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REINVENTING THE WHEEL BY TAKING IT AWAY: HOW AUTONOMOUS VEHICLES WILL SHAPE LAND USE LAW

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Tomas Montoya*

I. Abstract

As the development and deployment of autonomous vehicles (AVs) accelerate, they are set to have a profound impact on a range of societal domains, including land use law. The potential benefits of AVs for land use are substantial, with the potential to free up large tracts of land, increase transportation efficiency, improve accessibility, and more. However, there are also significant concerns regarding the negative impacts of autonomous vehicles, such as increased urban sprawl, decreased public transportation and funding, and increased demand for curb space. As such, it is essential to examine the various ways in which AVs will impact land use laws and regulations to properly plan our future cities. This paper aims to consolidate existing research on AVs, provide a comprehensive analysis of the likely impacts of AVs on land use law, and explore new policies and regulations that will need to be put into place, if they haven't been already, to ensure that the continued implementation of AVs is consistent with broader societal goals of sustainability, equity, and efficiency.

II. Introduction

For decades, traditional automobile travel has been a key component of land planning. It's also often a point of contention in land use and zoning regulations, particularly when NIMBYs (not in my backyard), opponents to development, rely on traffic or roadway concerns to oppose development. Autonomous vehicles may not be a solution to NIMBYism, but AVs promise a transformative impact on transportation, urban planning, and land use. As we delve into the realm of AVs, we must understand the history of automobiles, the origins of zoning regulations, and models of how AVs will work. We will then explore the impacts of AVs on land use, including reduced parking demand, road and land recapture, and urban sprawl. We will also discuss other impacts of AVs including enhanced accessibility, environmental sustainability, and the challenges they pose for public transportation and infrastructure. By examining these factors, we can gain insight into the many implications of AVs on urban planning and zoning regulations. It is crucial to proactively address the challenges and leverage the opportunities presented by AVs to shape sustainable, efficient, and inclusive cities of the future.

III. Brief History of the Automobile

Since the introduction of the first mass-produced vehicle in 1908, Henry Ford's Model

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T, the world has not stopped trying to reinvent the wheel.[1] In the 1920s, the first remote control cars were developed and although they were technically "driverless" they weren't quite "autonomous" because they could not steer without human intervention.[2] It wasn't until the 1939 New York World's Fair that a future with autonomous vehicles was imagined and the built environment was completely transformed around these futuristic automobiles.[3] Although a vehicle completely free from human control was not developed until much later, the impact that the traditional automobile had on land use patterns became more pronounced. This is especially true after the passage of the Federal-Aid Highway Act of 1956 and the construction of the first interstate highways.[4] Since then, states, cities, towns, and counties have planned with vehicles in mind. Setback requirements were established to push buildings and structures back from lot lines to allow for more parking and parking minimums for developments were common in zoning codes.[5] Vehicle corridors, ingresses, egresses, and safety also became major components of land use regulation.[6] In recent years, autonomous vehicles have been a featured trope of sci-fi films and shows, such as *I, Robot*,[7] *Black Mirror*,[8] and others. Today, AVs are no longer a myth, they are here and increasing in numbers every day. The last 100 years showed how the automobile transformed cities across the U.S. to be very car-centric, but with humans soon to be no longer at the wheel, AVs will likely alter the built environment again and in ways not yet considered.

IV. Origins of Zoning

Before investigating the nuances of what AVs mean for future land use patterns, we must understand the foundations of land use law. In 1916, New York City was the first to enact a formal zoning ordinance.[9] It created zones for uses and even began to regulate development height and density.[10] For the rest of the 1910s and into the 1920s, many states and cities began enacting their own zoning ordinances.[11] Finally, in the 1920s, the first nationwide acts were introduced and published in *A Standard State Zoning Enabling Act* (SZEA) and *A Standard City Planning Enabling Act* (SCPEA).[12] These acts granted power to legislative bodies to establish zoning districts, regulations, subdivision control, mapped streets, and regional planning.[13] Thus, many municipal zoning statutes were modeled on these standard acts. At the time, the reasoning behind these acts was rooted in nuisance concepts.[14] Many people were concerned about living near the toxins and

[1] *The Model T*, FORD, https://corporate.ford.com/articles/history/the-model-t.html (last visited Mar. 7, 2023).
[2] Fabian Kröger, *Automated Driving in Its Social, Historical and Cultural Contexts*, AUTONOMOUS DRIVING: TECH., LEGAL & SOC. ASPECTS 41, 43 (2016).
[3] *Id.* at 48.
[4] Richard F. Weingroff, *Three States Claim First Interstate Highway*, 60 PUB. RDS. (Summer 1996).
[5] Jeremy Crute et al., *PAS Report 592: Planning for Autonomous Mobility*, AM. PLAN. ASS'N 1, 7 (Sept. 1, 2018).
[6] *Id.*
[7] I. ROBOT (20th Century Studios 2004).
[8] *See generally* BLACK MIRROR (Netflix 2016-2023).
[9] Julian Conrad Juergensmeyer et al., LAND USE PLAN. & DEV. REGUL. L. § 3.3 COMPREHENSIVE ZONING 41 (3d ed. 2013).
[10] *Id.*
[11] Stuart Meck, *Model Planning and Zoning Enabling Legislation: A Short History*, 1 MODERNIZING STATE PLAN. STATUTES: THE GROWING SMART[SM] WORKING PAPERS 1, 1 (1996).
[12] *Id.* at 1-2.
[13] *Id.*
[14] *Id.* at 3.

noises of industrial uses or other related uses.[15] This consideration of nuisances was also discussed by the U.S. Supreme Court in the landmark 1926 zoning case, *Village of Euclid v. Ambler Realty Co.*, which stated in *dicta* "[a] nuisance may be merely a right thing in the wrong place, like a pig in the parlor instead of the barnyard."[16] After this decision, this type of use zoning became known as "Euclidean zoning" and was adopted all across the country.[17] Since then, zoning ordinances have changed to incorporate more flexibility and regulate new components of development so long as they have some relation to the "public health, safety, morals, or general welfare." [18] This even includes zoning merely for design and aesthetic purposes.[19]

V. What Are Autonomous Vehicles?

"Autonomous vehicles" generally refer to any type of vehicle "that can move through the world using its own navigation software."[20] This definition includes "self-driving" vehicles which refers to a conventional automobile that "has the ability to drive itself—i.e. an onboard computer can take control [from the driver] of the steering wheel, the accelerator, and the brake."[21] This is similar to many modern functions in cars like Tesla's autopilot. Some autonomous vehicles are designed specifically for ridesharing which are often called "robo-taxis."[22] Autonomous vehicles designed only for delivering items rather than transporting people are often called "autonomous couriers."[23] An example of these autonomous couriers are food delivery robots on many college campuses[24] or companies seeking to deliver products with drones.[25] Thus, the term "autonomous vehicle" is broad and encompasses many different types of vehicles.

However, the term "autonomous vehicle" may not accurately describe a vehicle, depending on its functions. All the functions normally conducted by people when driving, including "localization, perception, planning, control, and management" must be conducted by an automated vehicle in all driving environments to be accurately labeled as an "autonomous vehicle."[26] In other words, the AV must be able to monitor other cars, pedestrians, weather, traffic, road conditions, and more. The Society of Automotive Engineers International (SAE) has created a taxonomy describing the different levels of

[15] *Id.*
[16] 272 U.S. 365, 388 (1926).
[17] Juergensmeyer, *supra* note 9.
[18] *Vill. of Euclid*, 272 U.S. at 395.
[19] *See generally Metromedia, Inc. v. City of San Diego*, 453 U.S. 490 (1981); *see also Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104 (1978) (cities and states may enact ordinances to further or preserve desirable aesthetic features).
[20] Anthony Raymond, How Autonomous Vehicles Will Change the World 9 (2020).
[21] *Id.*
[22] *Id.*
[23] *Id.*
[24] *Starship Technologies, Aramark Launch Contactless Robot Food-Delivery Service at ASU*, ASU NEWS (Sept. 4, 2020), https://news.asu.edu/20200904-asu-news-starship-aramark-launch-contactless-robot-food-delivery.
[25] Katie Tarasov, *A First Look at Amazon's New Delivery Drone, Slated to Start Deliveries this Year*, CNBC (Nov. 11, 2022, 4:43 PM), https://www.cnbc.com/2022/11/11/a-first-look-at-amazons-new-delivery-drone.html; *see also* David Guggina, *We're Bringing the Convenience of Drone Delivery to 4 Million U.S. Households in Partnership with DroneUp*, WALMART (Dec. 15, 2022), https://corporate.walmart.com/newsroom/2022/05/24/were-bringing-the-convenience-of-drone-delivery-to-4-million-u-s-households-in-partnership-with-droneup.
[26] Asif Faisel et al., *Understanding Autonomous Vehicles: A Systematic Literature Review on Capability, Impact, Planning and Policy*, 12:1 J. TRANSP. & LAND USE 45, 49 (2019).

automation for vehicles which was later adopted by the National Highway Traffic Safety Administration (NHTSA).[27] Figure 1 below briefly describes the levels of automation.[28] The key thing to note in the graphic is that a vehicle is not considered an autonomous vehicle unless it is level 3 or above.[29] Additionally, once a vehicle achieves level 4 automation pedals and steering wheels may not be installed in the vehicle.

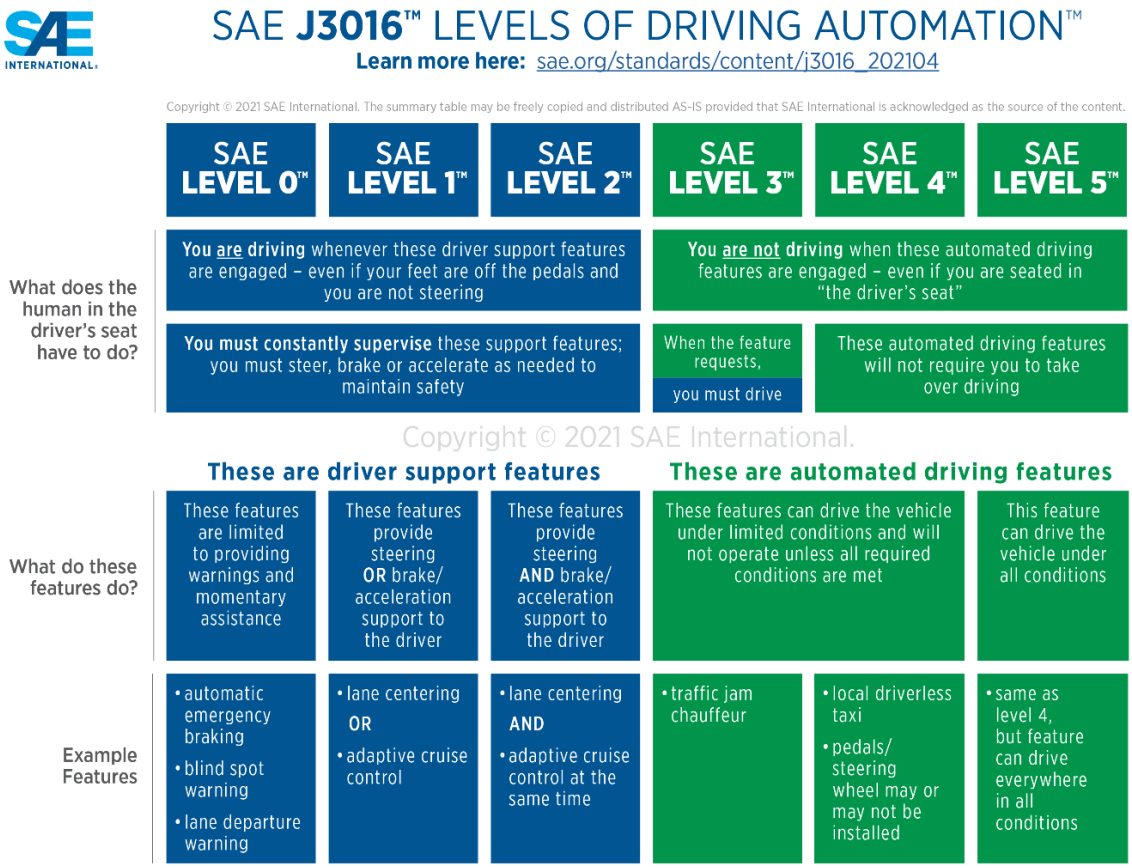

FIGURE 1: SAE AUTOMATION TAXONOMY[30]

Crashes involving traditional automobiles, vehicles lower than level 3 automation, are one of the leading causes of non-natural deaths for U.S. citizens,[31] with the NHTSA estimating about 42,795 fatalities in 2022 and 42,939 fatalities in 2021.[32] We must also consider the millions of people injured in motor vehicle accidents or the people affected by property damage caused by such accidents. Autonomous vehicles can significantly improve safety and reduce the number of accidents. With that in mind, the use of zoning and land use controls to regulate autonomous vehicles and the built environment would

[27] *Id.* at 48.
[28] *SAE Levels of Driving Automation™ Refined for Clarity and International Audience*, SAE INT'L: SAE BLOG (May 3, 2021), https://www.sae.org/blog/sae-j3016-update.
[29] *Id.*
[30] *Id.*
[31] *Global Road Safety*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/injury/features/global-road-safety/index.html (last updated Jan. 10, 2023).
[32] *NHTSA Estimates for 2022 Show Roadway Fatalities Remain Flat After Two Years of Dramatic Increases*, NHTSA (April 20, 2023), https://www.nhtsa.gov/press-releases/traffic-crash-death-estimates-2022.

foreseeably be constitutional because they have some relation to the "public health, safety, morals, or general welfare."[33] Additionally, the implementation of AVs may even lead to a relaxation of existing land use controls. This is even more persuasive given the way autonomous vehicles are likely to operate.

a. Operation of AVs

There is a debate in the literature regarding whether autonomous vehicles will be privately owned, operate as a service, or both.[34] Understanding the different methods of operation for AVs is important because it allows us to predict how AVs are likely to affect future land use patterns. As far as private ownership of AVs is concerned, not much would change except that the system is driving and not the person. The privately-owned AV could service the owner and other people approved by the owner who will have the exclusive ability to "call" or "hail" the AV. Additionally, since it is privately owned, the owner can leave their items in the vehicle because there would not be any other passenger calling their AV as in the ridesharing model.[35] However, this would be inefficient compared to the service model because the vehicle would likely remain idle for some period. This follows logically because after the private AV drops you off at your location it will not pick up another person, rather it will wait and park until the owner calls it again.[36] Additionally, private AVs are likely to be at a high cost not only in purchase price but also in routine maintenance due to the advanced operating systems and components and the technical expertise needed to perform that maintenance.[37] Some people may not want to incur those costs and will opt not to purchase their own AV and instead utilize a fleet that will handle those costs. Additionally, most people simply won't want to worry about having to park the AV or make sure it is charged. Though it is unlikely that private ownership of AVs would be banned in the U.S., these are all factors that would contribute to the decline of private vehicle ownership and the rise of robo-taxis and ridesharing.[38]

In contrast, the service model is much more efficient because AV fleets would utilize software "that optimizes the efficiency of the fleet so that a subscriber's wait and trip will be as short as possible."[39] Privately owned vehicles are a source of inefficiency because they are parked for about 95% of each day.[40] In the service model, the AV would simply pick up a new passenger nearby after dropping one off, which would reduce the amount of time a vehicle spends parked.[41] It is even predicted that software will allow passengers to share an AV ride.[42] For example, the AV may pick up multiple people who are heading to the same nearby location and the passengers would be picked up at multiple stops, which is akin to public transportation. This would further increase efficiency by reducing

[33] *Vill. of Euclid*, 272 U.S. at 388.
[34] *E.g.*, Faisel et al., *supra* note 26, at 50 ("AVs are expected to be operational as private and commercial vehicle[s].").
[35] However, it is possible that a person who owns an autonomous vehicle could "rent" it out to an AV fleet to make additional income. Used this way, the inefficiency of a privately-owned AV is reduced.
[36] Donald L. Elliott, *Getting Ready for Driverless Cars*, ZONING PRAC., Dec. 2017, at 2, 3.
[37] Todd Litman, *Autonomous Vehicle Implementation Predictions: Implications for Transport Planning*, VICTORIA TRANSP. POL'Y INST. 1, 10-11 (Jan. 25, 2023) (comparing the different ownership models and their costs).
[38] Elliott, *supra* note 36, at 3.
[39] *Id.*
[40] Crute et al., *supra* note 5, at 21.
[41] *Id.*
[42] Litman, *supra* note 37, at 8.

total vehicle miles traveled (VMT), congestion, and pollution.[43] Nevertheless, either the ridesharing AV fleet service model or the single-passenger AV fleet service model would have more pronounced effects on land use patterns than private ownership. Thus, the service model of AVs is the focus of this paper, though much of the analysis is relevant to a world where private ownership of AVs exists as well.

VI. Impacts of AVs on Land Use

There are projected to be many impacts on the built environment due to AVs, but not all those impacts are related to land use. Some of the more unrelated impacts will be consolidated in a later section.

a. Reduced Parking Demand

As alluded to earlier, one of the more significant land use changes due to AVs will be related to parking. Today, zoning codes regulate parking in many ways, such as minimum and maximum number of parking stalls allowed, dimensions of individual parking stalls, parking aisle widths, parking angles, off-street parking, driveways, materials used to make parking lots, and much more.[44] States and municipalities must also keep in mind the requirements demanded by the Americans with Disabilities Act (ADA) and the agencies granted authority by the ADA that set out further regulations, which include more than parking accommodations.[45]

The detail of these parking regulations demonstrates the importance of the automobile in the built environment. It also recognizes that parking is an integral component of traditional vehicles, which spend most of their useful life parked. They are parked when people are shopping, visiting, working, or sleeping, which is the bulk of the day.[46] However, these patterns of idle automobiles will become less common as service model AVs, as described earlier, become more prevalent. AVs have the potential to reduce parking space by about 61 billion square feet, which is nearly 42% of all parking spaces in the U.S.[47] This will reduce the urban heat island effect and open up valuable land in downtown cores for infill redevelopment opportunities.[48] Some old parking garages are already beginning to be redeveloped into mixed-use developments that include apartments, office space, a gym, and a dog washing station, recognizing that their structures are becoming obsolete due to age and the rise of AVs.[49]

[43] There may also be an in-between model via corporatized fleets. Hotels, airports, large employers, and others may operate their own AV fleet (by ownership or by agreement) which exclusively picks up and drops off employees and patrons, or at least prioritizes them over other members of the public.
[44] *See, e.g.*, CHANDLER, ARIZ., CODE OF ORDINANCES part VI, ch. 35, art. XVIII (2023).
[45] *See generally* Americans with Disabilities Act of 1990, Pub. L. No. 101-336, 104 Stat. 327; 28 C.F.R. § 36.304(b)(18)(2012) (providing accessible parking spaces).
[46] Gregory M. Stein, *The Impact of Autonomous Vehicles on Urban Land Use Patterns*, 48 FLA. ST. U. L. REV. 193, 206 (2021).
[47] Jason Henderson & Jason Spencer, *Autonomous Vehicles and Commercial Real Estate*, 14 CORNELL REAL EST. REV. 44, 46 (2016).
[48] Crute et al., *supra* note 5, at 46.
[49] David Kidd, *Neglected Parking Garages Are Being Given New Purpose*, GOV'T TECH. (Aug. 20, 2019), https://www.govtech.com/fs/infrastructure/neglected-parking-garages-are-being-given-new-purpose.html.

b. Road Recapture

Due to the efficiency and safety of AVs, rights-of-way may be reduced.[50] Though these changes likely won't occur until nearly all vehicles on the road are autonomous because current lane widths account for human drivers moving back and forth within the lane.[51] The estimated reduction of a highway lane due to AVs is about 3 feet.[52] This extra space could be used for extra lanes or other uses. The width reduction to non-highway roads may leave more space for bicyclists, pedestrians, drop-off lanes, or greenery.[53] Additionally, shoulders, which generally take up two additional lanes in size, may no longer be needed.[54] Their primary purpose is to allow drivers to pull to the side in the event of an accident or car problems, but they are rarely used.[55] When all vehicles on the road are AVs, they will likely talk to one another and be able to rapidly adjust to any obstacle, including an accident, a stopped vehicle, or emergency services.[56] For the same reason, medians between opposing traffic, which take up one or two lanes in size, may not be needed because humans won't be driving and AVs will recognize other AVs.[57] Due to their relation to rights-of-way, road signage, and billboards may also be reduced or eliminated because people won't need to use them to navigate as they won't be driving anymore.[58] Though it may not seem important, signage is a large portion of zoning and land use ordinances.[59]

c. Land Recapture, Lot Size Reduction, and Affordable Land

In addition to roadway recapture, there are many other ways that land can be reclaimed due to AV use. Enumerated in many land use codes are specific automotive uses, including parking lots, gas stations, dealerships, repair shops, parts retailers, car washes, and other auto-oriented uses.[60] These uses will become obsolete, depending on the model of AVs implemented, with the shared model having the most impact. This land can be repurposed for uses in higher demand, such as warehouses and distribution centers, EV charging stations, AV repair facilities, open spaces, and more.[61]

Other non-auto-oriented uses, but designed with the traditional automobile in mind, will also be affected. These auto-designed uses include restaurant drive-throughs and residential garages. Drive-throughs are within the ambit of land use codes, particularly design standards.[62] Many fast-food operators, drug stores, and banks seek larger lots to accommodate a drive-through component because land use codes can regulate the drive-through lanes and queuing (sometimes called "stacking"), exits and entrances, and

[50] Crute et al., *supra* note 5, at 41.
[51] *Id.*
[52] Stein, *supra* note 46, at 210-11.
[53] *Id.*
[54] Raymond, *supra* note 20, at 193.
[55] *Id.*
[56] *Id.* at 194.
[57] *Id.*
[58] *Id.* at 195.
[59] *See, e.g.*, CHANDLER, ARIZ., CODE OF ORDINANCES part VI, ch. 39.
[60] AM. PLANNING ASS'N, PREPARING COMMUNITIES FOR AUTONOMOUS VEHICLES 28 (Jennifer Henaghan ed., 2018).
[61] *Id.*
[62] *See, e.g.*, CHANDLER, ARIZ., CODE OF ORDINANCES part VI, ch. 35, art. XIX, § 35-1902(8)(c)(1).

more.[63] The rise of AVs will allow these operators to reduce their lot sizes, which means two things: (1) these operators will have lower costs with smaller lot sizes and (2) more land will be available. This effect will likely go beyond drive-through windows as well and create "ghost kitchens."[64] Ghost kitchens are restaurants that operate primarily online that allow for pick-up or delivery only (via companies like DoorDash), with no dining rooms.[65] This model became more popular due to the COVID-19 pandemic which caused many establishments to expand to delivery because they were required to close their dining rooms to the public.[66] This online-focused model is expected to be worth $71.4 billion by 2027.[67] AVs will likely accelerate that trend. Thus, considering many land use codes create lot size minimums for specifically enumerated uses, those may need to be reevaluated to contemplate less land-intensive uses.

For similar reasons, individual parking garages typically seen in single-family homes and townhomes will be less prevalent, particularly in the shared AV model.[68] Garages are typically regulated by building codes and standards, while the land use code focuses on the design and appearance of the garages themselves. The typical two-car garage comprises about 576 square feet of a home; this does not include the driveway which could double that size.[69] In a shared AV model, where people are less likely to own their own vehicles, there is no need for a garage or a driveway. If those are removed, the standard lot size for a house could fit an additional house or two.[70] With the US experiencing a housing shortage,[71] this could be a solution for municipalities trying to free up land for residential or multifamily development. Of course, more dwellings on smaller lots means increased density, which also implicates many governments' density regulations and calculations.

d. Urban Sprawl

Lastly, AVs may either encourage or discourage urban sprawl; the experts are still hashing out the debate as to which way it will go.[72] It's argued that AVs may encourage sprawl because they will lower the cost of travel, be less stressful to drive or ride in, and the passengers can utilize their travel time to sleep or be productive.[73] Additionally, if AVs are more efficient at traveling, reduce congestion, and can operate at higher speeds, then they may also encourage urban sprawl because it will take the same amount of time to go a further distance than in a traditional automobile.[74] On the other side of the debate, some experts suggest that AVs will lead to the "reurbanization of urban centers" because they will reduce private vehicle ownership, promote density, and promote walkable

[63] *Id.* (requiring queuing lanes be a minimum of 14 feet in width and 150 feet in length from the drive-up window to the start of the queuing lane. The queuing lane must accommodate at least 6 vehicles from the start of the lane to the menu board).
[64] Raymond, *supra* note 20, at 136-37.
[65] *Id.*
[66] Sandy Smith, *A Look Inside the $43 Billion Ghost Kitchen Industry*, NAT'L RETAIL FED'N (Oct. 13, 2021), https://nrf.com/blog/look-inside-43-billion-ghost-kitchen-industry.
[67] *Id.*
[68] Raymond, *supra* note 20, at 180.
[69] *Id.*
[70] *Id.* at 181.
[71] Anna Bahney, *The US Housing Market is Short 6.5 Million Homes*, CNN, https://www.cnn.com/2023/03/08/homes/housing-shortage/index.html (last updated Mar. 8, 2023).
[72] Litman, *supra* note 37, at 6.
[73] Crute et al., *supra* note 5, at 32.
[74] *Id.*

environments.[75] Cities across the U.S. are already using their zoning ordinances and general plans to encourage walkable environments and discourage automobile dependence.[76] AVs would only accelerate these trends. Some are calling this "sprawl repair," meaning AVs will increase the efficiency of urban and downtown districts for transit, distribution, and other aspects of the city.[77] Furthermore, if the cities take action to develop "mobility hubs," this would further promote compact development.[78]

VII. Other Impacts of AVs

a. Accessibility

As previously mentioned, municipalities must keep in mind the American Disabilities Act when implementing land use policies and building standards. This will only become more important with the rise of AVs. In the U.S., roughly one in every five people has a disability, such as blindness, deafness, physical issues, and many others.[79] There is also a large segment of the population who cannot drive, including those who are too young to drive and those who can no longer drive due to age.[80] AVs will restore freedom to these populations as they won't need to rely on anyone else (parents, caregivers, etc.) to drive them and the AVs will come to their locations instead of having to find the nearest public transit option.[81] However, to ensure these benefits, a wider application of the ADA may be necessary. There will not only be an intensified need to design buildings, streets, and cities for accessibility, but the AVs must themselves be accessible.[82] When AVs become the dominant form of travel, we must ensure that they can accommodate wheelchairs by including ramps, wider doors, and more.[83] Similarly, AVs must assist those with visual or mental impairments in navigating to the vehicle.[84] Additionally, the need for accessibility goes beyond the AVs and extends to the platforms and apps used for ride-hailing. Application of the ADA to AVs would be the most efficient way to ensure uniformity in accessibility across the states.

b. Pollution and Sustainability

In 2021, about 95% of all new vehicles sold were still gas operated.[85] Of those, heavy-duty vehicles, which are typically those vehicles with more than 4 wheels, are responsible for 25% of all U.S. transportation emissions.[86] When you add on non-heavy-duty

[75] *Id.*
[76] *See, e.g.*, PHOENIX, ARIZ., ZONING ORDINANCE, ch. 13, § 1301(B) (establishing the purpose of this section of the code is to promote density, promote multiple modes of transportation, and decrease automobile dependence, among others).
[77] AM. PLANNING ASS'N, *supra* note 60, at 17.
[78] *Id.*
[79] *Id.* at 12.
[80] Crute et al., *supra* note 5, at 31.
[81] *Id.*
[82] AM. PLANNING ASS'N, *supra* note 60, at 13.
[83] *Id.*
[84] *Id.*
[85] Gabe Samuels & Yonah Freemark, *The Polluted Life Near the Highway: A Review of National Scholarship And a Louisville Case Study* 6, URB. INST. (Nov. 2022), https://www.urban.org/sites/default/files/2022-11/The%20Polluted%20Life%20Near%20the%20Highway.pdf.
[86] *Id.*

vehicles, this number is even higher. There are also non-air pollution sources, such as tire wear, brake wear, and road wear.[87] This pollution also extends beyond physical particulates to include noise pollution and light pollution.[88] Despite the best efforts of land use regulations to minimize nuisances, all these pollution sources have a detrimental effect on human health and the environment. Additionally, few local land use regulations incorporate highway setback standards or development prohibitions to minimize exposure to any pollutants.[89] This might be due to takings laws, specifically regulatory takings where a property owner is either deprived partially or entirely of the economic value of their property due to regulations established by the local government.[90] There are also state regulations that expand on takings law.[91] Such setback standards or development prohibitions may be considered a "regulatory taking" because the owner of the property near the highway would be prohibited from building on their property within a certain distance of the highway. Though that is speculative because it could be argued there is a legitimate public health, safety, and welfare purpose, but governments generally don't want to take that risk.[92] Either way, pollutants have affected everyone, including those adjacent to highways or roadways.

Not all of these will be solved with autonomous vehicles; however, many may be reduced. Since all autonomous vehicles will likely be electric vehicles and AVs will operate more efficiently than human drivers, a pollution reduction may be realized.[93] However, such impacts may not be apparent until most of the vehicles on the road are AVs. Firstly, AVs will significantly reduce emissions, though the estimates vary.[94] Of course, this will cause additional demands on the nation's electrical grid and renewable power production will be needed to prevent increased pollution from power plants.[95] However, unlike traditional gas stations, EV charging stations don't contaminate the air, soil, or groundwater, which is a significant environmental benefit.[96] This may prompt municipalities to spur the remediation and development of brownfields caused by gas stations. Electric AVs will also reduce noise pollution because they are quieter than gas vehicles. Unfortunately, AVs will still have tire wear, brake wear, and road wear. In fact, they may have more of it depending on travel habits. Due to the lower cost of travel, the additional populations without the ability to drive that can travel, potential urban sprawl, and "empty congestion" AVs may ultimately have more VMT than people.[97] Arguably, the largest contributor would be "empty congestion" which is AVs driving without any passengers, usually to

[87] *Id.* at 7.
[88] *Id.*
[89] *Id.* at 13.
[90] *See Lucas v. South Carolina Costal Council*, 505 U.S. 1003 (1992) (held there was a full regulatory taking when the state legislature enacted a law that prohibited the property owner from building a habitable structure on his property that was located on an eroding beach); *see also Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104 (setting out factors to determine when there has been a taking).
[91] ARIZ. REV. STAT. ANN. § 12-1134 (A) (requiring just compensation for reduction in fair market value of a property as a result of any land use law enacted after the property is transferred to the owner).
[92] *Id.* § 12-1134(B) (creating exceptions for public health, safety, nuisances, and more); *see also Gorieb v. Fox*, 274 U.S. 603, 609 (1927) (affirming that a setback ordinance was not a taking requiring just compensation because the setback keeps dwellings farther from dust, noise, and fumes, and adds to the attractiveness of a residential district).
[93] Litman, *supra* note 37, at 6.
[94] Crute et al., *supra* note 5, at 31.
[95] Samuels & Freemark, *supra* note 85, at 5.
[96] Brian Ross et al., *Preparing for the Electric Vehicle Surge*, 39:10 ZONING PRACTICE 1, 4 (Oct. 2022).
[97] Crute et al., *supra* note 5, at 33.

go pick up a passenger.[98] There seems to be a tradeoff with AVs in that they require less parking, but they will use the road more frequently. This affects roadway planning which then affects the built environment.

c. Public Transportation and Infrastructure

The lower cost of AVs and the ability to hail a ride from any location may spell problems for government investment in public transportation and public infrastructure. Governments will need to find alternative sources of revenue to replace parking fees, traffic fines, emission testing, gas taxes,[99] and taxes lost due to a decline in dealerships and other auto-oriented uses.[100] Many of these sources go towards funding roadway repairs or expansions. Although roadway expansion may not be as necessary, AVs will still contribute to road wear and those repairs must be funded. Of course, some of that lost revenue may be somewhat offset by property taxes from new buildings constructed on land that once was relegated to parking. Additionally, funding may be saved if first responders (police, medical, fire, etc.) become less necessary due to law-abiding AVs. Generally, around 80% of a municipality's police force is allocated for traffic control in some way.[101] Those officers could be reallocated accordingly, although, these savings could be offset by an increase in inspectors, engineers, and data management professionals.[102] There may also be savings if there are fewer accidents causing property damage since AVs will operate more safely than humans. How much funding can be offset or saved is still unknown. However, new sources of revenue such as taxes on VMT or EV charging could emerge.

Likewise, public transportation is also at risk. Many governments already subsidize the cost of public transportation to move people around cost-effectively and increased ridership reimburses the government for that investment over time.[103] The shift to autonomous buses and other autonomous mass transit options could save millions in labor costs alone.[104] A reduction in accidents and other operation costs may also result in significant savings.[105] Despite those savings, AVs as a cheap and more comfortable alternative may entice riders away from public transportation.[106] To the extent that mass transit ridership declines significantly, governments may find they will have to reduce mass transit options or operate at a loss.

VIII. Current and Anticipated Regulations for Avs

a. Rethinking Parking

There are a lot of approaches to parking that governments can embrace due to AV emergence. Although AVs will reduce parking, they will still need some parking for

[98] *Id.*
[99] Stein, *supra* note 46, at 233.
[100] AM. PLANNING ASS'N, *supra* note 60, at 33.
[101] Dale Neef, *Driving Change: Preparing for Autonomous Vehicles is a Local Government Reality*, ICMA PM MAG. (Jun. 27, 2018), https://icma.org/articles/pm-magazine/pm-article-driving-change.
[102] *Id.*
[103] Stein, *supra* note 46, at 238.
[104] Crute et al., *supra* note 5, at 35.
[105] *Id.*
[106] Stein, *supra* note 46, at 238.

storage, charging, or maintenance. Parking structures for these purposes are likely to be pushed outside of the city onto exurban lands.[107] All of these parking structures, whether some remain in core downtown areas or not, will need to have considerable charging capacity since all AVs are likely to be electric.[108] Zoning regulations need to be prepared to permit, by right or conditionally, parking structures outside of dense downtown areas. This is particularly true if they would like to make more land available and promote the redevelopment of valuable urban centers.

Additionally, certain developers are also working on communities that are entirely "car-free"[109] and there is already a trend in cities, such as San Francisco and San Diego, removing parking minimums from their ordinances.[110] While it's clear that larger cities are getting creative to free up land, smaller municipalities are also preparing for reductions in parking demand. Chandler, Arizona amended its code of ordinances several years ago with a new purpose to "[a]dapt to changes in demand for parking and loading areas resulting from changes in transportation behavior such as ride-sharing and new technology such as autonomous vehicles."[111] The ordinance even allows for a reduction in parking requirements of up to 40% due to ride-sharing and autonomous vehicles.[112] As the number of AVs on the road rise, the prevalence of similar code provisions will likely increase as well. The original purpose of parking minimums was simply to ensure that there would be enough parking for a particular use on a property. Uses with a lot of vehicle turnover and foot traffic, such as grocery stores require a lot of parking. Many land use codes still operate this way. This reinforces the idea that development is very car-centric. However, there is less of a need to ensure a set amount of parking for certain uses because people will get dropped off instead of parking. Instead of allowing a reduction to parking minimums, an alternative could be establishing parking maximums.[113] Portland's ordinance sets out differing parking maximums according to the use category.[114] Those uses that are easily accessed by walking, biking, or nearby public transportation, will have lower parking maximums because parking is not needed as much as those uses located in the periphery of the city. Perhaps the best approach until full autonomy is a mix of the two, considering private vehicle ownership will not disappear overnight.

b. Dedicated Drop-Off and Pick-Up Lanes

When Uber and Lyft launched, one of the biggest concerns was dropping people off. Some streets are overly narrow and are replete with on-street parking, leaving ride-sharing services to drop people off or pick people up in the middle of the street. This has obvious safety concerns, but it also impedes traffic flow. AVs will only exacerbate this problem. Thus, there will be a need for designated drop-off and pick-up areas or lanes for

[107] *Id.* at 207.
[108] *Id.* at 206.
[109] *See generally*, CULDESAC, https://culdesac.com/ (last accessed Oct. 1, 2023).
[110] Jack Skelley, *California Relaxes Parking Mandates to Free Up Land for Multifamily Development–but Will Neighbors and Lenders Approve?*, URB. LAND INST. (Jan. 3, 2023), https://urbanland.uli.org/planning-design/california-relaxes-parking-mandates-to-free-up-multifamily-development-but-will-neighbors-and-lenders-approve/.
[111] CHANDLER, ARIZ., CODE OF ORDINANCES pt. VI, ch. 35, art. XVIII, § 35.1800.
[112] *Id.* § 35.1807.
[113] *See, e.g.*, PORTLAND, OR., CITY CODE § 33.266.115 (establishing parking maximums to promote efficient use of land, enhance urban form, encourage other travel modes, and protects air and water quality).
[114] *Id.*

efficiency and public safety.[115] Such areas already exist in high passenger loading and unloading locations, such as airports, hotels, elementary schools, and stadiums. It is also common to find designated drop-off and pick-up areas for public transportation, such as bus stops. Governments must be prepared to expand these areas for AVs. They must explore new curb cuts and designs for these drop-off areas to accommodate people, especially those with disabilities or impairments. Today, few zoning codes have ordinances addressing drop-off or pick-up locations for office buildings, multifamily, or other uses.[116] Incorporating these into a building's design or site plan will be increasingly important, especially in those locations where people will be arriving or leaving at the same time, such as office buildings.[117] In some cases, previously existing on-street parking might be converted into these drop-off areas.

c. New Uses and Flexible Zoning Codes

As discussed, AVs will free up large portions of land by reducing auto-oriented properties, reducing parking, eliminating driveways and garages, narrowing roadways, and reducing drive-through stacks. Zoning and building codes should be promulgated to allow lower lot sizes, higher densities, and larger floor-to-area ratios, otherwise the freed land will simply remain vacant and not be put to its best or most efficient use. New uses will need to be categorized, such as large-scale AV repair facilities, large-scale AV cleaning facilities, large-scale charging facilities, or a combination of these.[118] New tools for spurring development will need to be implemented to redevelop former parking sites or brownfields. "Brownfields" refer to land that has been contaminated with a hazardous substance, such as gasoline (from leaking gas stations), and requires remediation before it can be redeveloped.[119] This development or redevelopment will need to focus more on other forms of transportation, such as walking, biking, and more.

Aside from newly constructed developments, can existing properties reuse land they free up? Can a property owner decide to eliminate all their parking one day, provide drop-off zones, and expand the use with the remainder of their site? Could the property owner perform a lot split and sell the other parcel to another party for development? This calls for flexibility in zoning codes.[120] For example, a one-acre lot with multifamily development of 35 units and a parking lot may not be able to construct additional units on the former parking lot because density calculations may require a rezoning of the property to a category that allows for higher density. Or should this land be used for additional amenities, landscaping, green space, or stormwater management? Should land freed up from dedicated rights-of-way be preserved for not only drop-off zones but also for smart technology infrastructure?[121] The speed of change may require that

[115] Stein, *supra* note 46, at 230.
[116] Elliott, *supra* note 36, at 4.
[117] Stein, *supra* note 46, at 231.
[118] Raymond, *supra* note 20, at 315-16.
[119] Small Business Liability Relief and Brownfields Revitalization Act, Pub. L. No. 107-118, 115 Stat. 2356-2375 (codified in scattered sections of CERCLA, 42 U.S.C.A. §§ 9601-9675, including 42 U.S.C.A. §§ 9601(35), (39)-(41), 9607(o)-(r), 9622(g), 9628) (defining "brownfields" and promoting redevelopment and encourage cleanup).
[120] Brandon Fuller, *Cautious Optimism About Driverless Cars and Land Use in American Metropolitan Areas*, 18:3 CITYSCAPE: A J. POL'Y DEV. RSCH. 181, 183 (2016).
[121] Tyler Duvall et al., *A New Look at Autonomous-Vehicle Infrastructure*, MCKINSEY & CO. (May 22, 2019), https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/a-new-look-

municipalities update their plans and codes more frequently to address some of these issues.[122]

Perhaps form-based codes provide this flexible solution. A form-based code is "a land development regulation that fosters predictable built results and a high-quality public realm by using physical form (rather than separation of uses) as the organizing principle for the code."[123] As has been noted, traditional zoning codes tend to over-regulate, which causes problems for developers by prohibiting certain projects:[124] projects that could otherwise exist if it were not for density thresholds, minimum lot sizes, and minimum setbacks. Certainly, a developer could secure a variance from some of these requirements, but that is another, potentially lengthy and costly process, which may deter development. This may also impact municipal administration efficiency if they receive a large increase in variance applications. The main point is that form-based codes would allow for flexibility to technological change without requiring municipalities to amend their zoning codes as frequently or impede efficiency.

IX. Other Legal Issues

One of the first legal issues that come to mind when considering autonomous vehicles is insurance liability. Who should be responsible in the event of a crash involving an AV? In theory, liability should shift from the driver of the vehicle to the manufacturer.[125] Since the driver will do less and become more reliant on the technology supplied in the vehicle, product liability theories may be more applicable in AV crashes.[126] Manufacturing defects, software errors and glitches, and other problems are common with technology. If any of these occur during a trip with an autonomous vehicle, it could very well cost someone's life. To mitigate some of that liability, manufacturers are likely to install redundant systems in the event of main system failure.[127] However, a new problem posing significant liability is hacking.[128] Future insurance models must include cybersecurity insurance to counter this problem. Due to the number of cameras and sensors, issues regarding customers' privacy and data arise. Manufacturers will be in a better position to collect data from passengers than insurers.[129] This data will be essential for insurers' ability to underwrite the risks.[130] Should policies require data-sharing in the interests of public safety?

Aside from insurance, there will need to be uniformity of AV regulation across the U.S. Each jurisdiction will need standards for installation, technical requirements, and scheduled updates.[131] These regulations become important when AVs go beyond their

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at-autonomous-vehicle-infrastructure. Advanced traffic management systems can communicate with AVs to allow for safer and more efficient travel.

[122] AM. PLANNING ASS'N, *supra* note 60, at 16.

[123] Daniel Herriges, *6 Reasons Your City Needs a Form-Based Code*, STRONG TOWNS (June 8, 2020), https://www.strongtowns.org/journal/2020/6/8/6-reasons-your-city-needs-a-form-based-code.

[124] *Id.*

[125] Karlyn D. Stanley et al., *Autonomous Vehicles and the Future of Auto Insurance*, RAND CORP. (2020), 1, 15.

[126] *Id.*

[127] Crute et al., *supra* note 5, at 17.

[128] *Id.* at 29.

[129] Stanley, *supra* note 125, at 14.

[130] *Id.* at 16.

[131] Stein, *supra* note 46, at 218.

testing areas and cross-state lines, which would cause a significant burden on interstate commerce. As it is, many states have different regulations for AVs and some states have no regulations for them at all. Some states strategically have more permissive AV laws to encourage growth and investment in the state economy.[132] The federal government has been working for years on uniform AV regulation that would preempt state regulation through the SELF DRIVE Act and the AV START Act, but they have not made much progress.[133] This lack of uniformity impedes AV growth and could potentially prohibit certain vehicles from crossing state lines. Until the states develop accepted standards, or the federal government steps in, the dormant Commerce Clause may hang over AV regulation as a means of achieving uniformity.[134]

X. Implementation Challenges

The implementation of an entire fleet of AVs is not without its challenges. Autonomous technology is still evolving and there are a lot of unknowns. What will AVs look like between now and when they are nearly 100% of all vehicles on the road? What changes will we need to make to roadway infrastructure to assist with this transition? How do we as a society justify AVs replacing millions of jobs? To increase the efficiency of AVs, how do we address the last mile problem?

a. Roadway Infrastructure and Conditions

AVs will not be able to operate on all roads and in all conditions overnight. To assist AVs in safe and efficient operation, roadway infrastructure needs to be changed accordingly. Road alignments, road markings, roadway surfaces, bridge design, tunnel and underpass design, traffic signs and signals, lighting, and weather, all have significant impacts on the operation of AVs.[135]

Studies have shown that the horizontal and vertical curvatures of certain roads affect AVs' ability to identify lane markings, their collision avoidance systems, speed control systems, and more.[136] While the number of AVs on the road is still small, the effects of roadway alignments will worsen as more AVs are introduced. Of course, the AVs may not be able to detect lane markings if they are poorly marked or inconsistent, which poses another problem.[137] Additionally, AVs will have problems because not every road is constructed with the same material. In rural or exurban areas, dirt or gravel roads without lane markings are common. An AV system that is trained on smoothly paved roads with lane markings cannot operate, or operate safely, without those conditions. This would effectively prohibit those outside of urban areas from riding in an AV. Even on paved

[132] Zachary Briers, *Automated Vehicle Regs and the Dormant Commerce Clause*, LAW 360 (Feb. 9, 2017, 1:05PM), https://www.mto.com/Templates/media/files/Reprints/Automated%20Vehicle%20Regs%20And%20The%20Dormant%20Commerce%20Clause.pdf.
[133] Lillianna Byington, *Self-Driving Car Bill Sponsor Sees Path to Enactment Next Year*, BLOOMBERG (Jul. 20, 2022, 3:18 PM), https://about.bgov.com/news/self-driving-car-bill-sponsor-sees-path-to-enactment-next-year/.
[134] Briers, *supra* note 132.
[135] Oguz Tengilimoglu et al., *Implications of Automated Vehicles for Physical Road Environment:A Comprehensive Review*, 169 TRANS. RESEARCH PART E: LOGISTICS & TRANS. REV. 1 (2023).
[136] *Id.* at 7-8.
[137] *Id.* at 12.

roads, the increased travel can increase pavement deterioration which can cause wheel wandering, skidding, loss of control, and more.[138] This increased travel and the ability of AVs to travel closer together ("platooning") raises structural integrity questions for bridges, which were designed with the number of vehicles and weight in mind.[139] Tunnels and overpasses may also need to be redesigned to accommodate satellite signals and connectivity which AVs rely on to operate.[140] AV recognition technology is also impacted by the lack of uniformity in traffic signs and signals.[141] Proper roadway illumination will also be important to assist the recognition technology in detecting these signs, roadway markings, and other variables.[142] Lastly, weather conditions can affect an AV's recognition technology as well. Individually, each of the issues above is a problem for efficient and safe AV operation; however, combined, these issues render AV operation impossible in certain situations. Until roadway infrastructure is updated to AV use, it will be some time until AVs dominate the roadway.

b. Public Perception and Job Losses

Despite the many benefits of AVs, public perception will be key to their increased adoption. About 62% of local government officials believe AVs will face public opposition.[143] This belief is supported by a study showing that 63% of Americans would not want to ride in an AV.[144] Additionally, 45% of Americans are not comfortable sharing the road with AVs. When coupled with the fact that AVs may affect 15.5 million workers, including truck drivers, taxi drivers, delivery drivers, construction workers, waste management professionals, healthcare professionals, first responders, and more, the opposition only grows.[145] However, AVs are projected to be a trillion-dollar industry that will create a lot of jobs as well, requiring maintenance, cleaning, programming, and other roles.[146] Nevertheless, this is not a change that occurs overnight.

c. Last-Mile Problem

The first and last-mile problem in the context of passenger transport refers to the difficulty of picking up and dropping off riders in front of their destination.[147] In other words, people have to travel (walk, bike, etc.) to a designated pick-up location to be driven to their destination and once dropped off people will need to travel to their destination. This problem has been one of the biggest barriers to increasing public transit ridership.[148] However, AVs offer an opportunity to reduce the first and last-mile problems for passengers and pick them up closer to or in front of their homes, workplaces, or other

[138] *Id.* at 9, 11.
[139] *Id.* at 16.
[140] *Id.*
[141] *Id.* at 13.
[142] *Id.* at 18.
[143] Freemark et al., *Are Cities Prepared for Autonomous Vehicles?*, 85 J. AM. PLANNING ASS'N 133, 145 (May 24, 2019).
[144] Lee Rainie et al., *4. Americans Cautious About the Deployment of Driverless Cars*, PEW RSCH. CTR. (Mar. 17, 2022), https://www.pewresearch.org/internet/2022/03/17/americans-cautious-about-the-deployment-of-driverless-cars.
[145] Crute et al., *supra* note 5, at 38.
[146] *Id.*
[147] *Id.* at 35.
[148] *Id.*

destinations.[149] However, the last-mile problem in the context of package delivery is not as simple. The last mile contributes to over 25% of total shipping costs.[150] Delivery drivers must find your address, park their vehicle, walk to your front porch, ring the doorbell, or knock, then leave the package with its recipient or somewhere on the porch. It sounds simple, but some addresses are hard to find, some areas are in gated communities, the delivery may require walking up several flights of stairs, and there are any number of other obstructions to the efficient delivery of packages. At the moment, AVs cannot perform all of these tasks, though, companies like Amazon are already exploring solutions to this problem.[151] The patent details two or more autonomous vehicles, such as a drone and a small autonomous courier, working in tandem to overcome common delivery obstacles.[152] However, other last-mile problems will persist. Some have speculated that solving the last-mile problem may require changing structures to include mechanized drop-boxes for AVs to drop off packages and a box to pick up packages, trash, or recyclables.[153] Until then, such challenges may impede the growth of autonomous couriers which means package delivery is likely to remain costly and inefficient.

d. Nonconforming Uses

Another challenge, which is always a challenge when local governments update zoning ordinances, is addressing nonconforming uses. A nonconforming use is a use that is unlawful after the passage of a new ordinance but may continue if it lawfully existed before the adoption of the new ordinance.[154] There are several types of nonconforming uses: (1) nonconforming buildings, (2) conforming uses of nonconforming buildings, (3) nonconforming uses of conforming buildings, and (4) nonconforming uses of land.[155] For example, a bar in a residential-zoned area may be a nonconforming use if it existed before the land was zoned residential. Essentially, these are vested rights that cannot be taken without just compensation.[156] However, nonconforming uses may not exist in perpetuity if the use is changed, if the property is substantially destroyed, if the use of abandoned or discontinued for a certain period, or if significant repairs or alterations are made.[157]

Many of these nonconforming use restrictions are already present in many land use codes today. However, despite those limitations, some nonconforming uses can continue for decades. Thus, if municipalities amend their ordinances as predicted or suggested in this article, then there will potentially be many nonconforming uses that conflict with the operation of AVs or future development generally. As such, there may be a need to include a more aggressive method of eliminating nonconforming uses. Such aggressive and proactive management of nonconforming uses originated in the early 1900s.[158]

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[149] *Id.*
[150] Raymond, *supra* note 20, at 102.
[151] U.S. Pat. No. 10,514,690 B1 (issued Dec. 24, 2019).
[152] *Id.*
[153] Raymond, *supra* note 20, at 110.
[154] Juergensmeyer et al., *supra* note 9, at § 4:31.
[155] *Id.*
[156] U.S. Const. amend. V ("[N]or shall private property be taken for public use, without just compensation.").
[157] Juergensmeyer et al., *supra* note 9, at § 4:33.
[158] *Hadacheck v. Sebastian*, 239 U.S. 395 (1915) (Court affirmed that the City could remove uses that existed before the City's ordinances applied to the annexed land without providing just compensation); *see*

Amortization is a tool that allows governments to proactively terminate nonconforming uses without waiting for a nonconforming use to be destroyed or abandoned. Generally, amortization allows the nonconforming use to continue until the owner has recouped their investment or until the end of the nonconforming use's "estimated useful economic life."[159] As long as the time period allows for either of those two things, then just compensation is not required, and the amortization ordinance is constitutional.[160] In planning for a future with AVs, the transportation network will be even more important than it is today. Nonconforming uses can get in the way of building an AV-friendly network, such as pick-up and drop-off areas, curb cuts, and more. To prevent disruption and promote development in an AV-centric environment municipalities should consider adopting amortization provisions for parking lots, on-street parking, parking garages, and other auto-oriented uses that will become nonconforming upon enactment of parking maximums or other suggested provisions in this article.

XI. Conclusion

In conclusion, the implementation of AVs presents both opportunities and challenges. AVs are expected to reduce parking demand, lead to opportunities for road and land recapture, and provide more affordable land. However, they may also contribute to urban sprawl, "empty congestion," and increased vehicle miles traveled. Beyond land use, AVs will enhance accessibility by providing mobility solutions for people who are unable to drive, thereby increasing transportation equity. Additionally, AVs have the potential to address pollution and sustainability concerns by facilitating the adoption of electric vehicles and optimizing traffic flow. However, governments will need to find alternative sources of revenue, and public transportation systems will need to be updated.

Other legal considerations in AV implementation must also be considered. The potential shift of liability from drivers to manufacturers, the necessity of uniform regulations across jurisdictions, and cybersecurity and data issues all require careful attention. Furthermore, challenges in AV implementation must be addressed. Changes to roadway infrastructure, public perception, job displacement, and the last-mile problem in passenger transport and package delivery necessitate innovative solutions.

In essence, the integration of AVs into our daily lives has the potential to revolutionize urban planning, redefine land use, and transform the way we move. By proactively addressing the challenges and leveraging the opportunities presented by AVs, we can strive towards creating sustainable, accessible, and efficient cities of the future. Stakeholders, policymakers, and communities must collaborate and prepare for this transformative shift in transportation.

also State ex rel. Rema Realty Co. v. Jacoby, 168 La. 752 (1929) (upholding amortization in an ordinance which granted a drug store one year to liquidate).

[159] Joseph Michaels, *Amortization and the Constitutional Methodology for Terminating Nonconforming Uses*, 41 URB. LAW. 807, 810 (2009).

[160] *Id.* at 814.