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Estimating the Effect of Vehicle Speeds on Bicycle and Pedestrian Safety on the Georgia Arterial Roadway Network

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Background

Despite a decreasing trend in overall crashes, bicyclist and pedestrian fatalities have increased steadily since 2009 in the United States. A large body of research suggests vehicle speeds are a key contributing factor for crashes. Furthermore, vehicle impact speed has been identified as the principal determinant of severity and death in the event of a pedestrian crash. However, there have been few studies of bicycle or pedestrian crash probability that incorporate detailed vehicle speed data. Newly available probe vehicle data provide information on speed throughout the roadway network at all hours of the day. Probe vehicles speeds are an important new tool for studying the relationship between bicycle and pedestrian crashes and speed.

Aim & Methods

This study uses probe vehicle speed data to examine the impact of vehicle speed distributions on bicycle and pedestrian crashes on the Georgia network of major arterial roadways. The analysis uses INRIX speed data on more than 7,000 road segments throughout the state and the Georgia DOT GEARS crash database. A Negative Binomial crash count model relates crash and speed data for the year 2017. Models using speed percentiles (85th, 50th and 15th) are contrasted with models using speed differences (85th - 50th and 50th - 15th percentile), which capture the spread of the high and low ends of the speed distribution. A small set of covariates are included: segment length, number of lanes, AADT, and regional fixed effects.

Results

Preliminary results indicate that the distribution of vehicle speeds has a positive relationship with bicycle and pedestrian crash frequency on Georgia arterials. Furthermore, the high end of the speed distribution, measured by the difference in 85th and 50th percentile speeds, has an impact of greater magnitude and statistical significance than the low end of the distribution. Models including speed percentiles show a negative relationship with speed, but the speed coefficients are not robust to different model specifications. Two major implications arise. First, research that shows a negative relationship between speed and crashes may be flawed, as it does not account for the distributions of speed. Second, speed difference is a more precise measure of the impact of speed dispersion, since standard deviation assumes that speed dispersion at the low end contributes to crashes as much as the high end.

Conclusions

These results indicate that roadways with a greater spread of vehicle speeds at the high end of the distribution present a greater traffic safety risk to the vulnerable road users that share space with cars. To improve bicycle and pedestrian safety, practitioners should identify roads with disproportionately high speeds and focus on reducing the highest vehicle speeds. Vehicles with the greatest speeds both contribute to more bicycle/pedestrian crashes and generate more severe outcomes for vulnerable road users in the event of a crash.