DEVICES TO REDUCE THE RISK TO YOUNG PEDESTRIANS FROM REVERSING MOTOR VEHICLES

SUPPLEMENTARY REPORT

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for
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The views expressed in this report are those of the author and do not necessarily represent the views or policy of any organisation.

INTRODUCTION

This supplementary report describes developments that have occurred since the main project report was prepared in March 2001.

In Febuary 2001 the US magazine Sensors included my request for information about sensors systems that are capable of detecting children near vehicles. This was highly successful. In addition draft copies of the report were sent to suppliers of equipment, where they agreed to treat the report in confidence. The following notes describe the key points is these responses. Note that there may be conflicting information between suppliers of different types of equipment.

SUMMARY OF RESPONSES

Tod Ruff, National Institute for Occupational Safety and Health (NIOSH), US Dept of Health and Human Services

Mr Ruff recently investigated the problem of large mining vehicles reversing over people or small vehicles. His investigations and outcomes were very similar to ours. He sent by post two reports of these investigations, which evaluated electronic tags, radar (microwave) proximity sensors, ultrasonic proximity sensors and video systems. He concluded that a combination video camera and an electronic tag or proximity sensor was the best solution. This conclusion was reached in our report.

One of Mr Ruff's reports included a draft specification for testing potential systems. This would be useful for refining the specification in our report.

Like us, Mr Ruff found that radar proximity sensors were prone to false alarms and were inadequate, by themselves, to prevent injuries. Ultrasonic sensors were found to be even less effective and, in any case, had insufficient range for mining operations.

Electronic tag systems require all personnel to wear a "radio frequency identification system" (RFID). They can also be fitted to vulnerable small vehicles. The subject vehicle is fitted with a sense that sounds an alarm if a tag moves to within range. The driver can also see the ID(s) on a display so that multiple detections can be resolved. Subject to the uncertainty about ensuring everyone wears a tag, these systems appear to be very effective in the mining environment and they never generate false alarms. Despite this, the author considered that a video system would enhance their effectiveness.

There are obvious difficulties in "tagging" children (George Orwell might have had something to say about the idea). On the other hand, there might be other situations where such tags might be useful for monitoring young children (pool area alarms, front door alarms...).

In a second report Mr Ruff evaluated, amongst others, a system that combines a video camera with radar proximity sensor. Apparently the system has been succesfully used in UK mines for several years ("Sensor Vision", Vision Techniques and Ogden Safety Systems, http://www.visiontechniques.co.uk)

Mr Ruff provided the following comments on the draft report:

- Infrared sensors should be considered. He is aware of a trial in theUSA.
- He agrees that the best solution combines proximity sensor and video system. He is also investigating stereoscopic video systems.
- He suggested mounting a video monitor above the rear seat [Also recommended in my final report]

- He pointed out that cardboard or wood are unsuitable surrogates for human bodies. He recommends using people but acknowledges difficulties with using children.

Hirotoshi Ishikawa, Japanese Automobile Research Institute.

Ishikawa san provide an outline of Japanese IT developments. "People sensors" are in develoment but it appears that none are currently designed to address the problem of children and reversing vehicles.

Wayne Albin, instrumentation consultant, USA

Mr Albin prepared comprehensive comments on the draft report. He was complimentary about much of the work but had philosophical difficulties with some areas. In particular:

- He considers that the investigations and draft specification focussed too much on available technology and not enough on potential technology. In particular he considers that there is scope for computer technology to assist in identification of humans - "You avoid false alarms by designing a system that has some intelligence built into it, not by putting blinders on a dumb system". [This may be too demanding for practical, affordable systems. It is not precluded by the draft specification but cheaper systems may make development of an intelligent system less likely]
- He considers that the system should be designed to detect crawling children as well as walking toddlers (he asks whether they are any statistics on this). The same applies for children running into the path of a reversing vehicle. Also he considers that we should be aiming for 100% avoidance, not the 95% suggested in the report. [These expectations may be unreasonably high and a suitable system is likely to be prohibitively expensive but it is certainly worth monitoring developments to see if the specifications should be tightened. The evaluated systems would all pick up an infant who was crawling more than about 500mm from the rear of the vehicle because they all have beams that angle downwards. The blind spot is below the bumper bar and within 500mm of the rear of the vehicle - current designs of sensors cannot be mounted low enough to detect in this zone. In any case, crawling children are much less likely to reach driveways unsupervised than toddlers. Running toddlers are likely to be detected by the proposed system. However, there simply might not be enough reaction time to avoid a collision - no system (except perhaps one that automatically and "instantly" applies the brakes) is likely to be able to deal with this situation in all circumstances]
- He considers that the characteristics of the alarm are not adequately covered. It should send the message "drop whatever you are doing, no matter how urgent, to deal with this". [This is fine for a system that has no false alarms but it would appear difficult to achieve this in a fully automated system.]
- He is wary of microwave systems that only alert the driver if there is relative motion are inadequate. He considers ultrasonic systems are unsuitable.
- The system should be able to discriminate between animate and inanimate objects. [Again this may be too demanding for practical, affordable systems.]
- Systems that integrate proximity sensors with video systems should be more effective. [There is nothing to prevent this in the draft specification.]
- He considers a range of driver sizes should be used to establish blind spots. [This should be considered, although with video systems, the driver size should not make a difference.]
- He questions the effectiveness of educating drivers to drive very slowly when reversing. [This is outside the scope of the specification although the calculations of stopping distance would be useful for education material.]

- He does not consider there would be incentive for companies to develop systems at their own cost. [Wait for the reaction to public circulation of the report].

William Schiffbauer

Referred to an invention "Mobile machine hazardous working zone warning system" that appear to have features that are suitable for the driveway situation". http://outside.cdc.gov:8000/ciss/pdfs.html

Heyward Williams, instrumentation consultant

Mr Williams wrote the report that was used as a basis for our investigations. He advised against using cardboard as a test device and pointed out that humans are mostly made of water.

Harry Shamir, instrumentation consultant

Mr Shamir suggested that infrared detectors tuned to human body heat should be used. Also "fly eye" lens have benefits in this field.

Fred Luffman, instrumentation consultant

Mr Luffman says "cardboard is not a good substitute for a person" and will give spurious results. Also ultrasonic sensors can be affected by air currents, particularly in hot weather.

Darold Wobschall, instrumentation consultant

Mr Wobschall cautioned against using ultrasonic detectors. For example, they sometimes do not detect loose clothing.

Cheryl Camplbell, C-Back International (manufacturers of a sensor system)

Ms Campbell was disappointed that a C-Back system was not evaluated. She claims that the system has a greater range than other systems [This appears to be true but the range of 2.2m is still too small]. The system has an option that also alerts pedestrians [this could be useful provided the driver doesn't use it as a way of indicating "get out of the way" - a problem with current reversing beepers].

She claims that video systems alone are not sufficient to address the problem.

CONCLUSION

There are several changes that could be made to the draft specification to address issues raised above. For example, at this stage, it appears that a "live human" is the only reliable test target for a proximity sensor. However, it is considered that the draft in its present form is still suitable for its intended purpose - to elicit comment from stakeholders.

ADDITIONAL REFERENCES

Paine M. and Henderson M. (2001) *Devices to reduce the risk to young pedestrians from reversing motor vehicles*, Research report prepared for NSW Motor Accidents Authority, March 2001.

Ruff T.M. (2000) *Test results of collision warning systems for surface mining dump trucks,* Report of investigations 9652, National Institute for Occupational Safety and Health, US Dept of Health and Human Services, Pittsburgh, PA, May 2000.

Ruff T.M. (2000) *Test results of collision warning systems for surface mining dump trucks: Phase 2,* Report of investigations 9654, National Institute for Occupational Safety and Health, US Dept of Health and Human Services, Pittsburgh, PA, February 2001.

See also the hyperlinks above.