



## RESEARCH SERVICES SECTION

# TECHNICAL SUMMARY

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### PROJECT COST:

\$118,908



Researchers studied user-activated warning crosswalks such as this one in Woodbury, Minnesota.



# Evaluating Active and Passive Crosswalk Warnings at Unsignalized Intersections and Mid-Block Sites

## What Was the Need?

A growing interest in walking and bicycling in Minnesota has led to a need to evaluate the safety and usability of pedestrian and bicycling facilities. One area that has received considerable attention is crosswalk safety at intersections without traffic signals or at mid-block sites.

Warnings at uncontrolled crosswalks are intended to promote caution in approaching drivers. Passive warning crosswalk sites feature roadway markings accompanied by yellow pedestrian warning signs facing oncoming traffic. Active warning sites feature these passive warnings accompanied by a flashing light attached to a roadway shoulder sign or suspended above the roadway. The light either flashes continuously or is activated by a pedestrian or bicyclist wishing to use the crosswalk. Passive warning installations typically cost no more than \$500; the cost to install an active warning system ranges from \$5,000 to \$12,000.

Previous studies into the safety effect of passive and active warnings at these types of sites have provided no clear guidance. If new research shows that passive warnings are as effective as active warning systems in safeguarding pedestrians and bicyclists using uncontrolled crosswalks, Minnesota's cities and counties could save money by installing lower-cost passive warning systems.

## What Was Our Goal?

The objectives of this study were to:

- Review literature to evaluate research findings relevant to crosswalk warning systems.
- Conduct a field study of the relative benefits of active and passive warnings at selected suburban and urban pedestrian crosswalk sites.
- Develop recommendations and design alternatives for low-cost pedestrian crosswalk warnings.

## What Did We Do?

From July through November 2007, researchers collected data at 18 pedestrian crosswalk sites in the Twin Cities metropolitan area that had roadway speed limits of 25 mph, 30 mph or 35 mph, some with passive and some with active warning systems. Monitoring took place during daylight hours when pedestrian and bicyclist traffic was expected, with observation periods ranging from 50 to 110 minutes. Data from 7,305 vehicle crosswalk and 596 vehicle-pedestrian interactions were recorded.

Researchers used two novel technologies for this project. First, a modular, portable camera boom system, affixed to the back of a vehicle with a trailer hitch, allowed researchers to gather video data of vehicle behavior. Then they used a computer vision software platform to analyze the video. The program identifies and tracks an object as it changes position from frame to frame across successively recorded 30 frames/second camera images; it uses this tracking information to automatically compute distances, velocities and accelerations of moving vehicles, and vehicle and pedestrian counts. The result is an automated collection of a large amount of sophisticated data that can be used to calculate average vehicle velocities and deceleration/acceleration values for each interaction. This allowed researchers to produce an aggregate comparison of behavior at intersections

*“This study found no significant difference in active and passive warning systems in promoting more cautious driving behavior at uncontrolled crosswalks.”*

–Deb Bloom,  
City Engineer,  
City of Roseville

*“When it comes to designing warning systems for uncontrolled pedestrian crosswalks, the presence or absence of the crosswalk user, not the warning itself, has the greatest influence on the driving behavior of motorists approaching the crosswalk.”*

–Thomas Smith,  
Research Associate,  
University of Minnesota  
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Researchers used a portable camera boom system to gather observational data on vehicle-crosswalk and vehicle-pedestrian interactions at uncontrolled crosswalks in the Twin Cities metropolitan area.

with passive versus active warning systems, as well as the behavior of drivers when a pedestrian or bicyclist was present or absent.

### What Did We Learn?

The findings of this project were mixed. No significant differences in overall velocities and deceleration/acceleration values were noted between drivers at intersections with active and passive warnings, whether or not a pedestrian or bicyclist was present. However, drivers approaching uncontrolled crosswalks with active warnings, particularly user-activated warnings, tended to drive more slowly than drivers approaching crosswalks with passive warnings. This supports the current practice of installing these more expensive systems at sites with higher vehicular traffic, where more vehicle/pedestrian interaction is expected. User-activated warnings were not activated by pedestrians.

Researchers believe the ambiguity of warning signs at uncontrolled crosswalks accounts for the study’s mixed results; these signs refer to an event (someone crossing the street) that may or may not occur at the time the motorist approaches the crosswalk. Because of this ambiguity, most motorists approaching an uncontrolled crosswalk tend to pay attention to whether or not a pedestrian or bicyclist is present, not to the type of warning.

### What’s Next

A prevailing perception that active warning systems are more beneficial than passive warnings in safeguarding pedestrians and bicyclists at uncontrolled crosswalks was not validated by this study. More research is needed to establish guidelines based on empirical evidence for choosing warning systems at these crosswalks.

An effective solution to safeguard pedestrians and bicyclists may lie in the development of a crosswalk active warning system where the flashing light is activated automatically by the presence of a pedestrian or bicyclist near the crosswalk. Further efforts to enhance safety might include an evaluation of motorist and non-motorist understanding of pedestrian right-of-way laws and the vehicle code, and development of an educational program to promote more cautious driver behavior at uncontrolled crosswalks.

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*This Technical Summary pertains to the LRRB-produced Report 2009-03, “Warning Efficacy of Active Versus Passive Warnings for Unsignalized Intersection and Mid-Block Pedestrian Crosswalks,” published January 2009. The full report can be accessed at <http://www.lrrb.org/PDF/200903.pdf>.*