

Feasibility Study of Airbag Concept Applicable to Motorcycles Without Sufficient Reaction Structure

Abstract

Published in: Traffic Injury Prevention, June 2015

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Objectives:

An airbag system for motorcycle applications was developed and marketed in 2006 followed by many research projects on the system. In the airbag system, the bag should be supported during the kinetic energy-absorbing period of a rider in a collision. The previously developed system employed a configuration in which motorcycle structures support the airbag, such as a gauge unit and/or a steering structure. The supporting structure functions to receive the reaction force to hold the airbag during a crash to properly absorb the rider's kinetic energy. However, the previous system requires a larger area for this reaction structure and is applicable only to the motorcycles that can provide that area. To overcome this limitation, we propose an airbag system employing another concept. In this concept, the airbag does not use its vehicle structures as a reaction structure but uses the structures of an opposing vehicle, such as doors and/or pillars of an opposing vehicle. In this project, we aim to verify the effectiveness of the proposed system when installed in a motorcycle that cannot provide a larger area for the reaction structure.

Methods:

In the system with this concept, it is assumed that the occupant protection performance is largely affected depending on impact configurations. Accordingly, full-scale motorcycle-to-car crash tests using 125 cm³ scooter-type models with and without the proposed system were conducted in various impact configurations. The 7 impact configurations specified in ISO 13232 were selected as the test configurations. Injury variables and injury indices of head, neck, chest, and abdomen were evaluated with the motorcyclist dummy.

Results:

Injury variables and indices obtained from the crash tests with the airbag were compared to those of the baseline tests. In 2 impact configurations, the airbags were supported by the side structures of the opposing vehicle and performed to reduce the injury variable of head and/or chest compared to that of the baseline test.

Conclusion:

Through the crash tests, beneficial protection effects of the airbag system were confirmed in particular impact configurations. No significant risk for the occupant due to the airbag was observed in the conducted crash tests. It was concluded that the proposed airbag system has feasibility to reduce rider injury in a collision of a motorcycle without sufficient reaction structure.