Monitoring Pedestrian and Driver Behavior at Pedestrian-Activated Crossings

What Was the Need?
State law requires drivers in Minnesota to yield to pedestrians and cyclists at crosswalks, whether marked or not. Pedestrian-activated crossings (PACs) allow cyclists and pedestrians to alert drivers that they are using a crosswalk. Installed to improve pedestrian safety, PACs are typically selected and placed based on national guidance.

Road agencies deploy two of the most commonly considered PACs in Minnesota—rectangular rapid-flashing beacons (RRFBs) and High-intensity Activated crossWalK beacons (HAWKs)—on roadways as recommended by the American Association of State Highway and Transportation Officials (AASHTO) and at other locations to further enhance the safety of walkers, joggers and cyclists.

Little is known about the best uses of RRFBs and HAWKs and how effective they are at reducing pedestrian–vehicle accidents and injuries. MnDOT and other agencies lack data on each system’s performance, impact on driver behavior and efficacy for pedestrians.

What Was Our Goal?
The goal of this project was to examine pedestrian and vehicle interactions at RRFBs and HAWKs in Minnesota to guide decision-makers on where such crossings are most appropriately located. Investigators would record activity at intersections, examine the impact of the facilities on driver and pedestrian behavior, determine how effective the systems are in atypical locations with higher speed limits and wider roadways, and determine the safety benefits of crossing options.

What Did We Do?
Researchers conducted a literature search of driver behavior and pedestrian safety for HAWKs and RRFBs. The research team constructed a model for determining the impact of the crossing treatments in reducing crashes based on traffic and roadway conditions and driver yielding rates.

Investigators then selected for analysis 38 PAC sites at 34 locations in Minnesota, including 24 RRFB crossings, five HAWK crossings, seven flashing LED crossings and two standard pedestrian crossings without activated systems. Battery-operated video systems were mounted at observation sites. Video recorded crosswalk activity from sunrise to sunset for at least seven days at a Duluth site in September 2015 and at the other sites in April through October 2016.

Researchers sorted video results by recording hourly vehicle volumes, the time of day that pedestrians crossed and whether crossings coincided with vehicles within a minimum safe stopping distance based on the area speed limit. Researchers logged 100 interactions at each crossing, sometimes logging an entire day’s worth of pedestrian–vehicle interactions at sites with fewer events. The research team recorded vehicle

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speeds, yielding behavior and a range of pedestrian characteristics, including where the pedestrian began walking or cyclist began riding a bicycle (for example, within the crosswalk, outside the marked walk or from the curb); if the system was activated; and who yielded to whom. Investigators examined logs to determine correlations between pedestrian and driver behavior.

What Did We Learn?
Researchers compared simulation model results to injury severity distribution data for the Twin Cities area and concluded that yield rates could not be correlated with pedestrian safety. Logistical challenges and equipment failures reduced the number of examined crossings to 27 for analysis, yielding thousands of hours of video.

With HAWKs, long activation time seems to contribute to pedestrians crossing before systems signal them to cross. Vehicle operators see a sequence of yellow and red flashing and solid lights in cycles that require seven seconds or more before signaling pedestrians to walk. Sequences may not be intuitive for all pedestrians and drivers.

Crossing delay times were significantly lower with RRFBs, which do not deploy a delay before allowing pedestrian crossings. When drivers do not yield at activated RRFBs, crossing delays lengthen to a level comparable to activated HAWKs. Driver yield rates at RRFBs increase with the number of lanes at the location.

The greater the number of lanes to cross, the more likely pedestrians were to activate systems. Analysis of yield rates with and without activated pedestrian signals suggests that good visibility, extra signage and advance notice may be sufficient to improve driver yield rates. Yield rates were higher at sites with overhead systems. At RRFB sites with low driver yield rates, HAWKs may improve yield behavior.

What’s Next?
This study produced data but no actionable recommendations for selecting and locating systems. Researchers were unable to determine the relative efficacy of HAWKs and RRFBs in terms of pedestrian safety. Future research, however, can draw upon the significant amount of data this research produced as part of a more directed study of pedestrian and driver behavior and safety at pedestrian-activated crossings.

Produced by CTC & Associates for:
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