

NATIONAL TRANSPORTATION SAFETY BOARD
Public Meeting of September 11, 2018
(Information subject to editing)

Safety Report
Select Risk Factors Associated with Causes of Motorcycle Crashes
NTSB/SR-18/01
NTIS PB2018-101427

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

Executive Summary

Motorcyclists—motorcycle riders and their passengers—have the highest risk of fatal injury among all motor vehicle users. In 2016, 5,286 motorcyclists died in traffic crashes in the United States (NCSA 2018). Per mile traveled, motorcyclist fatalities occurred nearly 28 times more frequently than passenger vehicle occupant fatalities in traffic crashes (NCSA 2018). Like accidents across all modes of transportation, motorcycle crashes are complex events that can be influenced by multiple human, vehicle, and environmental factors. However, because motorcycles afford riders less protection, the likelihood of injuries and fatalities in a crash is much greater. In this safety report, the National Transportation Safety Board (NTSB) assesses select risk factors associated with the causes of motorcycle crashes in the United States and makes recommendations for improving motorcycle crash prevention.

The Federal Highway Administration (FHWA) provided the data analyzed in this report from its 2016 *Motorcycle Crash Causation Study (MCCS)*. The *MCCS* represents the most recent data available for studying motorcycle crashes and risk factors in the United States since the US Department of Transportation published its comprehensive *Motorcycle Accident Cause Factors and Identification of Countermeasures* report in 1981. The NTSB analyzed the *MCCS* crashes involving a motorcycle with an engine displacement that exceeded 50 cubic centimeters or a maximum design speed above 31 mph, and at least one reported injury sustained by the motorcycle rider or passenger. All crashes occurred in Orange County, California, between 2011 and 2015. The NTSB's research goals were to (1) identify and assess factors that contribute to motorcycle crash risk, (2) compare these factors with previous research findings about motorcycle crash risk, and (3) evaluate the need for motorcycle safety improvements.

This safety report analyzed select risk factors associated with the causes of motorcycle crashes and evaluated strategies for crash prevention. The *MCCS* data were appropriate for identifying factors associated with an increase or decrease in motorcycle crash risk that warranted further evaluation. These factors were then examined as potential safety issue areas and compared

to existing motorcycle safety research and publications to determine the need for safety improvements.

Previous NTSB safety recommendations to encourage universal motorcycle helmet use and to establish a *per se* blood alcohol concentration (BAC) limit of 0.05 grams per deciliter or lower for all drivers were not reiterated in this report. Nearly 100% of all motorcycle riders and passengers analyzed in the *MCCS* were wearing helmets, presumably a direct result of the universal helmet law in California. Although the use of a helmet is an important safety issue associated with the protection of motorcycle riders, injury mitigation (and therefore helmet use) was beyond this safety report's scope and stated focus on motorcycle crash causation and crash prevention. Concerning the role of alcohol, the BAC for the majority of the riders and passengers was either not tested or not available in the *MCCS*.

The NTSB identified the following motorcycle safety issues:

- **Inadequate integration of motorcycles in crash warning and prevention systems and with vehicle-to-vehicle and vehicle-to-infrastructure systems.** Multiple-vehicle crashes involving a motorcycle and another motor vehicle represented the majority of the crashes in the *MCCS*. In many of these crashes, the other vehicle driver reported not detecting the motorcycle or that a dangerous condition existed, and the motorcycle rider reported having insufficient time to react and complete a collision avoidance maneuver. Vehicle-based crash warning and prevention systems on passenger vehicles and connected technologies (vehicle-to-vehicle and vehicle-to-infrastructure) all have the potential to prevent crashes involving motorcycles by improving motorcycle conspicuity. However, these systems are not always being designed to detect or fully integrate motorcycles.
- **Need for enhanced braking and stability control systems on motorcycles.** The reduced stability on a motorcycle compared to four-wheeled vehicles can make braking, swerving, and other collision avoidance maneuvers more complicated. More than a third of the crashes analyzed involved a loss of control that contributed to crash causation. Running wide on curves and slide outs due to inappropriate braking were among the most common loss-of-control scenarios. More widespread availability of enhanced braking and stability control systems on motorcycles could improve safety by enhancing the effectiveness of braking, collision avoidance performance, and stability control for both novice and experienced riders.
- **Limitations of the most recent data collected on motorcyclist alcohol and other drug use and motorcycle crashes in the United States.** Although alcohol and other drug use is well established as a risk factor in motor vehicle collisions, more focused research is needed to understand the contribution of alcohol and other drug use as a risk factor in motorcycle crashes and whether specific countermeasures could reduce alcohol- and other drug-related motorcycle crashes. The *MCCS* attempted to collect the data needed to support such research; however, rider BAC and any indicator of the presence of drugs other than alcohol were either not tested or not available in many cases.

- **Need to evaluate the effectiveness of motorcycle rider licensing procedures.** Licensing procedures are intended to reduce crashes, injuries, and fatalities by requiring that riders have the basic knowledge and skills to ride a motorcycle safely. However, there is widespread variation in motorcycle rider licensing procedures across the United States. Despite efforts to ensure that all riders are licensed, the greater number of unlicensed riders involved in fatal crashes, when compared to unlicensed drivers of other motor vehicle types, has remained largely unchanged over the past decade. There has been limited independent research on unlicensed riders or the effectiveness of motorcycle rider licensing procedures, which makes it difficult to measure the impact these procedures are having on reducing motorcycle crashes, injuries, and fatalities.

As a result of this safety report, the NTSB makes recommendations to the National Highway Traffic Safety Administration, the FHWA, the Motorcycle Industry Council, the American Motorcyclist Association, and the Motorcycle Safety Foundation.

Findings

1. Many high-risk traffic situations between motorcycles and other motor vehicles could be prevented if vehicle drivers were better able to detect and anticipate the presence of a motorcycle when entering or crossing a road, making a turn, or changing lanes.
2. Motorcycle riders' collision avoidance performance could be improved by extending the range of hazard detection and providing riders with more information, enhanced awareness, and more time to react to crash risks.
3. Vehicle-based crash warning and prevention systems will be most effective at preventing collisions when they can reliably detect all vehicle types, including motorcycles.
4. The integration of motorcycles with connected vehicle-to-vehicle and vehicle-to-infrastructure systems has been limited compared to other vehicle types.
5. Antilock braking system technology would improve motorcycle safety by enhancing the effectiveness of rider evasive actions through improved braking performance and stability.
6. Stability control systems on motorcycles could reduce single-vehicle crashes that involve loss of control and running wide on a curve and off the road, which would reduce the prevalence of motorcyclists killed or injured by impacts with roadside fixed objects.
7. More focused research is required to understand the contribution of alcohol and other drug use as a risk factor in motorcycle crashes and whether specific countermeasures could reduce alcohol- and other drug-related motorcycle crashes.
8. Motorcycle licensing procedures have not been adequately evaluated for safety and effectiveness, which makes it difficult to determine if current licensing procedures are achieving reductions in motorcycle crashes, injuries, and fatalities or encouraging unlicensed riders to become fully licensed.

Recommendations

As a result of this safety report, the National Transportation Safety Board makes the following safety recommendations:

To the National Highway Traffic Safety Administration:

1. Incorporate motorcycles in the development of performance standards for passenger vehicle crash warning and prevention systems.
2. Incorporate motorcycles in the development of performance standards for connected vehicle-to-vehicle systems.
3. Work with the Federal Highway Administration to incorporate motorcycles in the development of performance standards for connected vehicle-to-infrastructure systems.
4. Require all new motorcycles manufactured for on-road use in the United States be equipped with antilock braking system technology.
5. Conduct or sponsor research to evaluate the effectiveness of stability control systems for motorcycles.
6. Based on the research recommended in Safety Recommendation 5, develop and publish performance standards for stability control systems on motorcycles, and require systems meeting those standards on all new motorcycles manufactured for on-road use in the United States.
7. Examine the influence of alcohol and other drug use on motorcycle rider crash risk compared to that of passenger vehicle drivers, and develop guidelines to assist states in implementing evidence-based strategies and countermeasures to more effectively address substance-impaired motorcycle rider crashes.
8. Evaluate the effectiveness of state motorcycle licensing procedures for reducing motorcycle crashes, injuries, and fatalities among novice and unlicensed riders; based on the results of that evaluation, update the *Guidelines for Motorcycle Operator Licensing* or other guidance as appropriate.

To the Federal Highway Administration:

9. Work with the National Highway Traffic Safety Administration to incorporate motorcycles in the development of performance standards for connected vehicle-to-infrastructure systems.

To the Motorcycle Industry Council, the American Motorcyclist Association, and the Motorcycle Safety Foundation:

10. Inform your members about the findings of this safety report, and promote the safety benefits of advanced motorcycle antilock braking and stability control technologies.

References

- FHWA (Federal Highway Administration). 2016. *Motorcycle Crash Causation Study* (Cooperative Agreement DTFH61-06-H-00034). McLean, VA: Turner Fairbank Highway Research Center.
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- NCSA (National Center for Statistics and Analysis). 2018. *Motorcycles: 2016 Data*. DOT HS 812 492. Washington, DC: NHTSA.