Study on Motorcycle Safety in Negotiation with Horizontal Curves in Florida and Development of Crash Modification Factors

Abstract

Author information: Wang, Zhenyu, Lee, Chanyoung, Lin, Pei-Sung, Guo, Rul, Xin, Chunfu, Kolla, Rama Durga, Tammayya Naidu, Yang, Runan, Vasili, Abhijit

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Motorcycle crashes are overrepresented on horizontal curves, especially along rural two-lane roads. Most roadway design and traffic control strategies on horizontal curves include limited considerations for motorcycles. It is necessary to conduct a study to investigate the factors contributing to motorcycle crash risk on horizontal curves and identify effective countermeasures to improve motorcycle safety. This project aimed to fill the gap by completing the following four tasks:

1. A comprehensive literature review to summarize current practices of preventing motorcycle crashes on horizontal curves;
2. A crash analysis to address relevant factors and how to influence motorcycle crash risk on horizontal curves, including crash occurrence, risk of fatalities and severe injuries, and motorcyclist-at-fault;
3. A field experiment to evaluate the effectiveness of Dynamic Speed Feedback Signs (DSFS) to reduce motorcycle speed and increase motorcyclist attention on curve risk;
4. A before-after crash analysis to address the effectiveness of DSFS in motorcycle crash reduction on horizontal curves;
5. Recommendations to address the identified curve-related safety issues for motorcycles in Florida and prevent motorcycle injury on horizontal curves.

Advanced statistical models were used to analyze 11 years (2005–2015) of motorcycle crashes data collected on curves on Florida roadways. Crash Modification Factors (CMFs) of curve radius and curve type for single-motorcycle crashes on rural two-lane highways were developed. The CMFs can be used in Highway Safety Manual (HSM)-compatible motorcycle safety management. Significant factors contributing to motorcycle crash frequency, severity, and motorcyclist-at-fault on horizontal curves were also identified and quantified. A field behavior experiment collected speed profile data and eyetracking data from 10 participants with different DSFS operation modes ("OFF" – without DSFS, "STATIC" – continuously display speed limit, "DYNAMIC" – feedback scheme with flashing and "SLOW DOWN" display).

The results indicate that DSFS in "DYNAMIC" mode can effectively increase motorcyclist attention on curves and intention to reduce speed. The before-after with comparison group study shows that the implementation of DSFS on rural two-lane undivided curves can reduce lane departure motorcycle crashes by 22%. Based on the analysis results, recommendations were developed for increasing awareness of curve risks, decreasing speed, roadside clearance, implementation of DSFS, and education/training.