Designing for Pedestrian Behavior

Marc Start, PE PTOE

18th Annual SCDOT / ACEC-SC Meeting

December 2, 2015

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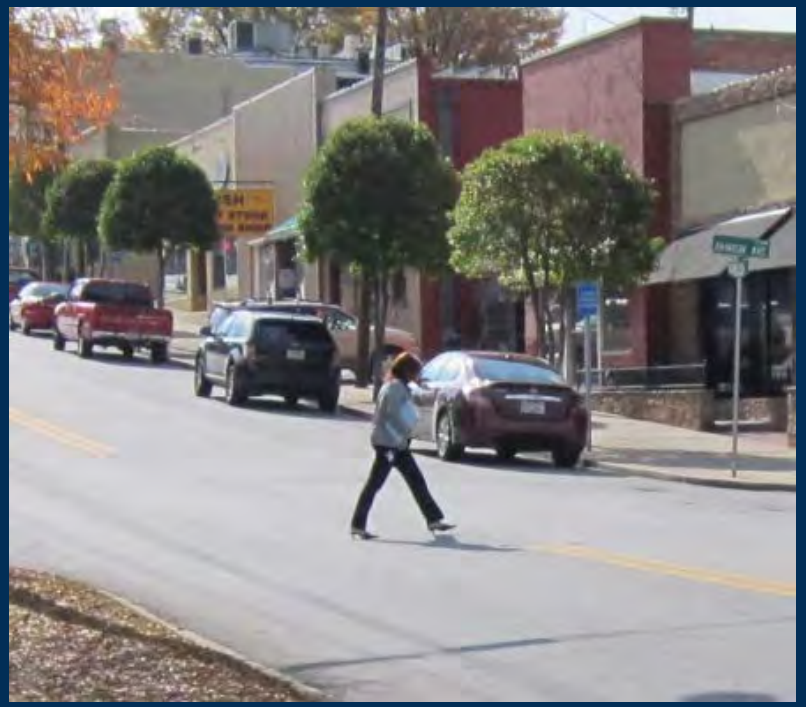
Pedestrian Behavior

- **Who are we dealing with?**

Pedestrian Behavior Influences

- **Pedestrian factors**
  - Age / mobility
  - Risk tolerance
  - Distractions
  - Familiarity
- **Other factors**
  - Crossing location
  - Traffic conditions
  - Driver behavior



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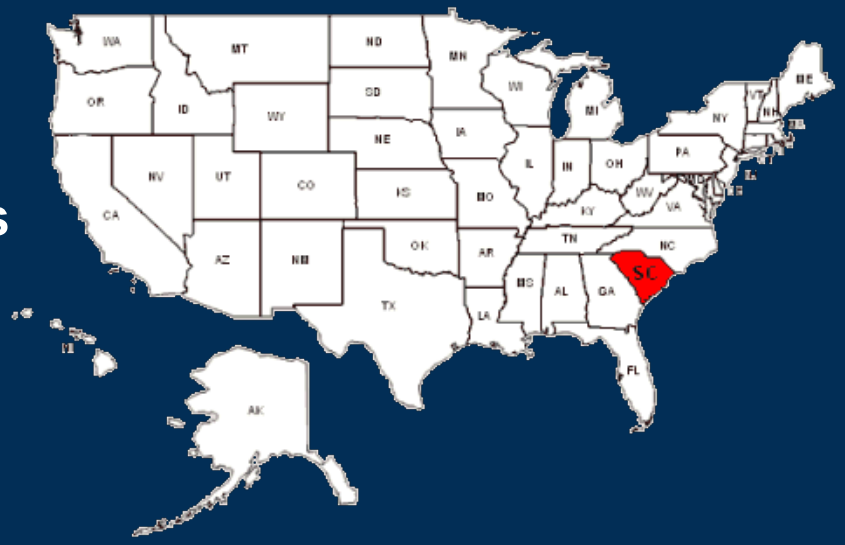
Pedestrian Safety Statistics (2013)

- **United States**
  - 4,735 pedestrian fatalities
  - 14% of traffic-related fatalities



- **South Carolina**
  - 100 pedestrian fatalities
  - 8th highest rate in nation

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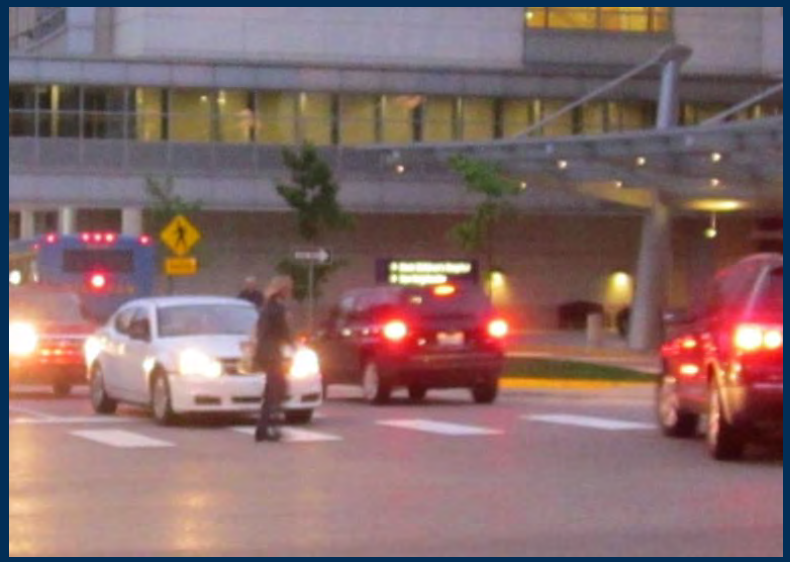
Pedestrian Safety Statistics

- **NHTSA 2013 Pedestrian Crash Statistics**
  - 69% at non-intersection locations
  - 73% in urban areas
  - 72% in dark conditions



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Pedestrian Safety Statistics

- **NHTSA 2013 Pedestrian Crash Statistics**
  - Injury rate for 20-24 age group is 2X the average rate
  - Fatalities
    - 69% male
    - 34% - pedestrian intoxicated
    - 15% - driver intoxicated
    - 6% - both intoxicated

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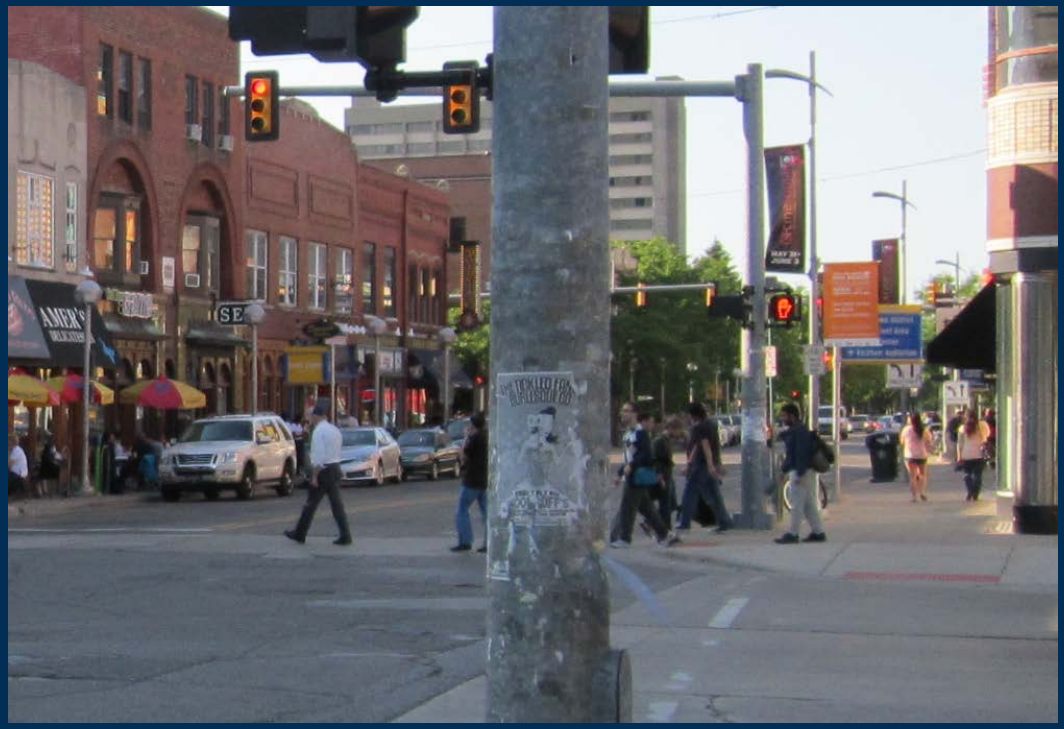
Related Factors

- Failure to yield ROW……23%
- In roadway improperly……19%
- Under the influence……18%
- Darting/running into road..17%
- Not visible……..14%

Pedestrian Safety at the Project Level

- Pedestrian crash rate?
- Feedback from regular users?
- Behavior?



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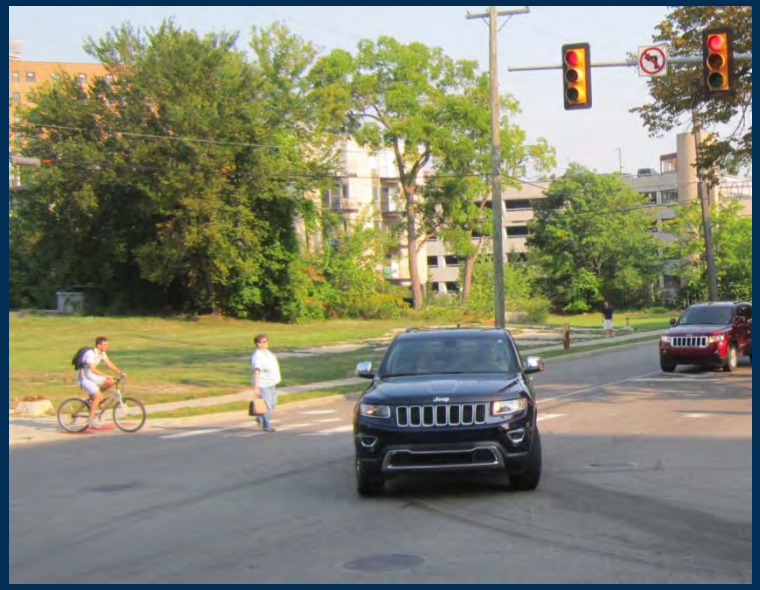
Pedestrian Safety

- **Pedestrian behavior is a convenient indicator to collect for predicting safety outcomes**
- **Similar to other crash exposure metrics**



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Typical Agency Reactions

- Why do pedestrians cross away from the crosswalk? A safe street crossing is provided.
- The pedestrians do not wait to cross with the pedestrian signal. The pedestrian crossing time is programmed correctly.

We need more information in order to make better decisions about pedestrian safety….

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Public comments – blame the pedestrian

Parents, take notice. Please teach your children to become responsible adults by showing them to look both ways before they cross the street.

Public comments – blame the infrastructure

You plunk a cross walk in the middle of the block with really no warning - where drivers are used to progressing freely - add the hubris of the pedestrian - of course someone is going to get hurt. What engineers and council members thought this was a good idea?

Getting beyond the public debate….

How can we improve safety?

- **Engineering: infrastructure**
- **Enforcement: monitoring compliance**
- **Education: influence behavior**

How do we design for pedestrians? We should first measure the problem.

GEORGIA SECTION INSTITUTE OF TRANSPORTATION ENGINEERS

Technical Paper Competition

1ST PLACE *is hereby awarded to*

Marc Start, PE, PTOE

For your preparation of the technical paper entitled

Pedestrian 101: Measuring Pedestrian Compliance and Project Applications

June 16, 2015

France Campbell, PE, PTOE
Technical Committee Chair, Georgia Section ITE

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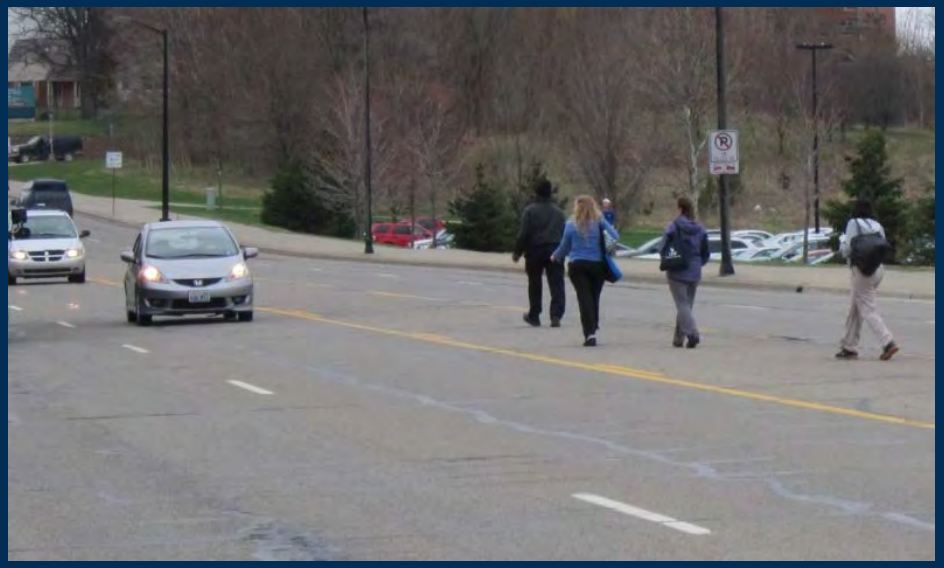
Agenda

- Challenges
- Quantifying pedestrian behavior
- Project applications (5)
- Specific applications to consider

Challenges

It is unusual to measure pedestrian behavior

- **Behavior seems random**
- **Pedestrian non-compliance is expected**



The typical approach is to implement a solution, rather than measure the pedestrian compliance

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Challenges

- We should work <u>with</u> pedestrian behavior to improve compliance
- Agency sensitivity with reporting results

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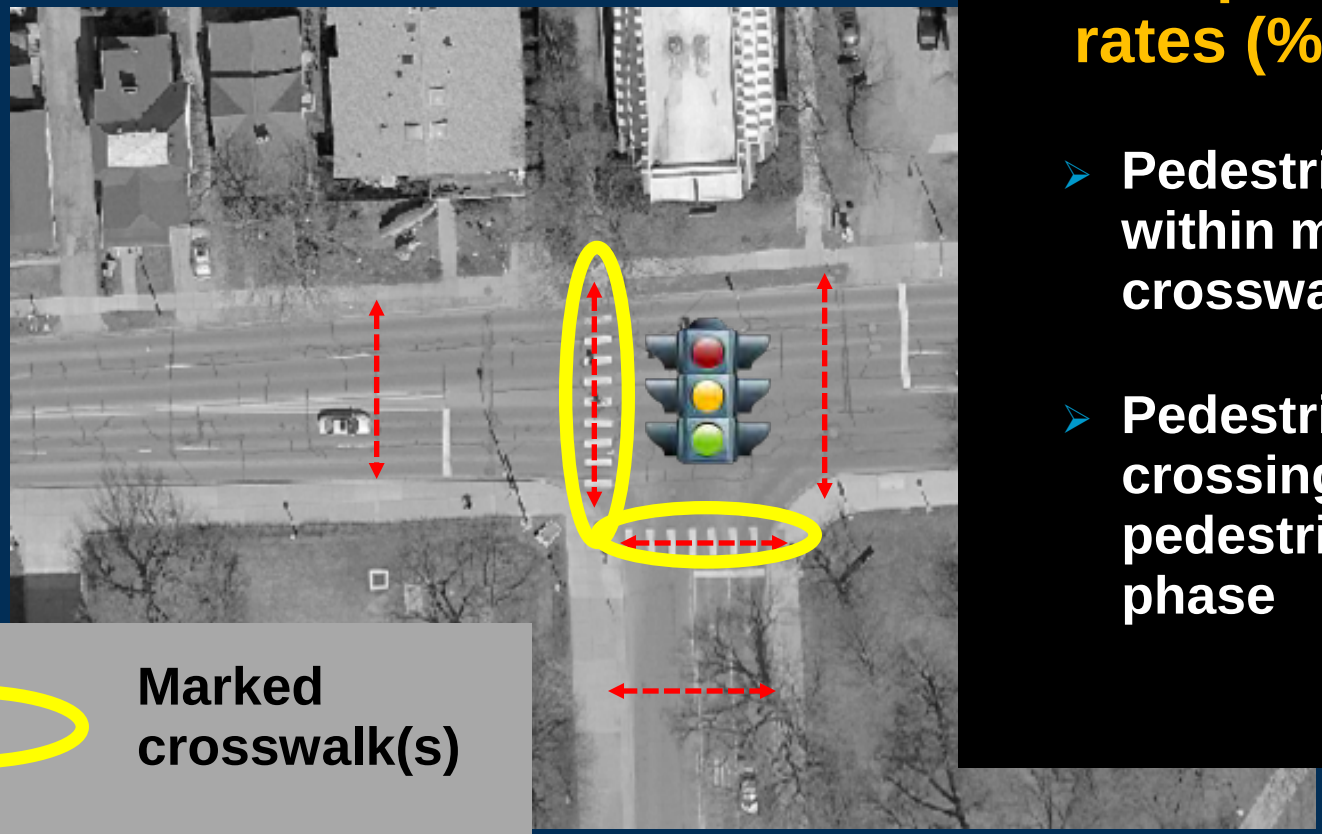
Signalized Intersection Data Collection



- **Compliance rates (%)**
  - Pedestrians within marked crosswalks
  - Pedestrians crossing during pedestrian phase

Marked crosswalk(s)

Observed pedestrian path(s)

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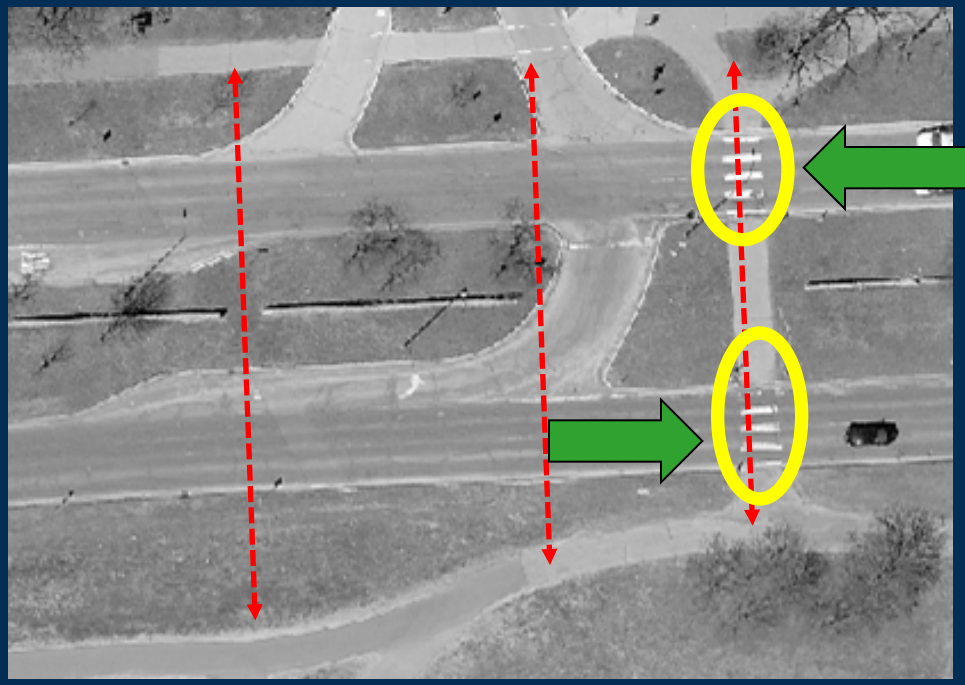
Mid-Block Crosswalk Data Collection

Marked crosswalk(s)

Observed pedestrian path(s)

Approaching driver response



- **Compliance rates (%)**
  - Pedestrians within marked crosswalks
  - Motorists yielding for pedestrians in crosswalk

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Compliance Results

- Consistent!
- Observations provide greater understanding

Pedestrian Compliance Rate Categories

Category	Pedestrian Compliance Rate Range	Action Items
Excellent	95 - 100%	No action necessary
Good	90 – 94%	Further action may not be necessary
Acceptable	80 – 89%	Consider low-cost safety countermeasures
Marginal	60 - 79%	Consider safety countermeasures
Poor	Less than 60%	Strongly consider safety countermeasures

Example of Compliance Results

Pedestrian Crossing (Type)	Pedestrian Compliance - Use of Marked Crosswalk	Pedestrian Compliance – Use of Traffic Signal Pedestrian Phase	Driver Compliance – Yield to Pedestrian at Crosswalk
Location 1 (signal)			
Location 2 (mid-block)			
Location 3 (mid-block)			
Location 4 (mid-block)			
Location 5 (signal)			
Location 6 (signal)			
Location 7 (signal)			
Location 8 (signal)			

Compliance greater than 80%

Compliance between 60% and 80%

Compliance less than 60%

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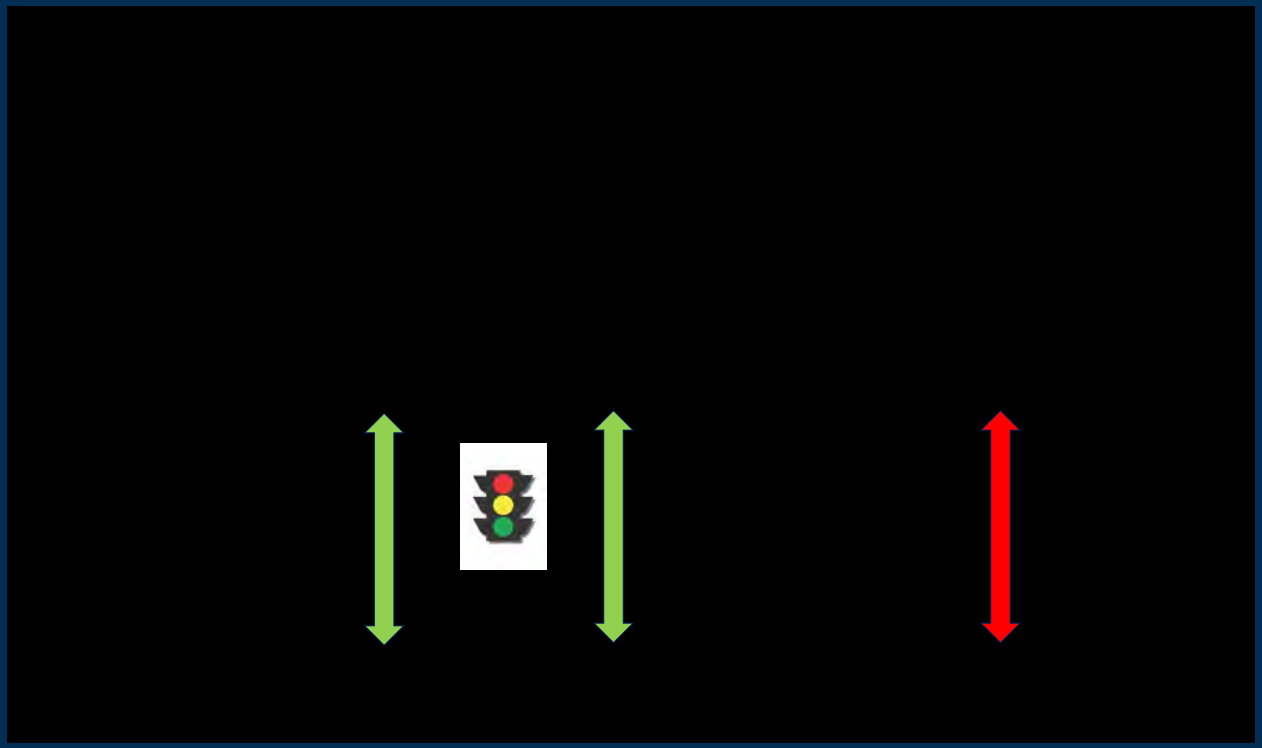
Example # 1 - Employee arrival activity, morning

Traffic signal operation change comparison



Example # 1 - Employee arrival activity, morning

Traffic signal operation change comparison

Condition	Total Pedestrians	Compliance with pedestrian signals
Before	63	76%
After	62	95%

25% improvement

"Control" (no changes)

Condition	Total Pedestrians	Compliance with pedestrian signals
Day 1	58	70%
Day 2	58	72%

3% improvement

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Example # 2 - Academic setting, mid-day classes

Traffic signal cycle length reduction comparison

Example # 2 - Academic setting, mid-day classes

Traffic signal cycle length reduction comparison

North & South Crosswalks

Condition	Total Pedestrians	Compliance with Pedestrian Signals
Before	147	53%
After	95	60%

13% improvement

East & West Crosswalks

Condition	Total Pedestrians	Compliance with Pedestrian Signals
Before	408	71%
After	192	75%

6% improvement

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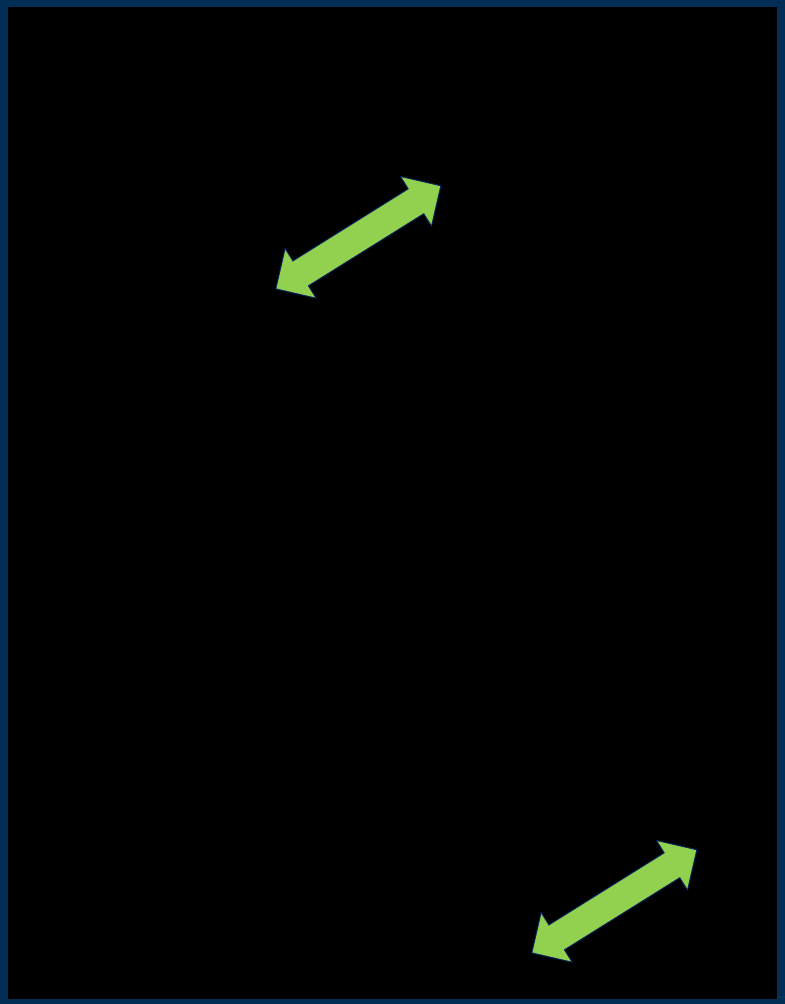
Example # 3 – Mid-block Crossings

Median Refuge Islands



Example # 3 – Mid-block Crossings

Median Refuge Islands

Pedestrian Behavior

Location	Compliance with Crosswalk	Actual Pedestrian Wait Time (sec)
North crossing	100%	1 sec
South crossing	86%	1 sec

Driver Behavior

Location	Observation Sample Size	Driver Compliance (Yield to Peds)
North crossing	59	73%
South crossing	108	76%

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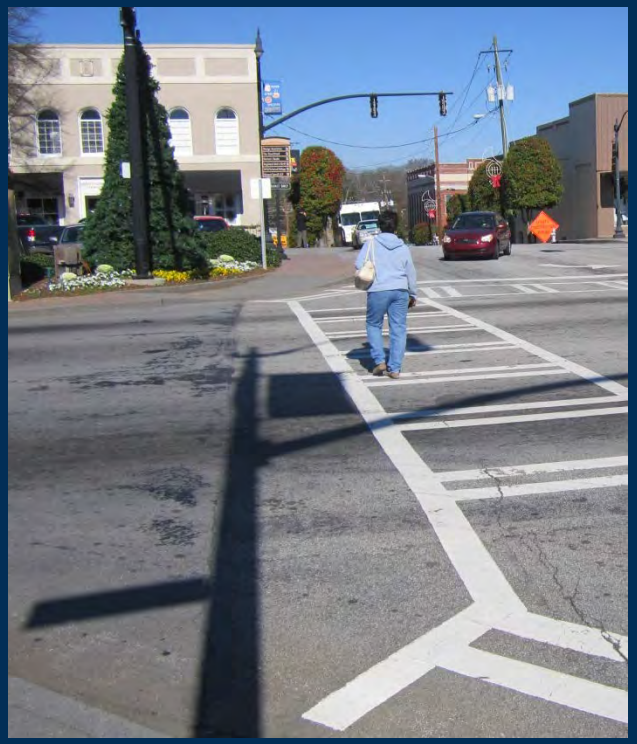
Example # 4 – Downtown Shopping Area

Traffic signal phasing change comparison



Example # 4 – Downtown Shopping Area

Traffic signal phasing change comparison

Time Period / Condition	Compliance with Pedestrian Signal	Actual Pedestrian Wait Time (sec)	
Morning			
Before	77%	12	-51%
After	38%	13	
Mid-Day			
Before	78%	20	-37%
After	49%	29	
Afternoon			
Before	75%	16	-59%
After	31%	19	

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Example # 5 – Downtown Mid-Block Crossings

Temporary mid-block pedestrian crossings

Temporary mini-humps
3’ wide crossing surface
2” high
Design speed 10 mph

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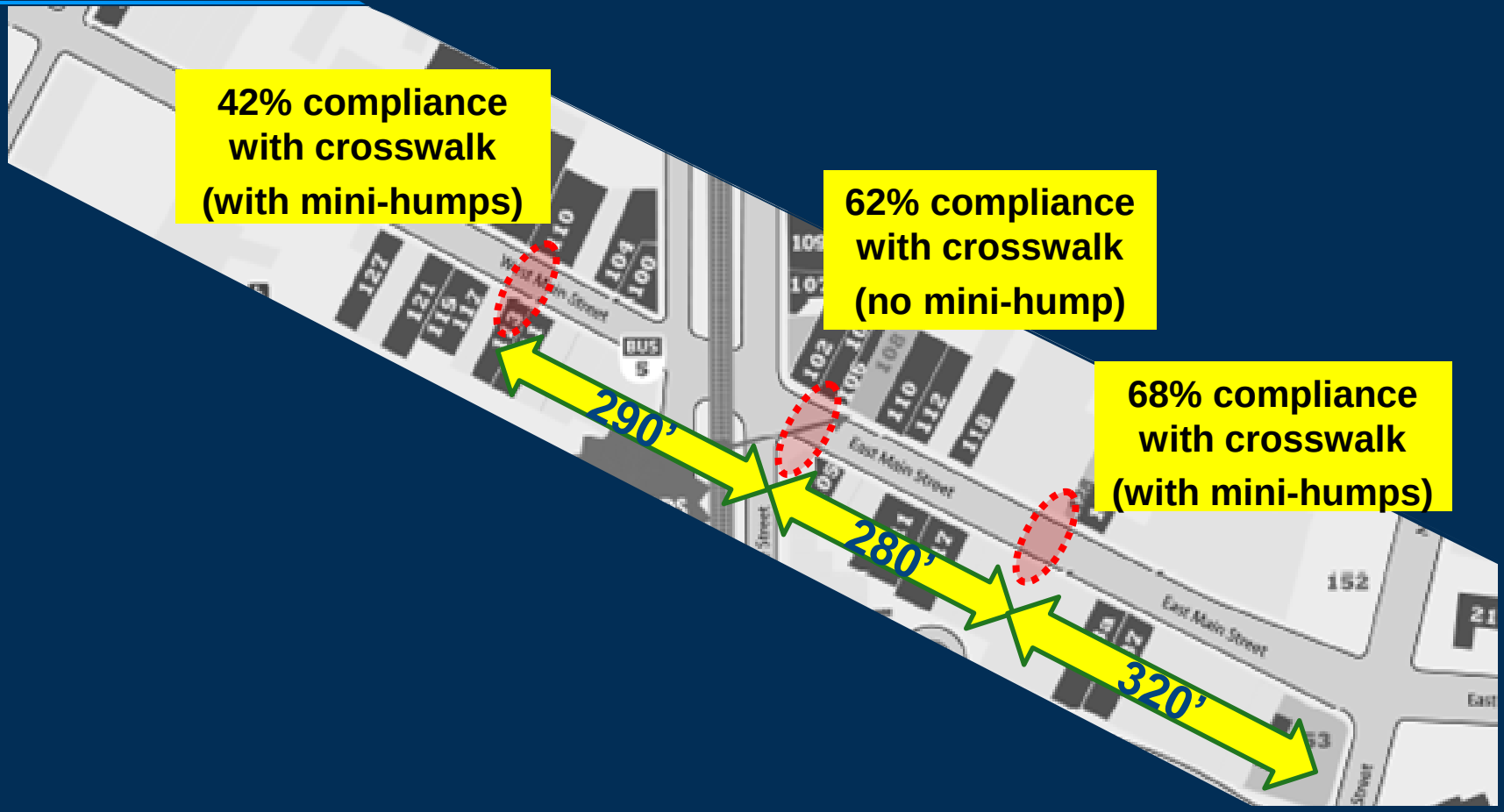
Example # 5 – Downtown Mid-Block Crossings



Specific Applications to Consider

- Improving pedestrian safety (performance measure)
- Truth-testing complaints about pedestrian behavior and driver behavior
- Selecting “best fit” pedestrian crossing locations
- Identifying mid-block pedestrian crossings that need strengthening (greater visibility)
- Determining the impact of traffic signal operation changes on pedestrian behavior

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Thank you!

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