Laboratory 1: National Automated Vehicle Policy Stakeholders

CEE 6602 Urban Transport Planning

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1. Introduction

According to the U.S. Department of Transportation's (USDOT) Federal Automated Vehicles Policy (FAVP) published in 2016, an automated vehicle system (AV) is "a combination of hardware and software (both remote and on-board) that performs a driving function, with or without a human actively monitoring the driving environment" (USDOT, 2016). SAE International, a "global association of more than 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries", has identified six tiers of automation that vary according the degree of control a human driver has over a vehicle and the extent to which a human driver is required to monitor the driving environment during travel (SAE International, 2017; USDOT, 2016). Table 1 lists these six tiers:

Table 1: Levels of Vehicle Automation

SAE Automation Level	Description
Level 0	"The human driver does everything"
Level 1	"An automated system on the vehicle can sometimes assist the human driver conduct some part of the driving task" (USDOT, 2016, pg. 9)
Level 2	"An automated system on the vehicle can actually conduct some parts of the driving task, while the human continues to monitor the driving environment and performs the rest of the driving task" (USDOT, 2016, pg. 9)
Level 3	"An automated system can both actually conduct some parts of the driving task and monitor the driving environment in some instances, but the human driver must be ready to take back control when the automated system requests" (USDOT, 2016, pg. 9)
Level 4	"An automated system can conduct the driving task and monitor the driving environment, and the human need not take back control, but the automated system can operate only in certain environments and under certain conditions" (USDOT, 2016, pg. 9)
Level 5	"The automated system can perform all driving tasks, under all conditions that a human driver could perform them" (USDOT, 2016, pg. 9)

Recognizing that AVs have the potential to fundamentally transform our nation's transportation system in unprecedented ways, the USDOT's charge is "not only to keep pace, but to ensure public safety while establishing a strong foundation such that the rules of the road can be known, understood, and responded to by industry and the public" (USDOT, 2016). In light of vast uncertainty regarding precisely how AVs will operate and impact the transportation system, policy guidance has become necessary in order to ensure some level of coordination across all levels of government and industry as automated mobility technology nears deployment. Additionally, the USDOT's primary responsibility to the public is to promote and protect the safety of transportation system users. While AVs inherently have the potential to make personal mobility "safer and even more ubiquitous than conventional automobiles and perhaps even more efficient," the USDOT believes that it is possible to achieve "more significant safety improvements by establishing an approach that translates our [USDOT'S] knowledge and aspirations into early guidance" (USDOT, 2016).

Federal AV policies have the potential to significantly impact urban transportation planning. By providing a unifying policy framework , federal policy may ultimately help reduce or remove the need for dedicated parking infrastructure in urban centers throughout the country, allowing existing parking infrastructure to be repurposed for housing, public open space, or other uses. However, this may have a negative fiscal impact in many cities due to the fact that parking fees are often a major source of city revenue (Madia, 2017; Sisson, 2016).

Several analyses have noted that currently, roadways are designed in part to accommodate human error, with wide lanes and large signage to manage traffic and alert drivers of roadway conditions. By minimizing or completely removing human error, AVs and the federal policies that support them may actually allow for the streamlining of existing road infrastructure and a reduction in the amount of land dedicated for automobiles (Madia, 2017). Additionally, researchers at MIT predict that the widespread adoptions of AVs could results in as much as an eighty percent reduction in the number of vehicles on the road (Lubell, 2016). Should this be the case, urban transportation planners will be able to begin planning for fewer automobiles and a potential increase in pedestrian and bicycle transportation as more space becomes available for those modes (Madia, 2017; Lubell, 2016). Despite these predictions, some analysts have cautioned that AVs could actually increase urban sprawl without adequate policies and

disincentives. Strong federal policy, coupled with context-sensitive local policies, can help prevent this outcome (Lubell, 2016).

Due to the technological and policy complexity that is inherent to the development and deployment of AVs, many stakeholders will need to be involved in shaping policy frameworks over time. This report identifies the stakeholders who should be included in federal AV policy development and provides justification for their inclusion. Section 2 of this report presents a literature review that defines the goals and objectives of USDOT in developing AV policies, discusses the relationship between land use and AVs, and discusses the equity issues associated with AVs. Section 3 presents a stakeholder review, including identification of the primary stakeholders associated with AVs, the position of each stakeholder, the relative amounts of power and authority stakeholders have in relation to each other, coalitions of stakeholders that appear to have formed over time, and actions that have already been taken by stakeholders regarding federal AV policies. Section 4 comprises concluding thoughts and recommendations regarding stakeholder participation in USDOT's forthcoming update to the Federal Automated Vehicles Policy to be published in 2017.

2. Literature Review

The following review summarizes the body of literature concerning current policy objectives with regard to AVs, the relationship between urban land use and AVs, and concludes with a discussion of the equity issues associated with AVs. This provides important context for the stakeholder review that follows this section.

2.1 Current Policy Objectives

The Federal Automated Vehicles Policy of 2016 outlines stipulations and standards to be followed by AV manufacturers. The stipulations for manufacture, distribution, and sale are delineated under "Guidance", "Scope", and "Performance Guide" within the policy's 2016 outline, authored by the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) (USDOT, 2016).

The main objective set forth is that of vehicular compliance with all safety standards outlined within the Federal Motor Vehicle Safety Standards guidebook released in 2016. Upon meeting

these standards, an AV is self-certified by the manufacturer to be market-ready. While these standards are extensive in number, one may opine there is a relative amount of liberty granted to the manufacturers, distributors, and sellers in that they need not submit to inspection by outside authority at any stage in the factory-to-floor process.

Given the relative newness of AV technology and the relative dearth of real-world testing that has accompanied their development, one may further opine that an outside authority should assert itself. In reality, this does not happen until after deployment by the consumer. Upon self-certification, AVs are still subject to the authority of the NHTSA in that they may be cited for defects or recalled from circulation. Because such measures often result in sizeable losses to manufacturers, distributors, and sellers of AVs, the USDOT grants self-certification liberty to these entities in anticipation that the points outlined in the NHTSA guidebook will be followed by AV manufacturers.

There is still an overtone of liberty in the current policy, which may be negatively interpreted as a potential for ineffectiveness or noncompliance with current national safety standards. As stated in the current FAVP, “This guidance is not mandatory.” (USDOT, 2016). Additionally, the current federal policy may be interpreted as incomplete, in that the USDOT expects future stipulations for AV sale, but not current stipulations, to include such research as objective testing, benefits assessment, human factors assessment, performance metrics assessment, and cybersecurity testing (USDOT, 2016).

The USDOT wishes to hold public workshops for the purpose of obtaining data on public opinion as it pertains to the guidance for AV performance standards. To increase effectiveness, the NHTSA asserts that it may propose to make the stipulations outlined in the above guidance legally binding. Stakeholders in the sphere of public safety would assert that this would be the most feasible way to ensure adherence to safety measures, given the scope of individuals and groups involved in the factory to floor stages of AV technology.

The scope of the above guidance encompasses all manufacturers, designers, retail entities, and testers of AV technology. These include any entities that outfit vehicles with automation capabilities for public or private use; that is, this scope envelopes AV technologies to be manufactured for sale to individual private owners, corporate private owners and municipal

public owners in the realm of public transit and taxi services, and all owners employing AV fleet vehicles. Additionally, the guidance encompasses light, medium, and heavy-duty AVs.

Naturally, there are only so many levels upon which AV policy can dictate the outcome of AV operation. Policy guidance is applicable only at production and test levels; once operated beyond these levels, the AV is considered to be at deployment-level. To make it to deployment-level, all AVs are required to be certified ready for use on public roadways. If needing to test a vehicle that may not yet meet safety standards, the NHTSA allows manufacturers, designers, testers, etc. to seek temporary exemption via the NHTSA's authority for the purpose of such testing (USDOT, 2016).

The framework of the USDOT's Vehicle Performance Guidance provides the standards for AV equipment, both original and replacement, and includes guidance for each specific automated component, as well as cross-cutting functions such as data recording and sharing, cybersecurity, privacy, and system safety. Additionally, cross-cutting functions such as consumer education, human-machine interface, and crashworthiness are covered.

At the federal level, NHTSA responsibilities include enactment of the Guidance, Scope and Performance Guide expounded upon above. Additionally, the NHTSA takes on the role of enforcing policy via fines and recalls, and of managing non-compliance remediation measures nationwide. The NHTSA also takes on the role of educating the public on AV safety, and of issuing updated performance guides. At the state level, roles performed in meeting safety objectives include those of licensing drivers and registering vehicles, of traffic law enforcement, of performing vehicular safety inspections (where states choose to do so), and of regulating vehicle insurance (USDOT, 2016). At the municipal level, cities and counties are able to exert control over land use and municipal transportation infrastructure, which is the focus of the next section.

2.2 Relationship between Land Use and AVs

It is predicted that land use decisions will change dramatically with the advent of autonomous vehicles, giving rise to numerous redevelopment efforts. In addition to a decrease in roadway congestion, it is predicted that parking congestion will likewise experience dramatic reduction with increasing AV activity (Lewis, 2017; Litman, 2017).

Lewis (2017) focuses primarily on the evolution of parking and existing parking infrastructure. He asserts that surface lots may become obsolete with the advent of AV technology; with commuters being dropped off curbside, and vehicles having no objection to traveling distances to park, the need for parking lots within 100 feet of establishment entrances and metered curbside parking decreases. In terms of redevelopment patterns, Lewis (2017) believes that extant parking structures may either face demolition in favor of greenspace and recreational development, or redevelopment into any number of structures. These structures include affordable housing development, office spaces, and storage. Additionally, Lewis (2017) expounds upon the concept of "people reclaiming right-of-way", meaning that there will be more room for pedestrian traffic with the decrease in room for driver error accompanying the advent of AV technology. This could translate into an increase in bicycle lanes, shade trees, and greenspaces.

Most impactful is the idea that cars will become less noisy and less pollutant-emitting as autonomous vehicles become more ubiquitous. Lewis (2017) believes in the possibility that highways will evolve into "boulevards", in that fewer negative externalities will be associated with living near highways with clean, quiet vehicles passing by.

2.3 Equity Issues Associated with AV Technology

According to the current Federal Autonomous Vehicles Policy, "Innovations have the potential to transform personal mobility and open doors to people and communities - people with disabilities, aging populations, communities where car ownership is prohibitively expensive, or those who prefer not to drive or own a car - that today have limited or impractical options" (USDOT, 2016). Among the beneficial outcomes of pushing autonomous vehicles to market, and eventually seeing them incorporated into the daily commute patterns of nationwide populations, equitable transit for low-income populations holds a position at the forefront of advertising. Indeed, it is projected that the future holds autonomous travel as an option for everyone. However, there are a few facts to consider before one accepts autonomous vehicle technology as nothing but advantageous for all.

Litman (2017) asserts that reduced traffic congestion, a seeming end to parking lot congestion, and the conservation of fuel energy with an accompanying decrease in carbon emissions will be

among the beneficial outcomes of autonomous vehicle availability. Additionally, a reduction in need for federally subsidized transit is projected, accompanying an increase in independent mobility for low-income earners (Litman, 2017) and all transit riding populations. A caveat to this is the question of affordability of autonomous vehicle technology. Litman (2017) asserts that the benefits of AV technology will be had by affluent users within the target period of 2020 to 2030, while low-income populations will most likely not reap these benefits until the target period of 2040 to 2060. Hence, while AV technology may be touted as a way to move everyone into the future, there remains the fact that arrival time in the future will be income-based.

3. Stakeholder Review

This section presents an analysis of the stakeholders who should play a role in shaping future federal policy regarding AVs. Section 3.1 identifies the relevant stakeholders, section 3.2 identifies the positions associated with each stakeholder, section 3.3 identifies their relative amounts of power and influence, section 3.4 identifies coalitions of stakeholders that have formed, and section 3.5 notes actions that stakeholders have already taken with regard to federal AV policy.

3.1 Primary Stakeholders

Stakeholders in a project typically include all parties affected in some way by the project, and their numbers and categories can be very large and diverse. Even attempting to narrow them down by describing them as ‘primary’ or ‘key’ can prove to be vague. However, the Federal Automated Vehicles Policy (FAVP) identifies what it considers to be the main stakeholders in several places. Broadly, it categorizes them as affiliated with either the government, academia, industry or the public (which the FAVP recognizes as the most critical) (USDOT, 2016). The document also elaborates that these broad stakeholder categories have emerged as a corollary of safety being the main priority of the USDOT. Put another way, those parties with the most to lose due to vulnerabilities in AV technology are considered to be the primary stakeholders.

In more specific terms, the FAVP identifies these stakeholders as State governments, field experts and industry leaders, and public and safety advocates. The “traveling public, traffic safety professionals, researchers, industry, government, the disabled community and others” have been cited as the stakeholders that have helped create the existing federal AV policy

(USDOT, 2016). The American Association of Motor Vehicle Administrators (AAMVA) is one example of an educational association that partnered with the USDOT to investigate AV technology and brainstorm on policy. The NHTSA (National Highway Traffic Safety Administration) is the government agency tasked with regulating AVs.

Vulnerable groups such as the disabled and elderly, and those without access to private vehicles (as well as those who choose not to) are among the groups indirectly described as having a stake in AV technology. Similarly, the fields of city planning, energy and the environment are described as areas which can benefit much from AV technology, and affiliated people (such as elected officials and municipal employees, construction companies and academics) are therefore also stakeholders (USDOT, 2016). Furthermore, the FAVP has named several private entities as industry stakeholders with regard to:

1. AV data sharing: IEEE and SAE International,
2. AV cybersecurity: "National Institute for Standards and Technology, NHTSA, SAE International, the Alliance of Automobile Manufacturers, the Association of Global Automakers, and the Automotive Information Sharing and Analysis Center" (USDOT, 2016),
3. AV machine-human interfaces: "SAE International, ISO, NHTSA, American National Standards Institute (ANSI), the International Commission on Illumination (CIE) and other relevant organizations." (USDOT, 2016)

The FAVP emphasizes the importance of public stakeholders, both in their contribution towards current policy and towards future policy iterations. Input from road users (pedestrians, passengers and drivers) has been recommended for AV manufacturers (and related groups) for crystallizing ethical issues. In conjunction with the Model State Policy put forth in the 2016 FAVP, some other stakeholders are identified in the following excerpts from the FAVP:

"…representatives [in each state] from the governor's office, the motor vehicle administration, the State department of transportation, the State law enforcement agency, the State Highway Safety Office, office of information technology, State insurance regulator, the State office(s) representing the aging and disabled communities, toll authorities, and transit authorities." (USDOT, 2016)

"…transportation research centers located in the State, the vehicle manufacturing industry, and groups representing pedestrians, bicyclists, consumers and other interested parties." (USDOT, 2016)

"North American Cross-Border Coordination: NHTSA will explore the opportunity for cross-border consistency by engaging Canadian and Mexican authorities to leverage this Policy within their own regulatory framework." (USDOT, 2016)

3.2 Stakeholder Positions

The overall uncertainty associated with the exact nature and outcomes of AVs, coupled with anticipation of massive benefits in transportation in general, sets the tone for the position of most parties on AVs. Few parties would be expected to outright oppose AVs, while many will be wary of the changes in safety, security, competition and existing physical and social structures that this technology will bring.

The government's position will be to support AV technology, all the while making sure that attempts at regulating AV production do not impede the development and implementation of the technology. As evidenced by the FAVP, the federal government views the anticipated revolution of transportation as a result of AVs as inevitable, and does not wish to lag behind in the realization of its benefits due to pressure by trade unions and those needlessly suspicious of the new technology. However, cybersecurity and the use of AVs in crimes will remain a prime concern for government as the technology proliferates. Other concerns may include unemployment due to fewer human drivers being needed, induced demand (as many people unable to drive can now use a vehicle), and the infrastructure changes required as a result of AVs. Members of academia will likely take a similar position to that of the federal government, although their stance will evolve as unforeseen effects of AV technology and problems resulting from it are observed in the U.S. and around the world.

The automobile manufacturing and technology industries have so far responded almost unilaterally in favor of AVs, as these industries will naturally want to extract as much monetary benefit as possible from this highly lucrative technology. Already, many automobile manufacturers and even technology giants have invested massively into the technology, in

anticipation of large profits and security in the transportation choice of the future (Perch, 2015; Intelligent Car Coalition, 2015).

The public is, interestingly, identified by the FAVP as the most critical stakeholder and is also likely to be the most ambivalent about the adoption of the new technology. Safety and job protectionism are likely to be their main concerns, as they will be affected most directly by accidents involving AVs and the phasing out of human drivers. Proponents of the technology will mainly cite the mobility and accessibility afforded to the non-driving segment of the population on the same level as the driving segment (and the resulting economic benefits), along with improvements in safety, comfort and leisure.

3.3 Relative Stakeholder Power and Authority

The current dynamic of authority shared between the different stakeholders may appear to be largely equitable; the public comprises and elects the government, which issues directives to industry to safeguard both the industry's competitive advantage as well as the environment. However, due to the revolutionary nature of AVs, a disproportionate amount of power rests in the hands of AV manufacturers. If faced with exceedingly strict government regulations and public distrust, manufacturers can simply move to more forgiving locations, perhaps even to different nations. With the rise and worldwide adoption of AVs now largely acknowledged as being only a matter of time, even the government's role has been relegated to one of guidance rather than regulation of industry.

Academia, a stakeholder that informs both the government and industry, is perhaps similar in power. At least the intellectual authority afforded to academia allows it to hold a significant amount of sway over all other stakeholders, as it is the segment that is perhaps most aware of the technical issues, potential and outcomes of new technology. Largely independent of regulation and control, academia has the rare ability to form an intellectually informed standpoint, although interference with industry and government may put that ability into question.

The government however is, in many respects, the most powerful stakeholder. Recognizing that its own authority would erode without strong public institutions, it has elevated the public to the level of an important stakeholder (as mentioned numerous times in the FAVP), at least on

paper. The authority of the public can be gauged by its ability to lobby to have the technology suspended as a result of casualties resulting from AV usage. While this may seem unlikely, the position of the government is clear in that it has taken the role of coordinating AV deployment by manufacturers nationwide.

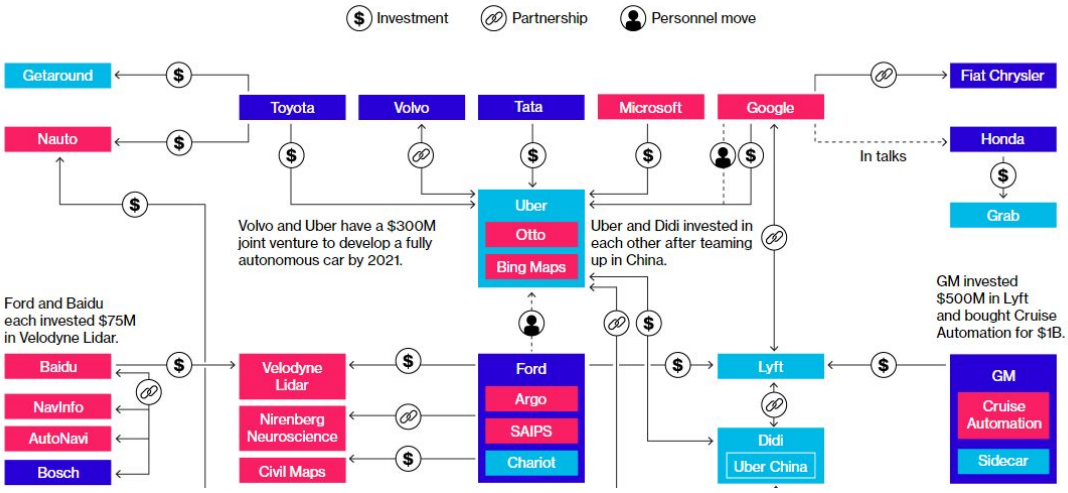
3.4 Stakeholder Coalitions

Early trends in the development and adoption of AVs reveal the formation of several important coalitions. The biggest coalition at the time of this writing is between the automobile manufacturing industry and large technology companies, who together have "created the Smart Transportation Innovation Coalition that is intended to help make policymakers realize the benefits of autonomous vehicle and connected car technologies, so that they can accelerate the process of making them mainstream" (Perch, 2015). The Smart Transportation Innovation Coalition comprises the "Alliance of Automobile Manufacturers (AAM); Association of Global Automakers, which primarily represents Asian manufacturers; National Automobile Dealers Association; Information Technology Industry Council, a trade group representing nearly 60 technology firms including Apple, Google, Intel and Microsoft; Motor & Equipment Manufacturers Association, which represents auto suppliers; Intelligent Transportation Society of America; and Intelligent Car Coalition" (Perch, 2015).

A similar coalition is the Intelligent Car Coalition, which "gathers leading stakeholders in the auto, communications and tech industries to talk about policy issues, share ideas, build relationships, establish joint policy stances and thought leadership, and advocate for innovation in the connected and autonomous car fields" (Intelligent Car Coalition, 2017). Members include "communications companies such as AT&T and Verizon; associations like CTIA-the Wireless Association, the Alliance of Auto Manufacturers, and Global Automakers; and auto tech suppliers such as HARMAN" (Intelligent Car Coalition, 2017). Together, the Smart Transportation Innovation Coalition and the Intelligent Car Coalition have lobbied the federal government in the hope of shaping a federal AV policy that provides AV researchers and manufacturers with the freedom to innovate and bring their products to market.

A number of automobile manufacturers and large technology companies have partnered to research and develop AVs. The infographic in Figure 1 provides a detailed depiction of many of the major corporations involved and their relationships with one another.

Figure 1: Major Automobile Manufacturers and Technology Companies Developing AVs



Source: www.bloomberg.com/graphics/2016-merging-tech-and-cars/

Future coalitions between fuel providers, automobile insurers and rider-sharing service providers are expected to fall in place within two to three years. AV's will be able to drive to fueling stations autonomously which will require appropriate infrastructure to support the fueling process. Because automobile insurers are now switching their business models to focus more on automobile manufacturers than on drivers, some have posed the question of whether a driver's license will be required to operate an AV (Bertoncello and Wee, 2015).

3.5 Stakeholder Actions Relative to Federal AV Policy

Beyond the stakeholder actions described above, the content of the current Federal Autonomous Vehicle Policy is the product of significant input from a wide range of stakeholders including the traveling public, traffic safety professionals, researchers, industry, government, the disabled community and others (USDOT, 2016). Thus, the full gamut of stakeholders has taken part in shaping the current policy and will likely take part in guiding the scope and content of future policy iterations.

4. Conclusion

Many would say that such a vision for an equitable, environmentally-friendly future as what is being offered by the AV industry is one worth investing in. Indeed, a future where employees of all income brackets have access to independent mobility, where cars are efficient machines run

independently of fossil fuels, and where noise pollution is a thing of the past is an attractive one. The goal of all stakeholders and policy makers who are in favor of autonomous vehicle technology is to see this vision through to real-world deployment, albeit in feasibly metered steps where safety measures, equity, and land use development are all taken into consideration.

The axiom of developers, testers, and sellers of AV technology spurred forward by the impetus of economic gain is understandable, as is their trust in technology to avoid failure and skirt disaster. Lab testing and decades of development guided by such brilliant minds as we have seen emerge from the technology sphere, while facilitative of ease of mind, is not sufficient to ensure a flawless experience with autonomous vehicles. Indeed, it is policy makers who ensure adherence to the safety standards that work to keep operators out of harm's way. It is the stakeholders in AV technology who ensure, benefit from, and are reliant upon optimality of service. It is the transit and land use planners and engineers who design a cityscape that will be most pleasant for urbanites while accommodating the evolving traffic flow of automated vehicles.

A smarter policy for future governance of automated vehicles is one that includes greater involvement of the players discussed in the above report. In this way, we surmise that we may reach a more rapid move toward equitable access to autonomous vehicles, more stringent enforcement of safety standards, and a landscape characterized by intelligent land use.

References

Bertoncello, M. and Wee, D. (2015, June). *Ten ways autonomous driving could redefine the automotive world.* Retrieved from http://www.mckinsey.com/industries/automotive-and-assembly/our-insights/ten-ways-autonomous-driving-could-redefine-the-automotive-world

Intelligent Car Coalition. Retrieved from http://intelligentcarcoalition.org/about/

Lewis, C. (2017, January 25). *Autonomous Vehicles will change land use planning. What you should be thinking about now.* Retrieved form http://www.stantec.com/blog/2017/effect-of-autonomous-vehicles-on-land-planning.html#.WajXvNGQzIW

Litman, T. (2013). Autonomous Vehicle Implementation Predictions: Implications for Transport Planning. *Transportation Review Board Annual Meeting, 2015*.

Lubell, S. (2017). *Here's How Self-Driving Cars Will Transform Your City.* Retrieved from https://www.wired.com/2016/10/heres-self-driving-cars-will-transform-city/

Madia, E. (2017, May 24). *How Autonomous Cars and Buses Will Change Urban Planning (Industry Perspective)*. Retrieved from http://www.govtech.com/fs/perspectives/How-Autonomous-Cars-Buses-Will-Change-Urban-Planning-Industry-Perspective.html

Perch, J. (2015, May 13). *Automakers and Tech Companies Form a Coalition for the Advancement of Autonomous Vehicle and Connected-Car Technologies.* Retrieved from https://www.dmv.com/blog/automakers-and-tech-companies-form-a-coalition-for-the-advancement-of-autonomous-vehicle-and-connected-car-technologies-521

SAE International. Retrieved from http://www.sae.org/about/

Sisson, P. (2017, July 7). *Driverless cars: Who's doing what, and how it impacts urban transportation*. Retrieved from https://www.curbed.com/2017/7/7/15935126/google-uber-driverless-car-waymo-autonomous

United States Department of Transportation. (2016). *Federal Automated Vehicles Policy*. National Highway Traffic Safety Administration.