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.

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.

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:

\[ N_{\text{predicted}} = \exp(\alpha + \beta_1 \times X_1 + \beta_2 \times X_2 + \beta_3 \times X_3 + \ldots + \beta_i \times X_i) \]

where:

\[ N_{\text{predicted}} \] = 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.

Preliminary NB Model Results

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>St. Error</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-6.813</td>
<td>0.4011</td>
<td>0.0894</td>
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<tr>
<td>Speed limit</td>
<td>-0.0217</td>
<td>0.0107</td>
<td>0.0428</td>
</tr>
<tr>
<td>Turn lane on major road (Yes)</td>
<td>0.9646</td>
<td>0.4049</td>
<td>0.0172</td>
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<tr>
<td>Turn lane on major road (No)</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Parking on major road (Yes)</td>
<td>0.4182</td>
<td>0.2817</td>
<td>0.1</td>
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<tr>
<td>Parking on major road (No)</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Model Goodness-of-Fit Statistics

- Mean Absolute Deviance (MAD): 0.73
- Mean Square Prediction Error (MSPE): 1.58
- Pseudo R²: 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.

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