

# Pedestrian Treatments

by

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# Recent Research Efforts

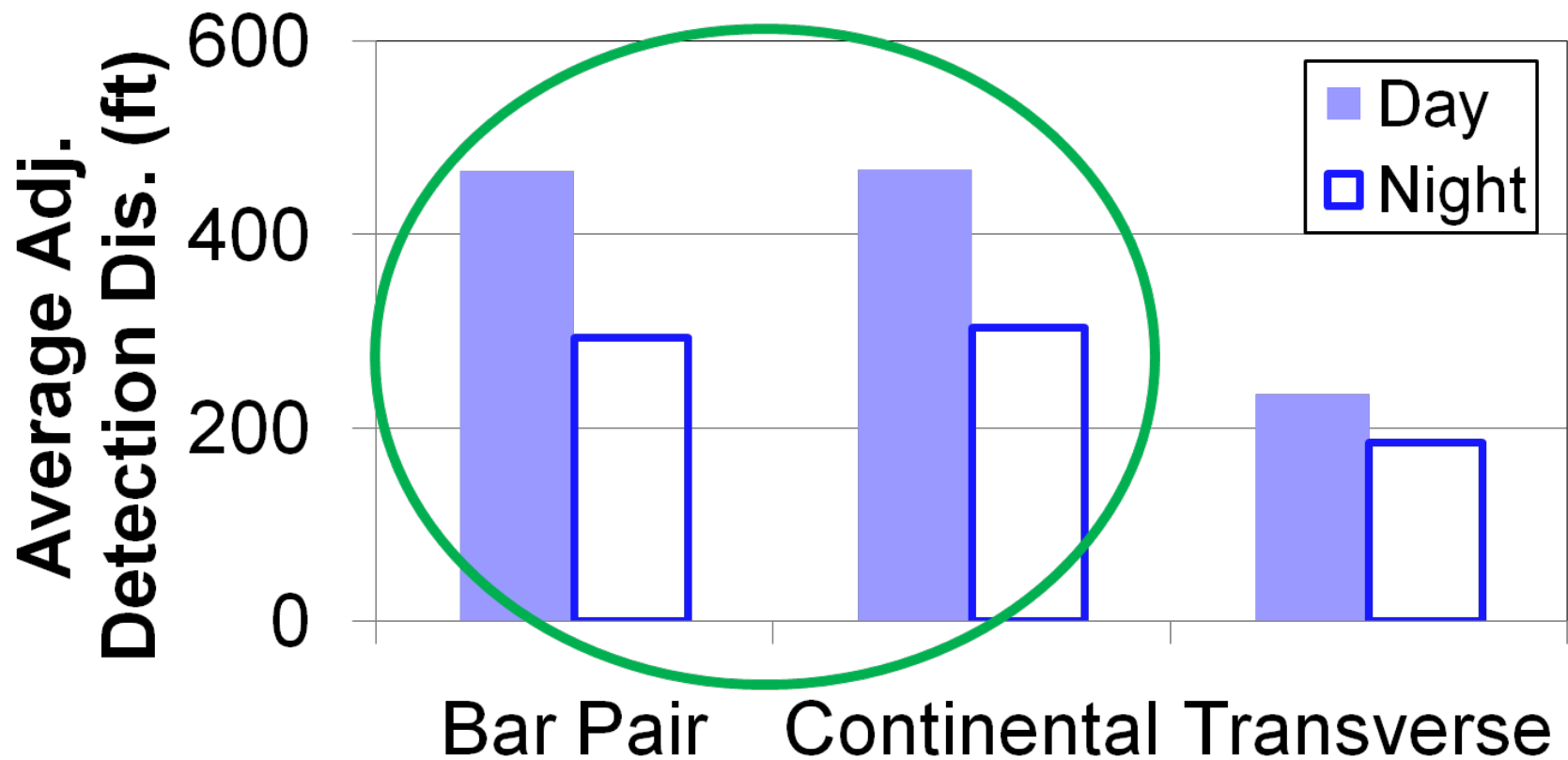
- FHWA Studies
  - **Crosswalk markings**
  - Driver yielding (DY) at **rectangular rapid flashing beacons (RRFB)**
  - Crash reduction at HAWKs, now known as **pedestrian hybrid beacons (PHB)**
  - Evaluations of RRFB configuration
- TxDOT
  - Driver yielding at **traffic control signals (TCSs)**, RRFBs, PHBs

# FHWA: Crosswalk Patterns

	Bar Pairs	Continetal	Transverse
<b>Group 1</b> <b>45</b> <b>Rural</b>			
<b>Group 2</b> <b>30</b> <b>Mixed</b>			
<b>Group 3</b> <b>30</b> <b>Urban</b>			
	<b>Bar</b>	<b>Con</b>	<b>Tra</b>

# FHWA: CW Detection Distance

## Key Finding = Light / Marking



# FHWA: CW Recommendations

## MUTCD Potential Changes

- High visibility markings
  - Define
  - Install at non-intersection locations
- If >35 mph speed limit and non-intersection uncontrolled crossing, 8 ft crosswalk width

Basic

Two  
Transverse  
Lines

Bar Pairs

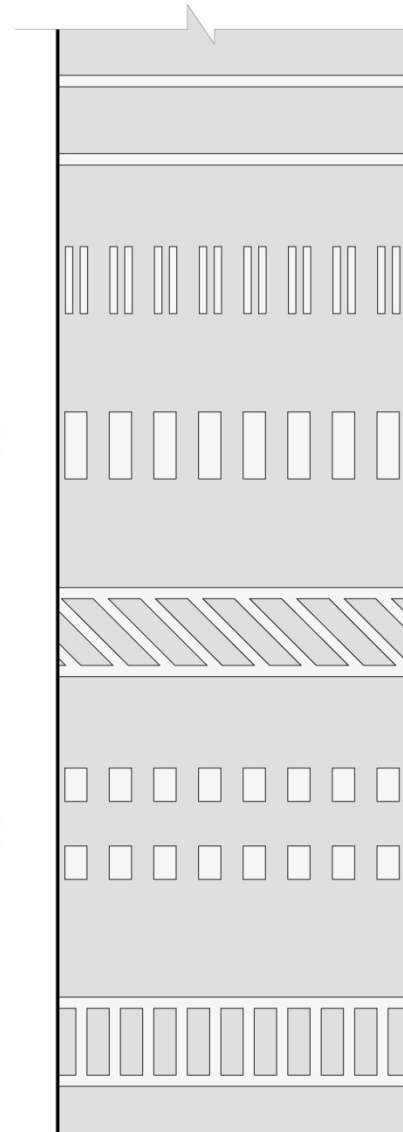
Continental

High Visibility

Diagonal

Double  
Continental

Ladder



# Rectangular Rapid Flashing Beacon



# History of RRFB

- Idea: use beacon from emergency flashers on police vehicles
- Eye catching
- First installed in Florida in early 2000s
- FHWA Interim Approval – July 16, 2008
  - [http://mutcd.fhwa.dot.gov/resources/interim\\_approval/ia11/fhwamemo.htm](http://mutcd.fhwa.dot.gov/resources/interim_approval/ia11/fhwamemo.htm)

# FHWA: RRFB Driver Yielding

<b>Time</b>	<b>Range</b>	<b>Mean</b>
<b>Baseline</b>	<b>0 to 26%</b>	<b>4%</b>
<b>One week</b>	<b>64 to 97%</b>	<b>79%</b>
<b>One month</b>	<b>62 to 96%</b>	<b>84%</b>
<b>Two years</b>	<b>72 to 96%</b>	<b>84%</b>



# FHWA: Closed-Course Study @ TAMU Riverside Campus



C-A12



C-B12



C-B8



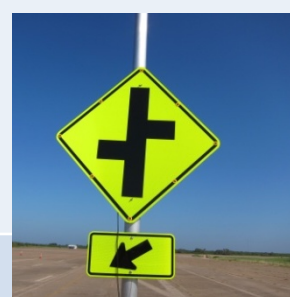
C-V12



R-B



R-A



LED



No Beacon



# Status for RRFB

- **Interim approval (national)**
- Desired = crash reduction factor
- Desired = guidance on speed limits, crossing distance, ADTs appropriate for device (when to use PHB or RRFB)
- Desired = better understanding of what influences effectiveness
- Desired = better guidance on light intensity

# Pedestrian Hybrid Beacon



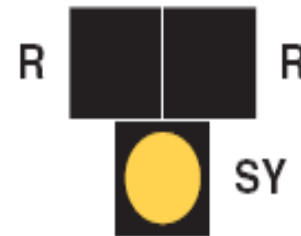
# Sequence for PHB



1. Dark Until Activated



2. Flashing Yellow Upon Activation



3. Steady Yellow



4. Steady Red During Pedestrian Walk Interval



5. Alternating Flashing Red During Pedestrian Clearance Interval



6. Dark Again Until Activated

## Legend

- SY Steady yellow
- FY Flashing yellow
- SR Steady red
- FR Flashing red



# FHWA: HAWK Safety Evaluation

- Safety evaluation: Empirical Bayes method
- 21 treatment sites
  - All at stop-controlled intersections/major driveways
- 102 unsignalized intersections for reference site group
- Statistical significant changes:
  - 29% reduction in total crashes
  - 69% reduction in pedestrian crashes

# TxDOT: Overview

- National attention for these ped treatments:
  - Pedestrian hybrid beacon (PHB)
    - 94 to 100% driver yielding
  - Rectangular rapid flashing beacon (RRFB)
    - 35 to 83% driver yielding
- New “tools” in the traffic engineer’s toolbox
- Will results be this good in Texas?
- What about higher posted speed roads or wider crossing distances?

# TxDOT: Site Selection

- Tried to identify all sites with PHB or RRFB in Texas
- Selected all higher speed or longer crossing distance sites
- Collected data at as many other sites as we could afford

# TxDOT: Data Collection / Analysis

- Staged pedestrian
- Similar clothes + approach style
- Marker @ SSD
- 40 crossings
- Count number of drivers not yielding and number of drivers yielding
- Used data for each crossing in statistical analysis
- Calculated site's average driver yielding for general comparisons





# TxDOT: City



Treatment	City	Sites	Driver Yielding
TCS	Austin	1	100%
	Dallas	4	99%
	Houston	2	95%
	All	7	98%
PHB	<b>Austin</b>	<b>25</b>	<b>92%</b>
	Houston	4	73%
	San Antonio	1	94%
	Waco	2	85%
	All	32	89%
RRFB	Frisco	1	75%
	<b>Garland</b>	<b>19</b>	<b>92%</b>
	Waco	2	34%
	All	22	86%



# TxDOT: PHB Results

- Statistically significant
  - City
  - Direction of traffic (one- or two-way)
  - Crossing distance (20 to 92 ft represented in data)
    - Using Austin results: 89% for 45 ft, 92% for 68 ft
    - DY is high across range of crossing distances, supports use of PHB on wide crossings
- Not statistically significant
  - Posted speed limit (30 to 45 mph represented)

# TxDOT: RRFB Results

- Statistically significant
  - City
  - Direction of traffic (one- or two-way)
    - May be a reflection of crossing distance (all one-way had 44 ft while two-way had 38 to 120 ft)
  - Posted speed limit (30 to 45 mph represented)
    - Higher speed = higher yielding but difference is really small (e.g., 91% @ 35, 92% @ 40)
  - Crossing distance (20 to 92 ft represented in data)
    - **Lower** driver yielding for wider crossing distance
    - There may be a crossing distance where a ped treatment other than RRFB should be used

# TxDOT: Time Since Installation

- As time goes on..., which is true?
  - Driver yielding decreases because newness wears off????
  - Driver yielding increases because drivers are learning what to expect / how to react????
- PHB
  - Focused on 4 or more lanes Austin sites
  - Driver yielding **improved** the longer the treatments had been installed (statistically significant)
- RRFB
  - Results similar but not significant (may be because of sample size limits)

# TxDOT: Key Findings

- More ped treatments in a city = better yielding
- Yielding improves as drivers become more familiar with the ped treatment
- PHB
  - Appropriate for wider cross sections and higher speeds
- RRFB
  - Lower yielding for longer crossing distances, therefore, consider other devices

# Questions / Sources

- Kay Fitzpatrick, [K-Fitzpatrick@tamu.edu](mailto:K-Fitzpatrick@tamu.edu)
- TxDOT study: report under review, due soon
- Crosswalk markings:  
<http://www.fhwa.dot.gov/publications/research/safety/pedbike/10067/10067.pdf>
- Safety Effectiveness of HAWK:  
<http://www.fhwa.dot.gov/publications/research/safety/10045/10045.pdf>
- RRFB driver yielding:  
<http://www.fhwa.dot.gov/publications/research/safety/pedbike/10046/10046.pdf>
- RRFB beacon shape, brightness: ongoing