National Center for Sustainable Transportation

POLICY BRIEF

Automated Vehicles are Expected to Increase Driving and Emissions Without Policy Intervention

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March 2020

Issue

Automated vehicles hold the potential to disrupt our transportation system in the 21st century. Experts predict that vehicles could be fully automated by as early as 2025 or as late as 2035. Vehicle automation holds great promise, including improving safety and efficiency and expanding mobility. However, the technology could also lead people to drive more often and longer distances, resulting in more road congestion, energy use, and emissions. Methods are needed to help the public and private sectors understand automated vehicle technologies and their system-level effects.

Researchers at UC Davis explored what an automated vehicle future in the San Francisco Bay Area might look like by simulating:

1. A 100% personal automated vehicle future and its effects on travel and greenhouse emissions.
2. The introduction of an automated taxi service with plausible per-mile fares and its effects on conventional personal vehicle and transit travel.

The researchers used the Metropolitan Transportation Commission's activity-based travel demand model (MTC-ABM) and MATSim, an agent-based transportation model, to carry out the simulations. The results provide insight into the relative benefits of each service and automated vehicle technology and the potential market for these services.

Key Research Findings

Automated vehicle technology is likely to increase vehicle miles traveled and associated greenhouse gas emissions. Because automated vehicles operate efficiently, they create more roadway capacity. They also give passengers the freedom to do other tasks, lowering the perceived "costs" of driving. Researchers found that these factors, combined with new travelers having access to automated vehicles, led to much more driving in the simulations. The increase varied from 11% in the automated personal vehicles simulation to 18% in the automated taxis simulation compared to a base case scenario in the same time horizon.

Congestion could improve—or worsen somewhat—due to induced travel. The more efficient operations expected from automated vehicles could improve congestion, but in doing so could induce more vehicles to travel. The net result is unclear. Many regional activity-based models still fail to fully account for the effect of highway capacity on travel demand. Currently, models may over-estimate congestion benefits of automated vehicle technology.

Automated vehicle technology could undermine efforts to maintain or expand use of carpooling, transit, walking, and bicycling modes. The researchers found that automated taxis could provide overall faster and cheaper service than transit in the outer areas of the region, which reduced regional transit share by about one-half in the simulation.

Road pricing policies could counteract negative impacts of automated vehicles. The researchers modeled an increase in the cost of driving to simulate road pricing and found that it counteracted the effect of automated vehicles on vehicle miles traveled (Figure 1). The per-mile road user charge resulted in increased transit use, bicycling, and walking, and reduced vehicle miles traveled compared to the base case. However, much of the reduction was seen in shared vehicle trips. This suggests that incentives for carpooling (such as carpool lane access) may not be effective when compared to the travel time benefits of automated vehicles. New carpooling incentives may be needed to promote shared vehicle trips.

More Information

This policy brief is drawn from "Automated Vehicle Scenarios: Simulation of System-Level Travel Effects Using Agent-Based Demand and Supply Models in the San Francisco Bay Area," a report from the National Center for Sustainable Transportation, authored by Caroline Rodier, Miguel Jaller, Elham Pourrahmani, Joschka Bischoff, Joel Freedman, and Anmol Pahwa. The report can be found on the NCST website at https://ncst.ucdavis.edu/project/automated-vehicle-scenarios-simulation-system-level-travel-effects-using-agent-based-demand.

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

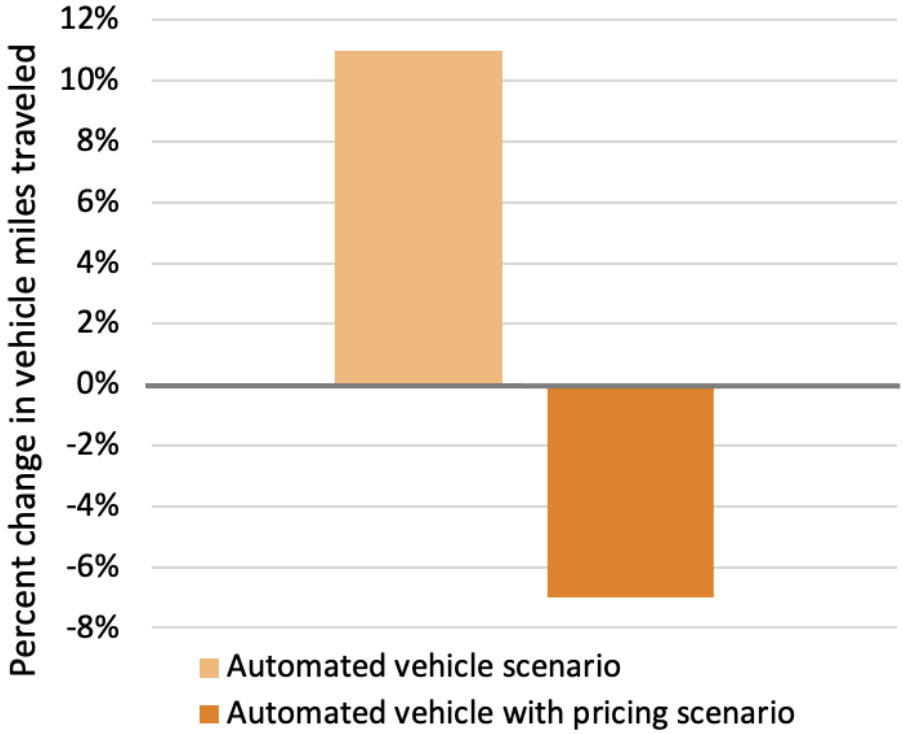

Figure 1. A personal automated vehicle scenario that accounts for increased roadway capacity, reduced value of driving time, reduced vehicle operating costs, and new drivers is expected to significantly increase vehicle miles traveled compared to the base case scenario. Adding a road user charge mitigates the effect.

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DOI:10.7922/G2G73BZW