Mixing it up

The future of CAVs and the mixed vehicle fleet

By Dr. Sven Maerivoet

Maerivoet is a senior researcher working at Transport & Mobility Leuven in Belgium. His expertise focuses on traffic flow modelling, Intelligent Transportation Systems (ITS), and CAVs.

As the introduction of Connected Automated Vehicles (CAVs) becomes feasible, it is increasingly necessary to investigate their impacts on traffic safety and efficiency. In addition, we also need to learn to communicate these results to the broader public. Granted, we love using acronyms whenever we can, talking about Society of Automotive Engineers (SAE) levels, Vehicle-To-Everything (V2X) communications, debating about 5G versus G5, and so on. But when people think about CAVs, what comes to mind are Level 4- and 5-type vehicles, not necessarily the earlier level vehicles on the market today.

We're not there yet though. And for now, during the early stages of market introduction, reality is going to present its own set of issues when CAVs of all SAE levels and conventional vehicles will be sharing the same roads. These 'mixed fleets' of traffic pose their own challenges. For example, what if these CAVs enter "transition areas" where automation is currently not possible due to missing sensor inputs—think of extreme weather conditions or rural areas—highly complex situations, or unforeseen circumstances such as lane blockages due to incidents or emergency vehicles? At the moment, we expect CAVs to issue a take-over request to the driver, leading to a transition-of-control. And if this is not feasible, then the vehicle must execute a minimum-risk maneuver.

Manufacturers are dealing with these topics in a variety of ways, going even as far as trying to get their vehicles to recognize the gestures of law enforcement officers on the roadways. The link with artificial intelligence is never far away, even though it is not so science-fiction as some may believe, but rather more down-to-earth using statistical machine learning techniques. There is also a lot to be said for advanced forms of both hierarchical and decentralized traffic management, where one of the goals is to have a smooth coexistence of CAVs and conventional vehicles. Going further, we should also at least assist our future vehicles in coping with challenges related to navigating certain infrastructure. By itself this poses no problem for the human mind that can be resourceful and adjust in these instances, but in some cases, infrastructure may need to adapt so that vehicles with more automated capabilities can function as designed.

Europe is entering its peak in research related to CAVs and vehicle connectivity, with several projects like TransAID, MAVEN, CoEXIST, and INFRAMIX. Sparked by various research projects, manufacturers, research institutions, and policy makers are working together to achieve a deeper understanding of the intricacies of all the possible traffic interactions involved in having this mixed fleet on our roadway. There is added interest from the field of human-machine interfaces, and this interest is not limited to just roadway vehicles, as there is further automation taking place with trains and ships as well.

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There are two main factors that are contributing to aiding our understanding of how CAVs will interact on our roadways: accommodating legislation for real-life testing and materialisation of large-scale detailed computer simulations of not just a single vehicle, but entire cities of mixed traffic. This testing and simulation provides a valuable key to the widespread adoption of these breakthrough technologies.

Let's see where we get the next five years! In addition to the mixed vehicle fleet, we're likely to see concepts such as mobility-as-a-service and shared mobility become more frequent topics in the future.