# Using Current Practice Regional Models To Test Autonomous Vehicle Effects On Travel Demand And Public Agency Policy Responses


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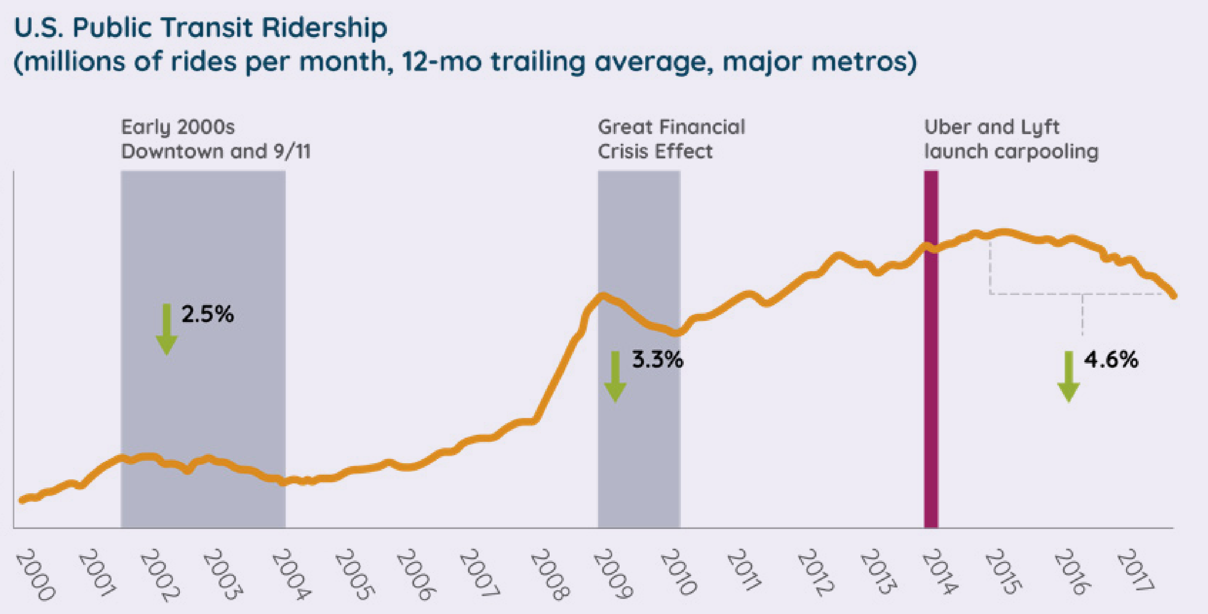
## Abstract


In this paper, autonomous vehicle (AV) effects are evaluated through the same methods that transportation professionals use in planning for new infrastructure to support population and employment growth. The authors explore AV effects using current practice regional travel forecasting models with a focus on vehicle travel and transit ridership effects. Resulting forecasts show the potential for substantial increases in vehicle travel and decreases in transit ridership as vehicle travel convenience increases and vehicle travel costs (both time and money) decline. The paper identifies a potential conflict between private market incentives for increasing the use of vehicles with public goals to reduce vehicle miles of travel (VMT) and emissions; increase active transportation; and expand transit ridership. Remedies are offered in the form of potential government policy responses and counter measures designed to offset undesirable AV travel outcomes. A scenario was tested with potential countermeasure strategies revealing the potential to fully offset VMT increases and transit ridership decreases associated with potential AV effects.


## Disrupting the Status Quo

The emergence of transportation network companies (TNCs) serve as proxy for some of the potential effects of AVs. For example, TNCs reduce the need to own a vehicle and make vehicle travel more convenient by avoiding parking and taking riders door-to-door. As such, they have influenced other modes and have contributed to undesirable consequences such as reducing transit ridership




Adapted from **MetLife Investment Management, American Public Transportation Association**
Note: Major metros include Boston, Chicago, Los Angeles, New York City, San Francisco, and Washington D.C.

Various academic studies have attempted to predict the effects of AVs especially on metrics such as VMT. Theses studies have produced a wide range of potential effects but only three of them relied on travel forecasting models used in public agency practice. This study added results from 12 existing regional models from around the U.S.

**Table 1: Short to Long Run Scenario Modeling Studies**

| AUTHOR | LOCATION | METHOD | AV | PARAMETERS | TOTAL VMT | MODE SHIFT |
|---|---|---|---|---|---|---|
| Thakur et al. 2016 (15) | Melbourne, Australia | Travel & land use model calibrated to regional forecasts | 100% Personal | Value of Time (VOT) | +30% | - 3% Transit |
| Childress et al. 2014 (16) | Seattle, WA | MPO regional activity-based travel model | 100% Personal | Road capacity, VOT, & parking costs | +3.6% to +19.6% | -2% Walk |
| Gucwa 2014 (17) | San Francisco, CA | MPO regional activity-based travel model | 100% Personal | Road capacity | +2% to 7.9% | |
| Auld et al. 2017 (18) | Ann Arbor, MI | Activity & agent-based travel model (POLARIS) data MPO (survey & network) | 20% to 100% Personal | Road capacity | +0.4% to +28.2% | |
| Levin & Boyles 2015 (19) | Downtown Austin, TX | Modified 4 Step Model & MPO travel data | 100% Personal | Road capacity | | -63% Transit |
| Azevedo et al. 2016 (20) | CBD Singapore | Activity & agent travel model (SimMobility) with travel survey, network & taxi data | 100% Shared | Operating & Parking cost structure | | +3% Transit +29% shared AV |
| de Alameidia Correia & van Arem 2016 (21) | Small city Delft, Netherland | Agent-based model with travel survey data, generalized cost functions | 100% Personal | Parking Cost and VOT | +17.3% to +325% | |

## Methodology

To demonstrate how AVs could influence future travel demand, a series of model tests were performed using 12 regional models from around the U.S. The tests are all based on full market penetration of AVs in the horizon year of the models, which was 2035 or later. While the twelve regional models tested relied on different structures, software, quality of data inputs, etc., they represented a cross-section of the current state of the practice. Forecasting models used in this study included models from the following regions:

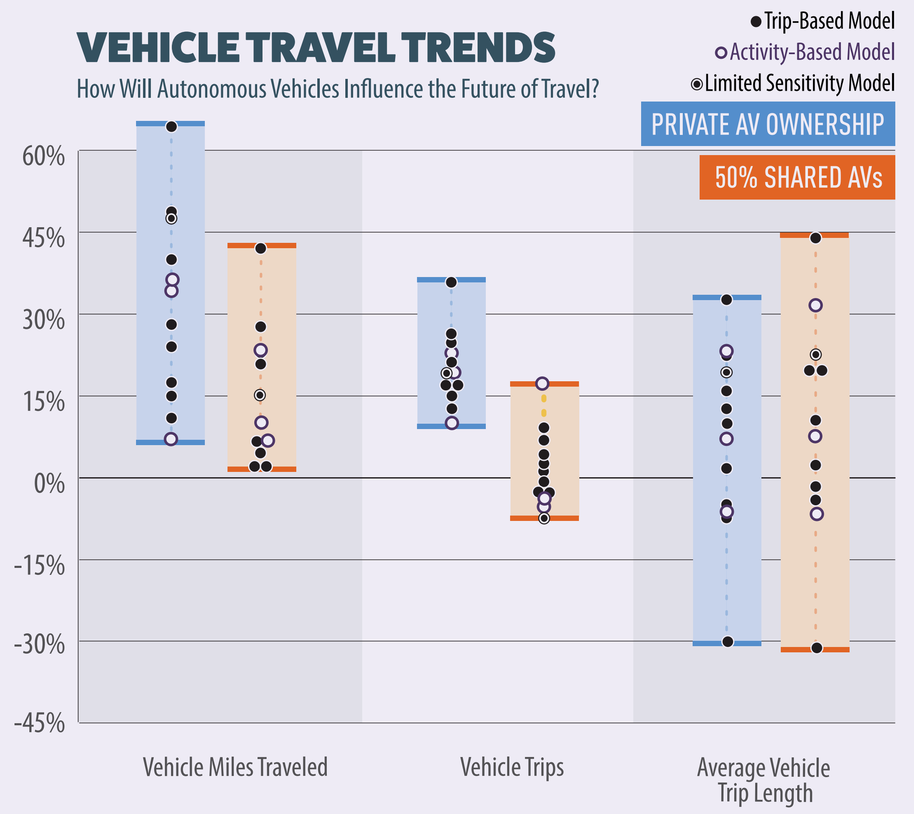
- West Coast – 3 Activity Based Models and 6 Four-Step Models
- Rockies – 1 Four-Step Model
- East Coast – 1 Four-Step Model
- Upper Midwest – 1 Four-Step Model

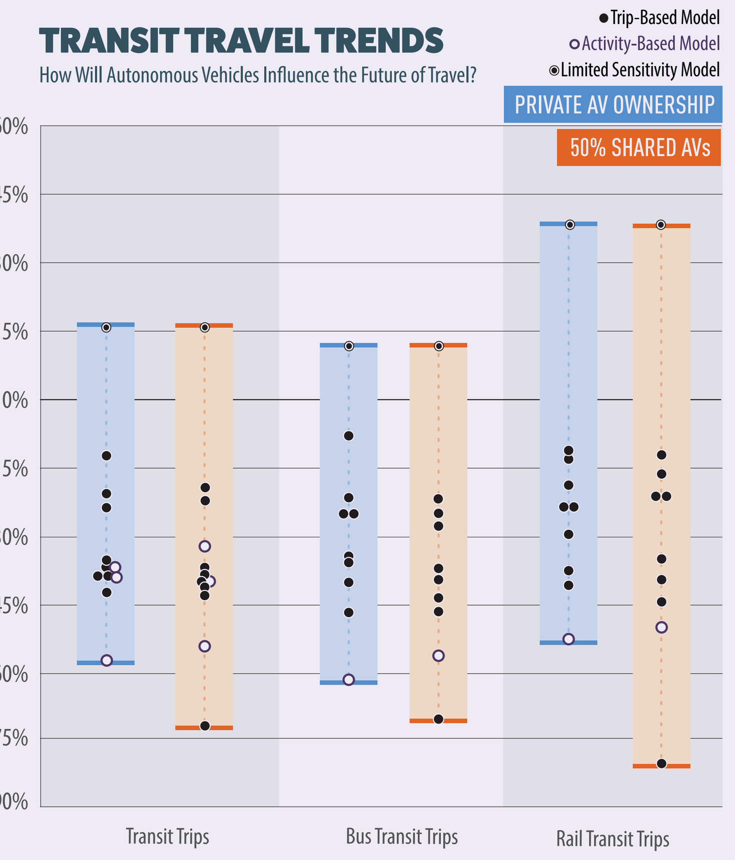
The specific variables changed in the models included the following:

- Terminal Time – reduce to 0
- Parking Cost – reduced 50%
- Value of Time – reduced 50%
- Auto Availability – all households have at least one vehicle
- Freeway Capacity – increased to 3,300 vehicles/hour/lane
- Increased Trip Making – non-work trips increased 25%
- Auto Occupancy – no change in base test but reduced drive-alone trips by 50% in shared test

## Results

The highlights of the results are summarized in the charts.

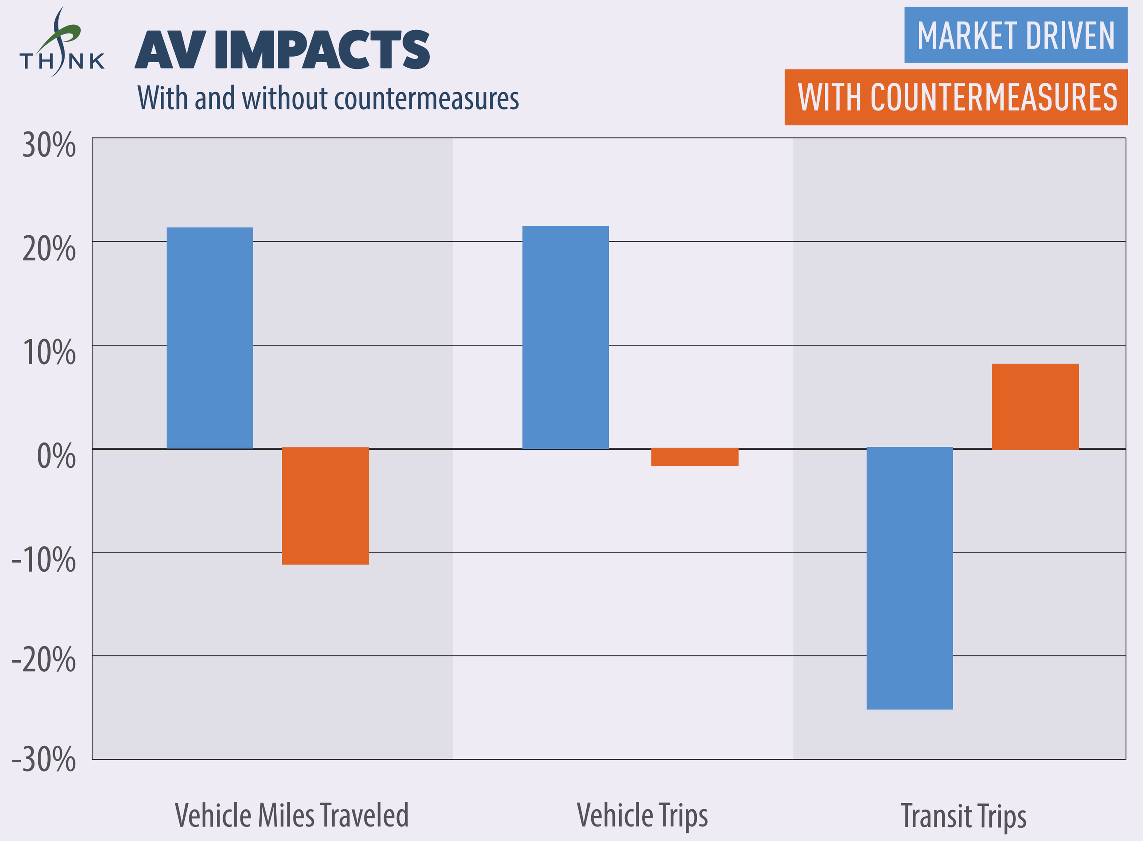



The variations in results among the models may be due to different model strengths and weaknesses rather than actual variations in effects. The models did not capture all induced growth and induced vehicle travel effects as the tests did not account for zero-occupant trips or long-term land use effects. The model tests themselves were designed as 'stress tests' to better understand potential AV effects and model sensitivity to help inform future research and analysis.

## Offsetting AV Effects

The modeling results are important for framing discussions about travel demand trends and the potential policy responses for any undesirable changes. The actions of government can influence these outcomes. As such, we tested how improving transit competitiveness, increasing the cost of vehicle travel, and using technology to reduce personal and commercial trips could influence the overall AV effects. The modeling results find that countermeasures have the potential to offset the negative impacts that could be caused by AVs in the three regions tested.




## Conclusions

This paper presents evidence from current practice models that AV influence on travel behavior could substantially increase vehicle travel and decrease transit ridership if public agencies do not take policy or regulatory action. This is simply a reflection of how travel behavior preferences embedded in current practice models respond to individual input parameter changes influenced by AVs. This analysis does not consider how the objectives of the private market may amplify these effects given that revenue models for TNC or mobility as a service (MAAS) depend on the level of vehicle use.

Offsetting these potential undesirable effects is possible but likely requires government actions. While ultimate outcomes are surrounded by uncertainty, public agencies can start to build on the quantitative assessments from this paper and the analysis by others cited in the paper. Public agencies can consider this analysis an important first step in a risk assessment of AV effects. The next step is to recognize that action is likely necessary to achieve desired future outcomes especially in communities already striving to reduce vehicle travel for sustainability purposes.

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