



Inclusive Design of Autonomous Vehicles: A Public Dialogue

**February 22 – May 5, 2021
Summary Report**



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Introduction

Background

From February 22 to May 5, 2021, the U.S. Access Board hosted *Inclusive Design of Autonomous Vehicles: A Public Dialogue*. Offered in conjunction with four virtual public forums, this national online dialogue was part of an ongoing effort to ensure that autonomous vehicles (AV) are accessible to persons with disabilities.

This report provides background and highlights from the online dialogue, the contents of which will be included in the Access Board's written summary report of the virtual forums. The report and links to recordings of the virtual events will be available on the Access Board's website as a resource for the design of accessible AVs.

The Access Board collaborated with federal partners to develop and support this important national discussion, including the U.S. Department of Labor's Office of Disability Employment Policy (ODEP), and the U.S. Department of Health and Human Services' Administration for Community Living (ACL). Representatives from federal partner agencies promoted the dialogue to their constituents and served as moderators by reviewing and responding to participant ideas and comments.

The online dialogue provided an additional opportunity for the public and key stakeholders—such as equipment manufacturers, accessibility specialists, advocacy organizations, automotive manufactures and designers, AV technology companies, state and local government officials, researchers, transportation service providers and subject matter experts—to share information about accessibility for autonomous vehicles.

During the national online dialogue, 195 stakeholders shared ideas on the following topics: (1) Accessibility for Passengers with Mobility Disabilities: Entering and Exiting; (2) Accessibility for Passengers with Mobility Disabilities: Maneuvering and Securement; (3) Accessibility for Passengers with Sensory or Cognitive Disabilities; and (4) Next Steps for Accessible Design of AVs.

Online Dialogue Topics

Inclusive Design of Autonomous Vehicles: A Public Dialogue featured the following four campaigns:

1. Accessibility for Passengers with Mobility Disabilities: Entering and Exiting

Under this campaign, the dialogue asked visitors to provide ideas around the design and development of AVs to ensure accessible entering and exiting for individuals with mobility disabilities. This campaign complemented the Access Board's March 10, 2021, virtual public forum, which discussed methods and technologies for entering and exiting autonomous vehicles.

2. Accessibility for Passengers with Mobility Disabilities: Maneuvering and Securement

Under this campaign, stakeholders were asked to share their current ideas for the design and development of AVs to ensure accessible onboard maneuvering and securement for individuals with mobility disabilities. This campaign complemented the U.S. Access Board's March 24, 2021, virtual public forum, which addressed maneuvering and securement in vehicles.

3. Accessibility for Passengers with Sensory or Cognitive Disabilities

Under this campaign, the dialogue asked participants to share their ideas and comments for accessible ride hailing, on-board communication and interacting with AVs for passengers with hearing, visual or cognitive disabilities. This campaign complemented the U.S. Access Board's April 7 and 21, 2021 virtual public forums that covered a variety of subjects related to the accessibility for passengers with sensory and cognitive disabilities.

4. Next Steps for Accessible Design of AVs

Under this campaign, the Access Board asked stakeholders for ideas for future research needs and next steps required to ensure the accessible design and development of AVs for all travelers including those with disabilities.

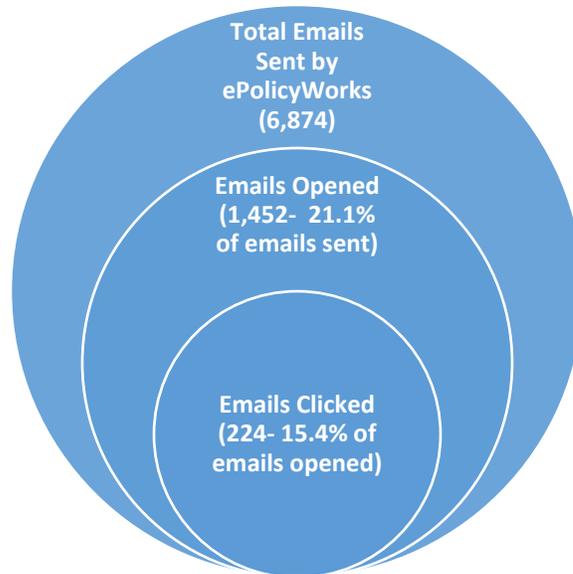
Outreach Efforts

Inclusive Design of Autonomous Vehicles: A Public Dialogue asked manufacturers, accessibility specialists, advocacy organizations, technology companies, state and local government officials, researchers and transportation specialists, and other stakeholders to share their ideas and take part in the important discussion on efforts to ensure a future with accessible AVs. To ensure a wide range of participants, ePolicyWorks conducted numerous strategic outreach efforts, including distributing targeted eblasts and posting news about the dialogue on social media. For example, ePolicyWorks sent emails to the registrants of previous ePolicyWorks AV and accessible transportation online dialogues, as well as advocacy organizations, transportation subject matter experts, university researchers, state and local government officials, and other key stakeholders, including members of the disability community.

ePolicyWorks Email and Social Media Outreach

ePolicyWorks conducted six distinct email campaigns over the course of the dialogue. The emails included the following:

1. General dialogue invitation emails and Campaign One announcements with link to the March 10th virtual listening session emails
 2. Campaign Two announcement email with link to the March 24th virtual listening session
 3. Campaign Three announcement email with link to the April 7 virtual listening session
 4. Campaign Three reminder email with link to the April 21st virtual listening session
 5. General dialogue “last chance” emails
- Total Emails Delivered: 6,874
 - Total Emails Opened: 1,452
 - Total number of clicks on links in emails (excluding multiple clicks of the same link): 224



In addition to the email campaigns, ePolicyWorks posted tweets on @ePolicyWorks throughout the dialogue to inform followers about both the virtual listening sessions and the online dialogue.

- Number of @ePolicyWorks impressions of virtual listening session and online dialogue promotions: 23,793 impressions and 233 engagements (from 22 promotion tweets)

Independent Online Dialogue Promotion

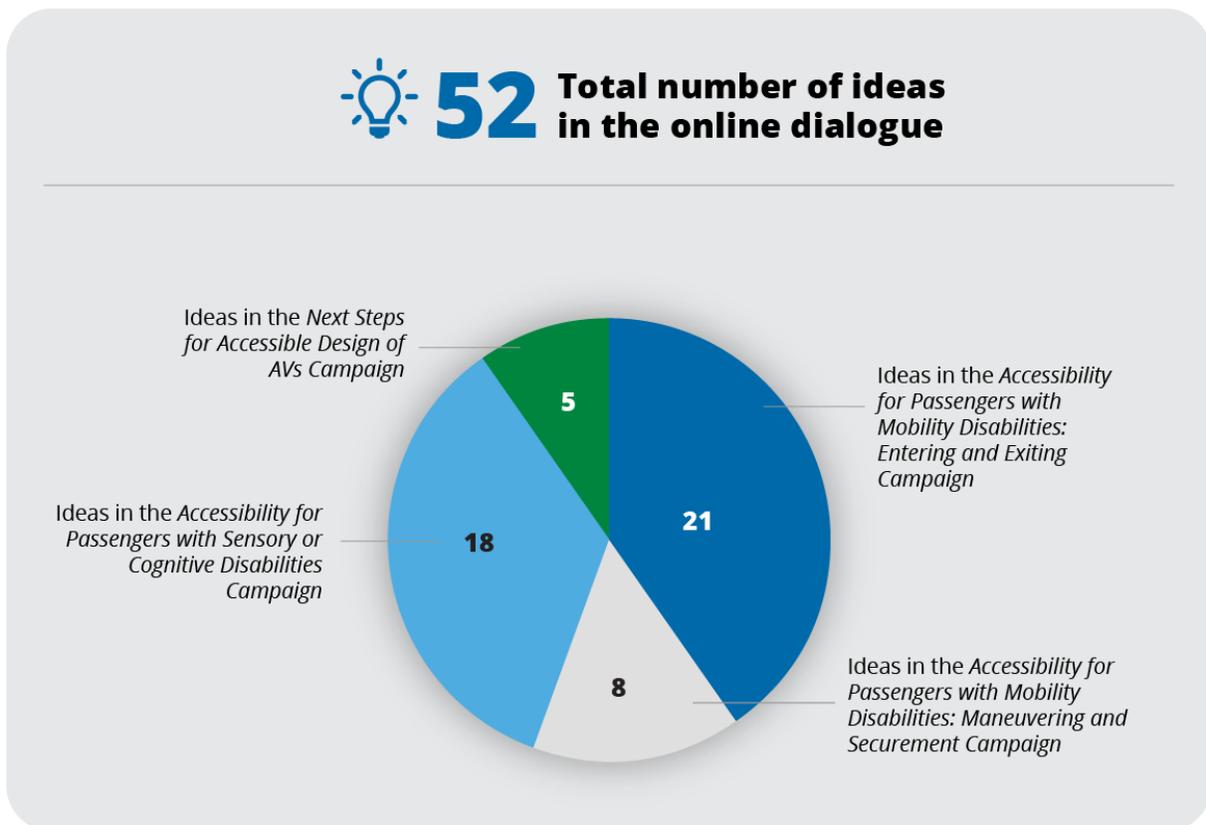
Beyond outreach by the Access Board, the U.S. Department of Labor and other federal agencies, many other stakeholder organizations promoted the online dialogue through Facebook, LinkedIn, Twitter, emails, blogs, newsletters and action alerts. Below is a sampling of the organizations and publications that disseminated details about the online dialogue:

- The Administration for Community Living
- The National Center for Mobility Management
- Mid-Atlantic ADA Center
- University of Washington
- Blinded Veterans Association
- Washington State Employment Security Department
- Maryland Department of Rehabilitation Services
- Independent Living Research Utilization Program
- PAVE (Partners for Automated Vehicle Education)
- Southeast ADA Center
- National Mobility Equipment Dealers Association
- Autistic Self Advocacy Network
- Maryland Technology Assistance Program

Online Dialogue Participant Summary

Inclusive Design of Autonomous Vehicles: A Public Dialogue opened on February 22 and closed at the end-of-day on May 5, 2021. Detailed below is information on the contributions to the dialogue—i.e., ideas, comments and votes, along with the number of online dialogue views, registrants, participation rates and geographical location of dialogue visitors.

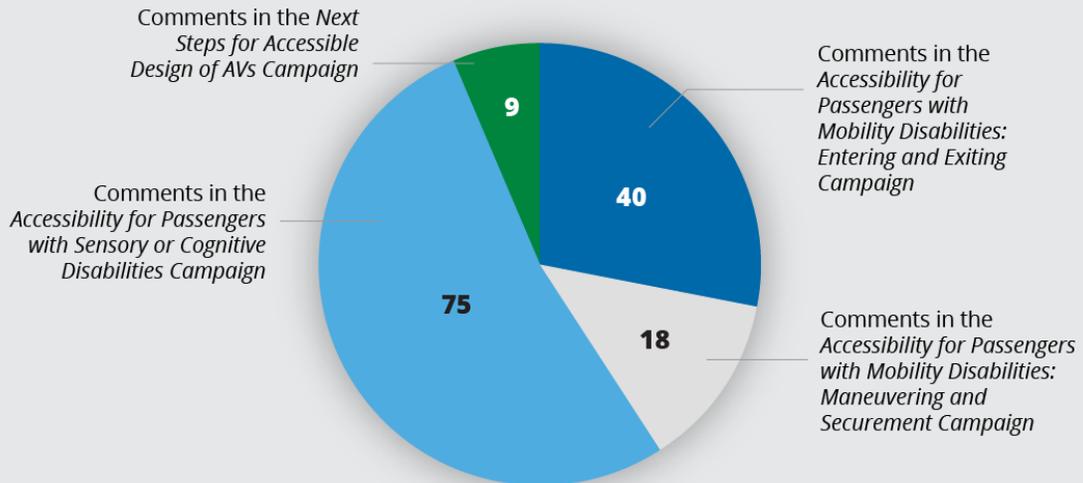
Contributions to the Online Dialogue



Total number of ideas in the online dialogue: 52

- Ideas in the *Accessibility for Passengers with Mobility Disabilities: Entering and Exiting Campaign*: 21
- Ideas in the *Accessibility for Passengers with Mobility Disabilities: Maneuvering and Securement Campaign*: 8
- Ideas in the *Accessibility for Passengers with Sensory or Cognitive Disabilities Campaign*: 18
- Ideas in the *Next Steps for Accessible Design of AVs Campaign*: 5

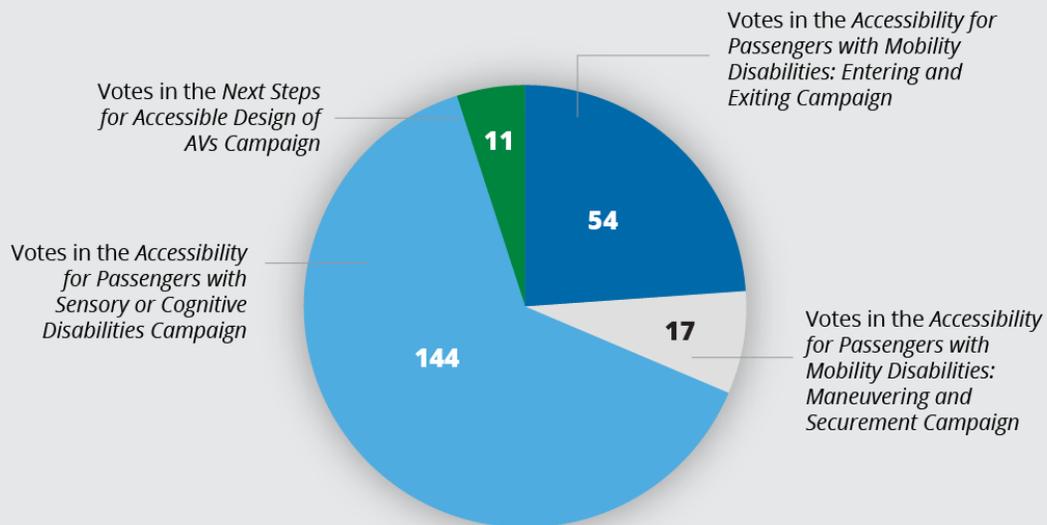
 **142** Total number of comments in the online dialogue



Total number of comments in the online dialogue: 142

- Comments in the *Accessibility for Passengers with Mobility Disabilities: Entering and Exiting Campaign*: 40
- Comments in the *Accessibility for Passengers with Mobility Disabilities: Maneuvering and Securement Campaign*: 18
- Comments in the *Accessibility for Passengers with Sensory or Cognitive Disabilities Campaign*: 75
- Comments in the *Next Steps for Accessible Design of AVs Campaign*: 9

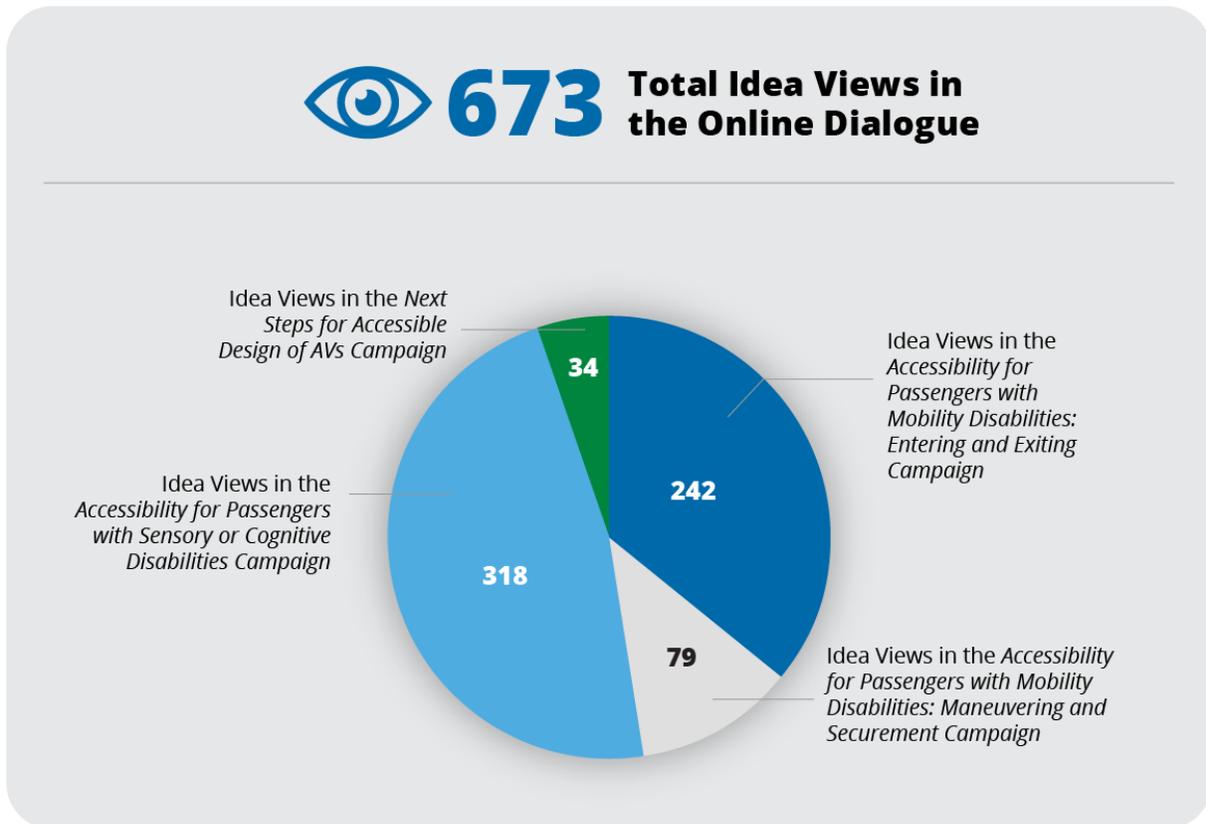
226 Total number of votes in the online dialogue



Total number of votes in the online dialogue: 226

- Votes in the *Accessibility for Passengers with Mobility Disabilities: Entering and Exiting Campaign*: 54
- Votes in the *Accessibility for Passengers with Mobility Disabilities: Maneuvering and Securement Campaign*: 17
- Votes in the *Accessibility for Passengers with Sensory or Cognitive Disabilities Campaign*: 144
- Votes in the *Next Steps for Accessible Design of AVs Campaign*: 11

Idea Views in the Online Dialogue



Total number of idea views* in the online dialogue: 673

- Idea Views in the *Accessability for Passengers with Mobility Disabilities: Entering and Exiting Campaign*: 242
- Idea Views in the *Accessability for Passengers with Mobility Disabilities: Maneuvering and Securement Campaign*: 79
- Idea Views in the *Accessability for Passengers with Sensory or Cognitive Disabilities Campaign*: 318
- Idea Views in the *Next Steps for Accessible Design of AVs Campaign*: 34

**Idea Views include the number of times a verified registered member of the dialogue opened the idea detail page to view the full description of an idea.*

Visitors, Registrants and Participants in the Online Dialogue

From February 22 to May 5, 2021, *Inclusive Design of Autonomous Vehicles: A Public Dialogue* could be viewed by any individual with the URL TransportationInnovation.IdeaScale.com. Visitors to the URL could access all the links and ideas, comments and votes in the online dialogue.

In order to participate in the dialogue—i.e., add an idea, comment or vote—individuals must have completed the registration process. The registration process entails completing an online form and verifying their email address. Once an individual is verified, they can create a password, log in and add ideas, as well as comment and vote on ideas submitted by others.

For the following metrics, “visitors” are defined as all individuals who visited the URL of the dialogue, whether or not they choose to register. “Registrants” are those who successfully verified their email and created a password. “Participants” include anyone who submitted an idea or commented or voted on an idea submitted by another.

- Total number of U.S. visitors to the online dialogue: 2,788 individuals
- Total number of visits to the online dialogue: 5,025
- Total number of page views: 11,578 pages
- Average number of times visitors came to the online dialogue: 1.43
- Average length of time they spent visiting the online dialogue: 2:17 minutes
- Average pages they viewed during a visit to the online dialogue: 2.30 pages
- Total number of registrants in the dialogue: 195 individuals
- Total number of registrants who participated by contributing an idea, comment or vote: 64 (33% of registrants)
- Total number of registrants who contributed ideas: 40
- Total number of registrants who contributed comments: 40
- Total number of registrants who contributed votes: 57



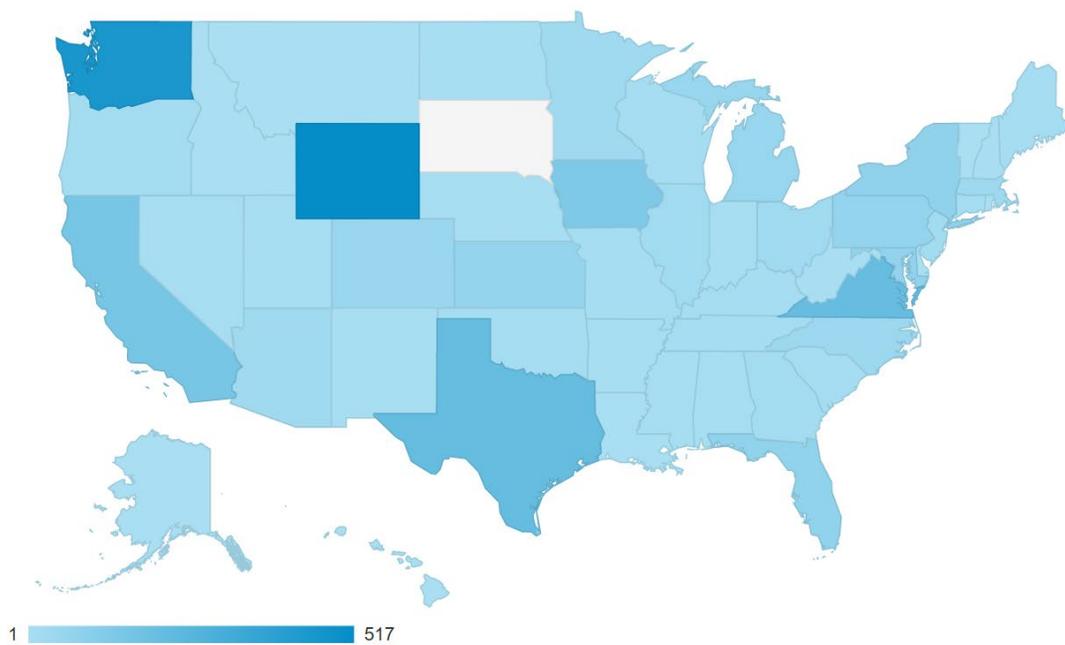
Visitors to the Online Dialogue

In total, 2,788 individuals visited *Inclusive Design of Autonomous Vehicles: A Public Dialogue* during the time it was open for participation. Below is the state affiliation of the visitors to the dialogue.

<u>State</u>	<u>Total Number of Visitors</u>	<u>Percentage of Total</u>
Wyoming	517	18.54%
Washington	452	16.21%
Texas	218	7.82%
Virginia	212	7.60%
California	161	5.77%
Iowa	140	5.02%
District of Columbia	99	3.55%
New York	80	2.87%
Florida	79	2.83%
Maryland	74	2.65%
Pennsylvania	71	2.55%
Kansas	67	2.40%
Michigan	56	2.01%
Colorado	55	1.97%
North Carolina	44	1.58%
Massachusetts	39	1.40%
Illinois	35	1.26%
Arizona	32	1.15%
Minnesota	32	1.15%
Ohio	30	1.08%
New Jersey	22	0.79%
Georgia	20	0.72%
Oregon	20	0.72%
Oklahoma	15	0.54%
Missouri	14	0.50%
Wisconsin	14	0.50%
Connecticut	13	0.47%
Maine	13	0.47%
Tennessee	13	0.47%
Kentucky	12	0.43%
South Carolina	12	0.43%
Nevada	11	0.39%
Alabama	10	0.36%
Arkansas	9	0.32%
Mississippi	9	0.32%
Utah	8	0.29%
Indiana	7	0.25%

State	Total Number of Visitors	Percentage of Total
New Mexico	7	0.25%
North Dakota	6	0.22%
Nebraska	6	0.22%
New Hampshire	5	0.18%
West Virginia	5	0.18%
Louisiana	4	0.14%
Rhode Island	4	0.14%
Delaware	2	0.07%
Hawaii	2	0.07%
Alaska	1	0.04%
Idaho	1	0.04%
Montana	1	0.04%
Vermont	1	0.04%
Unknown	28	1.00%

Map of Dialogue Visitors*



** Map depicts Google Analytics State Affiliation of Online Dialogue Visitors as reported in the table in the section above.*

Online Dialogue Registrant Profiles

When registering for *Inclusive Design of Autonomous Vehicles: A Public Dialogue*, registrants were asked to characterize their interest in accessible AVs. Registrants were allowed to choose multiple answers, if applicable. Below is a summary of the responses:

<u>Interest in autonomous vehicles</u>	<u>Number of Registrants</u>	<u>Percentage of Total</u>
Person with a disability (user)	125	19.9%
Government agency (federal, state or local)	82	13.0%
Accessibility specialist/consultant	49	7.8%
Advocacy organization	43	6.8%
Researcher (university or think tank)	26	4.1%
Transportation service provider	22	3.5%
Accessibility equipment manufacture	19	3.0%
Automotive manufacture or designer	18	2.9%
AV Technology Company	16	2.5%
Other	229	36.4%

Review and Analysis of Online Dialogue Contributions

Over the course of *Inclusive Design of Autonomous Vehicles: A Public Dialogue*, participants from across the U.S. shared ideas and recommendations about how AVs can be designed so that are accessible to all people, including persons with disabilities. Advocates, manufactures, researchers, IT companies, organizations, and state and local government representatives jointly contributed 52 ideas, 142 comments and 226 votes to the dialogue. Based on these contributions, several themes emerged as key ideas among the stakeholders.

Key Themes

Based on a preliminary analysis of the ideas posted to the dialogue, several key themes emerged, including the following:

Securement, Height of Vehicle and Zero Ground Entry

Contributors to the dialogue shared specific recommendations for AVs including a minimum head clearance of 6 feet for entering and exiting an autonomous vehicle and zero entry. One commenter suggested having the door width increased to more than 32-inches, perhaps to 36-inches. Another suggested making mobility vehicle ramps a little bit bigger for people who have difficulty with driving their power wheelchair. Others requested the ability to sit front facing for all individuals utilizing AVs. In addition, commenters recommended the incorporation of human assistance for people with disabilities who require aid.

Service Animals in the Design of Accessible Autonomous Vehicles

One commenter brought up the issue of service animals and the need for them to be considered in the design of AVs, including securement of the animals as well as safe loading and unloading.

Coordination Between Vehicle Manufactures and Infrastructure Developers

Several dialogue participants discussed the need for coordination between vehicles and infrastructure. One submitter emphasized the need to view the entire mobility/transportation ecosystem holistically and suggested thinking about the vehicle and its associated infrastructure as one. Specifically, the commenter indicated that there should be coordination of design languages as well as a dialogue between the vehicle manufacturers and the infrastructure builders.

Consideration the Entire AV System to Ensure Accessibility

Several dialogue ideas spoke to the range of issues that need to be addressed in order to provide access to all. These issues include the ability to enter/exit the vehicle, safety during the trip, solutions to address when something goes wrong with the technology, and the ability to take goods/aids with the passenger. Noted issues also included those beyond the design of the

vehicle itself, including summoning the vehicle, locating the vehicle, paying for the vehicle, and issues around ownership and insurance. In addition, other issues include providing service to “harder-to-serve” populations that are largely not being addressed by the public or private sector. As one submitter put it “we need to think of this as an entire 'AV ecosystem' issue—and think well beyond the issues around vehicles themselves. Those are important, but in no way sufficient if we want to get to equitable outcomes.”

Incorporation of Input from Stakeholders Throughout the Design, Development and Implementation Effort

Many participants in the dialogue emphasized the need to include stakeholders in the design, development and implementation process. One participant shared an experience during a listening session in the state of Michigan: “One of the main points of agreement was that individuals with disabilities need to be involved at all levels—design, development, testing, and policy making. Greater diversity during these processes will significantly impact the levels of accessibility that autonomous vehicles—both privately owned and publicly operated—have as they are rolled out and operated.” Another idea submitter suggested the expansion of AV early rider programs to include individuals who utilize wheelchairs or who are blind or have a cognitive disability.

Design of the Vehicle to Ensure it is Easy to Understand and Maneuver

Several ideas in the dialogue discussed the extra challenges in ensuring AVs are accessible to everyone. One person mentioned the need for auditory prompts and feedback for individuals who rely on sound for navigation. For older adults, participants discussed the need for adequate lighting, rails and handles to grasp, help buttons and real-time two-way communication, as well as easy to deploy safety belts. In addition, they suggested adding extra time to enter and exit the vehicle without fear of doors closing or warning signals, which can startle individuals with cognitive differences and other hidden disabilities. Also, one idea recommended adding an option to minimize the number of sound warnings and signals inside the vehicle, as well as adjustment of the pitch and volume.

Concerns Regarding Electromagnetic Radiation Sensitivity

Some participants in the dialogue raised concerns about how individuals with electromagnetic radiation sensitivity may be affected by AVs and the associated infrastructure. Comments indicated that persons with electromagnetic sensitivities may not be able to use AVs due to the radiation they generate. Moreover, the infrastructure needed for AVs may be harmful to these individuals.

Appendix: Relevant AV Resources Shared During the Online Dialogue

- [Older Adults, New Mobility, and Automated Vehicles by Urbanism Next at the University of Oregon](#)
- [Blumenthal & Markey Call for In-Depth Federal Investigation, Recommendations for Automated Driving & Driving Assistance System Improvements after Deadly Tesla Crash \(press release\)](#)
- [Clearing Our Path \(Creating Accessible Environments for People Impacted by Blindness\)](#)
- [Health-Promoting Nature Access for People with Mobility Impairments: A Systematic Review by International Journal of Environmental Research and Public Health](#)
- [CarFreeMe.com](#)
- [Dementia Friendly America](#)
- [Travel by Persons with Mental Health Conditions \(report, UK\) by Roger Mackett – Centre for Transport Studies, University College London](#)
- [ONEder and The Arc of Northern Virginia Transition Suite](#)
- [Transportation Autism Project by Rutgers Center for Advanced Infrastructure and Transportation](#)