

Dangers of Equipment Blind Spots

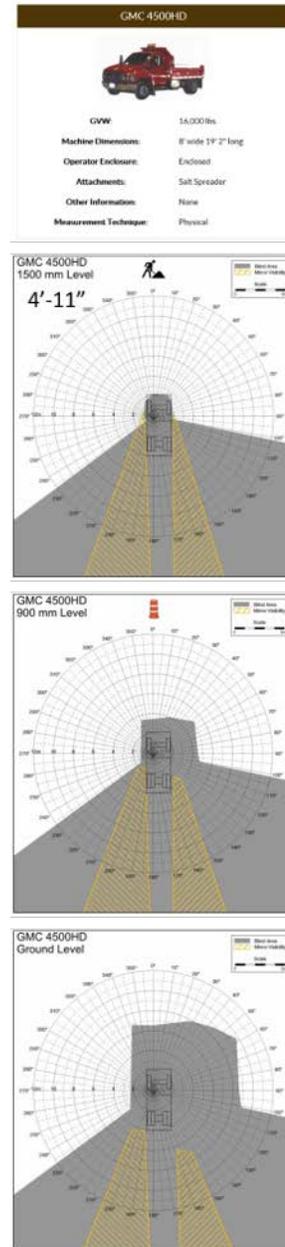
Interaction of construction and maintenance equipment (trucks, loaders, skid steers, backhoes, trailers, etc.) with personnel and fixed objects in maintenance yards and within work zones happens more often than you think. Thankfully, the equipment typically backs into or runs over an inanimate object, resulting only in property damage (no relief to the operator, of course, who probably has to go provide a “sample” and then talk to some people), but personal injuries can happen and even fatalities. These runovers and backovers are largely preventable by a better understanding of operator visibility limitations and good practices.

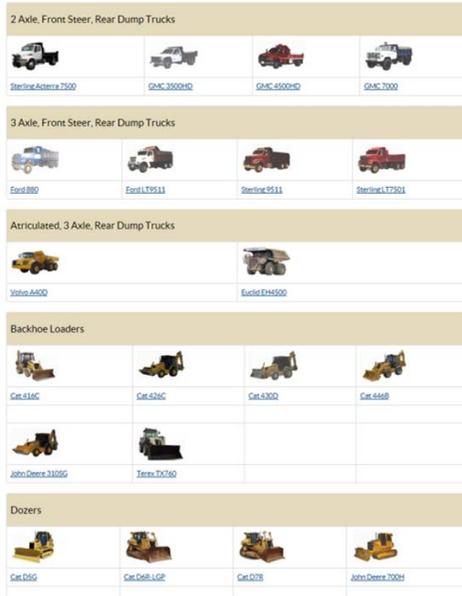
Equipment visibility dangers is an excellent tailgate safety talk (we developed one for you – read on) and there are some helpful [figures](#) from NIOSH that illustrate the problem from the operator’s vantage point. A physical walk around exercise with the crew can really drive the point home.

The National Institute for Occupational Safety and Health (NIOSH) assembled a [series](#) of diagrams for various types and sizes of equipment typically used by construction and maintenance personnel and they illustrate the areas around a given piece of equipment that are unable to be seen by the operator.

An example of one series, for a typical light dump truck, is shown at right. For that truck design, size, and configuration, the three “look down” or “plan” view figures represent the field of view likely for the operator and a gray area representing the “blind spot). The yellow hatched area represents the area the operator can see using mirrors. The first figure shows the gray area that the operator cannot see on the ground; you will notice a large area in front of the truck, biased to the right side, and a large sweeping area behind the truck, compensated to some degree by the mirrors. The second figure in each series shows the gray area where the operator cannot see an object that is 900 mm above ground (~35 inches; our government really is a dog with a bone on that whole metric thing), typical of a temporary traffic control channelizing device, such as a traffic drum. Notice the area is smaller in the front at this level, but typically unchanged to the side and rear – in the front, the hood configuration heavily influences the field of view at various heights. The third figure illustrates the field of view for spotting a 1,500 mm (~4’-11”) object – imagine a shorter worker or a taller worker hunched over a little with a work task, like shoveling. Again, you see the blind spot diminish dramatically in the front, but largely unchanged to the rear and sides.

Similar figure series are [available](#) for a lot of the typical equipment used for construction and maintenance of roadways and bridges. NIOSH provides figures for ten different dump truck





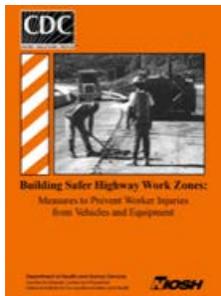
types, including 2-axle, 3-axle, and articulated, off road trucks. Six backhoes and six dozers are illustrated. Then there are four motor graders, three hydraulic excavators, and seven loader configurations. A cold planer (milling machine), a recycler/reclaimer (think full-depth reclamation), a vibratory roller, three scrapers (aka, “pans”), and a transfer/shuttle buggy (sometimes used to support asphalt paving operations) are also featured.

Notice how different a typical front end loader figure looks. Because they typically feature operator cabins with nearly 360° glass, and only the support pillars and any mounted accessories will usually obstruct the operator’s field of vision.

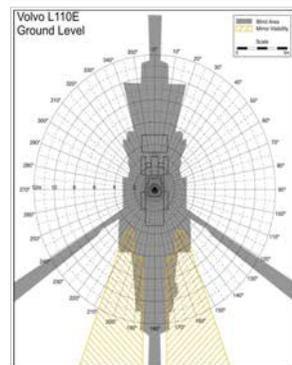
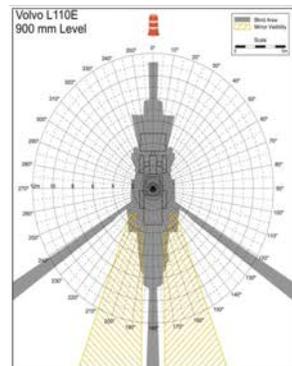
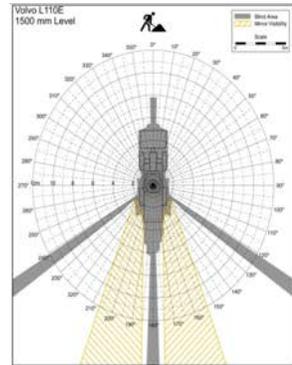
Let’s stop and look at the hard facts that support why you should be raising your crew’s awareness of these limitations on operator fields of view. An average of 772 total fatalities occurred in construction and maintenance zones from [2015-2017](#). From 2003-2017, 1,844 workers lost their lives at road construction sites, for an average of 123 per year. In the Federal Highway Administration’s Worker Safety resource [page](#), we learn that the primary causes of worker fatalities in recent years included runovers and backovers (48%, often by dump trucks), collisions between vehicles/mobile equipment (14%), and being caught between or struck by construction equipment and objects (14%). The good news, as seen by the chart on the next page, is that worker fatalities has generally declined; we like to think this is due to training efforts and improved practices; if so, we should double our efforts.

NIOSH provides yet another useful [resource](#), “Building Safer Highway Work Zones: Measures to Prevent Worker Injuries from Vehicles and Equipment,” with detailed injury prevention measures such

as work zone layout, use of temporary traffic control devices, motorist education/speed enforcement, flaggers, high-visibility apparel, and many more. In addition, they provide a host of case examples relevant to the work we routinely see in the construction and maintenance of roadways.



If you have trouble imagining how a worker could be run over by a backing dump truck, or even an asphalt paver, read through some of the case studies and you may recognize the conditions that brought about the



Roadway Construction Worker Fatalities Trends

Year	# of fatalities	% change from prior year	% change from 2005
2010	106	-9%	-36%
2009	116	+15%	-30%
2008	101	-5%	-39%
2007	106	-24%	-36%
2006	139	-16%	-16%
2005	165	-	-

fatalities related in the NIOSH document. For example, Case #1 details how a paving crew member who was directing various trucks to queue at the paver lost his situational awareness, ended up in the blind spot of one of the backing trucks, and later died from loss of blood. Case #3 relates a fatality when the operator of a dump truck set his parking brake, left the running truck to perform a brake adjustment under the truck, and other worker, seeing that the truck was in the way of the paver, entered the cab and moved the truck, unaware that its operator was underneath; the operator died of multiple traumatic injuries. Case #18 talks about a worker who jumped onto a backing asphalt paver (unbeknownst to the paver operator), then slipped off, and was run over by the paver; his multiple injuries caused his death nine days later. Case #23 details a fatality from a backing loader. There are multiple other case examples of fatalities from dump truck runovers or backovers.

These incidents may be rare, but they clearly have the potential to be tragic. Talking about equipment visibilities with your crews should be one of many tailgate safety talks you hold throughout the year. This can take the form of a simple talk or you can actually lead an exercise to drive the point home to them. On the Delaware T²/LTAP Center’s [webpage](#), you can find several resources to use. A set of blind spot training slides includes examples of NIOSH figures, some of the statistics we’ve talked about here, some of the case examples, and best practices. A separate file has four of the NIOSH figures arranged on pages in a PDF document sized as 24”x36” that you can have printed and post one or more in the breakroom (they are suitable for framing if you wish extra style points – please send us a photo if you do). We have also added a tailgate safety talk on the topic.

Our Municipal Engineering Circuit Rider developed a blind spot exercise (inspired by a similar exercise used by Emmett Russell, a former OSHA inspector and, more recently, OSHA 10-hour Safety Training instructor for ARTBA) that he has conducted with numerous local agency crews over the past three years or so. Matt is happy to visit Delaware local agencies and lead the exercise or you can hold it yourself. Our roughly edited video is [linked](#) at our website and shows how the exercise is conducted.



The idea is to lead crew members on a tour of a truck perimeter (or loader, backhoe, skid steer, etc.), stopping at the front of the truck, the sides of the truck, and the rear. At each point, the crew is asked what they might do around the piece of equipment that might put them there and potentially out of view of the operator. For example, in the front, they might

mention connection/servicing of a snow plow, inspection/maintenance of lights, or removing tangled brush or other debris. Along the sides they might mention various inspections or fueling operations. In the rear, they might talk about salt spreaders, tailgate checks, connecting trailers and lights or even, finding shade. This gets them thinking about how many different ways they can inadvertently be out of sight of the operator and in harm's way. Traffic drums can be positioned in front of the truck while an operator in the cab advises at what point the drum is out of site, visually illustrating a large area in front of the truck where workers can get into trouble. A great way to illustrate the large, invisible area behind the truck is to finish with the entire crew crowding behind the truck until the operator can see none of them (an homage to the 1960s pastime of stuffing phone booths and Volkswagens with people; suggested by DelDOT's Brian Urbanek).

If there is time, the crew can be asked how they think mirrors help, how things are different while the truck is running (mirrors shake), and what the operator can do about that (the left hand can steady the shaking mirror, but unless it's Mister Fantastic from the Marvel Comics, his/her arm won't reach over to the right one, so there may be greater risk on the right side than the left). You can also ask them to think about how proper adjustment of the operator's seat and mirrors can impact the blind spots. Often, the perimeter tour and your questions will have them thinking and talking about the risks, solutions, and maybe even their own close calls.

If a truck is used, ask the crew to think about how other equipment they use (including other style/size trucks) would have different blind spot profiles. If a loader or other piece of articulated equipment is used, ask them what happens when the machine turns – how does the operator's field of view (including the mirrors) change? If a backhoe is used, how can the visibility change as the boom, stick, and bucket are moved side to side and out and back. If you get them talking about it, that means they're thinking about it, and they will be that much more situationally aware, both as operators and as ground crew, and that translates into greater safety.



Crew members should be reminded of good safety practices for workers on foot around moving equipment. Always wear high visibility apparel that is appropriate for your job task and work environment. Tie your shoes (and pull up your pants and get your hands out of your pocket and straighten that tie, mister). Be aware of equipment and vehicle blind areas, and avoid being near these areas. Confirm communications signals with an operator and do not approach until the operator gives acknowledgment. Always maintain eye contact with equipment operators – good pedestrian behavior rules. Be aware of equipment travel paths and avoid standing or walking in these areas. Listen for reverse signal alarms in the area. Always be situationally aware. Do not rely solely on one safety practice; always be aware of your surroundings and ensure that other workers are aware of you.

The Delaware T²/LTAP Center's Municipal Engineering Circuit Rider is intended to provide technical assistance and training to local agencies and so if you have safety questions or other transportation issues, contact Matt Carter at matheu@udel.edu or (302) 831-7236.