

Assessing the potential benefits of the motorcycle autonomous emergency braking using detailed crash reconstructions.

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OBJECTIVE:

The aim of this study was to assess the feasibility and quantitative potential benefits of a motorcycle autonomous emergency braking (MAEB) system in fatal rear-end crashes. A further aim was to identify possible criticalities of this safety system in the field of powered 2-wheelers (PTWs; e.g., any additional risk introduced by the system itself).

METHODS:

Seven relevant cases from the Swedish national in-depth fatal crash database were selected. All crashes involved car-following in which a non-anti-lock braking system (ABS)-equipped motorcycle was the bullet vehicle. Those crashes were reconstructed in a virtual environment with Prescan, simulating the road scenario, the vehicles involved, their precrash trajectories, ABS, and, alternatively, MAEB. The MAEB chosen as reference for the investigation was developed within the European Commission-funded Powered Two-Wheeler Integrated Safety (PISa) project and further detailed in later studies, with the addition of the ABS functionality. The boundary conditions of each simulation varied within a range compatible with the uncertainty of the in-depth data and also included a range of possible rider behaviors including the actual one. The benefits of the MAEB were evaluated by comparing the simulated impact speed in each configuration (no ABS/MAEB, ABS only, MAEB).

RESULTS:

The MAEB proved to be beneficial in a large number of cases. When applicable, the benefits of the system were in line with the expected values. When not applicable, there was no clear evidence of an increased risk for the rider due to the system.

DISCUSSION AND LIMITATIONS:

MAEB represents an innovative safety device in the field of PTWs, and the feasibility of such a system was investigated with promising results. Nevertheless, this technology is not mature yet for PTW application. Research in the field of passenger cars does not directly apply to PTWs because the activation logic of a braking system is more challenging on PTWs. The deployment of an autonomous deceleration would affect the vehicle dynamics, thus requesting an additional control action of the rider to keep the vehicle stable. In addition, the potential effectiveness of the MAEB should be investigated on a wider set of crash scenarios in order also to avoid false triggering of the autonomous braking.