Research shows that incidents related to large equipment and pedestrians can be reduced if both the equipment operators and those who work nearby are aware of the limits on the drivers’ ability to see what’s around them.

Check your own incident and injury reports before leading this safety meeting. You may want to open the meeting using your own statistics or information from an actual incident investigation.

When an accident involving underground mobile equipment and visibility happens, the results are likely to be serious. An analysis of incidents related to mobile equipment over a 10-year period showed that visibility may have been one of the factors in more than half the lost-time injuries. It was also a factor in the single mobile equipment fatality that occurred during the period.

A research team from Laurentian University, supported by WSN (then MASHA) designed a simple experiment to accurately measure a driver’s ability to see pedestrians and obstructions. A small, intense light was mounted on the seats of several common makes and models of load-haul-dump vehicles. The light was positioned at the height of an average operator’s eyes.
Measurements were taken from many pre-selected points around the vehicle. When the light disappeared, the researchers knew an operator wouldn’t be able to see a person or obstruction at that point.

There are more than 30 different models of LHDs operating in Ontario mines and they’re all different in design. Some have better visibility characteristics than others. How many different models are you using at your mine?

Before showing this slide, ask your group to think of anything they know which might prevent an LHD operator from seeing pedestrians or obstacles. List these on a flip chart.

From the recorded measurements the researchers were able to produce a “shadow diagram” for each model of vehicle they tested.

- The red areas indicate where the roadway is invisible from the driver’s seat.
- Dark blue designates when a kneeling person disappears from view.
- Yellow shows where a 5’6” tall pedestrian can’t be seen.

In this sample diagram, researchers have noted which obstructions on the vehicle blocked the operator’s line of sight. Some of these (bucket and boom) would be difficult or impossible to modify while others such as lights, fire extinguisher and remote control box, could be modified for better visibility.

Even with the bucket all the way down, the operator of this 8-yard LHD machine can’t see a pedestrian standing within 20 feet of the front of the vehicle. Of course, raising the bucket and boom into position for travelling only makes this situation worse…and more dangerous.

What is the accepted travel height for a loaded LHD bucket at your mine? Discuss how bucket height may reduce the operator’s ability to see obstacles and pedestrians while moving. Is this practice included in your training program for LHD operators?

Much of the responsibility for an operator’s ability to see pedestrians and obstructions from an LHD lies with the manufacturers of these machines. The cab on this model, while offering some protection for the operator, causes severely restricted vision. Vehicle manufacturers are using the results from the research study to refine the designs of their vehicles for improved operator visibility.
Other, less obvious design elements of these vehicles will require more engineering and design to improve the operator’s line-of-sight vision. The engine cover of this LHD, for instance, is a major obstacle requiring significant design and manufacturing changes before visibility is improved. But being aware of this condition will help both operators and pedestrians work more safely.

If there are LHD operators in your group, ask them to comment on design elements of their machines which particularly inhibit their ability to see pedestrians or obstacles.

Even in well-lit areas such as the entrance to this shop, it’s important to remember that physical obstructions to visibility still exist. Hat lamps and reflective materials may be less effective in such areas for warning operators of pedestrian traffic. Also, an operator’s or pedestrian’s eyes may need time to adjust when moving from a dark to a well-lit area, or vice versa.

Are there well-lit places like this in your operation? Ask your participants if they’re ever bothered by the glare of the lights.

When it’s necessary for people on foot to work closely with a vehicle operator, discuss the work before starting. Review visibility limitations and the signals they will use. This may be an effective means of reducing or eliminating the hazards involved in the job.

Does your mine have a safety standard for hand and light signals? If not, do you need one? If you have a standard, how well does it work?

Reflective materials on clothing, hard hats and equipment can significantly improve a pedestrian’s visibility to a machine operator. Ontario Mining Regulations require workers to wear reflective materials on headgear and outside clothing when working in an underground mining environment. (Section 262.(2)). Guidelines have been prepared for the amount, type and position of these reflective materials.
Injuries have occurred when LHD operators were not expecting pedestrians to be walking through their work area. Unless travel on foot is a common occurrence, operators should be told at the start of every shift when to expect to encounter pedestrians in their work area.

Does your standard shift line-up include notifying operators of expected pedestrian traffic through working sites?

Seeing and being seen is critically important to the safety of pedestrians in Ontario’s underground mines. Understanding existing limitations to a vehicle operator’s vision, and following regulations and guidelines will help to reduce or eliminate the hazards.

You may leave this slide on the screen while leading a review of the relevant regulations. If there is time, have the group review and discuss the actual accident reports included.

A Note for Maintenance Personnel

LHD operator visibility isn’t just controlled by the basic design of the machine. Vehicles are routinely modified in maintenance shops for the following reasons:

- add extra lighting
- add driver protection
- add storage for remote control equipment
- add fire fighting equipment and automatic fire extinguishing systems
- add exhaust systems and exhaust scrubbing equipment
- add storage for hand tools

Depending on where they’re located, any or all of these modifications may obstruct the operator’s view from the driver’s seat. Using the visibility measurement systems from the Laurentian University study, mechanical departments can determine if a planned vehicle modification will adversely affect operator visibility before the changes are made.