



HARVARD Kennedy School

TAUBMAN CENTER

for State and Local Government

Developing Urban Mobility Policy in Response to Autonomous Vehicles: A Multi-Party Policy Development Simulation

Lance Eliot and Mark Fagan

October 2021





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ABOUT THE TAUBMAN CENTER FOR STATE AND LOCAL GOVERNMENT

The mission of the Harvard Kennedy School's **Taubman Center for State and Local Government** is to support current and future public sector leaders in improving the governance of states, counties, metropolitan regions, and cities through research, teaching, programs, and convenings.

The Taubman Center works to:

- Develop the next generation of state and local government leaders
- Generate big ideas and solutions to state and local government challenges
- Help state and local government implement and scale solutions

The Taubman Center focuses on urban policy issues, including economic development, transportation, education, public infrastructure, land use, social services, public sector technology and data utilization, procurement, and performance management.

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ABSTRACT

Mobility of people and goods is one of the defining characteristics of an urban environment. Efficient and effective mobility enables economic vitality, urban livability, and can contribute to an equitable environment. Unfortunately, this does not automatically happen. The arrival of transportation network companies, or TNCs (e.g., Uber, Lyft) demonstrated that ride-hailing provided a great service to many, but it also resulted in numerous undesirable consequences, such as increased congestion, safety and privacy concerns, the cannibalization of public transit, and unequal access to the service. Well-designed public policy is needed to foster the right outcomes to maximize public and private value. This challenge is exacerbated when disruptive innovation is taking place, and the introduction of autonomous vehicles (AVs) to move people and goods is just such a disruption. The right policy response to AVs must balance the interests of many stakeholders, from residents, visitors, and business owners to the AV companies and vulnerable populations.

This simulation enables policymakers and stakeholders to develop the operating environment and regulations that position a municipality to tap the opportunities that AVs offer while minimizing the adverse consequences. This exercise is based on an anticipated scenario of how AVs may arrive in cities in the coming few years. It details the players and their interests. Using the descriptions provided, participants engage in a three-round simulation to reach consensus on the best path forward.

The simulation is designed as a facilitated simulation for use by both practitioners and students. It concludes with a framework for how policymakers can migrate from their current position to their desired state.

I. SIMULATION OVERVIEW

The goal of this simulation is to develop a consensus view of the urban mobility operating environment and associated policy options to guide the arrival of AVs in a city in ways that provide public and private value. The mayor's policy office facilitates this exercise. The simulation is designed to run with five to ten key stakeholders, including AV providers (those offering passenger cars, vans, and land-based delivery vehicles) and advocacy groups representing privacy interests and vulnerable populations. The simulation can be run with fewer participants; however, there must be representation from both AV providers and advocacy groups to make this exercise meaningful.

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The simulation consists of three sessions. The first is a joint roundtable hosted by the mayor’s office. The intent is to allow all participating stakeholders to share their perspectives on AV policy with each other. The second session is a one-on-one meeting between each of the stakeholders and the mayor’s office. This provides the mayor’s office an opportunity to better understand stakeholder interests and explore potential policy options. The final session is a joint roundtable hosted by the mayor’s office where the mayor’s policy lead presents a proposal for reaction, refinement, and hopefully consensus agreement among the participating stakeholders.

The content for the participants consists of:

- a. the AV Arrival Simulation Scenario detailed below;
- b. stakeholder-specific information in the appendix; and
- c. any additional research that participants wish to conduct in taking on their role.

While the city and stakeholders are fictitious, their roles in the simulation are based on an amalgam of current AV service offerings from California to Arizona to Michigan to Massachusetts as well as AV provider plans. The scenario thus provides a real-world glimpse at the progression of AVs into a hypothetical local mobility system that has organically allowed AVs to enter into the landscape, but now seeks to develop an AV strategy that supports the city’s short- and long-term goals.

Infused into the scenario are many of the challenges beyond the technology associated with AV transport such as user acceptance, congestion, equity and data privacy. Dimitris and Müller noted, “Automated vehicles (AVs) represent a socio-technical transition of the mobility system. Thus far, research has focused predominantly on the technical dimension (i.e., technology development and operation, short-term impacts) of this transition.”¹

As such, the scenario intentionally interweaves both the anticipated advantages and the adverse impacts the advent of AVs in urban settings entails. The options and tradeoffs involving AVs and policy actions are still evolving, difficult to assess, and can be conflicting at times. As González-González, Nogués, and Stead state, “On one hand, AVs offer the potential to reduce the urban space requirements for roads and parking, creating more space for high-quality, livable areas. On the other hand, greater motorization and the availability to perform leisure or work activities while traveling in AVs could increase the number of trips and travel distances, encouraging urban traffic

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¹ Dimitris, M., and Müller, S. (2021). “The Societal Dimension of The Automated Vehicles Transition: Toward A Research Agenda.” *Cities*, Volume 113.

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congestion and sprawl. These diverse, and sometimes conflicting, estimates and opinions give rise to considerable uncertainty among urban policy decision-makers, sometimes leading to planning inaction.”²

II. SIMULATION SCENARIO: A CITY POLICY RESPONSE TO AV ARRIVAL

Context

Autonomous vehicles (AVs) are advancing toward practical use amid a plethora of pilot projects, initial tryouts, and numerous experimental field-testing efforts that are taking place in everyday city streets and amongst public settings all across the United States and many other countries. These AV deployments are anticipated to increase in frequency and depth, inexorably becoming more pervasive and prominent as the technology advances.³ Furthermore, additional entrants, such as new startups that aim to produce and employ AVs in many forms, will seek to add their AVs to the existent mix. All told, there is a real and altogether predictable expectation that even in the near term, there will be more AVs on our roadways and they will be used for a widening variety of urban area transport functions.

Though AVs hold great promise for contributing to a safer mobility-for-all goal, they nonetheless also present substantive concerns involving congestion, safety, privacy, equity, and a host of other possible drawbacks. As stated in a recent research study on urban planning and the emerging autonomous mobility era, “The future implementation of autonomous vehicles (AVs) in cities can have significant impacts, both positive and negative, on their sustainability.”⁴

Historically, conventional (i.e., non-autonomous) vehicular transportation has had an enormous impact on the shaping cities. The urban landscape is a cumulative reflection of how policymakers have, over time, reacted to, prepared for—and in some instances, proactively anticipated the advent of—advances in human-driven transport. Some researchers assert that AVs will upend the prevailing urban form and

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2 González-González, E., Nogués, S., and Stead, D. (2019). “Automated Vehicles and The City of Tomorrow.” *Cities*, Volume 94.

3 Eliot, L. (2020). *AI Driverless Cars Realities: Practical Advances in Artificial Intelligence and Machine Learning*. LBE Press Publishing.

4 Soledad, N., González-González, E., and Cordera, R. (2020). “New Urban Planning Challenges Under Emerging Autonomous Mobility: Evaluating Backcasting Scenarios and Policies through an Expert Survey.” *Land Use Policy*, Volume 95.

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that policymakers will need to rethink the entire nature of urbanization. As Stead and Vaddadi note, “Motorization in cities has fundamentally transformed urban patterns of development, ranging from residential parking and density standards of single buildings on the one hand to urban infrastructure construction and the expansion of entire cities on the other. The introduction of automated vehicles (AVs) has enormous potential to transform urbanization patterns and urban design even further.”⁵

Policymakers at the local and state levels are at risk of not being sufficiently prepared for either the gradual or rapid expansion of AVs in their jurisdictions. There is a paucity of prior experience in such matters due to the newness and complexity of AVs and the extraordinary challenges that such technology now presents. Moreover, city leaders are facing a range of high-impact issues such as responding to Covid and addressing social justice issues. Thus, when it comes to AVs some policymakers run the risk of falling asleep at the wheel. “With few exceptions,” Brovarone, Scudellari, and Staricco write, “the attitude of local authorities is dominated by a laissez-faire approach. The difficulty of dealing with high degrees of uncertainty and the absence of clear ideas on desirable visions are among the main reasons for this policy inaction.”⁶

The City Setting

In our scenario, the city has a population of 900,000 and is part of a 3.5-million-person metropolitan area. The population has been growing about 2 percent per year due to an influx from other parts of the country and from outside of the United States. Population density is around 200 people per square mile. The median income is about \$60,000 per year, and 65 percent of commuters get to work in single occupant cars.

This city has a central business district, which is the employment hub for the metropolitan area. This is also the location of many of the city’s cultural spaces. The business district has an active night life and increasingly people are moving into the city center to take advantage of its employment and social offering. The bulk of the city’s residences are divided into eight neighborhoods reflecting a range of ethnic and socioeconomic enclaves. The rich history of the city and its arts offerings make it an attractive tourist destination.

A plethora of ongoing tensions and issues impact the city, its elected and civic leaders, and its residents and businesses. There are many longstanding educational and economic inequities that are disproportionately affecting residents of color. There

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5 Stead, D. and Vaddadi, B. (2019). “Automated Vehicles and How They May Affect Urban Form: A Review of Recent Scenario Studies.” *Cities*, Volume 92.

6 Brovarone, E.V., Scudellari, J., and Staricco, L. (2021). “Planning The Transition to Autonomous Driving: A Policy Pathway Towards Urban Livability.” *Cities*, Volume 108.

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are environmental concerns, and rising carbon emissions remains a complicated problem. Generally, one can assume that issues common to most contemporary cities of this size in the United States are also present in this city.

The existing transportation infrastructure is in need of a lot of upgrades and deferred maintenance due to budget constraints and competing interests. Many of the roadways are in bad shape and there is scarce funding available to maintain and fix the existing infrastructure. Besides potholes and street surface woes, there are frustrations over the lack of available bike lanes, many sidewalks are cracked and at times unpassable, and citizens complain about parking is a constant outcry. Locals contend that the parking rules are nonsensical and byzantine.

Individual ownership and the use of a car are still relatively customary in this city, though many residents are starting to feel the stark logistical or economic pains of vehicle ownership and are questioning whether having a car remains viable. Overall usage metrics such as passenger miles (PM) and vehicle miles traveled (VMT) keep rising, further exacerbating the city's infrastructure difficulties due to the increasing wear and tear on its streets and highways. Congestion is nearly overwhelming at traditional commuting times and keeps getting worse, as well as during non-peak hours of the day and night. Complicating matters further are disputes with the state and county over the management of and financial investments needed for inter-jurisdictional roadways.

The city has numerous public transit capabilities, including light-rail, commuter rail, buses, and the like. These transit options have gradually evolved over many years. Similar to many growing cities, much of the public transit system has organically and opportunistically expanded. Given the lengthy history of the city, some of the public transit system is overlapping, duplicative, and does not necessarily reach all areas. Significant gaps remain in terms of where the transit goes and what travelers need to do to utilize the options available.

Residents and businesses alike fervently complain about the public transit services. It seems that each of the public transportation options has its own idiosyncratic schedule, confounding efforts by the public to try to line up a given trip without incurring large time gaps (and physical transition gaps) while traversing from one transit mode to another. Furthermore, the buses have a special tokenized payment card for use, but this is not readily usable on the light-rail system (nor is the light-rail payment option usable on the buses).

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The AV Operators

The most widespread deployment of AVs in this municipality is being undertaken by a large tech firm that has been developing self-driving cars for many years (the firm is renowned for being one of the original pioneers of this type of advanced autonomous technology). This multi-billion-dollar-sized tech company has gained a notable and quite positive reputation in cities where it has tested/operated for carefully undertaking its AV deployment efforts.

The mainstay of this tech firm has little directly to do with self-driving, and their interest in autonomous vehicles began as a wildcard R&D offshoot. Its AV activities became significant enough that it formed a separate entity named GoFast to become the focal point for its various self-driving initiatives. Rather than being in the automotive business per se, **GoFast's** mission entails crafting the core technology that makes self-driving cars feasible. GoFast-developed components are added to and embedded into a conventional car, thus transforming the vehicle into a self-driving car.

Not just any car can be converted into a self-driving car via the addition of GoFast's systems. The various hardware and software that GoFast makes must be tailored to a particular base car. As a result, GoFast formed a collaborative partnership with a major automaker and has concentrated its AV capabilities on the cornerstone brands and models of that specific car company.

Currently, GoFast-operated self-driving cars are considered to be at self-driving Level 4. This is a level within a globally accepted industry-standard of six possible levels involving the use of advanced automation and autonomous driving (the levels count from zero to five). The topmost level is Level 5, which has not yet been achieved by any company and remains an elusive goal—namely, being able to craft a self-driving car that can operate on its own in whatever situation or setting that a human could manage to drive a car.

Level 4 involves the articulation of any limits or constraints regarding autonomous driving capability and varies considerably by each AV maker. In industry parlance, Level 4 entails establishing the operational design domain (ODD) for whatever self-driving car a maker has devised. Any self-driving cars rated at Level 4 are supposed to indicate what the ODDs are for their vehicles. For example, the existing GoFast self-driving cars will work when the weather is good but cannot cope with driving in inclement conditions such as snow or ice.

Another aspect of the ODD encompasses potential geographic boundaries. The developers of GoFast have stated that their existing self-driving cars in this municipality will only function in certain parts of the metropolis. This is because those designated regions have been specially mapped by GoFast and the self-driving cars are

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programmed to be able to drive in those mapped areas. If a GoFast self-driving car were to try to venture beyond the geographical areas that have been pre-mapped (the “geofenced areas”), it would no longer reliably work and would be exceeding the pre-defined ODD (i.e., outside its geofenced area).

Currently, GoFast has 100 self-driving cars operating throughout the city, doing so only in these specially mapped and geofenced areas, which are almost exclusively located in the downtown business district. There is an ongoing effort by GoFast to map additional areas of the city and to expand the territories into which their cars can go. Meanwhile, many residents in the non-mapped areas have been vocal about their being left out of GoFast’s self-driving car service, while others have expressed concerns about their proliferation.

GoFast is being run as a ride-hailing service similar to a taxi or transportation network company (TNC) such as Uber and Lyft. Those that wish to go for a ride in a GoFast self-driving car need to download a GoFast-specific app. The app is used to request a ride, similar to any human-driven ridesharing service, and the app looks for the closest GoFast self-driving car to wherever the prospective rider is. If a potential rider is outside of GoFast’s mapped areas, the request is declined. Likewise, if the destination of a rider is outside of the mapped areas, the originating request is denied since the GoFast self-driving car would be unable to deliver the passenger to their desired destination.

Some residents within the city believe that their communities were intentionally omitted from the mapping process because their neighborhoods are considered less desirable by GoFast as it attempts to become a profitable ridesharing service. GoFast denies that any such intentional act or omission occurred and says it is rushing as expeditiously as it can to expand its coverage areas.

The self-driving cars being made available for ride-hailing use by GoFast have generated a great deal of demand by those that live, work, or play in the covered areas. At first, many people, especially wealthier millennials and tourists, rode in self-driving cars as a kind of novelty. There was quite a bit of excitement involved within these circles, including a torrent of selfies and social media postings about riding in a self-driving car. After the initial excitement waned, the use of self-driving cars has settled down into a more mundane mode of traveling from point A to point B within the city.

GoFast self-driving cars are being run at a noticeably lower price in comparison to taking a comparable ride in a human-driven car. This makes using the GoFast self-driving cars especially attractive to riders. On the other hand, the geographical ODD limitations are a factor that people must weigh when deciding on using GoFast

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versus a conventional human-driven car or ridesharing service. Paying a lower price to get only part of the way to one's desired destination is troubling since one still has to find other alternatives to complete the rest of one's journey.

Human drivers that are employed in ride-hailing as a key portion of their income are understandably upset about the lower prices of the GoFast ride-hailing service. While some customers prefer dealing with and supporting a job for a human driver, so far there is a gradual shift taking place with more passengers opting to use less expensive self-driving cars rather than the available human-driven ride-hailing options. Those human drivers reliant upon essential income from ride-hailing are seeing a significant drop in their revenue. Some drivers have resorted to trying various gimmicks to get riders to use human-driven ride-hailing, such as pointing out that riders can interact with the driver during their journey (drivers are promoting that they tell jokes, listen to rider stories, and provide a semblance of humanity that cannot be found via a self-driving car).

Due to the normal seasonal changes in the city, there is also an off-putting impact that occurs when the weather turns sour. GoFast pulls its self-driving cars from duty since they are not able to handle the snow or ice that sometimes coats the roadways. This in turn reduces the available supply of ride-hailing services and simultaneously increases the cost of the services due to the surge in demand with the drop in supply. In theory, this would spur more business for the human-driven ride-hailing services during such occasions, but the problem arises that human-driven ride-hailing does not increase overnight to readily offset the loss of hundreds of self-driving cars that are temporarily grounded. Also, GoFast's self-driving cars can be quickly reinstated into use if the weather improves. Thus, human drivers that are doing ride-hailing are on edge about when or if the self-driving cars are going to be on the roads or not. This is an ongoing tension, and no satisfactory solution has emerged.

Another existing controversy involves children riding in self-driving cars by themselves. Human-driven ride-hailing services have various stipulations about when a child that is unaccompanied by an adult can ride in a human-driven ride-hailing car (with an adult present—namely, the driver—but this can be a worrisome safety concern in its own right). GoFast discourages the use of their self-driving cars by anyone under age 18, though this is not strictly enforced. Parents that are unable to arrange for transport for their children to school or extracurricular activities have been increasingly allowing them to ride alone in self-driving cars. Some believe this is a handy way for kids to travel, while others are adamant that this is going to give rise to troubling problems and should be entirely prohibited.

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GoFast is not the only self-driving option in town. A legendary automaker decided to purchase a self-driving tech company named **Steamer**. This enabled the automaker to start making its own self-driving cars (thus, not needing to be reliant upon a third party for its self-driving capabilities). The tech capabilities of Steamer are akin to those of GoFast; the self-driving technology is added or enmeshed into a conventional car.

Steamer provides Level 4 self-driving cars and has ODDs that are quite similar to those of GoFast. Like GoFast, Steamer only goes to certain parts of the municipality and runs only when suitable weather conditions exist. There is a significant overlap in the geographical coverage of Steamer and GoFast, whereby they are both servicing roughly the same areas of the city. Steamer has 40 self-driving cars that are deployed each day and has aspirations for a larger fleet. All the same considerations and issues relevant to the GoFast deployment are equally applicable to the Steamer deployment.

Both Steamer and GoFast are focused on cars, predominantly mid-sized sedans, as their self-driving platforms. Another AV effort is underway by a company called **Mosey**. Mosey is developing self-driving shuttles that can transport up to six passengers. The Mosey self-driving shuttles are currently being used only in the downtown area of the city. Mosey shuttles run on a set schedule. The routes are fixed. Mosey is generally similar to any human-driven shuttle service, but there isn't a human driver at the wheel. If a rider has an issue while on a self-driving shuttle, they are supposed to press a button inside the shuttle to alert a remote agent. The remote agent can then communicate with the passenger that is in the shuttle.

Some riders insist they will not ride in the self-driving shuttles due to concerns about the lack of a human driver being present when there are multiple, unrelated people in the vehicle. This is not a qualm about the shuttles' self-driving capability. Instead, the concern is that there is not a human officially present to aid riders as they get on or off the shuttle; many also believe that a human driver tends to keep the peace on shuttles and that riders may "act up" without the driver's presence. At first, Mosey included a human driver for purposes of overseeing the self-driving system. If the self-driving system had difficulty with a driving maneuver, the human safety driver took over. Eventually, these disengagements of the shuttle diminished and there was no need for the backup human driver. When those human drivers were removed from the shuttle activities, riders began to realize that there was no longer any official "norm setter" present in the shuttles. Mosey is currently experimenting with having a formal helper that goes along in the shuttles, doing so not as a driver, but to assuage concerns about the shuttle lacking anyone onboard in an official capacity.

Several retirement communities within this municipality have their own self-driving ridesharing services on their private property. **Trekit** provides self-driving

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cars that are purposely devised for gated retirement communities. The AVs are geofenced to stay within the borders of the retirement community in which they are deployed. The vehicles are restricted to going no faster than 25 miles per hour and usually go much slower. Unlike the traffic complexities that the GoFast and Steamer self-driving cars must contend with, the Trekit self-driving cars have a much easier job. The area they traverse is relatively unchanging and free of traffic (human-driven cars are not allowed). By going at slow speeds, the self-driving systems can quickly brake when needed, such as when bike riders arise or when a dog runs into the street. Overall, though the Trekit self-driving cars are rated at Level 4, the ODD is severely restrictive in comparison to the ODDs for Steamer and GoFast.

Another AV company called **Carriage** is deploying its self-driving vehicles into various parts of the city, doing so for delivery purposes only. Carriage's self-driving delivery vehicles do not have any provisions for carrying or seating human passengers. The vehicles have a distinctive shape and look that is quite unlike a conventional car. There are winged doorways that swing open to allow for putting items into the vehicle and taking items out of the vehicle. At this time, Carriage is focused exclusively on grocery-related deliveries. A person can go online and order groceries from a local grocery store. The personnel at the grocery store load the bagged goods into a Carriage self-driving delivery vehicle and then send the vehicle on its way to the location of the person that ordered the items. Once the vehicle arrives, the person is expected to come out to the vehicle and take out their groceries. Upon doing so, the vehicle either goes back to the grocery store or it might be loaded with additional groceries that need to be delivered to someone else.

The Carriage self-driving delivery vehicles are devised to travel primarily on neighborhood streets. They try to avoid going on any major streets or highways. The top speed established for the Carriage vehicles is 45 miles per hour, though they usually are going at a speed of 15 to 25 miles per hour. Carriage only deploys the vehicles in neighborhoods that have been extensively mapped for use by their self-driving system. The vehicles are rated at Level 4 and have a set of ODDs commensurate with their capabilities and deployment aspects.

Another self-driving delivery service is being provided by a firm called **Tangy**. The Tangy vehicles are very small in stature, often referred to as "rolling bots." They travel primarily on sidewalks. They only enter into the street when it is necessary to cross a street or cannot otherwise proceed while on a sidewalk. The Tangy self-driving delivery vehicles are programmed to proceed at the ordinary pace of a walking human, thus usually rolling along at about two to three miles per hour (they can proceed at a maximum of five miles per hour, though this is rarely done). Tangy is used to deliver

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fresh food, such as freshly prepared hot sandwiches or pizza. Local pizza places and sandwich shops have several of the Tangy self-driving delivery vehicles at their location and send the vehicles out with fulfilled orders.

These self-driving vehicles have a relatively short range and are intended to go from a neighborhood eatery to nearby homes. If they encounter an obstacle on the sidewalk during their brief journey, they are supposed to come to a halt and wait for the obstacle to move out of the way. After about two minutes of waiting time, if the object is still blocking the path, the bot sends an electronic message to the eatery to report that it is stymied. At that point, either the bot is called back to the eatery, or an employee of the eatery goes out to help the bot complete its delivery effort.

Many residents enjoy watching the rolling bots. The convenience and initial novelty were certainly appealing. On the other hand, problems have arisen. For example, when the rolling bot encounters a wheelchair rider on the sidewalk, the bot stops and blocks the path for the wheelchair to proceed. Another problem that sometimes occurs is that children see the bot and decide to play with it, putting items on top of the bot (covering its sensors so it cannot proceed), or turning the bot upside down (again, preventing the bot from making the intended delivery). Some bots have been vandalized as well.

AV Impacts

The advent of self-driving vehicles has been a boon for many residents, but a bust in other ways. Self-driving vehicles are programmed to do a pick-up/drop-off (PUDO) only when legally able to do so. This seems prudent and proper. Unfortunately, this also means that many passengers are surprised to discover that the self-driving car will not drop them off directly at their desired destination, nor pick them up at their desired origination point. Consider the drop-off aspects: a rider is given a lift by a self-driving car and is driven to the location that was specified. Assume the rider is going to an office building. Upon reaching the destination, the self-driving car detects that the curb in front of the office building is painted red. The self-driving system will not stop there since it is considered an illegal driving act.

The self-driving car roams around the block and finally finds an available and legal place to come to a halt. The passenger must now walk some distance to get to their desired destination. This turns out to be another factor in whether riders choose to use a self-driving vehicle or a human-driven ridesharing vehicle. The odds are that the human driver would be willing to stop at the red curb, despite the unlawful act of doing so.

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Partially due to such PUDO conditions and how self-driving cars are being programmed to work, human drivers for ridesharing services have promoted the fact that they will drop a passenger closer to their desired drop-off point. This might require stopping in the red, or possibly double-parking while the person gets out of the vehicle, but the human drivers are willing to exercise their discretion and do so in many cases.

This has caused a demonstrative rise in dangerous or illegal driving antics by human drivers of ridesharing services. Meanwhile, self-driving cars that are seeking a legal spot to do a drop-off are roaming around and around, adding to the traffic congestion. Other human-driven cars that get stuck behind a self-driving car that is looking for a suitable drop-off point are apt to get upset at the delay and try to maneuver around the slowly moving self-driving vehicle. This, in turn, has increased the number of fender benders and added to existing traffic woes.

Because of AVs' adherence to driving in strictly legal ways, the number of traffic violations for running stop signs, red lights, and so on has dropped quite a bit. Likewise, self-driving vehicles are not parking in prohibited parking zones. However, the city revenue normally collected by such driving infractions has plummeted and the coffers for spending on city improvements are dwindling. This is not yet a sizable problem, though the ongoing advent of AVs is anticipated to reduce these funds (i.e., the metropolis has traditionally counted on such infraction-based revenues occurring steadily from year to year).

AVs have also had an impact on privacy. A spate of recent videos has sparked some especially heated debate. The matter began when Trekit released a video that was recorded by the cameras in their self-driving cars. This video was used as a promotional campaign to showcase the value of self-driving cars in the local retirement communities. By piecing together the recorded video that the sensors had been collecting (normally these onboard cameras are used simply for navigation and self-driving), the video collage vividly indicated the tranquil nature of the retirement communities and showed residents as they pleasantly gardened in their front yards and sat outdoors together to have leisurely chats, etc.

However, residents and their loved ones were disturbed when they suddenly realized that the Trekit self-driving cars were recording the daily comings and goings of people in the retirement community. This possibility had not previously arisen as a focal point. Some were upset. Advocates said that snazzy videos released by Trekit for the promotional campaign violated the privacy rights of the residents and visitors to the retirement facilities.

Around that same time, Mosey released a recorded video that depicted the enjoyable nature of riding in their self-driving shuttles. This was video captured in real-time

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by cameras that were inward-facing, showing various riders that were reading, talking, and seemingly relishing riding in the Mosey self-driving shuttles. Many riders were surprised that there were cameras pointed at them while inside the Mosey self-driving shuttles. Outward-facing cameras made sense since they were needed to detect the surroundings and enable self-driving functionality, but video of the interior activities was received as a shocking invasion of rider privacy.

Eventually, it was revealed that all of the AVs being used throughout the city had been outfitted with cameras pointed both outward and inward, including the self-driving vehicles by Mosey, Steamer, GoFast, and Trekit. The need for the outward-facing cameras to aid in self-driving activities was obvious. However, everyone had assumed footage was only being used for the moment-to-moment act of driving. Few realized that the cameras were constantly recording and uploading footage to online databases being kept by the various AV operators. The justification for inward-facing cameras was three-fold. First, the cameras ensured passenger safety during the trip. Second, the images could be used for vandalism detection. Third, the cameras could be used for interactive customer service chats with remote agents of the fleet operators, allowing a rider to see and be seen during any such Zoom-like interactions.

Local media has been covering the controversy that has arisen now that the city residents have come to realize that the AVs are able to record whatever the self-driving vehicles detect as they make their rounds throughout the metropolis. The AV operators emphasize that the data can be quite useful. For example, Carriage has opted to post its collected outward-facing video onto several real estate websites, allowing people to go online and readily watch a video showing the current status of homes in the various neighborhoods where the self-driving delivery vehicles roam.

Concerns have mobilized several advocacy groups to weigh in on the arrival of AVs. Issues of personal privacy generated the formation of **Privacy Now**, a grassroots nonprofit working to ensure citizen privacy. The group has been focused on Internet, social media, and phone data privacy for the past several years. Their view is that, absent a proactive agreement to share AV passenger data, it is private. They argue that the Terms of Service fine print is not real affirmative consent. The Privacy Now team is very concerned about the arrival of AVs. The videos that surfaced showing riders and pedestrians has galvanized the group to lobby directly and via a grassroots campaign to limit the collection, retention, and sale of data.

Access for All is a nonprofit with a mission to ensure that residents and visitors in the city have equal access to mobility. The group focuses on affordable transportation and the availability of all modes to all people in the city regardless of race, gender, sexual orientation, or socio-economic status. The group has worked on these issues

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for decades, achieving notable success on access for those with disabilities. Evidence that TNCs are not providing service in lower socio-economic neighborhoods shifted their work in this direction and has drawn extensive citizen and political support. The group is worried about the rise of AVs for several reasons. First, they worry about ensuring AV access is provided equally in all neighborhoods. Second, they are concerned that those with disabilities might not be able to use AVs. Finally, they see the potential for AVs to cannibalize public transit, leading to less funding and less service for those who cannot afford AVs.

Looking Forward

Overall, AV activities in this city are abundantly underway and cover a wide variety of transportation tasks. There are door-to-door self-driving cars that transport people on a ride-hailing basis. Self-driving bots are using the sidewalks to provide home delivery of fresh food. There are self-driving delivery vehicles used to get groceries from local grocery stores to homes in local neighborhoods. There are self-driving cars within several retirement communities dedicated to providing convenient rides to those residents. There are self-driving shuttle buses.

Yet, this is just the start of the city’s AV adoption efforts. Additional AV makers have indicated they plan on getting underway in this metropolis. Moreover, AV transit buses and self-driving trucks are on the horizon. Beyond the expansion of ground-based AV, there is also widespread speculation that airborne AV is coming next. Initial tryouts involving autonomous drones that can deliver goods to homes are already taking place. There are also efforts underway to pair autonomous drones with various self-driving vehicles, allowing a drone to land on or take off from a moving, ground-based AV.

Residents of the city are generally upbeat about AV efforts. A recent survey revealed that most of the residents are pleased that AVs are becoming increasingly available. One concern that was raised was the lack of an integrated platform for knowing what AV and other mobility options were available, how they could be linked together for a journey, and a single means for payment across the options.

Another major point of angst is congestion. Residents can plainly see that traffic congestion has been worsening. In terms of road space, the human versus self-driving question is irrelevant to many respondents, whose primary desire is for less traffic. To them, a vehicle in the way is a vehicle in the way.

Specific to AVs, survey respondents also stated that the messiness about where to be dropped off and picked up is getting troublesome. Riders are increasingly worried about where they will be dropped off, though not because the drop-off may be

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an illegal spot; instead, the predominant concern is that self-driving cars resort to drop-offs that, though legally allowed, may be blocks from the intended final destination. Meanwhile, some respondents noted the wild driving antics of human drivers for ride-hailing services. Many drivers will do anything to appease passengers, including stopping at any curb at any time, and even stopping in the middle of active lanes of traffic to let riders out at their preferred destination spot.

Residents, and especially those in more affluent neighborhoods, generally gave AV efforts good reviews. Still, respondents are beginning to embrace a somewhat skeptical stance, feeling that perhaps AV operators are overextending their existing freedoms and/or might go beyond their initial welcome. Few residents can precisely put their finger on what should be done, other than to note that the AV operators should provide fees for the privilege of setting up shop and operating in their fine city.

The Mayor's Office

The **Mayor's Office** is led by Mayor Alex Smith, who is quite popular, with a 75 percent approval rating now in a second term (terms are four years). The high marks are a function of the mayor's focus on all neighborhoods in the city and delivering high-quality and responsive services that address local concerns. Smith gets particularly high grades for fostering equity and social inclusion, especially in education and economic development.

Through the mayor's time in office, mobility issues have been a lower priority and generally centered on fixing potholes, improving transit reliability, and trying to balance the parking dilemma (i.e., having enough parking for visitors and local residents). With the rapid growth of ride-hailing services like Uber and Lyft, increasing congestion, the cannibalization of public transit, and disregard for traffic norms, Smith has taken a "carrots and sticks" approach, funding an education program for ride-hail drivers and strictly enforcing traffic laws.

The mayor has welcomed the arrival of AVs in the city. Smith sees tech innovation as a key to the future economic prosperity of the city. The city's economic development office sold the mayor on the idea of creating a mobility technology cluster, with the establishment of several AV companies in the city to bring more as the tech labor force and policy environment create a virtuous cycle supporting an AV ecosystem.

The presence of AVs on the streets and some of the associated challenges, along with interest from several new players offering their services to the city, has the mayor thinking about the need for policies to shape the role of AVs in the city's mobility landscape.

III. FIVE POTENTIAL POLICY ACTIONS

For the mayor's office in this scenario, an additional catalyst for action was a policy white paper issued by the Taubman Center for State and Local Government at Harvard Kennedy School, titled *Autonomous Vehicles are Coming: Five Policy Actions Cities Can Take Now to Be Ready*.⁷ The policy paper provides state and local policymakers with guidance on how to prepare for the arrival of AVs. The paper's five action items are summarized below and in Figure 1.

1. Foster Mobility-as-a-Service (MaaS): The past decade has seen a dramatic expansion in modal options for getting around cities. In addition to traditional personal cars, taxis, and public transit, travelers now have ride-hailing services, pedal bikes, and electric scooters available. Travelers getting from home to work to entertainment have a range of cost and service choices. Unfortunately, the information on these options is not centralized, requiring travelers to consult numerous sites. Moreover, most modes have their own booking and payment system. Policymakers should consider establishing or facilitating a convenient, comprehensive, and seamless trip-planning, booking, and payment platform for multi-modal transport journeys in their locality. The goal is to provide travelers with an easy-to-use mobility optimizer. A subsidiary policy objective is to make public transit and/or active transportation more attractive, shifting people away from their private automobiles.

2. Rethink curb design and street space allocation: The advent of automobiles led to establishing raised curbs as a safety precaution 100 year ago. Subsequently, the curb has become a highly utilized, multi-purposed component of the urban landscape. The curb today continues to provide a safety demarcation between road/vehicle and sidewalk/pedestrian. It also serves as a warehouse for cars (i.e., parking) as well as a pick-up and drop-off spot for passengers and freight. Increasingly, cities are experimenting with using the curb to enhance livability by converting the space into parklets and cafés. Because the curb is prized by multiple users, it is often contested, leading to double parking, illegal parking in loading zones, and the like. AVs obey the rules that are programmed into the vehicle's software. The good news is that AVs will follow vehicular rules. The challenge is that if vehicles are blocking the curb, the AV will be stymied. Emerging technology will also enable the use of curbs to vary during the day

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7. The descriptions are drawn from *Autonomous Vehicles are Coming: Five Policy Actions Cities Can Take Now to be Ready* at: https://www.hks.harvard.edu/sites/default/files/Taubman/Research/Autonomous%20Vehicles%20Are%20Coming_Five%20Policy%20Actions%20Cities%20Can%20Take%20Now%20to%20Be%20Ready.pdf.

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(e.g., bike lanes in the morning, café space in the afternoon and delivery space in the evening). The coming of AVs provides a catalyst for city planners and policymakers to rethink the role of the curb and how its use will be enforced.

3. Manage and reduce congestion: Traffic congestion is an ongoing and often expanding problem for most cities. Congestion has been exacerbated with the growth of TNCs. AVs have the potential to reduce or increase congestion. If AV rides provide a cost- and quality-effective alternative to personal auto ownership via fleet operators, and if AV rides are pooled with several travelers, the congestion may be materially reduced. If, however, AVs divert travelers from public transit to AV rides, especially individual trips, congestion would worsen. Another fear is that AVs would circle with no rider in situations when no parking is available or when a rider stops to do an errand, raising traffic concerns of so-called “zombie cars.” The worst-case scenario is an individually owned AV with a single occupant that circles the city waiting for its owner to take a trip. City officials can influence the congestion outcome through the policies they adopt, from incentives for multi-rider trips and penalties for pick-ups and drop-offs in transit lanes to prohibitions on zombie cars.

4. Establish data-sharing guidelines and agreements: AVs will collect a vast amount of data, including data from outward-facing sensors and data via inside-facing sensors, that is of interest to public and private stakeholders. Gathering this information raises numerous usage questions. City planners can use this information to plan for infrastructure upgrades and new transit lines. Departments of Public Works may want the data to identify potholes and where changing traffic signal timing would improve vehicle flow. A wide array of private actors would like the information for a range of purposes, from targeting ads to riders and those in the streets to setting commercial rental rates based on traffic flows. The desirability of the information raises a host of data ownership and privacy questions. Do AV operators have the right to sell the information? What rules ensure the privacy of individuals on the street? Do AV operators have to share their data with city agencies? At the outset, policymakers need to diligently work on establishing suitable data-sharing guidelines and agreements with the AV operators operating in their locality. It is easier to craft the rules before, not after, AVs are widespread.

5. Reposition revenues: The current mobility environment raises substantial revenue for most cities. Municipal parking lots, garages, and metered parking generates millions. Even more funds are generated from parking and traffic violations. Predictions are that AVs will likely lead to a substantially significant revenue decline for

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municipalities as human drivers, who routinely incur speeding violations and unlawful parking tickets, are replaced with rule-abiding AVs. In addition, AVs are expected to lessen the demand for parking and therefore reduce parking-related revenues. Policy-makers should explore the magnitude of the revenue shortfall and how they will make it up. A portion will come from higher property values, as parking garages are replaced with more valuable residential and commercial buildings. AV fleet license fees and/or AV trip fees can also replace lost revenue. Cities need to determine their revenue plans now so that AV operators know how to plan their operations.

Figure 1: Five Actions Cities Can Take to Prepare for AVs

Policy Action	Recommendations
Foster Mobility-as-a-Service (MaaS)	Policymakers should consider establishing or participating in convenient and seamless regional Mobility-as-a-Service (MaaS) systems featuring comprehensive trip-planning, booking, and payment capacities for multi-modal transport journeys in their area.
Rethink Curb Design and Street Space Allocation	Policymakers should rethink curb design and street space allocation in their locality by “mapping” the curb to better understand usage, establishing a prioritization framework, and piloting alternative curb uses such as pick-up-and-drop-off (PUDO) zones.
Manage and Reduce Congestion	Policymakers should profile existing traffic patterns and congestion, develop a congestion pricing strategy and communications plan, improve transit uptake and performance, and ultimately conduct a scalable pilot program with congestion reduction as one of its key goals.
Establish Data-Sharing Guidelines and Agreements	Policymakers should determine data needs and wants, draft data-sharing guidelines, begin implementation with any existing AV operators in their locality, and routinely evaluate the value of data-sharing guidelines, revising guidelines as needed.
Reposition Revenues	Policymakers should understand that, for municipalities, AVs are expected to lead to significant decline in revenue tied to parking fees and infractions such as speeding or unlawful parking; as such, policymakers should consider alternative revenue mechanisms.

Source: Fagan, M., Comeaux, D., and Gillies, B. (2021). *Autonomous Vehicles Are Coming: Five Policy Actions Cities Can Take Now to Be Ready*. Harvard Kennedy School, Taubman Center for State and Local Government Working Paper Series.

IV. POST-SIMULATION MAPPING

The results of the simulation provide a point-in-time view of how a city wants AVs to support mobility. Rarely will the desired outcome be the current state. The results of the simulation can be used to help the city migrate from its current position to the desired state. A propensity matrix may be helpful in facilitating the transition. When examining urban mobility policies in the context of AV deployments, two major factors are useful to consider:

- The pervasiveness of AVs in the municipality; and
- The maturity of urban AV mobility policies.

Envision that the pervasiveness of AVs in a locality can be assessed as either “low” or “high.” A city that is only just beginning to witness AV adoptions would be rated as being at a minimal or “low” volume in terms of the pervasiveness of AVs, while a city that has widely and extensively embraced AVs might be rated as having a “high” volume of pervasiveness.

Similarly, urban AV mobility policy maturity could be rated as either low or high. A city that has not formulated AV-related urban mobility policies or that has done so to minimal extent would be rated as “low” in terms of their policy maturity, while a city that has deeply strategic and field-tested urban AV mobility policies would be rated at a “high” level of policy maturity.

The resulting four quadrants, depicted in Figure 2, are described below:

In the *Exploratory* use case, the pervasiveness of AVs is low and the municipality’s policy maturity is low. This is a common occurrence for most municipalities today. Most cities have only a scant amount of AV efforts underway in their locale and have little or no existing urban mobility policies about the advent of AVs.

For those municipalities that aim to get ahead of the curve entailing the advent of AVs, crafting AV policies before the emergence of AV pervasiveness in their area is the use case designated as *Readied*, which consists of low AV pervasiveness and high policy maturity.

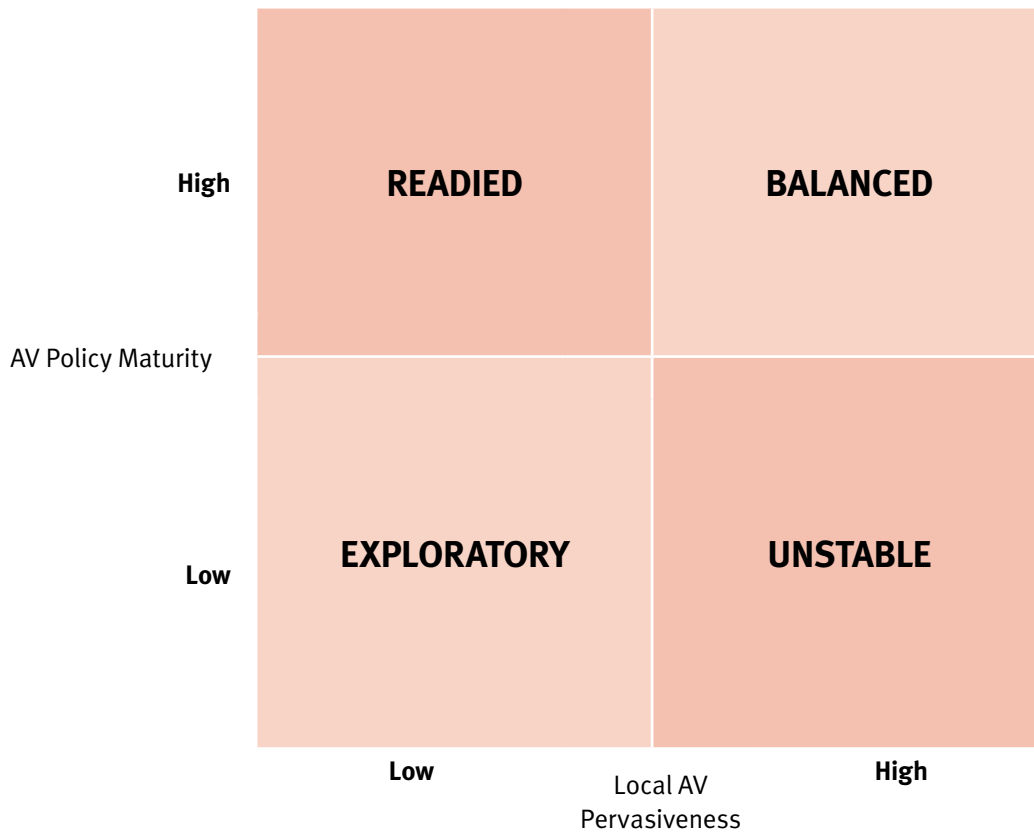
Once AV pervasiveness reaches a rating of high, the preferred condition for a municipality is that it is already at a heightened level of AV policy maturity. In this use case, the pervasiveness is high and the policy maturity is high, leading to a *Balanced* condition for coping with and managing AVs in the municipality.

The least desirable condition involves a high level of AV pervasiveness coupled with negligible or low policy maturity. In this use case, the situation is decidedly *Unstable* and the advent of AVs is presumably occurring without any sufficient urban

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mobility policies in place. This becomes an arduous hurdle of trying to establish and put in place the needed urban mobility policies while in the throes of widespread AV pervasiveness. Some liken this scenario to having to change the wings on an airplane while it is in midflight.

Figure 2: Autonomous Vehicles Urban Policies Propensity Matrix

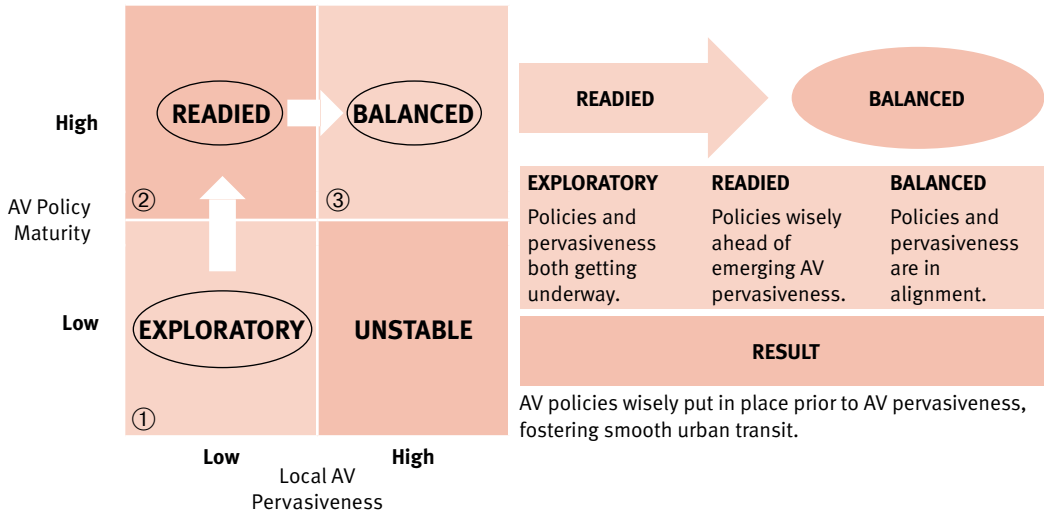


Generally, knowledgeable municipalities that aim to be well-prepared for the advent of AVs are likely to proceed as follows: **Exploratory → Readied → Balanced**.

Such municipalities start at a low level of AV policy maturity while AV pervasiveness is low (the *Exploratory* stage). Astute municipalities proceed to devise and promulgate urban AV mobility policies and do so ahead of the rise in AV pervasiveness (reaching the *Readied* stage). Eventually, AV pervasiveness catches up with the municipality's policy maturity and the two are in balance (the *Balanced* stage). This advantageous sequence is portrayed in Figure 3 below.

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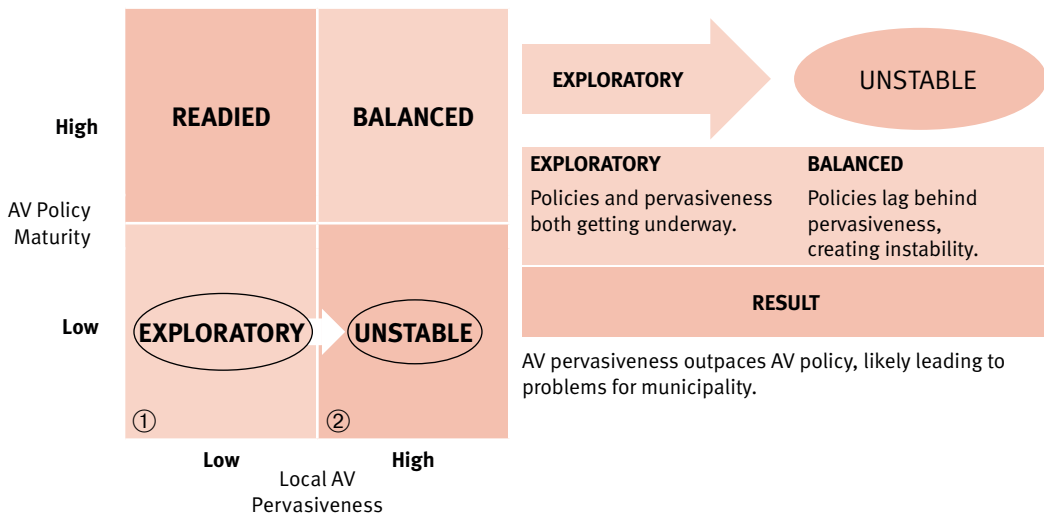
Figure 3: Preferable AV Policy and Pervasiveness Progression



Keep in mind that the Balanced stage can falter if AV policies are not appropriately maintained and updated in light of AV advances and further adoption of AVs in a municipality. Over time, there is an ongoing chance of AV pervasiveness getting ahead of the once-balanced status, so policymakers need to remain vigilant and continue to ensure that policies are refined and adjusted as needed.

Another form of faltering consists of municipalities that do not proceed on their urban policy efforts and therefore get caught behind when AV pervasiveness demonstrably rises. This can be characterized as: **Exploratory → Unstable**, as shown below in Figure 4.

Figure 4: Undesirable AV Policy and Pervasiveness Progression



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One basis for being caught unprepared for AVs may be lack of awareness. Some cities are simply unfamiliar with, and unaware of, the need to formulate urban mobility policies that take AVs into account. Unfortunately, in some cases, it is only once AVs have reached a heightened level of pervasiveness that the realization occurs that there is “suddenly” an outsized need for urban mobility policies. This was the case with the introduction of ride hailing and electric scooters in many cities.

These autonomous vehicle and urban mobility policy propensity matrices can serve as illustrative and anticipatory guides for municipalities that are witnessing a gradual introduction of AVs in their locality.

APPENDIX: PROPRIETARY INFORMATION FOR SIMULATION PARTICIPANTS

Contents

- Mayor’s Office
- AV Providers
 - GoFast
 - Steamer
 - Mosey
 - Trekit
 - Carriage
 - Tangy
- Advocacy Groups
 - Privacy Now
 - Access For All

Note: All simulation participants may add additional information that is consistent with the scenario described above and their stakeholder position detailed below.

MAYOR’S OFFICE

Proprietary Information

Goals:

- Emerge with a set of AV-related policies for which there is consensus among stakeholders.
- Improve mobility options for all to make the city more livable.
- Ensure equity for vulnerable populations.
- Foster economic development.
- Receive shared, anonymized aggregate data to provide mobility insights to city.
- Control the inflow of AV experiments (i.e., “crawl, walk, run”) to ensure all impacts are managed.

Positions:

- Negotiable:
 - Supports AV operator fee structures to replace lost revenues, including congestion pricing.
 - Supports penalties for “zombie car” mileage.
 - Considering greater non-parking/traffic-related uses for curb space.

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- Encouraging shared AV rides.
- Address the trade-off between ride-hailing driver jobs and the growth of AVs.
- Non-negotiable:
 - AV availability, even in the pilot stage, must reflect the diversity of the city.
 - No city funds can be spent to support AV rollout.
 - AVs must complement transit, especially bus service.

Information:

- The mayor is up for reelection in 18 months.
- The mayor has a strong favorability rating but voters in lower socio-economic areas are frustrated with a lack of attention to local issues, including transit deserts and lack of economic opportunities.
- Getting a set of policies put in place in the near-term might stave off state pre-emption, which the mayor would like to avoid.
- The Mayor's Office has built strong alliances with local universities, which provide access to expertise, research, and student project deliverables.

GOFAST

Proprietary Information

Goals:

- Maintain a dominant position in AV passenger mobility.
- Expand fleet from 100 vehicles to 400 and double the operating footprint over the next 18 months.
- Ensure rider information can be obtained and sold.
- Secure a city garage for maintenance, storage, and electric charging of AV fleet at no (or minimal) charge.

Positions:

- Negotiable:
 - Open to reporting traffic/mobility-related information to the city, but in aggregate format; prefers answering city's questions rather than proactively providing the data.
 - Open to designated pick-up and drop-off locations.
 - Open to opt-out for passenger data-sharing, but not opt-in.
 - Open to participation in a MaaS platform.

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- Non-negotiable:
 - Does not support prohibition on cream skimming/diverting riders from transit.
 - Does not support “zombie” vehicle mile fees.
 - City must agree that any AV operators’ geographic expansion must be contiguous to existing operations.

Information:

- GoFast currently has its own reservation/billing platform.
- Expansion is needed to secure next round of venture capital funding.
- At 2,000 vehicles, GoFast will break even, but profitability requires the sale of passenger data.

STEAMER

Proprietary Information

Goals:

- Rapidly expand service with a fleet targeting more than 200 vehicles in 12 months (from 40 today).
- Have the city serve as a showcase for its technology so other cities will want to contract with them.
- Sell privately-owned AVs.
- Sell outward facing, non-rider data.

Positions:

- Negotiable:
 - Open to discussing speed of expansion.
 - Open to expanding in less-affluent neighborhoods.
 - Open to discussing how to complement existing transit.
- Non-negotiable:
 - Must be allowed to obtain and sell anonymized aggregate external AV data.
 - Will not share detailed data with city (fearful of data being used by competitors).

Information:

- Offer rides at rates 15% below GoFast to grow market share and fleet.
- Selling external data to support the costs of developing and proving the AV technology.

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- Strategy involves shifting passengers from buses to support growth.
- Long-term goal is to sell its Level 4 cars to individuals as well as operating AV fleets.
- Will use several of the company’s dealerships to house and maintain the AV fleet.
- Views its propriety booking and billing system as a competitive advantage.

MOSEY

Proprietary Information

Goals:

- Operate a fixed-route AV shuttle system in the city focused on the high-density urban core.
- Increase frequency of service.
- Utilize dedicated pick-up and drop-off locations immediately adjacent to the most attractive venues.
- Integrate scheduling and payment for shuttle in existing public transit systems app.
- Have the city subsidize their service as they do for the public transit system.

Positions:

- Negotiable:
 - Open to expanding service into transit deserts with a commensurate subsidy.
 - Open to providing their operational data to the city.
 - Open to providing disability-enabled vehicles, for a fee or with a subsidy.
- Non-negotiable:
 - City must prohibit other fixed-route AV providers from operating in the same area.
 - If including something about add revenue, city must allow it for Mosey.

Information:

- Current service offers six-passenger AVs.
- Average utilization is 50%, but near 100% during afternoon and evening.
- Current operating speed is 25 mph; they would like approval for 30 mph.
- No interest in selling data.

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TREKIT

Proprietary Information

Goals:

- Be left alone; they are doing fine as a private, largely unregulated operator and want to keep it that way.
- Expand service into university campuses and the local airport.
- Increase capacity of existing vehicles from eight to 16 passengers.
- Keep other AV shuttle operators out of the market.

Positions:

- Negotiable:
 - Open to discussing whether or not AV data can be used for promotional purposes.
 - Open to coordinating service schedule with existing public transit service outside of the areas in which they operate.
- Non-negotiable:
 - Will not pay AV trip fees to the city.
 - Will not share data with the city.

Information:

- Has an expedited mapping process and a great safety record.
- Serves three retirement communities with a fleet of nine vehicles.
- An ambassador rides the shuttle to help riders on and off the vehicle.
- Company negotiates a flat-rate fee with each retirement community.

CARRIAGE

Proprietary Information

Goals:

- Expand geographic footprint in more affluent neighborhoods.
- Secure exclusive drop-off zones in front of large apartment/condo buildings.
- Leverage the mapping done by other AV operators.
- Expand service offering from groceries to a broader array of retail goods.

Positions:

- Negotiable:
 - Open to discussing delivery distance (beyond three miles).
 - Open to discussions of maximum allowable time at the curb.

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- Open to time-of-day restrictions on operations to reduce street and curb congestion.
- Open to paying city fleet operating fees.
- Non-negotiable:
 - Will not commit to equal service to all of city’s neighborhoods.

Information:

- Operating a fleet of 25 delivery AVs.
- Optimal delivery distance is one to three miles.
- Company partners with grocery stores and collects a fee from retailer and customer.
- Volume is growing rapidly, doubling every 90 days.
- Not currently profitable but anticipates hitting a break-even point in nine to 12 months.

TANGY

Proprietary Information

Goals:

- Take share from “Eats” and “Dash.”
- Secure exclusive operating geographies in more affluent neighborhoods.
- Secure fines for interference with bots.
- Sell customer data.

Positions:

- Negotiable:
 - Open to discussions of response time when bot is blocking a sidewalk.
 - Open to discussions on time of operations.
 - Open to discussions of interference fine levels.
- Non-negotiable:
 - Will not pay a fee for using the sidewalk.

Information:

- Tangy provides AV delivery of prepared food for multiple restaurants and ghost kitchens which provide prepared food for home delivery without a storefront.
- Restaurant and customer split the fixed fee per delivery.
- Success requires fast delivery to keep the food at desired temperature; short distances are best.
- Economics require density of three to four deliveries per trip.

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- Currently taking 15% loss on every delivery; selling customer data would take company at least to break even.
- Company fears bot damage and vandalism by some members of the public.

PRIVACY NOW

Proprietary Information

Goals:

- Ensure everyone has the right to data privacy, including riders and passersby.
- Strictly limit the sale of data collected by all AV operators.
- Any rider consent to data-sharing must be opt-in and explicit.

Positions:

- Negotiable:
 - Open to discussions of opt-in for rider data-sharing.
 - Open to providers sharing anonymized aggregate data with city.
- Non-negotiable:
 - Opposed to the sale of any non-rider data obtained by AVs.
 - Opposed to the use of inward-facing cameras.

Information:

- Privacy Now is well connected within the privacy community and has substantial resources for lobbying.
- The mayor is worried about data privacy and brought Privacy Now to the table.
- Group has been active and successful at the state level regarding Internet and social media privacy.
- Group considers AV data completely private and opposes any selling of the information to search engines or others.
- Group supports government receiving only aggregate data from private organizations because of fears that disaggregated information will be made public.
- Group views data privacy as extending to companies as well as individuals; therefore, opposes forcing fleet operators to share their internal, confidential information.

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ACCESS FOR ALL

Proprietary Information

Goals:

- Use AVs to enable improved mobility for vulnerable populations.
- Leverage AVs to serve transit deserts.
- Promote/implement transit-equivalent fares for disadvantaged communities.
- Provide access to AV services without a smartphone.
- Ensure AVs are accessible to those with disabilities.

Positions:

- Negotiable:
 - Open to discussions on percentage of AVs accessible by those with disabilities.
 - Open to discussions of fare levels for low-income AV riders.
- Non-negotiable:
 - AV access must be comparable for all.
 - A portion of the AV fleet must be accessible for those with disabilities.
 - Wheelchairs and vision-impaired people must have access to unobstructed sidewalks.

Information:

- Access for All is well funded by one of the wealthiest families in the city.
- Group has been advocating for AV testing in transit deserts.
- Would like to see AV employees hired from local low-income neighborhoods.
- Points to numerous vacant buildings in these neighborhoods that could serve as AV repair and charging stations.

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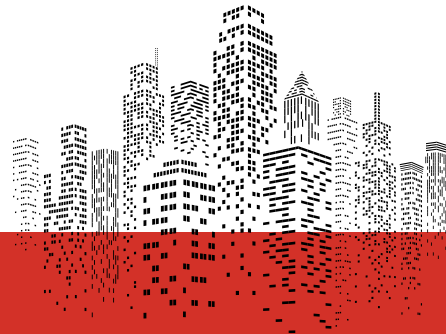
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A publication of the

Taubman Center for State and Local Government
Harvard Kennedy School
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Cambridge, MA 02138