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Leistungssteigerung städtischer Straßennetze - Improving the Performance of Urban Road Networks

Abstract

Authors

Dr.-Ing. Gabriel Tilg

Philipp Stüger, M.Sc.

Dr.-Ing. Matthias Spangler

Chair of Traffic Engineering and Control, Technical University of Munich

Dr.-Ing. Gerhard Listl

gevas humberg & partner Ingenieurgesellschaft mbH

Munich - Karlsruhe

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Abstract

Connected and automated driving can have a significant impact on the performance of future urban road networks. The aim of the project "Improving the Performance of Urban Road Networks", which is part of the research program “Forschungsprogramm Stadtverkehr” (FoPS) on behalf of the German Federal Ministry for Digital and Transport (BMDV), is to investigate these possible changes. To analyze possible impacts on network performance, microscopic traffic flow simulation is used as the primary tool. Based on the results and a survey of experts, recommendations will be developed for research and practice on how to address the impact of connected and automated vehicles (CAVs) on urban road networks in the future.

Three future scenarios with different levels of CAV penetration and traffic control measures are defined for the simulation-based investigations. In addition, four representative road sections are selected for the simulations. Compared to today’s baseline scenario without CAVs, correction factors of the capacity (determined with the help of the fundamental diagram of traffic flow) on the simulated road sections result from approximately 0.9 (for specific scenarios with dedicated CAV lanes) to around 2.5 (for a CAV penetration rate of 95% with traffic-adaptive reinforcement learning-based traffic control). The correction factors are then used to derive a possible transfer of the results to relevant guidelines, including their calculation methods and parameters.

Overall, the results of the study show that higher capacities can be achieved with high penetration rates, appropriate driving dynamics of automated vehicles, and adaptive traffic signal control. In the long term, this could allow the reallocation of lanes currently reserved for private motorized traffic to other road users or for other purposes. In the near future, however, further field tests and simulator studies must be conducted to update or verify the assumptions used in this study.

The present study provides a solid basis for the continuation of the investigations, as it also indicates which aspects need to be focused on (e.g.: fundamental diagram of traffic flow, empirical studies, and traffic control methods). Furthermore, a closer cooperation between academia and automotive industry is strongly recommended to further improve the integrated models for CAVs in traffic flow simulations.