Study Purpose

• Identify bus stop locations with unsafe pedestrian behavior
• Identify common characteristics of these bus stops
• Develop safety improvement strategies
Background

• Florida has national reputation for being pedestrian unfriendly

• 2016 Dangerous by Design Report
  – Of the 20 most dangerous metropolitan areas for pedestrians
    • 9 are in Florida.
    • The first 7 are all in Florida

Background

• Study sponsored by FDOT District 4
• Focused on Palm Beach and Broward Counties
• 9,085 ped crashes statewide in 2015
  – Broward ranked 2nd
  – Palm Beach ranked 4th
If a picture is worth 1,000 words...

Study Approach

1. Use GIS to map ped crashes near
2. Rank the bus stops according to
   a) No. of crashes near the bus stop
   b) Annual average daily traffic
   c) On/offs at the stop
Study Approach

3. Review police reports of all crashes near bus stops.

4. Conduct Road Safety Audits of worst bus stop locations in Broward and Palm Beach.

Data Sets and Sources

• 2011 to 2014 pedestrian crash data
  – Florida Department of Highway Safety and Motor Vehicles

• Bus stop on/off data
  – Broward County Transit and Palm Tran

• Annual Average Daily Traffic
  – Florida Department of Transportation
Step 1: Map pedestrian crashes in GIS

• Tested 100 and 300 foot buffers around bus stops
  – 300 foot buffer resulted in too much duplication (i.e. crash associated with more than 1 bus stop)
  – Went with 100 foot buffer
• 357 pedestrian crashes w/in 100 feet of BCT bus stops
• 196 pedestrian crashes w/in 100 feet of Palm Tran bus stops
Step 2: Append ped crash data with bus stop and AADT data

<table>
<thead>
<tr>
<th>Crash Report</th>
<th>Crash Date</th>
<th>Day of Week</th>
<th>Crash Time</th>
<th>Fatalities</th>
<th>Alcohol</th>
<th>Drugs</th>
<th>Weather Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>83922234</td>
<td>2/22/2013</td>
<td>Friday</td>
<td>02:14 PM</td>
<td>0</td>
<td>N</td>
<td>N</td>
<td>Clear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light Conditions</th>
<th>Age Category</th>
<th>Speed Category</th>
<th>Bus Stop ID</th>
<th>Bus Stop Configuration</th>
<th>Offs</th>
<th>Ons</th>
<th>AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daylight</td>
<td>3</td>
<td>4</td>
<td>3180</td>
<td>N</td>
<td>8</td>
<td>16</td>
<td>36,500</td>
</tr>
</tbody>
</table>

Step 3: Rank bus stops

- Three weighted variables
  - total pedestrian crashes within 100 feet of the bus stop (60%)
  - AADT of the street where the bus stop is located (20%)
  - average weekday bus passenger on/off for the bus stop (20%)

- Each bus stop given a score of 0 to 100
  - 0 was the worst
  - 100 was the best
Step 3: Rank bus stops

<table>
<thead>
<tr>
<th>RANK</th>
<th>BUS STOP ID</th>
<th>TOTAL PED CRASHES (2011-2014)</th>
<th>PED CRASH SCORE</th>
<th>MEAN AADT</th>
<th>AADT SCORE</th>
<th>BCT ON/OFFS</th>
<th>ON/OFF SCORE</th>
<th>COMBINED SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1808</td>
<td>4</td>
<td>0.0</td>
<td>51,500</td>
<td>6.6</td>
<td>208</td>
<td>19.4</td>
<td>26.0</td>
</tr>
<tr>
<td>2</td>
<td>2136</td>
<td>3</td>
<td>20.0</td>
<td>57,000</td>
<td>5.1</td>
<td>434</td>
<td>18.8</td>
<td>43.9</td>
</tr>
<tr>
<td>3</td>
<td>257</td>
<td>3</td>
<td>20.0</td>
<td>55,500</td>
<td>5.5</td>
<td>128</td>
<td>19.6</td>
<td>45.1</td>
</tr>
<tr>
<td>4</td>
<td>1791</td>
<td>3</td>
<td>20.0</td>
<td>48,500</td>
<td>7.5</td>
<td>158</td>
<td>19.6</td>
<td>47.0</td>
</tr>
<tr>
<td>5</td>
<td>775</td>
<td>3</td>
<td>20.0</td>
<td>45,000</td>
<td>8.4</td>
<td>25</td>
<td>19.9</td>
<td>48.4</td>
</tr>
</tbody>
</table>

Data Results

- 18 of the 357 ped crashes w/in 100 feet of a BCT bus stop involved a bus patron (5%)
- 8 of the 221 ped crashes w/in 100 feet of a Palm Tran bus stop involved a bus patron (3.6%)
- Near side stops were not disproportionately unsafe
  - 40% of BCT’s bus stops are near-side
  - 39% of the crashes involving a BCT bus patron (7 of the 18) occurred at a near-side stop
Data Results

• The single most recurring theme in the police reports was pedestrians crossing mid-block outside the crosswalks
• This behavior was repeatedly observed by the Road Safety Audit team

Stakeholder Surveys

• Meant to solicit feedback from local agencies on the data findings
**Stakeholder Surveys**

- Modified list of bus stops to be field reviewed based on local input
  - Example: Palm Beach MPO had produced a list of pedestrian hot spots in its Pedestrian and Bicycle Safety Study.

**Field Reviews**

- Road Safety Audits
  - 5 intersections in Broward
  - 5 intersections in Palm Beach
- Multi-disciplinary team
  - CUTR
  - FDOT
  - Broward County Transit & PalmTran
  - Broward County Traffic Engineering
  - Palm Beach MPO
Field Reviews

Reviewed connectivity to adjacent land uses

Reviewed adequacy of street lighting

Field Reviews

Reviewed for ADA compliance

Reviewed pedestrian signal length
Field Reviews

Reviewed signage

Reviewed pedestrian behavior
Recommendations

• RSA Team made site specific recommendations
  – Improve street lighting
  – Relocate a mid-block crossing
  – Add additional Yield to Pedestrian signs
  – Add illuminated No Turn on Red sign
  – Upgrade crosswalk markings
  – Add leading pedestrian interval to pedestrian signal
  – Add audible pedestrian signal
  – Increase pedestrian signal timing

Recommendations

• RSA Team made 2 general recommendations
  – Expand use of pedestrian barriers in the median
  – Add sidewalk stencils near bus stops directing passengers to the crosswalk
Pedestrian Barrier

[Image of pedestrian barrier on Oakland Park Blvd]

Pedestrian Barrier

[Image of pedestrian barrier with trees and grass]

10/12/2017
Sidewalk Stencil

During the RSA in Palm Beach, the team saw this at a bus stop

Sidewalk Stencil

That gave us the idea for this
Most important thing to come out of the study was not the specific recommendations but rather the process

FDOT District 4 now has a systematic process for reviewing bus stop location safety

GIS plays an important role in the process

RSAs promote collaborative problem solving

**Further Research**

Relative Safety of Far-Side Bus Stops versus Near-Side Bus Stops

– Research literature says far-side stops are safer for pedestrians but potentially less safe for buses (rear-ended collisions)

– Proposed research would look at the percentage of pedestrian crashes that occurred at near-side bus stops versus the percentage of bus rear-ended collisions at far-side bus stops
Contact Information

Brian Pessaro
Senior Research Associate
Center for Urban Transportation Research
University of South Florida
pessaro@cutr.usf.edu
(813) 974-5113