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Experiences with Autonomous Vehicle in U.S. Cities

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California Resilient and Innovative Mobility Initiative

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16. Abstract
This project convened a series of meetings and workshops to prioritize listening to multi-sector stakeholders from local government, advocacy, and industry in US cities where autonomous vehicles are operating. The objective was to listen and learn from all stakeholders, raise issues surrounding accessibility and equity, and to solicit responses. Key findings from the workshops include a consensus across the three sectors on the need for good channels of multi-stakeholder communication, and voices across all sectors agreed on the importance of disability access and serving diverse populations. Many parties, representing voices from all sectors, recognized that federal regulatory activities appear to be moving too slowly. Preventing any roadway incidents is a priority for many stakeholders, and some suggest a playbook for handling day-to-day roadway issues and common standards for first-responder interactions. Disability access is a high priority across all sectors, and there many see nearer term to accommodations for blind, hearing-impaired riders, but the timeline for providing service to people with non-folding wheelchairs is less clear. There is also ongoing debate surrounding the limits of regulatory purview, the role for cities, and how to actualize equitable expansion into rural areas. There is more work to do to advance a multi-sector dialogue around the role for local governments and community-based organizations in shepherding a safe, equitable and sustainable expansion of autonomous vehicles.

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The University of California Institute of Transportation Studies (UC ITS) is a network of faculty, research and administrative staff, and students dedicated to advancing the state of the art in transportation engineering, planning, and policy for the people of California. Established by the Legislature in 1947, ITS has branches at UC Berkeley, UC Davis, UC Irvine, and UCLA.

The California Resilient and Innovative Mobility Initiative

The California Resilient and Innovative Mobility Initiative (RIMI) serves as a living laboratory – bringing together university experts from across the four UC ITS campuses, policymakers, public agencies, industry stakeholders, and community leaders – to inform the state transportation system's immediate COVID-19 response and recovery needs, while establishing a long-term vision and pathway for directing innovative mobility to develop sustainable and resilient transportation in California. RIMI is organized around three core research pillars: Carbon Neutral Transportation, Emerging Transportation Technology, and Public Transit and Shared Mobility. Equity and high-road jobs serve as cross-cutting themes that are integrated across the three pillars.

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Experiences with Autonomous Vehicle in U.S. Cities

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California Resilient and Innovative Mobility Initiative

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Executive Summary

Executive Summary

Highly automated vehicles (AVs) also referred to as autonomous driving systems (ADS) can complete the full driving task without active physical control or monitoring by a human operator. These vehicles present unique challenges for local governments, regulators, planners, and community practitioners. Challenges include questions of legal liability, handling of data, and equitable service provision. While the US federal and state governments will play key roles in AV regulation, the focus of this project is to unpack the role of city governments in autonomous vehicle operations and management.

Local leaders are balancing pressures to innovate and evolve their cities in an increasingly digital era. AVs have been one highly visible example of this innovation, as they physically roll around numerous US cities. This white paper synthesizes insights from a UC Davis research project that engaged three AV companies and hosted three workshops to engage local stakeholders and innovators across several sectors in US cities. The project's goals were to:

✓ **Listen** to recent experiences of city local partners, AV companies, and research partners during pilot and deployment of AVs.

✓ **Learn** about priorities and protocols from all stakeholders and determine where UC Institute of Transportation Studies research may be able to fill gaps.

✓ **Focus on equity outcomes** by highlighting access for people with disabilities, bicyclists, and vulnerable road users.

✓ **Inform local, state, and federal AV policymaking** by reviewing lessons learned from early AV experiences.

A focus of this project was to hear directly from municipal government. Our research team hosted a city workshop that involved exclusively public sector employees. While the majority of participants were employed directly by city governments, two cities invited to participate sent state representatives to speak on behalf of the city. Highlights from this City event are as follows:

● According to a workshop participant poll, 31% of participants conveyed optimism that AVs would deliver benefits to their communities, and 54% of participants, are "somewhat" optimistic. [1]

● Staff in cities without widespread deployment voiced concerns that incidents, like stalled vehicles in roadways, or collisions, like those in San Francisco, could occur if AV presence scales up in their areas.

● Cities with limited deployment, or solely test vehicles, are looking to vanguard cities to develop best practices for day-to-day issue resolution that may avert similar issues in their cities.

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[1] These findings reflect the individual views of participants and does not reflect official views of the cities represented.

- Staff in some cities expressed concern about situations where services are not matched with community needs.

- Staff in most cities consider state control and/or preemption to present barriers to their activities interfacing with AV operators.

- Data collection is a high priority for many cities. Some are eager for data that can guide action on road and infrastructure issues, inform broader planning exercises, and encourage more transparency of traffic patterns.

- Several participants stated a preference for receiving AV operators' data in the Mobility Data Specification (MDS)[2] format to align with data on scooters, taxis, and other shared mobility devices reporting in this data standard.

- Interactions between AVs and first responders, such as firefighters and police, are a concern for many cities. Without a federal standardized approach for first responder interactions, responders would likely need to undertake onerous training on different systems.

- There was agreement among staff from several cities hosting full deployment that federal or state standards should be established to avoid dozens of company-specific protocols.

- Staff from several cities voiced concerns about community-wide labor impacts and job loss and felt ill-equipped to field questions from the public on workforce/job loss.

- Staff recommended that a playbook for provider-city interactions could outline potential issues for AV providers when entering a new market and list options for how to best engage with city representatives.

In a workshop involving six community-based organization (CBO) representatives. Four of the six participating CBOs were advocates for people with disabilities. Highlights from the workshop are as follows:

- CBOs had diverse stances on whether AVs were a priority among the communities represented.

- The pervasive concern from CBOs is how government will ensure that AV companies are held accountable for the promises they make.

- Most of the organizations called for concrete timelines and requirements, as well as the ability to revoke permits for compliance failure or hold companies accountable in other ways.

- Data collection priorities from CBOs include comments cautioning against reinventing the wheel. Participants pointed to existing data efforts to address accessibility in ridehailing and micromobility that can provide insights.

- Pricing transparency was identified as a potential source of inequity.

The following are highlights from conversations with three AV industry representatives:

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[2] About MDS | Open Mobility Foundation, (2020), https://www.openmobilityfoundation.org/about-mds/ (last visited Jun 15, 2023).

- Prior to testing and deployment, all companies participated in community outreach efforts. Early efforts to establish relationships with local stakeholders were a high priority for all AV operators.

- Success metrics vary for each operator, but each operator mentioned their progress to increase total driven miles, the ability of their ADS to operate in complex environments and highlighted that successes in interacting with vulnerable road users were a priority.

- All operators agreed that disjointed regulations across jurisdictions result in a challenging regulatory environment.

- All operators consider disability access to be a driving force of their work. Most companies are actively testing tools that make it easier for blind and hearing-impaired riders to ride. Only one company reported actively deploying vehicles that can accommodate people who use non-folding wheelchairs. A few are testing alternatives like in-app ridehailing services with human drivers to accommodate non-folding wheelchairs.

- All operators shared that urban and dense locations are slated for earlier markets. Several operators affirmed commitments to equitably deploying service within chosen metro areas.

Points of Agreement Across Sectors

- **Open communication:** Better channels of communication across sectors might help to prevent and resolve issues. There is some agreement about the need for open channels of communication, multi-sector partnerships, and better data architecture for coordinated information sharing about interactions.

- **Equitable and accessible service:** Parties from all sectors conveyed that disability access is a high priority and that serving racially, and economically diverse populations was a priority.

- **Federal actions necessary**: Many parties, representing voices from all sectors, recognized that federal regulatory activities appear to be lagging.

Points of Disagreement Across Sectors

- **Lack of playbook:** There is not a clear playbook to resolve day-to-day roadway stopping issues, nor agreement on what metrics and tools should be used by companies or required by regulators. Developing such a playbook is a priority for some stakeholders as the AV ride hail market grows.

- **Data collection:** The stakeholders have different priorities for what data to collect and different priorities for how to collect and distribute data.

- **Regulatory purview:** There is debate about the boundaries for federal leadership and preemption and different states or localities face different internal preemption battles.

- **Disability access:** The timeline for providing service to people with disabilities and how to interpret compliance requirements is a source of debate. Many stakeholders highlight near-term advances for blind and deaf riders. Other study participants point to major barriers for people who use non-folding wheelchairs to access AV ridehailing services.

- **Rural access:** Some government officials representing small or rural communities, as well as similarly focused CBOs, convey hopes that AV companies will choose to deploy their vehicles in more suburban and rural areas soon. However, among our sample of three companies, none have developed a plan to optimize service outside of urban centers.[3]

In conclusion, many convened stakeholders conveyed some optimism that automated vehicles can improve outcomes for their communities. It is clear from these discussions that it will take a combined force of industry, government, and CBOs to forge this path and much more work to establish best practices and ensure open channels of communication between all parties.

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[3] The authors note that it is possible, although out of scope of this study, to assess—among the dozens of other AV ride providers—how many are optimizing non-urban markets. More research is necessary to determine what strategies might make this more or less feasible.

Contents

Background

Cities are often seen as hubs of innovation. According to a European Commission report, "Cities are often places of great energy and optimism," due, in part, to the density of different multidisciplinary stakeholders.[4] While diversity fosters innovation, there is a risk that innovations may outpace the development of a holistic community response that embraces a city's unique mix of people and priorities. In the case of AVs, some local regulators and other policy stakeholders are looking for guidance. They are uncertain about when local authorities should step in, where they should build internal capacity, and where longer-term institutional investments or other actions may be necessary.

The focus of this research is to explore these nuances and highlight the ways that city and regional policy can address issues. Local responses to the introduction of AVs will be as multi-faceted because the US is diverse. While all cities play a key role in regulating land use and transportation in their jurisdictions, across the US, city purview over AV ridehailing will likely vary between regions and states. Safety, sustainability, and equity are three policy areas that relate to AV ridehailing services. In this section, we provide background on each area to enable a productive conversation about local management of AVs.

Safety

Definitions

While there is no widespread consensus across sectors on the definition of safety, the notion of safety as it pertains to AVs is clearly defined in official transportation regulatory text. In a 2016 AV guidance document, the National Highway Traffic Safety Administration (NHTSA) defined *safety* as protecting "the public against unreasonable risk of accidents."[5] For a given technology to present an "unreasonable risk," it must cause or be associated with a "non-negligible" number of crashes, injuries, or deaths in the future.[6] This definition lacks discrete thresholds for defining "non-negligible" crashes, which enables regulators to determine safety on a case-by-case basis. These nebulous thresholds imply a willingness to accept some number of crashes and/or traffic deaths as "reasonable."

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[4] European Commission, *Cities as Innovation Hubs*, URBAN DATA PLATFORM PLUS (2019), https://urban.jrc.ec.europa.eu/thefutureofcities/cities-as-innovation-hubs#the-chapter.
[5] MOTOR VEHICLE SAFETY, 49 USC § 30102(A)(9).
[6] *Id.*

Federal Safety Regulatory Landscape

On the vehicle safety side, innovators in the automotive industry expect autonomous vehicles to advance traffic safety,[7] and the US Department of Transportation (USDOT) has conceptually agreed. Guidance released by federal regulators points to opportunities for AVs to improve safety.[8] In the most recent guidance, titled *The AV Comprehensive Plan* published in 2021, the USDOT pledged to develop "safety focused frameworks and tools to assess the safe performance of advanced driving system (ADS) technologies." Thus far, USDOT has expanded the Automated Vehicle Transparency and Engagement for Safe Testing Initiative (AV TEST) tool in 2021 to map where AV test vehicles are officially operating and, and they publish a detailed snapshot of 12 months of ADS accident data.[9]

While a framework has not been solidified, piecemeal efforts towards safety have been taken. For example, in 2022, Federal authorities made updates to the Federal Motor Vehicle Safety Standards (FMVSS) to allow for deployment of AVs with both ADS and advanced driver assistance systems (ADAS), and there are several

City Safety Spotlight

Hundreds of cities have signed on to the **Vision Zero Network** or other pledges to advance a systems-based approach for preventing pedestrian, bike-involved, or other on-road crashes. Achieving this vision has been elusive. The list below ranks metropolitan areas in this study from those with the most walking-related deaths to the least per capita between 2018 and 2021:

Phoenix, AZ
Los Angeles, CA
San Francisco, CA
Washington, DC
Seattle, WA
Grand Rapids, MI
Boston, MA
Pittsburgh, PA

There are likely many variables contributing to these outcomes. More research is necessary to test the effectiveness of the myriad institutional, infrastructural, and technological solutions available.

* Source: Vision Zero Network, https://visionzeronetwork.org/ (last visited Sep 7, 2023).

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[7] Alliance for Automotive Innovation, *Benefits of Automated Vehicles*, https://www.autosinnovate.org/initiatives/innovation/autonomous-vehicles/benefits-of-havs (last visited Nov 1, 2023).

[8] AUTOMATED VEHICLES - COMPREHENSIVE PLAN, (2021), https://www.transportation.gov/av/avcp.

[9] US Department of Transportation, NHTSA, *Automated Vehicle Transparency and Engagement for Safe Testing Initiative (AV TEST) Initiative Test Tracking Tool*, (2023), https://www.nhtsa.gov/automated-vehicle-test-tracking-tool.

exemptions that AV manufacturers can pursue to navigate this process if, for example, a vehicle lacks a steering wheel and manual brakes, manufacturers can seek an exemption from standards referring to these mechanisms.

Advanced Driving System Safety Investigations

These exemptions align with the current federal vehicle approvals process which lacks a comprehensive permitting and approval process. Vehicle manufacturers do not receive a permit to sell their vehicles, they instead they submit the outcomes of a series of independently administered tests to demonstrate that they meet federal standards.

Federal and state regulators investigate these independent tests when non-negligible safety errors occur. To date, these investigations have been triggered by any number of accidents, including single cases. For example, a 2018 National Traffic Safety Board (NTSB) investigation chastised NHTSA for a lack of action on AV safety testing after an Uber autonomous vehicle caused a fatal crash in Tempe, Arizona, and a safety driver was determined to be negligent in observing the vehicle. However, the driver's inattention was not the only transgression. The NTSB investigation found that Uber's AV operations lacked a formal safety plan at the time of the crash. Uber did create a safety plan voluntarily months after the NTSB investigation. This type of comprehensive risk assessment, or safety plan, is neither a federal requirement, nor a requirement of the State of Arizona. Furthermore, before the accident, Uber did not include a fatigue risk management policy for their safety drivers, nor were personnel assigned to assess risks for safety drivers.[10]

In a more recent 2023 example, NHTSA issued a recall of Cruise's Collision Detection Subsystem after a vehicle using this software was involved in a collision initiated by a hit-and-run driver at night on a busy San Francisco Street. The recall report showed that, after the collision, "The Cruise ADS inaccurately characterized the collision as a lateral collision and commanded the AV to attempt to pull over out of traffic, pulling the individual forward, rather than remaining stationary."[11] In this recall, Cruise attests that an update to the software will provide a remedy, so that a future replication of this specific circumstance would result in a stationary vehicle response.[12] The California Department of Motor Vehicles' (DMV) response to the accident was swift and immediate, with an investigation resulting in permit suspension. The California DMV indicated that the Cruise service was "not safe for public operation," and the permit revocation was also predicated on a lack of transparency reporting the circumstances of the collision.[13]

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[10] NATIONAL TRANSPORTATION SAFETY BOARD, COLLISION BETWEEN VEHICLE CONTROLLED BY DEVELOPMENTAL AUTOMATED DRIVING SYSTEM AND PEDESTRIAN, (2018), HTTPS://DATA.NTSB.GOV/DOCKET/DOCUMENT/DOCBLOB?ID=40479021&FILEEXTENSION=.PDF&FILENAME=NTSB%20-%20ADOPTED%20BOARD%20REPORT%20HAR-19%2F03-MASTER.PDF.N

[11] LLC CRUISE, *Part 573 Safety Recall Report*, (2023), https://static.nhtsa.gov/odi/rcl/2023/RCLRPT-23E086-7725.PDF.

[12] *Id.*

[13] California Department of Motor Vehicles, *DMV Statement On Cruise LLC Suspension*, (2023), https://www.dmv.ca.gov/portal/news-and-media/dmv-statement-on-cruise-llc-suspension/.

The California DMV posts information publicly for each AV collision, and similar databases are available in other states. In some cases, cities post information about incidents and accidents reported in their jurisdiction.

Key Considerations for Data and Autonomous Vehicle Safety

Current data sharing requirements for autonomous vehicle operators require considerable reporting to federal and state entities. Federal requirements focus on collision reporting, and several states collect additional performance information. Unfortunately, these data are not clearly linked to performance metrics that might help assess specific, measurable improvements or inadequacies in safety, sustainability, or equity. Developing performance metrics would require overcoming considerable barriers to ensure that AV safety outcomes are comparable to metrics from driven vehicle fleets. Enforcement may require new tools for independent validation of data or new oversight bodies. A cohesive data framework for AVs will likely require federal leadership and input from state, local, and multi-sector stakeholders will be critical. Given the expanding digitalization of our streets, intersections, and cities, it will be increasingly important to be able to synthesize diverse data sources (e.g., instrumented connected vehicles and roadway infrastructure).

This information is intended to enable regulators of all jurisdictions to learn from early mistakes. Safety planning and reporting is a widespread practice in many safety-critical industries that rely on autonomous systems. It is used by NASA in space exploration as well as in aviation and maritime operations.

Equity and Disability Access

Many stakeholders, including advocates for marginalized groups and government officials, hope that automation will provide a practical alternative to private automobile ownership.[14] Car-oriented land use patterns are widespread in the US. They marginalize anyone who cannot drive themselves in vehicles at all or

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[14] Alex Adams, *AVs Can Open Up Greater Economic Opportunities for Low-Income Communities Left Out by Today's Transportation, New SAFE Study Finds*, SAFE (Jul. 16, 2020), https://secureenergy.org/avs-can-open-up-greater-economic-opportunities-for-low-income-communities-left-out-by-todays-transportation-new-safe-study-finds/.

regularly, whether due to the difficulty of driving with a disability or the high cost of car ownership.[15] While current alternatives, such as carsharing and ridehailing, serve important niches by serving those who cannot drive themselves or own their own vehicles, these options face limitations. In areas with car-oriented land use patterns, there are difficulties with first-/last-mile connectivity in the case of carsharing and the high cost of labor scaling with distance due to higher travel times in the case of ridehailing.[16] [17]

Thus, it has been widely theorized that, by eliminating the need for a human driver, AVs can lower costs to enable affordable mobility for people who have historically faced barriers to vehicle access, such as people with disabilities or low income. This would be especially beneficial for people who live in suburban or rural places that are not adequately served by public transportation or pedestrian infrastructure.
In practice, AV companies have been able to quickly implement features that help people with vision or communication disabilities. These include vehicular location and wayfinding features associated with the smartphone used to hail the ride, the vehicle itself, and interfaces within the vehicle.[18]

By contrast, several winners of the USDOT 2020 Inclusive Design Challenge demonstrated how new vehicle designs and systems can accommodate riders who use wheelchairs.[19] ADS ridehailing companies have not all implemented such designs and systems. There are few examples of concepts for AV designs that can accommodate wheelchairs and even fewer production vehicles. Concept vehicles have been made by Volkswagen[20] and Cruise.[21] There are also limited-scale deployed vehicles made by May Mobility[22] that require a human safety driver to be present.

Unsurprisingly, this has led to a diversity in perspectives from prominent stakeholders. The Lighthouse for the Blind and Visually Impaired, a San Francisco nonprofit group, has publicly voiced enthusiasm about the advent of AV service for blind riders in San Francisco and praised the access that AV services provide for their

[15] Susan Handy, *Chapter 23: Why Sustainable Transport Cannot Ignore Land Use*, Social and Political Science 2020 HANDBOOK OF SUSTAINABLE TRANSPORT 220 (2020).

[16] Susan A. Shaheen, Adam P. Cohen & Melissa S. Chung, *North American Carsharing: 10-Year Retrospective*, 2110 TRANSPORTATION RESEARCH RECORD 35 (2009).

[17] Susan Shaheen et al., *Advancing Social Equity and Congestion Relief: Understanding the Travel Needs of Underserved Populations That Rely on Transportation Network Companies in the San Francisco Bay Area*, UC BERKELEY: TRANSPORTATION SUSTAINABILITY RESEARCH CENTER (2022), https://escholarship.org/uc/item/9mv421b0.

[18] Waymo, *Waymo's Accessibility Work with Advocates Recognized by U.S. Department of Transportation*, (Aug. 9, 2022), https://ltad.com/news/waymos-accessibility-work-with-advocates-recognized-by-usdot.html.

[19] US Department of Transportation, *Inclusive Design Challenge*, (2024), https://www.transportation.gov/accessibility/inclusivedesign.

[20] Thanos Pappas, *VW Group Unveils OnePod Concept as The Flexible Autonomous Pod of The Future*, CARSCOOPS (Oct. 15, 2021), https://www.carscoops.com/2021/10/vw-group-unveils-onepod-concept-as-the-robotaxi-of-the-future/.

[21] Abhirup Roy, *General Motors' Cruise Unveils Wheelchair-Accessible Robotaxi*, Sep. 14, 2023, https://www.reuters.com/business/autos-transportation/general-motors-cruise-unveils-wheelchair-accessible-robotaxi-2023-09-14/.

[22] Rebecca Bellan, *May Mobility, Via Launch Wheelchair-Accessible Autonomous Shuttle Service*, Sep. 28, 2022, https://techcrunch.com/2022/09/28/may-mobility-via-launch-wheelchair-accessible-autonomous-shuttle-service/?guccounter=1.

Key Considerations for Data and Disability Access

An accessibility performance measurement system is likely a best practice to track progress on AV accessibility and differentiate the best performing AV companies and cities. The Consortium for Constituents with Disabilities has identified numerous qualitative issues that might inform such a system. The Consortium highlights the need for pick-up and drop-off (PUDO) zones to offer clear paths for people with disabilities to access vehicle zones from the curb and/or between PUDO zones and building entrances. Reaching this goal may require support from cities and active collaboration among stakeholders. Cities could catalogue which PUDO zones meet different accessibility criteria and standardize methods to provide these data to AV ride providers. The consortium highlights measurable strategies for AV operators to ensure that vehicle communications and hailing technology can accommodate hearing and vision impaired riders. Some suggestions include cataloging the availability of ramp extensions, automatic lockdowns, passenger restraints, and space for irregular or oversized wheelchairs. [24]

members.[23] However, hope expressed by other disability advocates has been tempered by realism about the limitations of AV technology.

In an open letter to a congressional committee convened to discuss automation, advocates urged Congress to think holistically about safety and accessibility and to recognize the public's role in addressing deficiencies in our transportation systems. Signers represented a broad cross-section of people with disabilities. They included Disability Rights Education and Defense Fund (DREDF), National Disability Rights Network, Paralyzed Veterans of America, Perkins School for the Blind, and others. They said,

> *"…the promise and safety of AVs will only be realized if the vehicles and the surrounding infrastructure are fully accessible, and the safety elements consider the needs of all people with disabilities,"* [24]

While more research is necessary to assess which of these types of vehicle enhancements are present in the first wave of AVs on the road, accommodations are unlikely to be uniform in the near-term. The timeline for their introduction will vary. AV operators, as private companies, will likely need to comply with the American

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[23] Lighthouse: For the Blind and Visually Impaired, *A Ride to Remember*, (Jun. 22, 2022), https://lighthouse-sf.org/2022/06/22/a-ride-to-remember/.

[24] Consortium for Constituents with Disabilities, *RE: Hearing on "Self-Driving Vehicle Legislation Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China,"* (2023), https://www.c-c-d.org/fichiers/CCD-Disability-AV-Framework-Hearing-Letter-072523-FINAL.pdf.

with Disabilities Act (ADA). ADA Titles II and III forbid discrimination against people with various disabilities, not just people who use wheelchairs. This includes people with vision, hearing, cognitive, mental, communication, or other physical disabilities. These individuals cannot be denied service because of their disability. Transportation companies must affirmatively provide information about services and, when applicable, ways to hail rides.

Title III of the ADA applies to privately operated services and allows numerous exceptions for providing equivalent service to people with disabilities. These loopholes have been thoroughly tested legally by taxi companies and other private transportation providers in the context of service for people who use wheelchairs. Title III requires taxi and ridehailing companies operating wheelchair-accessible vehicles to ensure that the design of those vehicles and associated ramps or lifts comply with accessibility specifications. However, the rule does not require companies to operate any wheelchair accessible vehicles or to keep operating such vehicles in the fleet indefinitely. This has resulted in a mobility marketplace which has seen the expansion of ridehailing services not equitably serving the disabled community.[25]

By contrast, ADA Title II applies to governmental and publicly funded operators. It is much more stringent in affirmatively requiring wheelchair access that covers areas and routes served by public transit vehicles, where those vehicles are not reasonably accessible. Progress for people with disabilities in the context of AVs may correspond to trends in private for-hire accessibility and may not be comprehensive until publicly operated AV service triggers Title II requirements.[26] Some modes that are likely to conform include autonomous paratransit, microtransit, and fixed route service.

Sustainability

There is considerable research suggesting that electric and shared AVs will lead to better environmental outcomes than internal combustion engine and/or single-owner AVs.[27] [28] So far, the AV industry has made progress on emissions reductions within their fleet, and some made early promises to make a majority of AVs electrified.[29] California also has codified this outcome in two pieces of legislation. First, California's SB 1014 sets a requirement that at least 90% of all transportation network company (TNC) fleet vehicles used in passenger service (e.g., Uber, Lyft, Cruise) are to be electrified by 2030 and each fleet is required to report net-

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[25] Erin McAuliff, *Transportation Network Companies (TNCs) and Disabled Access*, SAN FRANCISCO MUNICIPAL TRANSPORTATION AGENCY (SFMTA) (May 23, 2019), https://www.sfmta.com/blog/transportation-network-companies-tncs-and-disabled-access.

[26] Helen C. Wuellner et al., *Transportation Network Companies and Accessibility Under the ADA & Other Pathways to Transportation Equity*, 27 UC DAVIS SOCIAL JUSTICE LAW REVIEW 205 (2023).

[27] DANIEL SPERLING, THREE REVOLUTIONS: STEERING AUTOMATED, SHARED, AND ELECTRIC VEHICLES TO A BETTER FUTURE (2018), https://books.google.com/books?id=f0NEDwAAQBAJ.

[28] LEW FULTON, JACOB MASON & DOMINIQUE MEROUX, *Three Revolutions in Urban Transportation*, (2017), https://steps.ucdavis.edu/wp-content/uploads/2017/05/STEPS_ITDP-3R-Report-5-10-2017-2.pdf.

[29] Mollie Cohen D'Agostino et al., *California Automated Vehicle Policy Strategies* (2021), https://escholarship.org/uc/item/6s59c5b7 (last visited Apr 16, 2023).

zero greenhouse gas (GHG) emissions per-passenger-mile-traveled before 2030.[30] Second, California SB 500 reinforces and expands this, requiring that (SAE L3-L5) vehicles under 8,501 pounds in all AV fleets electrify by 2030. The state of Massachusetts is currently deliberating a similar bill that would require electrification of autonomous vehicles.[31]

Electrification is a sustainability solution that can reduce emissions in all driving scenarios. In addition, some mobility experts see an opportunity for AVs to unlock more shared mobility options. Sharing rides between parties, or ride-splitting, has the potential to improve financial viability and provide access for more people. However, it is not clear to what extent this strategy will reduce GHGs per passenger mile traveled because deadheading, where taxis or ridehailing services travel between trips with empty vehicles, may counteract benefits.

AVs may be able to more readily rest vehicles between paid trips compared to driven TNCs, which may be incentivized to move to a new location with greater earning potential. Thus, if AVs rest more, this might achieve greater system energy use efficiencies. However, it will likely require considerable market penetration to minimize the effects of deadheading as drivers move from ride drop-off to ride pick-up locations. Because of this, more research is needed to evaluate the extent to which shared AV rides reduce overall vehicle miles traveled.

Research points to a sustainable vision for AV service can promote sustainable transportation more holistically by supporting a car-light lifestyle. This vision may only come to fruition with a competitive and affordable suite of multi-modal alternatives to solo driving that complement public transit and active modes (e.g., biking, walking, and scootering).[32]

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[30] Bill Text - SB-1014 California Clean Miles Standard and Incentive Program: zero-emission vehicles., 10, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1014 (last visited Mar 9, 2020).

[31] Day, *An Act Limiting Autonomous Driving Capabilities to Zero Emission and Electric Vehicles*, HOUSE No. 3298 (2023), https://custom.statenet.com/public/resources.cgi?id=ID:bill:MA2023000H3298&ciq=ncsl&client_md=009e5e9c8a8e66aa5357ea87c7 0c3824&mode=current_text.

[32] FULTON, MASON, AND MEROUX, *supra* note 27.

Study Methodology

The UC Davis research team held three workshops and three industry interviews for a total of six meetings. These occurred between June and December 2023. We conducted two initial workshops. The first included city and state-level stakeholders and the second included representatives from Community-based Organizations (CBOs). Around the same time, we conducted three virtual meetings with ADS company representatives. After the initial workshops and interviews concluded, we invited all participants to provide feedback on this white paper digitally and to participate in a third and final all-sector workshop in December 2023, and a majority of participants chose one of these options. Industry participants uniformly provided feedback for this white paper and did not join the all-sector workshop. Feedback on this white paper and participation in the final workshop varied among other participants.

Industry Meetings: The research team convened a series of meetings to hear from industry voices representing AV ridehail enterprises. Among our small sample, two out of three are deployed officially in various US markets, and we met with each operator separately for one hour in August and September 2023 (Appendix C).

Cities Workshops: The project scope included listening to perspectives from local/city stakeholders in Los Angeles, San Francisco, Washington DC, Seattle, Grand Rapids, Boston, and Pittsburgh. Two state representatives from Arizona and Massachusetts participated and agreed to represent the major cities in their respective states. All invited participants joined a 90-minute workshop on June 26, 2023 (Appendix A). Most of these participants attended the final workshop held on December 8, 2023.

Community Based Organizations Workshops: We hosted a 90-minute workshop on August 17, 2023, involving six organizations including the Disability Rights Education and Defense Fund, Disability Rights Washington, the League of American Bicyclists, and SAFE. These organizations largely represent the disability and accessibility domain, though one organization represents bicyclists, and another more general represented road safety issues (Appendix B).

Results and Takeaways

Findings from Meetings with AV Industry Leaders

Operators Community Outreach Efforts

All industry teams seem to pursue somewhat similar outreach and engagement strategies prior to launching their respective services in each market. These include talking to elected officials, state DOT/DMVs, other agencies and, in many cases, building close relationships with these stakeholders. Representatives from most of the companies said that priorities varied across regions. For example, California is unlike Texas, and norms for engagement are unique in different cities. All conveyed that working with stakeholders was a top priority and were looking for better strategies to improve coordination among stakeholders. They all recognized that engagement would shift over the timeline of the AV operators' deployment.

One example of the need for customized strategies raised by an AV company representative was that some local and state representatives balk at regularly scheduled meetings, while others prefer them. There was agreement that regular meetings encourage relationship building, but that there may be human resource constraints or capacity issues. There was recognition that community sentiments may shift before and after launch or be affected by communications from local and national media outlets. In the eyes of company representatives we interviewed, the media has been unforgiving to early adopter cities.

Industry stakeholders expressed a mixture of excitement from the community while also receiving some skepticism among residents in different cities. These reactions are stoked by information and, in some cases, misinformation. One participant said that there is no need for a "red carpet" but neither should local government and media outlets create a "floor is lava" environment in which every minor incident is equated to a major liability. That approach hampers cooperation between companies and local governments on areas of mutual interest.

Successes and Challenges

Company representatives shared perspectives on how they track and measure their successes and how these are celebrated internally. Examples of successes include meeting benchmarks for miles driven and safe operation in complex urban environments. AV companies celebrate their effort to protect vulnerable road users such as pedestrians and cyclists, and celebrate achieving safety metrics that exceed those of human drivers, creating material benefits by planning for equity, improving accessibility features, and designing purpose-built vehicles that successfully marry years of innovative hardware development with complex software.

Representatives also shared examples of internal challenges such as ensuring that all edge scenarios are accounted for (as there will always be unknown possibilities) and expanding fleets to bring their vehicles to

more locations while simultaneously scaling the company to support these operations.

Governance

The policy discussion largely fell into the categories of (1) jurisdiction and (2) data sharing. Most industry stakeholders spoke to the need for more detailed updates to FMVSS and permitting with more predictability and consistency that offers alternate pathways to purpose-built vehicle approvals. For example, exemptions from FMVSS or full self-certification using updated FMVSS. There was acceptance that federal purview should focus on vehicle safety, whereas states are focused more on licensure. Mild frustrations were voiced about the lack of a clear pathway for AV operation in all states.

Data Sharing

Data sharing was a topic with inconsistent statements among industry stakeholders, yet there was thematic agreement on the need for clear rationale on why data are collected and how entities plan to use data. Representatives of AV companies said that a large amount of data are reported to meet compliance standards with both federal and state entities, with companies reporting to different entities periodically. Additionally, companies are required to submit reports immediately after any road collisions. These stakeholders highlighted that the AV industry has considerable transparency, given that AV companies openly share incident data with different regulators and the public. Moreover, these companies must report other performance data, especially to California regulators.

A representative of one company expanded on this point, noting that data collection should be about identifying opportunities for mutual gain and not opportunities for admonishments of minor incidents. Another stated that disputes between regulating entities about data were frustrating. They would prefer better channels for sharing data in a more organized and coordinated way. There is continued cause for concern about the potential use of Application Programming Interfaces (APIs) to share real-time data. Some issues raised were intellectual property invasion and consumers' willingness to provide personal movement data to the public sector.

Finally, all three participating industry parties conveyed a strong willingness and openness to work with first responders to improve data sharing practices. There are many ideas about how best to do this. Many of the industry representatives interviewed agreed that consistent data collection standards are preferred at the highest governance level possible, rather than a scattershot state or city-led approach.

Disability Access

All AV company representatives spoke optimistically about the potential for AVs to drastically improve transportation for people with disabilities. In some cases, they referred to recent forecasts from AV companies and non-governmental organizations (NGOs) pointing to large quantitative economic benefits for people with disabilities. All spoke of commitments to work with CBOs representing people with disabilities and with people with disabilities in various communities. In some cases, these relationships are through formal advisory committees or working groups focused on accommodating the diverse needs of people with disabilities with

AV design. Each company has added features to their respective AVs to help riders with vision disabilities locate vehicles from outside and interact with them once they are inside. Other features help riders with physical disabilities who do not use wheelchairs minimize the distance that they need to walk to and from vehicles.

None of the companies have yet deployed AV services suitable for people who use most non-folding wheelchairs (with riders sitting in the wheelchair in the vehicle). While representatives from all companies have expressed hope that they will ultimately develop and deploy AVs usable by people who use wheelchairs, this has yet to be tested at scale. Some company representatives shared that they have prototypes ready that accommodate some non-folding wheelchairs, while other companies have left consideration of such development for an undetermined future date.

Metrics for Future Growth

There is some agreement that AV operators will target early growth and expansion in denser urban environments, largely following the expansion of ridehailing services. Company representatives linked this strategy to the significant costs for new market expansion and highlighted that it is easier to recoup costs in denser markets. There was some agreement among AV operators of the need to serve sparser rural communities, aligning with hopes from government leaders and CBO representatives. At the same time, AV operators also emphasized the high cost of operating in rural areas, and thus the importance of government subsidies. They also underscored the need for more time to implement such services safely and effectively. A representative from one AV company said that, even though public support for AVs can help justify that company's decision to expand services into that area, it does not guarantee that service will be provided, even in suburban areas, due to lower density. That said, a representative from another AV company noted the inclusion of equity-related metrics when determining where to launch new services. Other opportunities include expanding charitable partnerships, such as those service that have provided autonomous delivery to food banks. Or equity can also be expanded by offering public ride subsidies for underserved community members, or offering more tools and support for expansions of electric vehicle use.

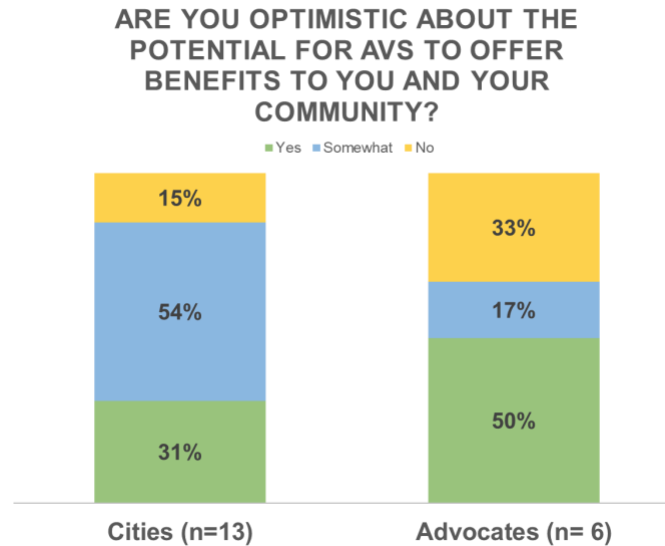# Highlights from Discussion with Cities and States

Our invited workshop participants included ten cities: (1) Three cities at the time of the workshop had current or former full ADS commercial deployments and (2) five cities had hosted temporary or ongoing pilots with limited scope (3) the remaining cities were considering ADS policy, so participated out of interest.

There was nearly total consensus that representatives of these cities see themselves as leaders and vanguards in navigating new local policy terrain in hosting AV deployments.

In our sample, four cities have hosted short- or longer-term pilots but have yet to see full commercial service come online. Among this group, primary concerns center around how to plan for the next stage, set protocols for interactions with emergency vehicles and motorcades, and develop policies to minimize unforeseen issues.

Lastly, we engaged with a city (represented by a state employee) where the state had established a tiered testing model for their AVs but has not yet established a pathway to full commercialization.

According to informal polls conducted during workshops, city and state officials have mixed views of automation.

ARE YOU OPTIMISTIC ABOUT THE POTENTIAL FOR AVS TO OFFER BENEFITS TO YOU AND YOUR COMMUNITY?

Yes ■ Somewhat ■ No

	Cities (n=13)	Advocates (n= 6)
No	15%	33%
Somewhat	54%	17%
Yes	31%	50%

When asked "Are you optimistic about the potential for AVs to offer benefits to you and your community?

- 31% of city/state employees indicated **yes.**
- 54% of city/state employees responded **somewhat**, and
- 15% of city/state employees responded **no.**

When asked "Are AVs a barrier or a solution to safety?" (Select all that apply)

- 92% indicated that they see it as a **solution** and
- 54% indicated that they see it as a **barrier.**

Preemption

Multiple government representatives mentioned preemption concerns. Their views on this topic are as diverse as the cities and states where they reside. Some representatives pointed to a need for more structure and oversight from state or federal authorities, while others highlighted a need for local control, as AV issues affect communities directly, putting pressure on local governments.

While the scope of this project was intentionally narrow and focused first on listening to local/city perspectives, two state representatives participated to represent the major cities in their state. One of the state representatives said that there is a need to improve coalitions between municipalities and cities to leverage a common and agreed-upon set of standards. Improving collaboration between these entities could

conceivably aid in diffusing pressure between city and state powers and reduce the need for cities to pass policies that may be better suited for statewide or regional oversight. Representatives of different cities have distinct views on boundaries for preemption and local control due to varying dynamics between cities and states. Representatives from cities that are part of interstate metropolitan areas pointed out that interstate issues add another dimension of complexity to regional cooperation.

City representatives expressed diverging preferences for oversight and regulations that could be implemented at various levels of government. However, there was widespread agreement on the need for updated FMVSS and accompanying federal regulations that enable cities to have a say in the management of AVs.

Access and Equity

Participants in this workshop widely acknowledged that, especially without intervention, there will likely be market gaps that cause some people and communities to miss out on the benefits of AV deployment. Most city and state representatives recognized that closing such gaps and ensuring that underserved areas or people with disabilities have access to AV services is a public priority.

There was a consensus that public policy tools must be used to assess and address these potential gaps. Participants suggested that investment in closing these gaps could include partnering with public transit services or offering subsidies for riders. Representatives of cities emphasized that these ideas would have to face public scrutiny in communities with tight budgets and that pursuing additional funding, outside of local resources, will be essential for ensuring geographically and socioeconomically equitable service. There was recognition that AV operators would initiate service in places where profits are the most certain, including dense urban areas that would likely have many competing modes and potential conflicts with public transit markets. Conversely, in cities or states with less density, this type of competition is less of a concern.

Data Collection

Throughout the cities workshop, participants reiterated the need for cities to have more data to better understand the incorporation of AVs onto their streets. For example, several participants suggested that efforts of ADS companies to create highly detailed digital maps of city streets and curbs generates valuable data. There was a discussion about how AV mapping and monitoring can lend valuable insights such as notifying cities when ADS vehicles notice instances of right-of-way defects or inconsistencies in roadways or signage.

Cities also discussed how data from AV activity can inform planners and citizens of where AVs are operating to ensure transparency and assess equity. For example, knowing whether and how AV ride providers are targeting certain populations or underserving others can enable meaningful oversight. One city representative voiced that they are hoping the data will differentiate between companies and enable government to identify best practices for the rate and structure of successful market scaling. For example, with dozens of AVs in testing in California, they want to learn how to differentiate whether and how companies are slowly scaling safely, or

when they are potentially flooding a market, this information might help them to better identify risk-taking tradeoffs.

Stakeholders were curious about whether the mobility data specification (MDS) 2.0 integration, which is being looked at by multiple cities, can be adapted to work for AV data sharing. There was also discussion of data providers such as Inrix filling data gaps, encouraging better reporting, and improving collection tools. There is a stark contrast in the data sharing requirements across different localities. For example, in some cities where AV operators were contracted to provide service, municipal governments have designed contracts that establish data sharing requirements and set reporting requirements to align with ADA compliance requirements.

Day-to-Day Issue Resolution

While AVs have interfered with roadway or bike lanes in some cities, other cities have not had these problems, but they may. In our June 2023 workshop there were comments from representatives of a few cities about looking to San Francisco as a testing ground for these issues. Representatives of these cities voiced they were not sure why SF deals with these issues more often, aside from a likely correlation with more vehicles being present. Since this first workshop, Austin has expanded a public portal to report on AV incidents. By the time of the December workshop, this mindset had evolved, and participants were eager for details on incidents so they could evaluate and understand them.

The burden of additional interactions with and training for first responders were a pervasive concern among representatives of the three cities with more active AV deployment. There were several calls for federal standards to reduce the burden on local law enforcement, fire, and other emergency service workers as they interact with AVs. One suggestion was an indicator light on the outside of an AV to indicate it's safe for a first responder to open a window or enter the car (i.e., the car responder can be assured that the vehicle is stationary during this intervention).

Other Areas of Concern

Concerns about labor were raised by a small subset of participants, referring specifically to impacts on the local workforce. These participants expressed concern that AV services may require an on-board employee for safety and/or disability accommodation, even if not to drive the vehicle. Also, participants expressed validations concerns that the only information that cities are receiving about AV safety comes from the AV companies themselves, which makes the public skeptical about the veracity of this information because of the lack of external validity.

Highlights from the Discussion with Community Based Organizations

We conducted workshops with several CBOs representing the interests of people with disabilities. Generally, AVs are seen as a technology that may greatly improve mobility options for the interest groups of these organizations. However, these CBOs want to ensure that AVs develop in a way that does not mirror

developments in human-driven motor vehicles where design features for people with disabilities are afterthoughts requiring expensive retrofits.

The Importance of Automated Vehicles

How AVs fit into the broader priorities of the organizations we met with varied significantly, although the majority of the convened groups were disability access organizations. However, all representatives we interviewed saw potential for AVs to alleviate problems their interest groups face. Representatives of some CBOs consider it important to proactively ensure that the needs of their interest groups are addressed from the outset and are considered in any possible legislation or industry developments. Their engagement included ongoing discussions with AV OEMs as well as with regulatory agencies at the federal level and at the state level in various states. Others mentioned that the organizational interest is also linked to the fluctuation of broader public interest in AVs as the market has evolved. The initial development of AVS was full of vitality, then slumped as struggling companies failed. Now, a resurgence of engagement is underway as widespread deployment occurs.

Several CBO stakeholders shared that it was a priority to ensure better service coverage and geographic equity in AV service. This sentiment came from CBO stakeholders representing different neighborhood types (urban, suburban, or rural) in distinct parts of the country and their points of emphasis differed according to the types of neighborhoods they represented. They acknowledged tensions in the views of people from different disability subgroups regarding AVs. Some people, such as those who use wheelchairs, expressed hesitation about being left behind. Others, including, but not limited to, those with vision disabilities or physical disabilities who do not use wheelchairs, expressed optimism about being able to benefit from the deployment of AV services immediately.

Representatives of CBOs recognized that new industry norms are emerging around AVs. Some feel it is important to get involved early to ensure that existing gaps in accessibility do not widen and that the interests of the people they advocate for are considered when developing laws and regulations.

Priorities for Accessibility Advocates

An equal seat at the table for CBOs when policy and legislation are created can help to ensure stronger accountability for the AV industry to meet the needs of underserved groups. In addition, some participants pointed to the need for other stakeholders, like those representing elderly people and children, to be present in these discussions.

The pervasive concern heard among CBO participants is that that companies must be held accountable to the promises they make. Though many conveyed a belief that there are well-meaning individuals employed by each of the AV companies, they also expressed concerns about a disconnect between what these people say to the CBO community versus what is conveyed in lobbying efforts. Several organizations report that promises may be dropped when leadership changes. The optimism of some groups is tempered by previous experiences working with ridehailing companies, taxi providers, paratransit providers, and other ride providers. One

organization highlights that safety regulatory processes have considerable gaps in protecting people outside of vehicles. They pointed out that, while internationally there are regulators who require crash testing for pedestrian crashworthiness, this is not a requirement for regulators in the US where the focus is on in-vehicle crashworthiness measures.

Several participants pointed to issues with AVs specific to people with sensory, intellectual, and physical disabilities. There was pervasive skepticism that tech solutions will be able to solve these complex universal design problems, especially automatic securement. The numerous types of folding and non-folding motorized and non-motorized wheelchairs may make it so that only certain wheelchair users are able to use certain AVs without a human driver or attendant.

Disability advocates had concerns related to reliability and security. For example, AVs without human drivers might drive away from riders with disabilities who need more time to approach or enter an AV if they are unable to move toward the curb where the AV is waiting. They also raised concerns about the physical safety of pedestrians with disabilities coming into proximity with AVs especially if those pedestrians are seated in wheelchairs where they are at a lower height than typical adults standing upright.

In one instance, there was an overlap in concerns relating to people with disabilities and to public transit workers who may be displaced by vehicle automation. In particular, the participant highlighted that public transit workers can have disabilities, too. The participant also pointed out that, even if public transit vehicles themselves are automated, workers could help promote interpersonal safety and manage spatial conflicts aboard vehicles among riders who use wheelchairs, riders with disabilities who do not use wheelchairs, riders with strollers or other carts, and other riders.

Several participants expressed broader concerns about interpersonal safety and the economics of AVs, given community experiences with using public transit and paratransit. One participant pointed to the potential for increased personal security risks associated with not having drivers on board vehicles. They pointed to a local example where the safety of bus riders was inhibited on articulated busses for riders who sat farther from the driver's field of view.

Legal Concerns

Participants pointed to legal issues including an interpretation of the requirement under ADA Title II that any public transit vehicle may require a human attendant even if automated. This may change the financial calculus for AV companies considering partnerships with public transit agencies. Broader concerns were voiced about private AV services being regulated more loosely under ADA Title III. This may encourage these types of services. However, externalities could include displaced public transit riders, which could harm community-wide transit provision. This is a key concern for transit-reliant people with disabilities. This sentiment was linked to experiences working with ridehailing service providers, where promises of equivalent service for wheelchair users ultimately were foisted to third-party companies to fill market gaps.

Another broad legal concern raised by CBOs is the use of mandatory arbitration for private ride providers. People involved in accidents (or even pedestrians or other people who downloaded an app for a given AV service but may not be using that service at a given time) when involved in road collisions with AVs are being prevented from suing due to mandatory arbitration clauses associated with the use of AV services. Additionally, there are unanswered legal and legislative questions about the purview of various federal agencies. In the absence of explicit Congressional approval, it is unclear which entities are responsible for regulating disability access in AVs. Federal agencies are hiring to fill gaps in expertise, which may help. Finally, participants lamented that disability advocacy communities, instead of maintaining cross-disability solidarity, may be splintering along the lines of specific disabilities with respect to supporting versus urging caution about AVs. This is, in part, a response to AV companies making much more progress for people with some disabilities than others.

Policy Goals

CBO participants called for concrete timelines, requirements, a recognition that the ability to revoke permits for compliance failure—or other ways to hold companies accountable—are essential elements of good public policy. CBOs recognize the need for federal, state, and local regulation. However, several organizations voiced that they are specifically looking to NHTSA to update the FMVSS in consideration of AVs. Concerns were raised regarding the ability of NHTSA's current self-certification processes to assess the safety of AVs and a desire for better guidelines for how these automated systems are tested. To reiterate from the section above, there were concerns about a lack of federal pedestrian crashworthiness testing (which is also not required for human-driven vehicles).

CBO participants envision and recognize that infrastructure updates can ensure that areas surrounding vehicle pick-up/drop-off points are accessible for anyone using any mode. Achieving this goal would improve the multimodal transportation landscape, benefitting many types of users. Sustainable multimodal transportation was identified as a broader goal, and one organization representative expressed concerns about AVs contributing to a more car-dependent world, and not advancing goals of sustainability or equity. These concerns can be assuaged by public policy that ensures that AVs optimize the attainment of community goals in tandem with profits.

CBO participants recognize that AVs have the potential to be transformational for people with disabilities. However, there are details and nuances to resolve to achieve this vision. Consideration of differences between priorities for pedestrians, bicyclists, and people with a diverse set of disabilities will be essential to accommodate everyone. There was general agreement amongst several CBOs that concrete government policy must be developed, and that advisory boards could potentially help inform the discussions.

Data Priorities

Participants consistently pointed to issues raised, opportunities made apparent, and lessons learned by working with data on TNC accessibility. They report that TNCs and micro mobility can provide insights on how data has been gathered or how it has failed to be provided. A lesson learned was shared by one participant,

after working with publicly available TNC/taxi ride datasets, they recognized that there was a need for more pricing transparency, to evaluate and compare ride charge rates. CBOs reported that upfront cost and surge/altered pricing data would be of interest.

One group highlighted the potential for data sales as a potential revenue stream, but one that would require safeguards to ensure community security. For example, some CBOs fear cities relying on private sector data for street mapping could cause conflicts of interest and accountability challenges.

Other participants highlight that metrics and information are only as good as the data quality, so ensuring all communities, groups, and individuals are accounted for when gathering data is vital. Using these data, equity-metrics can be developed to ensure that AVs are benefiting everyone and are accountable to their accessibility goals. A final optimistic point raised was the recognition that the federal agencies such as NHTSA are expanding capacity on accessibility metrics and have posted new staff positions in this area.

Conclusion

A close look at what is presently known about the operation of AVs reveals a reality that is more nuanced than the AV optimists or skeptics predicted a decade ago. There will be advancements as well as obstacles and challenges throughout the coming decade. There is sustained optimism from many stakeholders across all sectors that AVs will provide net benefits for communities. Even so, skeptics have legitimate concerns that need to be addressed, like expanding transparency, accountability, and accessibility across AV fleets. It will take collaboration between industry, government, and CBOs to forge a safe, sustainable, and equitable path. Much more work, and more policy research, is needed to establish best practices and ensure open channels of communication between all parties.

This study underscores how cities are looking to better understand what is going well, what actions they should take, and where to make strategic institutional investments. Many stakeholders are looking towards Washington DC for clarity on these questions. Federal frameworks for safety will likely delineate the policy landscape in which cities and states can act. It will be in cities large and small where the rubber hits the road for each AV.

Appendix A

Automated Vehicle Policy Best Practices Workshop
Date/Time: Monday June 26, 2023, 12:30-2:00 PDT
Zoom Link: Join Now

This workshop has the objective of identifying current best practices for cities, community-based organizations, and the industry in effectively managing the introduction of highly automated vehicles (AVs) in passenger mobility services. The forum will provide cities at the forefront of AV service deployment an opportunity to share takeaways from their experiences and ideas for improving outcomes. Participating cities include **[omitted]**. The workshop will facilitate the gathering of cities and states to engage in discussions concerning deployment goals, effective partnering strategies, preferences, data sharing best practices or challenges, as well as experiences related to implementing emergency protocols, among other relevant topics. It serves as a platform for sharing knowledge and fostering collaboration among stakeholders.

AGENDA

I. **Intro to UC Davis Project and Motivations – Facilitator, Mollie Cohen D'Agostino and Prashanth Venkataram** (5 min.)
II. **Icebreaker Poll Activity** (5 minutes)
III. **Intro Remarks from Cities/States with full AV Commercial service** (15 minutes)
   a. Q: Introduce what AV companies/services are operating in your jurisdiction, the scale of service and what you did to prepare/adapt?
IV. **Intro Remarks from Cities with pilots, or concluded pilots** (15 minutes)
   a. Q: What were your pilots and what is one thing you might do differently if you could do/start the pilot again?
V. **Moderated discussion:**
   a. Questions for group discussion: (10 minutes each)
      i. **Preemption:** Starting at a high level of policy making- Are there intrastate preemption issues regarding state, city, regional purview affecting your ability to regulate AVs?
      ii. **Market Gaps:** How do you see the market for AV passenger service growing in your state? Will this growth result in any service mismatches or gaps in access? (e.g., wheelchair accessible service, service to rural or equity-priority areas) What do you think are the best solutions to address these gaps?
      iii. **Data Collection:** Do you think your city/state's current AV data collection strategies are adequate, if not how would you change them?
      iv. **Day-to-Day Issue Resolution:** Can you provide an example of your city or state resolving an issue or incident with AVs? (e.g., stopped vehicle in roadway) How would you change/augment your city/state's incident procedure?
      v. Questions for each other?
VI. Next Steps and Adjourn (2 min.)

Appendix B

UC Davis Workshop: Automated Vehicles, Cities, and Communities
Date/Time: August 17, 12:00-1:30 PDT Zoom Link: **Join Here**

This small conversational workshop aims to provide a venue to listen to advocates and community-based organizations about their perspectives on the expansion of automated vehicles (AV) in communities across the US. We will welcome participants to share experiences interacting with public and private stakeholders regarding AVs and listen to ideas for improving outcomes in this industry. The discussion will address AV deployment goals, experiences, disability access perspectives, safety considerations, priorities for data sharing, implementing emergency protocols, among other relevant topics. It serves as a platform for sharing knowledge and fostering collaboration among stakeholders.

AGENDA

I. **Intro to UC Davis Project Motivations and Early Findings** – Facilitator, Mollie Cohen D'Agostino and Cooper Michael (10 min.)

II. Participants Intros

III. **Icebreaker Poll Activity** (5-7 minutes)

IV. **Introductions from participants** (2-3 minutes/person)

V. **Moderated discussion:**
   a. Questions for group discussion:
      i. How much do your organization/membership/clients care about automated vehicles (AVs) right now? Is it a low priority or top?
      ii. What is happening in your area regarding AV testing/service and what do you want from companies and different levels of government (city, state) regarding AV testing and deployment?
      iii. What are your top goals for changing the way AVs are testing/deploying in your cities?
      iv. Goals for improving disability access?
      v. Goals for data/information exchange between companies and communities?
      vi. Questions for each other?

VI. **Protocols for receiving compensation** ($100/group) - preference is Visa gift cards, other options available if need be.

VII. **Adjourn** (2 min.)

Appendix C

Automated Vehicle Policy Best Practices Interviews with AV Developers/Operators

Project description: This research project aims to identify current best practices for cities, community-based organizations, and the AV industry, to effectively manage the introduction of highly automated vehicles (AVs) in passenger mobility services. This project includes hosting several workshops to provide cities at the forefront of AV service deployment/testing an opportunity to share takeaways from their experiences and ideas for improving outcomes. Participating cities include **[omitted in draft]**. We also held a workshop with several community based, disability, and bicycle/pedestrian advocacy organizations. These workshops enabled participants to share deployment goals, priorities, effective partnering strategies, data sharing priorities or challenges, among other relevant topics.

These discussions will inform a white paper that will be published on our open access e-scholarship site, and the paper is intended for a well-informed but non-technical audience. This paper will be distributed within our UC ITS networks which are largely our partner academic institutions, planning/policy sector stakeholders, and members of the broader transportation industry (e.g., automakers/shared mobility providers).

AGENDA

I. **Intro to UC Davis Project and Motivations – Facilitator, Mollie Cohen D'Agostino and Prashanth Venkataram** (5 min.)

   Note Regarding confidentiality: Discussions will be summarized generally, without specific attribution, highlighting where there are consensus opinions or key differences within and across groups (e.g., within industry or across both industry and NGOs). All interviewed parties will have an opportunity to review the draft white paper before publication.

II. **Moderated discussion:**

   1. Where are you operating?
      1. Describe your experiences when you engaged cities and the community <u>prior</u> to choosing to launch in these locations? Please describe some highlights and lowlights or describe your *good/bad/ugly*?
      2. <u>After</u> launching, did you experience any notable changes in the way you interacted with different city or community partners, please share a *good/bad/ugly?*
      3. Regarding <u>expansion</u> into new markets, what metrics do you use to determine the comparable benefits of a given location?
         1. To the extent you can share, where are you planning to expand to? In what timeframe?
   1. Regarding your company's performance to date- what areas are you internally celebrating the most- and exceeding internal/external expectations?
      4. What areas are you facing the most challenges?
   1. What are your top priorities for legislative or agency action?

5. Where would you prefer more/less federal oversight? More state or local oversight, more federal preemption?
6. Regarding data sharing - what is your preferred approach? Please speak to whether you prefer static data sharing or sampling (e.g., Secure Data Commons) or an API based system that might enable two-way data sharing (e.g., MDS)?
7. Regarding possible public policies that would be disruptive, what keeps you up at night?

1. With regards to disability access, what are your plans for pursuing ADA compliance within your fleet? Specifically...
   8. Please address near-term and longer-term plans for providing wheelchair accessible rides.
   9. Any other plans or accomplishments in addressing accessibility for people with other disabilities (e.g., accommodations for people who are blind or with hearing impairments)?
1. Big picture - How do you see the market for AV passenger service growing?
   10. As communities may seek to address market gaps, such as directing AV service to rural communities or other less profitable areas, what do you see as possible policy mechanisms for encouraging growth in areas where barriers exist? (e.g., subsidies per ride, or investments in infrastructure)

II. **Share City/State and CBO Findings (If time allows)**
II. **Next Steps and Adjourn (2 min.)**