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Description of same-direction car-to-cyclist crash scenarios using real-world data from Sweden, Germany, and a global crash database

Paloma Diaz Fernandez, Irene Isaksson-Hellman, Hanna Jeppsson, Jordanka Kovaceva and Magdalena Lindman

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Vulnerable road users, as cyclists, have a high risk of suffering severe injuries when they are involved in a crash. The majority of the injured cyclists are involved in single-bicycle crashes; However, the most serious and fatal crashes occur when cyclists collide with a motorized vehicle. This study aims to describe the conflict situations between a passenger car and a cyclist travelling in the same direction, and relate them to pre-crash factors (such as speeds, light conditions, etc), crash configurations, injuries, and fatalities by using data from real-world crashes. The objective was to define relevant use cases, including variables, describing crash causation and injury mechanisms to be used in evaluation of active safety systems.

One of the goals of the ongoing MICA2 project is to improve the cyclist safety in overtaking manoeuvres by developing and testing a new generation of active safety systems. However, before improving the systems which aim for safer overtaking manoeuvres it is of great importance to first understand the causes and mechanisms of the crashes. This study introduces the use cases for same-direction car-to-cyclist crashes and derived from different real-world crash databases. This will guide the development of new reliable driver models, which in turn will lead to optimized active safety systems.

Same-direction car-to-cyclist crashes are analysed using data from different real-world crash databases, from Sweden (data from If and, Volvo Cars Cyclist Accident Database, V_CAD), Germany (GIDAS), and world-wide (IGLAD), to understand the crash causation and injury mechanisms. This study gives a broad overview of the traffic safety situation regarding different conflict situations (of interest for the overtaking manoeuvre) and injuries (fatal, severe, slight) since it covers crash data from many countries, expanding the variety of possible measures to avoid or mitigate those type of crashes. The results of these analyses identify three use cases: pure same-direction with overtaking, lateral movement of the cyclist to the left, and lateral movement of the car to the right. In particular, the derived use cases provide situations to test and evaluate the active safety systems using counterfactual simulations. The results show that the majority of same direction car-to-cyclist crashes occurred during daylight and in clear weather conditions. In this type of crashes the cyclist most frequently sustained injuries to the lower and upper extremities followed by the head.

As an outcome of this study a detailed description of the different use cases and corresponding pre-crash, crash and post-crash factors leading to different injury levels will be provided.