2021 – "Motorcycle Autonomous Emergency Braking (MAEB) Employed as Enhanced Braking: Estimating the Potential for Injury Reduction using Real-world Modeling"

ABSTRACT

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Publisher: Traffic Injury Prevention, Aug. 2021

Objective
Recent field-tests on Motorcycle Autonomous Emergency Braking system (MAEB) showed that higher levels of deceleration to improve its effectiveness were feasible. However, the potential of MAEB in mitigating rider injuries is not well understood, particularly in scenarios where the efficacy of standard MAEB is limited because the rider is manually braking. The purpose of this study was first, to assess the injury mitigation potential of MAEB and second, to test MAEB as an enhanced braking system applied in circumstances where the rider is braking before a crash.

Methods
Data from previously investigated motorcycle injury crashes that occurred on public roads in Victoria, Australia were reconstructed using a 2D model. The intervention of MAEB was applied in the simulations to test both MAEB standard and MAEB working as enhanced braking system. The effects of MAEB in mitigating crashes were separated by crash configuration and evaluated based on the modeled reductions in impact speed and injury risk, employing injury risk functions available in the literature.

Results
After modeling was applied, MAEB was found to be applicable in 30 cases (91% of those in which was estimated as "possibly applicable"). The modeled Impact Speed Reduction (ISR) among the 30 cases averaged 5.0 km/h. In the cases without manual braking, the mean ISR due to standard MAEB was 7.1 km/h, whereas the relative injury risk reduction ranged from 10% for MAIS2+ to 22% for fatal injuries. In the 14 cases with manual braking, the modeled application of MAEB as enhanced braking led to an average ISR ranging from 5.3 km/h to 7.3 km/h. This resulted in an injury risk reduction ranging from 9% to 12% for MAIS2+ and from 16% to 21% for fatal injuries, depending on the different modes of MAEB.

Conclusions
This study modeled the potential benefits of the highest levels of intervention for MAEB field-tested to date. The findings estimate the degree to which MAEB could mitigate motorcycle crashes and reduce injury risks for motorcyclists. New strategies for MAEB intervention as enhanced braking were modeled through crash simulations, and suggest improvements in the benefits of MAEB when riders are braking before the crash. This highlighted the requirement to perform new field-based tests to assess the feasibility of MAEB deployed as enhanced braking system.