



How will automated cars impact motorcycle safety?

Nowadays, the presence of motorcycles and other powered two-wheelers is significant on all public roads and will remain so in an increasingly connected and automated future environment. Today and in the future, motorcycles can provide a valuable contribution to reduce congestion in urban areas and improve parking availability. The mixed traffic scenario involving manually controlled through to fully automated vehicles such as passenger cars, motorcycles, trucks, etc. on communal, provincial, state roads and motorways will be predominant for a long time to come.

From a motorcyclist's perspective, automated vehicles present both opportunities and risks. The upside is the continuous, close monitoring of the surroundings and the instant response of automated vehicles, especially under normal driving conditions. The risks reside primarily in complex and confusing situations, the potentially dwindling attentiveness of human drivers and the extent to which the road behaviour of an automated vehicle can be predicted in any given situation.

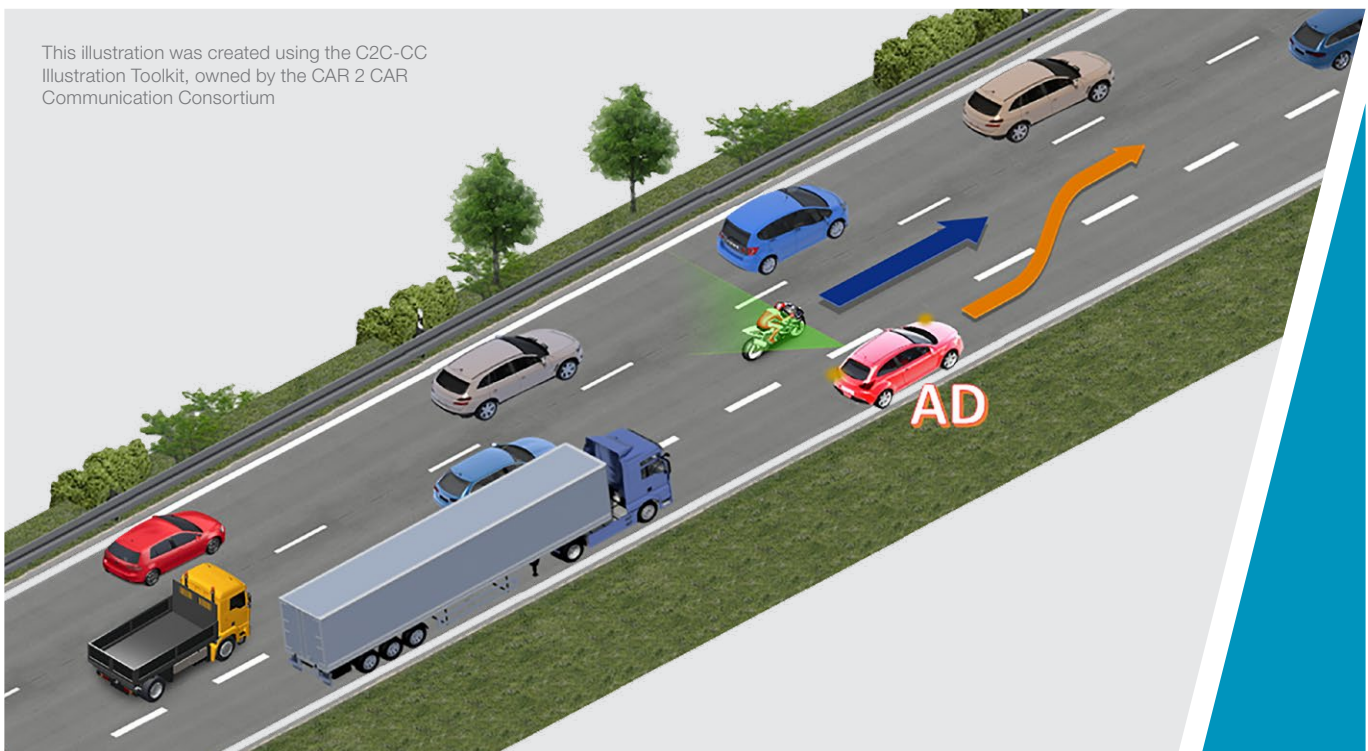
The key factor and enabler for automated driving are ADAS (advanced driver assistance systems). The ACEM position paper '[Detection of motorcycles by advanced driver assistance systems \(ADAS\)](#)', published in 2017, stresses that it is essential that ADAS correctly identify all road users, including motorcycles.

Current technical situation

Cars equipped with ADAS, sense their environment by means of a multitude of sensors, such as radar, camera and lidar and in the future V2X-communication will be deployed. This so-called sensor fusion is designed to create a "full picture" of where the car is heading, any obstacles and other vehicles in the vicinity, in order to calculate interventions or driving manoeuvres.

During the last decades the automotive sector has demonstrated great results with the help of new technologies for passive and active safety. At the same time, the safety performance of vulnerable road users (pedestrians, cyclists, motorcyclists and persons with disabilities or reduced mobility and orientation) in Europe has not progressed at the same pace as that of car occupants.

In the group of VRUs, motorcyclists are the only road users who share all kinds of road and traffic environment conditions, including full velocity range, with cars. This creates a major safety challenge. At the same time, motorcyclists are part of a VRU group for which there is a well-articulated definition that can be found in the type-approval framework. This could be used as an opportunity to define requirements for the recognition of motorcycles and for the definition of testing targets. Today's driver assistance systems (SAE J3016 level 1 & 2) work in a wide range of scenarios.



Automated systems in cars that handle lane changes but do not detect motorcyclists can result in serious road accidents.

However, real traffic scenarios are complex and the systems currently available are unable to cope with them without a substantial amount of driver involvement. The systems work quite well in some situations, such as detecting larger objects, with a defined or standardised shape, such as cars, trucks or traffic signs. However, the detection of smaller dynamic objects presents challenges to sensors and algorithms, just as it presents challenges to human perception. Therefore, automated systems should significantly improve the detection rate of motorcycles.

Due to their many different shapes and vehicle dynamics when compared to cars, as well as their small surface area (easy hidden, etc.), motorcycles pose an enormous challenge to the developers.

In 2016, a test was carried out by the Netherlands Vehicle Authority (RDW), requested by the Federation of European Motorcyclists' Associations (FEMA), the Royal Dutch Motorcyclists Association (KNMV) and the Motorcycle Action Group (MAG) in the Netherlands. This test, on the capabilities of ACC (Adaptive Cruise Control) to detect motorcycles showed unsatisfactory results in the ['Adaptive cruise control and motorcycle recognition' indicative study](#).

In some cases, modern cars do not have robust enough equipment to detect motorcycles. Several accidents in Europe and the US with cars 'on autopilot' indicate that some cars failed to detect motorcycles in all situations. Today, in some driver handbooks, one can find statements such as "the system may not detect small vehicles like motorcycles", which is simply not acceptable from a safety point of view.



Existing urban traffic is a challenge for ADAS.

The car industry is ready to introduce automation levels 3 and 4 vehicles into the market. As of level 3, which is expected to be introduced in the near future, the responsibility for control is transferred, at least temporarily, to the vehicle which must therefore have an observation and interpretation capability on a par with, or better than, a human driver.

Consequently, level 3 vehicles will have to be able to recognize the complex manoeuvres commonly undertaken by motorcycles in ordinary traffic (e.g. lane utilization, lean for cornering, lane splitting and weaving in traffic, etc.). The behaviour of drivers of different vehicle classes, especially motorcyclists, may vary considerably.

This variance also depends on traffic density (city or countryside) and on the country (different rules, traffic mix, cultural influences). All these differences in behaviour (worldwide) must be taken into account in the development of automated cars. This means that the same system has to work as well on a quiet road in Scandinavia as it does in more complex driving environments such as those in Paris or Rome.



Motorcycles are not necessarily in the centre of their lane. Another challenge for car sensors.

Proposals for a smooth interaction between motorcycles and automated cars

Automation must not only improve convenience for drivers but also safety for all road users. According to their degree of automation, passenger cars must be able to recognize motorcycles and their inherent complex manoeuvres and react accordingly.

Automated vehicles have to be able to recognize potential dangers and react appropriately. Now, instead of being designed solely with passenger car requirements in mind and to an even greater extent than in the past, all the sensors used will have to be designed and validated for motorcycles. Motorcycle manufacturers are ready to cooperate with passenger car manufacturers in the field of sensor systems and press ahead with improving the degree of recognition.

As well as improving the recognition capability of the sensor systems, development and validation will have to take into account the different driving dynamics of motorcycles. In a virtual environment, it will be necessary to consider motorcycles by means of a realistic and validated driving dynamics model.

OUTLOOK

In the future, increasing levels of automation in passenger cars will shift the task of dynamic driving further and further away from the driver and towards the vehicle itself. The technology used should be reliable and has to compensate for 'taking the human driver out of the loop'. Therefore, the development of automated assistance systems will have to be designed and validated as motorcycle compatible covering all the requirements, from situation recognition through to execution of manoeuvres.

In turn, the motorcycle industry is open to discussion, recognition and appeals to the car industry and legislators to take this issue seriously and start dialoguing with the motorcycle industry on how to ensure that future cars react to motorcycles in a safe manner. Through constructive discussion, both the car and motorcycle industries can learn from each other and take the steps necessary, on both sides, to increase safety for all road users.

ABOUT ACEM

The European Association of Motorcycle Manufacturers (ACEM) represents manufacturers of mopeds, motorcycles, three-wheelers and quadricycles (L-category vehicles) in Europe.

ACEM members include 18 manufacturing companies: BMW Motorrad, Bombardier Recreational Products (BRP), Ducati Motor holding, Harley-Davidson, Honda, Kawasaki, KTM, KYMCO, MV Agusta, Peugeot Scooters, Piaggio, Polaris Industries, Quadro Vehicles, Renault, Royal Enfield, Suzuki, Triumph Motorcycles and Yamaha.

ACEM also represents 17 motorcycle industry associations in 15 different European countries. About 300,000 jobs depend on the L-category industry in Europe. There are about 35.3 million motorcycles and scooters on Europe's roads (2015 figures).

To find out more about ACEM please visit www.acem.eu