National Center for Sustainable Transportation

POLICY BRIEF

Simulating the Effects of Shared Automated Vehicles and Benefits to Low-Income Communities in Los Angeles

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Issue

Studies show that automated vehicles are likely to increase vehicle travel, resulting in more congestion and greenhouse gas emissions (GHGs). Pricing policies such as increasing the cost of driving and reducing the cost of alternative travel modes could lessen the negative impacts of automated vehicle deployment, although it is unclear to what extent. Cities located in the Westside Cities Council of Governments planning area in western Los Angeles County could be candidates for early deployment of automated vehicles because of their high travel volumes, well-maintained roads, and temperate weather conditions. Los Angeles County also faces high levels of poverty. Thus, the Westside Cities area presents an important opportunity to study how automated vehicles and associated pricing policies might affect congestion, vehicle miles traveled (VMT), and GHGs, and whether they might improve mobility for marginalized populations.

Researchers at the University of California, Davis and the Technical University of Berlin evaluated these questions by simulating three scenarios in the Westside Cities area using an open-source, dynamic, agent-based travel model called MATSim.[1] The scenarios involve deployment of single- and multiple-passenger automated taxis, automated taxis with free transit fares, and automated taxis with both free transit fares and a personal VMT tax. The researchers then calculated the benefits of each scenario compared to the base case for various income groups, considering monetary travel costs and the value of travel time for each income group.

Key Research Findings

Automated taxi scenarios benefit low-income households, but adding free transit has an even greater benefit to these households (Table 1). The automated taxi-only scenario provided significantly more accessibility benefits in the form of reduced travel time and costs for travelers in three low-income classes than it did for the middle- and high-income travelers. Extremely low-income travelers received the most significant increase in benefits. The addition of free transit to the automated taxi scenario dramatically increased the benefits for extremely low-income travelers.

The addition of a VMT tax eliminates almost all of the benefits generated by the automated taxi and free transit scenario and creates losses for all three low-income groups (Table 1). The middle- to high-income group benefits somewhat

Table 1. Percentage change in benefits—overall and by household income—for simulated travel scenarios, compared to the base case. Negative numbers indicate instances in which a scenario would provide fewer accessibility benefits (i.e., increase travel time and/or costs) compared to the base case. The low-income categories are based on US Department of Housing and Urban Development income limits for eligibility for Los Angeles County assisted housing programs.

	Auto-Taxi	+ Free Transit	+ VMT Tax
Overall Benefits	6%	6%	0%
Mid to High Income	5%	5%	2%
Low Income	11%	11%	-15%
Very Low Income	22%	31%	-27%
Extremely Low Income	394%	1,139%	-1,028%

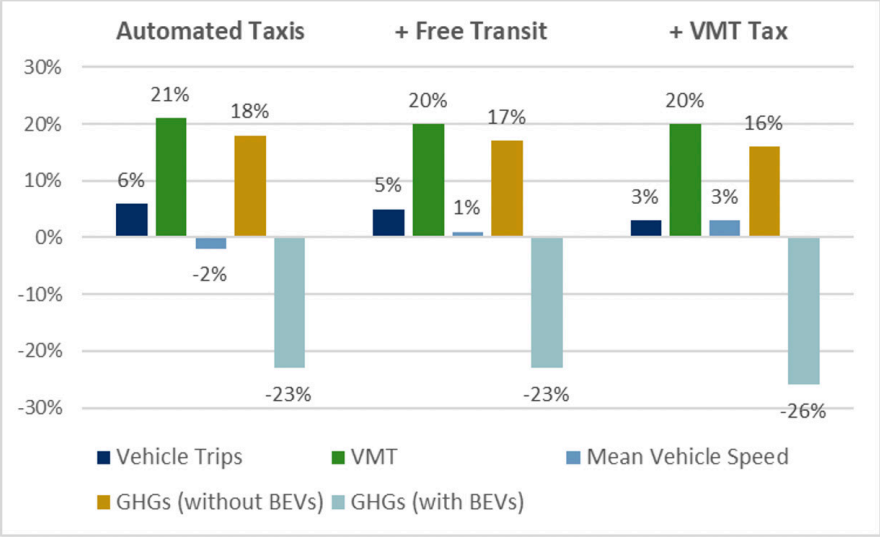

Figure 1. Percentage change in vehicle travel and GHG emissions compared to the base case

from this scenario due to reductions in travel time. Total benefits were unchanged from the base-case scenario.

Automated taxis increase VMT by about 20% across all scenarios (Figure 1). The increase in automated taxi mode shares plus new empty-passenger automated taxi travel more than offset reductions in personal vehicle travel and reduced transit travel by about 50%. However, the addition of free transit fares reversed this decline and increased transit use by about 8% relative to the base case. The addition of the VMT tax increased transit travel by 51% compared to the base case.

Automated taxis must be electric to avoid increases in GHGs. Scenarios in which automated taxis were not battery electric vehicles (BEVs) caused GHG emissions to increase by 16%–18% due to increases in vehicle travel. However, GHG emissions declined 23%–26% compared to the base case when automated taxis were BEVs.

The scenarios have a minor impact on congestion. The shared automated vehicle scenario produced a 2% reduction in mean vehicle speeds. The addition of the free transit and then the VMT tax policies increased mean vehicle speeds by 1% and 3%, respectively, because of smaller increases in vehicle trips and VMT.

Policy Implications

The results of this study have several important implications for current transportation planning. Transit service is essential to low-income travelers, and free transit fare policies for low-income travelers can significantly reduce disparities in access between higher- and lower-income travelers. Automated taxis (and by extension, low-cost solo and pooled ridehailing) will tend to increase vehicle travel without a very significant road user charge (i.e., much larger than the doubling of distance-based costs for personal vehicles simulated in this study). The size of such a road price may face strong opposition from the public. On the other hand, these results indicate that a distance-based VMT tax will negatively impact low-income travelers. Policymakers should consider waiving road pricing measures for low-income travelers or reinvesting them in easy-to-access programs that provide free or reduced-cost transit, microtransit, or ridehailing. Finally, public policies should require zero-emission technology in automated vehicles in the long term and in transit and ridesharing vehicles in the near term.

More Information

This policy brief is drawn from "How Can Automated Vehicles Increase Access to Marginalized Populations and Reduce Congestion, Vehicle Miles Traveled, and Greenhouse Gas Emissions? A Case Study in the City of Los Angeles," a report from the National Center for Sustainable Transportation, authored by Caroline Rodier and Huajun Chai of the University of California, Davis, and Ihab Kaddoura of the Technical University of Berlin. The full report can be found on the NCST website at https://ncst.ucdavis.edu/project/westside-mobility-study-update.

For more information about the findings presented in this brief, contact Caroline Rodier at cjrodier@ucdavis.edu.

[1] *The open-source travel model developed for this study is available for use at: https://github.com/matsim-scenarios/matsim-los-angeles.*

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