Research Report Summary

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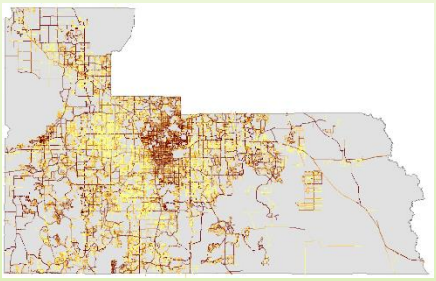
An Assessment of Traffic Safety between Drivers and Bicyclists based on Roadway Cross-Section Designs and Countermeasures Using Simulation



STRAVA bicycle volume in Orange County

Variables significantly affecting bicycle crashes at intersections

Variable	Effect
Traffic volume	+
Bicycle volume	+
Intersection size	+
Signalized intersection	+
Number of legs	+
Bike lane	-
Sidewalk width	-
Median width	-
Speed limit	+

Overview

Cycling is encouraged in countries around the world as an economical, energy-efficient, and sustainable mode of transportation. Simulation is an important approach to analyzing the safety of cycling by identifying the effects of different factors. To ensure the success of a simulation study, it is essential to identify the factors that have significant effects on bicycle safety. Although many studies have focused on analyzing bicycle safety, they lack bicycle exposure data. This lack of data could introduce bias in identifying factors. This study represents a major step forward in estimating safety performance functions (SPFs) for bicycle crashes at intersections. The bicycle STRAVA data that includes bicycle exposure information was used as input to develop

SPFs for predicting frequency of bicycle crashes at intersections.

Results

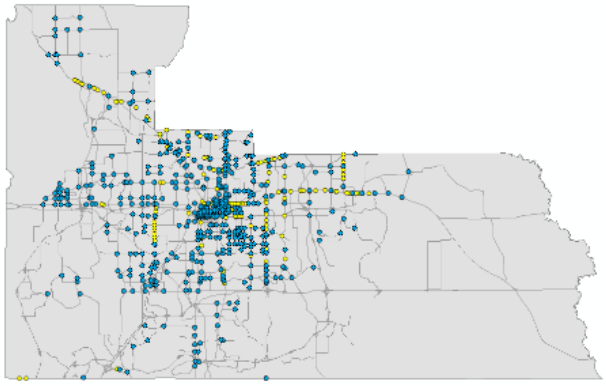
Safety performance functions were developed utilizing negative binomial models. Several variables were found to have significant associations with bicycle crashes at intersections, including traffic volume, bicycle volume, bike lanes, intersection size, signal control system, number of intersection legs, sidewalk width, pavement condition, median width, and speed limit. There was a significant positive association between the existence of bicycle lanes and the reduction of bicycle crashes. Another finding was that signalized intersections were more likely to have higher rates of bicycle crashes than unsignalized intersections due to high bicycle volume. Similarly, three-legged intersections tend to have lower bicycle crash frequencies than four-legged intersections. In addition, the results concur with previous studies that bicycle crash rates decrease with an increase in bicycle volumes, namely, the safety-in-numbers effect.

Conclusions

In general, the present study contributes to the growing body of research that crowdsourced data could be a good source of bicycle exposure for bicycle crash analysis at intersections. This study can help transportation agencies by identifying efficient ways to determine bicycle volume and by identifying critical factors for enhancing bicycle safety and improving bicycle infrastructure at intersections. Transportation engineers and planners should focus on improving road geometry characteristics to further enhance bicycle safety at intersections (e.g., improving pavement condition, considering low speed limits, and having a sufficient sidewalk width, shoulder width, and median width). Policy-makers might consider the recommendations about bicycle infrastructure and road geometry for improving cyclist safety. Such policies could also encourage bicycle use as a safe, economical, energy-efficient, and sustainable mode of transportation.

Furthermore, it is recommended that the identified geometric factors be included in simulation studies. It is expected that the studies could help further explain why the identified factors have significant effects on the occurrence of bicycle crashes at intersections. For example, a simulation study could be conducted to explore drivers' reactions and behaviors when they meet a bicyclist at an intersection with and without a bike lane.

"Bicycle infrastructure and road geometry have a significant effect on improving cyclists' safety. We should include the proper factors in the simulation study"



Study intersections in Orange County