopes of assisting with the scaling of ADS and AV technologies across the nation.

The scan identified several key challenges, including resource constraints, procurement complexities, and regulatory inconsistencies. States often grapple with limited funding and skilled personnel, hindering the scalability of AV initiatives. Procurement processes are frequently ill-suited to accommodate rapidly evolving technologies that may need iterative approaches to successfully deploy, delaying project timelines. Additionally, the absence of a cohesive federal regulatory framework exacerbates cross-state regulatory disparities, complicating efforts to establish seamless AV operations. Another common thread from those in attendance was that their responsibilities within the state DOT are primarily for infrastructure and facility operations, not vehicle design. The discussion around infrastructure "readiness" for successful deployment continues to be a point of discussion for several IOOs.

Despite these challenges, the scan highlighted numerous success stories that offer valuable lessons. Texas's emphasis on fostering public-private partnerships has accelerated freight-focused AV deployments. Florida's strategic planning and robust legislative support have positioned it as a leader in connected vehicle and AV integration. States' collaborative approach involves frequent outreach to diverse stakeholders, from disability advocates to defense technology partners, which creates a supportive ecosystem for AV innovation. Colorado's and NJ Transit's approach to enhance fleet vehicles demonstrates a clear business case for the adoption of ADS and AV within a state DOT, while states like Utah and Georgia scale connected vehicle technologies to improve safety and efficiency while also providing a groundwork for future ADS and AV solutions.

Recommendations from the scan underscore the need for standardized federal guidelines and decisions to harmonize state-level policies, thus supporting the scaling of AV technologies across the nation. Public engagement initiatives should also be prioritized to ensure community buy-in and address concerns about safety and access, while investing in infrastructure readiness, particularly connected vehicle technologies. Enhanced pavement markings continue to be a point of discussion to create an environment conducive to AV deployment, with some arguing benefits, while others desire an ability from the AV to know how to position themselves without perfect or enhanced pavement markings.

The findings also emphasize the importance of a phased implementation strategy. States are encouraged to begin with pilot projects, gradually scaling up based on data-driven insights as evidenced in North Carolina's gradual and comprehensive pilots of automated shuttles across multiple test sites. Capacity building, including staff training and securing dedicated funding, is essential for sustaining long-term AV programs such as in Ohio and Minnesota. Continuous monitoring and adaptation of strategies will be vital as technologies and regulations evolve.

Recommendations

Based on the weeklong event, the NCHRP scan team recommends the following two primary actions to advance AV development across the nation, each containing a set of actionable recommendations:

1. Strengthen Agency Engagement to support Autonomous Vehicle Development
2. Promote National Alignment on Automated Vehicle Standards and Regulations

Provided below are details for each recommendation.

7.1. Action 1: Strengthen Agency Engagement to Support Autonomous Vehicle Development

Rationale: Cross-state collaboration on AV initiatives is essential to accelerate and streamline technology development, ensure compatibility across state lines, and establish a supportive framework for AV deployment. By proactively engaging in the field of AV technologies, agencies can better position themselves to lead and support these advancements within their own state and, therefore, across the nation.

7.1.1. Actionable steps for new or emerging AV programs within a State DOT:

- Establish Agency Responsibility, Designate Resources, and Empower Staff to Lead Programs
  - Define agency goals as they relate to AV within your state. Determine the desired level of involvement to support deployment within a state agency, such as the DOT, and begin advocacy for support of the program.
  - To support AV programs, determine where and what resources may be needed. These can span from the hiring or repositioning of staff as champions of the program, finding buckets of existing funding within existing programs, or for accelerated program support to provide new funding. Use examples from this report and other leaders in AV program as examples of organizational structures for proposed teams.
  - Identify and request support from executive leadership to provide broad agency staff buy-in.
  - Leverage internal network of offices, divisions, and teams and external trusted contacts to foster collaboration and share insights regarding AV developments. Successful programs have a "hub and spoke" approach, where central coordination may occur, but responsibilities or empowerment of other stakeholders, including other state or local agencies, results in more successful AV program adoption. These include agencies responsible for information technology, economic development, emergency management, and governor or legislative offices, among others.
  - Conduct a thorough review of national standards and reports from various sources (e.g., those noted in the Resources of Interest section) and stay informed on the current state of AV practices and policies.

- Document the Agency's Current AV Role
  - Assess and document your state's regulatory and policy environment for AV. Identify a team member or internal group to manage and update this knowledge.
  - Collaborate with agency public relations teams to craft AV-related messages that help inform the public about AV definitions, operations, data, safety-implications, and potential benefits.
  - Conduct stakeholder engagement and education that includes public outreach, discussions with policymakers and legislators, and collaboration with other internal agencies.
  - From the previous action, consider your state's current openness and readiness for AV adoption, identifying specific areas where your agency can align with state interests, encourage open discussions on policies for AV, and ultimately contribute to policy and legislation language.
  - Plan for long-term operations and maintenance strategies prior to AV deployment.
  - Evaluate agency and statewide responsibilities for AV adoption, ensuring that roles are well-distributed across relevant stakeholders.
- Evaluate Infrastructure Capability to Support AV
  - Determine your state's availability of infrastructure data to better understand the "readiness" of your infrastructure for AV.
  - Evaluate some of the known factors affecting AV operations, including pavement markings, signage (e.g., adoption of newest Manual of Uniform Traffic Control Devices [MUTCD]), lighting, camera LED flash rates, and data streams to the public.
- Involve your teams in regional and national conversations around AV
  - Partake in national conversations, such as through the Intelligent Transportation Society of America (ITS America™), the AV Pooled Fund Study, the AccelerateAV.org forum, the Transportation Research Board (TRB), AASHTO, and other committees currently discussing this topic.
  - Encourage stakeholders from other teams and agencies across your state to partake in their respective national committees, for example with the American Association of Motor Vehicle Administrators (AAMVA) and National Association of Insurance Commissioners (NAIC™).
- Invest in Connected Vehicle (CV) Infrastructure as a Foundation for AV and Broader Intelligent Transportation Systems (ITS)
  - Recognize that CV infrastructure investments will support not only AV but also other ITS applications.
  - Prioritize funding for CV technologies, such as improved signals and work zone management, which are essential for AV functionality and the overall efficiency of transportation networks.

7.1.2. Actionable steps for established AV programs within a State DOT:

- Document experiences of demonstrations, pilots, and deployments for others to deepen and scale their own knowledge more effectively.
- Engage in national dialogues to promote findings and demonstrate state desires to test and adopt AV solutions.
- Join national committees and volunteer to lead task forces or studies.
- Mentor and empower other states and local entities.
- Identify whether your state needs to pivot or scale AV solutions.
- Establish and confirm state DOT and other state agency roles — responsibilities span across state agencies, not just the DOT.

7.2. Action 2: Promote National Alignment on Automated Vehicle Standards and Regulations

Rationale: Achieving national consistency in AV regulations —especially for freight, emergency response, and cybersecurity—will facilitate smoother interstate AV operations, improve safety, and reduce compliance complexity for AV stakeholders.

7.2.1. Actionable Steps for all State DOTs, local governments, and industry partners:

- Advocate for Federal Leadership and Regulation
  - Support the development of federal regulations that provide a consistent regulatory framework across states, including specific provisions for AV freight operations and guidelines for AV emergency response and cybersecurity.
  - Emphasize the need for ongoing discussions among stakeholders to identify feasible regulatory approaches and address complexities, such as defining roles to oversee the "driver" in a software-driven context.
  - Be aware of and proactively prepare for potential preemption of state regulations if NHTSA or other federal entities assume primary regulatory authority for AV. States should advocate for clarity in federal standards regarding vehicle control systems, such as requirements for AV without steering wheels, and other Federal Motor Vehicle Safety Standards (FMVSS), and understand the impacts to the state should those preemptions be implemented.
- Coordinate Through National Organizations and Non-Profit Entities
  - Leverage the convening power of national organizations like USDOT, AASHTO, ITS America, TRB, and AAMVA to build consensus and unify AV policies across states.

    - Engage actively with committees and working groups within organizations like Society of Automotive Engineers, Institute of Electrical and Electronics Engineers, National Transportation Communications for Intelligent Transportation System Protocol, and MUTCD, contributing to and staying informed about emerging AV standards and best practices.

- Participate in Standards Development Committees
    - Support agency participation in key standards-setting bodies, ensuring that your agency's needs and insights are represented in developing AV-related standards.
    - Monitor and contribute to standards established by SAE™, American National Standards Institute (ANSI™), International Standards Organization for Standardization (ISO™), The Institute of Electrical and Electronics Engineers, Incorporated (IEEE™), and other relevant organizations, aligning state and national policies with a shared vision for AV development.

Through these two overarching recommendations of strengthening engagement and promoting national alignment, the NCHRP scan team encourages a collaborative, well-supported approach to AV integration that balances regulatory oversight with technological innovation. These actions aim to foster a safer, more efficient, cost-effective, and cohesive environment for the adoption of AV and CV technologies across the United States.

Implementation Strategy

The scan team is engaged in and contributes to a diverse set of committees and national groups related to ADS and AV. In coordination with CTC & Associates, a list of detailed implementation strategies within the next year have been identified and tasked to various scan team members.

Identified below are some of the proposed venues for presentation of findings and dialogue on the topic of AV testing and adoption:

- AASHTO (e.g., Annual Meeting, Connected and Automated Vehicles Community of Practice (CAV CoP) and Committee on Transportation System Operations (CTSO))
- ITS America committees and annual conferences (e.g., World Congress in Atlanta, 2025)
- SAE International (e.g., Automated Transportation Symposium in Phoenix, 2025)
- Transportation Research Board committees and annual conferences (e.g., annual meeting in Washington D.C., January 2025)
- Various transportation associations such as the Institute of Transportation Engineers and WTS International

Conclusion

The findings of the NCHRP Domestic Scan 23-02 underscore the varied yet converging efforts of states in advancing and deploying ADS and AV technologies. Central to these efforts is the interplay between policies, organizational frameworks, pilot projects, and resources available to help scale the deployment of these emerging technologies. States have tailored their approaches to balance innovation with public safety, using both grassroots and centralized models to address local and state-level transportation needs. While policy frameworks range from permissive to highly regulated, the universal recognition of the need for federal alignment is evident. A cohesive national framework would harmonize state-level policies, reduce regulatory fragmentation, and facilitate broader adoption of AV technologies.

Key challenges identified include resource constraints, procurement complexities, and regulatory inconsistencies. These barriers highlight the critical need for dedicated funding, skilled personnel, and streamlined processes to enable scalable AV initiatives. Despite these hurdles, the scan revealed numerous success stories and a desire for ADS and AV success across the nation. The interest and continued funding of these projects demonstrate how targeted investment, public-private collaboration, and community engagement can drive innovation while ensuring public trust.

Public engagement emerged as a cornerstone for building community buy-in and addressing transportation mobility concerns. Initiatives like North Carolina's CASSI program, NJ Transit, and Minnesota's grassroots demonstrations exemplify how inclusive strategies can transform public perceptions and support AV integration. Moreover, the emphasis on leveraging CV infrastructure lays the groundwork for safer and more efficient AV deployments.

The recommendations from this scan emphasize the need for phased implementation strategies, beginning with pilot projects and gradually scaling based on data-driven insights. Strengthening agency engagement, fostering collaboration, and prioritizing infrastructure readiness are essential for sustained progress. By addressing policy gaps, investing in capacity building, and maintaining adaptability, states can harness the transformative potential of AV technologies to enhance transportation safety, mobility, and other known transportation concerns.

Ultimately, this scan provides a roadmap for integrating AV technologies into state and local transportation frameworks. The collective experiences and lessons learned offer valuable guidance for navigating the complexities of AV development and adoption, ensuring that these technologies contribute meaningfully to the broader goals of sustainable and equitable transportation systems.

Appendix A: Amplifying Questions

Amplifying questions were initially sent as an online survey to allow participation from states from across the United States. Once responses were provided, speakers were asked to delve further into each question during their presentation to the Scan Team.

The NCHRP Domestic Scan 23-02 Team, *"Recent Experiences in Advancing and Deploying of Automated Vehicle Technologies,"* is requesting input from State Departments of Transportation on their experiences with the deployment of Automated Vehicles. Please complete this survey by January 23rd. If you have any questions about the Domestic Scan, please contact our Chair, Ms. Tara Olds at tara.olds@state.mn.us . Multiple responses by stakeholders across the same agency are welcome.

1. What State Department of Transportation (or agency) do you work for? **(open ended)**
2. What prompted your agency's involvement in Automated Vehicles (AVs) and Automated Driving Systems (ADS)? Some examples include top-down executive requests, grassroots championing, legislative directives, local agency initiative, federal/state funding opportunity, and vendor-led initiatives. **(open ended)**
3. What kind of AV deployments have you directly funded? **(select all that apply)**
   - Personal Delivery Devices (PDD — on sidewalks)
   - Personal Delivery Devices (PDD — on roadway only)
   - "Robotaxi"
   - Shuttles
   - Transit
   - Freight Trucks
   - Heavy Duty Vehicles (e.g., truck mounted attenuators)
   - Other
4. How long did your deployments last? **(select all that apply)**
   - One-off demonstrations at meetings or events
   - Time-limited pilots for less than one year
   - Time-limited pilots for greater than one year
   - Recurring or long-term deployment with no end date expected
5. During what times of day did your deployments occur? **(select all that apply)**
   - During the day at certain times
   - During the day anytime
   - During the night at certain times
   - During the night anytime

6. Did your deployments require pre-determined Operating Design Domains (ODD)? If so, what were they? For example, only in work zones, freeways, or only on one specific pre-defined circuit. Please specify any maximum speed restrictions. **(open ended)**
7. Did your deployments require infrastructure changes? If so, what were they? For example, hardscaping, landscaping, routing signing and delineation, or enabling technology such as a Real-Time Kinematic (RTK) base station or Vehicle-to-Infrastructure (V2I) equipment. **(open ended)**
8. What data elements did you collect during your deployments? **(open ended)**
9. How were data reported during or after your deployments? **(open ended)**
10. What funding source(s) did you use to support your AV deployments? Please detail the type of federal funding or the type of state dollars (e.g., Federal SMART grant, Federal ATCMTD/ATTAIN grant, National Highway Performance Program, local sales tax measures, toll collections, or state operational dollars). **(open ended)**
11. Have any of your AV deployments been funded by other agencies or private companies? If so, by whom and for how long? **(open ended)**
12. How do you measure the success of your deployments? If you had no deployments, what are your thoughts on how to measure success? **(open ended)**
13. Do you have a standard for grading your roadways with respect to AV/ADS operations? If so, how were these standards developed and how have you performed this grading across your roadway network? **(open ended)**
14. Any important (even if obvious) lessons learned? **(open ended)**
15. Within the transit world, how did (or how do you believe) AV solutions compare to traditional transit solutions? Why opt for automated over human-driven vehicles? **(open ended)**
16. What should an Infrastructure Owner Operator do to support AV and ADS? **(open ended)**
17. How do you incorporate the AV/ADS needs into your states design standards? Do you monitor AV industry recommendations and incorporate those into your state's standards? **(open ended)**
18. How have you permitted, or how would you permit, a deployment when it is not directly referenced or obvious in law to allow AV or ADS on public facilities? **(open ended)**
19. How have or should connected vehicle technologies support AV and ADS? **(open ended)**

Appendix B: Scan Team Member Contact Information

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Regional Transportation Commission of Southern Nevada
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Appendix C: Scan Team Members Biographies

TARA OLDS, PE (CHAIR) is the Director of Minnesota's Connected and Automated Vehicles Program where she leads the state's policy, planning, research, and testing of emerging transportation technologies. Tara works to advance safe deployment of CAV technologies and to promote equitable and sustainable transportation systems and solutions. Her background spans across engineering design, planning, traffic safety, construction, project management, and community engagement. Tara has a B.S. in civil engineering from the University of Iowa and a master's degree in Public Affairs from the University of Minnesota's Humphrey School of Public Policy. She is passionate about creating meaningful and inclusive engagement to ensure our current and future transportation systems meet the diverse needs of our communities.

DONGHO CHANG is the State Traffic Engineer, Director of Transportation Operations of Washington State Department of Transportation. He has worked over 29 years in the transportation engineering field focused on improving safety and mobility for all travel modes. Dongho has worked as the Traffic Engineer for City of Seattle and Everett, and as Area Traffic Engineer for Washington State Department of Transportation where he was responsible for traffic signals group, traffic analysis and channelization review, and a traffic safety program. Dongho is active with Institute of Transportation Engineers and NACTO.

NICK HEGEMIER is the Managing Director of Infrastructure for DriveOhio, a center formed within Ohio DOT to focus on Smart Mobility. His current duties include the development of standards for connected and automated vehicles to be deployed in the state. He is currently involved in many national CAV efforts, including leading the AV Pooled Fund Study, and is President of ITS Midwest as well a board member for the OmniAir Consortium™, a global certification entity for technologies, including connected vehicles. He received his degree in Electrical Engineering from The Ohio State University and has over 21 years of Intelligent Transportation System experience.

BRIAN KARY has worked with the Minnesota Department of Transportation (MnDOT) since 1999. His work with the department has included working in Traffic Operations, Traffic Analysis, and Incident Management, including being the Director of MnDOT's Regional Transportation Management Center. In his current position, he is the director for MnDOT's Transportation Systems Management and Operations program or TSMO. His role is to lead a proactive, consistent, and deliberate statewide approach to TSMO that seeks innovative approaches to improve operations of our state highways. He also oversees MnDOT's Connected and Automated Vehicles unit and Electrical Services Section.

BLAINE LEONARD, PE, F.ASCE, is the Transportation Technology Engineer at the Utah Department of Transportation (UDOT) in Salt Lake City. In this role, he leads the planning and deployment of connected and automated vehicles and related traffic management technologies. His team is on the forefront of operational, connected vehicle deployments. He is active (and has chaired various efforts) in AASHTO, the CAT Coalition, ITE, ITS America, SAE, and other national groups with a focus on these technologies. Blaine has been with UDOT since 2001 and spent 20 years in the consulting engineering business prior to that, including as a partner or owner in two firms. He served as the President of the American Society of Civil Engineers (ASCE™) in 2010 and has won awards from ASCE, AASHTO, SAE and the Utah Engineers Council. He is a licensed engineer in six western states and is Past Chair of Utah's licensing board. He holds Bachelor's and Master's Degrees in Civil Engineering from the University of Utah, where he was named a Distinguished Civil Engineering Alumni in 2010 and has twice served as an adjunct professor.

ENGY SAMAAN, PE, is the State Arterial Management Engineer for the Florida Department of Transportation's (FDOT) Connected Mobility and Technologies (CMTP) program as part of the State Traffic Engineering and Operations Office (TEOO). Through this role, she oversees the State Arterial Management Program (STAMP), the State Wrong-Way Driving (WWD) Initiative, and the State Managed Lanes Program. She has served FDOT since 2019, previously working as a Project Development Engineer in the Office of Environmental Management. Through both of her roles at FDOT, Engy has supported key revisions to many FDOT publications, including the FDOT Project Development and Environmental (PD&E) Manual, the FDOT Design Manual (FDM), the FDOT Traffic Engineering Manual (TEM), and the Efficient Transportation Makers (ETDM) Process. Engy earned her Bachelor of Science in Civil Engineering from Alexandria University in 2011 and earned a Master of Engineering in Transportation Leadership from the University of Florida in 2024.

SARAH SEARCY is an applied research professional and program manager with over thirteen years of experience serving North Carolina to advance safe, equitable, and innovative multimodal transportation throughout the state. As the Emerging Technologies and Innovation Manager in the North Carolina Department of Transportation (NCDOT)'s Office of Strategic Initiatives and Program Support (SIPS), she serves as the dedicated lead for Connected and Automated Vehicles (CAV) and manages NCDOT's innovation program. Sarah previously served as the Senior Advisor for Innovation in NCDOT's Integrated Mobility Division, where she directed projects and programs that improve shared mobility options and promote transportation systems that work for everyone. She managed the Connected Autonomous Shuttle Supporting Innovation (CASSI) program for NCDOT to pilot CAV in partnership with communities across the state. Prior to joining NCDOT in 2021, Sarah was with the Institute for Transportation Research and Education (ITRE) at NC State University for over eight years, most recently as the Bicycle and Pedestrian Program Manager. Sarah is a Fulbright award recipient and two-time East Carolina University alumna with a bachelor's degree in Art and Anthropology and a master's degree in Sociology.

INDER PREET SINGH, PE was appointed to the position of Deputy Division Chief of Transformational Mobility Program in Caltrans Division of Traffic Operations in July 2023. His Program is responsible for accelerating the adoption of Connected and Automated Vehicles (CAV) technology and other emerging concepts such as Roadway Digital Infrastructure, Smart Cities/Regions, etc. in California. In addition, he also serves as the Project Director for the groundbreaking Enhance Vulnerable Road User (VRU) Safety using Generative Artificial Intelligence (GenAI) project. This confidential project was amongst the first set of GenAI vendor contracts awarded in California history. He has been with Caltrans for over 15 years and previously served in a variety of leadership assignments including Single Focal Point, Regional Project Manager, etc. to deliver several high-profile highway improvement projects in the San Francisco Bay Area while fostering strong collaboration with federal, state, and local partners. Inder Preet received a Bachelor of Science in Civil Engineering from JMI University in India and a Master of Science in Construction Engineering and Project Management from The University of Texas at Austin. He is also a registered Civil Engineer in the State of California.

JOANNA WADSWORTH, PE is the engineering manager at RTC FAST and has over two decades of experience practicing civil and transportation engineering. She has both private- and public-sector experience on a variety of projects, including traffic studies, traffic signal designs, intelligent transportation system designs and deployments, and multi-modal transportation planning and design. Her focus at RTC includes traffic management, traffic signal operations, incident management, and Smart City technology planning and design. A native of Las Vegas, Wadsworth earned a Bachelor of Science degree in civil engineering and a Master of Science in civil/transportation engineering from the University of Nevada, Las Vegas. She is a certified Professional Civil Engineer in Nevada.

CAROLE DELION, PE (Subject Matter Expert for Domestic Scan) is the Founder & CEO of Delion Consulting LLC, a Maryland-based firm specializing in advanced transportation solutions.
Before establishing her own company, Ms. Delion spent a decade at the Maryland State Highway Administration, beginning her career in transportation planning before transitioning to operations and emerging technologies. She quickly distinguished herself as a leader in connected and automated vehicles, becoming a recognized expert in the field. Her knowledge extends across transportation systems management, artificial intelligence, data governance, intelligent transportation systems, unmanned aerial systems, and electric vehicles. She is a graduate from the University of Maryland and is passionate about mentoring others to become leaders in their fields.

Appendix D: Key Contact Information & Associated Web Resources

Agency	Contact	Websites
Arizona DOT	Mohammed Islam msislam@azdot.gov	https://azdot.gov/mvd/services/professional-services/autonomous-vehicles-testing-and-operating-state-arizona
Caltrans	Inderpreet Singh inderpreet.singh@dot.ca.gov	https://dot.ca.gov/programs/traffic-operations/cav
Colorado DOT	Heather Pickerings-Hilgers, Heather.PickeringHilgers@state.co.us	https://www.codot.gov/programs/innovativemobility/mobility-technology/autonomous-vehicles
Florida DOT	Christine Shafik Christine.Shafik@dot.state.fl.us	https://www.fdot.gov/traffic/its/home
Georgia DOT	John Hibbard JHibbard@dot.ga.gov	https://www.dot.ga.gov/GDOT/Pages/OfficeDivisionDetails.aspx?officeID=17
Maryland Motor Vehicle Administration	Michele Gross mgross10@mdot.maryland.gov	https://cav.mdot.maryland.gov/
Minnesota DOT	Tara Olds tara.olds@state.mn.us	https://www.dot.state.mn.us/automated/
RTC of Southern Nevada	Joanna Wadsworth wadsworthjo@rtcsnv.com	https://www.rtcsnv.com/
NJ Transit	John (“Jack”) Dean JDean@njtransit.com	https://www.njtransit.com/Avatar
North Carolina DOT	Sarah Searcy sesearcy1@ncdot.gov	https://www.ncdot.gov/divisions/integrated-mobility/innovation/cassi/Pages/default.aspx
Ohio DOT’s Drive Ohio	Nick Hegemier Nick.Hegemier@dot.ohio.gov	https://drive.ohio.gov/home
Pennsylvania DOT	Derrick Herrmann, deherrmann@pa.gov	https://www.pa.gov/agencies/penndot/research-planning-and-innovation/automated-vehicle.html
Seattle DOT	Armand Shahbazian armand.shahbazian@seattle.gov	https://seattle.gov/transportation/projects-and-programs/programs/autonomous-vehicles
Texas DOT	Darran Anderson Darran.Anderson@txdot.gov	https://www.txdot.gov/about/programs/innovative-transportation/connected-automated-vehicles-task-force/welcome-to-texas-autonomous-vehicle-companies.html
Utah DOT	Blaine Leonard bleonard@utah.gov	https://transportationtechnology.utah.gov/automatedshuttlepilotproject/
Washington DOT	Daniela Bremmer Daniela.Bremmer@wsdot.wa.gov	https://wstc.wa.gov/autonomous-vehicle-work-group/

Key Contacts for National AV Committees

AV Pooled Fund Study

Nick Hegemier: Nick.Hegemier@dot.ohio.gov

Resources of interest:

- https://drive.ohio.gov/programs/av-cv/av-pooled-fund
- https://accelerateav.org/

AASHTO CAV Community of Practice

Daniela Bremmer: Daniela.Bremmer@wsdot.wa.gov

Resources of interest:

- https://transportation.org/cav/state-cav-community-of-practice/