Autonomous Vehicles:

Effects on Land Use, Climate Change and Social Equity

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Disclaimer

This study has been prepared for the California Governor's Office of Planning & Research. The student author conducted this study in partial fulfillment of the requirements for the degree of Master of Public Policy at Mills College. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Mills College Public Policy Program, the sponsoring Client organization, or any other organization or agency.

Executive Summary

Purpose

Self-driving cars are almost here. Right now you can buy a car that can park itself, change lanes safely and be summoned by you. In a few years' time self-driving cars, or autonomous vehicles (AVs), will be past the testing phase and potentially available for purchase. AVs may significantly alter the transportation paradigm. How can AVs be utilized to help everyone get where they need to go without jeopardizing the environment?

AVs may exacerbate or alleviate land use, climate change and transportation goals established in legislation. The direction and scale of their impact will largely depend on whether they are shared-use and their efficiency. Vehicle tailpipe emissions account for approximately 37 percent of the State's greenhouse gas (GHG) emissions, and therefore targeting transportation is a key strategy to mitigate climate change. Two potential land use changes from AVs are sprawl and repurposed urban parking. If people are willing to have a longer commute in an AV because they can work or watch the news rather than driving, then this may lead to unsustainable development. Alternatively, if people forego personal vehicles and use shared AVs that do not park in city centers, then the reduced need for parking structures provides an opportunity to use those spaces for other purposes.

In addition to environmental concerns, it is in the public interest to consider social equity in land use and transportation planning. Environmental justice is an integral piece of the California Environmental Quality Act (CEQA) and programs funded by the U.S. Department of Transportation. The State can consider policies that improve access to AVs for *all* potential users. The transportation equity objectives focus on access to destinations and cost.

Background

Autonomous technology is a spectrum. The National Highway Traffic Safety Administration categorized AV technology into Level 0 through Level 4. Levels 1 – 2 are safety features already available in several vehicle models. Level 4 is full automation whereby the vehicle's technology is responsible for all safety-critical functions and monitoring for an entire trip and can operate unoccupied. Tesla and Google plan to release fully AVs, which require zero human interaction, between 2018 and 2020.

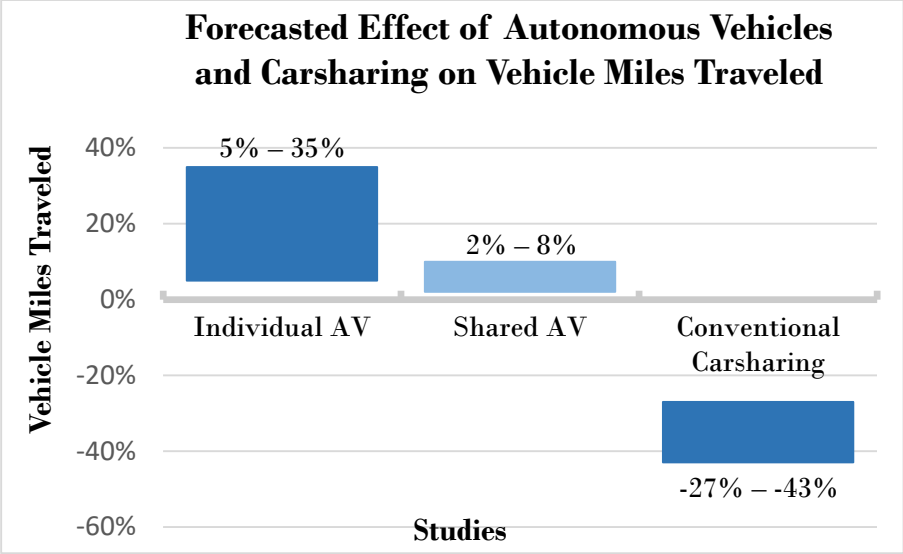
At present, there is no State policy guiding sustainable land use or transportation planning for the arrival of AVs. Guidance at the federal level is similarly lacking. The only law providing clarity for AVs in California is SB 1298 (2012), which required the Department of Motor Vehicles (DMV) to establish regulations for testing and deployment. In December 2015 the DMV published draft regulations for deploying AVs, which were negatively received by industry.

Results in Brief

There is a substantial range in results due to a great degree of uncertainty and lack of real travel data on AVs. Data taken from published models and reports were aggregated to forecast impacts. To quantify the effect AVs may have on sprawl, climate change and transportation equity, vehicles mile traveled (VMT), GHG emissions and cost per mile were used as indicators. VMT is a measurement of miles traveled by vehicles within a specific region for a specific period of time and is a proxy for sprawl.

Results forecast:

- VMT may increase more than 35 percent and current carsharing programs indicate potential for reduced VMT.
- GHG emissions may decrease by 90 percent—*if* AVs are shared-use and electric.
- Cost per mile may be as low as $0.18 per mile *if* AVs are shared-use, or as high as $30.00 per mile for an individual. Mark-up costs will probably not drop for about twenty years, when they could be comparable to today's $0.27 to $0.76 per mile.



These ranges are due to whether changes in human behavior and demographics shifts are considered, whether AVs use electric or internal combustion engines, technology costs dropping over time, varying degrees of market penetration and which roads AVs are allowed on.

Findings and Recommendations

The arrival of AVs is imminent and their impacts on people and the environment are uncertain, but are likely to jeopardize the State's climate change and land use goals. I recommend that the California Governor's Office of Planning & Research (OPR), a comprehensive state planning agency for long-range environmental goals, pursue the following policies to improve outcomes.

Strengthen Prioritization of Infill Development

Infill development is an important strategy to accommodate California's population growth in a transportation-efficient manner and to reach its GHG reduction goals. Supporting transit-oriented infill development reduces VMT and GHG emissions and improves access to destinations, especially for low-income people if the development is multifamily affordable housing. OPR could strengthen prioritization of infill development, and one way is to assist the Strategic Growth Council in developing their process for approving grants, especially in considering how to prepare for shared AVs, supporting shared mobility programs and including other transportation equity considerations.

Incentivize Shared-Use

AVs that are part of a shared fleet are a very important factor to realize potential land use benefits. High occupancy shared rides in a shared vehicle would reduce VMT the most. While all models point to an increase in VMT, it is much more likely that shared AVs will result in a *smaller* increase in VMT and reduced GHG emissions. Ways to incentivize shared-use include: 1) implement and structure VMT fees to discourage unoccupied AVs and incentivize shared rides, 2) improve shared mobility programs to increase usage by low-income communities of color and people with disabilities, and 3) shape the Transportation Network Company (TNC) model.

Convene a Task Force

OPR may take a leadership role in facilitating policy development on AVs by creating a task force with existing OPR staff, representatives from other agencies and non-governmental stakeholders. The task force may pursue the recommendations in this report as well as share information throughout the state about AV policy development. The task force could support public-private partnerships that are piloting solutions. Examples include the GoMentum Station in Concord and the partnership between Lyft and the Metropolitan Transportation Commission.

Research Incentivizing AV Efficiency

AVs are expected to achieve improved fuel economy by using technologies such as smoothed acceleration/deceleration. This would reduce GHG emissions. Autonomous technology can be used on any type vehicle, but *if* it's used on electric vehicles or zero emission vehicles then pollution and GHG emissions can be reduced even further. Regulating AV efficiency is a complex issue that deserves focused research before policies are enacted in order to minimize unintended consequences and unnecessary government expenditures.

Legislation to Mandate AV Fleet Travel Data as Public

The dearth of data is a major problem for transportation researchers. It is also very challenging to forecast how AVs may impact sprawl and access to destinations due to data modeling limitations. Getting public access to travel data from AVs would assist research and analysis for future decision-making. OPR may suggest a CPUC rule-making process to require that the data reported by TNCs differentiate between conventional, human-driven vehicles and AVs.