Research Report Summary

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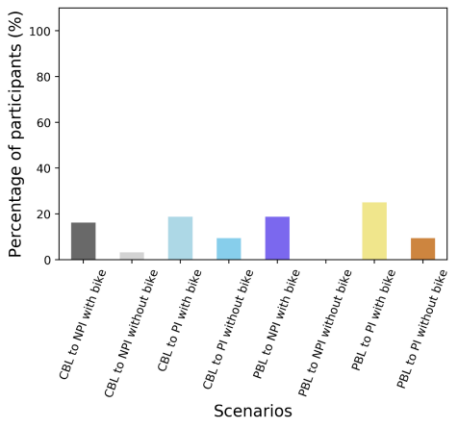
3/4/2019

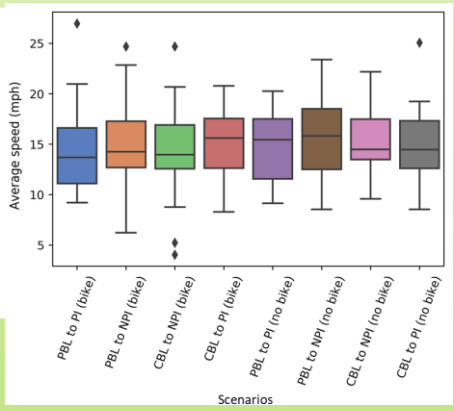
Using Simulation to Assess Conflicts Between Bicyclists and Right-Turning Vehicles

Protected bike lanes physically separate bicyclists from motorized traffic. As a result, interactions between the two roadway users are eliminated while traveling on that segment. Research findings reveal that crashes and conflicts are commonplace in intersections after protected bike lanes [1, 2]. There is a concern that after a period of separation, drivers do not anticipate interacting with bicyclists and thus fail to scan for them while performing a right turn at the intersection. This behavior has the potential to result in right-hook crashes.

This study examines the effect of the transition from protected (i.e., separated) to non-protected (i.e., mixed-traffic) environments and vice versa on driver behavior. Four segment-intersection combinations were tested in a driving simulator experiment where the participants were prompted to make a right turn at the intersection after traveling on a straight segment. The segment was characterized by the presence of either protected or conventional bike lanes to the right of the driver.



Right glances while at the intersection approach



Box plot of speed at the intersection across all eight scenarios

The intersection treatment was either protected or non-protected. In four out of eight drives, drivers encountered and passed a bicyclist on the segment before approaching the intersection. Driver glances were collected to evaluate the effect of infrastructure on driver ability to perform right scans at the intersection prior to a right turn. Speed data were also analyzed to study the impact of segment and intersection treatments, as well as their combinations, on driver behavior.

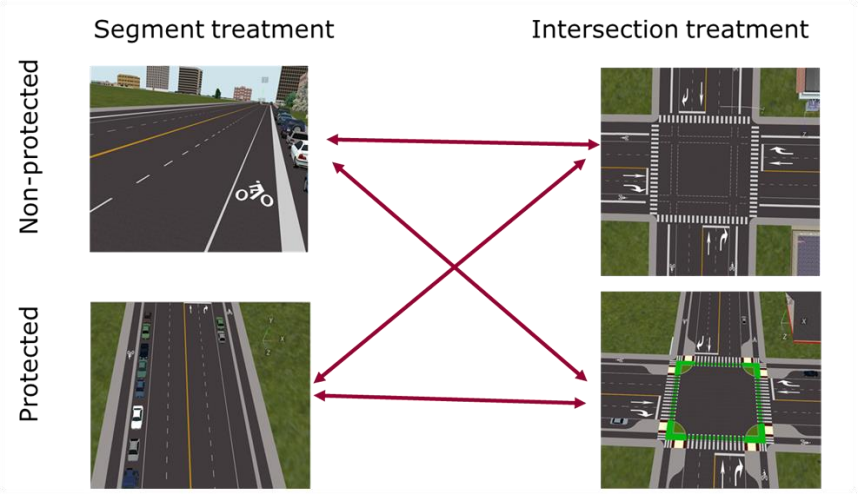
Results suggest that the presence of a bicyclist triggers significantly lower speeds at the segment level for both protected and conventional bike lanes.

Regardless of bicyclist presence, speeds were significantly lower while traveling next to protected bike lanes than conventional bike lanes. However, speed was not found to vary at the intersection among the eight scenarios.

Glances were recorded as a binary variable for different target zones during a drive. In the drives where a bicyclist was present, 100% and 76% of participants glanced at the bicyclist in the cases of conventional and protected bike lanes, respectively, while traveling on the segment. Younger drivers and the presence of protected bike lanes were also found to reduce the probability of glances at the bicyclist while on the segment.

Logistic regression was used to test the association between glance behavior and the following factors: gender, age, cycling frequency, presence of bicyclist, segment treatment, and intersection treatment. The results indicate that bicyclist presence is strongly associated with driver glance behavior at the intersection.

The results of this study also indicate that the presence of a bicyclist significantly affects speeds in the segment regardless of the segment treatment that is present. In addition, the presence of a protected intersection did not seem to have an impact on speed selection at the intersection; however, in its absence, speeds were found to be significantly affected by the presence of a bicyclist upstream.



Segment and intersection bicycle treatment combinations

References

1. Jensen, S. U. (2008, January). Bicycle tracks and lanes: A before-after study. In *Transportation Research Board 87th Annual Meeting* (pp. 1-13).
2. Sayed, T., Zaki, M. H., & Autey, J. (2013). Automated safety diagnosis of vehicle-bicycle interactions using computer vision analysis. *Safety Science*, *59*, 163-172.

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