COLLEGE OF ENGINEERING
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Research Horizons Day & Research Week April 6-13, 2018

Research Horizons Day

Comprehensive Bicycle-Vehicle Crash Investigation on Urban and Rural Roadways in Alabama

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Introduction and Study Objectives

- This study represents an ongoing research to develop safety performance functions (SPFs) for bicycle-vehicle crashes in the state of Alabama.
- The SPFs follow the negative binomial (NB) functional form, which is the primary method included in the Highway Safety Manual (HSM).
- As a preliminary analysis, one bicycle-vehicle SPF is developed for urban two-lane undivided roadway segments.
- To develop the SPF, 226 bicycle-vehicle segment-related crashes were used that occurred over a 5-year period from 2011 to 2015 on Alabama roadways.

Methodology

- Full SPFs (also known as multivariate SPFs) were employed to incorporate a variety of variables other than traffic volume (i.e., AADT) and segment length.
- The general form of the full SPF using the NB functional form is:

$$N_{predicted} = \exp(\alpha + \beta_1 \times X_1 + \beta_2 \times X_2 + \beta_3 \times X_3 + \text{---} + \beta_i \times Xi)$$

where:

$N_{predicted}$ = predicted crash frequency from the SPF.

$\alpha, \beta_1, \beta_2, \ldots, \beta_i$ = regression coefficients of the intercept and the i variables, respectively.

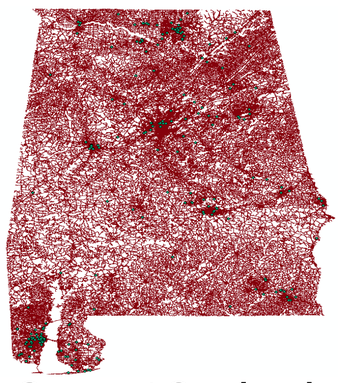
$X_1, X_2, \ldots, X_i$ = the i roadway, geometric, and traffic variables.

Data Collection

- Detailed review of 1,332 police crash reports in Alabama (from 2011 to 2015) were performed.
- Relevant geometric design and operational variables were collected from Google Maps that were rarely explored in previous bicycle safety studies, e.g.: number of turn lanes on major and minor roads, parking presence, median type, presence of bicycle-related signs, intersection type, and traffic control type on minor roads.

Data Preparation and Processing

- ArcGIS tool was used to geo-locate and cluster segment crashes onto the roadway network.
- The annual average daily traffic (AADT) shape files (available from ALDOT) were merged spatially with the roadway network shape file.
- A unique ID was then created to identify each roadway segment.



Sample Bicycle-Vehicle Segment Crashes in Alabama

Preliminary NB Model Results

➢ Urban Two-Lane Undivided Roadway Segments SPF (75 sites):

Parameter	Estimate	St. Error	P-Value
Intercept	-0.6813	0.4011	0.0894
Speed limit	-0.0217	0.0107	0.0428
Turn lane on major road (Yes)	0.9646	0.4049	0.0172
Turn lane on major road (No) *"Base scenario"*	---	---	---
Parking on major road (Yes)	0.4182	0.2817	0.1
Parking on major road (No) *"Base scenario"*	---	---	---

Model Goodness-of-Fit Statistics	
Mean Absolute Deviance (MAD)	0.73
Mean Square Prediction Error (MSPE)	1.58
Pseudo R^2	0.15
Akaike Information Criterion (AIC)	103.385
Small-Sample-Size Corrected Version of AIC (AICC)	106.745
Bayesian Information Criterion (BIC)	112.180

Preliminary Conclusions

- On urban 2-lane undivided roadway segments, presence of turn lanes increased bicycle crashes.
- On urban 2-lane undivided roadway segments, presence of on-street parking increased bicycle crashes.

Acknowledgements

The authors would like to acknowledge the Alabama Department of Transportation (ALDOT) for the grant provided to conduct this research. The opinions, findings, and conclusions on this poster are those of the authors and not necessarily those of the State of Alabama DOT.