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Automated and connected vehicles

Effects on traffic, mobility and urban design

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Editorial

Automated and connected vehicles: Effects on traffic, mobility and urban design

The rapid development of new vehicle technologies is expected to soon lead to a higher number of connected vehicles on the roads (those constantly sending information such as their location and speed), as well as the emergence of autonomous (self-driven) and automated (connected and autonomous) vehicles. The new technologies have the potential to change considerably our personal mobility and living styles in ways which are still difficult to grasp.

Because these changes are still relatively unknown, transport and city planners might be ill prepared for what may come in the next years. It is thus relevant to research how to take into account these new vehicles both in operational and planning studies at urban, regional, and national scales. In this special issue the guest editors invited authors to submit papers that contribute to methodologies and applications addressing the important topic of how to estimate the effects of automated and connected vehicles on traffic, mobility, and urban design. We obtained a very diverse set of papers dealing with multiple aspects regarding the impact of vehicle automation, and covering both policy to operational implications. After a rigorous peer-review process, four papers were selected for this special issue of IJTST.

The special issue starts at the policy level with a paper by Walker and Marchau. This paper illustrates how the implementation of automated vehicles, although promising, might face some uncertainties such as public acceptance, liability, and privacy-related issues. Authors propose an adaptive approach for implementation that enables policy makers to introduce adaptations over time as knowledge is gathered about the automated vehicles. They use the concept of automated taxis to explain how this would work for a large city.

The next paper, by Martinez and Viegas, applies an agent-based model to the city of Lisbon to simulate a self-driving fleet of vehicles. In particular, shared taxis and taxi-bus services are used as a substitute of today's cars and buses. The paper quantifies the effect of these systems in terms of the number of vehicles needed to satisfy urban mobility, number of kilometers travelled, and CO₂ emissions. Results show that there is an enormous potential to reduce the number of cars and emissions.

Zooming into a particular area of a city and a specific trip stage, Scheltes and Correia have curiously used the same type of simulation model as in the Lisbon case-study, an agent-based approach, in order to study in detail the usage of automated one-seat electric passenger cars to provide last mile transportation. Authors focus on system options such as type of electric charging, network, pre-booking, and vehicle relocation to design several simulation scenarios. They conclude that the system is competitive with walking; however, cycling is still very attractive and actually more sustainable than using cars. Hence the usage of these small automated vehicles might be better suited for high income segments of the train passengers.

The last paper, by Laan and Sadabadi, quantifies the operational impacts of autonomous vehicles (AVs) in freeway corridors by deploying dedicated AV lanes. The authors use a cell transmission model to emulate real traffic, and model the behavior of autonomous vehicles by modifying the underlying fundamental diagram. The model is illustrated on a real freeway corridor, where varying penetration rates of autonomous vehicles are tested. Results show that the overall performance improves with an increasing penetration rate up to certain level, after which it deteriorates significantly.

The four papers published in this special issue, although represent a small portion of the work being currently undertaken in the area of connected and automated vehicles, do shed light on some of the most important effects they will have on traffic, mobility, and urban design. They come from authors in diverse regions of the world and they touch upon different problems and challenges associated with these technologies, ranging from policy to specific traffic impacts. We hope this special issue contributes to fomenting research in this area by generating ideas that further advance our knowledge on the mobility implications of new vehicle technologies.

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