Transportation Synthesis Report
RESEARCH & LIBRARY SERVICES
research@dot.wi.gov

HAWK Pedestrian Signals: A Survey of National Guidance, State Practice and Related Research

Prepared for
Bureau of Highway Operations

Prepared by
CTC & Associates LLC
WisDOT Research & Library Unit
January 29, 2010

Transportation Synthesis Reports are brief summaries of currently available information on topics of interest to WisDOT staff throughout the department. Online and print sources for TSRs include NCHRP and other TRB programs, AASHTO, the research and practices of other transportation agencies, and related academic and industry research. Internet hyperlinks in TSRs are active at the time of publication, but changes on the host server can make them obsolete. To request a TSR, e-mail research@dot.wi.gov or call (608) 267-6977.

Request for Report

A system known as HAWK—High intensity Activated crossWalK—is a pedestrian-activated beacon developed by the city of Tucson, Ariz., to increase pedestrian safety at midblock crosswalks and minor street intersections, and in school zones. These hybrid signals do not contain a green indication. Instead, they have two red indications over a yellow indication. Pedestrian hybrid beacons like the HAWK are designed for use in locations that do not meet traffic engineering standards for a conventional signal. Some HAWK signals also provide visually impaired pedestrians with audible information when the walk signal is on.

A March 2009 brochure published by the City of Tucson Transportation Department[1] describes the HAWK signal:

> The HAWK consists of a Red-Yellow-Red signal format for motorists. The signals remain off until a pedestrian activates the system by pressing a button. First, a FLASHING YELLOW light warns motorists that a pedestrian is present. The signal then changes to SOLID YELLOW, alerting drivers to prepare to stop. The signal then turns SOLID RED and shows the pedestrian a "WALK" symbol. The signal then begins ALTERNATING FLASHING RED and the pedestrian is shown a flashing "DON'T WALK" with a countdown timer. Drivers are allowed to proceed during the flashing red after coming to a full stop and making sure there is no danger to pedestrians.

WisDOT Bureau of Highway Operations is interested in the national guidance and research related to HAWK signals, and how other states are using these pedestrian hybrid beacons.

Summary

The most significant recent development related to HAWK signals is the release of FHWA's 2009 edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. The previous edition of the MUTCD did not address pedestrian hybrid beacons like the HAWK. Prior to release of the 2009 edition of the MUTCD, transportation agencies wishing to use the HAWK signal were required to seek approval from FHWA for an

[1] See http://dot.tucsonaz.gov/traffic3/pdfs/Crossings%20brochure_3-09.pdf for the March 9, 2009, brochure "Crossings: Special Pedestrian/Bicycle Beacon Signals."

experimental installation. We include a selection of those requests for experimental installation in this TSR to show how transportation agencies are implementing this relatively new signal technology.

We gathered information in six topic areas related to the HAWK pedestrian beacon:

- National guidance
- Requests for experimental installation
- Recent HAWK installations
- Related research
- Research in progress

Following is a summary of findings by topic area.

National Guidance

- The 2009 edition of the MUTCD provides guidance for the application, design and operation of pedestrian hybrid signals like the HAWK.

- The 2006 publication *NCHRP Report 562* examines engineering treatments to improve pedestrian safety at unsignalized crossings; HAWK signals are among the crossing treatments evaluated. An appendix to the report provides a step-by-step, worksheet-based process to consider treatment options.

Requests for Experimental Installation

- Requests submitted to FHWA in connection with experimental installation of HAWK signals can provide insight into how transportation agencies have elected to use these pedestrian beacons. Below we summarize the sampling of requests for experimental HAWK installations highlighted in this TSR, including a request from Grafton, Wis.:

State	City/Village/County	Location for Proposed HAWK Installation
Alaska	Juneau	40-mph, three-lane roadway in a school zone with heavy traffic during times of high pedestrian volume
Arizona	Phoenix	Two locations: a midblock, high-visibility ladder crosswalk adjacent to a school driveway, and a crosswalk across a six-lane arterial street that features a center reversible-flow traffic lane, which prevents the construction of a median pedestrian refuge island at or near the intersection
Colorado	Golden	Northwest crosswalk at a multilane roundabout
Georgia	DeKalb County	Four midblock pedestrian crossings on a six-lane state roadway with 45-mph speed limit
Indiana	Fort Wayne	Multiuse trail crossing where minor road is controlled by a stop sign
Kansas	Dodge City	Major arterial street at a midblock crosswalk; the new crossing will be provided to link a new multiuse pathway trail with a college campus in a midblock section
Michigan	Ann Arbor, Ypsilanti, St. Clair County	General request for use on state trunk lines; proposed installations on Business Route I-94 and Business Route US 12 and at a trail crossing
Minnesota	St. Cloud	State highway crossing adjacent to a library and high school
Oregon	Portland	Two intersections: one currently unsignalized and the other with a legacy half signal
Rhode Island	Providence	State-owned urban principal arterial

State	City/Village/County	Location for Proposed HAWK Installation
Virginia	Alexandria	"T" intersection on a multilane arterial roadway with a 35-mph posted speed limit and average daily traffic of 32,000 vehicles
Wisconsin	Grafton	State trunk highway intersection in the city's business district (25-mph, four-lane, undivided urban arterial)

Recent HAWK Installations

- A variety of approaches have been used to inform the public of the presence of recently installed HAWK signals, how they operate, and how pedestrians and motorists are expected to interact with them. We provide links to Web pages, brochures, press releases, videos and other resources relating to HAWK installations in:
  - Alaska (City of Juneau)
  - Arizona (City of Tucson)
  - Colorado (City of Golden)
  - District of Columbia
  - Idaho (Ada County)
  - Illinois (City of Champaign)
  - Michigan (West Bloomfield Township and St. Clair County)
  - Minnesota (City of St. Cloud)
  - Oregon (City of Klamath Falls)
  - Virginia (City of Alexandria)

Related Research

- A paper presented at the 2009 TRB Annual Meeting documented the safety effectiveness of the HAWK signal. Results of a before-and-after study of intersection-related crashes indicated a 28 percent reduction in all crashes and a 58 percent reduction in pedestrian crashes after installation of the HAWK beacon.

- Treatments for pedestrian crossings at midblock locations such as the HAWK and PUFFIN (Pedestrian User-Friendly INterface) are evaluated for their performance from safety and operational perspectives in a paper presented at the 2009 TRB Annual Meeting.

- A June 2008 article in the *APWA Reporter* considers some of the concerns raised in connection with HAWK signals and identifies how those concerns have been, or will be, addressed.

Research in Progress

- NCHRP Project 3-78A is evaluating roundabout crossing solutions for visually impaired pedestrians by examining the results of test installations of the HAWK signal and a raised crosswalk. A final report is expected in early 2010.

- A 2007 lawsuit prompted the test installation of a HAWK signal at a multilane roundabout in Oakland County, Mich. Results of testing are expected in August 2010.

- The Kansas DOT's study of a HAWK signal installed at a midblock pedestrian crossing in Lawrence, Kan., will include a before-and-after analysis of pedestrian usage and motorist delay, and a survey of pedestrians and motorists that evaluates their acceptance and understanding of the HAWK signal. This research project is expected to conclude in May 2012.

National Guidance

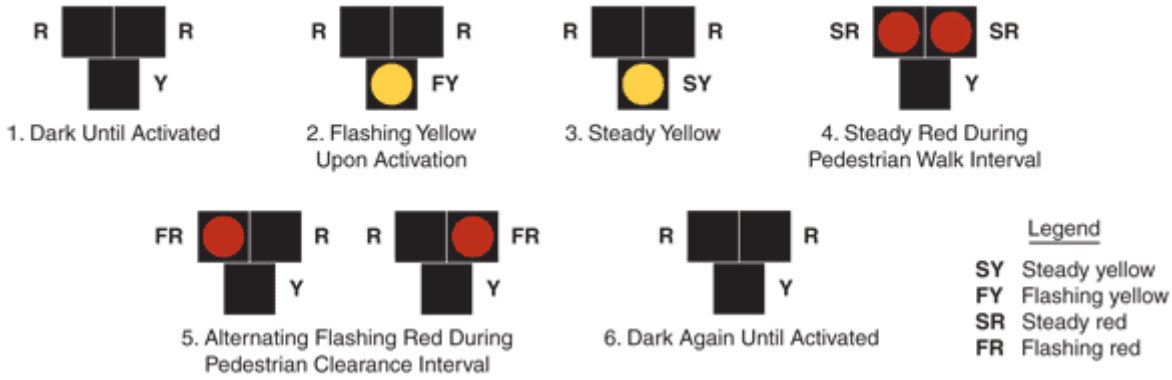
Below we highlight national guidance in the form of an update to the MUTCD that provides guidance for the application of pedestrian hybrid beacons, and a 2006 NCHRP report that examines treatments to improve pedestrian safety at unsignalized crossings.

Manual on Uniform Traffic Control Devices for Streets and Highways, 2009 Edition, FHWA, 2009.
http://mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdf
Prior to the release of the 2009 edition of the MUTCD, transportation agencies wishing to install HAWK pedestrian beacons required the approval of FHWA before proceeding with installation as an experimental use. The 2009 edition of the MUTCD includes a new chapter that provides for the application of pedestrian hybrid beacons, a class

of pedestrian beacons that includes HAWK signals. With this revision, HAWK signals are no longer considered an experimental application requiring FHWA approval before installation, and their use will be governed by relevant provisions in the MUTCD.

The following figure from the 2009 edition of the MUTCD shows the six intervals in a sequence for a pedestrian hybrid beacon:

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



Highlights of the guidance that appears in Chapter 4F, Pedestrian Hybrid Beacons, which begins on page 509 of the report (page 551 of the PDF), include:

- A pedestrian hybrid beacon:
  - Is a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.
  - May be considered for installation at a location that does not meet traffic signal warrants, or at a location that meets traffic signal warrants but a decision is made to not install a traffic control signal.
- When an engineering study finds that installation of a pedestrian hybrid beacon is justified, then:
  - The pedestrian hybrid beacon should be installed at least 100 feet from side streets or driveways that are controlled by stop or yield signs.
  - Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk, or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance.
  - The installation should include suitable standard signs and pavement markings.
  - If installed within a signal system, the pedestrian hybrid beacon should be coordinated.
- On approaches having posted or statutory speed limits or 85th-percentile speeds in excess of 35 mph and on approaches having traffic or operating conditions that would tend to obscure visibility of roadside hybrid beacon face locations, both of the minimum of two pedestrian hybrid beacon faces should be installed over the roadway.
- On multilane approaches having posted or statutory speed limits or 85th-percentile speeds of 35 mph or less, either a pedestrian hybrid beacon face should be installed on each side of the approach (if a median of sufficient width exists) or at least one of the pedestrian hybrid beacon faces should be installed over the roadway.

Improving Pedestrian Safety at Unsignalized Crossings, *NCHRP Report 562*, 2006.
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_562.pdf
This research project, jointly sponsored by the Transit Cooperative Research Program and NCHRP, had two main objectives:

- Recommend selected engineering treatments to improve safety for pedestrians crossing high-volume, high-speed roadways at unsignalized intersections, in particular those served by public transportation.
- Recommend modifications to the MUTCD pedestrian traffic signal warrant.

Researchers used a field study to provide insight into the actual behavior of motorists and pedestrians at locations with existing pedestrian crossing treatments. Forty-two study sites were selected in seven states. Sites were chosen in an effort to distribute the different types of crossing treatments so that data for a particular treatment were not collected from a single city. However, at the time of this research, HAWK signals were installed only in Tucson, Ariz. Site selection focused on arterial streets with a range of operational and design characteristics. See Table 17 on page 38 of the PDF for a description of study sites and their characteristics.

Highlights of the report include:

- Table 21 on page 47 of the PDF summarizes motorist yielding compliance at sites with active HAWK signals. Compliance ranged from an average of 93 percent (literature review) to 97 percent (staged pedestrian crossing) to 99 percent (general population pedestrian crossing).
- For the "red signal or beacon" devices, which include the HAWK signal, the number of lanes did not affect performance.
- Each treatment that showed a red indication to the motorist (for example, half signal, HAWK or midblock signal) had between 90 percent and 95 percent of the pedestrian crossings within 10 feet of the crosswalk.

Appendix A, Guidelines for Pedestrian Crossing Treatments, which begins on page 65 of the PDF, provides a five-step process to consider options for pedestrian treatments at unsignalized intersections.

- **Step 1.** Select the appropriate worksheet. Worksheet 1 is for peak-hour speeds of 35 mph or less; Worksheet 2 is used for peak-hour speeds that exceed 35 mph, in communities with less than 10,000 in population, or where a major transit stop exists.
- **Step 2.** Check minimum pedestrian volume. The minimum pedestrian volume for a peak-hour evaluation is 20 pedestrians per hour for both directions if the major road speed exceeds 35 mph. If fewer pedestrians are crossing the street, then geometric improvements rather than signs, signals or markings can be considered.
- **Step 3.** Check the MUTCD signal warrants to determine whether to consider a signal at the site.
- **Step 4.** Estimate pedestrian delay using the average pedestrian delay equation from the 2000 Highway Capacity Manual.
- **Step 5.** Select a treatment based upon total pedestrian delay and expected motorist compliance.

Appendices B to O of the report are available at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w91.pdf. Topics addressed in the appendices include:

- International pedestrian crossing installation guidelines and signal warranting practices.
- On-street pedestrian surveys.
- Motorist compliance to engineering treatments at marked crosswalks.
- Walking speed.
- Gap acceptance.
- Guidelines development.

Requests for Experimental Installation

The 2009 edition of the MUTCD provides guidance for the use of pedestrian hybrid beacons. Before this guidance was issued, transportation agencies wishing to install a HAWK signal were required to obtain prior approval from the FHWA as an experimental installation. Listed below are selected agency requests submitted to FHWA that offer some perspective on why transportation agencies are electing to install HAWK signals and where the proposed installations will be located.

Details of other requests for HAWK experimental installations requested in 2009-2010 are available at the American Traffic Safety Services Association Web site at http://www.atssa.com/cs/root/news_pr/2009_interpretation_letters ("2009-2010 Experimentation/Interpretation Letters"). Archival information is available back to 2004.

Wisconsin
http://www.atssa.com/galleries/default-file/4-374(E)-HAWKPedestrianBeacon-GraftonWI-INCOMING.pdf
The village of Grafton, Wis., submitted an October 16, 2009, request to experiment with the use of the HAWK pedestrian beacon on WIS 60, a primary thoroughfare in the city's business district. The HAWK beacon would be placed on a 25-mph, four-lane, undivided urban arterial. The site for the proposed HAWK installation is a signalized intersection approximately 335 feet west of the intersection. "Yield to Pedestrian" signing for the intersection has not been effective, and traffic signals are not warranted due to low volume at the intersection. A November 5, 2009, letter from FHWA approved the request. (See http://www.atssa.com/galleries/default-file/4-374(E)-HAWKPedestrianBeacon-GraftonWI-11-5-09.pdf.)

Alaska
http://www.juneau.org/plancomm/documents/STF_CSP09-03.pdf
This May 20, 2009, letter requests the installation of a HAWK signal in the city of Juneau at one crosswalk location: a 40-mph roadway in a school zone with three lanes and extremely heavy traffic during time periods that coincide with significant pedestrian volume. Project plans and specifications begin on page 10 of the PDF.

Arizona
http://www.atssa.com/galleries/default-file/4-355(E)%20INCOMING%20-%20Phoenix.pdf
This December 31, 2008, request is in connection with two pedestrian crossing locations in Phoenix on multilane arterial streets with relatively high-speed traffic and high traffic volume. The first location is a midblock, high-visibility ladder crosswalk adjacent to a school driveway. The second location is at a crosswalk across a six-lane arterial street that features a center reversible-flow traffic lane, which prevents the construction of a median pedestrian refuge island at or near the intersection.

Colorado
http://www.atssa.com/galleries/default-file/Response%20to%20Request%20to%20use%20HAWK%20Pedestrian%20Crossing%20Beacons-Alexandria%20CO.pdf
This June 30, 2008, request was made in connection with a test installation associated with the NCHRP 3-78A study. (See page 11 of this TSR for more information about the NCHRP 3-78A study.) The HAWK signal was proposed to be installed at the northwest crosswalk at the multilane roundabout at South Golden Road/Johnson Road in Golden, Colo. See pages 6 and 7 of the PDF for plans and specifications.

Georgia
http://www.atssa.com/galleries/default-file/4-370(E)-HAWK_Beacon-DeKalb-County_Incoming.pdf
This request from DeKalb County Public Works seeks approval for four HAWK signals at midblock pedestrian crossings on a six-lane state roadway with a speed limit of 45 mph. The proposed locations have already been constructed with pedestrian islands and are currently operating with pedestrian-activated flashing beacons. The request is dated May 19, 2009; installations were expected to be completed in 2009. See pages 4 through 8 of the PDF for plans and specifications.

Indiana
Memo: http://www.atssa.com/galleries/default-file/4-375(E)-HAWK_FortWayneIN_INCOMING.pdf
Plan and profile: http://www.atssa.com/galleries/default-file/4-375(E)-HAWK_FortWayneIN-P&PSheet.pdf
This October 19, 2009, request is for installation of a HAWK signal on a trail crossing at an intersection in Fort Wayne where the minor road is controlled by a stop sign.

Kansas
http://www.atssa.com/galleries/default-file/Nov%2013%2008%204-352-(E)%20-%20HAWK%20Pedestrian%20Crossing%20Beacon%20-%20Dodge%20City%20KS.pdf
This November 7, 2008, request (page 2 of the PDF) from the city of Dodge City requests approval to experiment with a HAWK signal along a major arterial street at a midblock crosswalk in Dodge City. The new crossing will be provided to link a new multiuse pathway trail with a college campus in a midblock section.

Michigan

http://www.atssa.com/galleries/default-file/4-368(E)-INCOMING_MI-DOT.pdf
In this May 15, 2009, request, Michigan DOT seeks approval for the use of pedestrian hybrid signals on state trunk lines, noting that the pedestrian hybrid beacon "is emerging as middle ground between an uncontrolled crossing and a stop and go signal." FHWA approved installations on business routes in Ann Arbor and Ypsilanti.

http://www.atssa.com/galleries/default-file/4-369(E)-INCOMING-St.Clair_County-MI.pdf
This June 16, 2009, request from the St. Clair County Road Commission seeks permission to install a HAWK signal at a trail crossing.

Minnesota

http://www.atssa.com/galleries/default-file/4-366(E)-HAWK-MNDOT-INCOMING.pdf
Minnesota DOT's May 11, 2009, request seeks approval for use of a HAWK signal in St. Cloud, Minn., at a location on State Highway 23 at the intersection with 12th Avenue where a coordinated signal system does not allow for adequate vehicle queuing and progression spacing. See pages 5 and 6 of the PDF for plans and specifications of the proposed signal system.

Oregon

http://www.atssa.com/galleries/default-file/10-17-05.pdf
This October 4, 2005, request (page 3 of the PDF) is for installation of modified HAWK signals at two intersections in the city of Portland: one currently unsignalized and the other with a legacy half signal that does not conform to MUTCD. A description of the proposed installation follows: "The side street will have a stop sign and pedestrian heads and push buttons for crossing the major street. In Portland we will also install bicycle indications for the minor street. This system allows the pedestrian or cyclist to cross busy arterials at minor streets, while not encouraging more vehicular traffic on minor local streets." After initially considering experimental approval of the half signal, the city determined that the HAWK "is a better option since it does not display a green indication to arterial traffic and the vehicle heads are normally dark. The activation of the vehicle heads should provide additional warning to motorists regarding the changing state of the signal." See page 9 of the PDF for a plan of the new HAWK installation.

Rhode Island

http://www.atssa.com/galleries/default-file/4-359(E)%20INCOMING%20-%20RI%20DOT.pdf
This March 2, 2009, request is for the installation of one pedestrian crossing location on a state-owned urban principal arterial in the city of Providence.

Virginia

http://alexandriava.gov/uploadedFiles/localmotion/info/fhwa_HAWK_alex_052008_FINAL.pdf
The city of Alexandria's May 20, 2008, request includes 13 potential HAWK locations. According to the request, the HAWK signal has the following benefits: "The primary improvement of a HAWK beacon over a standard signal may be that it is dark until it is activated. The flashing yellow is intended to capture a driver's attention when a continually flashing signal often becomes part of the scenery in fairly short order. The HAWK is only activated when needed by pedestrians, reducing the likelihood of misunderstanding between drivers' and pedestrians' intents." The first installation proposed in the 2008 request is at a "T" intersection that is challenging for pedestrians wishing to cross a multilane arterial roadway with a posted speed limit of 35 mph and average daily traffic of 32,000 vehicles.

Recent HAWK Installations

Below we provide links to brochures, press releases, Web pages and videos aimed at the general public to educate pedestrians and motorists about recent HAWK installations. Some of these publications include photographs of the completed installations.

Alaska (City of Juneau)
A HAWK pedestrian signal on Mendenhall Loop Road at Floyd Dryden Middle School went live in October 2009. The new system was funded by a Safe Routes to Schools grant. Related links:

- State of Alaska Department of Transportation & Public Facilities, Traffic & Safety Web site ("High-Intensity Activated Crosswalk (HAWK) Pedestrian Signals")
  http://www.dot.state.ak.us/stwddes/dcstraffic/hawk.shtml
- October 14, 2009, press release
  http://www.dot.state.ak.us/comm/pressbox/arch_2009/PR09-25160.shtml

Arizona (City of Tucson)
The HAWK pedestrian beacon was developed by the city of Tucson, Ariz., to increase pedestrian safety at school crossing locations. The first five HAWK signals were installed in December 2004, and today the HAWK is used at more than 80 locations in Tucson. In addition to addressing the HAWK signal, the city's Web site and "Crossings" brochure discuss two other pedestrian signal systems:

- PEdestrian LIght Control ActivatioN (PELICAN) system, which provides a safe, two-stage crossing for pedestrians. The crossing incorporates the median island refuge between the two stages.
- TwO GroUps CAN (TOUCAN) cross system, which was designed to provide a safe crossing for two groups—pedestrians and bicyclists. TOUCAN systems are placed at locations of heavy bicycle and pedestrian crossing activity and along roadways that are prioritized for nonmotorized uses, sometimes known as "bike boulevards."

Related links:

- City of Tucson Department of Transportation Web site ("Pedestrian Traffic Signal Operation")
  http://dot.tucsonaz.gov/traffic3/tspedestrian.php
- Brochure: "Crossings: Special Pedestrian/Bicycle Beacon Signals"
  http://dot.tucsonaz.gov/traffic3/pdfs/Crossings%20brochure_3-09.pdf
- HAWK operation video
  http://dot.tucsonaz.gov/traffic3/video/hawk.php

Colorado (City of Golden)
In September 2008, a HAWK pedestrian beacon was installed at one of the pedestrian crosswalks at the roundabout on South Golden Road at Johnson Road in the city of Golden. Related link:

- City of Golden publication: "HAWK Pedestrian Beacon"
  http://ci.golden.co.us/files/hawk%20pedestrian%20flasher.pdf

District of Columbia
In August 2009, the district installed a HAWK signal at Georgia Avenue and Hemlock Street NW, the first of its kind in the district. Related link:

- Brochure: "HAWK Pedestrian Signal Guide: What You Need to Know"
  http://ddot.dc.gov/ddot/frames.asp?doc=/ddot/lib/ddot/information/bicycle/pdf/ped_safety/dc_hawk_brochure.pdf

Idaho (Ada County)
The Ada County Highway District turned on its first HAWK pedestrian signal in August 2008, just west of the Cole and Ustick intersection in Boise. Two HAWKs were installed along Floating Feather Road in September 2009 and two additional HAWKs are planned. Related links:

- Ada County Highway District Web site ("HAWK Pedestrian Signal")
  http://www.achd.ada.id.us/Community/HAWKsignal.aspx
- Brochure: "HAWK Pedestrian Signal: A User's Guide for Pedestrians & Motorists"
  http://www.achd.ada.id.us/PDF/HAWKbrochure2.pdf

- HAWK operation video
  http://www.achd.ada.id.us/Media/HAWKVO.wmv

Illinois (City of Champaign)
The city of Champaign planned to install a HAWK signal at a marked midblock crossing on Bradley Avenue on December 15, 2009. The section of street where the HAWK will be used has been on the list of streets with speeding problems, with the majority of drivers regularly driving 10 mph or more over the posted 35-mph speed limit. The city sees the HAWK signal as the next step to enhance pedestrian safety at this uncontrolled pedestrian crossing. Related links:

- City of Champaign Web site ("HAWK Pedestrian Signal")
  http://ci.champaign.il.us/departments/public-works/pwd-projects/hawk-pedestrian-signal/
- Brochure: "What to Do at a HAWK Pedestrian Signal"
  http://ci.champaign.il.us/wordpress/wp-content/uploads/2009/08/What-to-do-at-a-HAWK-Signal.pdf

Michigan

West Bloomfield Township
The HAWK installation at the Maple/Drake roundabout in West Bloomfield Township is being tested to determine if it will enhance pedestrian access. See page 12 of this TSR for additional information about this test HAWK installation required by a Michigan roundabout lawsuit. Related link:

- Brochure: "The HAWK Crosswalk Beacon at the Maple/Drake Roundabout: A User's Guide"
  http://www.twp.west-bloomfield.mi.us/info/HAWKbrochure.pdf

St. Clair County
This is the first use of a pedestrian hybrid signal at a trail crossing in the state of Michigan. The HAWK signal is intended to make it easier for users of the Wadhams-to-Avoca trail to cross Wadhams Road. Related link:

- Brochure: "Hybrid Pedestrian Signal: A Pedestrians and Motorists User Guide for the New Signal for the Wadhams to Avoca Trail Crossing at Wadhams Road"
  http://www.stclaircounty.org/offices/parks/forms/Wadhams%20Road%20Crossing%20Brochure%2009.pdf

Minnesota (City of St. Cloud)
Part of the Highway 23 reconstruction and the first HAWK pedestrian signal installed in the St. Cloud area, this HAWK signal was scheduled for activation in late October 2009. Related links:

- Article: "HAWK Pedestrian Crossing System"
  http://www.dot.state.mn.us/d3/projects/hwy23bridge/pdfs_images/hawk/article.pdf
- Handout: "How the System Works: HAWK Pedestrian Crossing System"
  http://www.dot.state.mn.us/d3/projects/hwy23bridge/pdfs_images/hawk/HawkSystemoperationoverview.pdf
- Handout: "HAWK Pedestrian Crossing System: Indications for the Motorist"
  http://www.dot.state.mn.us/d3/projects/hwy23bridge/pdfs_images/hawk/HawkSystemIndicationsmotorist.pdf
- Handout: "HAWK Pedestrian Crossing System: Indications for the Pedestrian"
  http://www.dot.state.mn.us/d3/projects/hwy23bridge/pdfs_images/hawk/HawkSystempedestrian.pdf

Oregon (City of Klamath Falls)
In October 2009, Oregon DOT installed a HAWK signal in Klamath Falls, the first HAWK installed by ODOT in Oregon. ODOT's brochure, "HAWK Pedestrian Signal Guide: What You Need to Know," clarifies how side street traffic is handled with the HAWK signal: "Unlike a standard traffic signal, intersections with HAWK signals do not have any traffic signals facing the side street approaches. Any side street that is controlled by a stop sign will continue to be controlled by a stop sign when a HAWK signal is in place." Related links:

- October 16, 2009, press release
  http://www.ci.klamath-falls.or.us/content/news/main/static/Public-Notice-10-16-09.pdf
- Brochure: "HAWK Pedestrian Signal Guide: What You Need to Know"
  http://www.ci.klamath-falls.or.us/content/StreetUpdates/static/HAWK-brochure9-30-09-ODOT.pdf

Virginia (City of Alexandria)
The city of Alexandria installed a HAWK signal at Van Dorn Street at Maris Avenue in June 2008—a pilot location for a citywide program. The city considers use of the HAWK for unsignalized crosswalks on high-traffic streets that do not meet engineering standards for installation of a conventional traffic signal.

- City of Alexandria Office of Transit Services & Programs Web site ("HAWK pedestrian signal")
  http://alexandriava.gov/HAWK
- Brochure: "HAWK Beacons: What You Need to Know"
  http://alexandriava.gov/uploadedFiles/localmotion/info/HAWK%20brochure.pdf

Related Research

Below we provide information about studies that offer data on the safety effectiveness of the HAWK signal, an evaluation of alternatives that can be used for pedestrian crossings at midblock locations, and responses to common concerns about HAWK installations.

"Safety Effectiveness of HAWK Pedestrian Treatment," Kay Fitzpatrick, Eun Sug Park, *TRB 88th Annual Meeting Compendium of Papers DVD*, Paper #09-1652, 2009.
Abstract: http://pubsindex.trb.org/view.aspx?id=881295
This paper documents a before-and-after study of the safety performance of the HAWK pedestrian beacon. Researchers used an empirical Bayes method to compare the crash prediction for the after period had the treatment not been applied to the observed crash frequency for the after period with the treatment installed. The evaluation used data for 21 HAWK sites and 71 reference sites and found the following changes in intersection-related crashes after the HAWK beacon was installed: 28 percent reduction in all crashes and 58 percent reduction in pedestrian crashes.

"Pedestrian Crossings at Mid-Block Locations: A Fuzzy Logic Solution for Existing Signal Operations," George (Xiaozhao) Lu, David A. Noyce, *TRB 88th Annual Meeting Compendium of Papers DVD*, Paper #09-2844, 2009.
Abstract: http://pubsindex.trb.org/view.aspx?id=881951
This paper presents several common alternatives for signalizing a typical midblock crosswalk. Researchers conclude that two-phase timing and the HAWK treatment significantly improve vehicle operations over one-phase timing and other options. Compared with these alternatives, the PUFFIN (Pedestrian User-Friendly INterface) system is user-friendly due to its dynamic pedestrian clearance interval; however, PUFFIN does not use the fuzzy logic control that has proven effective for complex optimization problems such as traffic signal timing. To model the range of variables employed in midblock pedestrian crossings, researchers developed a user-friendly FLC signal and evaluated it against PUFFIN to quantify the potential safety and efficiency benefits. Result shows the FLC effectively controls the signal timing and offers equal or better performance than PUFFIN from safety and operational perspectives.

"New Traffic Control for an Old Pedestrian Crossing Safety Problem," Richard B. Nassi, Michael J. Barton, *APWA Reporter*, Vol. 75, No. 6, June 2008: 44-49.
http://www.apwa.net/Publications/Reporter/ReporterOnline/index.asp?DISPLAY=ISSUE&ISSUE_DATE=062008&ARTICLE_NUMBER=1773
Written after the publication of *NCHRP Report 562* and before the release of the 2009 edition of MUTCD, this article notes issues surrounding the HAWK pedestrian-activated beacon and describes how they have been, or will be, resolved.

- **Dark beacons**. There was some concern that the HAWK device could be perceived as a nonoperating traffic signal and cause drivers to stop unnecessarily. The authors note that the research conducted for *NCHRP Report 562* did not observe this behavior. A concern was also raised that the HAWK could be

considered a half signal, which is prohibited by the MUTCD. Unlike a half signal, where the signal indication for the main street rests in green with stop signs on the side street, the HAWK beacon's operational sequence does not show conflicting information to drivers.

- **Potential driver confusion**. *NCHRP Report 562* notes that driver compliance for the HAWK crossing technique is 97 percent. The HAWK does not change drivers' responsibilities and is essentially a supplement to the current right of way codes.

- **Proliferation of devices**. The authors note that in Tucson, Ariz., the HAWK is used for crosswalks that require a device that is more than a flashing beacon but not a full signal. Rather than adding a device, the HAWK is replacing existing devices with a more appropriate treatment.

- **Uniformity**. Concerns about uniformity should be allayed with the addition of guidance for pedestrian hybrid signals in the 2009 edition of the MUTCD.

At the time of this article's publication, there were 60 HAWK installations in Tucson. Citywide crash data over the 60 installations indicated an average of approximately 1.8 crashes per year. When the authors removed the instances where pedestrians did not activate the HAWK beacons when crossing, that rate falls to 1.3 crashes per year. The article's conclusion notes that, as of April 9, 2008, there had been no fatalities in any HAWK crossing.

The article closes with a discussion of PUFFIN, a modified HAWK device that detects pedestrian walking speeds and allows for extended signal phases as needed. The authors note the significance of this modification in connection with the decrease in the standard walking speed from 4 feet per second to 3.5 feet per second that, at the time of the article's publication, was proposed by FHWA. This decrease in walking speed is reflected in the 2009 edition of the MUTCD (see page 497 of the MUTCD (page 539 of the PDF) at http://mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdf).

Research in Progress

A final report on an NCHRP project to examine crossing solutions at roundabouts is expected in early 2010, while results from another project that tests a HAWK installation—this time at a Michigan multilane roundabout—are expected in August 2010. A third project—studying a HAWK installation at a midblock crossing in Lawrence, Kan.—is expected to conclude in 2012.

NCHRP 3-78A, Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities
http://www.trb.org/trbnet/projectdisplay.asp?projectid=834
From the TRB Web site: "The objective of this research is to recommend a range of geometric designs, traffic control devices, and other treatments that will make pedestrian crossings at roundabouts and channelized turn lanes useable by pedestrians with vision impairment. These recommendations should be suitable for inclusion in transportation-industry practice and policies, including the AASHTO Policy on Geometric Design of Highways and Streets and the FHWA Manual on Uniform Traffic Control Devices. Exploration of the proper balance among the needs of passenger cars, trucks, pedestrians (including pedestrians with vision impairments), and bicycles is central to achieving the objectives of the research."

In fall 2008, researchers installed two treatments—a HAWK signal and raised crosswalk—at a two-lane roundabout site in Golden, Colo. The treatments were removed after completion of the study. The NCHRP Web site lists the project's completion date as December 31, 2009; a final report is expected in early 2010.

Researchers presented initial observations in an e-session at the 2009 TRB Annual Meeting. (See http://onlinepubs.trb.org/webmedia/trbmedia/AM2009/794sch/softvnetplayer.htm.) Detailed findings will appear in the project's final report. Initial observations about the pedestrian hybrid signal include:

- Red-light running was observed.
- Some drivers waited during the flashing red.

- Stopping patterns changed, with drivers stopping as they would at a signalized intersection, providing obvious auditory cues for visually impaired pedestrians attempting to cross.
- Researchers noted good yield/stop identification by pedestrians.

Test Installation Required by Michigan Roundabout Lawsuit
In August 2007, Richard Bernstein filed a lawsuit against the Road Commission for Oakland County claiming that the county's roundabouts prevented disabled citizens from safely crossing intersections. A March 2009 stipulated interim order required the RCOC to install and test two pedestrian signal treatments—a HAWK signal and Rectangular Rapid Flash Beacon—at two Oakland County, Mich., roundabouts and provided a schedule for testing and reporting. The court order delays the judicial proceedings until approximately August 2010, when a final report of the testing is due.

A HAWK signal was installed at the Drake/Maple Road roundabout on July 13, 2009, and will remain in place for one year as a pilot study. Installation of an RRFB is scheduled for May 2010 at the Farmington/Maple Road roundabout. Before-and-after testing of both sites is expected to conclude by August 2010. Plans and specifications for the Drake/Maple Road roundabout are available at http://www.callsam.com/images/stories/news_docs_pics/roundabouts_Order-Ex-2_3-27-9%20.pdf.

Note: The Rectangular Rapid Flash Beacon is typically used to increase yielding rates on multilane roads. When activated, two rectangular yellow LED beacons in each RRFB flash in a rapidly alternating "wig-wag" flash pattern (left light on, then right light on). The RRFB is mounted immediately between the crossing sign and the sign's arrow plaque.

"Increased Pedestrian Safety and Decreased Motorist Delay with a HAWK Pedestrian Signal," Kansas Department of Transportation, expected completion date: May 31, 2012.
http://rip.trb.org/browse/dproject.asp?n=15282
This research project in progress will study a HAWK pedestrian signal installed at a midblock pedestrian crossing in Lawrence, Kan., and document the safety benefits of the crossing to pedestrians and reduction of delay to motorists. Data collected by video cameras will allow for analysis of before-and-after data on pedestrian usage and motorist delay at the signal. A survey of a sample of pedestrians and a sample of motorists will evaluate their understanding and acceptance of the HAWK signal. Materials related to the research include:

- Kansas State University Transportation Center Newsletter: Fall 2009
  http://transport.ksu.edu/reports/TransportationNewsletter-Fall09.pdf
  See page 3 for "Research Program Spotlight." Results noted in the newsletter include:
  - The average excessive delay to vehicles at the HAWK signal (0.94 seconds) is statistically less than the excessive delay at the signalized midblock crossing (10.1 seconds).
  - Researchers found a statistically significant difference between the delays, indicating that the HAWK at midblock crossings reduces traffic delay compared to a traditional signalized midblock pedestrian signal.
- HAWK operation video
  http://www.youtube.com/watch?v=JPbnBDtNKFQ