



MASCAT project

MASCAT simulation platform video
Investigating the impact of the introduction of cooperative vehicles

5 IMPACTS OF CONNECTED AND AUTOMATED VEHICLES ON TRAFFIC, SAFETY AND POLLUTANT EMISSIONS

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Connected and Automated Vehicles (CAV) are about to revolutionise the mobility of goods and people while also increasing its safety. These vehicles not only help to streamline the use of infrastructures but also to uphold mobility and self-reliance for an ageing population. The most promising benefit, and most looked forward to, concerns the potential safety improvements that would result in reducing, if not altogether eradicating road accidents. Besides, the connected – or smart – vehicle can help reduce traffic congestions and thereby curtail associated pollutant emissions. To this end several technologies are being used such as "targeted traffic and real-time" information and the capacity for traffic to organise itself through the information exchange mechanism (vehicle-to-V2V-vehicle and vehicle-to-V2I-infrastructure communications).

Assessing the impacts of Connected and Automated Vehicles on traffic

Ifsttar³ is currently conducting new research projects on the impact of these vehicles on road traffic and more specifically on congestion³. It has been observed that the presence of even just a few Connected or driverless vehicles could significantly mitigate the shockwaves due to the stop-and-go phenomena and reduce their energy consumption.

Moreover, thanks to their connectivity and automation, these vehicles are thus becoming both mobile sensors and actuators. This in turn makes it possible to rethink existing traffic management strategies and give rise to new control strategies (e.g.: speed smoothing, dynamic speed limit, platoon management, departure into/from a lane).

Simulating Cooperative and Automated Traffic

More precisely, recent research conducted at Ifsttar's COSYS department (Components and Systems) has resulted in the proposal of a "multi-agent modelling" of partly cooperative and automated traffic. This proposal describes traffic flow by a so-called "microscopic" traffic model that computes the exact trajectory of each vehicle (agent). This model reproduces the major driving behaviours such as car following, lane change or insertion, route choice.

The cooperation is provided by a multi-agent model whereby each vehicle receives information about its surrounding environment and accordingly adapts its kinematics based on a perception-decision-action process. The system's response has also been studied according to the percentage of connected and automated vehicles but also the agents' confidence level

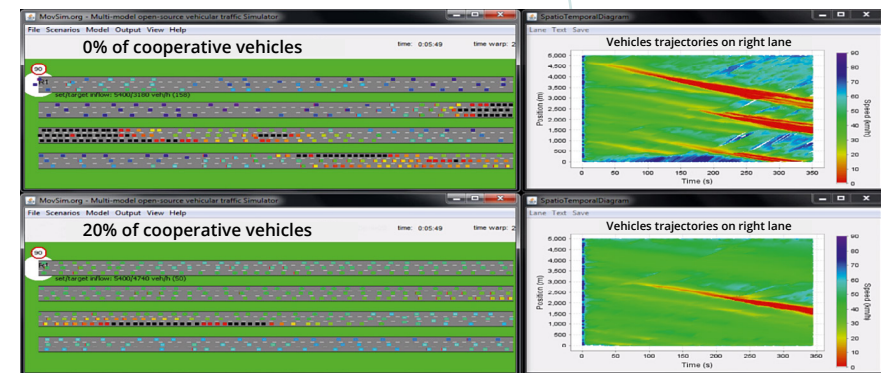
in the information they receive from other agents. A simulation platform named MASCAT (Multi Agents for the Simulation of Cooperation and Automation of Traffic), was developed in this framework.

Self-organised Vehicles to Better Traffic Control

The findings of these research projects highlight the capacity of connected vehicles to organise themselves in order to homogenise traffic characteristics, enhance safety and reduce traffic-related environmental impacts.

These impacts become visible from a fairly low penetration rate to the extent that a mere 10% of connected vehicles amidst the traffic will suffice to significantly improve its fluidity.

This is a good indication of the case for deploying these vehicles, even during a transition phase (more or less long) that will see a mix of non-equipped and partially equipped vehicles (phase known as "fixed traffic situation").



1. LICIT: Transport and Traffic Engineering Laboratory
2. COSYS: Components and systems Department
3. Accumulation of vehicles on roads causing traffic disturbance. Congestions are commonly called "traffic jams" or "gridlock".

Further readings

Guériau M., Billot R., El Faouzi, N.-E., Monteil J., Armetta F., Hassas S. (2016) *How to Assess the Benefits of Connected Vehicles? A Framework for the Design of Cooperative Traffic Management Strategies. Transportation Research Part C: Emerging Technologies*, 2016, 67, 266 - 279.



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