Principles for Autonomous Urbanism

NYU Rudin Center for Transportation

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Executive Summary

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The promises of autonomous vehicles in cities are clear – but so are the challenges. While they show incredible potential for moving both people and goods – from providing mobility for populations underserved by public transit to creating safer traffic conditions – without incentives, regulations, and proper preparation, cities may not reap these benefits.

This document, developed with stakeholders in the public, private, and advocacy sectors, aims to outline how policymakers, industry, and stakeholders can mitigate challenges and pursue opportunities to collectively unlock the positive benefits of AVs for cities. To identify specific principles that are applicable to a range of U.S. cities, Nuro and the NYU Rudin Center for Transportation brought together five working groups of practitioners, policymakers, advocates, and industry leaders between September 2022 and January 2023. These participants hailed from cities large and small, as well as from suburbs and state authorities, representing public, private, and non-profit sectors. Taken together, the discussions produced a set of ten principles that can be applied to cities of all sizes when introducing autonomous vehicles.

Ten Principles for Autonomous Urbanism:

1. Engage early and often.
2. AV companies should work with cities to help improve urban infrastructure to serve all residents and users.
3. Communication with first responders is critical.
4. AV deployment should lead to safer streets, not stranded assets.
5. Rigorous safety standards must be met.
6. Data-driven decision-making is valued.

7. AVs should lead the conversion to zero-emission vehicles and support public transit.
8. AVs should be efficient users of space.
9. Workforce gains should be maximized through public-private collaboration.
10. Economic opportunities and access to services should be equitable.

These principles are intended to inform urban plans in advance of the introduction of new transportation modes. They should assist cities in strategically aligning with their needs and goals of safety, sustainability, accessibility, equity and livability – while also fostering innovation. Furthermore, these principles should offer a framework for public-private partnerships that will help to increase availability of safer, cleaner, and more efficient transportation options, and the infrastructure to support them.

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Introduction

As the autonomous vehicle industry advances toward a potentially monumental shift in moving people and goods without driver intervention, countless use cases in cities can be conjured. Most urgently, autonomous vehicles (AVs) can be harnessed to streamline safe traffic patterns, offer new modes of mobility for passengers underserved by public transit, and deliver goods to areas lacking sufficient access and choice. However, without reasonable regulations and incentives in place, cities may realize limited to no exposure to these benefits or experience challenges that outweigh the advantages. Important in this consideration is ensuring policy frameworks do not inadvertently disincentivize AVs over the status quo.

Through forward-thinking urban policy, challenges can be mitigated and opportunities pursued. This document, developed with stakeholders in the public, private and advocacy sectors, aims to outline how policymakers, industry, and stakeholders can collectively unlock the positive benefits of AVs for cities.

Urban policymakers are presently aiming to make streets safer for all users, accessible to users with disabilities, equitable to all populations, and sustainable for future generations. Their efforts typically take several forms, such as inducing active transportation, including increased walking and cycling infrastructure; improving curb access, especially for pedestrians with mobility devices; narrowing streets and lowering speed limits to reduce safety hazards; and incentivizing residents away from the use of personal vehicles.

If autonomous vehicle companies achieve their promises, AVs could be a crucial component in delivering these urbanist goals. As AVs adhere to federal safety standards and state laws governing AV testing and deployment, they may offer significant improvements to street safety (currently, more than

43,000 Americans die on public roads each year). Even just compliance with speed limits would present a significant improvement in street safety when deploying a large AV fleet, according to the European Union.[1] AVs can offer dynamic transit, letting us reimagine bus routes, or first/last-mile transit that offers safe passage home from train stations. AVs can be developed with accessibility from the start, presenting a friendlier way for users with limited mobility, low vision, or low hearing to get around.

However, the vehicles are hardly designed in a vacuum, and will require input and cooperation from city leaders for productive interaction. For example, wheelchair-accessible vehicles are still not largely reachable from curbs without ramps. In addition, in the interests of sustainability and safety, cities should continue to encourage active transportation by building dense housing, wide sidewalks, and protected bike lanes. These elements are foundational to cities' goals and offer the most protection for all user types.

To this end, the optimal way to advance both urbanist and AV companies' goals involves public-private partnerships to develop guidelines, regulations, and best practices. This document conveys core principles that will harness the advantages of AVs to meet the needs and goals of U.S. cities of all sizes.

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[1]European Transport Safety Council. (2017, September 27). *Briefing: Intelligent speed assistance(ISA)*. European Transport Safety Council. https://etsc.eu/briefing-intelligent-speed-assistance-isa/

Methodology: Working Group

The principles in this document were developed in a series of five stakeholder working groups composed of recognized voices and emerging leaders with expertise in cities, transportation, and/or technology. Select representatives from industry, associations, prominent researchers, and other stakeholders from across the United States were invited to participate. A full list of participants, who met monthly between September 2022 and January 2023, can be found in the Appendix. Discussion topics included:

- Community Engagement
- Infrastructure
- Safe Streets
- Accessibility
- Livability
- Sustainability
- Equity

Developing the Core AV Urbanism Principles

The autonomous urbanism principles that follow were developed in order to seek policy recommendations that can be applicable to a wide variety of United States cities. Because of the diverse needs of U.S. cities according to their density, weather, and topography, these principles are intended to serve as a baseline for developing more nuanced localized needs. Overall, the intention is to foster public-private partnerships that will help to increase availability of safer, cleaner, and more efficient transportation options, and the infrastructure to support them.

Urbanism Principles

With the encouragement of the U.S. Department of Transportation, many cities are trending towards goals of reducing excessive vehicle traffic congestion, increasing traffic safety, encouraging active transportation (such as walking and cycling), and building more sustainable and resilient infrastructure. As AVs continue to be slowly introduced in cities, cities must ensure they set their priorities for streets, including safety, accessibility, lower carbon emissions, active transportation, and the promotion of walking- and cycling-centric lifestyles. As they work with companies testing and deploying AVs, cities can consider what these new vehicles offer in terms of meeting these goals. Cities can choose to collaborate with companies to ensure the value proposition is evident and promote the technology within their communities.

Early in AV operations in cities, a period of real-world testing and adjustment may be necessary to learn about the interaction between these vehicles and their urban environments. At this early stage, cities, communities, and companies must align on how they can work together to establish confidence in advance of full deployment. Still, while this confidence is typically established in terms of meeting safety standards, it also must be judged by understanding and meeting local transportation priorities.

Use Cases

Autonomous vehicles can contribute to urban life in a significant number of ways. Assuming vehicles meet applicable federal and state motor vehicle safety standards and operators are transparent, AVs could:

1. Deliver food, medicine and other necessities to areas with insufficient access to fresh food markets, especially in partnership with food banks and other community organizations.

2. Offer shared ride services in areas underserved by public transportation – in terms of full trips, first/last-mile to stations and stops, and chained trips – enhancing equitable access to mobility.

3. Supplant single-occupancy vehicle trips with shared rides and batched deliveries, increasing the efficiency of road space and helping residents realize car-lite or car-free living.

4. Normalize smaller vehicle sizes that are more sustainable, space-efficient, and safer for vulnerable road users.

5. Extend mobility for seniors and people with disabilities, helping to increase access to services and social opportunities.

6. Make streets safer in terms of law-abiding vehicles that are not subject to human flaws like speeding, distracted driving, impaired driving, and road rage.

7. Offer accessible transportation, with considerations for different types of disabilities built into the vehicles' design from the start.

8. Accelerate the transition to electric vehicles, partner with cities on charging networks, support renewable energy generation, and explore innovative ways to improve resiliency (e.g. providing backup power to buildings, such as homes and businesses that have lost power in the event of a storm or other emergency).

9. Support sustainable urban development by reducing the demand for private car ownership, freeing up space for affordable housing and public infrastructure.

With proper partnership and regulation, AVs can help cities achieve goals of efficiency, safety, equity, and sustainability. To that end, the core principles outlined below aim to harness the abilities of city policymakers and AV companies to result in the best possible outcomes. While local circumstances will necessitate customization, these principles are intended to serve as a foundation for collaborative solutions.

Autonomous Urbanism Principles

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1. Engage Early and Often.

Cities and AV companies should collaborate to build trust, safe interactions, and familiarity with autonomous vehicle technology and community impacts. This is especially crucial in historically marginalized communities. Companies should proactively engage with local stakeholders, such as neighborhood and community organizations, transit agencies, first responders, the disability community, and workforce development agencies. Insights from these stakeholders can assist in informing vehicle design, operations, pilots, user studies, and student and worker training.

Examples include:

- **goMARTI self-driving shuttle pilot**
  Via launched the 18-month goMARTI (Minnesota's Autonomous Rural Transit Initiative) pilot in Grand Rapids, Minnesota, in September 2022, which involved the collaboration of several public and private stakeholders. This pilot is the United States' first rural transit program that uses wheelchair-accessible AVs with ADA-compliant ramps.[2] To promote and familiarize the community with the program, the goMARTI team attends community events and allows people to interact with vehicles. Their website also offers a survey for new riders to provide

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[2] Prejean, L. (2023, March 8). May Mobility, Via Plan to Transform Public Transit. *Metro Magazine*. https://www.metro-magazine.com/10194019/may-mobility-via-plan-to-transform-public-transit

their feedback.[3] Gathering input from the community during the pilot period will improve the program and streamline permanent implementation.

- **Waymo's [Let's Talk Autonomous Driving](#) community outreach and education program**

  Waymo's Let Talk Autonomous Driving initiative shares personal stories from those who benefit from AV services. They have partnered with numerous relevant organizations to spread the positive impacts of AV usage, and furthermore, the team has attended and sponsored events nationwide to connect with communities.[4] The dedicated Let's Talk Autonomous Driving website contains resources that explain Waymo's work and technology.[5] The transparency demonstrated by working with affected communities and offering informational resources demystifies AVs and their potential impacts.

- **[Jacksonville Transportation Authority, Beep and Mayo Clinic partner to transport COVID-19 tests](#)**

  In 2020, Beep and the Jacksonville Transportation Authority partnered to meet community needs during the time of the pandemic. The partners launched autonomous vehicles to transport COVID-19 tests at Mayo Clinic in Jacksonville. The self-driving shuttles with no attendant onboard served two primary objectives. First, it freed up cycles for Mayo Clinic staff who would have otherwise transported samples thus enabling them to focus on other important tasks. Secondly, moving the samples autonomously also removed a level of human interaction with the tests and helped reduce exposure to the virus.[6]

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[3] goMARTI. (n.d.). *Enagagement*. goMARTI. Retrieved June 13, 2023, from https://www.gomarti.com/engagement

[4] Waymo. (n.d.). *Waymo in the community*. Waymo. Retrieved June 13, 2023, from https://waymo.com/community/

[5] Waymo. (n.d.). *Let's talk—Join the conversation about autonomous driving technology*. Let's Talk Autonomous Driving. Retrieved June 13, 2023, from https://ltad.com

[6] Beep. (n.d.) *Jacksonville, FL: Mayo Clinic*. Retrieved June 26, 2023, from https://ridebeep.com/location/mayo-clinic-jta-jacksonville/#:~:text=Mayo%20Clinic%20%7C%20JTA%20%20

2. AV developers should work with cities to improve urban infrastructure to serve all residents and users.

AV developers should have a clear understanding of local transportation priorities and align investment and operations to the greatest extent possible. Cities should work with companies to safely deploy and scale AVs in the areas where they can offer the biggest safety benefits, e.g. high-injury network streets. Since AVs can improve the capacity and efficiency of existing roads and transit, cities and companies should support efforts to redirect funds traditionally used for widening roads into making existing streets safer for all road users (e.g., bike lanes, daylighting, safer curbs, enforcing and/or lowering speed limits, etc.).

Examples include:

- **Motional for Safe Streets**
  The Motional for Safe Streets initiative, launched in 2022, aims to look at road safety more holistically, beyond just AVs. Motional participates in legislation support, advocacy and awareness, and community engagement with organizations specializing in road safety. Some of their early causes have addressed cyclist and pedestrian safety, traffic-calming measures, and sponsoring educational events.[7] Supporting road safety broadly will improve all road users' experience and outcomes as AVs are deployed.

- **Safer Streets Data**
  AV companies operating on public roads today often work with city and state agencies to share road safety data – especially around hazardous

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7C%20Beep&text=Using%20autonomous%20vehicles%20to%20transport,to%20limit%20risk%20of%20exposure.
[7] Iagnemma, K. (2022, June 22). Introducing Motional for safe streets . Motional. https://motional.com/news/introducing-motional-safe-streets

intersections, segments, and dangerous road conditions and designs. For example, Nuro has worked with the City of Houston to make improvements to streets on their High Injury Network that improve unsafe conditions for pedestrians and vehicles.

3. Communication with first responders is critical.

Cities, companies, and first responders should coordinate to implement efficient training, communication channels, and engagement protocols with first responders. Cities should designate a staff member to coordinate communication between parties. AV companies should publish a Law Enforcement Interaction Plan (LEIP) that uses industry best practices and meets specific regional requirements, where applicable.

Examples include:

- **AV Engagement with Emergency Responders**
  Many AV companies produce Law Enforcement Interaction Plans they share with agencies and first responders. These contain procedures, instructional how-to guides, and vehicle information necessary to support first responders in emergencies or other situations. Nuro, among others, engages with first responders to refine their emergency response procedures, support community education events, and ensure their technologies are safely integrated into neighborhoods.[8] Waymo[9] and Cruise[10] also provide videos to first responders interacting with their vehicles. Training first responders to identify and safely

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[8] Nuro Team. (2021, November 18). How Nuro works with emergency response providers. *Nuro.* https://medium.com/nuro/how-nuro-works-with-emergency-response-providers-e00c346780c3
[9] Waymo. "Waymo Emergency Response Guide and Law Enforcement Interaction Protocol." https://waymo.com/firstresponders/
[10] Cruise. "Cruise Resources for First Responders." https://getcruise.com/firstresponders/

respond to situations involving new technology will be vital as AVs are introduced into cities.

4. AV deployment should lead to safer streets, not stranded assets.

AV companies should design their systems to operate on roadways as they exist today, using sensors to read traffic control devices common to all road users. AVs should <u>not</u> be the motivation for cities to install connected infrastructure (V2X).

5. Rigorous safety standards must be met.

AV companies should meet applicable federal and state motor vehicle safety standards as well as those governing AV testing and deployment. Companies should communicate their safety standards by publishing a Voluntary Safety Self-Assessment and promote transparency regarding their safety approach (e.g. software, hardware, operations).

Examples include:

- **NHTSA's Voluntary Safety Self-Assessments**
  Numerous AV developers have released Voluntary Safety Self-Assessments (VSSA) per the US DOT and the National Highway Traffic Safety Administration (NHTSA)'s guidelines. According to the official documentation, a VSSA "is intended to demonstrate to the public (particularly States and consumers) that entities are: (1) considering the safety aspects of automated driving systems (ADS); (2) communicating and collaborating with DOT; (3) encouraging the self-establishment of industry safety norms for ADS; and (4) building public trust, acceptance, and confidence through transparent testing

and deployment of ADS. It also allows companies an opportunity to showcase their approach to safety, without needing to reveal proprietary intellectual property."[11] While not required or incentivized, entities in AV development can use their VSSAs to highlight their safety commitments and considerations.

- **League of American Bicyclists' Guidelines for AV-Cyclist Interactions**
  The guidelines for AV-Cyclist interactions developed by the League of American Bicyclists emphasize the importance of AVs' ability to assess interactions with cyclists in various situations properly. Even typical cyclist behavior is inconsistent due to the lack of bike infrastructure. Cyclists have to adjust accordingly to their surroundings. To avoid contributing to that problem, AVs should be consistent and understandable. They should be able to understand and predict cyclist behaviors based on the scenario and local laws, be prepared for uncertainty, and proactively reduce speed.[12]

6. Data-driven decision-making is valued.

Data shared between cities and companies should achieve the purpose of improving safety on our roads while protecting personal privacy and proprietary information. Together, cities and companies should develop models for maximizing safety across cities.

Examples include:
- **Bellevue's Video Analytics Traffic Safety Program**

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[11]US DOT & NHTSA. (2017). *Automated driving systems 2.0: a vision for safety* (p. 16). https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf
[12]*Autonomous vehicles.* (n.d.). League of American Bicyclists. Retrieved June 13, 2023, from https://bikeleague.org/take-action/policy-advocacy/on-the-issues/automated-vehicles/

Bellevue's Video Analytics Traffic Safety Program was launched in 2016. The City of Bellevue, Washington, collaborated with Microsoft and the University of Washington to develop a tool that proactively identifies safety hot spots and potential safety improvements much more quickly than traditional methods. The pilot led to video analytics partnerships with Transoft Solutions Inc., the Together for Safer Roads coalition, and later the Advanced Mobility Analytics Group, Jacobs Engineering, as well as a renewed collaboration with Microsoft.[13]

- **NHTSA Standing General Order on Crash Reporting**
  In 2021, NHTSA issued a Standing General Order (SGO) requiring manufacturers and operators to report to the agency certain crashes involving vehicles equipped with automated driving systems or SAE Level 2 advanced driver assistance systems. The SGO allows NHTSA, states, cities, members of the public, and others to access nationally standardized information related to crashes. It also enables NHTSA to respond to those that raise safety concerns utilizing their investigation and enforcement authority.

7. AVs should lead the conversion to zero-emission vehicles and support public transit.

AVs powered by electricity, particularly electricity that comes from renewable energy, can help to reduce emissions from personal vehicles by providing convenient alternatives to single-occupancy, gasoline-powered trips. AV developers should manufacture electric models and transition fleets to them

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[13] Pacific Northwest Transportation Consortium. (2021, November 15). *City of Bellevue wins 2021 national roadway safety award for its video analytics traffic safety program.* https://depts.washington.edu/pactrans/city-of-bellevue-wins-2021-national-roadway-safety-award-for-its-video-analytics-traffic-safety-program/

as quickly as is feasible. AVs should also expand public transit and make it more accessible and equitable. Public-private partnerships should focus on ways to complement transit, such as providing an alternative to paratransit customers for low-cost grocery delivery or low-cost transit integrations.

Examples include:

- **SAVE Coalition**

    The Coalition for Safe Autonomous Vehicles and Electrification (SAVE Coalition) is a group of leading AV development companies - Zoox, Nuro and Einride - building electric, autonomous vehicles with innovative designs to improve road safety and sustainability. In the past, SAVE supported the SB 500 bill in California, which requires all light-duty AVs under 8,501 pounds built after 2030 to be EVs, a bill that was signed into law in September 2021.

- **Cruise "Farm to Fleet" program partnership with CA Central Valley farms**

    In the "Farm to Fleet" program, Cruise purchases renewable energy credits from farms in California's Central Valley to power its fleet of all-electric self-driving vehicles in San Francisco. Cruise became the first AV developer to commit to a completely electric fleet, powered by renewable energy sources.[14] This model can have an impressive impact as it is scaled up and can help cities reach their sustainability goals by reducing emissions from traditional gas-powered vehicles.

- **Waymo electric I-PACE launch in AZ**

    In late April 2023, Waymo deployed the Jaguar I-PACE and fifth-generation Waymo Driver in the Phoenix East Valley, making the entire Waymo One ride-hailing fleet fully electric. The Waymo One

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[14]Grant, R. (2021, August 25). Farm to fleet: how cruise powers its self-driving cars with clean energy from family farms. *Cruise*.
https://www.getcruise.com/news/blog/2021/farm-to-fleet-how-cruise-powers-its-self-driving-cars-with-clean-energy/

system has the potential to improve vehicle utilization, allow repurposing of parking space, provide a complement to other mobility modes, improve pedestrian safety, and reduce local emissions.[15]

- **[May Mobility-Moovit partnership to fill gaps in public transit](#)**
  May Mobility, an AV developer, and Moovit, a Mobility as a Service (MaaS) provider, are collaborating to improve connections by including shared AV rides as an option in Moovit users' trip planning. May Mobility's AV fleets, powered by Multi-Policy Decision (MPDM) technology, will work to join Moovit's urban mobility app and on-demand reservation and routing software to allow riders to utilize shared AVs as an accessible transportation option.[16]

- **[Nuro-Houston METROLift-Texas A&M TTI partnership](#)**
  During the COVID-19 pandemic, contactless delivery provided a valuable service for individuals advised to stay at home. In response, Nuro launched a research pilot with Houston METRO and Kroger to offer free delivery of groceries to paratransit customers in their service area. They also partnered with researchers at Texas A&M Transportation Institute (TTI). Findings showed that "40% of respondents expressed interest in participating in the program as a way to get fresh, healthy food options through a convenient and affordable service. Respondents also mentioned their interest in having a delivery service provide for their needs compared to the potential hassles of physically going to their desired grocery store."[17] This public-private partnership offered a

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[15]The Waymo Team. (2023, March 30). Paving the way toward a fully electric ride-hailing fleet. Waypoint – The Official Waymo Blog. https://waymo.com/blog/2023/03/paving-way-toward-fully-electric-ride.html
[16]May Mobility. (2023, April 13). *May Mobility and Moovit partner to deploy complete autonomous mobility package*. May Mobility. https://maymobility.com/posts/may-mobility-moovit-partner-to-deploy-complete-autonomous-mobility-package/
[17]Nuro Team. (2021, November 11). Partnering with Houston Metro to deliver for people with disabilities. *Nuro*. https://medium.com/nuro/partnering-with-houston-metro-to-deliver-for-people-with-disabilities-a35fd043eb85

critical service in a time of need and utilized the data and feedback from these trips to improve the program.

8. AVs should be efficient users of space.

Productive vehicle-miles-traveled (i.e. miles operated with passenger or goods in the vehicle) should be maximized to ensure vehicles maximize capacity with passengers and/or cargo, and limit empty VMT (i.e. those not carrying a passenger or goods). Adjacent to appropriate land use (e.g. retail or commercial), cities considering policies or programs that maximize productive use of the curb (e.g. economic activity and transit vs. personal parking), should address for all vehicle types, AV developers included. AV developers should continue to innovate on vehicle designs, prioritizing vehicles right-sized to the use case.

Examples include:

Innovative Designs

- **Cruise Origin**

  Without an internal combustion engine, hood, or steering device, the bulk of the vehicle's interior can be dedicated to passengers and their comfort, as seen in Cruise's Origin design. Even with these additions, the Cruise Origin is roughly the same size as a traditional crossover utility vehicle, accessed via an exterior-mounted keypad, which activates two sliding doors that part down the middle.[18]

- **Nuro Vehicle**

  Nuro's completely passengerless delivery vehicles are about 20% narrower than a typical car without compromising cargo volume, making it easier to share the road with pedestrians and cyclists.[19]

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[18]Lopez, J. (2020, January 21). This Is Cruise Origin, GM's First Driverless Car [Blog]. *GM Authority*. https://gmauthority.com/blog/2020/01/this-is-cruise-origin-gms-first-driverless-car/
[19]Mihalascu, D. (2022, January 13). *Nuro unveils third-gen autonomous delivery vehicle built with byd*. InsideEVs. https://insideevs.com/news/560458/nuro-autonomous-delivery-vehicle-byd/

- **Zoox Vehicle**

  Zoox has employed a carriage-style interior, with no steering wheel or space for a human driver. This makes it so the vehicle has no designated front or back, and can even slide sideways into parking spaces.[20]

9. Maximize workforce gains through public-private collaboration.

Public officials and AV developers should work to partner with workforce development agencies, local community organizations, schools (particularly community and technical colleges), and labor groups on job training and workforce development. AV companies can provide living wage jobs in this new industry, particularly for local workers upskilling from current positions, including those who face barriers to employment.

Examples include:

- **Nuro's Autonomous Upskilling Initiative**

  Nuro has partnered with two universities to build skills for students interested in autonomous and electric vehicles. At San Jacinto College in Texas, students can pursue a one-year certificate program that teaches how to merge computer design and automotive engineering skills and prepare for jobs in the AV industry.[21] Similarly, at De Anza College in California, the Autonomous and Electric Vehicle Technician

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[20]Walker, A. (2020, December 29). *Zoox is only barely a car, and that's its most promising feature*. Curbed. https://www.curbed.com/2020/12/zoox-self-driving-car-startup.html

[21]Fenwick, A. (2023, February 24). *San Jacinto College and Nuro announce first AV technician certificate program in Texas*. San Jacinto College. https://www.sanjac.edu/news/san-jacinto-college-and-nuro-announce-first-av-technician-certificate-program-texas

pathway combines coursework related to electric vehicle technology and computer programming. A tuition-free path is also available.[22]

- **Pima Community College partnership with TuSimple**

  In 2019, Pima Community College and TuSimple partnered up to develop the first autonomous driving certificate program available to individuals holding Commercial Drivers' Licenses. Through a curriculum consisting of five courses, "the certificate will prepare individuals for jobs such as training the autonomous system as test drivers, operating the vehicle in situations where autonomous driving is not suitable and to remotely monitor the system from a command center." Additionally, "TuSimple will prioritize hiring graduates of the certificate program for jobs at its Tucson, AZ testing and development center."[23]

10. Economic opportunities and access to services should be equitable.

AV developers and cities should maintain open communication when locating facilities, including business offices, depots, and fleet parking. They should also seek to maximize economic opportunity and jobs in underserved areas and amongst historically underserved populations. In addition, state and local governments can support customers with low incomes, disabilities, and those who qualify for government assistance – like Supplemental Nutrition Assistance Program benefits or Social Security Income – by providing subsidies or other incentives.

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[22]De Anza College. (n.d.). *Autonomous and electric vehicle technician pathway.* De Anza College. Retrieved June 13, 2023, from https://www.deanza.edu/autotech/av.html
[23] Pima Community College. (2019, June 13). TuSimple and PCC announce autonomous vehicle driver program. Pima Community College.
https://www.pima.edu/news/press-releases/2019/201906-tu-simple.html

Examples include:

- **May Mobility's autonomous public transit service for 55+ community**

  May Mobility launched an on-demand public transit service using AVs in Sun City, Arizona, a community which is designed for adults 55 and older. Powered by Via, the goal of the deployment is to use AVs to expand access to safe, reliable, and equitable on-demand transportation within Sun City. The company also aims to understand how its technology is adopted and addresses mobility challenges faced by aging adults.

- **Nuro's Delivery to Food Deserts**

  "Food deserts" are areas with little to no access to fresh, healthy foods. To assist residents living in food deserts, Nuro is aiming to provide low- to no-cost grocery delivery services with its autonomous, occupantless delivery vehicles. It is estimated that this service has the potential to reach 70% of the total low-income population in food deserts nationwide. Nuro partnered with the Houston Food Bank, Second Harvest of Silicon Valley, and Waste Not in Greater Phoenix to provide thousands of free food deliveries to families in need during the pandemic.[24]

Conclusion

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Much of the work to improve cities' safety hazards, congestion, and isolation is already underway. Cities across the United States are working to induce active transportation, including increased walking and cycling

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[24] Lawal, S. (2020, July 15). Serving America's food deserts. *Nuro*. https://medium.com/nuro/serving-americas-food-deserts-a7442e922053

infrastructure; improve curb access, especially for pedestrians with mobility devices; narrow streets and lower speed limits to reduce safety hazards; and incentivize residents away from the use of personal vehicles. If autonomous vehicle companies achieve their promises of safety and efficiency, AVs could help deliver these urbanist goals.

The greatest potential for the advancement of both urbanist and AV companies' goals requires public-private partnerships to develop guidelines, regulations, and best practices. We encourage cities to continue pursuing urbanism goals, while incorporating the benefits of new AV technologies.

Appendix A: Workshop Participants

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Workshops were facilitated by the NYU Rudin Center for Transportation:

- Sarah M. Kaufman, Interim Executive Director
- Christina Curry, Research Assistant
- Edwin Jeng, Research Assistant

With Katie Stevens, Acting Head of Policy, Nuro and Greg Rogers (former Public Policy Manager, Nuro)

Workshop participants and their affiliations as of January 2023 are listed. Each person listed attended at least one workshop.

1. Story Bellows, CityFi
2. Bryan Boyer, University of Michigan
3. David Burns, US Conference of Mayors
4. Fabio Capillo, Houston
5. Danette Carll, NY/NJ Port Authority
6. Ellie Casson, Waymo
7. Carlos Cruz-Casas, Miami
8. Mollie D'Agostino, UC Davis
9. Veronica Davis, Houston
10. Crissy Ditmore, Optibus
11. Ellen Dunham-Jones, Georgia Tech
12. Paul Escobar, Zoox
13. Henry Greenidge, Tusk Ventures
14. Chase Klingensmith, Pittsburgh
15. Brittney Kohler, National League of Cities
16. Nico Larco, University of Oregon
17. Ken McLeod, League of American Bicyclists
18. Michelle Merchant, Tulsa, OK
19. Ryan Michael, State of Michigan
20. Chris Pangilinan, MTA - NYCT Paratransit
21. Trevor Pawl, State of Michigan

22. Phil Pierce, Zoox
23. Eli Promisel, Silicon Foundry
24. Karina Ricks, CityFi
25. Greg Rodriguez, Stantec
26. Greg Rogers, Aries Public Policy LLC
27. Sophie Jantz
28. Priyanshi Shah, Stantec
29. Joe Shannon, Motional
30. Dani Simons, USDOT
31. Maria Town, American Association of People with Disabilities
32. Terry Travis, EV Noire
33. Carol Tyson, DREDF
34. Seth Wainer, NY/NJ Port Authority
35. Jun Wang, Georgia Tech
36. Marla Westervelt, Populus
37. Ryan Westrom, Citian
38. Allanté Whitmore, SAFE / Coalition for Reimagined Mobility
39. Ariel Wolf, Venable

Appendix B: Further Reading

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The following documents, policies, and projects provided guidance and perspective in the shaping of the principles above:

1. American cars are getting too big for parking spaces. VICE. (2023, February 8). https://www.vice.com/en/article/y3pyzx/american-cars-are-getting-too-big-for-parking-spaces

2. Autonomous vehicles survey results. BikePGH. (2019, February 7). https://bikepgh.org/our-work/advocacy/save/

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