Spatial Analysis and GIS Support for Sustainable Pedestrian Safety

Matthew Roe
NYMTC Sept. 11th Fellow
New York City Department of Transportation
Office of Research, Implementation & Safety
Targeted, cost-effective measures to support walking and other priority modes.
Crash Severity ≠ Crash Frequency

NYC Pedestrian Fatality & Crash Rates
Methodology

- **Problem**: Where should NYCDOT focus its pedestrian safety efforts?
- **Crash density analysis**
- **Crash Factors** and ‘Severity Profiles’
- **Time-series** density analysis
- **Data Access via GIS**
# Seniors: An At-Risk Group

## Age Groups: Share of Population and Fatalities

### 2002-2006

<table>
<thead>
<tr>
<th>Age Group</th>
<th>% of Total Population</th>
<th>% of Pedestrian Fatals</th>
</tr>
</thead>
<tbody>
<tr>
<td>65+</td>
<td>11.8%</td>
<td>11.8%</td>
</tr>
<tr>
<td>25 - 65</td>
<td>55.5%</td>
<td>51.6%</td>
</tr>
<tr>
<td>14 - 24</td>
<td>12.4%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Under 14</td>
<td>20.3%</td>
<td>6.9%</td>
</tr>
<tr>
<td>Under 14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Kernel Density Analysis:
Where have senior pedestrians been severely injured?

- Extracted NYSDMV data
- Mapped senior pedestrian severe injury + fatality crashes
- Calculated density - Kernel function (1000’ radius)
- Selected 25 focus areas
- Drew boundaries
- Investigated 5 pilot areas
- Implemented improvements in first 2 areas
- Consultant study initiated on 20 other areas
Safe Streets for Seniors – Typical Treatments

**Before**

- Planted Median Refuge with Roadway Narrowing
- Neckdown/bulb out

**After**

Signal Improvements:
- 3 ft/sec clearance
- LPIs, up to 12 sec
- Shorter waiting time/shorter cycles when possible
Contributing Factor Analysis and ‘Severity Profile’

- What contributes to severity of pedestrian crashes?
  - Assumption: severity of crashes is more relevant than number of crashes
  - Hypothesis: higher speed crashes will occur at mid-block, at signalized locations, and when crossing against signal

- Mid-block vs. Intersection
  - Insignificant difference in % fatal

- Control Type
  - Insignificant difference in % fatal

- Signal Compliance
  - Crossing with (.6% fatal) vs. against signal (2.6% fatal): Fatality rate and KSI rate yield extremely significant difference ($p<.0001$)
Time-Series Analysis

- How have crash patterns changed over ten years?
- Weighted by severity
- Two 5-year periods analyzed
- Identify success of previous programs (e.g. Queens Boulevard) and emerging hotspots (e.g. Flushing)
Time-Series Analysis

- How have crash patterns changed over ten years?
- Weighted by severity
- Two 5-year periods analyzed
- Identify success of previous programs (e.g. Queens Boulevard) and emerging hotspots (e.g. Flushing)
Mapping for Accessibility

- All crashes mapped for GIS querying
- Eases corridor and large-area investigations
  - Community requests
  - Safe Streets for Seniors program
  - Congested Corridors
  - Other large projects
Multiple Interfaces

For area-wide study, you need ArcGIS . . .

. . . for everything else, there’s Google Earth
Where to Look for Pedestrian Safety Issues

- **Areas:**
  - CBDs
  - NORCs – senior pedestrian safety

- **Land Use:**
  - Retail
  - Subway, Intermodal Stations – 15+ of top 20 in ‘06

- **Facilities:**
  - Undivided multilane roadways
  - Bridge & Tunnel Exits
Regional Applications

• GIS can streamline daily data access
• Geospatial analysis (e.g. kernel density)
  – Can help identify sites for investigation at intersection, facility, and neighborhood level
  – Can identify problematic location types
• GIS can help planners correlate crash patterns to location types
  – crash types
  – severity profiles (% severe/fatal)
Recommendations

• Goals might conflict: preventing crashes and decreasing their severity
• Decrease top speeds and peak acceleration rates
• Design for the users
  – 3 ft/sec timing in senior areas
• Mitigate turn conflicts
  – LPIs
  – Dedicated turn phases where unavoidable
• Improve compliance – or work around it
  – Decrease cycle length and design for convenience
  – Build tolerance for mistakes into the system without increasing speeds
• Examine effects of treatments on speed (short-term) and severe/fatal injuries (long term)
Future Research Program

• Methodology
  – Severity vs. Frequency
  – How accurate is a ‘severity profile’ for ordinal ranking of priority locations for treatment?
  – How much do crashes vary from year to year at a given location
  – How do precinct reporting practices differ?

• Engineering
  – Before-and-after analysis of SSFS and other treatments
  – Safety effects of intersection control and facility design options

• Education
  – User knowledge and behavior
  – Effectiveness of targeted education efforts
DOT Applications

- Ongoing Studies
- Continue to incorporate pedestrian mobility improvements into safety measures
- Expand engineering & planning toolbox
- Use new methods to prioritize locations for treatment
Questions?

Matthew Roe
mroe@dot.nyc.gov