2021 - Field Testing the Applicability of Motorcycle Autonomous Emergency Braking (MAEB) During Pre-crash Avoidance Maneuver

ABSTRACT

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Objective

Autonomous Emergency Braking (AEB) is a promising technology for crash avoidance or pre-crash impact speed reduction through the automatic application of braking force. Implementation of AEB technology on motorcycles (MAEB) is still problematic as its interaction with the rider may compromise the safety. In previous studies, MAEB interventions at low decelerations were shown to be easily manageable by common riders in straight line condition, but they were not previously tested in lateral maneuvers such as lane change and swerving, which are common in pre-crash situations. The objective of this paper is to assess the applicability of MAEB activation during lateral avoidance maneuver and to estimate its benefits in this scenario.

Methods

Field tests were carried out involving common riders as participants, using a test protocol developed on the experience of previous studies. The test vehicle was a sport-touring motorcycle equipped with an automatic braking system that could be activated remotely by researchers to simulate MAEB intervention. The motorcycle was equipped with outriggers to prevent capsizing. The Automatic Braking (AB) interventions using a nominal deceleration of 0.3 g were deployed at pseudo-random times in conditions of straight-line travel and a sharp lane-change maneuver emulating a pre-crash avoidance action. The straight-line trials were used as the reference condition for analysis.

Results

Thirty-one participants experienced AB interventions in straight-line and lane-change at an average speed of 44.5 km/h. The automatic braking was deployed in all the key phases of the avoidance maneuver. The system reached a deceleration of 0.3 g for a time of intervention of approximately 1 s. The participants were consistently able to control the vehicle during the automatic braking interventions and were always able to complete the lane-change maneuver. The speed reductions obtained with the AB interventions during lane change were very similar to those obtained in the straight-line conditions.

Conclusions

MAEB interventions with decelerations up to 0.3 g can be easily managed by motorcycle riders not only in straight-line conditions but also during an avoidance maneuver. Further investigations using higher deceleration values are now possible.