Submission ID: 118

Lund, Sweden
10-12 November 2021
iCSC International Cycling Safety Conference

CAN BIKE-TO-CAR COMMUNICATION PREVENT CYCLIST FATALITIES?

Jeroen Uittenbogaard, Jan de Jongh, Andreas Wienss and Piet Deschuymer

Keywords: AEB, Simulation, Communication, Benefit, Effectiveness, Prevention

The overall number of fatalities in traffic accidents in Europe is decreasing substantially. Unfortunately, the number of fatalities among cyclists does not follow this trend. In The Netherlands, where the percentage of cyclist fatalities is the largest in Europe, the absolute number of killed cyclists even surpassed the number of killed car occupants in 2017. From the accident statistics it becomes clear that a major share of these killed cyclists in traffic accidents results from a collision with a motorized vehicle. The automotive industry focusses on this issue in terms of passive and active safety. One of the most promising active safety systems is an autonomous emergency braking system (AEB). Such systems support the driver e.g. with an audio, visual and/or haptic warning and by automated full or partial braking to avoid or mitigate imminent crashes. Since 2014, AEB systems that aim at avoiding and mitigating car-to-car rear end collisions are part of the Euro NCAP star rating. In 2016 and 2018, Euro NCAP introduced AEB for pedestrians and cyclists as part of their test and assessment procedure, respectively and will extend it in the coming years. Both simulation and first implementation results showed that preventing all defined accident scenarios is not currently possible due to the limitations of the sensors and perception algorithms, which means that cyclists are still at risk.

A possible solution to increase this AEB performance of the car is to add communication from the cyclist to the car. For that purpose Bosch, Shimano and TNO have formed a consortium to initiate a simulation study which is able to model the relevant accident scenarios, in-vehicle sensors, AEB logic, vehicle dynamic and communication in a realistic manner. In this study the effectiveness of several forms of communication, each with its own advantages and drawbacks, are compared to current and future in-vehicle sensors. Two strategies are used; the communication is trusted completely where the AEB-logic treats it just at its own sensors (1) and one where the communication is just used as a preparation for the in-vehicle sensors to quicker classify cyclists (2). Two types of messages will be send: location information and the intention of the cyclist.

The advantage of the location information is most apparent when the cyclist is behind an obstruction blocking the view of the in-vehicle sensor. By adding communication the vehicle can still ‘see’ the cyclist and take the appropriate actions. The intention of the cyclist can be accurately and with a longer time horizon estimated on the bicycle than by in-vehicle sensors. By sending this information to the vehicle, the vehicle is able to start braking sooner preventing or mitigating the crash. By adding this communication from the cyclist to the vehicle, the velocity reduction should increase when compared to conventional in-vehicle sensors. A benefit analysis will condense all the results to provide an answer on the question of how many additional accidents can be avoided and mitigated.