Cones Sound a Warning of Work Zone Intrusion

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The Manual on Uniform Traffic Control Devices (MUTCD) contains standards and guidance on the design and application of traffic control devices to guide road users in and through work zones. However, some work zones present safety challenges that require additional efforts to enhance workers' safety. For this reason, Federal regulation 23 CFR 630 Subpart K encourages state highway agencies to consider the use of other traffic control devices that can help reduce work zone crashes and improve worker and road user safety. Local agencies may have situations where extra safety is also needed.

A number of measures identified in this regulation specifically address motorist and worker safety; one of these is an intrusion alarm system. This article will describe how intrusion alarms work, and report on research conducted in Kansas that compared two of the available models.

Intrusion alarms

Where they are used. Intrusion alarms are used primarily in temporary work zones with short work duration where adding a positive protection system such as concrete barrier is not feasible. Intrusion alarms do not take the place of a physical barrier, but will give workers a number of seconds to clear the area when the work zone is breached by an errant vehicle.

Technology used. Intrusion alarms use one or more sensors mounted on a typical work zone barrier such as a cone, drum,

At left, three types of audible cones: Top, SonoBlaster®, Middle, Intellicone®, Bottom, Safety Line™.

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or delineator. Some models have the alarm mounted on the device and will sound if struck by an errant vehicle. One model has a transmitter on the cone and a receiver closer to the workers in the work zone.

Popular types. Commonly used cone-type intrusion alarms are the following:

SonoBlaster®: This is a stand-alone, impact-activated system. Upon impact by an errant vehicle, the device's built-in CO_2 powered horn blasts to signal the intrusion into the protective zone, giving the workers reaction time to move out of the harm's way. Each unit comes with one CO_2 cartridge, good for one use. The cost for one unit, including the mounting bracket, is less than $100. Additional cartridges are sold separately at $3.00 each. http://www.transpo.com/roads-highways/safety-products/wz-intrusion-alarm

Intellicone®: This system has two components – a base unit (Portable Site Alarm) that acts as a signal receiver equipped with an audio-visual alarm; and a series of integrated lamps and sensors that transmit the signal to the base unit when tilted past a certain angle. The base unit is powered by an internal rechargeable battery. The sensors are each powered by a 6V

battery. http://www.intellicone.co.uk/

Safety Line™ SL-D12: This system also consists of transmitter and receiver. A dual infrared beam is projected by the transmitter to the receiver. When an errant vehicle enters the work zone obstructing the beam, it causes the air horn and the strobe light on the receiver to be activated. Multiple units can be linked together. The units are powered by 12V batteries with an option of solar panels to extend the battery life in between the charge. The cost per system (receiver and transmitter) is $4,000.
http://ops.fhwa.dot.gov/wz/workshops/originals/Ken_Kochevar_ID.ppt

Research in Kansas

A recent Master's thesis research project conducted by Chris Novosel at the University of Kansas field tested two of these intrusion alarm systems – SonoBlaster® and Intellicone® - at several locations in eastern Kansas:

• Storm sewer project on a collector street in Lawrence;
• Street widening project on a principal arterial in Lawrence;
• Bridge repair project on an interstate highway in Lenexa;
• Crash attenuator replacement project on an interstate highway in Kansas City, Kansas.

Novosel said the perceived and actual levels of protection and the ease of use influence the acceptance of the devices by work zone employees. In his research he asked workers in Kansas and other states that use warming cones following questions:

Is the intrusion alarm effective in warning workers of vehicles that breach the work zone in such a way to allow them to take action to avoid being struck by the vehicle?

Does the intrusion alarm give the workers a feeling of protection and safety?

Is the intrusion alarm easy to install, activate, and replace?

The findings indicated that there were some difficulties with both systems, mainly with the sound levels of the alarms. In general, however, workers responded favorably to the systems and felt like the audible cones would give them more time to react to work zone intrusion.

When asked workers about the sound level of the alarm for the two systems tested, the overall response was that SonoBlaster's alarm was slightly easier to hear than Intellicone's, particularly in a louder ambient environment due

Resources on Intrusion Alarms

The National Work Zone Safety Information Clearinghouse https://www.workzonesafety.org. Search for "intrusion alarms."

Wireless sensors in traffic cones to protect workers, David Crawford, June 18, 2014. http://eandt.theiet.org/news/2014/jun/wireless-traffic-cones.cfm

'Screaming" motorway traffic cones to protect workers, Birmingham & Black Country, May 14, 2013. http://www.bbc.com/news/uk-england-birmingham-22523145

Eradicating work zone danger, World Highways Magazine, July 2013 http://www.worldhighways.com/categories/road-markings-barriers-workzone-protection/features/eradicating-work-zone-danger/

Work Zone Intrusion Alarm Effectiveness, Final Report, NJ-2010-004, New Jersey DOT, September 2010. http://www.nj.gov/transportation/refdata/research/reports/NJ-2010-004.pdf

Transpo SonoBlaster® Overview Video, 3:08 minutes, Uploaded April 17, 2009

Transpo Sonoblaster® WZ Alarm Mounting and Deployment Video, 7:08 minutes, Uploaded April 17, 2009. www.youtube.com/watch?v=WRFjerUnNVo

to background traffic and construction activities.

Limitations of the study

Some of the limitation of the research included
• Set up, take down and monitoring the devices in the field were done by the researcher, so no information on how workers felt on the ease of use of the systems was available. However, from Chris' experience the set up and take down process was easier for Intellicone® than SonoBlaster®
• The workers awareness of the field testing likely affected their reaction time.
• The systems were not tested for night time or moving operations.
• The field test was conducted using a limited number of devices at each site, which was far below the manufactures' suggested number of units to be used in an actual work zone environment.

In sum

In general, workers indicated that both systems were recognizable as an alarm when loud enough to hear. They indicated that such devices would make them feel safer to some extent at varying degrees. When asked where these systems can be most effective, their response was

- On major highways with high speeds;
- On roads with low ambient noise;
- In areas with limited sight distance such as along horizontal curves and or vertical curves; and
- Night time operation with limited visibility. ▪

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Sources:

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- Novosel, Christopher. Evaluation of Advanced Safety Perimeter Systems for Kansas Temporary Work Zones. Master Thesis. December 11, 2014.
- SonoBlaster® Work Zone Intrusion Alarm, Transpo® Industries, Inc. http://www.transpo.com/SonoBlaster.html
- Intellicone®:Creating safer working environments, Highway Resource Solutions. http://www.intellicone.co.uk/
- Intrusion Devices–New and Emerging Technology in Worker Safety, Ken Kochevar, FHWA Safety/ITS Specialist, PPT presentation. http://ops.fhwa.dot.gov/wz/workshops/originals/Ken_Kochevar_ID.ppt