

Adapting the Pedestrian Hybrid Beacon (HAWK) for Bicycle Use

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Background

The City of Tucson developed the Pedestrian Hybrid Beacon, or HAWK, to help pedestrians cross busy streets. The HAWK is now an approved traffic control device, and its use and operation are detailed in Chapter 4F of the Manual of Uniform Traffic Control Devices (MUTCD). Recently, the City of Tucson collaborated with the Pima Association of Governments to expand the HAWK crossing design to explicitly accommodate bicyclists.

Frequently, when a traffic signal is installed at an intersection of a minor, residential street, the signal will attract traffic onto the residential street and cause traffic problems that will have to be mitigated by an extensive traffic management program. These problems include increased traffic volumes, cut-through traffic, and excessive traffic speeds. The HAWK crossing device (and BikeHAWK) applies all of the positive crossing protections without the undesirable and unintended increases in neighborhood street traffic.

Development of the BikeHAWK

The City of Tucson had a lot of experience with the HAWK pedestrian crossing treatment, and the HAWK had already proven itself as gaining high levels of driver stopping compliance. The HAWK pedestrian beacon is relatively simple to install compared to the other bicycle crossing treatments used in Tucson, like the TOUCAN, which is a full signal with islands that allow bikes and pedestrians to cross, but blocks vehicular traffic from crossing (See: <http://cms3.tucsonaz.gov/transportation/pedestrian-traffic-signal-operation>). In addition, the cost of a BikeHAWK is substantially less expensive than treatments such as the TOUCAN. Therefore, the BikeHAWK was developed to make HAWK crossings more amenable to cyclists crossing the major streets and extend the benefit of the HAWK to cyclists, as well.



Figure. 1: Swan Rd/3rd Street BikeHAWK

Design of BikeHAWK

The BikeHAWK was designed to match the behavior of cyclists using a HAWK crossing. Designers observed how cyclists behave while approaching and using a HAWK crossing. Since the design matches natural behavior, little education has proven to be necessary for high compliance by road users.

The city's first BikeHAWK was installed at Third Street and Swan Road in Tucson, Arizona (Figure 1). Third Street is a busy bike route along residential streets, serving the University of Arizona,

and has some of Tucson's highest bicycle activity. The bike route crosses Swan Road, a 4-lane divided highway posted at 40 mph and carrying over 30,000 vehicles per day. The alignment of the bike route jogs to the north at Swan Road.

The key elements of the BikeHAWK are consistent with the MUTCD or have been approved by the FHWA for experimentation. These include:

- a) A short contra-flow bike lane to position cyclists into a safety zone
- b) Placement of signal detection buttons in easy reach of cyclists
- c) MUTCD approved signing advising cyclists to observe pedestrian signals
- d) Supplemental signing to enhance necessary MUTCD signing, markings and signaling
- e) Use of green pavement markings to extend the bicycle path across the intersection, (for jurisdictions that have received interim approval)
- f) Signs encouraging cyclists to ride with traffic after the crossing has been completed and it is safe to make the maneuver

The following is a discussion of each of these elements.

a) Contraflow lane

The approach to the crossing is clearly marked to guide cyclists to the beacon activation button, and place them in the proper position to activate the beacon without the need to dismount. A green contraflow lane delineates the designated approach to the crossing and emphasizes the separation from vehicular traffic (Figure 2).

Cyclists were observed making the "contraflow" maneuver safely at the normal HAWK pedestrian crossing before it was converted into a BikeHAWK. The green contraflow lane markings legitimize the observed, or normal, "left turn" type movement by the cyclists from the near center of the residential street toward the HAWK crossing. As cyclists approach, they turn left into the contraflow lane. The green contraflow lane, with optional channelizing curb system with flexible posts, identifies the proper position for the cyclists and the drivers at the entrance to the BikeHAWK. The addition of a protected contraflow lane with channelized curb system and flexible posts was observed to result in slower turning movements, creating a traffic-calming effect.



Figure 2: Contraflow lane



Figure 3: Bicycle Detection



Figure 4: Signing

b) Signal detection

To facilitate access to the push button, the sidewalk area for the Third/Swan location was lowered to grade so the cyclists could ride up to the pedestrian push button without dismounting. The City's second design, at Speedway Boulevard and 10th Street, includes an additional activation button next to the curb for cyclist's easy access and activation (Figure 3).

c) MUTCD-approved signing

The BikeHAWK operation uses the MUTCD approved technique of having the cyclists cross with the pedestrian indications. The R9-5 sign is used in to inform cyclists to use the pedestrian signal. When motorists are presented with a solid RED indication, a WHITE WALK symbol is illuminated, alerting the cyclists of their opportunity to cross. The signal then changes to a FLASHING DON'T WALK symbol, with COUNTDOWN, alerting the cyclist not to begin crossing but that they may complete their crossing, identical to a pedestrian's rights and duties.

Other MUTCD signing includes the W11-15, Bicycle/Pedestrian warning sign, which is installed in advance of the crossing to alert motorists to the crossing.

d) Supplemental signing

The BikeHAWK looks to the driver like a normal HAWK beacon, with additional signing to alert motorists about the presence of bicycle cross traffic. When activated, the BikeHAWK shows approaching vehicular traffic the normal HAWK beacon indications (see MUTCD 2009, Chapter 4F, "Pedestrian Hybrid Beacon").



Figure 5: BIKES OK/BIKES WAIT illuminated signs

The City of Tucson chose to install a supplemental illuminated sign next to the pedestrian signal to reinforce the meaning of the pedestrian indications for cyclists. The illuminated sign reads BIKES OK when the WHITE WALK pedestrian symbol is illuminated. The sign reads BIKES WAIT at all other times. These illuminated signs are the same color as the pedestrian signal indications. The illuminated sign is wired directly to the pedestrian signal and mimics the MUTCD pedestrian signal phasing. The cyclist is required by law to follow the pedestrian signal and the illuminated sign confirms the proper response.

e) Green pavement markings

Green pavement markings are used to delineate the contraflow lanes on approach to the BikeHAWK. At the crossing itself, the cyclists see adjacent to the high-visibility crosswalk an 8-ft green path designated for their use. The green markings extend the bicycle lane across the intersection, and adds conspicuity to the bicycle presence while separating the pedestrians from the bicyclists using the BikeHAWK signal.

f) "Ride With Traffic" Signs

Signs are installed to remind cyclists of their duty to ride with traffic after the crossing has been completed and it is safe to make the maneuver. The signs used are the MUTCD signs R5-1b (Bicycle Symbol WRONG WAY) and R9-3cP (RIDE WITH TRAFFIC).

A multi-disciplinary team, comprised of planners, engineers and law enforcement, collaborated on the BikeHAWK to ensure the BikeHAWK operates successfully. The signing and markings have been incorporated into the design not because of crash problems, but to enhance road-



Figure 6: Green pavement markings

user understanding and to facilitate enforcement in the unlikely event of a crash. The signing and markings used at the BikeHAWK are shown in Figure 7.

Expansion of the BikeHAWK in Tucson

The second BikeHAWK was installed at 10th Ave and Speedway Boulevard. Tenth Avenue is a residential street in a very active neighborhood, Dunbar Springs. At Tenth Avenue, Speedway Boulevard is a busy 6-lane divided highway and carries over 33,000 vehicles per day. Speedway Boulevard separates Dunbar Spring neighborhood from Pima Community College. The BikeHAWK was in part installed at this location to improve access from the neighborhood to the community college.

This second BikeHAWK includes a few new treatments based on the learning experience of the first installation. This includes a push button curbside so the cyclist can lean on the curb and access the signal without riding to the pedestrian push button. In addition, the green colored section outside the crosswalk was outlined in white striping “cat tracks” to enhance visibility. In addition, a NO TURN ON RED sign has been installed to reduce potential conflicts between right-turning motorists and cyclists who are crossing from the contra-flow lane to continue riding with traffic.

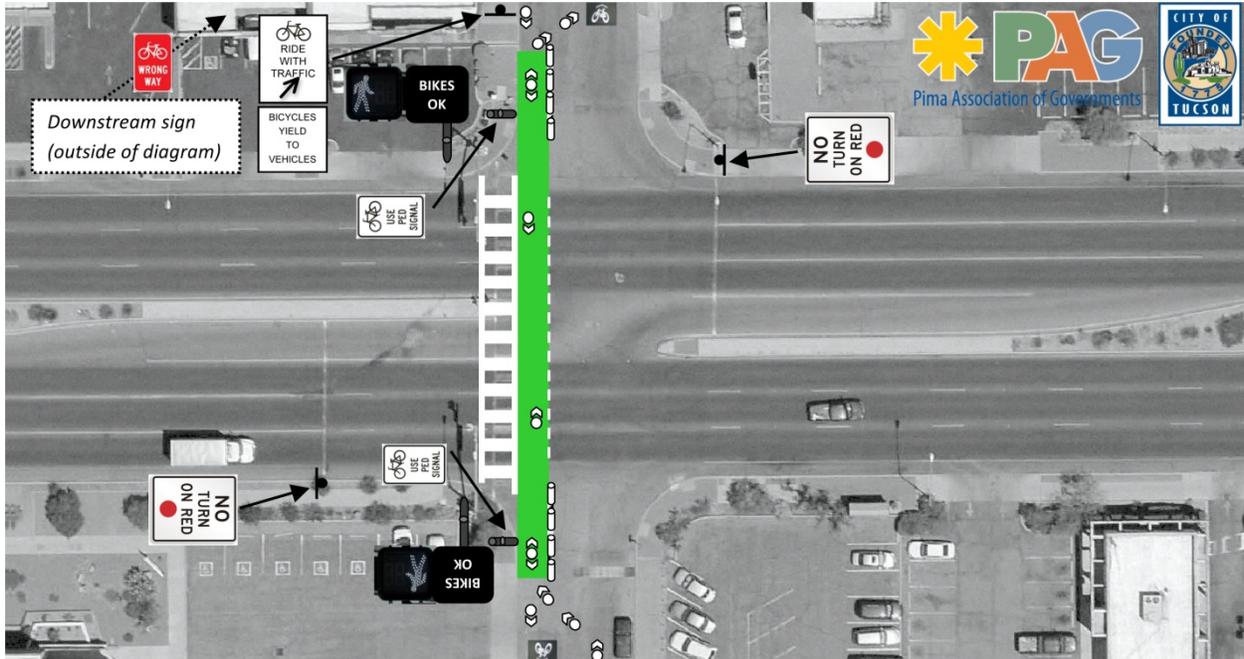


Figure 7: BikeHAWK layout with signs

Use of the BikeHAWK

The Third Street/Swan Road BikeHAWK has been in operation since June 2012 and has been well-received by the community. The news media have interviewed cyclists, and all cyclists indicated they understand and appreciate the new device. The most common theme in their response is that it makes them feel safer when crossing the busy street. Peak-period pedestrian and bicycle counts conducted at the BikeHAWK at Third Street/Swan Road by the Pima Association of Governments, during their normal counting program in 2012, have shown that:

- 96% of the riders use the BikeHAWK as designed for crossing the 4-lane divided highway
- 100% of family riders with children or children alone use the BikeHAWK
- 94% of the crossers were cyclists and 6% were pedestrians
- The device was easily understood by all users and cyclists followed the designated paths with ease
- There continues to be a high level of driver compliance to the crossing device, and drivers stop when required, observed at 100% compliance during 2012 field observation
- 50% of riders using the BikeHAWK were males, 46% were females, and 6% were children. This level of female ridership is higher than the average regional use documented in the 2011 PAG Regional Bicycle/Pedestrian Count (27%). Research has shown that higher female ridership can indicate a perception of safer facilities, which can lead to higher ridership overall.

Future Installations

The Tucson BikeHAWK employs traffic control devices and techniques that are already approved by the FHWA and accepted by traffic engineers. Dangerous and illegal driver behaviors are minimized or eliminated, and the neighborhood traffic intrusion is avoided.

The device has been so successful that the City of Tucson received funding for the installation of four more BikeHAWKs. In addition, the Regional Transportation Authority is considering a proposal to fund a regionwide retrofit of existing HAWK crossings to facilitate bicycle crossing. It is estimated that to modify an existing HAWK costs in the range of approximately \$10,000 to \$20,000 depending upon the location, sidewalk and ramp concrete work.

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