Study shows autonomous vehicles can help improve traffic flow

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Researchers conducting tests in Tucson, Arizona in July 2017. Credit: Rutgers University

Improvements in traffic flow and fuel consumption are boosted when even a few autonomous vehicles are immersed in bulk traffic, according to research by a Rutgers University-Camden scholar, Benedetto Piccoli, and a team of researchers who recently presented their findings to policymakers in Washington, D.C.

At an exhibit at the Washington Auto Show on Jan. 24 and 25, the multidisciplinary team of researchers with expertise in traffic flow theory, control theory, robotics, cyber-physical systems, and transportation engineering demonstrated to policymakers how autonomous vehicles in their National Science Foundation-funded study helped to prevent traffic jams and can dissipate them when they appear.

The NSF invited the researchers to discuss their work with auto industry leaders and government officials, including U.S. Senator John Thune, chair of the Senate Committee on Commerce, Science, and Transportation.

"The experience was great since we had to interact with a new audience," says Piccoli, the Joseph and Loretta Lopez Chair in Mathematics at Rutgers University-Camden, where he also serves as associate provost for research.

Piccoli joined collaborators Dan Work of Vanderbilt University and Benjamin Seibold of Temple University to share details of their research, and gave visitors a chance to view their experiments through a virtual-reality experience by watching a 3D representation of the experiments in which a single autonomous vehicle circled a track continuously with at least 20 other human-driven cars.

Human drivers naturally create stop-and-go traffic, such as when someone makes a lane change or merges, or because of natural oscillations in human driving. The researchers found that by controlling the pace of the autonomous car in their field experiments, the autonomous car controlled the traffic flow by dissipating the stop-and-go waves so that traffic wasn't oscillating as it does when all of the cars are driven by humans. The researchers determined that even a small percentage of autonomous vehicles (5 percent) could have a significant impact in eliminating waves and reducing the total fuel consumption by up to 40 percent and the braking events by up to 99 percent.

"Most of the policymakers, car manufacturers, car dealers, and others we talked with were very impressed with the research results and got a positive feeling about autonomous vehicles," says Piccoli. "They all agreed that the impact on real traffic economy and environmental impact could be of great importance."

The NSF invited the research team to present at the auto show as part of the NSF-funded Cyber-Physical Systems research project on Control of Vehicular Traffic Flow via Low Density Autonomous Vehicles.

The researchers also had the opportunity to attend two U.S. Senate hearings regarding transportation,

energy, and manufacturing research, which included policymakers from across the nation and from around the globe, including China, Germany, the United Arab Emirates, Korea, and the United Kingdom.

The team's paper, "Dissipation of Stop-and-Go Waves via Control of Autonomous Vehicles: Field experiments," is available in ArXiv.com and will appear on *Transportation Research – part C*.

Provided by Rutgers University