

City of Minneapolis, Minnesota

Request to Experiment

Flashing Yellow & Red Beacons at Marked Crosswalks

August 25, 2014



Introduction

The City of Minneapolis requests permission to experiment with a variation of the standard flashing yellow beacon and related signage at marked crosswalks. To increase vehicle compliance at marked crosswalks, the City of Minneapolis would like to pilot a sequence of actuated flashing yellow and red beacons at marked crosswalks in the place of existing pedestrian-actuated flashing yellow beacons. A variation of related pedestrian push button instructional signage is also requested.

The Minneapolis Public Works Department currently operates 43 flashing yellow beacons at marked pedestrian crosswalks. Thirty-four of the flashing yellow beacons are pedestrian-actuated. The purpose of the flashing yellow beacon is to increase motorist compliance at marked crosswalks by providing a stronger visual enhancement for approaching motorists to stop. Minnesota statute requires motorists to stop for pedestrians and bicyclists in a marked

crosswalk. Flashing red beacons may provide motorists with a clearer message that is consistent with Minnesota's existing crosswalk laws.

This request outlines the nature of the challenge, a description of the proposed change, specific locations where this change would be applied and how the City of Minneapolis plans to implement, monitor and evaluate the effectiveness of the treatment.

1 - A statement of the nature of the problem, including data that justifies the need for a new device or application.

The City of Minneapolis currently operates 43 flashing yellow beacons at marked pedestrian crosswalks. The purpose of a flashing yellow beacon is to increase the stopping compliance of motorists at marked crosswalks, thus enhancing the safety of pedestrians and bicyclists crossing the roadway. The City of Minneapolis believes that the flashing red beacon may provide a stronger message to motorists in the place of existing flashing yellow beacons.

Minnesota Statute requires vehicles approaching a marked crosswalk to stop for pedestrians in a crosswalk and remain stopped until the pedestrian has passed the lane in which the vehicle has stopped. Bicyclists are also be treated as pedestrians when in a marked crosswalk.

Where traffic-control signals are not in place or in operation, the driver of a vehicle shall stop to yield the right-of-way to a pedestrian crossing the roadway within a marked crosswalk or at an intersection with no marked crosswalk. The driver must remain stopped until the pedestrian has passed the lane in which the vehicle is stopped.
(Minnesota State Statute 169.21 Subd. 2)
A person lawfully operating a bicycle on a sidewalk, or across a roadway or shoulder on a crosswalk, shall have all the rights and duties applicable to a pedestrian under the same circumstances. [[Minnesota State Statute 169.22, Subd. 4\(f\)](#)]

Preliminary observations at several locations considered for pilot application show that compliance with this law is not as high as desired. With standard yellow beacons and pedestrian warning signage (W11-2) in place, motorists continue to violate the state law associated with stopping for a pedestrian in a crosswalk.

The City of Minneapolis believes that lack of motorist compliance is partly due to the message that the color yellow delivers. The Minnesota Manual on Uniform Traffic Control Devices (MMUTCD) states that flashing yellow beacons can be used to "supplement appropriate warning or regulatory sign or marker" (MMUTCD 2009: 4L.3). In this case the regulatory marker is the marked crosswalk and related pedestrian warning signs. However, it is clear that the flashing yellow beacons are supplementing a regulatory marking that is not, at times, fully understood, recognized or respected by motorists.

This problem is not unique to Minneapolis. In the United States, many agencies have explored alternatives to flashing yellow beacons as a means of increasing motorist compliance and decreasing crashes. Common alternatives include mid-block traffic signals (half signals), High-Intensity Activated Crosswalk beacons (HAWKs), Rectangular Rapid Flash Beacons (RRFBs) and pedestrian refuge medians. The City of Minneapolis has considered all these alternatives but has found most to be cost-prohibitive, not always feasible or ineffective.

Half signals and HAWKs are costly. The MMUTCD discourages the use of HAWKs at or near intersections and half signals in all cases (MMUTCD 2009: Section 4F.2). Many of the flashing yellow beacon crossings in Minneapolis are located at intersections. Pedestrian medians have proven effective in Minneapolis, but are often cost-prohibitive and come with geometric and physical restrictions. Minneapolis plans to test RRFBs at several locations concurrently with the requested red beacon experiment, but the message conveyed by the RRFB is less clear, meant mainly to highlight the warning sign.

The requested experimental treatment could be utilized anywhere a standard flashing yellow beacon might be deployed, at a fraction of the cost of a HAWK or half signal, with a clear message to motorists to stop for a pedestrian or bicyclist in a crosswalk.

2 - A description of the proposed change, how it was developed and how it deviates from the current MMUTCD.

The two MMUTCD guidelines that allow for the current flashing yellow beacon are found in the 2009 edition, Section 4L.3. They authorize the use of a flashing yellow beacon to provide additional warning to vehicles approaching marked crosswalks.

A Warning Beacon shall consist of one or more signal sections of a standard traffic signal face with a flashing CIRCULAR YELLOW signal indication in each signal section. A Warning Beacon shall be used only to supplement an appropriate warning or regulatory sign or marker. (MMUTCD 2009: Section 4L.3)

Warning beacons that are actuated by pedestrians, bicyclists or other road users may be used as appropriate to provide additional warning to vehicles approaching a crossing or other locations. (MMUTCD 2009: Section 4L.3)

The proposed change would adhere to all the design and operation standards outlined in MMUTCD Section 4L.3. The proposed change is the addition of a flashing red beacon phase following a short yellow flashing beacon phase. All other operations and design elements of the beacon are authorized by the current MMUTCD. The flash rate will be 60 flashes per minute and the beacons will flash simultaneously at locations with multiple signal heads. To avoid confusion with railroad crossing beacons, locations with multiple signal heads will not flash in a wig-wag pattern.

Description of Flash Sequence

The pilot locations will include overhead mounted beacons and will be pedestrian-actuated with accessible pedestrian signal buttons. The beacon sequence would proceed as follows:

- 1) When inactive, beacon would remain dark.
- 2) Button pushed by pedestrians and/or bicyclists
- 3) Accessible button announces: *Warning beacons activated to cross [name of road]. Proceed with caution.*
- 4) Yellow flash phase begins; lasts five seconds.
- 5) Pedestrian observes traffic and begins to cross.
- 6) Red flash phase begins; length of flash period variable based on crossing distance and pedestrian speed of 3.0 feet per second.
- 7) Beacon returns to inactive state.

If a second individual presses the signal button during the red phase, the red flashing phase timing will re-set to the full crossing time required and the red flashing phase will be extended.

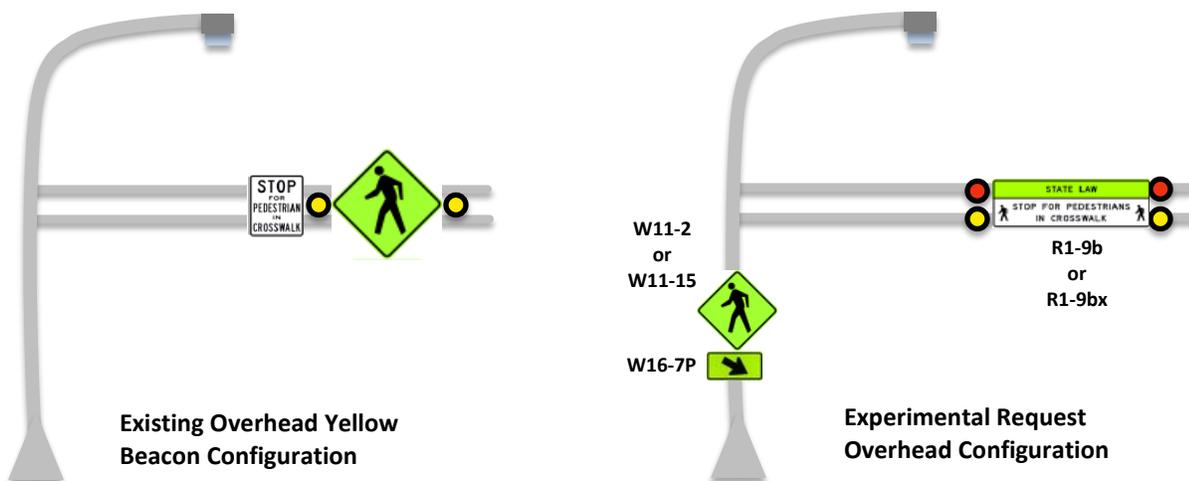
The proposed flashing red beacon system was developed by City of Minneapolis Traffic Engineering staff after concerns were raised over the effectiveness of existing flashing yellow beacons. The primary motivation for this change is to deploy a treatment with high rates of compliance without the high capital and operational expenses of a half signal or HAWK signal, but with a clearer message than an RRFB.

3 - Supporting data that explains how the experimental device was developed, if it has been tried, the adequacy of its performance, and the process by which the device was chosen or applied.

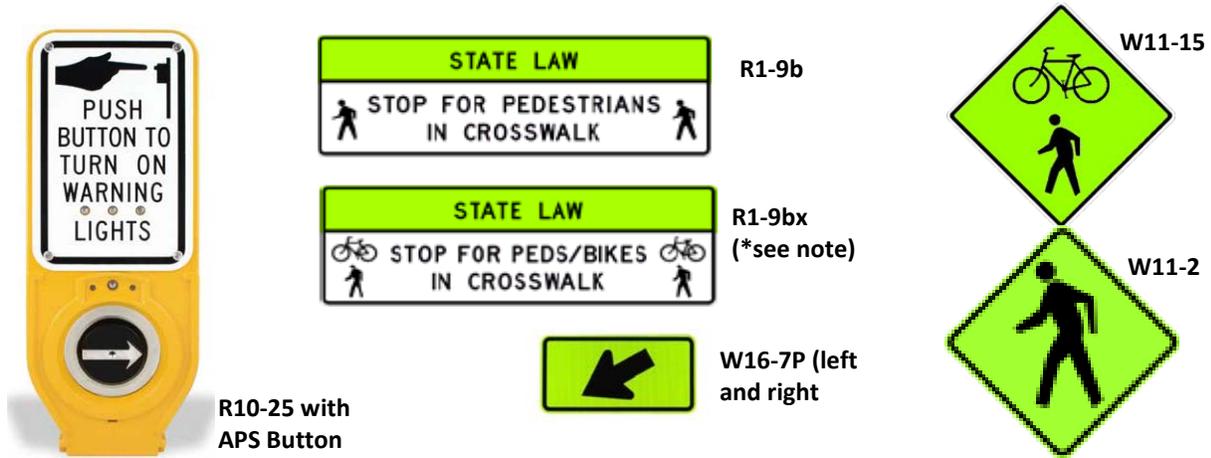
The City of Minneapolis is not aware of any U.S. examples of flashing red beacon crossings used in the context outlined in this request. However, the HAWK signal, which uses flashing red beacons in conjunction with other red and yellow signal phasing has been shown to increase overall safety and has high rates of motorist compliance. An FHWA study of 21 HAWKs in Tucson, Arizona found that the treatment reduced the total number of crashes by 29 percent, severe crashes by 15 percent and pedestrian crashes by 69 percent. With the HAWK, compliance among motorists approaches 100 percent. Other research has found compliance with overhead passive signals (such as flashing yellow beacons) to be between 25-45 percent (Fitzpatrick 2010).

The City of Minneapolis hopes to capture the positive effects of the HAWK with less capital and operational expenses and a clearer message than what is communicated with RRFBs. A recent application of the HAWK in St. Cloud, MN cost \$80,000. The City of Minneapolis anticipates that retrofitting an existing yellow beacon would cost significantly less per installation, and even an entirely new beacon would be significantly less than a HAWK. RRFBs are similarly low-cost, but the flash indication has no statutory meaning – it is intended to bring additional attention to the existing warning signs and crosswalk markings. Given the low cost, any increase in motorist compliance or decrease in crashes would make the treatment cost-effective.

4 - Any illustration(s) that enhances understanding of the device or its use.



Signs & Actuation to Accompany Yellow & Red Flashing Beacons



Please see Appendix A: Pedestrian-Bike Crossing with Activated Overhead Red/Yellow Beacons) for a detailed sketch of the proposed beacon.

*Minnesota Traffic Regulations state that: "A person lawfully operating a bicycle on a sidewalk, or across a roadway or shoulder on a crosswalk, shall have all the rights and duties applicable to a pedestrian under the same circumstances." Minnesota Statutes 2014, section 169.222, subdivision 4(f).

5 - A legally binding statement certifying that the concept of the traffic control device is not protected by a patent or copyright.

To the best of the City of Minneapolis' knowledge, the concept of using flashing red beacons to supplement standard traffic control devices is not protected by a patent or copyright.

6 - The proposed time period and location(s) of the experiment.

Implementation of the proposed flashing yellow/red beacons is scheduled for the summer of 2014. The treatment will be deployed at four locations, as outlined in Appendix B. To determine the four pilot locations, all 43 existing flashing yellow beacons were analyzed. Final pilot locations were based on feasibility and represent a variety of traffic conditions and land use contexts. Monitoring and evaluation will occur before installation and during the first six months following installation with continued monitoring for at least two years.

7 - A detailed research or evaluation plan providing for close monitoring of the experimentation, especially in the early stages of field implementation. The evaluation plan should include before and after studies as well as quantitative data enabling a scientifically sound evaluation of the performance of the device.

The City of Minneapolis intends to conduct before and after evaluation of the flashing yellow/red beacons. The FHWA report *Pedestrian and Bicyclist Traffic Control Device Evaluation Methods* outlines a procedure for planning a bicycle or pedestrian project evaluation (FHWA 2011).

The six-step process will be used when evaluating this request:

- Problem Identification: What is the safety or traffic operations issue?
- Research Question: What is the research question?
- Measures of Effectiveness: How will performance be assessed?
- Evaluation Designs: What is the study approach?
- Evaluation Methods: How will users, traffic operations or crashes be measured?
- Selecting components to the evaluation plan: How can time, budget, and practicality be balanced to execute the plan?

Problem Identification

Minneapolis has installed a number of overhead yellow warning beacons with crosswalks through the years. Both measured evaluation and anecdotal observation have revealed that motor vehicle drivers inconsistently yield a pedestrian attempting to cross with this treatment. Minneapolis would like to experiment with a red flashing phase of a similar beacon, intended to emphasize existing traffic statutes requiring motor vehicles to stop for pedestrians and bicycle in a crosswalk.

Primary Research Questions

- Is the new treatment being used as intended?
- What effect has the treatment had on traffic safety for all modes?
- How do pedestrians, bicyclists and motorists perceive the treatment?

Measures of Effectiveness

Minneapolis will review the following measures for evaluation of the requested treatment:

- Before and after crash rates with a particular focus on pedestrian, bicyclist and rear end crashes
- Before and after motorist stopping compliance rates
- Before and after pedestrian and bicyclist push button rates
- Informal surveys of pedestrians and bicyclists to determine recognition, comprehension and effectiveness
- Informal surveys of motor vehicle drivers to determine recognition, comprehension and effectiveness

Evaluation Design

Evaluation for this experiment will be conducted by way of a longitudinal before-after study of the pilot locations. Monitoring and evaluation will begin in spring 2014 prior to beacon installation and during the first six months following installation with continued monitoring for at least two years. Installation would be anticipated early summer 2014. Post-installation recording will occur after an acclimatization period for roadway users, and after the autumn school semester has commenced.

Evaluation Methods

The primary method of evaluation will consist of before and after video observing user behavior at pilot locations. Trained observers will review video data for the following incidents:

- Incidence of beacon actuation by crossing pedestrians
- Pedestrians crossing with no vehicle present

- Vehicle stopping for waiting pedestrian
- Vehicle slowing for waiting pedestrian
- Vehicle not stopping for waiting pedestrian
- Vehicle stopping as necessary, and then starting during flashing red sequence

The results of video observation will be represented in table format.

Evaluation will include an informal survey of roadway users. This will be conducted via the Minneapolis 311 information call center. Signage will be placed at all legs of the crossings to encourage users to contact 311 with comments. Please see Appendix C for a signing detail that will be installed after beacon installation and remain in place for a number of months.

The results of these comments will be included in the written evaluation.

Selecting Components to the Evaluation Plan

The evaluation plan will include site observations, informal surveys, and crash data analysis. These will be conducted for a limited time period of over approximately six months. Less formal monitoring of the beacons (crash data only) will continue for an additional two years beyond the installation date. Existing City of Minneapolis functions will be utilized to collect two sources of information – Minneapolis 311 Service (informal surveys) and Minneapolis Traffic Division Crash Data Collection (crash incidence and type). Observations will be conducted by City staff and a contractor hired for this purpose.

8 - An agreement to restore the experimental site to a condition that complies with the provisions of the MUTCD within 3 months following completion of the experiment. The agreement must also provide that the sponsoring agency will terminate the experiment at any time if it determines that the experiment directly or indirectly causes significant safety hazards. If the experiment demonstrates an improvement, the device or application may remain in place until an official rulemaking action occurs.

Minneapolis Public Works agrees to the above conditions.

9 - An agreement to provide semi-annual progress reports for the duration of the experimentation and a copy of the final results to the FHWA's Office of Transportation Operations within three months of the conclusion of the experiment.

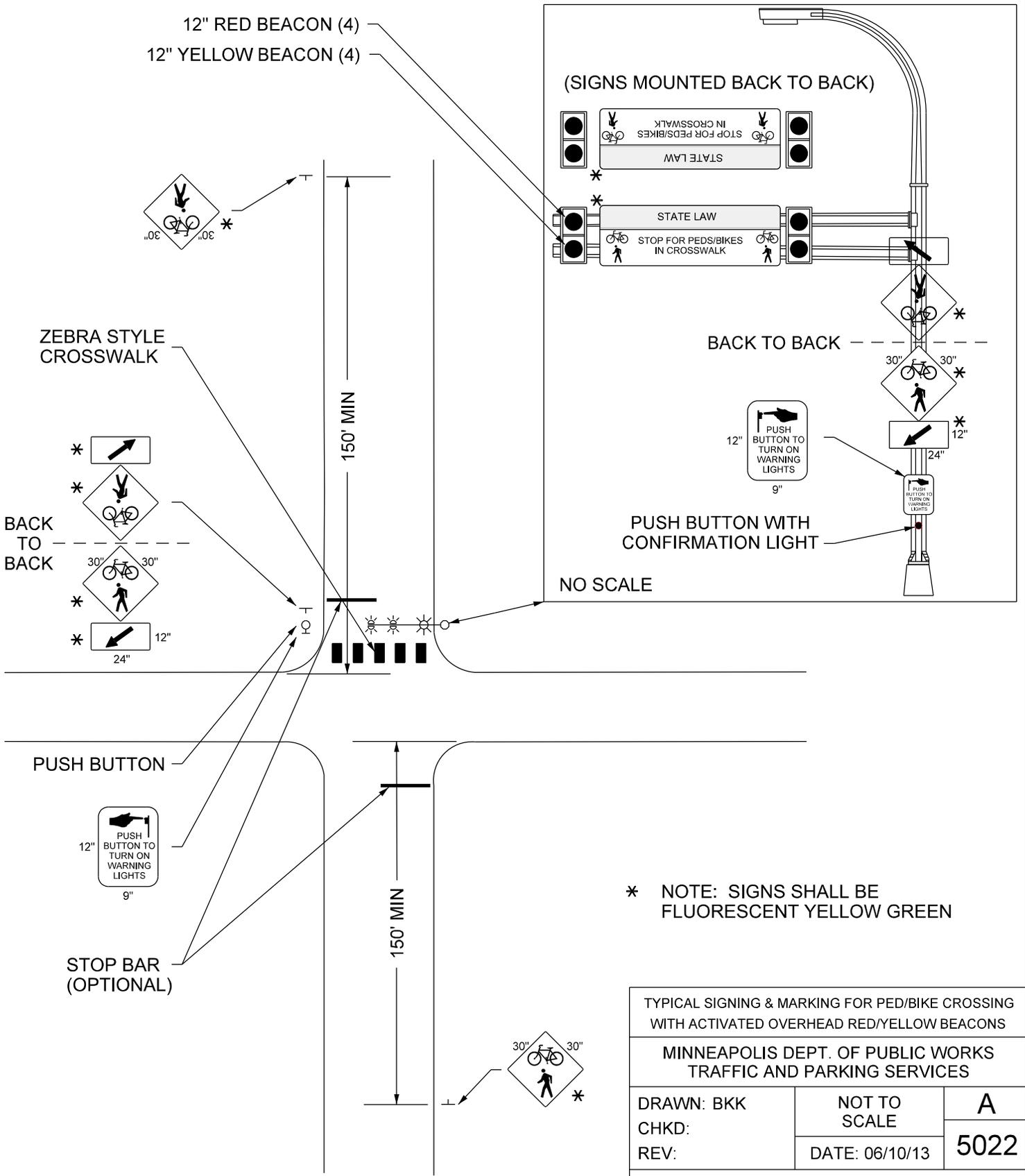
Minneapolis Public Works agrees to the above conditions.

References

Federal Highway Administration. Pedestrian and Bicyclist Traffic Control Device Evaluation Methods. U.S. Department of Transportation. May 2011.

Fitzpatrick, Kay and Eun Sug Park. Safety Effectiveness of the HAWK Pedestrian Crossing Treatment. Federal Highway Administration. Publication No. FHWA-HRT-10-042. July 2010.

PEDESTRIAN-BIKE CROSSING WITH ACTIVATED OVERHEAD RED/YELLOW BEACONS



TYPICAL SIGNING & MARKING FOR PED/BIKE CROSSING WITH ACTIVATED OVERHEAD RED/YELLOW BEACONS		
MINNEAPOLIS DEPT. OF PUBLIC WORKS TRAFFIC AND PARKING SERVICES		
DRAWN: BKK	NOT TO SCALE	A
CHKD:		
REV:	DATE: 06/10/13	5022
FILENAME: A-5022.DGN		

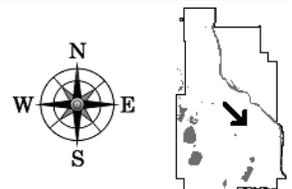
Attachment B: Experimental Test Locations

Location 1—Midtown Greenway & 28th Street E

The Midtown Greenway is a major commuter and recreational trail, carrying an average of 3,000 bicyclists and hundreds of pedestrians each day. The trail crosses 28th St E at grade. 28th St E carries an average of 8,800 vehicles per day. The beacon is overhead mounted, pedestrian-actuated and facilitates midblock trail crossings for the Midtown Greenway. East 28th Street previously had two travel lanes in each direction, creating a potential *double threat*. In 2011, a center median was added, reducing traffic to one lane in each direction.



Existing Overhead Yellow Beacon—28th St E & Midtown Greenway



Attachment B: Experimental Test Locations

Location 2—Midtown Greenway & Minnehaha Ave S

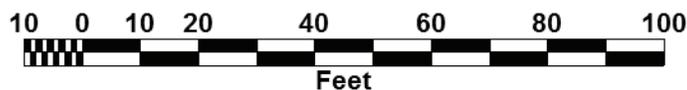
The Midtown Greenway is a major commuter and recreational trail, carrying an average of 3,000 bicyclists and hundreds of pedestrians each day. The trail crosses Minnehaha Ave S at grade. Minnehaha carries an average of 9,081 vehicles per day. The beacon is overhead mounted, pedestrian-actuated and facilitates midblock trail crossings for the Midtown Greenway. Minnehaha previously had two travel lanes in each direction, creating a potential *double threat*. In 2011, the road underwent a *road diet* as part of the federal Non-Motorized Transportation Pilot Program (NTPP) converting 4 lanes to 3 and adding bike lanes.



Existing Overhead Yellow Beacon—Midtown Greenway & Minnehaha Ave S



LOCATION	MOUNTING	ACTUATED?	PLACEMENT	AADT	DOUBLE THREAT?
Midtown Greenway &	Overhead	Yes-Push Buttons	Mid-Block	9,081	No



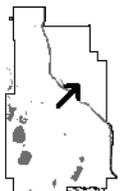
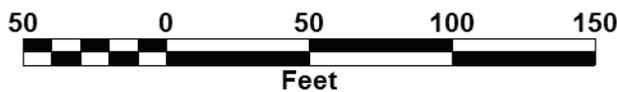
Attachment B: Experimental Test Locations

Location 3—10th Ave SE & 5th St SE

The intersection of 5th St SE and 10th Ave SE is located in a residential neighborhood in close proximity to the University of Minnesota campus. Fifth Street Southeast is a bicycle boulevard with high volumes of bicycles and pedestrians. Tenth Avenue Southeast is a neighborhood collector with an average of 7,700 vehicles per day. In 2010, 10th Ave SE underwent a 4:3 lane conversion and currently has two travel lanes, one center turn lane, and two bike lanes. This has eliminated the potential for a *double threat*. The beacon at 10th Avenue Southeast is overhead mounted, pedestrian-actuated and facilitates crossings across the north and south legs of the intersection.



Existing Overhead Yellow Beacon—10th Ave SE & 5th St SE



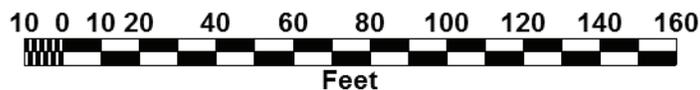
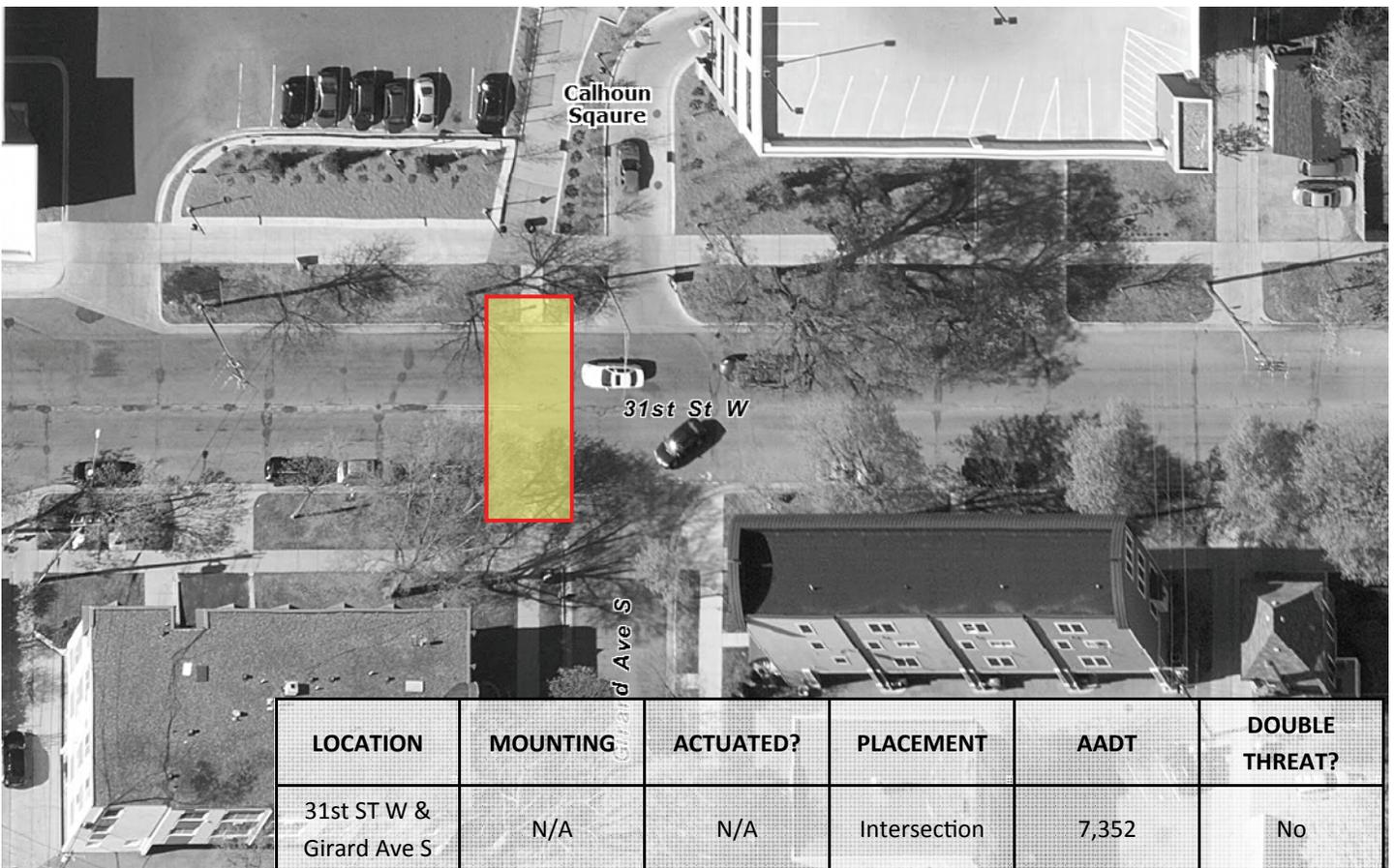
Attachment B: Experimental Test Locations

Location 4—31st St W & Girard Ave S

The intersection of 31st St W and Girard Ave S is located at the edge of a high-density residential neighborhood and a vibrant commercial district. 31st St W is a neighborhood collector with an average of 7,352 vehicles per day. 31st street consists of two lanes in each direction and a parking lane on the south side of the street. There is no *double threat* scenario. This location does not currently have an overhead beacon. Video observation of the north-south crossing of 31st St indicated a large number of crossing pedestrians. The new beacon is intended to facilitate this crossing. A new ADA-compliant curb ramp will be included with the project.



New beacon location—31st St W & Girard Ave S



Attachment C: Example Public Comment Signing Plan

