Agenda

1. Project Partners
2. Challenges Evaluating Pedestrian Safety
3. Three Case Study Intersections in Midtown
4. Quantify Pedestrian Safety in the Absence of Traditional Data Resources
5. Conclusion
Project Partners

MIDTOWN Alliance

MTOP

JACOBS

AECOM

Brisk Synergies
Challenges Evaluating Pedestrian Safety

• Countermeasures are traditionally guided by collision data
  – Collected in the field by emergency services, such as police or paramedical services (may lack necessary technical details)
  – Relatively low frequency of traffic crashes makes meaningful statistical analysis challenging
  – Year-to-year variation, especially at the intersection-level
Surrogate Safety Data to Measure Risk:

THE HEINRICH TRIANGLE AND TWO BASIC TYPES OF SURROGATES
Past practices have mostly used two basic types of surrogate measures. These are:

- Surrogates based on events which are proximate to and usually precede the crash event.
- Surrogates that presume existence of a causal link to expected average crash frequency. These surrogates assume knowledge of the degree to which safety is expected to change when the surrogate measure changes by a given amount.

The difference between these two types of surrogates is best explained with reference to Figure 3D-1 which shows the Heinrich Triangle. The Heinrich Triangle has set the agenda for Industrial and Occupational Safety ever since it was first published in 1931 (12). The original Heinrich Triangle is founded on the precedence relationship that ‘No Injury Crashes’ precedes ‘Minor Injuries’.

0.3% of all accidents produce major injuries
8.8% of all accidents produce minor injuries
90.9% of all accidents produce no injuries

Source: H. W. Heinrich, Industrial Accident Prevention, 1950, pp. 24

Note: The term accident is used in this graphic to remain consistent with the original source. The HSM does not use the term accident, and AASHTO prefers the use of the term crash.

Figure 3D-1. The Heinrich Triangle
Spring Street at 5th Street Case Study

- Pedestrian Scramble Before and After Study
- Pedestrian Behavior/Compliance
- Pedestrian-Vehicle Conflicts
Quantify Pedestrian Safety

• Pedestrian Compliance

• Near Collision Data (Potential Conflicts)
  – **Post Encroachment Time (PET):** Time difference between the vehicle and the pedestrian or bicyclist at a conflict point.
  – This study used a PET value of < 3.0 seconds
    • **High Severity:** PET ≤ 1.0 Second
    • **Medium Severity:** 1.0 Second < PET ≤ 2.0 Seconds
    • **Low Severity:** 2.0 Seconds < PET ≤ 3.0 Seconds
Spring St at 5th St Study Periods

• Before Study: September 19, 2017
• Ped Scramble Implemented January 2, 2018
• After Study 1: January 19, 2018
• After Study 2: February 27, 2018
Pedestrian Compliance at a Ped Scramble

• Pedestrian compliance was compared with a ped scramble at the intersection of Courtland Street at Gilmer Street.

**Spring Street at 5th Street:**
- Georgia Tech’s Campus
- One-way 4-lane arterial (Spring)
- 120-second cycle length
- **Double-serve ped scramble**

**Courtland Street at Gilmer Street:**
- Georgia State University Campus
- One-way 4-lane arterial (Courland)
- 120-second cycle length
- **Single-serve ped scramble**
Pedestrian Scramble Operations

Single-Serve Pedestrian Scramble

- Serve pedestrian phase once/cycle
- High Pedestrian Delay

Influence pedestrian behavior to cross street with parallel vehicle movement

Double-Serve Pedestrian Scramble

- Serve pedestrian phase twice/cycle
- Low Pedestrian Delay

Improve pedestrian compliance compared with traditional pedestrian scrambles
### Spring St at 5th St: Pedestrian Compliance

**Pedestrian Compliance Rates**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pedestrian Compliance Rate</th>
<th>Percent Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring St. at 5th St (After Condition)</td>
<td>Courtland St. at Gilmer St</td>
</tr>
<tr>
<td>Morning</td>
<td>97%</td>
<td>81%</td>
</tr>
<tr>
<td>Midday</td>
<td>98%</td>
<td>74%</td>
</tr>
<tr>
<td>Afternoon</td>
<td>99%</td>
<td>88%</td>
</tr>
<tr>
<td>Total</td>
<td>98%</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Total Number of Noncompliant Pedestrians</strong></td>
<td><strong>113</strong></td>
<td><strong>1,196</strong></td>
</tr>
<tr>
<td>Total Pedestrian Volume</td>
<td>6,796</td>
<td>6,112</td>
</tr>
</tbody>
</table>
# Pedestrian Scramble Post Encroachment Time (PET)

## Before and After PET

<table>
<thead>
<tr>
<th>5th Street and Spring Street</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity of Potential Conflicts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Risk</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Medium Risk</td>
<td>38</td>
<td>6</td>
</tr>
<tr>
<td>Low Risk</td>
<td>150</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>32</td>
</tr>
<tr>
<td>% of Pedestrians involved in a potential conflict</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>Total Pedestrian Count</td>
<td>4,409</td>
<td>2,520</td>
</tr>
</tbody>
</table>
Pedestrian Scramble Insights

- **47% reduction** of total potential conflicts when pedestrian arrive first
- **32% reduction** of total potential conflicts with pedestrians and right-turning vehicles
- Near **100%** pedestrian **compliance** with scramble phase
  - 100% reduction of high severity potential conflicts
Pedestrian Scramble Insights

- Turning vehicle speed increases
  - Right turning: 5 to 8 mph
  - Left turning: 12 to 16 mph

- Pedestrian potential conflicts were largely consistent throughout the day

- Difference between pedestrian potential conflicts and bicycle potential conflicts

- More pedestrians involved in potential conflicts during the weekend than during the weekday
Tenth Street at I-75/I-85 SB On-Ramp Case Study

- Significant pedestrian and bicycle corridor connecting Midtown with Georgia Tech’s Campus and Turner Broadcasting Campus
- Significant turning vehicle volume to access Connector on-ramp
- Quantify aggressive driver behavior (8 mph right-turn speed)
## Freeway On-Ramp Intersection Post Encroachment Time (PET)

### Pedestrian and Bicycle PET

<table>
<thead>
<tr>
<th>Severity of Potential Conflicts</th>
<th>10th Street and I-75 Entrance Ramp</th>
<th>Pedestrian-Vehicle Conflicts</th>
<th>Bicycle-Vehicle Conflicts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Risk</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Medium Risk</td>
<td>114</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Low Risk</td>
<td>495</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>617</td>
<td>56</td>
</tr>
<tr>
<td>% of Pedestrians/Bicyclists involved in a potential conflict</td>
<td>10%</td>
<td>15%</td>
<td></td>
</tr>
</tbody>
</table>

| Total Pedestrian or Bicycle Count | 6,242 | 374 |
Freeway On Ramp Intersection Insights

Pedestrians

- 617 Pedestrian - Vehicle Potential Conflicts
  - 275 with left-turning vehicles
  - 342 with right-turning vehicles
- 322 (52%) are cases where the pedestrian arrived first

Bicyclists

- 56 Bicycle - Vehicle Potential Conflicts
- 18 with left-turning vehicles
- 38 with right-turning vehicles
- 23 (41%) are cases where the bicyclist arrived first
Freeway On Ramp Intersection Insights

• Greater potential conflict with right-turning vehicles than with left-turning vehicles
• Difference between pedestrian potential conflicts and bicycle potential conflicts
• Number of high risk pedestrian-vehicle near collision events (8)
• Justification for improvements
Peachtree Street at 13th Street Case Study

- Unsignalized (two-way stop control) intersection
- Surrounding land-use is mixed (office, residential, retail)
- Significant pedestrian volume throughout the day
### Pedestrian PET

<table>
<thead>
<tr>
<th>Potential Conflicts</th>
<th>Peachtree Street at 13th Street</th>
<th>Pedestrian-Vehicle Potential Conflicts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Risk</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Medium Risk</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>Low Risk</td>
<td>254</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>340</td>
</tr>
</tbody>
</table>

| % of Pedestrians involved in a potential conflict | 45% |
| Total Pedestrian Count                            | 762 |
Unsignalized Intersection Insight

- **31%** of conflicts were cases where the pedestrian passes in front of the vehicle.
- Higher number of total potential conflicts with southbound vehicles; higher number of high severity potential conflicts with northbound vehicles.
- Number of high risk pedestrian-vehicle near collision events (7)

### Southbound and Northbound Vehicle-Pedestrian Conflict Comparison

- **340 Pedestrian-Vehicle Potential Conflicts**
  - **154** with northbound vehicles
  - **186** with southbound vehicles
- **107 (31%)** are cases where the pedestrian arrived first.
Signal Warrant (Peachtree Street at 13th Street)

Intersection Signal Warrant:

Mid-block PHB Signal Warrant:

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

DOES NOT MEET WARRANT

MEETS WARRANT
### Signal Warrant (Peachtree Street at 13th Street)

#### Intersection Signal Warrant:

![Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume](image)

- The graph does not meet the warrant criteria.

#### Table 11. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations:

<table>
<thead>
<tr>
<th>Roadway Type (Number of Travel Lanes and Median Type)</th>
<th>Vehicle ADT ≤ 9,000</th>
<th>Vehicle ADT &gt; 9,000 to 12,000</th>
<th>Vehicle ADT &gt; 12,000–15,000</th>
<th>Vehicle ADT &gt; 15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 48.3 km/h (30 mi/h)</td>
<td>56.4 km/h (35 mi/h)</td>
<td>64.4 km/h (40 mi/h)</td>
<td>≤ 48.3 km/h (30 mi/h)</td>
</tr>
<tr>
<td>Two lanes</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Three lanes</td>
<td>C</td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>Multilane (four or more lanes) with raised median</td>
<td>C</td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>Multilane (four or more lanes) without raised median</td>
<td>C</td>
<td>P</td>
<td>N</td>
<td>P</td>
</tr>
</tbody>
</table>

**Notes:**
- ADT: Average Daily Traffic
- C: Crosswalks
- P: Pedestrian islands
- N: None
Signal Warrant (Peachtree Street at 13th Street)

- MUTCD Pedestrian Hybrid Beacons (PHB)
  "The pedestrian hybrid beacon should be installed at least 100 feet from the side streets or driveways that are controlled by STOP or YIELD signs."

- FHWA Safety Effects of Marked versus Unmarked Crosswalks at Uncontrolled Locations
  
  $N = \text{Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased by providing marked crosswalks alone.}$
Insight Summary

• Quick and effective way of evaluating and validating “before and after” pedestrian safety numbers

• Quantifiable safety-related behaviors of pedestrians, bicyclists, and drivers
  – Potential conflict (near-miss) risk profile
  – Temporal characteristics (day of week, daylight, peak hours, etc.)
  – Aggressive driver (vehicle turning speed)
  – First to arrive (pedestrian or vehicle)

• Reinforced intuition/field experience and supported constructive discussions

• Pedestrian vs. bicycle evaluation (significant differences)

• “Data clarity”; professionals and the public understand the data results
Conclusion

• **Spring Street at 5th Street:** Results were used to justify the permanence of the ped scramble

• **10th Street at I-75 / I-85 SB On-Ramp:** Results could be used to justify pedestrian and bicycle safety at the cost of vehicle capacity

• **Peachtree Street at 13th Street:** Results were used to justify the installation of a signal in the absence of signal warrants with existing traffic volume and crash data
Contact:
Chris Puglisi, P.E.
chris.puglisi@jacobs.com
(404) 978-7563

Marc Start
marc.start@aecom.com
(404) 357-6631