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Title

Synthesis of State-Level Planning and Strategic Actions on Automated Vehicles: Lessons and Policy Guidance for California

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Publication Date

2020-09-01

DOI

10.7922/G2XG9PF1

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September 2020

Technical Report Documentation Page

1. Report No. UC-ITS-2020-55	2. Government Accession No. N/A	3. Recipient's Catalog No. N/A
4. Title and Subtitle Synthesis of State-Level Planning and Strategic Actions on Automated Vehicles: Lessons and Policy Guidance for California		5. Report Date September 2020
		6. Performing Organization Code ITS Berkeley
7. Author(s) Stephen Wong, orcid.org/0000-0002-3638-3651 ; and Susan Shaheen, Ph.D., orcid.org/0000-0002-3350-856X		8. Performing Organization Report No. N/A
9. Performing Organization Name and Address Institute of Transportation Studies, Berkeley 109 McLaughlin Hall, MC1720 Berkeley, CA 94720-1720		10. Work Unit No. N/A
		11. Contract or Grant No. UC-ITS-2020-55
12. Sponsoring Agency Name and Address The University of California Institute of Transportation Studies www.ucits.org		13. Type of Report and Period Covered Final Report (January 2020 – July 2020)
		14. Sponsoring Agency Code UC ITS
15. Supplementary Notes DOI:10.7922/G2XG9PF1		

16. Abstract

This synthesis provides a summary and comparative analysis of actions states across the United States are taking in response to automated vehicles (AVs). The research focuses on state-level stakeholder forums (e.g., task forces, committees) and state-level strategic actions (e.g., studies, initiatives, programs) initiated by a state legislature, a governor, or a state agency. The analysis found that AV stakeholder forums and strategic actions address a diverse set of focus areas, but they pay minimal attention to the implications of AVs on the environment, public health, social equity, land use, public transit, goods movement, and emergency response. Also, forums and strategic actions commonly include members from state transportation departments, the legislature, and academia; however, representatives from industry and non-governmental organizations (NGOs) are included less often. Academia and researchers participate in the majority of AV forums and actions, either in an advisory capacity (i.e., sharing expertise and experience) and/or through conducting research. Based on this analysis, the synthesis concludes with a recommendation for California to form a state-level working group representing leaders from the public sector, industry, NGOs, and academia to advise the Governor and the Legislature on AV policy across a range of focus areas.

17. Key Words Automated and autonomous vehicles, policy making, stakeholders, meetings, workshops, state government agencies, partnerships		18. Distribution Statement No restrictions.	
19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. of Pages 49	22. Price N/A
Form Dot F 1700.7 (8-72)		Reproduction of completed page authorized	

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The California Resilient and Innovative Mobility Initiative (CA RIMI) is led by the University of California Institute of Transportation Studies (UC ITS) — with branches at UC Berkeley, UC Irvine, UC Davis, and UCLA — in partnership with the California State University Transportation Consortium (CSUTC) led by the Mineta Transportation Institute (MTI) at San Jose State University. The CA RIMI serves as a living laboratory bringing together university experts, policymakers, public agencies, industry stakeholders, and community leaders to inform the state transportation system's immediate COVID-19 response and recovery needs while establishing a long-term vision and pathway for directing innovative mobility to develop sustainable and resilient transportation in California.

Acknowledgments

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Synthesis of State-Level Planning and Strategic Actions on Automated Vehicles:

Lessons and Policy Guidance for California

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Executive Summary

Executive Summary

This synthesis provides a summary and comparative analysis of actions states across the country are taking in response to automated vehicles (AVs) (i.e., vehicles capable of performing driving tasks under some to all circumstances with minimal to no human input). We focus on state-level stakeholder forums (e.g., task forces, committees) and state-level strategic actions (e.g., studies, initiatives, programs) initiated by a state legislature, a governor, or a state agency. Across the forums and strategic actions, we:

1) Analyze the focus areas being addressed (e.g., safety, infrastructure, data management and collection, emergency response, etc.)
2) Identify who participates in and/or advises AV activities (e.g., state agencies, legislators, industry representatives, non-governmental organizations, etc.)
3) Evaluate the required and recommended products/outcomes (e.g., legislation, regulations, research, networking) to address current and future AV impacts
4) Consider relevant regional differences (e.g., Midwest, Northeast, South, West), and
5) Describe the role of academia (e.g., public and private universities, research).

We also provide a brief review of recent AV actions by companies during the COVID-19 pandemic and conclude by offering recommendations for advancing AV leadership in California.

Key Findings

- AV stakeholder forums and strategic actions address a diverse set of AV focus areas, but the most common concerns are safety and testing as well as implementation and regulatory issues, with less attention paid to the implications of AVs on the environment, public health, social equity, land use, public transit, goods movement, and emergency response.

- Forums and strategic actions usually include different types of representatives. The most common members come from state transportation departments, the legislature, and academia with representatives from various industry sectors, and non-governmental organizations (NGOs) included less often.

- Forums and strategic actions are tasked to produce a wide number of deliverables and outcomes (including building partnerships and networks).

- Academia and researchers participate in the majority of AV forums and actions, either in an advisory capacity (i.e., sharing expertise and experience) and/or through conducting research.

- The Midwest region of the U.S. appears to have taken more steps than other regions in developing forums and strategic actions that 1) cover a range of focus areas, 2) include diverse representation, and 3) produce a variety of products.

- State-level actions initiated by governors tend to cover more topics and produce a larger variety of products in contrast to actions initiated by state legislatures.

Strategic Options for California

Based on our analysis, California should consider forming a multi-year state-level working group representing leaders from the public sector, industry, NGOs, and academia to advise the Governor and the legislature on AV policy across a range of focus areas (e.g., safety, social equity, environment, cybersecurity/privacy, data management and collection, public health, infrastructure, land use, etc.). This holistic, multi-issue advisory body should produce a variety of products (e.g., white papers, recommendations, convenings, webinars, cross-agency collaboration, public-private partnerships, pilot projects, and research evaluations). This interagency, multi-stakeholder group could be led by California public universities, which can act as independent, third-party facilitators and/or conveners.

Second, California should consider building a coalition with other western states to coordinate on AV regulations and policies. While several states have made significant strides in AV preparation (e.g., Washington, Oregon, California), other western states have not yet developed robust stakeholder forums. This multi-state initiative could serve as a community of practice for sharing lessons learned, streamlining policies, and ensuring seamless AV interstate commerce and travel. In addition, alignment of western states on AV policy would help to improve the region's strategic advantage over other areas in the United States, building longer-term economic competitiveness.

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Introduction

With the growth of AV technology, governments across the U.S. are beginning to 1) allow AV testing, 2) address potential liability issues, 3) consider possible safety regulations, and 4) assess future economic benefits. AVs have been proposed as a strategy to decrease the number and rate of vehicle crashes, reduce fatalities, smooth traffic flow, increase economic productivity, lower energy use, decrease parking needs, and improve mobility and accessibility (Fagnant and Kockelman, 2015; Greenblatt and Shaheen, 2015; Shladover, 2017; Sperling, 2018)[1]. The environmental advantages of AVs for decreasing greenhouse gas emissions (GHGs), particularly as part of shared and electrified fleets, have also been identified (Sperling, 2018). Despite these potential benefits, significant limitations and challenges remain. First, research has suggested that AVs are likely to increase vehicle miles traveled (VMT) (Fagnant and Kockelman, 2015; Harb, et al., 2018), leading to increased energy use and pollution (Greenblatt and Shaheen 2015). In addition, AVs may shift travelers away from public transit and lead to more dispersed development patterns (Litman, 2020). Other problems related to AVs may include reduced security and privacy (from data collection requirements); increased infrastructure, vehicle, and services costs; and reduced employment for transportation network company (TNC) drivers (Fagnant and Kockelman, 2015, Litman, 2020).

How is California Preparing for Automated Vehicles?

The California Legislature started to actively introduce AV legislation in 2012 with Senate Bill (SB) 1298 (2012), requiring safety standards and performance requirements for AVs (see Table 1 for passed and pending legislation and Table 2 for failed legislation). However, passed and pending legislation have largely addressed individual components of AV implementation, such as testing and insurance, in a piecemeal manner. For example, Assembly Bill (AB) 1592 (2016) and AB 1444 (2017) permitted AV pilot testing for two different transportation authorities. AB 1184 (2018) permitted only the City and County of San Francisco to set AV taxes. Two bills — AB 87 (2018) and AB 516 (2019, pending) — only address how unauthorized AVs can be removed from the road and seized (e.g., for traffic violations). So far, the state has not developed a systematic legislative AV strategy; however, SB 59 (2019, pending) aims to form a multi-stakeholder advisory committee on AV policy headed by the California Transportation Commission (CTC) to address the effect of AVs on the environment, energy, and public health. Further details on SB 59 (2019, pending) can be found in the Appendix.

Executive branch activities have been largely led by the California Department of Motor Vehicles (DMV). In 2014, the DMV adopted regulations related to testing AVs on public roads. This has included testing with drivers present in the vehicle and vehicles without a driver (specifically the Autonomous Vehicle Driverless Tester Program). Both testing programs require a permitting process, collect AV collision and disengagement (e.g., when a vehicle leaves automated/autonomous mode) reports, and report mileage of AV testing. As of May 2020, 66 companies have been issued an AV testing permit with a driver inside the vehicle and as of April 2020, two companies have been issued an AV driverless testing permit (i.e., no driver in the vehicle). In 2018, AV testing expanded to include the California Public Utilities Commission (CPUC) with the creation of two pilot programs for passenger AV services. In the same year (2018), the California Multi-agency Workgroup on AV released the Automated Vehicle Principles for Healthy and Sustainable

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1 While some stakeholder forums and strategic actions either mention connected vehicles (CVs) or include CVs in the title of the forum and actions, we focus on AVs in this synthesis.

Communities that provides guidance for deploying AVs in alignment with the public interest and established state environmental and community goals. The Workgroup includes staff representatives from California Environmental Protection Agency, California State Transportation Agency, Caltrans, California Air Resources Board, California Department of Public Health, California Energy Commission, Department of General Services, DMV, Governor's Office of Business and Economic Development, the Governor's Office of Planning and Research, and the Strategic Growth Council. While the state has made progress in addressing AVs, the piecemeal approach and division of responsibility among the legislature and state agencies increases the likelihood of policy conflicts and duplicative work.

Table 1. Passed and Pending AV Legislation in California

Bill Number	Year	Description
SB 1298	2012	Requires the CA Highway Patrol and DMV to adopt safety standards and performance requirements of AVs; allows AVs to operate on public roads
AB 2734	2014	Expands the mechanisms and instruments for AV insurance coverage
SB 1204	2014	Creates the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program and includes AV projects as eligible for funding
AB 1592	2016	Authorizes the Contra Costa Transportation Authority (CCTA) to test AVs not equipped with a steering wheel, a brake pedal, an accelerator, or an operator inside the vehicle
AB 97	2017	Provides an additional $3.5 million in funds to the CCTA for planning, construction, and operation of an expanded AV testing facility
AB 669	2017	Extends the sunset date of the law allowing the testing of vehicle platooning
AB 1444	2017	Authorizes the Livermore Amador Valley Transit Authority to conduct a shared autonomous vehicle demonstration project for vehicles that do not have a driver seat, steering wheel, a brake pedal, or an accelerator.
SB 145	2017	Repeals the requirement that the DMV must notify the Legislature of an application for driverless autonomous vehicle testing
SB 595	2017	Authorizes a vote to increase bridge tolls in Bay Area by $3, which will fund a range of public transit improvements, including $10M to implement Shared Autonomous Vehicles (SAVs) to improve first- and last-mile public transit connectivity (administered by the CCTA)
AB 87	2018	Authorizes public employees who engage with traffic and parking laws to remove autonomous vehicles without a valid permit from the road
AB 1073	2018	Shifts funding in the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program toward zero-emission technology
AB 1184	2018	Authorizes the City and County of San Francisco to set taxes on rides originating in San Francisco provided by autonomous vehicles (whether via a TNC or other person); sets limits of taxes with lower ceilings for shared rides and rides provided by zero-emission vehicles

Bill Number	Year	Description
SB 1014	2018	Requires transportation network companies (TNCs) to account for and reduce the greenhouse gas emissions of their operations (setting stage for AVs)
ACR 215	2018	Expresses support for 23 Asilomar Artificial Intelligence (AI) Principles, which includes references to AVs
SB 59 (pending)	2019	Requires the California Transportation Commission to establish an advisory committee, the California Council on the Future of Transportation, to provide the Governor and the Legislature with recommendations for changes in state policy to ensure that California continues to be the world leader in autonomous, driverless, and connected vehicle technology
SB 336 (pending)	2019	Requires a public transit operator to ensure each of its fully automated transit vehicles are staffed by at least one of its employees while the vehicle is in service
AB 516 (pending)	2019	Alters the circumstances in which peace officers and public employees can remove or immobilize vehicles, including autonomous vehicles
AB 1964 (pending)	2020	Expands the definition of autonomous vehicles to include remotely operated vehicles and revises definitions related to collision avoidance systems

Note: Bills with non-substantive changes or brief references of AVs were excluded from both Table 1 and Table 2

Note: AB 96 (2017) was an earlier version of AB 97 (2017) but the line item for CCTA was not changed

Table 2. Failed AV Legislation in California

Bill Number	Year	Description
AB 2258	2014	Authorizes the City of Lancaster to research and develop autonomous public buses
AB 2866	2016	Allows the operation of AVs without a driver in the vehicle or without a brake pedal, accelerator, or steering wheel once meeting specific requirements and provisions
AB 2415	2016	Shifts funding in the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program toward zero-emission technology
AB 399	2017	Extends the CCTA AV pilot project for one year
AB 623	2017	Changes definition of AVs and requirements for the DMV in approving operation of AVs on public roads
AB 1141	2017	Requires the DMV to develop regulations for testing AVs used to transport freight
AB 1160	2017	Changes the definition of AVs to reflect autonomous technology or specified automation levels
SB 251	2017	Authorizes the County of Merced to test AVs not equipped with a steering wheel, a brake pedal, an accelerator, or an operator inside the vehicle
SB 369	2017	Clarifies that a vehicle with a collision avoidance system that still requires full human driver engagement is not an AV
SB 802	2017	Creates the emerging vehicle technology advisory study group led by the Office of Planning and Research

Bill Number	Year	Description
AB 2638	2018	Designates roads within the Castle Commerce Center in the County of Merced as non-public roads for purposes of AV regulatory requirements including disengagement and incident reporting
SB 1184	2018	Authorizes shared autonomous vehicle pilot projects near transit in the City of Sacramento
ACA 21	2018	Increases General Fund allocation to the California Infrastructure Investment Fund for specified infrastructure investments (including AV infrastructure) and deferred maintenance projects

Note: Bills with non-substantive changes or brief references of AVs were excluded from both Table 1 and Table 2

What are Other States Doing to Prepare for Automated Vehicles?

We conducted a review of state-level AV stakeholder forums (e.g., committees, task forces) and strategic actions (e.g., programs, initiatives) initiated through legislation, executive orders, or state agencies (e.g., departments of transportation, departments of motor vehicles) between 2014 and 2019. Information on current, pending, and recent actions and legislation was collected between January and March 2020 from individual state legislation and executive order databases and multi-state databases (e.g., the National Conference of State Legislatures); state departments of transportation websites; newspapers; and search engines. Figure 1 presents state-level strategic actions initiated across the 50 states and the District of Columbia (DC), while Table 3 presents the breakdown of the forums and strategic actions based on how each state defines its AV stakeholder forum or strategic action. Figure 2 shows that the most state actions have been initiated since 2017 and Figure 3 breaks down state actions by initiating body and region. We then present key takeaways from our review. We note that we found 51 different forums and strategic actions, but some states had multiple forums/actions while several states had none.
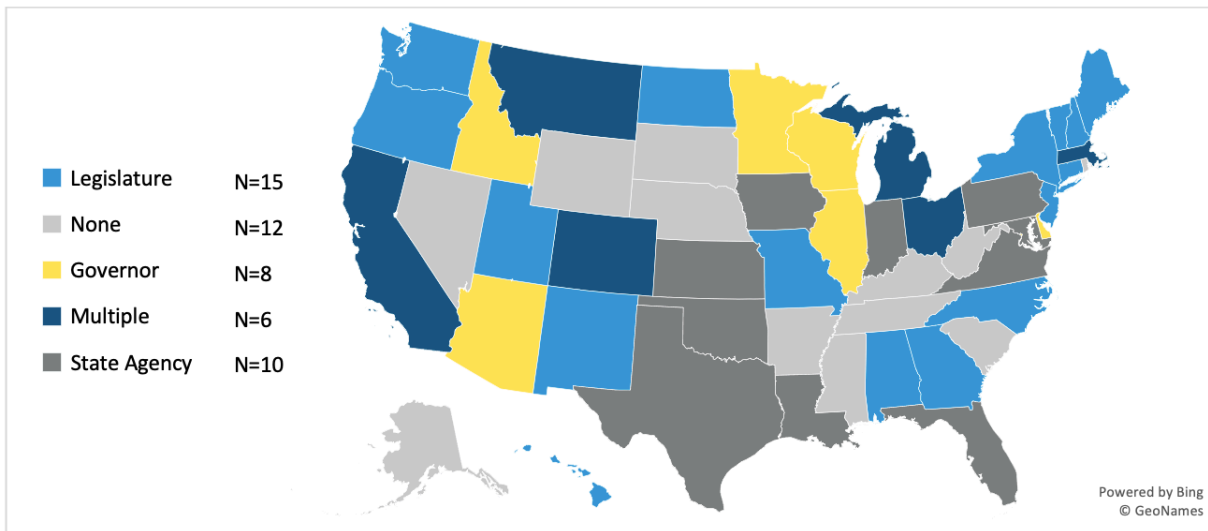
Figure 1. Map of the United States with States Color Coded by Bodies Initiating State AV Forums and Strategic Actions (n=51 states and DC)

Note: The Washington AV Working Group was initiated by both the governor and legislature. We classify the action as a legislative action only since: 1) the bill (HB 2970, 2018) gave statutory authority to the forum and 2) both the executive order and bill created the same forum (unlike multiple bodies creating *different* forums in other states).

Note: State agencies may be also following legislative and executive rules and regulations.

Table 3. Stakeholder Forums and Strategic Actions of AVs as Described by States (n=51 actions)

Forum or Strategic Action	# of States and DC	States and DC
Committees	12	AL, AZ, CA*, GA, ID, ME, MT, NH*, NM, NC, OH, WI
Task Forces	9	CO, CT, HI, MO, NJ, NY(2)*, OR, PA, TX
Programs	8	AZ, CA, CO, FL (2), MI, OH, VA
Working Groups	5	DC, MD, MA, OK, WA
Initiatives	3	FL, IL, IN
Commissions	3	ME, MA, MT
Councils	3	DE, MI, MN
Studies	2	ND, UT
Other**	5	HI, IA, KS, LA, VT

* Pending legislation

** E.g., Creating a CAV contact, AV projects, vision plans, technology teams, and stakeholder meetings
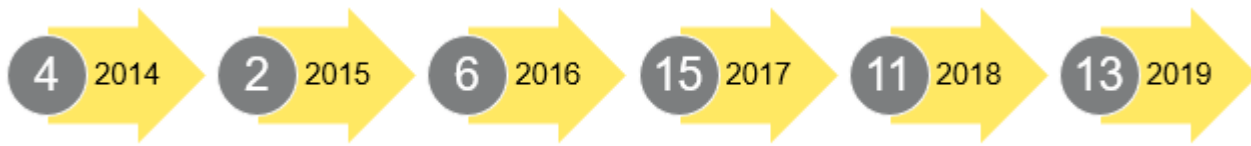
Figure 2. Timeline of AV Stakeholder Forums and Strategic Actions by Year (With Pending Legislation)
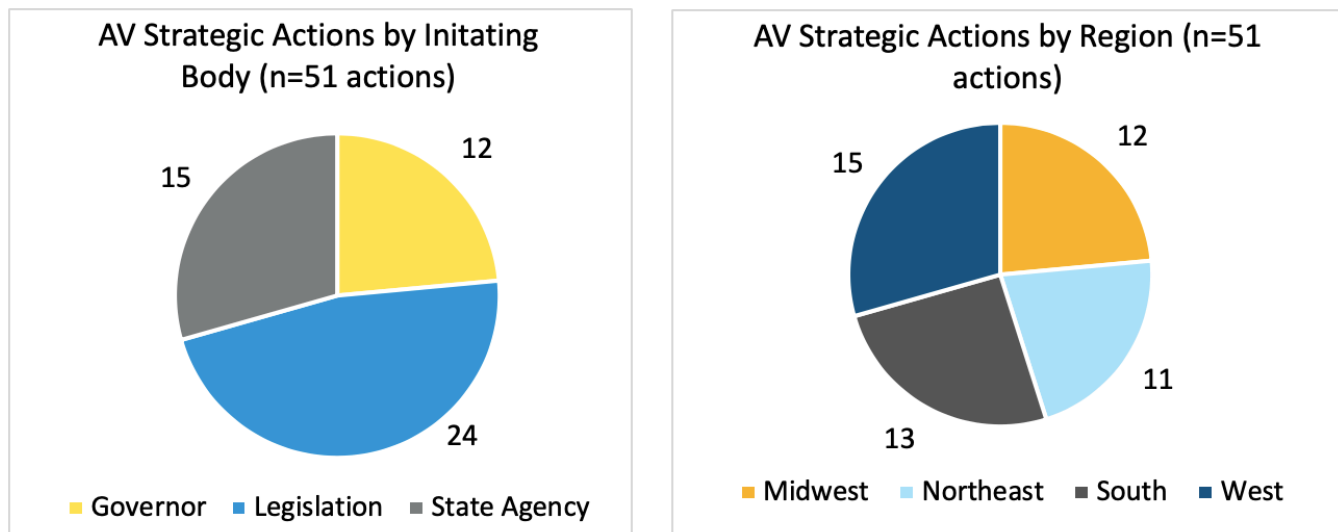
Figure 3. Number of AV Strategic Actions (n=51) Colored Coded by Initiating Body and Region Since 2014

Key: Census Regions

Midwest	Northeast	South	West
Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, and Pennsylvania, Rhode Island, Vermont	Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia	Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

Key Findings

1) AV stakeholder forums and strategic actions (n=51) primarily focus on safety, testing, and infrastructure. Safety and infrastructure are especially important for Midwestern and Southern states, while testing is emphasized in Northeast and Western states.

Out of 51 state strategic actions, 73 percent include a strong focus on safety (Figure 4). Safety concerns are typically described in terms of ensuring AV technology is safe enough for public roads or researching AV safety benefits. Testing procedures and processes for technology companies and auto manufacturers is also a key focus for most actions (61 percent). Infrastructure is also a popular focus area (55 percent) and usually addresses changes to the built environment that may be needed to integrate AVs and CVs. States in the Midwest and South focus more on safety and infrastructure while the Northeast and West prioritize testing. Details can be found in Table A1 in the Appendix.
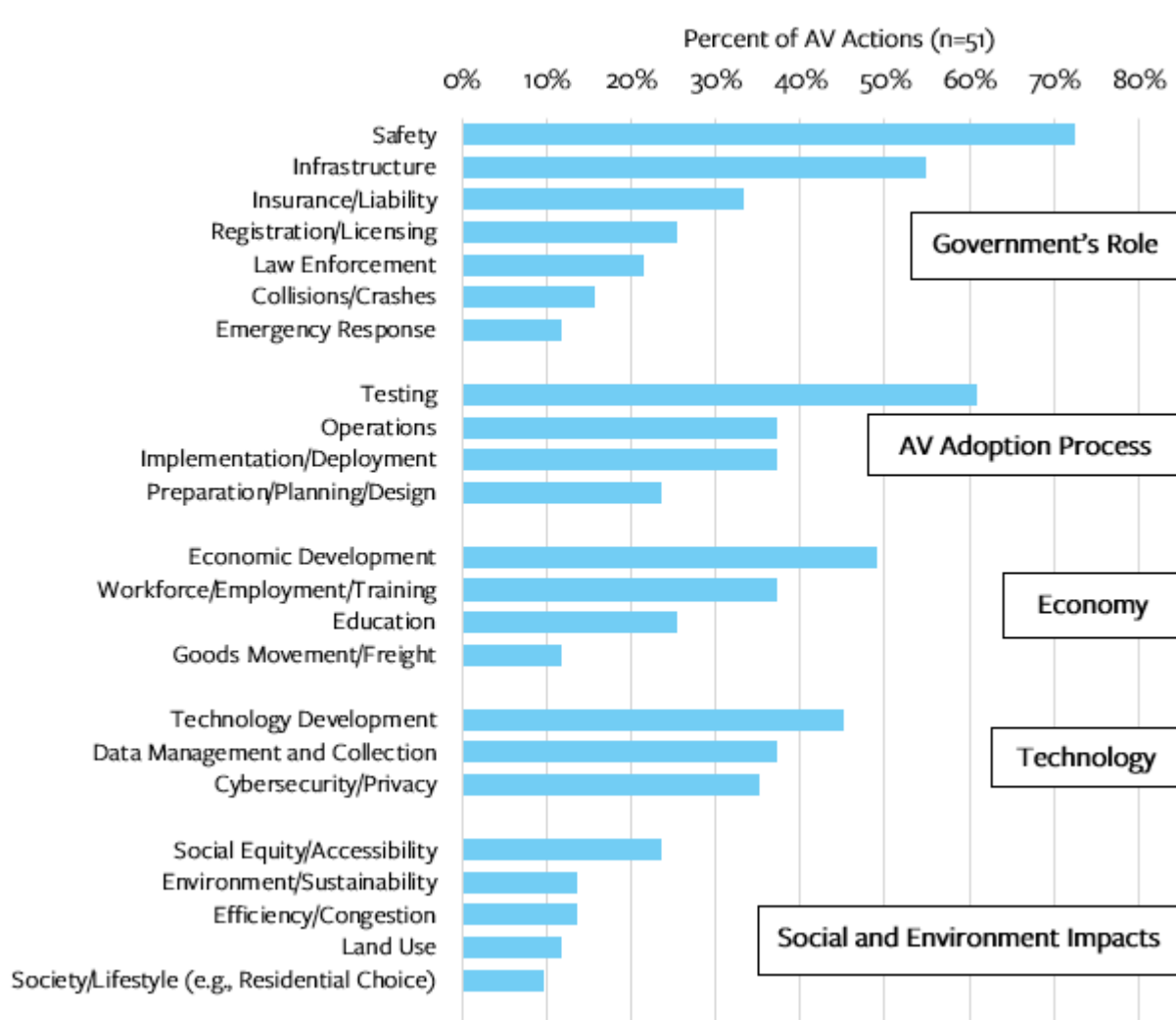
Figure 4. Focus Areas of AV Stakeholder Forums and Strategic Actions (n=51)

Note: Percentages are out of all AV actions (n=51) and areas of AV actions are labels only

2) Many state actions, especially from the Midwest and South, place a strong emphasis on the economic benefits of AVs. However, states across the U.S. are less prepared overall for workforce changes.

Almost half of the state strategic actions include a focus on economic development (49 percent), while 37 percent of actions consider workforce, labor, and/or training changes (see Figure 4). Economic development, in particular, is part of 83 percent of actions from Midwestern (n=12) and 69 percent of Southern (n=13) states (see Table A1 in Appendix). Economic development is typically described in terms of economic competitiveness and building a more robust economy that increases AV technology investment in the state. However, some states are concerned about AV impacts on jobs including reduced employment for professional drivers and requiring new AV training and job programs. Training also involves preparing workers to sit behind the wheel of an AV as drivers are often required for testing AVs on public roads.

3) On average, states place only moderate emphasis on the AV adoption process (in contrast to priority focus areas such as safety and economic development), and emphasis depends on the region.

Fewer state strategic actions are focused on aspects of the AV adoption process other than testing, from operations on public roads (37 percent) to implementation and deployment (37 percent) to planning and preparation (24 percent) (see Figure 4). While these adoption-related focus areas are not universal, they point to a phasing in of AV technology and the need for states to address many steps in the AV adoption process. Southern state actions (n=13) prioritize planning and preparation (46 percent); Midwestern state actions (n=12) emphasize implementation and deployment (67 percent); and Northeastern state actions (n=11) concentrate on operations (55 percent) (see Table A1). Thus, less attention is focused on how to holistically guide and regulate AV adoption across all adoption steps.

4) States are placing less emphasis on the implication of AVs for consumers (including data sharing, cybersecurity/privacy, insurance and liability, and registration/licensing) compared to priority focus areas (such as safety and economic development). This suggests the potential for consumer protection issues to arise in the future.

While some states (e.g., Florida, Indiana, Louisiana) focus their concern on AV and CV technology (e.g., hardware and software), others are more concerned about the implications of technology. Data management and collection are important focus areas for 37 percent of state actions while cybersecurity/privacy are important for 35 percent (see Figure 4). States are somewhat concerned about liability in crashes and long-term implications related to insurance (33 percent) and registration/licensing (25 percent) for either test drivers or future private AV ownership. These technological impacts also vary across the regions. Midwestern state actions (n=12) are addressing these issues more so than other regions (see Figure A1 and Figure 5). Southern state actions (n=13) are not currently focusing on registration/licensing (0 percent), while Northeastern state actions (n=11) are behind other regions on data (18 percent) and cybersecurity/privacy (18 percent) (see Table A1). For most states, these results suggest that without federal guidance state AV regulations could creating a patchwork of different laws that fail to comprehensively protect consumers.

5) The implications of AVs in terms of the environment, social equity, goods movement, land use, and emergency response are only associated with more comprehensive statewide AV actions.

State actions are less focused on the impacts of AVs on the environment (14 percent), land use (12 percent), goods movement/freight (12 percent), and emergency response (12 percent) (see Figure 4). These focus areas are typically reserved for ongoing AV forums, such as the Washington Autonomous Vehicle Work Group, the DC Interagency Working Group in AVs, the Oregon Task Force on Autonomous Vehicles, and the Massachusetts Autonomous Vehicle Working Group. The limited focus on the environment indicates minimal integration of AV policy with climate change goals and efforts to reduce vehicle miles traveled (VMT). Twenty-four percent of AV actions address the issue of social equity and accessibility, particularly the implications of AVs for older adults and individuals with disabilities. This focus is more common for Midwest states (42 percent) (Table A1). Overall, societal and lifestyle changes (e.g., residential choice, quality of life) are a key focus area for only 10 percent of AV actions.

Region	Midwest	Northeast	South	West
# of Key Focus Areas Region Leads Over All Other Regions*	9	8	4	2
Top Three Focus Areas Each Region Leads Over All Other Regions	Data Management and Collection Economic Development Implementation/ Deployment	Operations Emergency Response Testing	Preparation/ Planning Infrastructure Efficiency/ Congestion	Collisions/Crashes Environment/ Sustainability ----------------------

Figure 5. What Region is Ahead of Other Regions by AV Focus Areas? (Based on Strategic Actions, n=51)

* Focus areas covered by five or more actions (n=23)

Note: Some states (e.g., Washington in the West and North Carolina in the South) cover a diversity of topic areas, which is partially obscured by the regional (e.g., group of states) analysis of focus areas.

6) Few states are considering AV connections to public transit, shared mobility, mobility on demand or mobility as a service, urban air mobility, and public health.

Public transit and shared mobility are primary areas of interest for AV deployment in less than five states (Table A1 in Appendix, bottom). This suggests that current state policies are not proactively pivoting away from private vehicle ownership toward a fleet model (e.g., groups of vehicles owned/leased by an entity) Further, very few states are currently incorporating public health considerations into their AV actions (e.g., air quality/emissions, active transportation, quality of life, residential choice, travel behavior, infectious disease prevention). Finally, little attention is focused on urban air mobility (e.g., electric and/or automated flying vehicles) (2 percent), despite possible increasing integration of both electrification and drone automation in goods delivery.

7) AV actions initiated by executive orders tend to cover a broader range of AV issues compared to actions initiated by state legislatures or state agencies.

Stakeholder forums and strategic actions initiated by executive orders (n=12) appear to cover a wider range of AV focus areas, than those initiated by state legislature or state agencies. In particular, those actions include safety, testing, infrastructure economic development, technology, and cybersecurity/privacy (all at or above 75 percent as seen in Figure 6 and Table A2 in the Appendix). Legislative-initiated actions (n=24) also tend to be fairly diverse in the focus areas addressed but are more limited. State agencies (n=15) place considerable attention on safety (93 percent), but five focus areas (i.e., insurance/liability, registration/licensing, law enforcement, environment, land use) are not addressed by any state agency. Executive orders can be easily crafted to confer forums and strategic actions with a wide range of priorities and often do not require input from other stakeholders (e.g., legislators, state agencies).
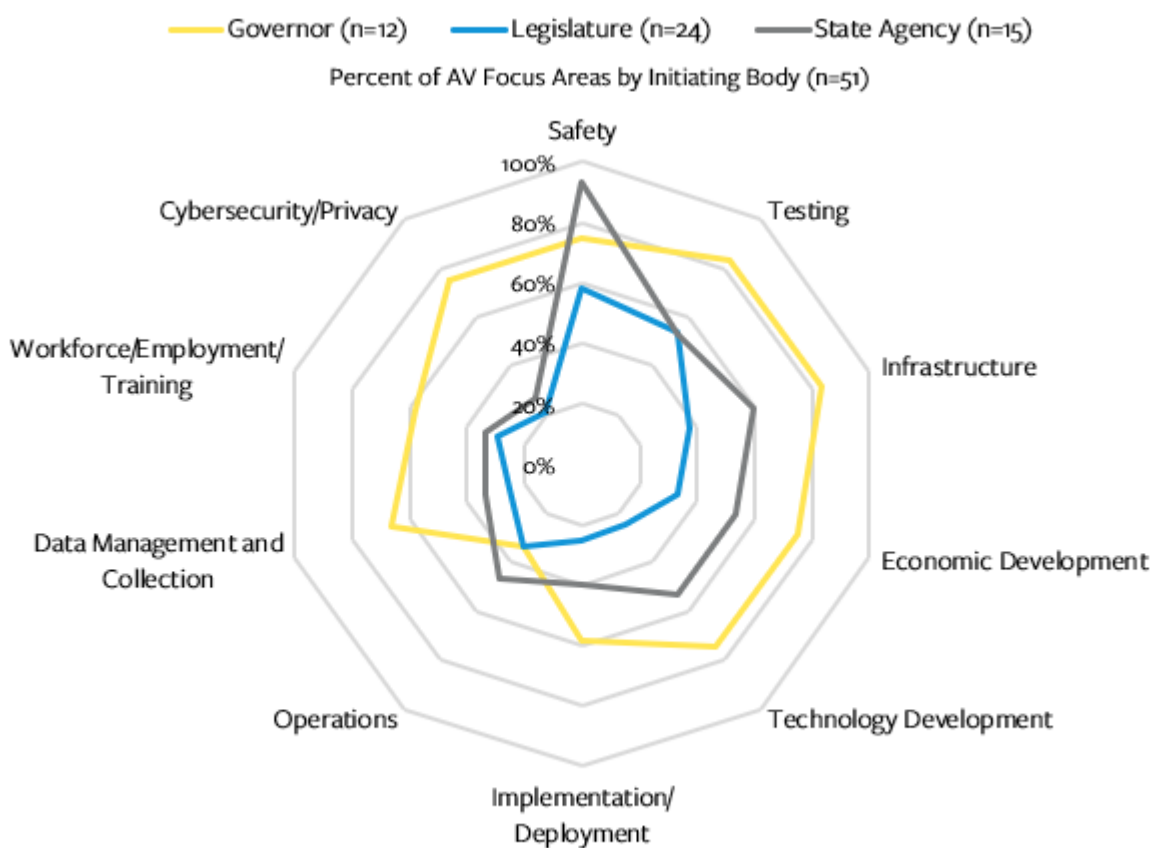
Figure 6. Percent of AV Focus Areas by Initiating Body (n=51)

8) Regardless of region, AV forums and strategic actions most often include officials from state departments of transportation (DOTs), state legislators, and academics/researchers.

Of the 51 state actions, 33 stakeholder forums and strategic actions include advisors and/or representatives (appointed or ex-officio). At least one official from a state DOT is represented in 85 percent of forums and strategic actions, followed by

state legislators (61 percent) and professors/university researchers (55 percent) (Figure 7). This representation is fairly consistent across regions, though all Midwestern forums and strategic actions (n=5) include state legislators (Table A3). These results together indicate that DOTs are almost always involved in AV policy, regulations, and coordination, while legislators and academics are less common.

9) Many state departments and agencies are involved in forums and bodies with members (n=33), indicating coordination and integration for some (but not all) actions.

Six state departments (i.e., commerce/economic development/business, public safety/protection, insurance, technology/information, motor vehicles or DMV, highway patrol/police) are represented in 36 percent to 42 percent of the 33 stakeholder forums and strategic actions (Figure 7). The diversity of agencies parallels the diversity of AV focus areas, but it also highlights the strong emphasis on topics related to safety, economic development, and insurance. The results suggest that some coordination exists where the forum or strategic action is a mechanism to gather all relevant agencies in the same place to discuss pressing AV issues. While the approach is less scattershot and avoids duplicative work, many forums and bodies do not have representatives from key state agencies, and regions differ over which agencies are represented.

10) Industry is somewhat represented in the 33 AV forums/bodies that include members. This indicates AV economic development and public-private partnerships receive some consideration.

Technology/AV/communication companies or organizations representing the industry are the most represented sector (39 percent) (Figure 7). Their membership on forums and bodies is especially high for Midwestern and Western states (both 60 percent), which likely reflects their economic development goals and/or the location of the headquarters of many of these companies (see Table A3). Automakers/manufacturers are represented 36 percent of the time and are often included if a technology/AV company is included. Industry sectors including insurance, freight/logistics, and consulting/law/other are each part of 24 percent of forums and bodies. Industry representation could help to address important AV challenges and policies and begin building public-private partnerships.

11) Many organizations, state agencies, and groups are not included in the 33 AV forums/bodies with members, suggesting important interests may not be represented in policy development.

A considerable number of organizations, state agencies, and groups (e.g., environmental agencies and organizations, labor/workforce agencies, consumer protection organizations, social equity organizations, bicycle/pedestrian safety organizations) are only represented in a few AV forums or bodies (Figure 7). This limited representation may suggest that states are reacting to AV technology in contrast to proactively guiding AV development. This underrepresentation also indicates that some interests, such as those related to social equity, the environment, or land use, may not be addressed in the forums/bodies, which could result in poorer AV outcomes (e.g., lower accessibility, higher GHGs, increased VMT).
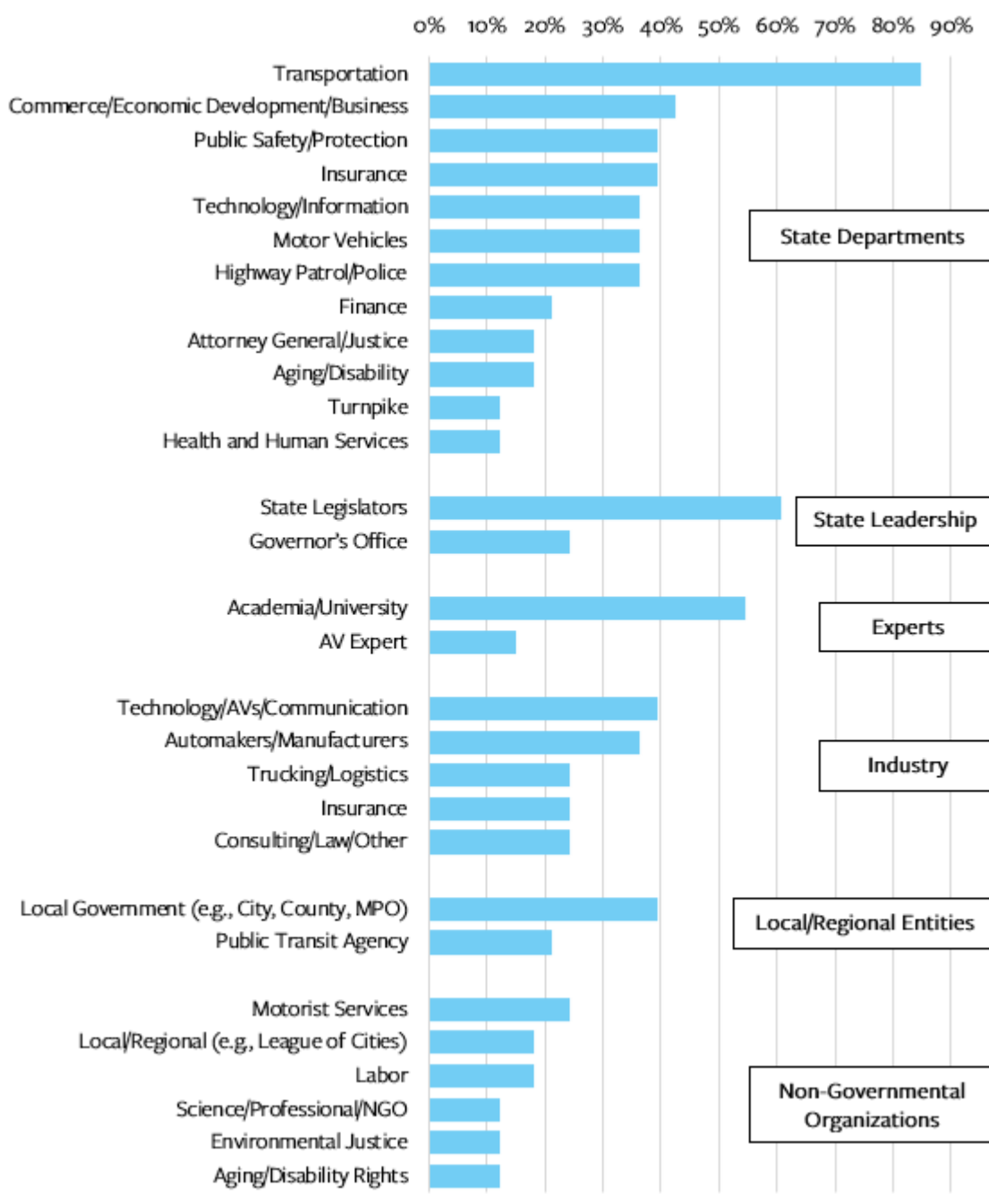
Figure 7. Representation on AV Stakeholder Forums and Strategic Actions with Members (n=33)

Note: The term AV expert is mentioned by several policies as a possible forum member but required qualifications are not listed.

Note: Not all individuals serve on committees together. However, some states (e.g., California, Oregon, Pennsylvania, Washington) have formed committees (or potential committees) with representation across most areas in Figure 7.

12) Legislative actions are more likely to require a stakeholder forum or strategic action to include members and/or advisors. Governor-initiated actions tend to be more inclusive of key agencies, organizations, and outside groups.

The majority of actions with a member-led forum or strategic action (n=33) were initiated by legislatures (61 percent) (see Table A4 in Appendix). Governor-initiated actions tend to include key state departments (e.g., transportation, commerce/economic development/business, insurance, public safety/protection). While all Governor-initiated actions include the state DOT, only 75 percent of legislature-initiated actions include state legislators (Figure 8). State agency-initiated actions seem less likely to involve other agencies, though when they do, they tend to include a variety of perspectives and interests (e.g., multiple industry sectors, non-governmental organizations, multiple state-level departments).
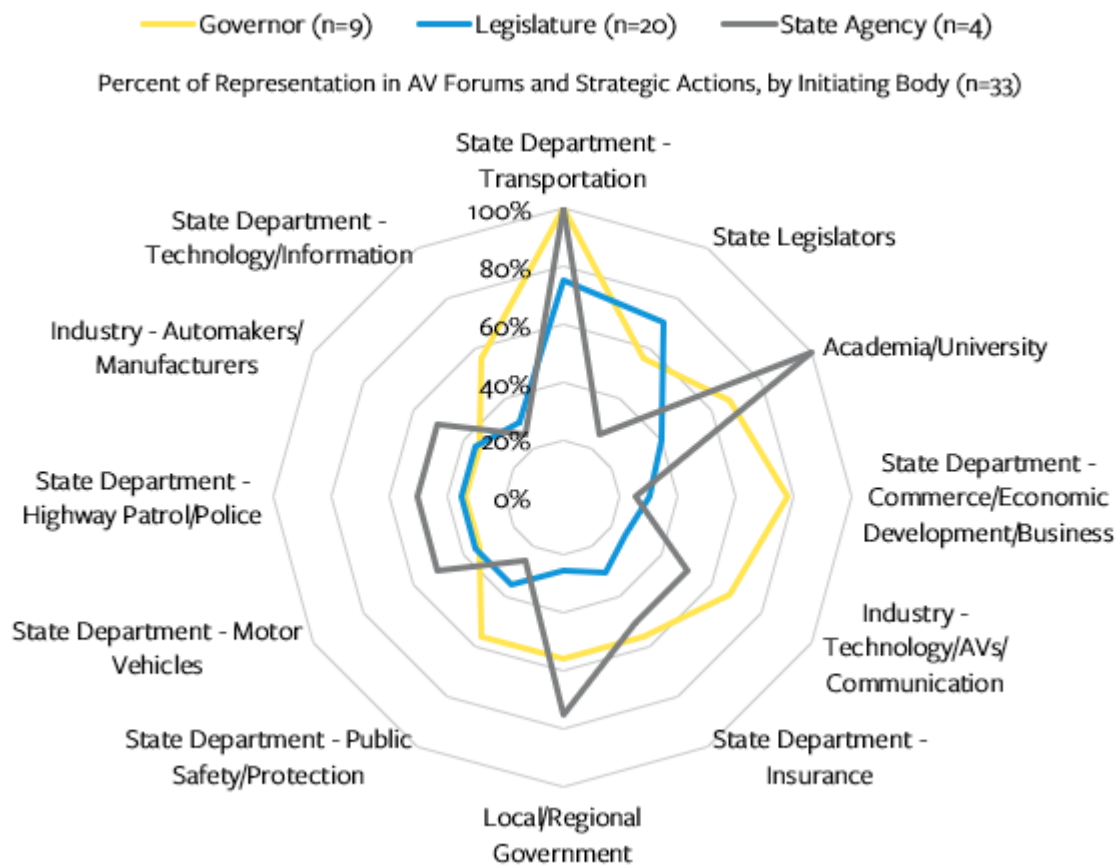
Figure 8. Percent of Representation in AV Forums and Strategic Actions, by Initiating Body (n=33)

Note: As an example, Figure 8 shows that 100% of actions with stakeholder representation initiated by Governors (n=9) and state agencies (n=4) included a state transportation agency. In contrast, only 75% of legislature-initiated actions (n=20) included a representative from a state transportation agency.

13) Most AV actions (n=51) require a report and/or recommendations/findings.

Of the 51 state actions, most require a report (73 percent) or recommendations/findings (69 percent) regarding AV topics (Table A5). In most instances, these are required by legislation or executive order (see Figure 9). Only about 40 percent of AV actions initiated by state agencies require a report or recommendations. Research is significantly more prevalent for Governor-initiated actions (58 percent) in contrast to legislative-initiated (33 percent) and agency-initiated actions (27 percent).
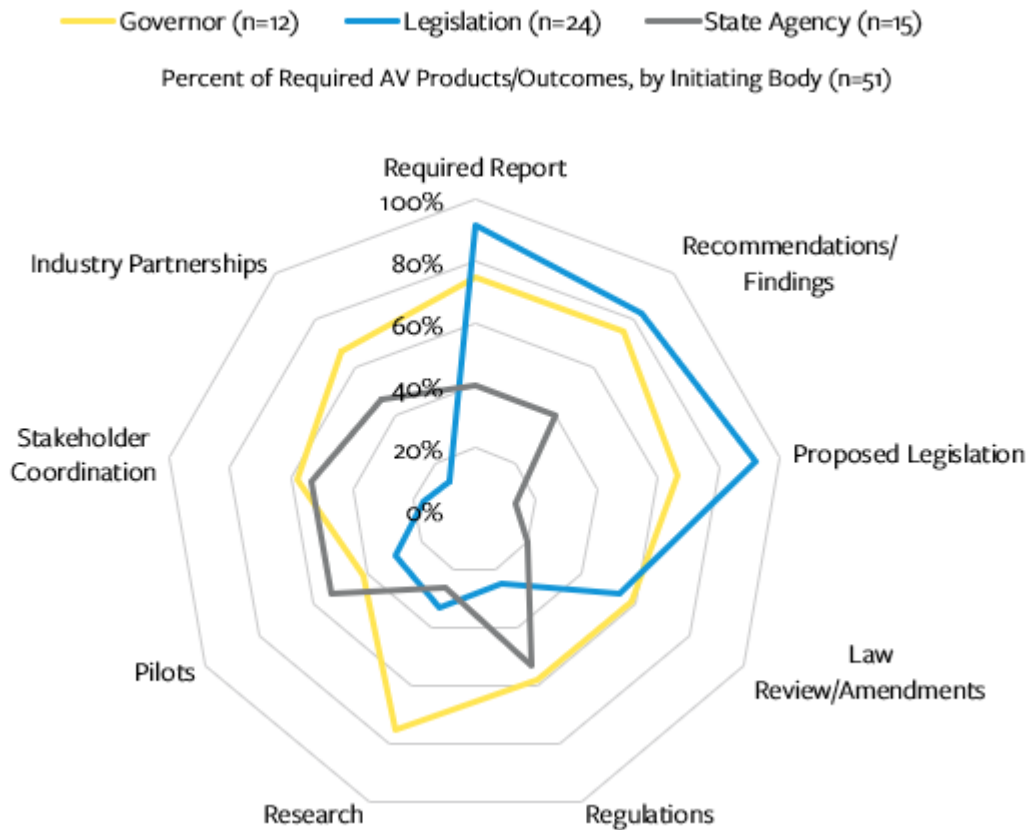
Figure 9. Percent of Required AV Products/Outcomes, by Initiating Body (n=51)

Note: As an example, Figure 9 shows that 92% of legislature-initiated actions (n=24) required a report, but only 40% of state agency actions (n=15) required one.

14) Most AV forums and bodies are designed to propose new legislation and create new regulations, along with reviewing and potentially amending current laws.

AV actions are often future oriented: 63 percent seek to propose new legislation and 41 percent call for developing new regulations (see Table A5 in the Appendix). In addition, 45 percent of actions are tasked with reviewing current legislation and/or considering amendments to the legislation (Table A5). Only four state actions do not incorporate any of these policymaking products.

15) AV research, pilot projects, stakeholder coordination, industry partnerships, and best practices are employed to prepare states for driverless vehicles.

Many state actions include conducting research (41 percent), establishing pilot projects (39 percent), and developing best practices (31 percent) (see Table A5 in the Appendix). In many cases, these deliverables are specifically described in the initiating legislation or executive order. A total of 37 percent emphasize coordination among stakeholders, such as among multiple state departments and different levels of government. Thirty-five percent of state actions emphasize building partnerships with industry (e.g., automakers, technology companies, insurance companies) to more effectively respond to AV technology and grow business opportunities. These results indicate that some states will be highly prepared to deal with the consequences of AV implementation (e.g., transition to driverless vehicles, new business models, changing land use patterns) through strategies such as forming partnerships and adopting best practices.

16) AV products/outcomes differ by the initiating entity, with AV actions driven by priorities in the legislature and integration across state agencies.

Legislature-initiated actions (n=24) focus predominately on generating reports (92 percent), producing recommendations/findings (83 percent), informing proposed legislation (92 percent), and reviewing/amending current legislation (54 percent) (see Figure 9). State agency-initiated actions (n=15) show most interest in pragmatic outcomes such as pilot projects (53 percent), stakeholder coordination (53 percent), physical projects (e.g., connected vehicle test beds, infrastructure sensors) (47 percent), and developing industry partnerships (47 percent). Governor-initiated AV actions encourage a broad range of products (nine different products/outcomes are required for 50 percent of actions).

17) Regions differ on expected AV products. This could result in incompatible laws across state borders or regions.

Regional differences in expected AV products indicate that Midwestern states are considering the greatest number of approaches to AVs (e.g., reports, pilot projects, etc.) (see Figure 10 and Table A6 in the Appendix). Northeastern states focus predominately on reports (100 percent), recommendations (100 percent), and proposed legislation (73 percent). Southern states expect a range of products but place more emphasis on pilot projects, stakeholder coordination, and industry partnerships compared to other states. Western states prioritize reports, recommendations (i.e., findings from reports), proposed legislation, and law reviews/amendments, but to a lesser degree than Midwestern states. These regional differences in approach could lead to different, and possible inconsistent state policies regarding AVs in the absence of federal guidance.
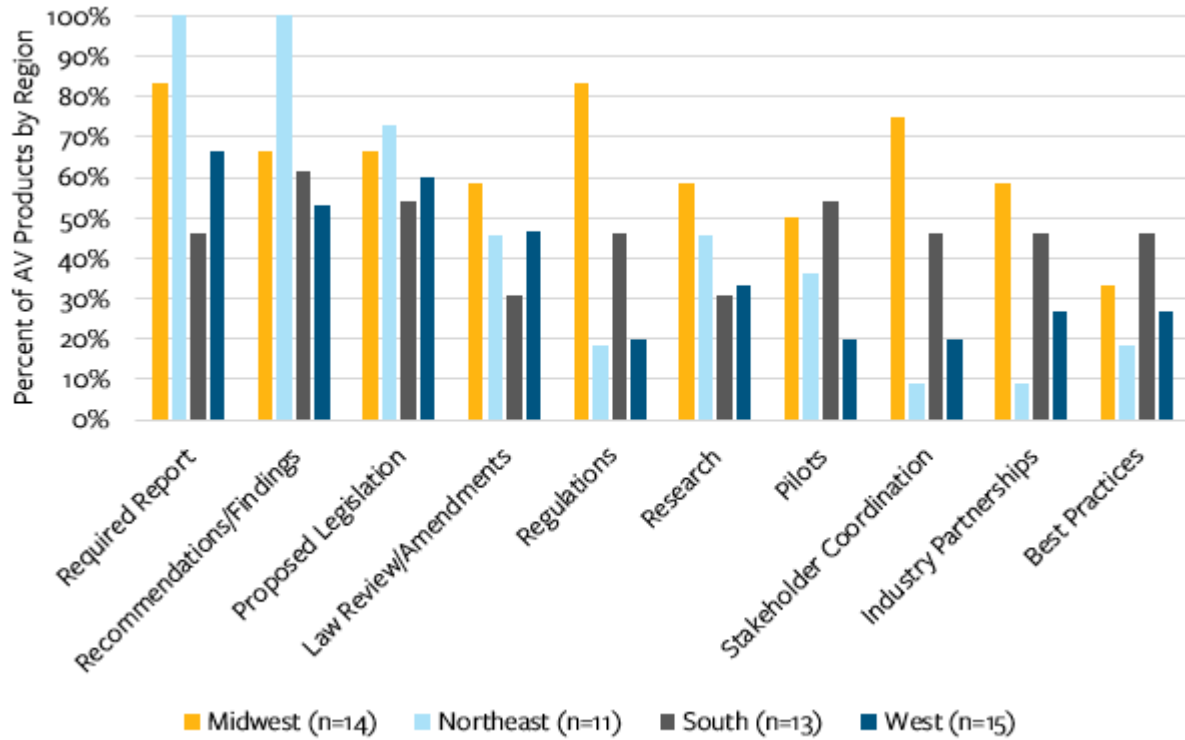
Figure 10. Percent of AV Products by Color Coded Region (n=51)

18) Universities and academics are actively involved in AV actions, serving as members on committees, councils, and task forces or partnering with AV entities on research.

Professors or university researchers are members or advisors on 18 AV actions (55 percent) out of the 33 that have forums or membership bodies (see Figure 7). Universities are a part of an additional 17 actions out of all 51, ranging from conducting AV research to developing facilities for AV testing. Across all AV actions with academic representation or involvement (n=33), all include public universities, and 9 percent also include private universities (see Figure 11). Forty-three percent of actions with academic representation involve two or more university systems; primarily in the West and in states with more than one highly ranked public institution. Engaging multiple public universities/colleges can encourage collaboration that could pool resources (e.g., equipment, testbeds, simulators) and involve more experts.
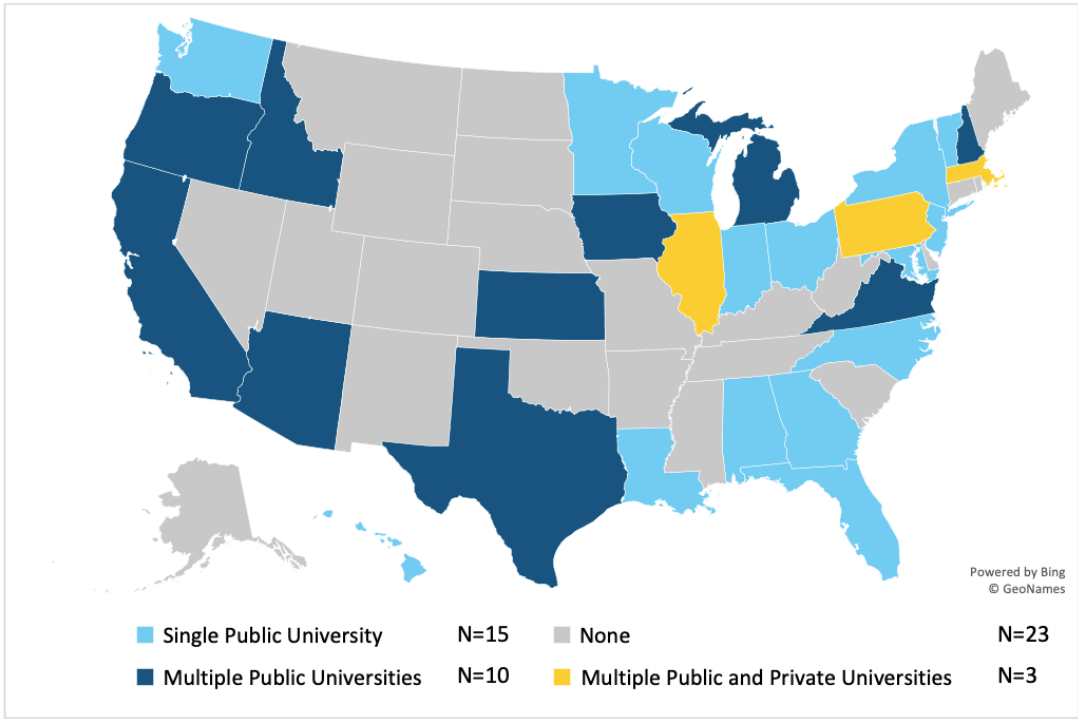
Figure 11. Map of the United States Color Coded by Academic Collaboration and Representation on AV Actions by State (n=51 states and DC)

Note: The map does not include AV research collaborations with national laboratories, federal funding partners, or private companies.

Automated Vehicles During COVID-19

Over the last six years, a significant number of states have responded to AV technology through different policy mechanisms and actions. However, a new era of actions may be imminent as COVID-19 has become one of the most transformative crises to affect the transportation system in the past century. With the severe impacts of COVID-19 around the world and across the United States, states may begin to act on AVs in several possible ways. First, states overwhelmed with the immediate public health, economic, and political impacts of the pandemic are likely to put AV actions on hold, especially actions originating from legislation or executive order. Second, states with severe fiscal challenges may reduce current actions (i.e., shrink AV entities inside DOTs) to save money. Finally, states still prioritizing AVs may shift their attention to rapid pilot deployments to test AVs in ways that could address COVID-19. This last scenario, to employ AVs in COVID-19 response and recovery, may be driven more by local governments and companies than by states.

As indicated in Table 4 (below), a number of companies developing AVs (both ground- and air-based) have aided in COVID-19 response. The most structured of these actions has been a partnership between Beep, Navya, the Mayo Clinic, and the Jacksonville Transportation Authority to shuttle COVID-19 tests and supplies across the Mayo Clinic campus in Florida (O'Kane, 2020). Wing, an automated on-demand delivery service that uses drones, experienced a significant increase in demand for packages and has been working to deliver food and household goods (Lewis, 2020). These actions point to a future where AVs could deliver packages and provide rides, all with minimal human contact to reduce the spread of viruses. Despite these actions, many companies, including Waymo, Nuro, GM Cruise, Argo AI, Pony.ai, Uber, Zoox, and Voyage have suspended testing due to the stay-at-home orders across most of the country (Hawkins, 2020a; Hawkins, 2020b; Etherington, 2020; Dickey, 2020). Zoox has also begun to layoff AV backup drivers (Hawkins, 2020a), indicating that some AV companies may not survive the economic downturn. On the other hand, some companies may thrive, such as Nuro, which recently received a second permit in California for driverless testing (Hawkins, 2020b). With such major transportation impacts of COVID-19, states may need to revisit their AV actions as companies continue to react and pivot to new business models.

Table 4. Select Responses by AV Companies to COVID-19

Company	Geography	Description
Beep	Florida	Shuttled COVID-19 tests and supplies within the Mayo Clinic campus in partnership with the Jacksonville Transportation Authority, Mayo Clinic, and Navya (O'Kane, 2020)
Starship Technologies	Arizona, California, DC	Expanded robot food delivery service to Arizona, California, and DC, which allows delivery of groceries and hot food up to 20 pounds without human contact (Korosec, 2020)
KiwiBot	California, Colorado	Delivered sanitary supplies, masks, and other hygiene products for Berkeley and Denver (Combs, 2020)
Wing	Virginia	Experienced a significant increase in demand for packages containing food and household goods, allowing for contactless deliver (Lewis, 2020)
Optimus Ride	California	Delivered food to seniors via autonomous shuttles (Lekach, 2020)
Neolix	China	Delivered medical supplies via vans in hardest hit areas (Wiggers, 2020)
Baidu	China	Delivered food via vans to health workers (Wiggers, 2020)
Unity Drive Innovation	China	Delivered fresh fruit and vegetables to 15 communities in eastern China via cargo vans (Combs, 2020)

Policy Options for California

California has taken a strong step forward in developing a more integrated and holistic plan for AVs through legislation since 2012, the development of AV testing programs, and the creation of AV guiding principles. Building upon these policy approaches, the state could consider the following options:

1) Create an interagency, multi-stakeholder committee or working group

California should consider creating a forum to discuss, debate, and create AV policies that consider both near-term and longer-term AV impacts. To build this forum, California should consider the following elements:

A) Employ public universities as third-party, independent facilitators and/or conveners.

A number of states (e.g., Michigan, Arizona, Virginia, Texas) are leveraging the expertise of their public universities in a variety of ways such as: 1) appointing academic representatives on state-level committees, 2) funding research to fill knowledge gaps and inform policy, and 3) partnering directly with researchers to deliver technological strategies for AV deployment. California should partner with its public universities in similar ways. One additional option California should consider, which is not being employed by other states, is employing public universities as third-party, independent facilitators and/or conveners. Public universities are uniquely positioned to serve in this role, given that they share the same mission as governmental bodies of serving society. In addition, public universities can operate outside of governmental silos, which is especially advantageous for complex, far-reaching issues (such as AVs) that crosscut the interests and work of many state divisions and departments.

B) Analyze a diversity of AV focus areas to better understand the full range of impacts.

Other states, while prioritizing some areas (e.g., safety, infrastructure, testing, economic development), are also considering how to guide AV adoption and prepare for additional AV impacts (e.g., environment, land use, social equity, congestion). To maintain economic competitiveness (i.e., job creation and business headquarters) and proactively address AV impacts, California could cover multiple focus areas beyond those mentioned above including employment and workforce development, security and privacy, law enforcement and policing, revenue streams and funding, public health, integration with public transit, and shared mobility.

C) Ensure diverse stakeholder representation on forums or strategic actions, including executive committees or special subcommittees.

Other states include a wide range of representatives and stakeholders to provide AV policy guidance. State departments often include: Transportation, Motor Vehicles, Labor and Workforce Development, Highway Patrol, Public Safety, Insurance, Business and Economic Development, Technology, and Finance. In addition to these state departments, California should include state agencies that have been active in AV policymaking including: Office of Planning and Research, Transportation Commission, Public Utilities Commission, State Transportation Agency, Natural Resources Agency, and the California Air Resource Board. Other agencies could also be added to increase the diversity of stakeholders such as: Aging, Business Oversight, Consumer Affairs, Employment Development, Public Health, and Justice. Tribal governments, while not represented in any AV actions, could also be included. Non-governmental organizations (e.g., social equity, consumer protection) and a logistics/trucking

company could also be considered. This diverse representation would ensure that AV policy is holistically addressed and minimizes unforeseen AV technology consequences.

D) Develop a series of subcommittees in the forum to allow greater input.

States with integrated forums or bodies often have a series of subcommittees (e.g., social equity, environment, land use, public health), which allow them to address potential societal and environmental issues in more detail. With a future-oriented outlook, subcommittees could be visionary, allowing California to be more proactive and address additional focus areas. Along with those mentioned above, subcommittees could include: emergency response, data collection and management, goods movements, travel behavior, public transit, urban air mobility, and mobility on demand or mobility as a service.

E) Adopt a multi-year forum approach, producing a variety of products to aid different government officials and levels of governance (i.e., local, regional, and state) in AV planning.

Most AV forums and advisory bodies are focused on producing a variety of deliverables/outcomes, including research, pilot projects, partnerships, and networks (e.g., cross-agency collaboration, public-private partnerships). Many forums and bodies are established by state authorities with substantial AV expertise. A focus on a single report, however, could limit the momentum needed to develop longer-term and proactive AV policies. California could benefit from a multi-year forum including stakeholder coordination, industry partnerships, pilot projects, and research evaluations to build endurance into its AV policies. Furthermore, legislation developed with public-private sector coordination could help to clarify requirements and/or opportunities for companies (e.g., testing requirements, data sharing specifications, project collaboration with local governments). Such actions could help California to remain competitive with other states.

2) Partner with other western states on AV policymaking to build a strong coalition.

Midwest states (particularly around the Great Lakes) have moved forward with more comprehensive forums or strategic actions that a) cover a variety of focus areas, b) include diverse members, and c) produce a number of deliverables and partnerships. The Northeast is also highly invested in certain focus areas (e.g., operations, emergency response, testing). Several Western states (e.g., Nevada, Utah, Wyoming) have focused less on AV preparation (unlike Washington, Oregon, and California). California's partnership with other western states could facilitate more seamless regulations across state boarders and build longer-term economic competitiveness.

Appendix: State Actions on Automated Vehicles

This appendix provides additional details on the formation of AV stakeholder forums and strategic actions. Several key examples are discussed to highlight integrated programs with significant influence on AV policymaking and regulatory control.

Advisory Committee on Autonomous Vehicles (SB 59)

California currently has pending legislation (SB 59, 2019) on the formation of an advisory committee for AVs. The bill requires:

- A committee composed of at least 22 people;
- Subcommittees led by the Governor's Office of Planning and Research on the environment, public health, and energy;
- Gathering of public comments on issues and concerns related to AVs;
- Recommendations for statewide policy changes and updates; and
- A report to the legislature by January 1, 2022 with biannually reports thereafter until 2030.

The bill requires that the committee be selected by the chair of the CTC, including representatives from:

- Insurance interests;
- Labor organizations representing transportation workers;
- Local government;
- California public research institution;
- Vehicle manufacturers;
- Technology companies developing AVs;
- Disability rights organization;
- Local transit agency;
- Statewide motorist service membership organization;
- Bicycle or pedestrian safety organization;
- Environmental justice or environmental equity advocacy organization; and
- Public health, science, or environmental organization.

The bill also requires that the following individuals serve (ex-officio) on the committee:

- Secretary – Natural Resources Agency;
- Secretary – Labor and Workforce Development Agency;
- Chair – Transportation Commission;
- Director – Office of Planning and Research;
- Director – Department of Transportation;
- Commissioner – Highway Patrol;

- Commissioner – Department of Insurance;
- Director – Department of Motor Vehicles;
- Director – Office of Business and Economic Development; and
- Chair – Air Resources Board.

Additional Cross Tabulations on AV Stakeholder Forums and Strategic Actions

Table A1. Focus Areas of AV Forums/Actions by Census Region of the U.S. (n=51)

Focus Area	# of Forums/ Actions	Midwest (n=12)	Northeast (n=11)	South (n=13)	West (n=15)	All (n=51)
Safety	37	92%	55%	85%	60%	73%
Testing	31	58%	73%	46%	67%	61%
Infrastructure	28	67%	45%	77%	33%	55%
Economic Development	25	83%	27%	69%	20%	49%
Technology Development	23	58%	36%	62%	27%	45%
Implementation/Deployment	19	67%	45%	31%	13%	37%
Operations	19	25%	55%	31%	40%	37%
Data Management and Collection	19	75%	18%	38%	20%	37%
Workforce/Employment/Training	19	58%	36%	38%	20%	37%
Cybersecurity/Privacy	18	58%	18%	38%	27%	35%
Insurance/Liability	17	50%	36%	23%	27%	33%
Education	13	25%	36%	31%	13%	25%
Registration/Licensing	13	33%	36%	0%	33%	25%
Preparation/Planning/Design	12	25%	18%	46%	7%	24%
Social Equity/Accessibility	12	42%	9%	31%	13%	24%
Law Enforcement	11	25%	27%	8%	27%	22%
Collisions/Crashes	8	8%	9%	15%	27%	16%
Efficiency/Congestion	7	25%	0%	31%	0%	14%
Environment/Sustainability	7	8%	18%	8%	20%	14%
Land Use	6	8%	18%	15%	7%	12%
Goods Movement/Freight	6	25%	0%	15%	7%	12%
Emergency Response	6	0%	27%	8%	13%	12%
Society/Lifestyle (e.g., residential choice)	5	8%	18%	15%	0%	10%

Other focus areas with under five forums and strategic actions: Weather impacts; revenue streams; oversight; health; fleets; public transit; history of transportation; energy use; current AV deployment; regional differences; urban air mobility; telecommunications; first- and last-mile connections

Table A2. Focus Areas of AV Forums/Actions by Initiating Body

Focus Area	# of Forums/ Actions	Governor (n=12)	Legislature (n=24)	State Agency (n=15)	All (n=51)
Safety	37	75%	58%	93%	73%
Testing	31	83%	54%	53%	61%
Infrastructure	28	83%	38%	60%	55%
Economic Development	25	75%	33%	53%	49%
Technology	23	75%	25%	53%	45%
Implementation/Deployment	19	58%	25%	40%	37%
Operations	19	33%	33%	47%	37%
Data Management and Collection	19	67%	25%	33%	37%
Workforce/Employment/Training	19	58%	29%	33%	37%
Cybersecurity/Privacy	18	75%	21%	27%	35%
Insurance/Liability	14	50%	46%	0%	33%
Insurance	13	33%	38%	0%	25%
Education	13	42%	29%	7%	25%
Registration/Licensing	13	33%	38%	0%	25%
Preparation/Planning/Design	12	25%	21%	27%	24%
Social Equity/Accessibility	12	50%	13%	20%	24%
Law Enforcement	11	33%	29%	0%	22%
Collisions/Crashes	8	0%	17%	27%	16%
Efficiency/Congestion	7	17%	4%	27%	14%
Environment/Sustainability	7	33%	13%	0%	14%
Land Use	6	25%	13%	0%	12%
Goods Movement/Freight	6	8%	4%	27%	12%
Emergency Response	6	17%	13%	7%	12%
Society/Lifestyle (e.g., residential choice)	5	8%	13%	7%	10%

Other focus areas with under five forums and strategic actions: Weather impacts; revenue streams; oversight; health; fleets; public transit; history of transportation; energy use; current AV deployment; regional differences; urban air mobility; telecommunications; first- and last-mile connections

Table A3. Representation on AV Stakeholder Forums and Strategic Actions with Members by Region in the U.S. (n=33)

Representative Department/Group	Total	Midwest (n=5)	Northeast (n=10)	South (n=8)	West (n=10)	All (n=33)
State Department - Transportation	28	80%	90%	75%	90%	85%
State Legislators	20	100%	50%	63%	50%	61%
Academia/University	18	40%	50%	63%	60%	55%
State Department - Commerce/Economic Development/Business	14	60%	20%	38%	60%	42%
Industry - Technology/AVs/Communication	13	60%	20%	25%	60%	39%
State Department - Insurance	13	40%	30%	50%	40%	39%
Local/Regional Government (e.g., city, county, MPO)	13	60%	20%	50%	40%	39%
State Department - Public Safety/Protection	13	20%	60%	38%	30%	39%
State Department - Motor Vehicles	12	0%	70%	38%	20%	36%
State Department - Highway Patrol/Police	12	60%	20%	38%	40%	36%
Industry - Automakers/Manufacturers	12	40%	30%	25%	50%	36%
State Department - Technology/Information	12	60%	30%	38%	30%	36%
Governor's Office	8	40%	20%	13%	30%	24%
Industry - Insurance	8	40%	10%	0%	50%	24%
Industry - Consulting/Law/Other	8	60%	30%	13%	10%	24%
Industry - Trucking/Logistics	8	20%	10%	38%	30%	24%
Organization - Motorist Services	8	20%	10%	25%	40%	24%
State Department - Finance	7	40%	20%	13%	20%	21%
Local/Regional Transit Agency	7	0%	30%	13%	30%	21%
State Department - Aging/Disability	6	20%	30%	25%	0%	18%
State Department - Attorney General/Justice	6	0%	10%	25%	30%	18%
Organization - Labor	6	20%	20%	0%	30%	18%
Organization - Local/Regional (e.g., League of Cities)	6	20%	0%	25%	30%	18%
Expert - AV	5	0%	40%	13%	0%	15%
Organization - Aging/Disability Rights	4	0%	20%	0%	20%	12%
Organization - Environmental Justice	4	0%	10%	0%	30%	12%
State Department - Health and Human Services	4	20%	20%	0%	10%	12%
Organization - Science/Professional/NGO	4	20%	20%	0%	10%	12%
State Department - Turnpike	4	0%	30%	13%	0%	12%

Three or less representatives: Residents/General Members; State Department - Air/Natural Resources/Environment; State Department - Emergency Management; State Department - Labor/Workforce; State Department - Secretary of State; Expert – Insurance; Expert – Transportation; Federal Government; Organization - Bicycle/Pedestrian Safety; Organization – Law; Organization - Law Enforcement; Public Utilities; State Department - Planning/Research; State Department - Regulations/Licensing; Expert – Automotive; Organization - Consumer Protection; Organization - General Business; Organization - Public Health; Organization - Social Equity; Organization – Tax; Organization – Utility; State Department – Agriculture; State Department – Education; State Department - General Services/Administration; State Department - Land Conservation and Development

Table A4. Representation on AV Forums/Actions with Members by Initiating Body (n=33)

Representative Department/Group	Total	Governor (n=9)	Legislature (n=20)	State Agency (n=4)	All (n=33)
State Department - Transportation	28	100%	75%	100%	85%
State Legislators	20	56%	70%	25%	61%
Academia/University	18	67%	40%	100%	55%
State Department - Commerce/Economic Development/Business	14	78%	30%	25%	42%
Industry - Technology/AVs/Communication	13				39%
State Department - Insurance	13				39%
Local/Regional Government (e.g., city, county, MPO)	13		25%		39%
State Department - Public Safety/Protection	13		35%	25%	39%
State Department - Motor Vehicles	12	33%	35%	50%	36%
State Department - Highway Patrol/Police	12	33%	35%	50%	36%
Industry - Automakers/Manufacturers	12	33%	35%	50%	36%
State Department - Technology/Information	12	56%	30%	25%	36%
Governor's Office	8	44%	20%	0%	24%
Industry - Insurance	8	33%	20%	25%	24%
Industry - Consulting/Law/Other	8	56%	10%	25%	24%
Industry - Trucking/Logistics	8	33%	15%	50%	24%
Organization - Motorist Services	8	33%	15%	50%	24%
State Department - Finance	7	22%	25%	0%	21%
Public Transit Agency	7	22%	15%	50%	21%
State Department - Aging/Disability	6	22%	10%	50%	18%
State Department - Attorney General/Justice	6	33%	15%	0%	18%
Organization - Labor	6	11%	20%	25%	18%
Organization - Local/Regional Jurisdictions (e.g., League of Cities)	6	22%	15%	25%	18%
Expert - AV	5	0%	20%	25%	15%
Organization - Aging/Disability Rights	4	0%	15%	25%	12%
Organization - Environmental Justice	4	11%	15%	0%	12%
State Department - Health and Human Services	4	11%	15%	0%	12%
Organization - Science/Professional/NGO	4	11%	10%	25%	12%
State Department - Turnpike	4	0%	15%	25%	12%

Three or less representatives: Residents/General Members; State Department - Air/Natural Resources/Environment; State Department - Emergency Management; State Department - Labor/Workforce; State Department - Secretary of State; Expert – Insurance; Expert – Transportation; Federal Government; Organization - Bicycle/Pedestrian Safety; Organization – Law; Organization - Law Enforcement; Public Utilities; State Department - Planning/Research; State Department - Regulations/Licensing; Expert – Automotive; Organization - Consumer Protection; Organization - General Business; Organization - Public Health; Organization

- Social Equity; Organization – Tax; Organization –Utility; State Department – Agriculture; State Department – Education; State Department - General Services/Administration; State Department - Land Conservation and Development

Table A5. Products of AV Forums/Actions by Region (n=51)

Focus Area	# of Actions	Midwest (n=12)	Northeast (n=11)	South (n=13)	West (n=15)	All (n=51)
Required Report	37	83%	100%	46%	67%	73%
Recommendations/Findings	35	67%	100%	62%	53%	69%
Proposed Legislation	32	67%	73%	54%	60%	63%
Law Review/Amendments	23	58%	45%	31%	47%	45%
Regulations	21	83%	18%	46%	20%	41%
Research	21	58%	45%	31%	33%	41%
Pilot Projects	20	50%	36%	54%	20%	39%
Stakeholder Coordination	19	75%	9%	46%	20%	37%
Industry Partnerships	18	58%	9%	46%	27%	35%
Best Practices	16	33%	18%	46%	27%	31%
Federal Guideline Integration	14	17%	27%	31%	33%	27%
Safety Certifications	11	8%	36%	8%	33%	22%
Projects	11	25%	9%	54%	0%	22%

Table A6. Products of AV Forums/Actions by Initiating Body (n=51)

Products	# of Forums/ Actions	Governor (n=12)	Legislature (n=24)	State Agency (n=15)	All (n=51)
Required Report	37	75%	92%	40%	73%
Recommendations/Findings	35	75%	83%	40%	69%
Proposed Legislation	32	67%	92%	13%	63%
Law Review/Amendments	23	58%	54%	20%	45%
Regulations	21	58%	25%	53%	41%
Research	21	75%	33%	27%	41%
Pilot Projects	20	42%	29%	53%	39%
Stakeholder Coordination	19	58%	17%	53%	37%
Industry Partnerships	18	67%	13%	47%	35%
Best Practices	16	33%	29%	33%	31%
Federal Guideline Integration	14	33%	29%	20%	27%
Safety Certifications	11	25%	17%	27%	22%
Projects	11	17%	8%	47%	22%

Additional Information and Key Examples

In this section we provide additional information on the identified stakeholder forums and strategic actions, broken down by category (e.g., committee, work group, program, etc.). We also highlight one key example that has more holistically addressed AV policymaking for the state.

We found that 12 states have formed or are proposing to form committees. These committees are largely tasked with providing reports and recommendations to the legislature or Governor on autonomous vehicles. One of the earliest committees was the Arizona Self-Driving Vehicle Oversight Committee (Executive Order 2015-09), which brought together experts at state agencies and academia to support testing and development of AVs in Arizona. Another example of Governor-initiated action was Executive Order 2018-01 in Maine, which created the Maine Highly Automated Vehicles Advisory Committee. The committee provides recommendations on how best to advance testing and operation of vehicles while maintaining safety and compliance with regulations. Recommendations from the Idaho Autonomous and Connected Vehicle Testing and Deployment Committee included encouraging legislation to allow AV testing in the state and facilitating a business-friendly environment for the industry. On the legislative side, North Carolina created the Fully Autonomous Motor Vehicles Committee in 2017 through HB 469 and SB 337, which continues to review and consider all matters related to AVs including potential changes to regulation and laws. Other states with committees initiated by legislation include Alabama, Georgia, and New Mexico. The Transportation Public Safety Committee in the Ohio House of Representatives commissioned their own study in 2017, which helped set a baseline for policy and regulations that would be closely followed by DriveOhio (a statewide smart mobility center established by executive order). Several committees are currently pending in the legislature (California and New Hampshire), while the Autonomous Vehicle Technology Study Committee in Georgia was only active for 2014.

Wisconsin: Governor's Steering Committee on Autonomous and Connected Vehicle Testing and Deployment – Established 2017 (Executive Order 245).

This committee was developed to create a coordinated effort on how best to test and operate AVs and CVs in Wisconsin. Composed of 27 members including researchers from the University of Wisconsin – Madison, the committee submitted a report in 2018 highlighting key recommendations for the state to better prepare for CAVs (connected and autonomous vehicles). Specifically, the report recommended that Wisconsin modify and clarify current laws and regulations (e.g., definitions, vehicle registration, operator licenses, rules of the road) to allow for safe testing and deployment of CAVs. Moreover, the committee suggested that Wisconsin create a CAV working group at the Department of Transportation that would take the responsibility of responding to technology, promoting research, and building strategic partnerships. Currently, Wisconsin is using the Wisconsin Automated Vehicle Proving Grounds, a network of test beds across the state led by the University of Wisconsin – Madison that is preparing the state for deployment of CAVs through research, testing, and certification.

Similar to AV committees, task forces have been established to provide recommendations to state governments related to testing, regulations, liability, policy, and safety. The eight task forces have been established by a legislature or state agency (not through executive order). New Jersey passed legislation in 2019 (AJR 164 & SJR 105) to create the Advanced Automated Vehicles Task Force to study AVs and offer recommendations to the legislature to safely transition to AVs. Similarly, Connecticut reestablished its Autonomous Vehicle Task Force in 2019 (SB 924), expanding its objectives to include evaluating current AV standards and guidelines established at the federal level. The task force focuses strongly on how the state should regulate AVs. In Hawaii, the Autonomous Vehicle Legal Preparation Task Force (HCR 220, 2019) has a fairly limited scope as it focuses only on the legal and regulatory implications of AVs (and the transition to AVs). Unlike other states, Hawaii includes mayors of cities and counties in the task force. Colorado included a task force within legislation on automated driving motor vehicles (SB 213, 2017). The task force is predominately staffed by state agencies and is linked to the Colorado Department of Transportation Connected and Autonomous Technologies Program. For agency-created task forces, the Pennsylvania Autonomous Vehicle Policy Task Force (2016) focused on AV testing policy, while the Texas Connected and Autonomous Vehicle Task Force (2019) currently aims to be a coordinating entity that builds partnerships and economic benefits with other AV and CV initiatives in Texas. In addition to these clearly defined task forces, the 21st Century Missouri Transportation Task Force focuses mostly on general transportation planning with a small section on AVs, and New York currently has two pieces of legislations pending that would create an AV task force.

Oregon: Task Force on Autonomous Vehicles – Established 2018 (HB 4063).

This task force was created to provide recommendations to the Oregon State Legislature on "licensing and registration, law enforcement and crash reporting, cybersecurity, and insurance and liability." A wide variety of stakeholders make up the task force including legislators, agency staff, industry representatives, and academics (from the University of Oregon). Together, members delivered a comprehensive report in 2018 with recommendations including an extensive list of requirements for AVs to be permitted to be tested on Oregon roads. The task force was extended for the next year and delivered a second report in 2019 that focused on more long-term impacts related to road and infrastructure design, land use, public transit, and workforce changes. Much of the document provides examples from other countries and cities, offering a series of best practices for long-term AV policy.

STATE OF OREGON

TASK FORCE ON AUTONOMOUS VEHICLES
2019 FINAL REPORT TO THE OREGON STATE LEGISLATURE

Sept. 12, 2019

Programs and initiatives represent a more structured effort to coordinate policy, guidelines, and regulations at the state level. Seven states have developed programs, while three states have distinctly named initiatives related to AVs and/or CVs. All of these programs and initiatives are operated and managed by state agencies including departments of transportation (DOTs), departments of motor vehicles (DMVs), and chambers of commerce. While the origins of these programs and initiatives are somewhat unclear, the Autonomous Illinois Initiative was established by the Illinois Department of Transportation in direct response to Executive Order 2018-13. The Institute of Automated Mobility (IAM) in Arizona was also established by executive order (2018-04) and acts as a brain trust for agencies, industry, and universities to collaborate on AV testing in Arizona. Most programs were begun by departments of transportation (DOTS) including the Colorado Connected and Autonomous Technologies Program, the Indiana Autonomous, Electric, and Connected Vehicles Initiative, the Virginia Connected and Automated Vehicle Program, and the Michigan Connected Vehicle Program. Most of these programs are project-based, focusing on piloting technology on roadways and creating a pathway for industry to test vehicles. Florida has three different programs and initiatives that divide responsibility and goals. The Florida Automated Vehicles (FAV) program is run by the Florida DOT and focuses on educating the public on automated vehicle technology and ensure AV safety. The Florida Connected Vehicle Initiative (also run by Florida DOT) is project-based and emphasizes building adequate infrastructure to allow for vehicle-to-infrastructure, infrastructure-to-vehicle, and vehicle-to-vehicle communication. Finally, the Autonomous Florida program is run by the Florida Chamber of Commerce and aims to position Florida at the forefront of AV technology by working with industry partners. One unique program is the California Autonomous Vehicle Driverless Tester Program, which is run by the California Department of Motor Vehicles. The program allows companies to submit permit applications, develops driverless testing regulations, and acts as a clearinghouse for AV collision reports, disengagement reports, and general AV milestones in the state.

Ohio: DriveOhio – Established 2018 (Executive Order 2018-04K and Executive Order 2019-26D).

The DriveOhio program is a statewide center for smart mobility that is managed by the Ohio DOT. The program was established through Executive Order 2018-04K in 2018 and then reestablished one year later. Unlike other state programs that focus exclusively on AVs, DriveOhio has a broader, multi-objective approach that is based on key pillars of safety, mobility, access, reliability, and talent. The program aims to develop all types of advanced mobility and infrastructure technology along with being a leader in AV/CV testing and innovation. The program also designs and implements projects across the state and aims to create 164 miles of real-world road testing for CAVs. The Ohio State University Center for Automotive Research is a key collaborator and partner in DriveOhio as. DriveOhio also partners with the states of Michigan and Pennsylvania, the Transportation Research Center (a federal proving grounds with strong ties to Ohio State University and the Ohio DOT), and the Ohio Unmanned Aircraft Systems Center (a special aviation initiative within DriveOhio).

Similar to task forces and committees, working groups focusing on AVs have been initiated by several states and DC. Working groups are largely housed in DOTs and include members from state agencies, industry, and universities. The Maryland Connected and Automated Vehicles Working Group handles all strategic planning related to AVs/CVs for Maryland DOT. The working group is highly engaged, provides recommendations on a regular basis, and includes five sub-groups on special topics (technology, policy, emergency responders, freight, and business). Though Executive Order 572 (2016), the Massachusetts Autonomous Vehicles Working Group was tasked with providing guidance to the state on AV policy, regulations, and potential legislation. The group also releases testing reports, approval letters, and other key documents regarding AVs. The DC Interagency Working Group on Autonomous Vehicles (Mayor Order 2018-018) was created to comprehensively study AV technology, policy, and law. Similar to Maryland and Massachusetts, the working group has developed a series of resources to inform the public about current AV pilot projects, news, policies, and proposed legislation. Unlike the other working groups, the Driving Oklahoma Working Group at the Oklahoma DOT is not public facing (e.g., does not have a formal website or products available to the public). However, it has focused on developing best practices for AV/CV deployment in the state, while also working with public and private stakeholders.

Washington: Autonomous Vehicle Work Group – Established 2017 (HB 2970 & Executive Order 2017-02).

The Washington Vehicle Work Group, which was established through both legislation and an executive order, aims to provide policy recommendations on the operation of AVs in Washington and act as a clearinghouse for all AV related issues. The work group is composed of an executive committee that includes stakeholders from the legislature, state agencies, private sector businesses, non-profit entities, universities, and unrepresented communities. One key characteristic of the work group is its development of seven subcommittees — licensing, liability, infrastructure and systems, safety, system technology and data security, labor and workforce, and health and equity — that holistically address AV impact in Washington. The subcommittee on health and equity is unique to state actions on AVs. Led by the Washington State Department of Health, the subcommittee is focused on a variety of health concerns (e.g., air quality, noise, mental well-being, safety and social connections) and engages with communities, particularly communities of color. Indicating strong research partnerships, the University of Washington is represented by faculty on the various subcommittees and executive committee. Finally, the work group, in contrast to some task forces and committees, continuously meets and discusses AV issues, which creates a one-stop shop and integrated location for all AV-related guidance and resources for the state.

WASHINGTON STATE AUTONOMOUS VEHICLE WORK GROUP

Commissions: Several states including Maine, Massachusetts, and Montana have established commissions for transportation to more closely study and advise the state on AV and CV issues. The Maine Commission on Autonomous Vehicles and Use of Automated Vehicles for Public Transportation (HB 1204, 2018) is the only AV-specific commission and coordinates AV policy and legislative efforts among various state agencies. The Massachusetts Commission on the Future of Transportation covers broader areas of transportation, looking ahead to make effective transportation decisions and investments over the next 20 years. The commission includes an AV working group on the topics of policy and infrastructure and receives input from faculty at the University of Massachusetts and Harvard University. Similarly, the Montana Passenger Transportation Commission (Joint Resolution 40, 2017) was established to oversee a broad range of transportation services (e.g., rail, bus) in addition to AVs.

Councils: Through legislation (SB 995, 2016), Michigan developed the Michigan Council on Future Mobility, which is tasked with providing recommendations for changes in state policy related to automated, driverless, and connected vehicle technology. The 21-member council (which includes representatives from the University of Michigan and Michigan State University) produces annual reports and guidance on AVs and CVs along with electric vehicles, smart infrastructure, and mobility on demand. The Minnesota Governor's Advisory Council on Connected and Automated Vehicles (Executive Order 18-04 & 19-18) was established to provide advice to the governor and state agencies on a broad set of AV and CV topics including technology, policy, economics, and law. The 35-member council (which includes representatives from the University of Minnesota), with terms through 2023, also reviews current AV trends and studies potential applications for Minnesota. Finally, the Delaware Advisory Council on Connected and Autonomous Vehicles (Executive Order 17-14) was created to prepare Delaware with innovative tools and strategies to address the rise of AVs and CVs. The council is no longer active.

Other Actions: Two states, North Dakota and Utah, passed legislation (HB 1202, 2017 & HB 290, 2016 respectively) to study the potential of AVs including further actions that should be taken regarding policy and legislation. Prior to the development of a task force, Hawaii issued an executive order (Executive Order 17-07), which created a AV/CV contact for companies interested in testing technology on Hawaii roadways. The Iowa DOT started an Automated Vehicle (AV) Technologies project using proving grounds at Iowa City and the University of Iowa. Similarly, the Louisiana DOT created the Connected and Autonomous Vehicles Technology Team to monitor industry activity and formulate policy for the agency. Without a specific team or project, the Kansas DOT developed a Statewide Connected and Autonomous Vehicle Vision Plan to support practical and innovative AV/CV solutions in the state. Finally, Vermont passed legislation (HB 494, 2017) to require automated vehicle stakeholder meetings and workshops to begin developing AV guidance. The Vermont State Highway Safety Office is also taking an active role in the development of AV guidelines.

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