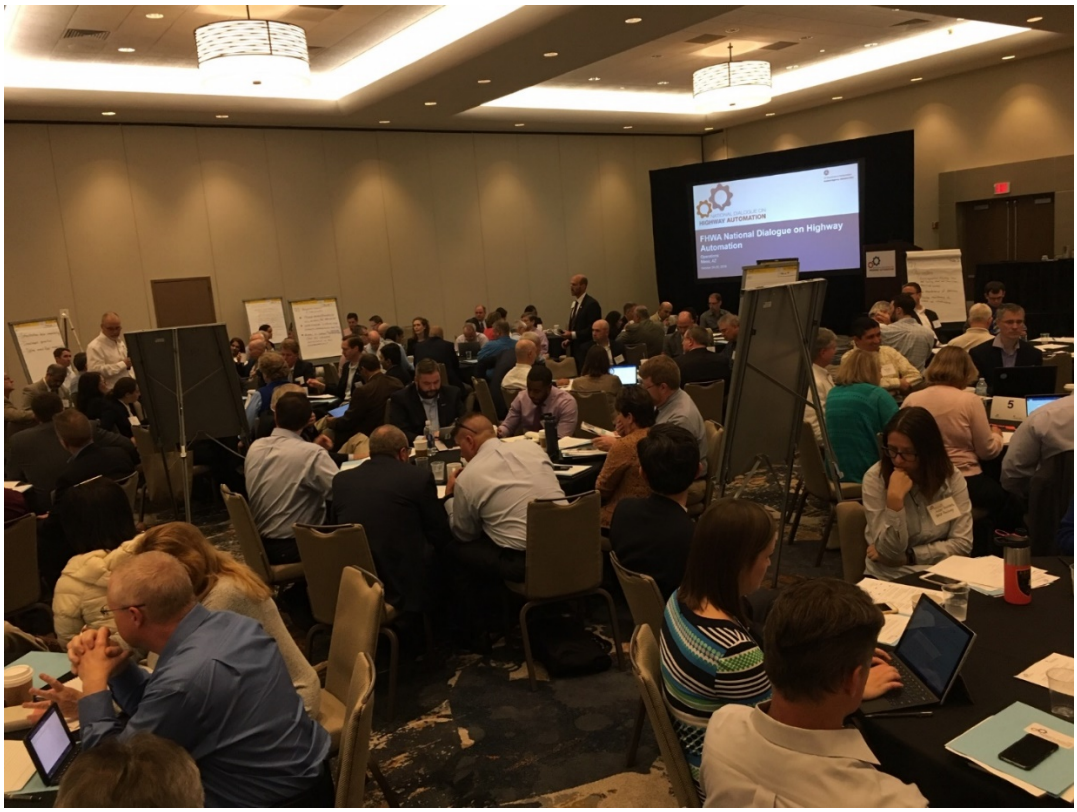
Federal Highway Administration

National Dialogue on Highway Automation: October 24-25, 2018 Operations Workshop Summary



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16. Abstract The Federal Highway Administration (FHWA) initiated the National Dialogue on Highway Automation (National Dialogue) workshop series. The National Dialogue was a series of meetings held across the country to facilitate information sharing and to engage the transportation community in a conversation focused on how to safely and efficiently integrate automated vehicles into the road network. This document summarizes the key themes discussed among participants from the October 2018 National Dialogue workshop held in Phoenix, Arizona.			
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Contents

Acronyms and Abbreviations

AASHTO	American Association of State Highway Transportation Officials
ADS	Automated driving systems
AV	Automated vehicle
CADS	Cooperative automated driving systems
CARMA	Cooperative Automation Research Mobility Applications
CAT Coalition	Cooperative Automated Transportation Coalition
CAV	Connected and autonomous vehicle
Conops	Concept of operations
DOT	Department of Transportation
DSRC	Digital short-range communications
FHWA	Federal Highway Administration
IOO	Infrastructure owner-operator
ITS	Intelligent Transportation Systems
MPO	Metropolitan planning organization
MUTCD	Manual on Uniform Traffic Control Devices
ODD	Operational Design Domain
OEM	Original equipment manufacturer
ROW	Right of way
SAE	Society of Automotive Engineers
SPaT	Signal phase and timing
TCD	Traffic control device
TMC	Transportation Management Center
TNC	Transportation Network Company
TSMO	Transportation Systems Management and Operations
USDOT	United States Department of Transportation

Overview

Automated vehicles (AVs) have the potential to transform the Nation's roadways. They could increase vehicle safety, improve transportation system efficiency, and enhance mobility for many people who may be unable to drive today. Although they offer a wide range of benefits, they may also introduce uncertainty for the agencies responsible for the planning, design, construction, operation, and maintenance of the Nation's roadway infrastructure.

In June 2018, the Federal Highway Administration (FHWA) initiated the National Dialogue on Highway Automation (National Dialogue), a series of meetings held across the country to facilitate information sharing and engage the transportation community in a conversation on how to safely and efficiently integrate automated vehicles into the road network. A diverse group of stakeholders provided input on key issues regarding automation. This input will help inform future and existing FHWA research, policies, and programs.

The National Dialogue series consisted of six national workshops, each held in a different location and focused on a unique topic: policy and planning, data and digital infrastructure, freight, operations, and infrastructure design and safety. The workshop series kicked off with an introductory webinar in May 2018. More information about the webinar and meetings is available on the FHWA National Dialogue on Highway Automation website.[1]

Workshop Objectives

The FHWA identified several objectives for the workshop series, as follows.

- Gain an understanding of potential impacts of automated vehicles on national highway infrastructure, safety, policy, operations, and planning.
- Prioritize actions to inform the integration of automation into existing FHWA programs and policies.
- Create models for sustained information sharing among public agencies and the private sector. Support newly developed partnerships among these organizations and define a clear path of communication among FHWA and automation stakeholders.
- Gather insights from infrastructure owners and operators (IOOs) and inform the development of possible technical guidance actions at the Federal level.
- Validate or provide direction into highway research priorities and roles among FHWA, national partner organizations, industry, and State and local governments.
- Develop an engaged national community or coalition on integrating automated vehicles

[1] https://ops.fhwa.dot.gov/automationdialogue/index.htm.

into the roadway system, using inputs from States, local governments, industry, and associations, alongside FHWA and other Federal agencies.

Operations Workshop

The FHWA conducted a National Dialogue workshop on October 24-25, 2018, in Mesa, Arizona, outside Phoenix. This workshop focused on operations. Over 170 transportation stakeholders from industry, government, academia, and associations participated.

This document summarizes key themes that participants raised throughout the breakout sessions. The views in this document reflect participants' inputs and do not represent official positions, policies, or statements on behalf of the FHWA or the U.S. Department of Transportation (USDOT).

Key Takeaways

AVs May Encounter Challenging Operational Scenarios and Must Navigate These Safely

There is an array of environments and situations in which AVs will be expected to operate. Complex urban areas, work zones, special events, and severe weather and road conditions represent some of the use cases that will pose operational challenges for AVs. Not only will AVs need to be able to maneuver these situations safely and efficiently, but they must also be able to adapt to the unpredictability of human drivers in such scenarios and during a period of mixed fleet operations.

Infrastructure Owners and Operators (IOOs) Seek Guidance on How to Prepare for AV Operations on Public Roads

Workshop participants expressed an interest in seeing the establishment of a broader vision or plan for the safe integration of AVs onto public roads. This could include a clear set of milestones, activities, roles, and guidance to IOOs as they prepare for AVs. As part of this discussion, the concept of readiness emerged as it relates to the preparation of the roadway infrastructure, transportation agencies, workforce, and policies to address operations-related issues for AVs. Some suggested that FHWA expand its efforts to engage with its partners, stakeholders, and the public about the challenges and opportunities of AVs to potentially inform development of future guidance.

Developing Objective and Accurate Information for Stakeholders and the Public is Critical for Safe and Efficient AV Operations

Misinformation around AVs and their capabilities is creating confusion among the public and within the transportation community. Workshop participants pointed to a need for objective and

credible information about AV technology, its opportunities and risks, as well as realistic and tempered expectations about AV capabilities. Some suggested the development of a consistent outreach strategy, which could include the development of a harmonized lexicon and terminology around AVs. This could ultimately reduce confusion and facilitate effective collaboration between stakeholders.

Public Safety Officials Require Clear Standard Operating Procedures for Interacting with AVs

Law enforcement, emergency responders, and the public safety community seek instruction on how to safely engage with AVs, especially since AVs are currently being tested on public roads and are operating with other road users. Workshop participants identified multiple instances where interactions with public safety officials or other roadway operators take place, including work zones and at the scene of an incident. Traffic simulation can assist with scenario planning and use case testing needed to understand these complex environments. Not every situation is predictable though. Participants identified the need for better understanding of the interaction of AVs with incident management processes and systems.

Workshop Design

The workshop began with an overview presentation describing the National Dialogue and USDOT activities in automation. The overview presentation is available on the FHWA National Dialogue website.[2]

The workshop was divided into four different sessions designed to gather input from stakeholders:

- *Breakout Session 1*: Small group discussions focused on data needs and challenges for integration of AVs.
- *Breakout Session 2:* Small group discussions focused on digital infrastructure definitions and needs.
- *Collaboration Corner:* Informal interactive session where participants provided input at multiple stations, each focused on a distinct topic.
- *Breakout Session 3:* Group discussion focused on developing an action plan for the transportation community on automation.

USDOT representatives facilitated breakout session discussions at individual tables. Participants had 10-15 minutes to read and think about the discussion questions on their own, followed by

[2] https://ops.fhwa.dot.gov/automationdialogue/index.htm.

group discussion. Information regarding the agenda, breakout session questions, and participants is included in the appendices of this document.

Breakout Session I: AV Impacts and Issues for Operations

This section summarizes stakeholder discussion from the first breakout session. The following questions were asked:

- What are the priority issues or challenges for traffic operations as AVs are introduced into the transportation system?
- What use cases or operational scenarios involving AVs need further attention from a network efficiency or operations perspective? (e.g., complex intersections, work zones, signal priority, etc.)
- What are the near-term operations challenges, especially as infrastructure owner-operators (IOOs) are interacting with AV pilots, demonstrations, and deployments on their roadways?
- How do we ensure the safety of emergency responders and others working in the roadway (e.g., when addressing an incident involving an AV and how will AVs impact traffic incident management procedures)?

Mixed Fleet Presents Operational Challenges

Varying levels of AV penetration in the vehicle fleet will influence how IOOs consider traffic operations challenges for the broader roadway network. Workshop participants pointed out how the vehicle fleet will remain mixed, with automated and non-automated vehicles operating together for the near future. A fully automated fleet may provide opportunities to more widely or uniformly apply strategies aimed at improving system operational efficiency, such as variable speed limits and speed harmonization. However, impacts of a mixed fleet are a source of uncertainty. In addition, prioritization of infrastructure investments and broader system management strategies will be made more difficult during a prolonged period of mixed fleet operation, considering the likely differences in how AVs and conventional vehicles will operate.

AVs May Encounter Difficulties in Specific Operational Environments

Throughout the workshop, participants continued to highlight concerns regarding the numerous operational environments that could pose a challenge for AVs. A sample list of the operational scenarios discussed included; work zones, temporary road closures, adverse weather conditions, poorly defined roadways (e.g., gravel roads), special events, special vehicles (e.g., school buses, emergency vehicles, snow plows), very rural environments (e.g., navigating around agricultural

vehicles), highly congested urban environments, railroad crossings, and interactions with wild animals crossing roadways. Severe weather may also make striping/signage unreadable or may damage sensors built into the roadway infrastructure. In addition to navigating these scenarios, AVs must also be able to safely transition between different types of environments and scenarios without being disruptive to traffic flow. Many participants suggested that more study and research is necessary to better understand the safety and efficiency impacts of AVs in a range of operational environments.

Development of Workforce Training and Resources on AVs Could Benefit IOOs and the Transportation Community

Automated vehicles use complex and emerging technologies that the transportation community may not fully understand. Workshop participants discussed the need for more training and information and resources for the existing transportation workforce, and also for identifying new types of skills and capabilities needed by transportation professionals in the future. Assessing workforce training requirements was identified as an important factor in supporting organizational readiness for AVs. Some suggested developing guidance addressing the specific levels and areas of expertise needed for operating traffic systems with AVs.

Prioritizing Funding and Resources for AV-Related Activities with Other Critical Investment Needs is a Challenge for IOOs

For IOOs, funding infrastructure maintenance, investment, and planning will likely entail tradeoffs. IOOs will face balancing the continuing maintenance, operations, and safety investments in infrastructure with preparing for AVs. The workshop discussion highlighted questions on the extent to which IOOs should continue funding traditional ITS technologies, connectivity and V2X capabilities. Several participants suggested IOOs could benefit from guidance on how to prioritize investments that could support broader AV integration.

Law Enforcement and Emergency Response Will Need to Know How to Interact with AVs

Clear plans and processes for law enforcement and emergency responders to address AVs are a priority due to the safety implications. This may require law enforcement interaction plans and adequate training for first responders to support safer integration of AVs. Workshop participants recommended that law enforcement interaction plans include additional information about how to pull over an AV, how an AV could be warned to move out of the path of an emergency vehicle, how to ensure that an AV will not leave the scene of an accident, and how to completely disable an AV with a "kill switch." However, they also recognized that more research may be needed to understand these issues.

Breakout Session II: Operations Strategies for Addressing AVs

This section summarizes stakeholder discussion from the second breakout session. The following questions were asked:

- What should infrastructure owners and operators be doing to prepare for and to manage system efficiency while AVs operate on their roadways?
- What information would be useful to either collect, exchange, or share to support AV operations? In what situations could data exchange between IOOs and original equipment manufacturers (OEMs) support more efficient AV operations (e.g., work zones)?
- What could FHWA be doing to support IOOs, industry, and the transportation community to support safe and efficient AV operations, as part of the broader transportation network?

Demonstrations and Pilots Can Provide Useful Information and Lessons Learned

Best practices learned from previous and ongoing pilots can be a useful source of information and lessons learned for communities interested in AVs. Pilots can provide data on the performance of AVs and their safety benefits, mobility impacts, and ability to navigate a range of roadway environments. Workshop participants suggested more systematic tracking of AV demonstrations and their outcomes to facilitate sharing of lessons learned. This could include a central location for pilot data, identification of best practices, and guidance for communities. This information should be shared in an accessible manner so organizations can easily find it. Other suggestions included increasing information sharing and partnerships between communities either participating or interested in participating in an AV demonstration or pilot. This information sharing could be facilitated between stakeholders across levels of government, different geographies, and different operational environments.

Direct Communication Between IOOs and AV Developers is Key to Addressing Operational Challenges

Workshop participants felt that more direct and effective communication between IOOs and AV developers is necessary for addressing the range of AV traffic operations challenges and issues discussed. A two-way exchange of data and information can help provide insights for both IOOs and those developing AV technologies, leading to a shared approach to address technical operations challenges. For example, IOOs have specific information about infrastructure assets, construction projects, road closures, and road regulations that would be useful for AV developers. As AV developers are testing their vehicles on public roads, they may also have access to information useful for IOOs, such as real-time road conditions, AV performance with surrounding traffic, and AV safety and mobility benefits. Several participants stated that only a joint approach can solve some of the complex operational challenges by AVs.

AV Impacts on Traffic Management Remain Unclear

The impacts of AVs on the efficiency of the transportation network and traffic management operations are not well understood. Automated vehicles could potentially have negative consequences on the transportation system (e.g., increasing vehicle miles traveled, decreasing speeds, worsening congestion, or causing safety issues). Yet, AVs may also present opportunities for implementing better practices with respect to speed management and land use policy (e.g., adaptive curb space management). Workshop participants suggested research to understand AV impacts and inform future traffic management strategies.

Multijurisdictional Coordination is Important for Supporting Nationwide AV Integration

Cooperation and communication between communities will become more important as AVs cross borders and jurisdictions. National integration and interoperability of AVs will inevitably require moving across jurisdictional lines. Coordination will be especially critical as communities will need to be able to share data that can be used by different AV technologies and systems. Workshops participants suggested developing data standards and a clear understanding of where responsibility lies for communicating data about speed limits, road conditions, and other operational factors to assist jurisdictions as they encounter AVs on their transportation network.

Collaboration Corner

Format

The Collaboration Corner consisted of a career-fair-style setup with seven stations for collecting different types of information from stakeholders. This setup encouraged a highly interactive session, with participants on their feet and moving from station to station. USDOT staff members were located at each station to encourage participation, clarify the exercise, engage in discussion, and ask follow-up questions. Participants were allowed to move at their own pace but were provided with informal prompts to move to a new station every 15 minutes. Information was collected at each station through two methods:

- **Sticky note exercise**—Attendees used sticky notes to respond to a specific prompt, which was presented on posters at each station. This was a public form of communication that allowed attendees to view and engage with their colleagues' suggestions.
- **Suggestion box**—Participants wrote their questions, suggestions, or other input on an index card and placed it into a suggestion box. This was a more private form of communication that allowed attendees to provide information that they may not have been comfortable sharing in a public forum.

Stakeholders provided input across the following seven stations:

1. **FHWA Operations Research Showcase:** Highlighting existing FHWA research

2. **Operational Environments and Use Cases:** Enabling AV operation in all environments
3. **Preparing State and Local Agencies for Automation:** Building capacity and providing guidance
4. **Data:** Assessing critical data needs for traffic operations decisionmaking
5. **Terminology:** Building our lexicon around highway automation
6. **Research Needs:** Evaluating current research or new research to consider
7. **Parking Lot:** What is missing?

The following section summarizes key themes and takeaways for each topic.

FHWA Operations Research Showcase

At the FHWA Operations Research Showcase, representatives from the FHWA Office of Operations R&D presented videos and fact sheets about their current research initiatives. The showcase focused on cooperative automation research, which investigates platooning, speed harmonization, lane changing, and other capabilities of vehicles that can communicate with other vehicles and infrastructure. Special emphasis was placed on CARMA: the Cooperative Automation Research Mobility Applications[3] technology. CARMA is an open source software platform that has enabled the testing of cooperative automated driving systems (CADS) use cases.

FHWA Operations staff provided information about the linkage of transportation systems management and operations and automation. Participants provided feedback on FHWA's existing research portfolio and suggestions for future research.

Table 1. Participant Input: Operations Research

Participant Input: Research Suggestions
• Impact of pavement marking configurations, patterns, and spacing on AV performance. • Impacts of heavy duty AVs on pavement conditions. • Use of roadside hardware as reference points to improve high definitions maps.

Operational Environments and Use Cases

At the Operational Environments and Use Cases station, participants used sticky notes to answer the following questions:

1. What are different use cases and operational design domains for automated vehicles?
2. What are the operations challenges?
3. What operations strategies can address challenging AV Operational Design Domains?

[3] Additional information available at: https://highways.dot.gov/research/research-programs/operations/CARMA.

Table 2. Participant Input: Operational Environment and Use Cases

Most Challenging Use Cases and ODDs
• Everyday occurrences that require vehicles to stop, including pedestrians crossing the road, passengers entering and exiting transit and school buses, and railroad at-grade crossings. • Mixed use cases emphasizing unpredictable human behavior, such as aggressive human driving and both pedestrian and bicyclist movements. • Complicated road configurations such as multi-leg intersections, diverging diamond interchanges, roundabouts, one-way bridges, and narrow residential streets. • Signs, signals, markings—importance of testing AV interaction with a variety of road infrastructure such as pavement markings, reversible lanes, dynamic message signs, and deteriorating or destroyed signs.
Operations Challenges
• Integrating dynamic shoulder lanes on freeways and urban streets or installing dynamic and connected control devices alongside static devices in mixed-use environments. • Special events, including inclement weather, maintenance events, incidents requiring dynamic message sign communications, and road closures.
Operations Solutions
• Emergency-specific planning—examples included establishing reserved radio frequency for emergency vehicles to broadcast basic safety messages and developing predefined evacuation routes that assume no central communication. • Standard and consistent pavement markings—various opinions were expressed about specific types and sizes of pavement markings that should be made standard, with emphasis on the need for nationwide consistency. • Updates to the Manual on Uniform Traffic Control Devices (MUTCD), and its consistent use and interpretation.

Preparing State and Local Agencies for Automation

At the Preparing State and Local Agencies for Automation station, participants used sticky notes to answer the following questions:

1. What are your workforce development and training needs around automated vehicles?
2. What types of technical assistance or guidance would be useful?

Table 3. Participant Input: Preparing State and Local Agencies

Workforce Development
• Balancing funding priorities. • Recruiting public sector talent. • Continuing education and training for current highway ecosystem. • Maintaining the knowledge of the current ecosystem (e.g., maintenance workers, traffic management and safety operations, government employees). • Providing training among those with various levels of education.

Technical Assistance
• Determining priorities for infrastructure upgrades and ITS maintenance. • Piloting and testing resources, including published results and findings, and advice on how to conduct tests. • Supporting interpretation and implementation of standards for AV equipment and infrastructure.
Guidance
• Defining roles and clarifying incentives with respect to highway automation deployment. • Developing requirements and readiness guidance for various types of equipment (e.g., traffic control devices (TCDs), signaling equipment, vehicles, intelligent transportation system (ITS) equipment, pavement markings, connected vehicle infrastructure).

Data

At the Data station, participants used sticky notes to answer the following questions:

1. What are the key data needs required for effective traffic operations decision making?
2. How can data best be shared among agencies to ensure interoperability and building upon best practices?

Table 4. Participant Input: Data

Data Needs for Operations
• Desire for data submitted by vehicles to inform opportunities for redesigning curb use, improving infrastructure, identifying near-miss conditions, and communicating weather conditions in real time. • Clarification of the distinction between public and private data, and the associated expectations. • Clarification of statutory authority for data collection. • Data standardization and guidance with respect to data ownership, data-sharing agreements, and data emerging from Transportation Management Centers (TMCs). • Request for data and/or data standards related to basic safety messages and security protocols. • Desire for dissemination of real-time data (e.g., currently occurring weather event).
Data Sharing Opportunities
• Requests for consistency in data structures and formatting. • Data sharing to support dynamic and adaptive systems (e.g., Connected and Autonomous Vehicles [CAVs] as mobile sensors for adaptive signal timing; dynamic rerouting to ease congestion). • Desire for publicly accessible data.

Terminology

Participants shared the most common terminology that they hear when discussing AVs and indicated which terms are helpful and which are confusing. They placed these terms along two axes to show how these terms are used. The vertical axis represented the frequency with which these terms are used, and the horizontal axis represented the level of confusion surrounding the use of these terms. Table 5 illustrates the terms placed into each quadrant.

Table 5. Participant Input: Terminology

	Confusing ←→ Clear	
←Frequency→	• DSRC • OEM • CAV • Automated vs Autonomous • CAV or CV/AV? What is "A"? Automated or Autonomous? • Connected (provider perspective) • Standards and standardization—what it is and what it isn't • Use cases (strategies) • Signal phase and timing (SPaT); 5G; Integration	• 5G • DSRC • Connected (infrastructure perspective) • Self-driving • Technologies by different names (e.g., forward collision, parking assist, lane assist), and what each actually does
	• ODD • 5.9 gHz • CARMA • IOO	

Research Needs

Participants identified the potential research areas for automation and discussed who should conduct the research and in what timeframe. Color-coded sticky notes were used to differentiate between public and private sector research needs, and participants were asked to categorize research needs as near-term (by 2020) or longer-term (by 2020 or later).

Table 6. Participant Input: Research Needs

Public Sector
• Obtain better understanding of driver distraction (near-term). • Investigate the interactions between AVs and specific infrastructure (e.g., temporary infrastructure including cones, raised reflective markings) (near-term). • Study how AVs behave in a range of specific use cases (near-term).
Private Sector
• Explore how AVs interact with and impact infrastructure such as traffic lights, pavement, and bridges (longer term). • Conduct research to better understand how AVs will behave in various types of mixed fleets (longer term). • Develop and test methods to efficiently route AVs. Methods might incorporate dynamic speed limits, ride sharing, detour routes, and dynamic signal timing, among other elements (near-term). • Require sensor calibration based on vehicle make, model, and year (near-term).

Parking Lot

Any remaining questions and comments that did not cleanly fit into the other topic areas were included in this topic area. Topics included:

- Minimizing the risk of AV passengers interfering with driving, particularly impaired driving
- Addressing security issues
- Understanding tort liability for public agencies
- Interest in requiring annual AV safety inspections nationwide
- Deployment of AVs with social equity and accessible mobility in mind
- Concerns about AV detection of and/or connectivity with pedestrians

Breakout Session III: Action Planning Discussion

This section summarizes feedback from stakeholders who participated in the final breakout session focused on developing an action plan around operations for AVs. Key suggestions from this discussion included the following:

- Build and maintain knowledge among all AV stakeholders and the public.
- Continue to engage State and local agencies on their role in facilitating the safe integration of automation.
- Host meetings, webinars, and other online forums to bring together IOOs, industry, and specifically ADS technology developers.
- Establish roadway readiness ratings for AVs.
- Provide funding for a national pilot program.
- Establish a national forum for dialogue related to discussing operational design domain for AVs.
- Develop a standard approach for updating traffic laws and ordinances for AVs.
- Transmit SPaT data in a standardized format.
- Identify infrastructure standards (e.g., for pavement markings, signage, digital infrastructure) to support AVs.
- Standardize emergency response procedures for AV-involved incidents.
- Cooperatively develop standards for exchanging critical infrastructure data with AVs.
- Clarify funding eligibility requirements for investments to support AV integration, including training of State and local agency staff as well as maintenance activities.

Conclusion

The National Dialogue on Highway Automation's Operations Workshop provided FHWA with diverse input about various issues and opportunities surrounding the integration of automated vehicles into the roadway system. Input provided from participants will inform FHWA policies, research, and programs. Operations issues were also discussed in the other National Dialogue workshops. Operations will continue to be important topics in the national conversation to advance roadway automation readiness. Additional information regarding the workshop series and related initiatives is available on the FHWA National Dialogue website.[4]

[4] https://ops.fhwa.dot.gov/automationdialogue/

Appendix A: Participants

Over 170 participants from 106 organizations attended the Operations Workshop of the National Dialogue on Highway Automation.

3M	AASHTO	ADOT
AECOM	Arcadis	Arizona Commerce Authority
Arizona House of Representatives	Arizona Senate Democratic Caucus	Arizona State University
Arizona Trucking Association	ATSSA	Battelle
BNSF Railway	Booz Allen Hamilton	California Highway Patrol
Caltrans	Carleton University	CDOT
CERTH-HIT	City of Boston	City of Mesa
City of Peoria	City of Surprise	City of Tempe
CDOT	Columbia University	Daimler Trucks
DDOT	FHWA	FTA
FHWA – AZ Division	FMCSA	Gannett Fleming, Inc.
General Motors	Georgia DOT	HDR Engineering, Inc.
HERE Technologies	HNTB	1-95 Corridor Coalition
iCone Products	INRIX	International Association of Fire Chiefs
International Research Center	InTrans Iowa State University	Iowa DOT
ITE	Iteris	ITSA
Jacobs	Kansas DOT	Kapsch TrafficCom USA
Kimley-Horn	Lee Engineering	Louisiana DOTD
Maricopa Association of Governments	Maricopa County	Maricopa County DOT
Maryland DOT-SHA	MCDOT	MDTA
Mercer Strategic Alliance	Merriweather Advisors	Minnehaha County
Minnesota DOT	NHTSA	National Operations Center of Excellence
NCSL	NCTCOG	Nissan North America
NJDOT	Noblis	Olsson
Oro Valley Police Department	Phoenix Street Transportation Department	Pima County Department of Transportation

Pinal County	ResponderSafety.com	RK Deering & Associates
Road Infrastructure Inc.	Robert Bosch LLC	Sam Schwartz Consulting
State Farm	Texas A&M Transportation Institute	Toyota
TransportCanada	TranSystems	TSMO
TuSimple	TxDOT	UA College of Engineering
UC Berkeley	Union Pacific Railroad	University of Arizona
University of Florida	University of Hawaii	USDOT
UW-Madison	Valley Metro	Verra Mobility
VHB	Virginia Tech Transportation Institute	Voxel51
Waymo	WSDOT	WSP

Appendix B: Workshop Agenda

Day 1: Wednesday, October 24, 2018

Time (PDT)	Agenda Item	Name
12:30 PM	**Registration & Sign-In**	
1:00 PM	**Welcome & Introduction**	**Karla Petty,** Division Administrator, Arizona Division Office, FHWA
1:05 PM	**Opening Remarks**	**John Halikowski,** Director, Arizona Department of Transportation
1:20 PM	**National Dialogue Overview**	**John Harding**, Team Lead, Office of Transportation Management, FHWA
1:35 PM	**Small Group Session 1:** *Impacts of Automated Vehicles on Operations*	All Participants
2:45 PM	**Break**	
3:00 PM	**Small Group Session 1: Report Out**	All Participants
3:30 PM	**Introductory Remarks**	**Martin Knopp**, Associate Administrator, Office of Operations, FHWA
3:35 PM	**Keynote Address**	**Brandye Hendrickson,** Deputy Administrator, FHWA
3:50 PM	**Collaboration Corner** *Participants rotate around to provide input on various topics.*	Topics: 1. **FHWA Operations Research Showcase:** Highlighting existing FHWA research 2. **Operational Environments and Use Cases:** Enabling AV operation in all environments 3. **Preparing State and Local Agencies for Automation:** Building capacity and providing guidance 4. **Data:** Assessing critical data needs for traffic operations decision-making 5. **Terminology**: Building our lexicon around highway automation 6. **Research Needs:** Evaluating current research or new reach to consider 7. **Parking Lot:** What is missing?
5:00 PM	**Wrap Up and Preparation for Day 2**	**John Corbin**, CAV Program Manager, Office of Transportation Management, FHWA
5:15 PM	**End of Day 1**	

Day 2: Thursday, October 25, 2018

Time (PDT)	Agenda Item	Name
7:30 AM	**Registration & Sign-In**	
8:00 AM	**Day 1 Recap and Day 2 Kickoff**	**Brian Cronin**, Director, Office of Operations Research and Development, FHWA
8:15 AM	**Small Group Session 2** *Operations Strategies for Addressing Automated Vehicles*	All Participants
9:30 AM	**Small Group Session 2 Report-Out**	All Participants
10:00 AM	**Break**	
10:20 AM	**Preparing for Automated Vehicles:** *Bringing industry and infrastructure owners and operators together*	Moderated by **Valerie Briggs**, Director, Office of Transportation Management, FHWA Panelists: • Tim Lane, Enforcement and Compliance Division Director, Arizona DOT • Ryan Rice, Director, Division of Mobility Operations, Colorado DOT • Matt Schwall, Head of Field Safety, Waymo • Jennifer Toth, Transportation Director, Maricopa County
11:30 AM	**Lunch (not included)**	
1:00 PM	**Small Group Session 3: What's Next?** *Each table selects a primary and secondary topic to address.*	Topics: a) Developing the Moonshot b) Near-Term vs. Long-Term Actions c) Federal, State, Local Roles d) Other Topics
2:30 PM	**Wrap Up and Next Steps**	**John Corbin**, CAV Program Manager, Office of Transportation Management, FHWA
3:00 PM	**End of Day 2**	

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