ELTEC Traffic Products and Warning Systems

PEDESTRIAN SAFETY – UTILIZATION OF RRFB AND HYBRID BEACONS

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PEDESTRIAN CROSSING STATISTICS

- STUDIES INDICATE CROSSWALK COMPLIANCE IS FROM 4% - 30%
- HAWAII REPORTED 50 NON-YIELDS TO PEDESTRIANS IN LESS THAN 1.5 HOURS
- ST PETERSBURG FL REPORTED INJURY RATE OF 49 PEOPLE PER 100,000 PEOPLE

PEDESTRIAN CROSSING STATISTICS: USA TODAY

- PAST 10 YEARS 47,000 DEATHS – 27, 189 IN LAST 6 YEARS
  - 4,531 DEATHS PER YEAR ON AVERAGE FOR LAST 6 YEARS
  - 87 DEATHS PER WEEK OR 12 DEATHS PER DAY
- PEDESTRIANS ACCOUNT FOR 11.8% OF ALL TRAFFIC FATALITIES
- 75% OF DEATHS WERE IN URBAN AREAS
- 70% OF DEATHS WERE AT NIGHT
- LESS THAN 1.5% FEDERAL $'s SPENT ON WALKERS AND CYCLISTS

TOP 10 CITIES MOST DANGEROUS TO PEDESTRIANS

- ORLANDO
- TAMPA-ST PETERSBURG
- JACKSONVILLE
- MIAMI
- MEMPHIS
- BIRMINGHAM
- HOUSTON
- ATLANTA
- PHOENIX
- CHARLOTTE

FACTORS MAKING PEDESTRIAN SAFETY A BIGGER PROBLEM

- AGING POPULATION
- MORE PEOPLE WALKING – ECONOMY AND OBESITY
- EAR BUDS & MUSIC
- TEXTING & TALKING ON PHONE

NEW APPROACH FOR PEDESTRIAN CROSSINGS

- STUDY CONDUCTED IN ST PETERSBURG FL WITH NEW APPROACH USING RECTANGULAR RAPID FLASHING BEACON (RRFB)
- RESULTS – OVER 80% COMPLIANCE; SOME AREAS AS HIGH AS 98%
- RECONFIRMED IN 2014 STUDY BY TTI – SHOWED THAT MOTORIST COMPLIANCE WAS 92%-93%

APPROVAL OF RRFB

- APPROVED BY FHWA IN JULY 2008
- MUST HAVE 2 LIGHTS ON EACH SIDE OF STREET IN EACH DIRECTION
- FLASH RATE OF 70-80 CYCLES PER MINUTE ALTERNATING BETWEEN LIGHTS (WIG-WAG)
- MUST BE ONE OF TWO APPROVED FLASH PATTERNS WITHIN LEDS (2-4/1 OR WW+S)
- LEDS MUST BE MINIMUM OF 5" X 2" AND 7" APART

APPROVAL OF RRFB (CONT)

- MUST MEET SAE J595 FOR CLASS 1 BRIGHTNESS
- MUST BE UNCONTROLLED CROSSING
- MUST HAVE SIGNS WITH EACH LIGHT BAR
- MUST BE DARK EXCEPT WHEN PEDESTRIAN ACTIVATES AND MUST GO OFF AFTER PEDESTRIAN CROSSES STREET

CLASS 1 LED REQUIRED

- DIFFERENT MANUFACTURERS ENTERING MARKET USED DIFFERENT LEDS – LIGHT INTENSITY NOT AS BRIGHT
- FHWA BELIVED THAT LIGHT INTENSITY IS KEY TO SUCCESS OF RRFB
- ISSUED RULING THAT RRFB'S MUST BE CLASS 1
- RECENT STUDY BY TTI INDICATES BRIGHTNESS MAY IMPACT MOTORIST ABILITY TO SEE PEDESTRIANS STEPPING INTO THE STREET

FLASH PATTERN

- FLASH PATTERN WAS ORIGINALLY 2-3 BUT WAS CHANGED TO 2-4/1 TO REFLECT ACTUAL STUDY SYSTEMS
- FLASH ISSUED APPROVAL OF ADDITIONAL NEW FLASH PATTER IN 2014 FOR WW+S PATTERN AS RESULT OF STUDIES IN 2014
- BRIGHTNESS MAKES MORE DIFFERENCE THAN FLASH PATTERN

NO DAYTIME DIMMING

- CONVERSATONS WITH FHWA INDICATED BRIGHTNESS IS PROBABLY KEY TO SUCCESS OF RRFB
- MOST NEW VENDORS SUPPLY RRFBS WERE DIMMING
- IN SEP 2012 FHWA RULED DAYTIME DIMMING IS NOT ALLOWED

SOLAR SIZING REPORT

- COMPANIES HAVE REMOVED DIMMING INDICATIONS FROM LITERATURE
- SIGNS OF DIMMING BY VENDOR
  - 30 DAYS OF BATTERY AUTONOMY
  - POWER/LIGHT MANAGEMENT OR SIMILAR TERMS
- REQUIRE SOLAR SIZING REPORT TO SUPPORT DESIGN OF SYSTEM

TYPICAL RRFB

RRFB IN OPERATION

HYBRID BEACON SYSTEMS

Pedestrian Hybrid Beacon

Also Known as "HAWK"

(**H**igh-Intensity **A**ctivated Cross**W**al**K**)

Hybrid Pedestrian Crossing

- What is a Pedestrian Hybrid Beacon?
  - Defined in MUTCD 2009 Edition Chapter 4F

A pedestrian hybrid beacon is a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians crossing a street or highway at a marked crosswalk.

HYBRID BEACON INSTALLATION

When a Hybrid Beacon is installed:

1. At least two beacon faces shall be installed for each approach.
2. A stop line shall be installed for each approach.
3. A pedestrian signal head shall be installed at each end of the crosswalk.
4. Hybrid beacon shall be pedestrian actuated.

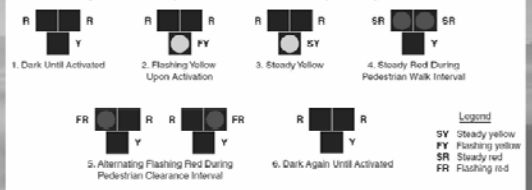
HYBRID BEACON INSTALLATION POLE

HYBRID BEACON INSTALLATION MAST ARM

Hybrid Pedestrian Signal Phasing

Guidance:
The duration of the flashing yellow interval should be determined by engineering judgment.
The duration of the steady yellow interval should have a minimum duration of 3 seconds and a maximum duration of 6 seconds.

Figure 4F-3. Sequence for a Pedestrian Hybrid Signal



Pedestrian Signal Head Operation

- **The pedestrian signal heads shall continue to display a steady UPRAISED HAND (symbolizing DON'T WALK) signal indication when the pedestrian hybrid beacon faces are either dark or displaying flashing steady CIRCULAR YELLOW signal indications.**
- **The pedestrian signal heads shall display a WALKING PERSON (symbolizing WALK) signal indications when the pedestrian hybrid beacon faces are displaying steady CIRCULAR RED signal indications.**
- **The pedestrian signal heads shall display a flashing UPRAISED HAND (symbolizing DON'T WALK) signal indication when the pedestrian hybrid beacon faces are displaying alternating flashing CIRCULAR RED signal indications.**
- **Upon termination of the pedestrian clearance interval, the pedestrian signal heads shall revert to a steady UPRAISED HAND signal indication.**

Common Questions/Concerns Regarding HAWK Signals

1. Dark beacon may be confusing
2. Will cause proliferation of devices
3. Creates non-uniformity
4. Driver understanding of alternating flashing red

1. Dark Beacon Confuses Drivers

- **Has not been observed during scientific studies by UNC & TTI**
- **Tucson experience shows that vehicles do not stop at a dark beacon**
- **Dark beacon critical to overcome 1/2 signal concerns**
- **Similar device used in Europe for last 60 years**

2. Proliferation of Devices

- **There is a need for a device at crosswalks that is more than a yellow flasher, but a full signal is not warranted or appropriate**
- **Allows for main street progression**
- **Reduces delay via 1/2 cycle operations, flashing red, split phase operations**
- **Pedestrian hybrid beacon can reduce the political and community pressures to install unwarranted full traffic signals**

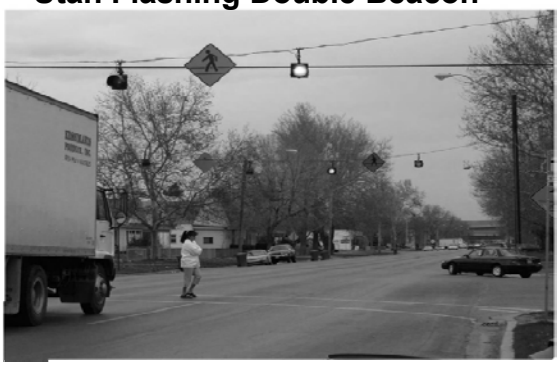
3. Creates Non-Uniformity

- Concern that the HAWK will further proliferate non-uniform designs and installations
- Already have non-uniformity - there are numerous variations in use throughout the nation currently now

•Florida Crossing Eyes

•King County Flashing Beacon

•Utah Flashing Double Beacon



•Ohio Flashing Yield Sign

•Ohio Yield Sign

- **California Flashing Beacon**

- **In-Pavement Lights**

- **Portland: 1/2 Signals**

•Seattle: 1/2 Signals

•L.A. Midblock Signals

4. Alternating Flashing Red

- Drivers not proceeding in a stop-and-go format during alternating flashing red and crosswalk is clear
  - –Sign
  - –Education
- Drivers not stopping during alternating flashing red phase
  - –Targeted enforcement
  - –Education

Summary

- Safety evaluation of HAWK beacon using Empirical Bayes method
- Before-After
  - 21 treatment sites
  - All at stop-controlled intersections/major driveways
  - Reference sites groups:
  - 103 unsignalized intersections
- Statistical significant changes:
  - 29% reduction in total crashes
  - 69% reduction in pedestrian crashes

References

- *Safety Effectiveness of the HAWK Pedestrian Crossing Treatment*
  Tech Brief, FHWA-HRT-10-045
  http://www.fhwa.dot.gov/publications/research/safety/10045/045.pdf
- Research Report, FHWA-HRT-10-042
  http://www.fhwa.dot.gov/publications/research/safety/10042/10042.pdf
- *Improving Pedestrian Safety at Unsignalized Crossings* (TCRP/NCHRP 112/562)
  http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_562.pdf

Ongoing Debate

•2009 MUTCD included "Guidance"

Growing Opportunity

Key Informational Resources

A Review of Pedestrian Safety Research in the United States and Abroad
http://www.walkinginfo.org/library/details.cfm?id=13

Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations
http://www.walkinginfo.org/library/details.cfm?id=54

Guide for the Planning, Design, and Operation of Pedestrian Facilities, American Association of State Highway and Transportation Officials, 2004 [Available for purchase from AASHTO]
https://bookstore.transportation.org/item_details.aspx?id=119

Pedestrian Road Safety Audits and Prompt List
http://www.walkinginfo.org/library/details.cfm?id=3955

FHWA Office of Safety Bicycle and Pedestrian Safety
http://safety.fhwa.dot.gov/ped_bike/

Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities (NCHRP Report 674)
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_674.pdf

Manual on Uniform Traffic Control Devices, Chapter 4F. Pedestrian Hybrid Beacons
http://mutcd.fhwa.dot.gov/htm/2009/part4/part4f.htm

Safety Effectiveness of the HAWK Pedestrian Crossing Treatment
http://www.fhwa.dot.gov/publications/research/safety/10042/10042.pdf

Crash Modification Factors (CMF) Clearinghouse [quick search "HAWK"]
http://www.cmfclearinghouse.org/

2010 Crash Modifications Factors Study

Study Title: Safety Effectiveness of the HAWK Pedestrian Crossing Treatment

Authors: Fitzpatrick, K., and Park, E.S.

Publication Date: JUL, 2010

Abstract: The High intensity Activated crossWalK (HAWK) is a pedestrian-activated beacon located on the roadside and on mast arms over major approaches to an intersection. It was created in Tucson, AZ, and at the time of this study, it was used at more than 60 locations throughout the city.

From the evaluation that considered data for 21 HAWK sites (treatment sites) and 102 unsignalized intersections (reference group), the following changes in crashes were found after the HAWK was installed: a 29 percent reduction in total crashes (statistically significant), a 15 percent reduction in severe crashes (not statistically significant), and a 69 percent reduction in pedestrian crashes (statistically significant).