Federal Highway Administration

National Dialogue on Highway Automation: August 1-2, 2018 Digital Infrastructure and Data Workshop Summary

August 2019

U.S. Department of Transportation
Federal Highway Administration

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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 August 2018 National Dialogue Digital Infrastructure and Data workshop held in Seattle, Washington.			
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Contents

Acronyms and Abbreviations

AV	Automated vehicle
CV	Connected vehicle
DOT	Department of Transportation
FHWA	Federal Highway Administration
IOO	Infrastructure owner and operator
LIDAR	Light detection and ranging sensor
OEM	Original equipment manufacturer
SAE	Society of Automotive Engineers
SPaT	Signal phase and timing
USDOT	U.S. 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 into the roadway system, using inputs from States, local governments, industry, and associations, alongside FHWA and other Federal agencies.

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

Digital Infrastructure and Data Workshop

The Digital Infrastructure and Data Workshop, held on August 1-2, 2018 in Seattle, Washington, was the second workshop of the National Dialogue series. Nearly 150 individuals 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

USDOT Has a Role in Facilitating Conversations About Data and Digital Infrastructure[2]

Many issues related to data and digital infrastructure involve multiple parties, including State agencies, cities, and private companies. As a result, it may be necessary to bring all stakeholders together in cooperative discussions around shared goals. Several meeting participants suggested that the Federal Government is uniquely positioned to convene and facilitate conversations about data and digital infrastructure.

Use Cases Can Help Provide a Framework for Defining Data Needs

Throughout the workshop, those in attendance frequently discussed how use cases can help stakeholders to better understand data and digital infrastructure needs. Use cases can define what data is being exchanged, by whom, and for what purpose. Insights gained from developing use cases can enable decision making by IOOs and policymakers. Use cases can help determine where opportunities exist for mutual benefit in data exchanges between entities. They can also help guide thinking around which entities could be responsible for storing, maintaining, sharing, or accessing data.

Data Standardization and Consistency Are Important for Interoperability

Consistency in data formats, standards, and requirements can support effective data exchanges and AV operations, although it is unclear what level of standardization or harmonization is necessary. Participants suggested that data and digital infrastructure for highway automation would benefit from voluntary, consensus-based technical standards. Although it is unclear what

[2] Digital Infrastructure is a term of art defined variably across technical fields and industries. It has not been prescriptively defined by USDOT or other national groups within the context of highway automation or automated driving systems. The use of the term in the workshop and in this summary is intended to loosely encompass information management and telecommunication systems that enable the collection, transmission, administration, storage, and analytical application of diverse data related to automated vehicle operation and the integration of automated driving systems with the roadway network.

level of standardization or harmonization is necessary, consistency in data formats, standards, and requirements can support effective data exchanges and AV operations. A consideration is that different use cases or applications could require varying levels of standardization. Several workshop participants in attendance suggested that some data and digital infrastructure requirements could be harmonized to acceptable levels without any additional attempts by government to manage them and that stakeholders should be aware of work by standards development organizations.

Critical Data Issues Must Be Addressed Cooperatively

During the workshop, attendees identified several critical data issues that they said require further exploration and collaboration. Some emphasized that they could only be addressed through a cooperative approach with stakeholders. They include the following:

- Ensuring cybersecurity of the system
- Protecting confidential business information
- Managing liability risk in data disclosures
- Preserving data security – protecting against unauthorized access or tampering
- Protecting personal privacy
- Providing data quality
- Addressing data lifecycle management and maintenance

In some cases, providers or third-party users of the data have made commitments regarding protections of collected data. Some saw a need for independent monitoring of data exchanges.

A Roadmap or Shared Vision Around AVs May Be Beneficial

Some participants expressed desire for a national vision or roadmap to help focus the conversation around end goals for a national digital infrastructure system and support an approach for achieving those goals. Workshop participants discussed the value of defining such a roadmap or national vision for highway automation. Some asserted that USDOT is well-positioned to develop this shared vision because of its national scope, convening power, and ability to balance multiple interests.

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.[3]

The workshop was divided into four 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 group discussion. Information regarding the agenda, breakout session questions, and participants is included in the appendices of this document.

Breakout Session I: Data for Integration of AVs

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

- Which use cases for voluntary data exchange do you consider critical to accelerating safe and efficient integration of AVs? Put another way, what are the most critical problems you think can only be solved by increasing data access?
- Who is involved in these most critical data exchanges? How should industry, public agencies, and the transportation community work together to enable needed data exchanges? Are there any existing data exchanges you think are good examples?
- What level of data standardization is needed to support AV-enabling data sharing and exchange?
- Who should store, maintain, access, and share data for AV integration?

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

- How can industry and public agencies work together to ensure data security and privacy? What are the liability issues hindering data exchange and how can they be overcome?

Different Types of Data Will Be Important for Enabling Safe and Efficient AV Operations

Participants discussed various types of data that would be useful for enabling safe and efficient AVs. Operational data, such as real-time data on work zones, road weather, special events, signal phase and timing (SPaT), and lane closures were identified as potentially important for supporting AV operations. Data regarding vehicle operating regulations or local rules of the road, such as speed limits and school zones, were also identified as useful for AVs. Public agencies desire access to data that could help them understand the impacts of AVs on the broader transportation system. These data could help public agencies assess the safety and mobility impacts of AVs and inform infrastructure investment and planning.

Data Providers, Public Agencies, and Third-Party Aggregators Have Unique Roles

AVs will both generate and use large amounts of vehicle and location data. Participants noted the significant potential value of this data to industry and third-party data aggregators. If the data were made available to third-parties, those users would have responsibilities for managing and using the data. Some thought that public agencies, as stewards of the public trust, could have roles in setting parameters on data use and governance. Some suggested that vehicle manufacturers could identify and share basic responsibilities for using vehicle-based data, especially in the context of data privacy and security. Workshop attendees also discussed data ownership and how the owner of a data source has special opportunities and obligations in managing the data it produces.

Public Agencies Have Differing Levels of Resources and Capability to Address AV Data

Public agencies have varying levels of resources to devote to data collection, management, and analytics related to AVs. Although some agencies have robust systems and the expertise to support data initiatives, other agencies do not. Workshop participants discussed managing expectations and recognizing the range of organizational capabilities for addressing AV data. Several noted the usefulness of identifying different tiers of organizational readiness, along with the expected level of support from each type of stakeholder (e.g., vehicle manufacturers, IOOs, etc.).

Breakout Session II: Digital Infrastructure

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

- How do you define digital infrastructure and what aspects of digital infrastructure are the most critical to enabling highway automation (e.g., data management hardware, software, policies, standards, agreements, communications technology)?
- What digital infrastructure aspects are needed to gather, process/quality check, assimilate, and disseminate each type of data element?
- What would a National Transportation Digital Infrastructure Framework primarily need to include (e.g., types of data, communications media, data management capabilities)?
- What is the government's role in implementing or supporting the development of digital infrastructure? What types of institutional capabilities, information, or guidance is needed?

The Digital Infrastructure Definition Is Emerging, Incomplete and Includes Multiple Components

There was not clear consensus among workshop participants around a specific definition of the digital infrastructure. However, they shared the perspective that a digital infrastructure represents the connected and interoperable components needed to gather and process data for AVs. The functions of a digital infrastructure include data capture, transmission, storage, information delivery and analysis. The parts of a digital infrastructure could include hardware, software, and protocols and policies (including standards). Several participants discussed how the digital infrastructure also includes humans—engineers and other people who interact with and operate the other parts. Although many parts of the digital infrastructure exist now, they exist to differing degrees in different places.

The digital infrastructure can also include multiple systems and components. Examples cited included traffic signal controllers with data processing capability, cell towers, and secure communication gear. Edge computing, where full data analysis capabilities are co-located with roadside sensors and other equipment, was also cited as a currently available subsystem. Some workshop participants noted that different private companies are operating their own digital infrastructures now, although these infrastructures (e.g., traffic data collection, mapping data systems, analysis and information dissemination systems) do not necessarily provide all functions needed for supporting highway automation.

Digital Maps Are a Key Part of the Digital Infrastructure

Participants described the value of high-definition maps of the physical environment in the

roadway. These maps might be constructed via light detection and ranging sensor (LIDAR), and would provide definition high enough to support AV navigation. Although maps are being produced by private-sector companies, there are opportunities to improve these maps through better information about real-time roadway conditions and characteristics. For example, some participants said that it would be valuable for the public sector to produce nationwide maps of infrastructure characteristics (e.g., bridge heights, lane widths, and right-of-way widths) and rules of the road, including dynamic elements such as signal phasing and timing. These maps may potentially reduce AV development costs and facilitate industry-agency communications and cooperation on prioritizing infrastructure improvements.

A National Transportation Digital Infrastructure Framework Could Be Valuable

Workshop participants discussed the value of having a national framework, which would consist of a set of agreements about how States, cities, and the private sector will work together on AV-related digital infrastructure. The objectives of a national framework could be to enhance safety and efficiency by supporting nationwide interoperability and consistency. The issues identified as being most valuable for the framework to address included:

- Data interfaces
- Intellectual property, confidential business information, and licensing
- Liability
- Data quality and trust in data sources
- Privacy protections
- Coordination of resources to support the development of digital infrastructure
- Prioritization of data sets and digital infrastructure elements

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:

- **Post-it exercise—**Attendees used post-it 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 on the following topics:

- **Identifying Data Needs:** Data for collecting, sharing, and standardizing
- **Digital Infrastructure and Connectivity:** Needs and challenges
- **Preparing for an Automated Future:** Focus areas and use cases
- **State and Local Issues:** Building capacity and providing guidance
- **Research Needs:** Collecting research needs statements
- **Terminology:** Developing a lexicon around highway automation
- **Parking Lot:** Gathering important questions and comments that didn't fit cleanly in any of the other categories

This section summarizes key themes and takeaways for each topic.

Identifying Data Needs

This topic focused on identifying which data are necessary for enabling safe and efficient AV operations and which entities should be involved. Input was solicited in three categories, each of which was represented on a separate flip chart at the station: (1) data to collect, (2) data to share, and (3) data to standardize. Participant inputs are summarized below.

Table 1 Participant Inputs: Data Needs

Data to Collect	
Public Sector	• Road conditions and potential hazards • Work zone information • Location and path of emergency vehicles • Operating conditions that an AV experiences
Private Sector	• Infrastructure status and quality • Information regarding near-misses and crashes with and without injuries • Pedestrian and bicyclist information
Data to Share	
Public Sector	• SPaT data • Road conditions and potential hazards • Location and path of emergency vehicles • Work zone information • Event, incident, and road closure information
Private Sector	• Non-sensitive data that would not raise anti-trust or anti-business concerns • Cyber threats and vulnerabilities • Collision and near-miss data • Consumer adoption metrics • Business models • Routing information
Data to Standardize	
Public Sector	• Vehicle-to-vehicle and vehicle-to-infrastructure communications message sets • Geo-mapping information • Work zone location and timing • Traveler information • Information collected by electronic data recorders in vehicles
Private Sector	• Probe vehicle data • Connected vehicle datasets and applications • Linear referencing

Digital Infrastructure and Connectivity

This topic focused on different aspects of digital infrastructure considered to be most critical to enabling automation, such as specific elements that support vehicle interoperability and automated vehicles operating in a mixed-fleet environment. Input was solicited in three categories: (1) needs, (2) challenges, and (3) roles.

Table 2 Participant Inputs: Digital Infrastructure and Connectivity

Needs
• Education for drivers, consumers, and road users • Dedicated spectrum for connected vehicle communications • Incremental deployment that supports both current and future vehicles and leverages existing infrastructure without being locked into one technology • Unambiguous standards for data transmission, connectivity, and interoperability • Connectivity along major travel routes (e.g., fiber-optic cable) • Proofs-of-concept and demonstrations
Challenges
• Developing consensus standards for connected vehicles • Obsolescence of infrastructure and technology • Data privacy and security • Funding and maintenance of digital infrastructure assets • Consistency of road signs and marking • Data storage and transmission efficiency
Roles
• Federal: Regulating aspects of AVs critical to safety of the transportation system. • State: Permitting of right-of-way for digital infrastructure field deployments • Original equipment manufacturers (OEMs), start-ups, etc.: information technology solutions • Public-private partnerships: No role identified

Preparing for an Automated Future

This topic focused on opportunities in data and digital infrastructure to support an automated future. Input was solicited in five categories: (1) policy and planning; (2) operations; (3) freight; (4) infrastructure design; and (5) safety.

Table 3 Participant Input: Preparing for an Automated Future

Policy and Planning	
Data	• Jurisdiction-specific regulatory information needs to be consistent and exchanged (e.g., traffic and privacy regulations). • A value proposition is needed for collecting, sharing, and validating information. • Data on vehicle operations can inform safety and long-range planning.
Digital Infrastructure	• Need to recognize potential impacts on the electric grid.

Operations	
Data	• SPaT information could potentially support transportation system efficiency. • Public agencies would like data to assist with asset management and integrated corridor management.
Digital Infrastructure	• Shared weather and hazard information could be useful.
Freight	
Data	• Freight operations would benefit from data to support real-time weight assessments and dynamic hazardous materials information.
Digital Infrastructure	• Updated rest area information could be useful.
Infrastructure Design	
Data	• Data can help prioritize infrastructure investments. • Important to determine minimum data elements and standards for infrastructure design. • Need to develop processes for data aggregation and transmission to IOOs. • Need to update intersection and railroad crossing information.
Digital Infrastructure	• Secure collection and storage architecture are important issues. • Real-time reporting of work zone information is needed.
Safety	
Data	• Data can inform system security, performance requirements, and modeling of safety-related factors. • Sharing of collision and near-miss information is needed.
Digital Infrastructure	• Need to develop standards for connected vehicles and infrastructure. • There should be different policies for companies at different levels of maturity (e.g., experienced OEMs vs. start-ups).

State and Local Issues

This topic focused on what State and local organization need to do to prepare for an automated future. Input was solicited in five categories: (1) information and tools, (2) technical assistance, (3) guidance, (4) workforce training and skills, and (5) other.

Table 4 Participant Input: State and Local Issues

Information and Tools	
Near-Term	• Information exchange from pilots to avoid duplication of efforts • Understanding of who needs what data for which purposes • Tools for automatic digital mapping
Long-Term	• Understanding the availability and types of AV data • Real-time work zone reporting • Traveler information reporting standards
Technical Assistance	
Near-Term	• Communications technology investment decisions • Network capacity and availability • Model data sharing agreements
Long-Term	• Digital mapping
Guidance	
Near-Term	• Infrastructure investments needed to accommodate AVs • Federal and State leadership and consistency • Data validation policies • Availability and protection of 5.9-GHz spectrum • Clarification of the State regulatory role
Long-Term	• Data governance • Inclusion of AV components in Federal grant criteria • Best practices for data exchange
Workforce Training and Skills	
Near-Term	• Professional capacity-building and training • Agile and open-source development • Funding for workforce development • Updated job descriptions and classifications to include technology skills
Long-Term	• Data scientists and other new skill sets
Other	
Near-Term	• Standards development and adoption • Clarification on whether connectivity will be required • Consideration of bicyclist/pedestrian needs
Long-Term	• Rural considerations • Elimination/reduction of barriers to entry • Impacts on “car culture”

Research Needs

This topic focused on identifying research that needs to be conducted and suggested responsible sectors and timeframes. Research needs were solicited in three categories: (1) urgent (by 2020), (2) medium-term (by 2025), and (3) long-term (by 2030 or later).

Table 5 Participant Input: Research Needs

Urgent (by 2020)	
Public Sector	• Collision and near-miss data related to pedestrians • Low-risk pilot studies • Impact on travel demand and patterns • Consumer education
Industry	• Electric grid impacts • Security risks • Sensor technology • Dynamic emission control • Collision prevention
Medium-Term (by 2025)	
Public Sector	• Infrastructure investments needed to accommodate AVs • Cross-sector/jurisdiction collaboration • Rural impacts • Mixed-fleet considerations • Changing role of traffic management centers • Traffic and curb use implications
Industry	• Conformance testing • Consumer adoption
Long-Term (by 2030 or later)	
Public Sector	• Interactions between AVs and all road users • Human-factors-style testing for automated systems • Modifications to the traffic control system
Industry	• Impacts on urban planning

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 6 illustrates the terms placed into each quadrant.

Some of the most confusing and frequently encountered terms include the various descriptions of

connected and/or automated vehicles, as well as the specific meanings of broadly defined words such as data, digital infrastructure, and standards.

Table 6 Participant Input: Terminology

	Confusing ←→ Clear	
←Frequency→	• Data: What data? Why is it needed? Who will use it? How will it be protected? • Standards: We talk about them, but what are they? • Enabling legislation • AV vs. connected vehicle (CV) • Road weather and real-time update • Data governance • Open data • Digital infrastructure • Connected vehicle • Automated driving system vs. AV vs. highly automated vehicle vs. connected and automated vehicle • SAE levels and full automation timeframes • Autonomous • Dedicated short-range communications • Uniformity • Cybersecurity and data privacy	• OEM • Anonymous vehicle sensor information needed • Probe data • Automated/Self-driving • SAE J3016 (taxonomy and definitions, internationally adopted)
	• Digital infrastructure • Data • Blockchain • Equity (automation helps access e.g., disabled, aging)	• Drive-by-wire • Subrogation

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:

- The need for the healthcare community to be involved in discussions regarding data
- Implications of AV use on urban planning
- Ensuring equal access and benefits
- Managing parking and unoccupied AVs
- Policies for children riding in AVs
- Potential impacts of personal aerial vehicles

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 data and digital infrastructure for AVs. Key suggestions from this discussion included the following:

- Set goals and expectations for the future of the transportation system.
- Strive for a digital infrastructure system that delivers both safety and mobility solutions through connected and automated vehicles.
- Work toward interoperability and appropriate levels of nationwide consistency.
- Develop consistent, clear, and harmonized standards.
- Coordinate both internally and externally to standardize terminology.
- Coordinate with other Federal agencies, State DOTs, and industry stakeholders to agree upon minimum needs and standards for data provided by public agencies.
- Develop examples of data requirements and digital infrastructure minimums for State and local DOTs to leverage while in discussion and collaboration with partners and stakeholders.
- Facilitate discussions with stakeholders on use cases reflecting integration of AV's into the roadway network that do and do not warrant data and digital infrastructure standardization.
- Support knowledge-sharing by facilitating, convening, and fostering stakeholder groups, task forces, and communities of practice that are prepared to address policies, practices, and issues as they arise.
- Work with States and cities to document and share lessons learned from AV testing and pilots. MPOs are in a good position to precipitate this process by providing their documented use cases and lessons learned.
- Continue to show the potential for new uses of transportation data by encouraging both the exchange of data and knowledge transfer of challenges associated with such exchanges.
- Facilitate peer exchanges between infrastructure owners and operators on data sharing and management models.
- Provide guidance and encouragement to State and local DOT leaders on the importance of data accessibility and sharing.
- Provide guidance or create standards for when and how law enforcement can access vehicle data and metadata.
- Provide opportunities to States to explore development of digital infrastructure that specifically supports connected and automated vehicles.
- Include data collection and retention policies and processes in corridor management project funding applications.

Conclusion

The National Dialogue on Highway Automation's Digital Infrastructure and Data Workshop provided FHWA with diverse input about various issues and opportunities surrounding the integration of AVs into the roadway system. Input provided from participants will inform FHWA policies, research, and programs. Digital infrastructure and data issues were also discussed in the other National Dialogue workshops. Digital infrastructure and data 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

Nearly 150 participants from 70 organizations attended the workshop.

1.21GigaWatts	3M	American Association of State Highway Officials
Amazon Web Services	America Walks	American Tower Corporation
Arcadis	Bellevue Chamber of Commerce	BNSF Railway
Booz Allen Hamilton	Cascade Bicycle Club	CATT Laboratory
CDM Smith	Center for Advanced Transportation & Energy Solutions	City of Bellevue
City of Richland	Colorado DOT	Columbia University
Continental AG, Silicon Valley R&D Center	Daimler	DeVere Public Affairs and Consulting
DKS Associates	Gannett Fleming Inc.	General Motors
Genetec	Global Automakers	HDR Engineering
Idaho Transportation Department	INRIX, Inc.	Intrans Iowa State University
Iteris	Kapsch	Kitsap County
Louisiana DOT	Mercedes-Benz RDNA	Merriweather Advisors
Minnesota DOT	National Governors Association	NCAR
New Jersey DOT	Nokia	North Central Texas Council of Governments
Office of Governor Jay Inslee	PCI	Pierce County Planning & Public Works
Portland Bureau of Transportation	Qualcomm Connected Experiences	RK Deering & Assoc.
Road-Tech Safety Services, Inc.	SCG, LLC	Seattle DOT
State of Washington	Stroz Friedberg	Synesis Partners LLC
Texas DOT	Toyota Motor North America	Transpo Group
Transport Canada	U.S. Department of Labor (Office of Disability Employment Policy)	Union Pacific Railroad
University of Iowa, National Advanced Driving Simulator	Verizon Smart Communities	Virginia Tech Transportation Institute
Washington State Transportation Commission	Washington State Patrol	Washington Trucking Associations
Washington DOT	WSP USA	

Appendix B: Workshop Agenda

Day 1: August 1, 2018

Time (PT)	Agenda Item	Name
12:30 PM	**Registration and Sign-In**	
1:00 PM	**Opening Remarks**	Mala Parker, Associate Administrator *FHWA Office of Policy and Governmental Affairs*
1:10 PM	**National Dialogue Overview**	John Harding, FHWA
1:25 PM	**Framing the Discussion**	Ariel Gold, USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO)
1:40 PM	**Small Group Session 1: Data for Integration of AVs** *Small group discussions with facilitators and co-facilitators at each table.*	Questions: • Which use cases for voluntary data exchange do you consider critical to accelerating safe and efficient integration of AVs? Put another way, what are the most critical problems you think can only be solved by increasing data access? • Who is involved in these most critical data exchanges? How should industry, public agencies, and the transportation community work together to enable needed data exchanges? Are there any existing data exchanges you think are good examples? • What level of data standardization is needed to support AV-enabling data sharing and exchange? • Who should store, maintain, access, and share data for AV integration? • How can industry and public agencies work together to ensure data security and privacy? What are the liability issues hindering data exchange and how can they be overcome?
2:50 PM	**Small Group Session 1 Report Out**	All Participants
3:30 PM	**Break**	
3:45 PM	**Collaboration Corner** *Market Square Format: Participants rotate around to different stalls to provide input on various topics.*	Topics: 1. **Infrastructure/Operational Data:** Data needs for safe AV operations & transportation system management 2. **Digital Infrastructure and Connectivity:** Enabling the AV data environment – what is digital infrastructure? 3. **Opportunities for National Digital Infrastructure Framework Development:** Partnerships between industry and public agencies 4. **Research Needs:** Collecting research needs statements 5. **Terminology:** developing a lexicon around highway automation 6. **Parking Lot:** What is missing?
5:00 PM	**Wrap Up and Preparation for Day 2**	John Corbin, FHWA
5:30 PM	**End of Day 1**	

Day 2: August 2, 2018

Time (PT)	Agenda Item	Name
7:30 AM	**Registration and Sign-In**	
8:00 AM	**Kick-Off Day 2**	Carl Andersen, FHWA
8:15 AM	**Instructions for Small Group Session 2**	John Corbin, FHWA
8:20 AM	**Small Group Session 2: Digital Infrastructure** *Small group discussions with facilitators and co-facilitators at each table.*	Questions: • How do you define digital infrastructure and what aspects of digital infrastructure are the most critical to enabling highway automation (e.g., data management hardware, software, policies, standards, agreements, communications technology)? • What digital infrastructure aspects are needed to gather, process/quality check, assimilate, and disseminate each type of data element? • What would a National Transportation Digital Infrastructure Framework primarily need to include (e.g., types of data, communications media, data management capabilities)? • What is the government's role in implementing or supporting the development of digital infrastructure? What types of institutional capabilities, information, or guidance is needed?
9:30 AM	**Small Group Session 2 Report-Out**	All Participants
10:00 AM	**Break**	
10:20 AM	**Preparing for Automated Vehicles: Digital Infrastructure and Data Perspectives**	Facilitated by Brian Cronin, FHWA Panelists: • Alex Alben, Chief Privacy Officer, Washington State • Ted Trepanier, Senior Director, Public Sector Services, INRIX
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: 1. Developing the Moonshot 2. Near-Term vs. Long-Term Actions 3. Federal, State, Local Roles 4. National Partnership Models
2:30 PM	**Wrap Up and Next Steps**	John Corbin, FHWA
3:00 PM	**End of Day 2**	

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