NLC
NATIONAL LEAGUE OF CITIES
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Autonomous Vehicles

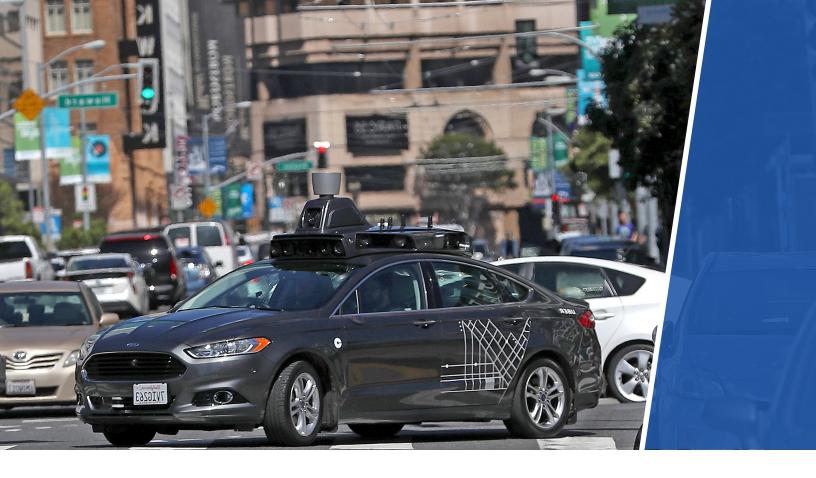## A POLICY PREPARATION GUIDE

Autonomous Vehicles

The development of autonomous[1] vehicle (AV) technology has recently shifted into overdrive. This rapid escalation has been signaled by major partnerships and acquisitions between tech firms and traditional automakers as they all aggressively pursue a technological edge in the race for deployment of fully autonomous vehicles. We've seen General Motors (GM) announce a partnership with Lyft, Ford announce partnerships with Lyft and Uber to provide automated vehicles, and Fiat team up with Google. Illustrating the important role that software is going to play in the future of automation, GM also acquired Cruise Automation. Manufacturers have invested significant capital in AV and positioned themselves for near future production. 2017 brought exciting new developments, including a partnership between Daimler and Uber in which the former will supply self-driving cars.[2] GM also unveiled its new car-sharing brand, Maven, and Ford announced plans to release a full fleet of autonomous ridesharing cars by 2021.[3] Mobility is changing, and the auto industry is competing to stay ahead of the curve.

Technology companies have also positioned themselves to be competitive in this space. Google logged 2 million autonomous miles in October 2016, soon thereafter spinning off its autonomous vehicle department into Waymo, a stand-alone company within the Alphabet conglomerate. Uber announced street-testing for autonomous vehicles using its ride sharing app in Pittsburgh in November, and celebrated a successful field delivery of beer with its autonomous truck Otto in the same month.

Embracing the potential benefits that transportation technologies offer, cities are also exploring and announcing partnerships around the testing of autonomous vehicles. Nutonomy launched the first autonomous ride hailing service, beating Uber by only two weeks, in Singapore—as well as later in the year forming a partnership with Boston.[4] Moreover, the Department of Transportation (DOT) has announced 10 proving grounds[5] to move autonomous vehicles testing from controlled to real world vehicle operating environments, with a focus on data sharing to develop best practices and future guidance.

The year also witnessed historic regulatory milestones with the release the U.S. Department of Transportation's (DOT) Federal Automated Vehicles Policy [6] through the National Highway Traffic Safety Administration (NHTSA), which received over 1,100 public comments.[7] As the DOT policy and comments clearly illustrate, one of the major challenges facing cities is how to promote a regulatory foundation that ensures safety while promoting the continued innovation of autonomous vehicles through increased testing. The fast pace of technological advancements tests the traditional foundations around government policymaking and procurement.

The number and complexity of issues that city officials and regulators have confronted in 2016 will continue to grow. This will be exacerbated by the continued promise of deployment of autonomous vehicles on our roads and the increased comingling of varying levels of automated vehicles with traditional

non-autonomous vehicles. While widespread deployment of autonomous vehicles is not here yet, nearly every major car manufacturer has set a deadline of producing fully autonomous cars by 2021, with China's Baidu aiming for 2019 and Tesla aiming for the end of 2017.

This represents both an important challenge and opportunity for cities. With the many benefits that AV technology promises, including reduction in traffic deaths, increased mobility for the disabled and seniors, reduced congestion, and enhanced connectivity for all demographics, cities have a unique opportunity to be proactive to not only engage in smart planning for AVs, but to also shape the policy around AVs to ensure such benefits are fully realized. Such smart planning includes coming to the table to address issues around public policies needed for the safe deployment and operation of AVs, including addressing sensitive issues like privacy and cybersecurity, land use,

enforcement and regulation and technology requirements and municipal capacities in future infrastructure planning.

Following NHTSA's release of the Federal Automated Vehicles Policy and subsequent releases of policy documents on Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) technology deployment, this resource explores the concerns and opportunities this transformative technology represents for cities. At this point, there are certainly more questions than answers, but with AVs currently operating on our roads, cities are encouraged to start discussing and considering the policies, outreach, and legal issues that need to be addressed in order to position themselves for a smooth transition to an automated future.

The following draws out the language set forth in NHTSA's Federal Automated Vehicles Policy to present issues and questions for cities to consider as they navigate the ever-changing world of AV technology.

Manufacturers

What concerns for safety and privacy might cities have that manufacturers should listen to?

In a nod to privacy concerns, the AV Guidance promulgated the Privacy Principles for Vehicle Technologies and Services, an industry-written document prepared in 2014 by the Alliance of Automobile Manufacturers and the Association of Global Automakers.[8] Cities should consider their own safety and privacy concerns that are not reflected in these principles, and push for these guidelines to reflect all stakeholder's concerns. By working with cities, manufacturers benefit from clear expectations related to privacy and public records requests. Such policies also promote transparency which benefits public outreach and support for innovative partnerships.

How can cities benefit from an anonymous data sharing mechanism between manufacturers?

As part of the future steps NHTSA envisions, the agency wants to establish a platform for manufacturers to share anonymized data from their vehicles.[9] These vast amounts of data are a potential boon, which cities will be well placed to take advantage of if properly developed and managed. Such data could be used for traffic control, public utilities monitoring, road safety evaluation, and identifying infrastructure needs to support the safe, effective, and efficient deployment of AVs. For example, imagine a city control center getting a real-time notification from a car the moment it encounters a pothole – that could be the future of public road maintenance.

In a nod in this direction, Uber announced the creation of Movement, its data-sharing platform for cities, in January 2017.[10] Subsequently, the New York City Taxi and Limousine Commission passed a ruling requiring ride-hailing companies to provide the city with more specific data, including pick-up and drop-off locations.[11] Cities should consider their data needs, and the relationship they seek to build with AV manufacturers as well as transit platforms and other mobility providers.

All parties will need to be satisfied with the security of the data being handled, as well as the level of transparency and good faith. While it is unlikely that AV manufacturers and transit platforms will divulge proprietary data to every municipal jurisdiction they travel through, cities can push for anonymized and private raw data remittance between AVs and their state DOT, requiring their DOTs to share high priority data with municipalities. This will allow for a more centralized and controlled remittance of raw data, while still ensuring access to cities, large and small. Ultimately, data sharing and analysis should be a partnership, which will benefit both cities and manufacturers in determining what is needed for safe deployment and how benefits can be maximized for residents.

Levels of Autonomy

The National Highway Traffic Safety Administration (NHTSA) policy adopted SAE International's (SAE) definitions for levels of automation. SAE outlines six levels of vehicle automation, from Level 0 (No Automation) to Level 5 (Full Automation). The levels are distinguished by how active the driver must be in controlling the vehicle and monitoring the roadway during operation.[12][13]

LEVEL 0

NO AUTOMATION

The driver is in full control of all aspects of the vehicle's primary functions at all times.

LEVEL 1

FUNCTION-SPECIFIC PARTIAL AUTOMATION

An automated system that can assist parts of the driving task, such as controlling speed, braking, or steering, for part of the time. Many drivers are already familiar with this level of automation, which includes cruise control and automatic braking.

LEVEL 2

FUNCTION-SPECIFIC FULL AUTOMATION

This level of automation enables a part of the driving to be entirely automated, with the human playing an active monitoring role. An example of this would be automatic parking, which automates an entire driving activity.

LEVEL 3

FUNCTION-SPECIFIC FULL AWARENESS AUTOMATION

This level of automation is aware of the environment around the vehicle, and can fully automate and monitor some parts of the driving. For these activities, the human driver must be ready to take back control, but is not actively monitoring every aspect of the driving. An example of this is the most advanced form of lane keeping assist in combination with radar cruise control.

LEVEL 4

ENVIRONMENT-SPECIFIC FULL AUTOMATION

The driver is no longer expected to constantly monitor driving or the driving environment, but the automated system can only operate in certain environments and under certain conditions. An example of this would be highway-only automation.

LEVEL 5

FULL AUTOMATION

The automated system can perform all driving and monitoring functions in all environments.

Public Policy Considerations

What opportunities do cities have to mold state AV policy?

NHTSA has provided guidance on a Model State Policy, and has asserted its regulatory authority over vehicle safety by cautioning states from regulating vehicle performance.[14] However, the Federal AV Policy does preserve traditional state and local authorities over enforcement of traffic laws and regulating motor vehicle insurance and liability.

Cities should think about how they would like to see AVs deployed both in a public and private capacity, as well as the type of state agency and regulatory structure that would best suit them. Any regulations should be focused around safety, which is the stated primary focus of the Federal AV Policy. Cities have an opportunity to come together and lobby their state governments to advance their concerns around the safe operation of AVs in their communities, including insurance requirements and local approval of any proposed AV testing in a city. Obtaining local approval also assists with promoting public outreach and education of AVs that may be operating on local roads.

How can state and federal AV policies help unite smaller and larger cities' transportation grids?

As states begin to craft their policies concerning AVs, cities should think about how state AV policy might impact smaller as well as larger cities, suburbs as well as urban cores. Through a regional and state investment and regulatory strategy, cities can strengthen the ties between urban cores and suburbs, or between different parts of the state. An example of this would be allocating an entire lane to AVs during rush hour on a central commuter artery, as well as financing the V2I infrastructure needed not only within the urban core but throughout the commuter system to allow for the platooning[15] of private and public vehicles, such as buses and long-haul trucks.

As part of its planning process, cities and their municipal or regional planning authorities should start to integrate transportation technology into long-term plans, and consider how new transportation technologies can complement existing public transportation and lead to more effective use of public dollars for future infrastructure projects. Deploying AV technology in public transit grids is an exciting opportunity to cut costs while increasing service and safety, and could potentially help cities rethink how to structure and finance their public transit options.

Do cities have the appropriate procurement policies in place to purchase the technology needed to support AV deployment?

Cities should assess their current procurement policies, and look specifically at whether these policies might inadvertently erect any roadblocks to purchasing the technology and smart infrastructure necessary to support AV deployment. There is an inextricable linkage between technology and city operations, and there has been a rapid advancement of technology over the past decade that has left many city governments without a clear procurement path for incorporating new technology into cities in a transparent manner. Cities should ensure that the parameters around which kinds of proposals they can accept and who they can offer contracts to do not prohibit them from working with the new technology companies that provide the infrastructure and platforms to

support AV technology. There are many new innovative contracting models being used by public agencies seeking to promote more collaborative procurements,[16] while respecting the needed transparency when public dollars are being used on a project. This is an area where both the private and public sector should continue to collaborate.

Municipal Coordination and Public Outreach

How can cities craft a unified autonomous vehicle policy, plan for the coexistence of existing transportation infrastructure and AVs, and coordinate between city departments?

Cities first need to assess existing laws and municipal codes that will impact any deployment of AV technology. With technology like AVs, cities need to get the right people to the table, which includes urban planners, public works, information technology, procurement policy, and law enforcement. Modifications to existing codes may be appropriate, or cities may have to think about the development of a new autonomous vehicles or smart infrastructure code.

In order to maximize resources for such coordination, working with regional agencies can provide real benefits. While coordination between city departments and regional entities is still in its infancy in most municipalities, the Boston Region Metropolitan Planning Organization has taken the lead in developing a comprehensive long term plan for AV technology in the Boston area.[17] The Boston MPO is building off a partnership between the city of Boston and the World Economic Forum which began testing autonomous vehicles on Boston city streets. This collaboration, as well as working with state manufacturers and the state DOT, will enable the MPO to consider all stakeholders while building a unified vision for a mixed transportation network in the near future.

How should cities approach gauging public acceptance of these technologies?

The introduction of autonomous Uber cars in cities like Pittsburgh, Pennsylvania and Tempe, Arizona has received mixed reactions from the public. Cities should engage in an open dialogue between all their residents and respond to varying levels of acceptance of this technology. This outreach should not be a one-off prior to introduction of AVs, but ongoing as new concerns emerge. While many warn of patchwork regulation of AVs, there should also be concern about technophobic sentiment and hostility toward this technology should the public not fully understand the benefits of AV technology and how such vehicles will be operated safely within communities.

How can cities help inform the greater public outreach that NHTSA has envisioned?

As NHTSA releases its next version of the Federal AV Policy, it is expected that it will hold another period of public comment as well as ongoing stakeholder engagement as these guidelines are transformed into regulatory laws.[18] Cities should monitor the many federal developments around AVs, including future hearings of the DOT Committee on Automation, which is co-chaired by Mayor Garcetti of Los Angeles, and includes Mayor Cornett of Oklahoma City as a member.[19] Cities should continue to stay informed and engaged by reaching out to their state and federal partners on this issue, even after future public comment periods have concluded. In this way, cities empower their residents as stakeholders with ongoing input into the regulatory regime designed at the national level and ensure important issues such as local control over the right-of-way is preserved and future infrastructure funding

for cities is addressed. Cities are a critical component to the safe, effective, and efficient deployment of AVs.

Infrastructure Investment

How can cities have active input in infrastructure investment decisions?

The NHTSA policy guide shows a real interest in the infrastructure investment that would make this technology safe.[20] Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) technology are examples of technologies developed by manufacturers which can ensure greater safety and connectivity. Cities should not only encourage such investment, but become an active investment partner. Cities can try to negotiate matching loans from state infrastructure banks or other financing vehicles to match any local investment in this infrastructure. Besides the obvious benefits of greater investment towards these mobility technologies, the added investment on the part of cities puts their skin in the game and empowers cities to have more of a direct say over implementation, both on a municipal and regional scale. Moreover, policies should be considered that ensure diversified approaches to funding future infrastructure needs.

How can cities best take advantage of any new infrastructure investment?

Municipalities across the country face shortfalls between their projected infrastructure expenditure needs and what they have to finance these needs. As state and national attention turn towards infrastructure investment, particularly as new technologies mandate an increased investment, cities should place themselves to take advantage of these trends. Cities

can link funding with new technologies to additional funding for capital improvements as well as existing maintenance. On a national level, an opportunity to return the national highway trust to solvency exists, which cities should press for. This includes consideration of vehicle miles traveled fees, as well as other innovative approaches to taxation and regulation.

What are the broadband needs of a mixed AV transit system, and how can this capacity building be financed?

The simple answer is always more. Cities should be aware that their wireless broadband needs will grow exponentially in the future, and should plan with the understanding that their infrastructure will need to be constantly updated. While 5G is an important goalpost today, it will surely be surpassed in the near future. Cities should be proactive in reaching out to the dominant provider in their region to plan the growth of infrastructure in a constructive manner so that future needs can be planned for and met, including spectrum needs around public safety, transportation, and connected devices becoming more integrated into cities. Cities should make informing themselves about federal

broadband regulation a municipal priority because it will affect them significantly for the foreseeable future, and there are important timing considerations around new provider applications. The preservation of local control over the right-of-way with regard to wireless and broadband deployment is an important issue that cities need to continue to proactively monitor and be involved with.

How should cities deal with the terabytes of data that will come with smart technologies?

The data processing requirements needed for cities to take advantage of the data being generated within them is often out of reach of many small and mid-sized cities. Partnering with local academic institutions has given many towns and cities affordable access to the data storage and processing ability they need. Additionally, cities need to carefully consider requirements around keeping data safe and protecting against cybersecurity threats, as well as budget for the infrastructure necessary to securely store it. Building the capacity to process, store, and utilize large amounts of data will be one of the most significant, if overlooked, steps cities can take to position them to take advantage of these future trends.

Recommendations

1 AVs are on our roads today, so start planning now.

The pace at which AV technology has developed and deployed has surpassed expectations and predictions. Pilot projects are operating on roadways in certain communities today. Cities should begin planning for this and holding public workshops with constituents now, with the objective of seeking stakeholder and constituent engagement and education in what is certain to be a complex policy process.

2 Policy development with the right people at the table.

Cities can begin considering the ways in which autonomous vehicles might fit into long range plans, and initiating discussions internally and externally about how to develop the critical policies needed for safe operation of AVs. By developing a framework for AV pilot projects that addresses issues like procurement and public safety transparently, cities can engage in

innovative partnerships to test (and ultimately control through informed decision-making) the ways in which autonomous vehicles might fit into and enhance their existing mobility options. Considering implications and impacts of automation on the local workforce might also be prudent. The development of policies should include various interests, including procurement, IT, and law enforcement. Most importantly, all planning efforts should be transparent, inclusive, and collaborative.

3 Track and monitor federal and state developments and make your voices heard.

There are many policy interests around emerging transportation technologies. Cities should stay apprised of future federal and state policy and legislative developments and make sure their interests are voiced during any future comment periods and hearings around this transformative issue. State and federal entities have always played a role in regulating transportation. However, cities are where this new technology will be deployed and are critical to maximizing the benefits of this technology for citizens. Accordingly, city policymakers and stakeholders should work with their colleagues at the state and federal levels to ensure that any new policy guidance, regulation, or legislation considers the issues relevant to cities.

4 Begin planning infrastructure needs and building data and computing capacity to position your city to take advantage of an automated mobility future.

Municipal leaders should consider their short and long-term infrastructure needs, and ensure that any new investments better position their cities to support and integrate autonomous vehicle technology. This will include efforts to invest in data storage and processing capacity, investing in sensor networks and broadband, and ensuring that streetscapes and right of ways can best accommodate AVs. As new patterns of transit evolve, cities should preserve flexibility in planning. Smart planning and collaboration now across all sectors for infrastructure needs will help ensure the safe, effective, and efficient deployment of AVs in ways that enhances the benefits for all residents.

In order to model what is needed for future policies on AV technology, NLC will revisit and update this resource regularly. This is only the start of an important discussion, and we welcome and look forward to your feedback on this evolving issue. Read NHTSA's full Federal Automated Vehicles Policy document here.

Endnotes

1 For purposes of this resource, we choose to use the word "autonomous" since fully automated technology without drivers in vehicles is not yet being tested on a widespread basis and in normal vehicle operating conditions. Instead, for now, we are seeing the testing of highly automated systems with the presence of operators for safety purposes. Find more information on levels of autonomy in the following pages.

2 Counts, Reese. "Your Next Autonomous Uber Ride May Be In A Mercedes-Benz". Autoblog. N.p., 2017. Web. 23 Feb. 2017.

3 Bigelow, Pete. "General Motors Unveils Maven, Its New Car-Sharing Brand". Autoblog. N.p., 2017. Web. 23 Feb. 2017, and Counts, Reese. "Ford Wants A Fleet Of Autonomous, Ride-Sharing Cars By 2021". Autoblog. N.p., 2016. Web. 23 Feb. 2017..

4 Davies, Alex and Aarian Marshall. 2016. "Self-Driving Cars Will Love The Driving Hell That Is Boston." WIRED. Accessed from https://www.wired.com/2016/11/nutonomy-autonomous-cars-boston/

5 City of Pittsburgh; Texas AV Proving Grounds Partnership; U.S. Army Aberdeen Test Center; AMC at Willow Run; Contra Costa Transportation Authority and GoMentum Station; San Diego Association of Governments; Iowa City Area Development Group; University of Wisconsin-Madison; Central Florida Automated Vehicle Partners; and North Carolina Turnpike Authority.

6 National Highway Traffic Safety Administration, U.S. Department of Transportation. (September 2016). Federal Automated Vehicles Policy.

7 NLC joined comments focused on preservation of local control of the right-of-way and addressing appropriations for paying for future infrastructure needs, including paved roads, clear lane markings, and signage.

8 Federal Automated Vehicles Policy, 19.

9 Federal Automated Vehicles Policy, 18.

10 Movement is a platform which allows cities access to Uber transit times, but has been criticized for keeping its data proprietary and not going far enough in sharing raw anonymized data or furthering a dialogue with cities based on their individual needs.

11 Meyer, David. 2017. "TLC Votes To Require Uber And Lyft To Disclose Trip Data." Streetsblog New York City. Accessed from http://nyc.streetsblog.org/2017/02/02/tlc-votes-to-require-uber-and-lyft-to-disclose-trip-data/#

12 Federal Automated Vehicles Policy, 9.

13 "Automated Driving." N.p., 2017. Web. 23 Feb. 2017, Accessed from https://www.sae.org/misc/pdfs/automated_driving.pdf

14 Federal Automated Vehicles Policy, 38.

15 A vehicle platoon is a group of vehicles traveling in close proximity, typically at highway speeds, with one vehicle in the lead. This method of travel is used to increase road capacity and fuel efficiency, and is often proposed as a feasible option for autonomous vehicles. In autonomous scenarios, it is often suggested that one manned vehicle would lead the platoon, controlling the speed and direction, and the other automated vehicles would follow using vehicle-to-vehicle communication.

16 The Los Angeles County Metropolitan Transportation Authority (Metro) has announced that four unsolicited proposals that could accelerate two mega projects have advanced to the next stage of an evaluation process through its newly established Office of Extraordinary Innovation.
Los Angeles Country Metropolitan Transportation Authority website. Retrieved from https://www.metro.net/projects/oei/partnerships-ups/
Last year, DOT also administered the Smart City Challenge and awarded Columbus, Ohio $50 million dollars in grant monies. Federal Department of Transportation website. Retrieved from https://www.transportation.gov/smartcity

17 Boston Region Metropolitan Planning Organization. 2017. Memorandum RE Work Program for Planning Connected and Autonomous Vehicles. Accessed from http://www.bostonmpo.org/data/calendar/pdfs/2017/MPO_011917_Work_Program_Autonomous_Vehicles.pdf

18 Federal Automated Vehicles Policy, 46.

19 U.S. Department of Transportation. 2017. USDOT Announces New Federal Committee On Automation. https://www.transportation.gov/briefing-room/dot0717.

20 Federal Automated Vehicles Policy, 5, and National Highway Traffic Safety Administration, Department of Transportation. (2016). Federal Motor Vehicle Safety Standards; V2V Communications (Docket No. NHTSA-2016-0126, RIN 2127-AL55).