The effects of roadway and built environment characteristics on pedestrian fatality risk: a national assessment at the neighborhood scale

Office of the Assistant Secretary for Policy
Office of Policy Development, Strategic Planning, and Performance

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Increases in pedestrian fatalities outpace other modes

<table>
<thead>
<tr>
<th>Year</th>
<th>Pedestrian</th>
<th>Bicyclist</th>
<th>In motor vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>4,302</td>
<td>623</td>
<td>27,889</td>
</tr>
<tr>
<td>2011</td>
<td>4,457</td>
<td>682</td>
<td>27,140</td>
</tr>
<tr>
<td>2012</td>
<td>4,818</td>
<td>734</td>
<td>28,003</td>
</tr>
<tr>
<td>2013</td>
<td>4,779</td>
<td>749</td>
<td>27,175</td>
</tr>
<tr>
<td>2014</td>
<td>4,910</td>
<td>729</td>
<td>26,901</td>
</tr>
<tr>
<td>2015</td>
<td>5,495</td>
<td>829</td>
<td>28,926</td>
</tr>
<tr>
<td>2016</td>
<td>5,987</td>
<td>840</td>
<td>30,382</td>
</tr>
</tbody>
</table>

2010-2016:
- 9% increase in fatalities
- 35% increase in pedestrian fatalities
- 39% increase in pedestrian fatalities
Leveraging diverse data sources tells us different things about risk.

- Traffic density, by roadway type (FHWA HPMS)
- Socio-demographic data (Census American Community Survey)
- Built environment data (EPA Smart Location Database & Census LEHD)
- Pedestrian Fatalities (NHTSA FARS)

Integrate spatially: Census tract geography
Data integration enables powerful analysis

- **Methods:** Zero-inflated negative binomial mixed effects regression models w/ random parameters
  - Offset: average daily population (exposure proxy)
  - Separate urban & rural models
- **Outcome:** pedestrian fatality count, 2012-2016
- **Explanatory variables (averaged, 2012-2016):**
  - Traffic density, by functional class
  - Built environment (density, diversity, and design)
  - Sociodemographic factors
Built environment, traffic density variables have significant effects

**Urban Tracts, Population and Employment Density Variables**

**Urban Tracts, Traffic Density Variables**

- **FC1 & FC2**: Interstates, expressways, and other freeways
- **FC3**: Non-access controlled principle arterials
- **FC4**: Minor arterials
- **FC5**: Major collectors
- **FC6**: Minor collectors

**Legend**
- Residential
- Office
- Retail
- Industrial
- Service
- Entertainment
- Activity mix index
- Change in ped. fatality rate per unit change in density
- Change in ped. fatality rate per 10,000 unit change in VMT density
Case study application: model estimates in Los Angeles county
Case study application: model estimates in Los Angeles county
Case study application: comparison to City of Los Angeles high-injury network
Data integration can inform data-driven policy

- Prospective, risk-based framework supports systemic safety approaches
- Supports estimations of how built environment changes may affect risk
- Identifies high-risk neighborhoods; does not identify appropriate interventions
Data integration can be challenging

- State-to-state differences can impact scalability of data transformations
- Some data are unavailable nationally
  - Robust measure of pedestrian exposure
  - Pedestrian injury data
  - Some roadway features (e.g., sidewalks)