3 Sharing, Electrification and Automation REVOLUTIONS

ITS UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

Policy Brief

April 2017

Land Use and Transportation Policies

Authors:
Marco Anderson, Southern California Association of Governments (SCAG)
Nico Larco, University of Oregon

Contributors:
Giovanni Circella, University of California at Davis
Lisa Aultman-Hall, University of Vermont

In November 2016, the Institute of Transportation Studies at the University of California, Davis (ITS-Davis) convened leading academic, government, private industry, and public interest stakeholders to explore science-based policies that could steer the three transportation revolutions- shared mobility, electrification, and autonomous vehicles, toward the public interest.

This policy brief reflects the opinions of the authors and not UC Davis. This brief is one in a series that presents a range of policy concepts, recommendations and research needs discussed at the 3 Revolutions Conference.

Contact: Mollie D'Agostino mdagostino@ucdavis.edu with additional questions.

*Visit: **3rev.ucdavis.edu** for additional policy briefs, event alerts, and news.*

Summary

For 50 years, American geography and land use has been centered on the personal car. The three revolutions in vehicle sharing, automation and electrification present new challenges and also great opportunities for land use and transportation planners. Absent policy reform the three revolutions may contribute to more sprawl, but a sustainable planning approach that supports both higher-density development and lower single-occupant (or zero-occupant) driving can once again put people first rather than their cars.

Introduction

The three revolutions in shared mobility, electrification and automation will radically transform transportation. These technological innovations have a large potential for decreasing the perceived time and cost of travel, increasing distances people are willing to travel, and increasing urban sprawl.[1] While some metro areas in the U.S. saw increased infill development over the last decade, simply encouraging more high-density development to occur is not enough to ensure sustainable communities in our new transportation era. Local and regional planners will need a suite of land use and transportation policies that support both higher-density

development and lower single-occupant (or zero occupant) driving.

This policy brief highlights key issues for land use and transportation planning, introduces a set of policy recommendations, and expands on where more research and analysis is needed to identify how the three revolutions can provide us an opportunity to rethink not just how we move around, but also the way our communities look and feel every day.

Findings

The following findings highlight the interconnected land use and transportation impacts of the three transportation revolutions.

Automation. Current research and modeling indicates that if automation technologies are deployed in an unfettered market setting, reductions in trip time and cost will likely increase single-occupant (and potentially zero-occupant) vehicle travel, increase trip distances and shift trips away from transit. Because passengers will be able to communicate, work, and even rest in their cars, autonomous vehicles may accelerate sprawl by increasing the distances people are willing to commute.[2]

Eventually this could result in shifting land use patterns as people with access to autonomous cars are willing to live farther away from city centers, where housing units are larger and increasingly available, and housings costs are typically lower per square foot.

Shared Mobility. The introduction of shared mobility services, such as ride-hailing, car-sharing, and bike-sharing has already started to revolutionize the way we travel. As more adoption occurs, these services could potentially affect vehicle ownership rates and the use of other modes of transportation, among other effects. Street level pick-up and drop-off design, parking, roadway funding models, will soon require updating as multimodal shared mobility services gain mode share.

Electrification. Widespread adoption of electric vehicles will may contribute to changing land use patterns and driving behaviors among electric vehicle users. This shift will also increase the need for Electric vehicle charging infrastructure.[3]

Convergence of The 3 Revolutions. A key objective of this brief is identifying a sustainable path forward. Through the convergence of shared mobility, automation, and electrification there is the potential to mitigate the negative externalities of 20th century auto-oriented sprawl, negate any additional sprawl associated with automation, and provide rapid responses to enable sharing and electrification.

Policy Recommendations

1) The best policies to mitigate autonomous vehicle-induced sprawl are many of the same policies currently being implemented to mitigate traditional sprawl.

Regional planning agencies across the country have been developing and disseminating land use and urban design strategies since the late 1990's with the objective of countering a bias towards auto-oriented urban form. These techniques have taken different names and include related approaches inspired by the concepts of smart growth, new urbanism, and now sustainable communities planning.

Since their reinvigoration, these techniques have been deployed and tested in new master-planned developments, re-invented suburban downtowns, and in revitalized urban communities. These strategies are shown to be most effective if coupled with pricing mechanisms, investments targeted at upgrading urban

1 The term sprawl signifies a historic land use pattern that favors development on the urban fringe to accommodate growth. In the U.S. it is typified by lower-density and auto-oriented land use patterns that separate residential from commercial and other land uses and expand a metro area boundary into previously rural land.

2 Childress, Suzanne, Brice Nichols, Billy Charlton, and Stefan Coe. "Using an Activity-Based Model to Explore Possible Impacts of Automated Vehicles." Presentation, 2015 Transportation Research Board Annual Meeting, 2015 https://psrc.github.io/attachments/2014/TRB-2015-Automated-Vehicles-Rev2.pdf

3 While this brief discusses electric vehicles to some degree, the focus of the brief is on sharing and automation. See https://3rev.ucdavis.edu/policybriefs for additional discussion of electric vehicle charging infrastructure.

public transportation, and the development of transit oriented developments.

2) The most important policy levers to mitigate against more sprawl and environmental damage will be pricing.

There are several types of effective pricing mechanisms that are recommended:

2a. Pricing mobility: Pricing travel by VMT, vehicle size and incentivizing increased vehicle occupancy, while strongly dis-incentivizing zero occupancy trips will send the necessary signals that use of the roadways incurs societal costs. And that all roadway users must share the burden of these costs. California[4] and Oregon[5] are among the leading states exploring options for replacing the gas tax with a VMT tax, both have established pilot programs as a first step.

2b. Pricing open space and incentivizing infill: Policies that accelerate adoption of sustainable development planning, facilitate infill and reveal the full life-cycle costs of greenfield development will be most effective at shortening vehicle trips.

Smart growth strategies such as facilitating infill development, encouraging density, discouraging greenfield development, and preserving valuable natural and working lands are already in the regional growth policies for the largest metropolitan areas in California and across the country.

Urban growth boundaries (UGBs) such as those employed statewide in Oregon[6] and Maryland[7] can also help minimize sprawl. In other areas, natural lands preservation can take the place of UGBs.

These policies will be more effective in discouraging significant autonomous vehicle travel increases to the extent that they are mandated and consistently funded.

2c. Pricing parking: A tiered set of parking reforms are needed as shared mobility increases and the need for parking decreases. It is also well-documented that parking pricing is proven to be an effective lever at affecting behavioral change in drivers.[8] There is consensus building that a shared autonomous vehicle future will drastically reduce demand for parking in some places,[9] but there is no guarantee that this scenario is the only that will come to pass. If excess on-site or adjacent parking continues to be the norm, then we can expect a proliferation of individually owned self-driving cars that drop off passengers and park nearby waiting to be summoned by riders.

First, jurisdictions should immediately eliminate (or drastically reduce) minimum parking requirements for buildings and implement parking maximums in urban areas with existing parking structures. As the future unfolds, jurisdictions may consider taxing existing, or new parking spaces, or mandating that new structured parking be designed to allow retrofit for other uses in the future.

3) Operationalizing a fix-it-first policy will allow regional transportation agencies to make best use of transportation investments and prevent sprawl.

The nation's infrastructure is becoming increasingly

4 California Transportation Commission (CTC) Home, State of California. "Road Charge Technical Advisory Committee." Last modified 2017. http://www.catc.ca.gov/meetings/Committees/Road_Charge/Road_Charge.html

5 State of Oregon, Oregon Department of Transportation. "About." MyOReGO. Accessed March 20, 2017. http://www.myorego.org/about

6 "The Urban Growth Boundary | Oregon First." When You Think Real Estate, Think Oregon First!. Accessed March 20, 2017. http://www.oregonfirst.com/2015/07/22/questions-answers-about-the-urban-growth-boundary

7 "Managing Maryland's Growth, Models and Guidelines, Urban Growth Boundaries : ConservationTools." ConservationTools. Accessed March 20, 2017. http://conservationtools.org/library_items/675-Managing-Maryland-s-Growth-Models-and-Guidelines-Urban-Growth-Boundaries

8 Shoup, Donald The High Cost of Free Parking, Chicago: Planners Press, 2005 and 2011.

9 Fagnant, Daniel J., Kara M Kockelman, and Prateek Bansal. "Operations of Shared Autonomous Vehicle Fleet for Austin, Texas, Market." Transportation Research Record: Journal of the Transportation Research Board 2536, no. 12 (2015).

compromised by decades of underinvestment in maintenance. Over time this underinvestment becomes more costly as the more roads deteriorate the more expensive they cost to fix.[10] Furthermore, the fractured nature of infrastructure funding results in sprawl as a function of preferences towards building new infrastructure and development at the expense of maintaining existing systems.

Automakers and technology companies have stated repeatedly that the most important thing that governments can do is provide smooth, clean, well-painted roadways. This will only continue to be a priority as the three revolutions unfold. Autonomous vehicles will likely require additional costs for maintenance (due to the need of better road infrastructure, good maintenance and well-painted roadways). This impact would be exacerbated if accompanied by land use shifts favoring lower-density development.

Transportation planning agencies should take this mission to heart by prioritizing maintenance of existing infrastructure.

4) Replacing federal, state and local auto-oriented transportation engineering with multimodal integrated transportation policies will encourage the environmental and community benefits of the three revolutions.

State, regional, and local jurisdictions must continue to break down the pillars of post-war, auto-biased planning policies. The following need to be reformed to reduce the probability of the three revolutions resulting in increased greenhouse gas emissions and decreased human safety and wellness.

4a. Ensure multimodal roadway engineering standards replace auto-centric policies. The three revolutions will mean that traditional one-size-fits-all auto-oriented engineering standards will no longer apply. Federal and state departments of transportation have issued guidance to allow new roadway designs that favor inclusion of active transportation. More state and local agencies are using guidance from the National Association of City Transportation Officials (NACTO) Urban Street Design Guide, which includes multimodal urban roadway designs.[11]

4b. Develop multimodal roadways and policies to support autonomous vehicles in performing safely. In the early days of the growth of the private automobile in America, automobiles were viewed as an intruder in the public space of the street and people actively resisted their introduction into urban environments. In the early 1920s, safety advocates adopted a more pragmatic approach, and began to transfer responsibility for street safety from the motorist to the people in the street.[12]

Urban planners and livability advocates have made significant gains in the last ten years in reestablishing the importance of walkable streets. In recent years, cities such as New York, Chicago, Los Angeles, and Seattle have adopted Vision Zero policies, which state that transportation decisions will be made to reduce traffic and pedestrian fatalities to zero.

To maintain and expand these gains, federal and state policies should require that safety benefits take precedence over congestion benefits in urban environments. While current federal guidelines require autonomous vehicles to comply with all relevant local vehicle laws, the guidelines also allow that in order to adapt to social norms, sometimes strict adherence can be waived. For example, humans understand when it is safe for a driver to cross double yellow lines into oncoming lanes to pass a stopped vehicle, or to safely pass a bicycle rider.

There may be certain scenarios where there is rationale for autonomous vehicles to drive at higher freeway travel speeds, such as on freeways, but on urban streets speed limits must be maintained, and perhaps lowered to increase safety for (and its perception among) non-motorized travelers.

10 Walter, Ingo. The Infrastructure Finance Challenge. New York: New York University/Stern School of Business, 2016.

11 Urban Street Design Guide." National Association of City Transportation Officials. http://nacto.org/publication/urban-street-design-guide

12 Peter D. Norton, Fighting Traffic: The Dawn of the Motor Age in the American City, Cambridge: The MIT Press, 2008 and 2011

Land Use and Transportation Policies

5) Reforming state, local and regional land-use policies to support the three revolutions will require reform to development and redevelopment practices and increased public private partnerships.

5a. State level reform of traffic impact study requirements. In California, SB 743 mandated that developers measure travel impacts of new residents traffic in terms of vehicles miles traveled, replacing the auto-oriented level of service measurements.[13]

This policy will likely incentivize developers to consider how they can reduce the VMT of the project by enabling adoption of electric vehicle charging infrastructure on-site or employing design elements to encourage car- and ride-sharing.

5b. Broaden the allowable uses for development/ traffic impact fees to encourage multimodal and sharing infrastructure. Cities can work with real estate developers to leverage creative development mitigation fees that are aimed at reducing emissions and VMT. The three revolutions will require developers to go further than paying only to widen roads or provide parking. Developers will play a critical part in shaping transportation options, including funding the development of shared mobility infrastructure. For example, in the San Francisco Bay Area, the Green Trip accreditation system allows developers and cities to agree to reduce parking requirements in exchange for shared mobility amenities such as bike sharing or car sharing stations.[14]

5c. Support transit-oriented community planning, which is more critical than ever in the new transportation era.

The last decade saw regeneration of central parts of many US cities through increased infill development and an increased number of households living in mixed-use central business districts.[15] However, the three revolutions, and autonomous vehicles in particular, have the potential to disrupt these trends.

Furthermore, simply encouraging high-density development to occur adjacent to transit is not enough to ensure transit remains competitive in a new transportation era. Local and regional plans should introduce a suite of policies that lead to both higher-density and lower car-dependent neighborhoods.[16]

Therefore, primarily, increasing density is an important priority for the three revolutions, given that there is a higher likelihood that autonomous vehicles will be shared in higher density transit-rich areas. In these areas residents and workers are more likely to take advantage of the ease of maintaining a car-free or car-lite lifestyle.

It is also important that development practice continue to support a range of land-use policies that reduces car-dependence and embraces sharing and transit use. This includes, among other elements, mixed-use zoning, reducing vehicle speeds, replacing obsolete parking with active uses, and replacing street parking with pick-up/drop-off areas.

These types of policies are essential in maintaining existing trends in millennial preferences for more accessible, and more centrally-located residences, and ensuring that millennials continue to adopt car-free or car-lite lifestyles.[17]

5d. Support development of complete suburban communities with mixed-use neighborhoods

13 Bill Text - SB-743 Environmental Quality: Transit Oriented Infill Projects, Judicial Review Streamlining for Environmental Leadership Development Projects, and Entertainment and Sports Center in the City of Sacramento. n.d. http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB743

14 GreenTRIP | TransForm. n.d. http://www.transformca.org/landing-page/greentrip

15 Wachs, Martin. "Turning cities inside out: transportation and the resurgence of downtowns in North America." Transportation 40.6 (2013): 1159-1172.

16 Isaac, Lauren. "How Local Governments Can Plan for Autonomous Vehicles." Road Vehicle Automation 3, 2016, 59-70. doi:10.1007/978-3-319-40503-2_6.

17 Circella, G., F. Alemi, R. Berliner, K. Tiedeman, Y. Lee, L. Fulton, S. L. Handy and P. L. Mokhtarian "Multimodal Behavior of Millennials: Exploring Differences in Travel Choices Between Young Adults and Gen-Xers in California", Paper, 96th Transportation Research Board Meeting, Washington DC, January 2017.

Land Use and Transportation Policies

Many Americans have expressed, through their choices, a preference for suburban amenities such as larger civic parks, ample sports facilities, and free-flow automobile speeds. At the same time, real estate developers and new home buyers have indicated a growing preference for small lot housing with suburban amenities with less personal yard space.

Complete suburban communities with safe walking and biking routes to schools and neighborhood retail may be able to improve the sustainability of suburban neighborhoods.[18] Effective policies include requiring new development adheres to sustainable design principles and that older suburban communities are retrofitted to incorporate these features.

Focusing a mix of land uses in strategic growth areas creates complete communities wherein most daily needs can be met within a short distance of home, providing residents with the opportunity to patronize their local area and run daily errands by walking or cycling rather than traveling by automobile.

Roadway designs that slow vehicle speeds increase options for non-single occupant travel, including shared mobility, will be even more important as adoption of automated vehicles increases.

These design techniques result in slower speeds, shorter trips, and possibly shifts in mode choice. In the future, sustainable planning may even have the potential to encourage the use of smaller, lighter, electric, slow speed automobiles.

Opportunities for Future Research

Transportation behavior and modeling research needs include the following:

- **Invest in experimentation for regional public sector partners:** Regional and local land use and transportation agencies are being asked to plan for an uncertain future. Funding is needed to update their scenario planning tools. Currently, most transportation planning models employ aggregated travel demand models and statistical analysis techniques that rely on historical data derived from years of observation and household travel survey responses.

  Regional transportation agencies across the country are experimenting with these computer models to better simulate the types of revolutionary changes in travel three revolutions, root their updates in the newest findings from travel behavior studies, and improve the ability of models to simulate real human behavior. However, this experimentation can be expensive, time consuming, require coordination with other researchers and transportation experts, and often does not receive enough resources in terms of staff and budget allocation.[19]

- **Expand travel and economic behavior research beyond travel demand models:** First, it will be important to better understand how people react to changes in travel options, and how this impacts their long-term (e.g. residential location), medium-term (e.g. vehicle ownership) and short-term (e.g. daily travel behavior, activity participation, mode choice, route choice, etc.) choices.

  Therefore, a continued research effort is needed to identify the potential changes associated with the introduction and adoption of new mobility services, through the coordination of dedicated data collections (including the collection of revealed preferences and individuals' attitudes and preferences). This could include creative behavioral experiments, stated preferences studies, use of virtual and augmented reality, activity-based modeling and travel forecasting improvement, scenario modeling and microsimulation studies.

18 The 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy. Southern California Association Of Governments, 2016. http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS.pdf.

19 Fagnant J., Daniel, Kara Kocklema. "Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations." Transportation Research Part A, July 2015, doi:10.1016/j.tra.2015.04.003

Land Use and Transportation Policies

- **Micro-level simulation to determine street level pick-up drop-off designs**. In addition to the regional travel demand modeling needed to understand overall travel patterns, urban planners need experimental data on how various autonomous vehicles will perform on city streets and roads. Most of the micro-simulations used to date demonstrate freeway driving conditions. However, some urban design decisions that will need to be made over the coming years involve regulation of on-street parking, and pick-up and drop-off zones for shared autonomous vehicles. Research is needed to identify how these zones interact with other policy priorities like increasing bike lanes in urban environments or prioritizing transit-only lanes. Micro simulations should also be applied to the role that vehicle automation will play in urban delivery systems.

Economic cost-benefit analysis. To evaluate societal considerations surrounding vehicle automation and locational choices a full cost-benefit analysis is required. This will include evaluation of societal costs of additional driving miles, and specifically quantification of any new or differing costs associated with zero-passenger miles.

Central to this type of analysis is also a quantification of the equity and environmental justice costs associated with an increase in autonomous vehicles on the roadways. The following considerations are a starting place to identify the types of societal costs and benefits. Further investigation is needed but these deserve mention:

- **Labor:** Automating driving will impact millions of professional drivers in the logistics and transit industries, and these jobs provide reliable source of income to many working class members.
- **Accessibility:** The extent to which shared autonomous vehicles also have the potential to connect low-income households to previously unreachable employment opportunities. It is important to focus on mitigating the negative impacts, but research is needed to determine the economic benefits that may come from increased mobility for low-income workers.

Acknowledments

Support for the 3 Revolutions comes from the following partners:

Climate Works
The Energy Foundation
The 11th Hour Project (The Schmidt Family Foundation)
Pices Foundation
The National Center for Sustainable Transportation
The University of California Institute of Transportation Studies