

# HAWK Signal

## Pedestrian Safety

Illinois Traffic Engineering & Safety Conference  
Thursday, October 21, 2010



# Background Information

- **High-intensity Activated crossWalk**
- Developed by the City of Tucson, AZ
- First installation in Tucson in 2000
- There are currently over 100 HAWK signals in Tucson
- Experimental until release of 2009 MUTCD
- Referred to as Pedestrian Hybrid Beacons in 2009 MUTCD Chapter 4F



# Tucson HAWK Signal Example



# Safety Performance in Tucson

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- Tucson installations include locations that, prior to the HAWK installations, had a history of pedestrian crashes and/or fatalities
- Of the 100+ installations over the past 10 years, there have been 6 injury crashes and **ZERO** pedestrian fatalities at a HAWK
- Since October 2008 there have been **ZERO** pedestrian crashes at HAWK signals in Tucson

Source: City of Tucson



# Bradley Avenue DSC Crossing in Champaign



# Bradley Avenue DSC Crossing in Champaign

- **Four lanes**
- **Bus stops on both sides of crosswalk.**
- **18,850 vehicles per day**
- **85th % speed of 47 mph (35 mph posted limit)**
- **1,137 veh/hr during the pedestrian peak**
- **14 ped/hr during the afternoon peak**
- **Majority of users are from the Developmental Services Center on the north side of Bradley.**



# Bradley Avenue DSC Crossing in Champaign

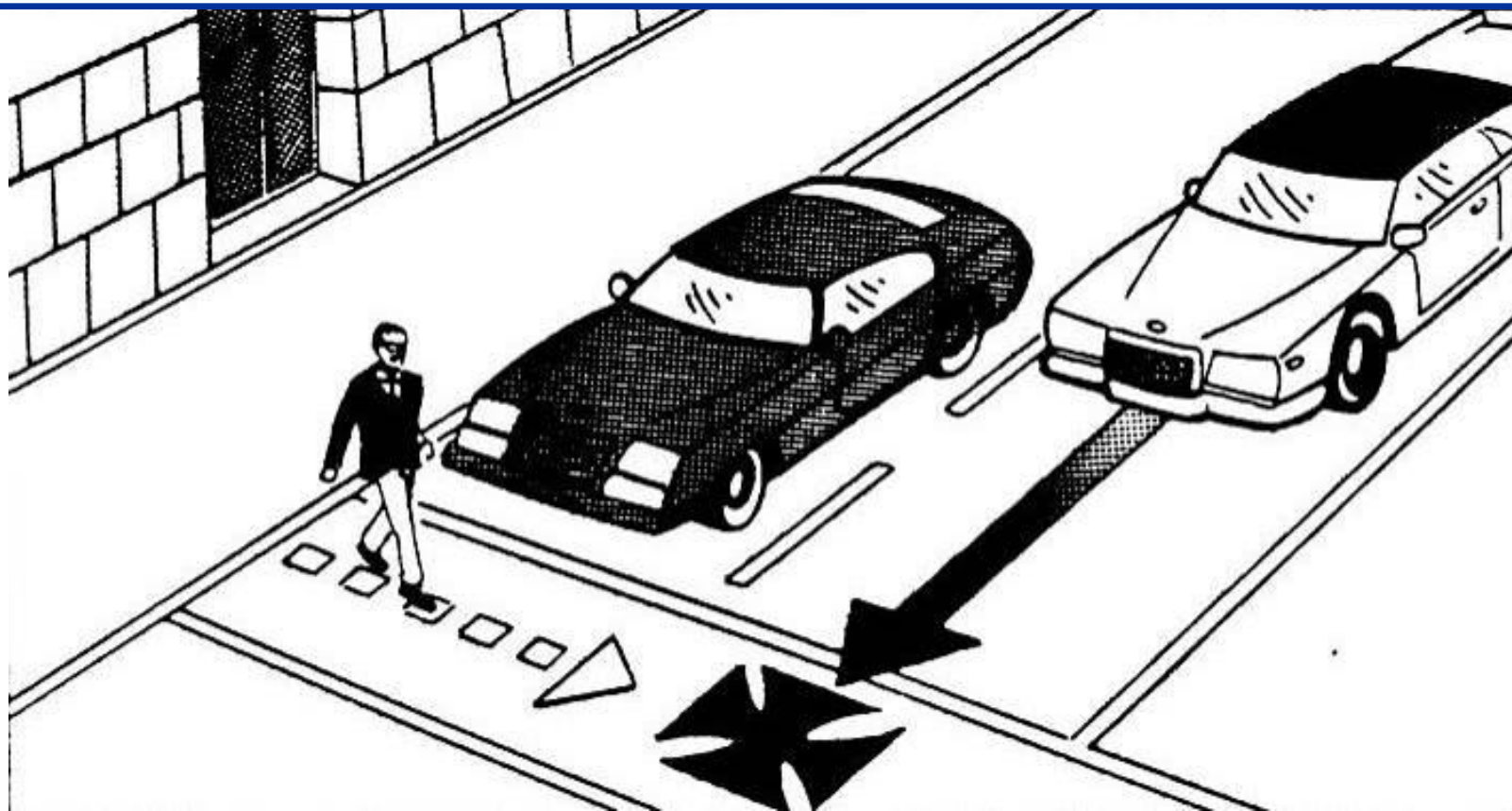
- **Original installation in the late 1980's included Pedestrian Warning signs, typical yellow flashers and standard crosswalk markings**
- **As new products and/or options became available, the City updated the crossing**
- **2007 version included**
  - **Yellow flashers**
  - **Advanced FYG Pedestrians Ahead signs**
  - **Back to Back FYG signs at crosswalk**
  - **Continental style crosswalk (9 feet)**
  - **On-street Ped Xing markings**

# Bradley Avenue DSC Crossing in Champaign





**In November 2007, there was a pedestrian fatality at the crossing.**



**1<sup>st</sup> car stops too close, masks visibility for driver in 2<sup>nd</sup> lane**

# Bradley at DSC – Study

- **Staff was asked to identify options to improve the safety of the crossing**
- **Discussions with DSC and MTD indicated bus re-routing to eliminate the need to cross at this location was not an option**
- **Staff asked CMT to evaluate the location in the context of two Federal publications:**
  - **Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations (FHWA-RD-04-100)**
  - **Improving Pedestrian Safety at Unsignalized Crossings (NCHRP Report 562)**



# Safety Effects of Marked vs. Unmarked (2002)

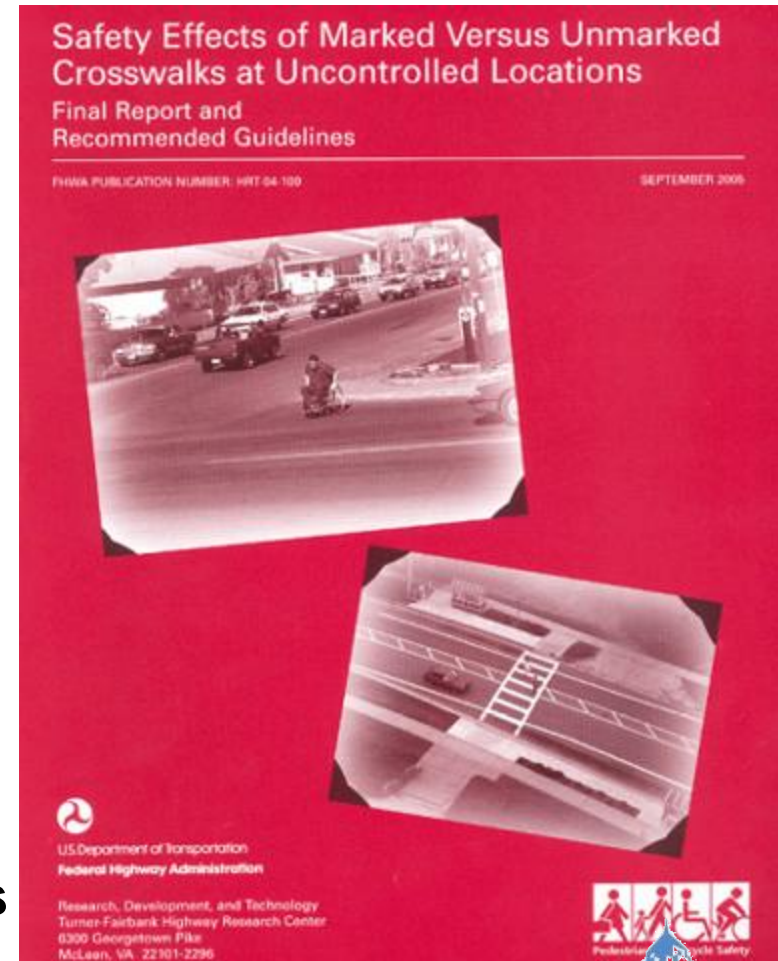
## Marked vs. Unmarked Analysis:

**Crashes correlate with ADT & number of travel lanes**

**Two-lane roads: No significant difference in crashes**

**Multilane roads (*3 or more lanes*)**

- **Under 12,000 ADT: no significant difference in crashes**
- **Over 12,000 ADT w no median: crashes marked > crashes unmarked**
- **Over 15,000 ADT & w median: crashes marked > crashes unmarked**



## Resulting Changes in 2009 MUTCD



*Marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph, or*

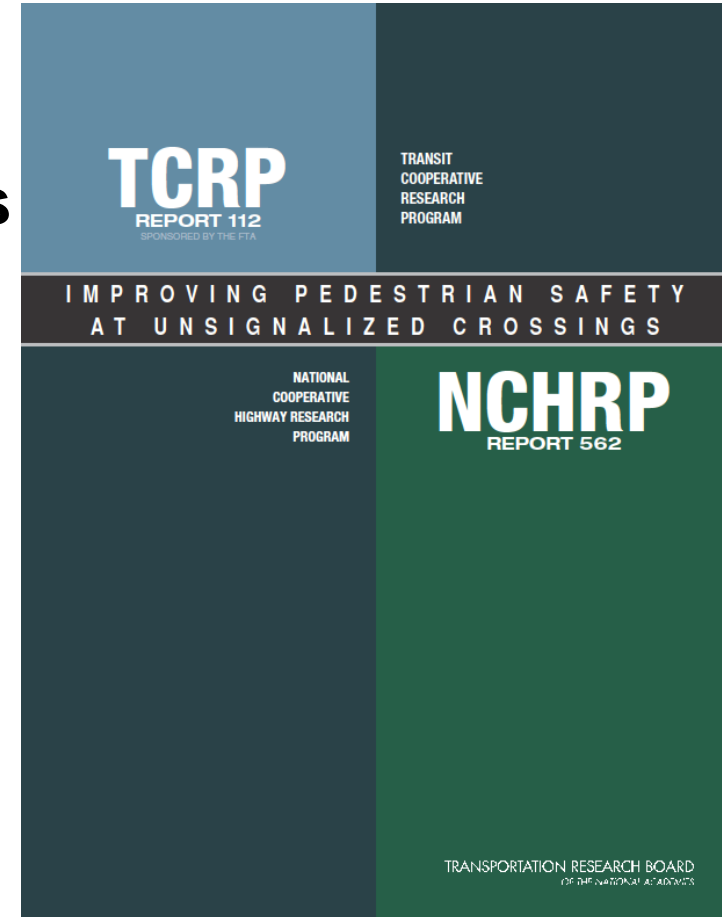
- 4 or more lanes without raised median island and ADT of 12,000 or more, or*
- 4 or more lanes with raised median island and ADT of 15,000 or more*



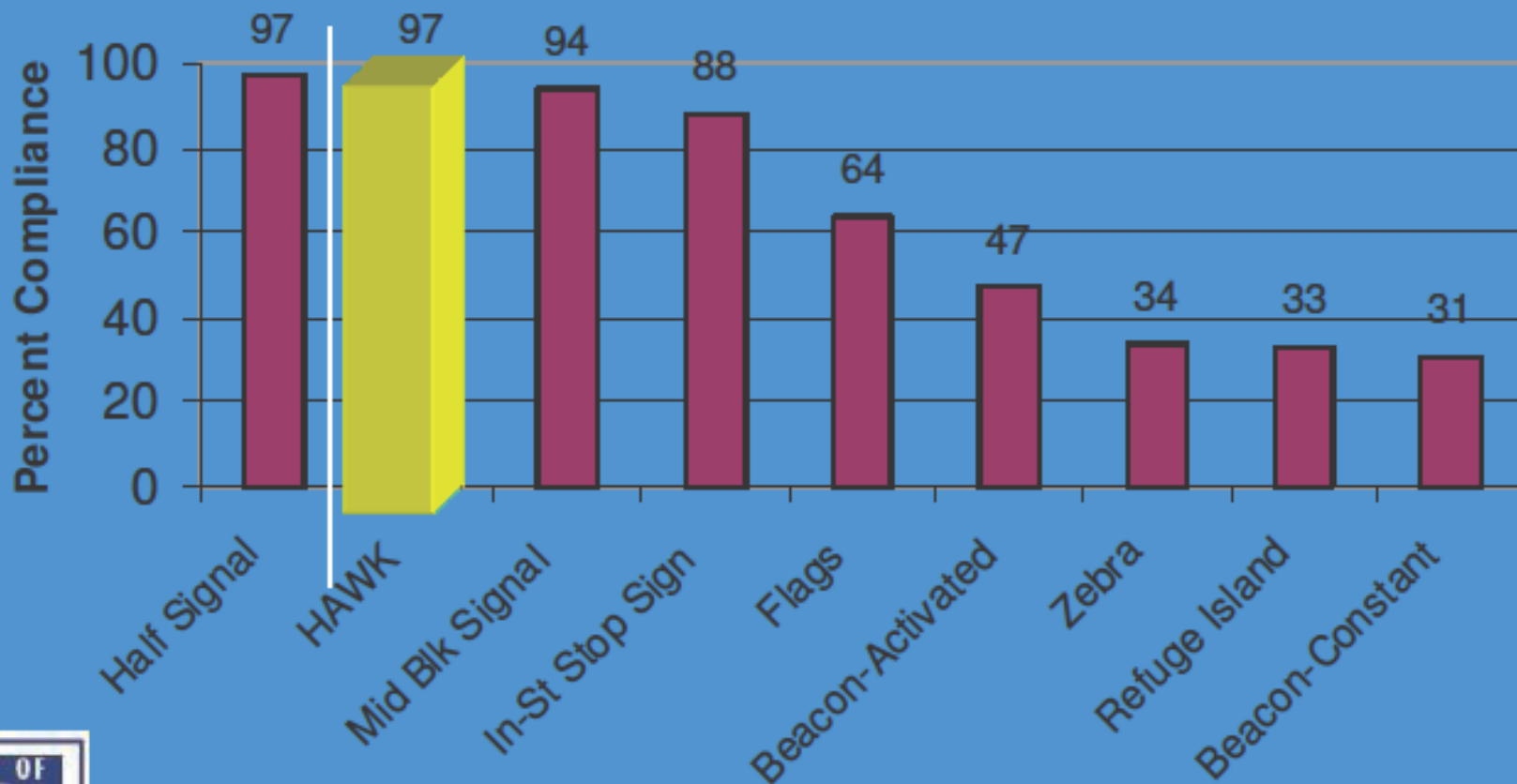
# Improving Pedestrian Safety at Unsignalized Crossings (NCHRP Report 562)

Released in 2006

- Evaluated compliance rates of treatments under various conditions
- Recommended treatments for high-volume, high-speed roadways at unsignalized crossings
- Resulted in changes to the 2009 MUTCD for pedestrian signal warrants (4C.05), addition of HAWK (4F), consideration of medians (3B.18)



# Innovative Crosswalk Treatments



RED INDICATIONS



CAUTION INDICATIONS

Source: Texas Transportation Institute, 2006





# Recommended Crosswalk Guidelines Worksheet (NCHRP Report 562)

## Uses:

- Pedestrian volumes
- Traffic volumes
- Crossing Distance
- Measured pedestrian delay (optional)

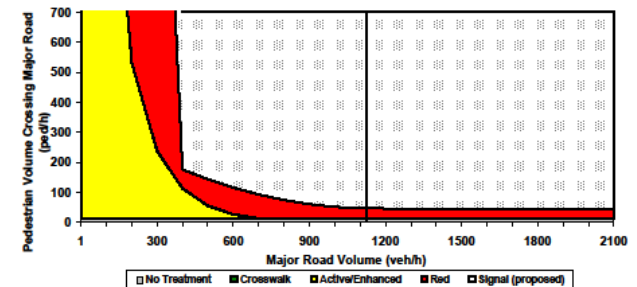
### GUIDELINES FOR PEDESTRIAN CROSSING TREATMENTS

This spreadsheet combines Worksheet 1 and Worksheet 2 (Appendix A, pages 69-70) of TCIP Report 112/NCHRP Report 562 (Improving Pedestrian Safety at Unsignalized Intersections) into an electronic format. This spreadsheet should be used in conjunction with, and not independent of, Appendix A documentation.

The spreadsheet is still under development, please inform TTI if errors are identified.

**Key**  
 Blue fields contain descriptive information.  
 Green fields are required and must be completed.  
 Tan fields are adjustments that are filled out only under certain conditions (follow instructions to the left of the cell).  
 Gray fields are automatically calculated and should not be edited.

Analyst and Site Information			
Analyst	CHT	Major Street	Bradley Avenue
Analysis Date	September 6, 2008	Minor Street or Location	DSC Crossing
Data Collection Date	August 6, 2008	Peak Hour	2 to 3 PM
<b>Step 1: Select worksheets</b>			
Posted or statutory speed limit (or 85th percentile speed) on the major street (mph)		1a	45
Is the population of the surrounding area <10,000? (enter YES or NO)		1b	YES
<b>Step 2: Does the crossing meet minimum pedestrian volumes to be considered for a traffic control device?</b>			
Peak-hour pedestrian volume (ped/h), $V_p$		2a	14
<b>Step 3: Does the crossing meet the pedestrian warrant for a traffic signal?</b>			
Major road volume, total of both approaches during peak hour (veh/h), $V_{maj}$		3a	1127
[Calculated automatically] Preliminary (before min. threshold) peak hour pedestrian volume to meet warrant		3b	91
[Calculated automatically] Minimum required peak hour pedestrian volume to meet traffic signal warrant		3c	93
Is 15th percentile crossing speed of pedestrians less than 3.5 ft/s (1.1 m/s)? (enter YES or NO)		3f	YES
If 15th percentile crossing speed of pedestrians is less than 3.5 ft/s (1.1 m/s), then reduce 3c by up to 50%.	Is rate of reduction for 3c (up to 50%)	3e	50%
	Reduced value or 3c	3f	97
<b>Step 4: Estimate pedestrian delay</b>			
Pedestrian crossing distance, curb to curb (ft), L		4a	55
Pedestrian walking speed (ft/s), $S_p$ (suggested speed = 3.5 ft/s)		4b	3
Pedestrian start-up time and end clearance time (s), $t_s$ (suggested start-up time = 3 sec)		4c	5
[Calculated automatically] Critical gap required for crossing pedestrian (s), $t_c$		4d	24
Major road volume, total both approaches OR approach being crossed if closest median island is present, during peak hour (veh/h), $V_{maj}$		4e	1127
Major road flow rate (veh/s), $v$		4f	6.45
Average pedestrian delay (s/person), $d_p$		4g	93715
Total pedestrian delay (h), $D_p$ . The value in 4h is the calculated estimated delay for all pedestrians crossing the major roadway without a crossing treatment (assumes 0% compliance). If the actual total pedestrian delay has been measured at the site, that value can be entered in 4i to replace the calculated value in 4h.		4h	34.4
		4i	155.1
<b>Step 5: Select treatment based up on total pedestrian delay and expected motorist compliance.</b>			
Expected motorist compliance at pedestrian crossings in region: enter HIGH for High Compliance or LOW for Low Compliance		5a	LOW
Treatment Category: <b>RED</b>			



This worksheet provides general recommendations on pedestrian crossing treatments to consider at unsignalized intersections; in all cases, engineering judgment should be used in selecting a specific treatment for installation. This worksheet does not apply to school crossings. In addition to the results provided by this worksheet, users should consider whether a pedestrian treatment could present an increased

Spreadsheet developed by  
Texas Transportation Institute

Project 5202010

PTI 10/1/2008  
10/1/2008

# Recommended Crosswalk Guidelines Worksheet (NCHRP Report 562)

## One of four results:

- Standard crosswalk with signs
- Active/Enhanced Enhanced – warning signs, high visibility markings and/or standard flashers
- Active – devices (flashers) displaying warning only when present
- Red – signal or beacon device (HAWK)
- Traffic signal (MUTCD ped warrant)

**GUIDELINES FOR PEDESTRIAN CROSSING TREATMENTS**

This spreadsheet combines Worksheet 1 and Worksheet 2 (Appendix A, pages 69-70) of TCP Report 112/NCHRP Report 562 (Improving Pedestrian Safety at Unsignalized Intersections) into an electronic format. This spreadsheet should be used in conjunction with, and not independent of, Appendix A documentation.

**Key**

- Blue fields contain descriptive information
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**Analyst and Site Information**

Analyst	CMT	Major Street	Bradley Avenue
Analysis Date	September 6, 2008	Minor Street or Location	DSC Crossing
Data Collection Date	August 6, 2008	Peak Hour	2 to 3 PM

**Step 1: Select worksheets**

Posted or statutory speed limit (or 85th percentile speed) on the major street (mph)	Za	45
Is the population of the surrounding area <10,000? (enter YES or NO)	Zb	YES

**Step 2: Does the crossing meet minimum pedestrian volumes to be considered for a traffic control device?**

Peak-hour pedestrian volume (ped/h), $V_p$	Za	14
Minimum required $V_p$	Zb	3

**Step 3: Does the crossing meet the pedestrian warrant for a traffic signal?**

Major road volume, total of both approaches during peak hour (veh/h), $V_{MHP}$	Za	1127
(Calculated automatically) Preliminary (before min. threshold) peak hour pedestrian volume to meet warrant	Zb	93
(Calculated automatically) Minimum required peak hour pedestrian volume to meet traffic signal warrant	Zc	93
Is 15th percentile crossing speed of pedestrians less than 3.5 ft/s (1.1 m/s)? (enter YES or NO)	Zd	YES
If 15th percentile crossing speed of pedestrians is less than 3.5 ft/s (1.1 m/s), then reduce Zc by up to 50%	Ze	50%
Results: The signal warrant is not met. Go to step 4.	Zf	0

**Step 4: Estimate pedestrian delay.**

Pedestrian crossing distance, curb to curb (ft), L	4a	56
Pedestrian walking speed (ft/s), $S_p$ (suggested speed = 3.5 ft/s)	4b	3
Pedestrian start-up time and evel clearance time (s), $t_s$ (suggested start-up time = 3 sec)	4c	5
(Calculated automatically) Critical gap required for crossing pedestrian (s), $t_c$	4d	11
Major road volume, total both approaches OK approach being crossed if raised median island is present, during peak hour (veh/h), $V_{MHP}$	4e	1127
Major road flow rate (veh/s), $v$	4f	16.1
Average pedestrian delay (seconds), $\bar{d}$	4g	817.6
Total pedestrian delay (h), $D$ . The value in 4h is the calculated estimated delay for all pedestrians crossing the major roadway without a crossing treatment (assumes 0% compliance). If the actual total pedestrian delay has been measured at the site, that value can be entered in 4i to replace the calculated value in 4h.	4h	364.5
Expected motorist compliance at pedestrian crossings in region: enter HIGH for High Compliance or LOW for Low Compliance	4i	155.1
Expected motorist compliance at pedestrian crossings in region: enter HIGH for High Compliance or LOW for Low Compliance	5a	LOW

**Step 5: Select treatment based up on total pedestrian delay and expected motorist compliance.**

Treatment Category:	RED
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**Pedestrian Volume Crossing Major Road**

**Legend:**

- No Treatment
- Crosswalk
- Active/Enhanced
- Red
- Signal (proposed)

This worksheet provides general recommendations on pedestrian crossing treatments to consider at unsignalized intersections; in all cases, engineering judgment should be used in selecting a specific treatment for installation. This worksheet does not apply to school crossings. In addition to the results provided by this worksheet, users should consider whether a pedestrian treatment could present an increased risk to bicyclists.

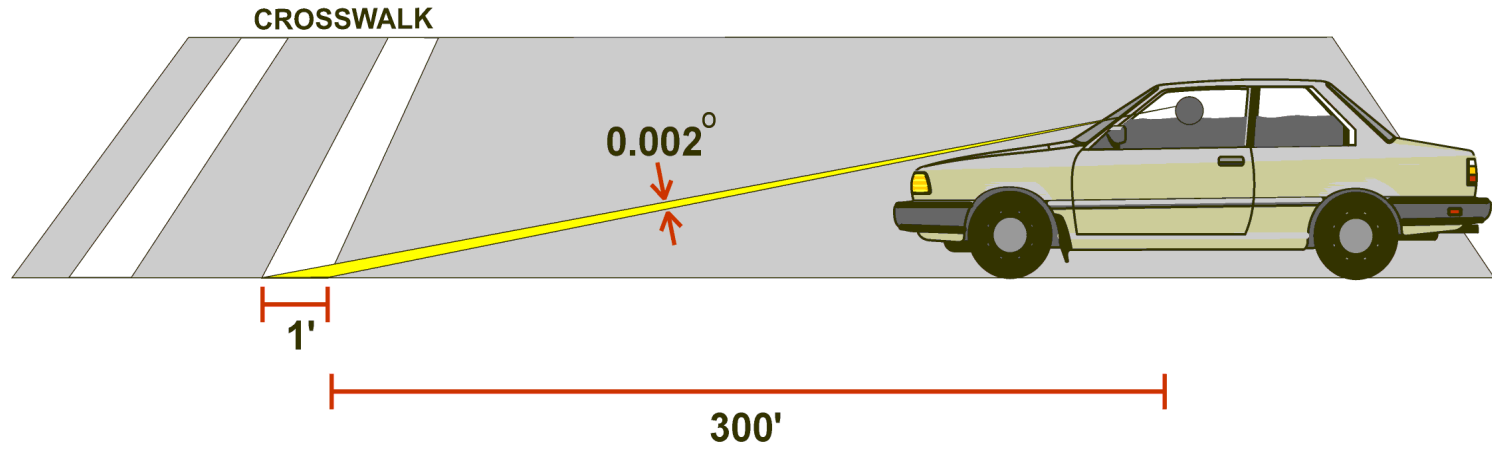
Spreadsheet developed by Texas Transportation Institute. Printed 5/20/10.

# Enhanced Crosswalk Example

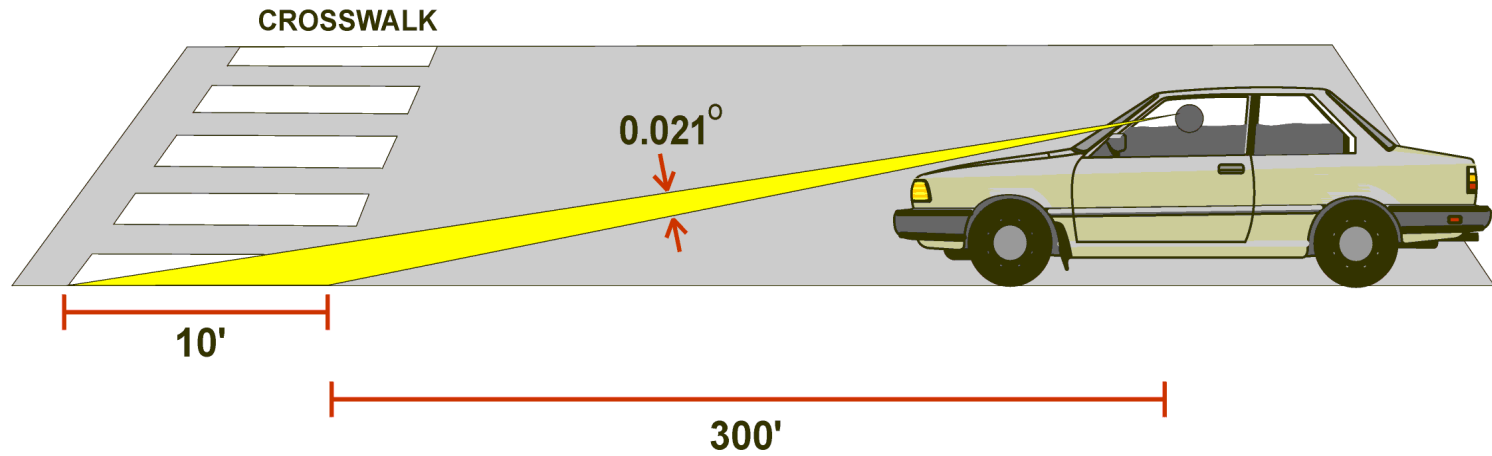




### LATERAL 12" STRIPE



### LONGITUDINAL MARKING



# Active Crosswalk Example

## Rectangular Rapid Flashing Beacons



**- Driver Yielding compliance of 80 to 100%**



# Bradley Avenue DSC Crossing in Champaign





Pedestrian  
view  
before



Pedestrian  
view now





Driver's  
View  
Before



Driver's  
View  
Now









# HAWK Signal Installation Costs

Construction and Materials –  
HAWK - \$91,500

Sidewalk/ADA - \$25,885

Refuge Median - \$8,785

Total construction cost –  
\$126,170



# HAWK Signal Project Management

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Key elements outside typical project:

- Involving DSC throughout the design process
- Development of public education materials
- Disseminating those materials to major traffic generators near the location and to the general public

Total of 265 Staff Hours

# How Does it Work?





# HAWK Sequence



**1**  
**Blank for  
drivers**



**4**  
**Steady  
red**



**2**  
**Flashing  
yellow**



**5**  
**Wig-Wag**



**3**  
**Steady  
yellow**



**Return  
to 1**



# Public Outreach Efforts

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- Project webpage on City website
- News Releases  
(contract award, start of construction and leading up to turn-on)
- Walking the HAWK video
- Informational slides running on City Channel
- Champaign Connection episode on City Channel
- Providing information to News-Gazette for article
- On-camera interview after signal turn-on

# Public Outreach Efforts

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- Providing Brochures and DVDs to DSC for training (DSC staff was also involved by reviewing the brochure and video)
- Forwarding the brochure and video to:
  - Major traffic generators (Kraft and Parkland College)
  - University of Illinois
  - Driver's License Facility
  - Mass Transit District



# How does a HAWK operate?

While slightly different in appearance, a HAWK signal operates much like a conventional signal in that it stops traffic flow.

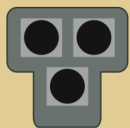
## What to do at a **HAWK** High Intensity Activated crossWalk Pedestrian Signal



[www.ci.champaign.il.us](http://www.ci.champaign.il.us)

### What Drivers See

### What Pedestrians See



1



The HAWK remains **DARK** for traffic until a pedestrian activates the push-button. While the HAWK is DARK, traffic can continue through the signal without stopping.



2



When a pedestrian presses the button, approaching drivers see a **FLASHING YELLOW** signal for a few seconds, indicating that the signal has been activated.

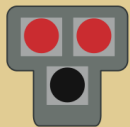
Flashing



3



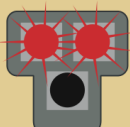
The flashing yellow is followed by a **SOLID YELLOW** signal, indicating that motorists should reduce speed and be prepared to stop.



4



The solid yellow is followed by double **SOLID RED** signals, requiring drivers to stop.



5



The double solid red signals are followed by alternating **FLASHING RED** signals. During this time, vehicles may continue through the signal after coming to a complete stop once pedestrians have finished crossing their half of the street. The signal will then go dark until activated again.

Flashing

Flashing

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