MICHIGAN HAZARD ALERT

MICHIGAN STATE UNIVERSITY: Prevention of work-related injuries & illnesses through research & investigation

LOOK FOR MOBILE EQUIPMENT BLIND SPOTS

Publication Date: 3/03/26

A **blind spot** or **blind area** is the area around a piece of mobile equipment (e.g., motorized vehicle, construction equipment, or forklift) that is not visible to the operator, either by direct line-of-sight or indirectly by use of internal and external mirrors. Blind spots occur due to the size and/or shape of the equipment, what that equipment may be transporting, or other obstruction (e.g., an iced windshield). Blind spot areas are in front of, to the side of, and at the rear of mobile equipment. Blind spots pose a fatal hazard to both workers on foot and the equipment operator. Equipment operators must be aware of their machine's blind spots and **should not depend upon backup alarms** to warn workers on foot.

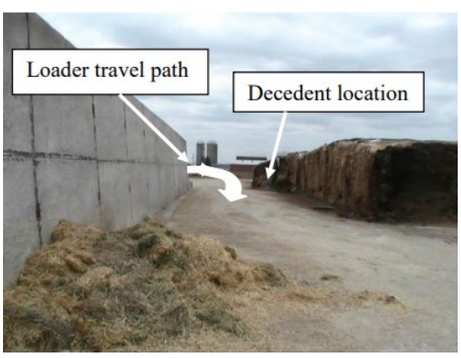
MIFACE Report #14MI122: Location of decedent when driver pulled forward

MIFACE Report #14MI122: View from driver's seat in truck cab

Since 2001 there have been **53** workers on foot who died in Michigan when they were run over or struck by machines or vehicles while they were positioned in the machine/vehicle operator's blind spot. There were an additional **9** operators who died when their machine/vehicle overturned while operating too close to an edge or while operating in reverse. Construction activities accounted for 24 (38.7%) of the 62 fatalities, followed by Transportation and Warehousing (13 deaths, 21.0%), Agriculture (7 deaths, 11.3%), and Manufacturing (5 deaths, 8.1%), and the remaining 11 deaths in multiple other industries.

EXAMPLES OF MICHIGAN WORK-RELATED FATALITIES RELATED TO EQUIPMENT BLIND SPOTS

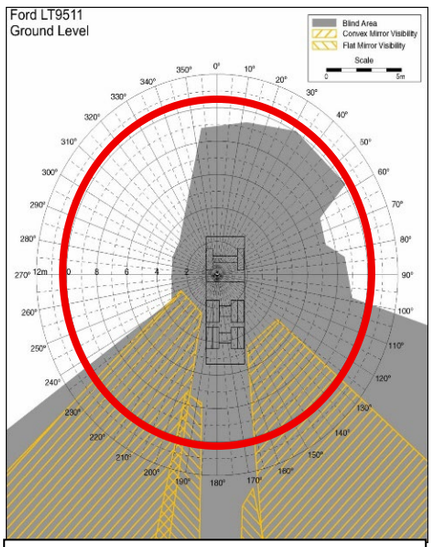
- A heavy equipment operator in his 40s was killed when he was run over by a fuel truck backing up. The fuel truck had an operational back-up alarm and lights. The fuel truck had just finished fueling equipment on a road widening construction site. The truck had backed up approximately 30-40 feet when it struck the decedent, who was walking with his back to the truck.
- A worker in her 50s died while walking behind a coworker as they were returning to the worksite after leaving the office area when she was struck and run over by a forklift transporting an over-filled six-yard dumpster measuring 71 inches wide by 58 inches tall by 66 inches deep in a recycling center parking lot. The forklift driver was traveling forward (not trailing the load).
- A farm hand in his 60s died when he was struck by a front-end loader with a 4-yard bucket while he was bending down cutting the strings on a bale of hay. The Komatso front-end loader operator was rounding the corner of the "H" bunker with "high moisture corn" in the bucket, transporting the feed to another area of the farm when he struck the decedent with the corner end of the bucket. See Photo at right depicting MIFACE Investigation 12MI008.
- A dirt compactor operator in his 20s was working at a construction site compacting dirt in an area that had two different levels. He was working at the higher elevation, two feet above the lower elevation. He was moving the compactor back and forth and came too close to the 2-foot drop. The compactor rolled over and the unbelted operator was thrown from the compactor. The compactor landed on top of him.



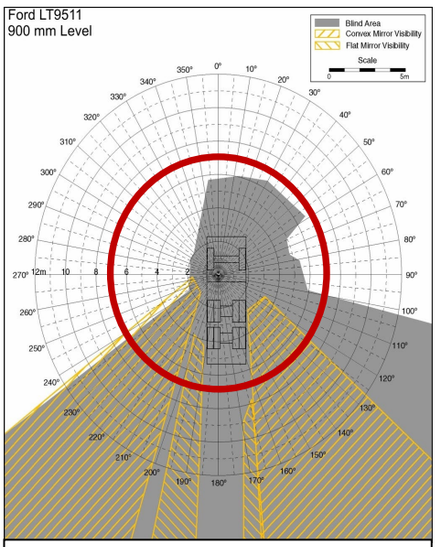
MIFACE Investigation 12MI008. Worker struck by front-end loader bucket.

PREVENTING INJURIES AND FATALITIES RELATED TO EQUIPMENT BLIND SPOTS

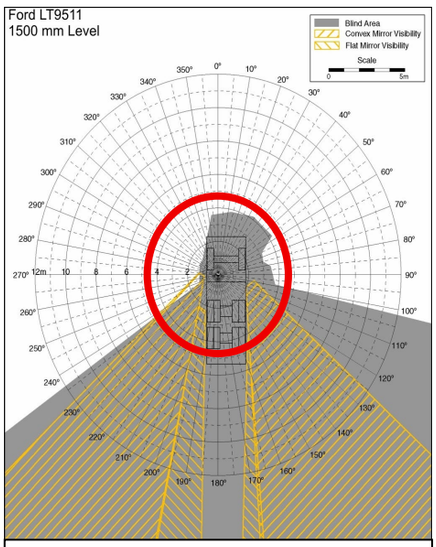
There are highly effective systems and practices for mobile equipment blind spots that, when used in combination, can dramatically reduce the risk of injury and death to a worker on foot and the equipment operator. **All employers whose employees work on foot around mobile equipment or operate mobile equipment should develop a blind spot safety program to identify the blind area around each piece of equipment**.



The red circle shows the approximately 38-foot blind area in front of the dump truck to see ground level



The red circle shows the approximately 23-foot blind area in front of the dump truck to see 3-feet above the ground



The red circle shows the approximately 16-foot blind area in front of the dump truck to see 4-feet 11-inches above the ground

Example NIOSH Construction Equipment Visibility Diagram: Ford LT9511 Dump Truck

- **Establish an operator blind spot training and awareness program.** Even with advanced technology, the operator remains the first line of defense. Equipment operators should be trained on safe operating procedures per the operator's manual. Training should, at a minimum, include:
  - **Machine-specific blind spot training:** Operators should be trained on the blind areas of each model they operate and how to adjust side and rear-view mirrors. **Use NIOSH blind-area diagrams**.
    - If the vehicle/machine is not listed in the NIOSH diagrams, manually estimate the vehicle blind area by following the NIOSH method or doing the following:
      - Have the operator sit in the driver's seat in a normal driving posture. Driver should remain as still as possible but may turn their head and torso but not beyond normal driving posture and look (but not lean) out of the windows.
      - Have people of varying height walk away at varying locations from the front of the equipment until the driver can see the pedestrian's feet (not their head or body), measure the distance and place a flag or cone.
      - Repeat the process for the side and rear of the equipment, using the equipment's side/rear view mirrors. The area within measured distance is the blind area. Have the operator leave the machine to visually see the blind spot distances.
    - **Unrecognized blind spots** should be highlighted. For example, when a compactor operator focuses on the ground on the edge being rolled, the opposite side of the machine becomes a blind area.
  - **Daily Inspections:** Operators should perform both an equipment inspection to ensure proper functioning of all installed safety equipment and an inspection of the site layout and activities being performed prior to starting the machine.
  - **Seat time in different scenarios:** Operator training should include congested areas, night operations, and limited-visibility conditions (dust, rain, glare).
  - **Develop an equipment operator backing procedure when backing is required**. Operator training should include at a minimum: perform a walk-around to determine obstacles/hazards and site/vehicle clearances, operator stopping equipment if he/she cannot see the spotter, sounding horn prior to backing, ensure backup alarms are functional, and demonstrating backing competency.
- **Retrofit older equipment with an aftermarket warning system kit(s) suitable for the environment in which the equipment is used.** Aftermarket kits can include onboard camera systems (rear, 360° cameras) and proximity detection systems, such as radar (best used in conjunction with a worker on foot using a radio frequency identification (RFID)-equipped vest, hardhat, or other RFID-equipped item) and ultrasonic detection that alerts the operator when something or someone enters the equipment blind area.
- **Develop an internal traffic control plan (ITCP) to coordinate the movement of workers, construction vehicles and equipment.** Although developed for roadway work areas, an ITCP can be beneficial on any construction site. **Establish at a minimum:**

- **Worker-Vehicle Separation** - a dedicated pedestrian route(s) should be clearly marked and physically separated from equipment areas.
- **Designate areas to get out and clean residue** after dumping or attending to the rear of the vehicles.
- **Eliminate vehicle-backing maneuvers** whenever possible.
- **Control entry and exit points** - limit site access.
- **Enforce on-site work rules**, such as spotters and personal protective equipment (PPE) requirements.

- **Utilize spotters and communication protocols.** No equipment-based warning system can replace a well-trained spotter with a direct communication line to the equipment operator.
  - **Designate trained spotters**: Spotter training should include but not be limited to, wearing high visibility equipment, signals to be used and agreed upon with driver, maintaining eye contact and a safe distance from backing vehicle on the driver's side, knowing equipment's blind area locations/swing/reverse behavior, and demonstrating spotter competency.
  - **Two-way radios**: Use dedicated channels for heavy machine operators and spotters. Ensure headsets are noise-canceling and rated for the site environment.
  - **Spotter areas**: Create safe pathways and no-go areas for spotters.
- **Train workers on foot.** Pedestrian training should include but not be limited to, where the equipment blind spots are and the need to stay out of them, the need to make eye contact with equipment operator prior to approach, recognition that backup alarms are not background noises and the need to pay attention to them, and the importance and reason for wearing the required PPE, including high visibility apparel/equipment.
- **Subcontractor blind spot safety program**: Require and ensure that all subcontractors working on site have developed, implemented, and enforced blind spot safety program.
- **Select and provide the appropriate performance class of site-specific high visibility PPE/apparel** to both equipment operators and workers on foot to enhance worker visibility**.**
  - **Perform a risk assessment**. Consider expected use settings and work activities to be performed.
  - **Use only garments certified and labeled as ANSI/ISEA 107-2020 (High Visibility Apparel) and ANSI/ISEA 207-2011 (High Visibility Public Safety Vests).**

Did You Know

- You can minimize blind spots as you travel on-the-road by adjusting your mirrors.
  - Center rear-view mirror
    - Tilt until the entire rear window is visible without moving your head
  - Driver's side mirror: Sit in driver's seat
    - Roll up window and lean head against it
    - Adjust the driver's side mirror so you just see the side of your car.
  - Passenger side mirror: Sit in driver's seat
    - Lean toward center of vehicle
    - Adjust passenger side mirror so you just see the passenger side of your car.
- Blind areas for equipment, including personal vehicles, depend upon many factors, including seat position, height of driver, and size of object. (Shorter drivers = larger blind areas.)
- On average, over 700 fatalities occur in work zones each year.
- ANSI-rated hi-visibility apparel meets either a Roadway (R), Off-Road (O) or Public Safety (P) performance standard and Class (1-3, Class E). To be effective, high visibility apparel must be kept in good condition. If the material gets too dirty or dull, it no longer does its job.

REFERENCES AND RESOURCES

- MSU Occupational and Environmental Medicine: (MSU OEM) blind spot investigations:
  - MIFACE Report #04MI107: Engineering Technician Dies When Backed Over by Cement Mixer
  - MIFACE Report #08MI040: Municipal Truck Driver Dies After Being Backed Over by Dump Truck
- MIOSHA Standards: LEO - MIOSHA Standards.
  - Construction Safety Standard Part 6: Personal Protective Equipment
  - General Industry Safety Standard Part 33: Personal Protective Equipment PPE for GI (#16)
- NIOSH Motor Vehicle Safety at Work: Highway Work Zone Safety, Construction Equipment Visibility Diagrams (Blind Spots)
- National Work Zone Safety Information Clearinghouse: Blind Spots
- Internal Traffic Control Plan Resources: Work Zone Safety: Developing Internal Traffic Control Plans (ITCPs) for Work Zones published March 2016,
- NIOSH Science Blog: Using Internal Traffic Control Plans to Prevent Construction Worker Injuries and Fatalities in Work Zones
- National Highway Traffic Safety Administration factsheet: Blindzone Elimination Mirror Method
- High Visibility Safety Apparel Resources
  - ANSI Blog ANSI/ISEA 107-2020: High-Visibility Safety Apparel
  - Guru's Safety Gear Blog: ANSI/ISEA 107-2020: detailed reference guide.
  - 3MTechnical Bulletin: ANSI/ISEA 107-2020 Made Easier: A Quick Reference to the High-Visibility Safety Apparel Standard (December 2020)