Research Report Summary

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Examination of driver behavior in response to bicyclist behaviors

Shared lane arrow markings, bicycle lanes, and paths

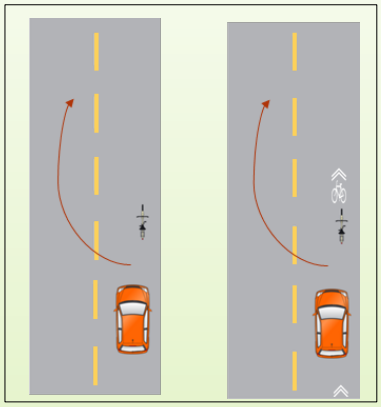
Intersections and trail crossings are particularly problematic for bicyclists, representing the majority of bicycle-motor vehicle crash locations. Non-intersection crashes, though less frequent, have higher likelihood of fatalities, compared intersections.

Motorist overtaking a bicyclist, bicyclist perspective, Iowa naturalistic bicycling dataset

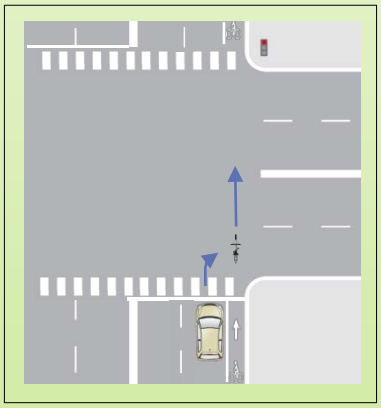
The aim of this study was examine the influence of age, gender, and bicycle-specific infrastructure (shared lane arrows, bicycle lanes, and bicycle paths) on driver performance in common bicycle-motor vehicle interactions.

This study utilized real-world naturalistic bicycling data and existing literature to identify the most problematic bicycle-motor vehicle interactions, as well as gaps in research. Three common bicycle-motor vehicle crash types were tested: overtaking with/without shared lane arrows, right turn across path with bicycle lane, and bicycle path mid-block crossing. These events were tested in the National Advanced Driving Simulator to examine driver performance.

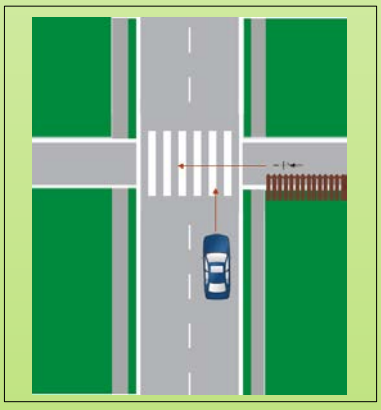
Bicycle events tested



Event 1: Overtaking a bicyclist, with and without shared lane arrow markings



Event 2: Right turn across path, with bicycle lane



Event 3: Mid-block bicycle path crossing

Shared lane arrow markings have become increasingly popular throughout the United States, especially since their official addition to the Manual of Uniform Traffic Control Devices (FHWA 2012) in 2009. They are intended to guide bicyclists out of the door zone, assist with position of bicyclists in line with traffic rather than side-by-side on narrow roads, alert motorists that bicyclists may be present, and reduce wrong-way riding. However, road users often do not understand these markings, sometimes interpreting them as warning of an upcoming crossing or bicycle lane (Boot et al. 2013).

"Beneficial aspects were found for shared lane arrow markings, including greater passing separation distances, compared to no shared lane arrows."

National Advanced Driving Simulator

The majority (81.3%) of participants did not make a complete lane change in order to overtake the bicyclist, and this did not vary by presence of shared lane arrow markings. Results did indicate beneficial aspects for shared lane arrow markings, including greater passing separation distances, compared to no shared lane arrow markings. None of the shared lane arrow condition drivers had closest approach distances of less than 3 feet, compared to 37.5% of those in the no shared lane arrow condition. Also, older drivers in the no shared lane arrow condition gave less passing distance to the bicyclist, compared to younger drivers.

Right turn across path crashes, also often referred to as 'right hook', are one of the most common bicycle-motor vehicle crash types. Results from our study indicated that older drivers had higher mean and minimum speeds and less wait time for the bicyclist to pass, compared to younger drivers, which either indicated less patience or more precise driving in relation to the bicyclist.

Design of bicycle paths often result in mid-block crossings and crossings with partial visual obstruction due to foliage, fencing, houses, buildings, etc. It is not uncommon for bicycle path crossings to occur in residential areas with low traffic volume, therefore a motorist might encounter a crossing on a daily basis and rarely at the same time as a bicyclist is crossing. In this tested event, no statistically significant differences in driving performances were found by age or gender, although older drivers had more hard decelerations, compared to younger drivers.

These results are informative for potential infrastructure design and education-based efforts. However, further research is recommended to better understand the comparative effectiveness of bicycle-specific infrastructure, such as shared lane arrows versus bicycle lanes vs protected bicycle lanes, in relation to crash and injury outcomes.

Overtaking event with shared lane arrows present

References

Boot, W., N. Charness, C. Stothart, M. Fox, A. Mitchum, H. Lupton, and R. Landbeck. 2013. Final Report: Aging Road User, Bicyclist, and Pedestrian Safety: Effective Bicycling Signs and Preventing Left-Turn Crashes. edited by Department of Psychology. Tallahassee, FL.

FHWA. 2012. Manual on Uniform Traffic Control Devices. edited by U.S. Department of Transportation. Washington, D.C.

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