

MIFACE INVESTIGATION: #04MI107

SUBJECT: Engineering Technician Dies When Backed Over by Cement Mixer

Summary

On July 29, 2004, a 40-year-old male engineering technician was struck and killed on a road-building project by a cement mixer that was traveling in reverse. The road surface was compacted aggregate and crushed limestone and had a slight incline. There were two cement mixers in the immediate vicinity. Cement mixer #1 was unloading cement into a curb-paving machine ("mule"). Cement mixer #2 had already completed unloading its cement into the mule and was being washed out by the driver. To determine if the mixer #1's concrete was within specifications, the victim took a sample that weighed approximately 600 pounds from chute and loaded the concrete into a wheelbarrow. The victim pushed the wheelbarrow past the driver side of mixer #1, and as he came to the rear of mixer #2, he turned sharply south, to his right to get to his truck. The victim's back was facing mixer #2. At approximately the same time, the driver of mixer #2 finished washing out his mixer, entered the cab, activated his backup alarms and began to move in reverse to leave the job site. See Figure 1. It appears that the victim heard the backup alarm from mixer #2 because a witness stated that he increased his pace to attempt to get out of the way of the mixer. It appears that the victim either tripped or lost control of the wheelbarrow and was struck and backed over by mixer #2. The victim was transported to a local hospital where he was declared dead.

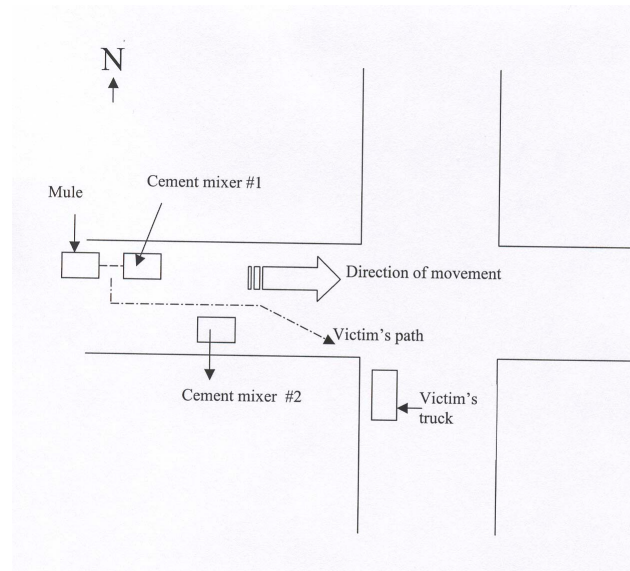


Figure 1. Drawing of incident scene

RECOMMENDATIONS

- Employers should ensure that workers on foot remain clear of moving equipment by developing and utilizing an "Internal Traffic Control Plan" for each highway and road work zone project.
- Ensure appropriate communication methods for workers on foot and equipment operators; equipment operators should use trained spotters.
- Review options for equipment-warning devices for both construction equipment and employees.

Key Words: Construction,
Road, Struck By

INTRODUCTION

On July 29, 2004, a 40-year-old male engineering technician was struck and killed on a road-building project by a cement mixer that was traveling in reverse. On July 29, 2004, the Michigan Occupational Safety and Health Administration personnel who had received a report on their 24-hour-a-day hotline at 1-800-858-0397 that a work-related fatal injury had occurred that day notified MIFACE investigators of the fatality. On May 25, 2005, the MIFACE researcher interviewed two professional engineers at company headquarters. MIFACE visited the location of the incident on the same day. MIFACE reviewed the autopsy results, death certificate, police report and pictures, and the MIOSHA citations. An individual who investigated this incident contacted MIFACE and provided MIFACE with incident investigation information.

The company for whom the victim worked was a civil engineering company and materials consultant who provided assistance in the planning, design and site evaluation of a specific site. The company also acted as a project consultant, providing materials testing and evaluations to meet project specifications. The company employed over 200 people nationally. At this office, they employ three engineers and nine technicians. The victim was first hired as a temporary summer worker. He rejoined the company after three months away, and had worked for the company approximately one and one-half years. According to the company engineers, he had an additional 15 years of experience working in the capacity of “inspector.” The company provided one-on-one, on-the-job training for new employees that covered both task and situation specific training. The employees had to demonstrate competence in field and laboratory work before they were allowed to work unsupervised. The company had a hazard communication program. The company had an accident prevention program and employees had received safety training from company employees and construction trade organizations. Company personnel conducted site visits, and had group meetings with topics that included both technical and safety issues. If the site conditions demanded it, employees received training concerning specific safety requirements that were applicable.

The MIOSHA investigation resulted in the issuance of one Serious violation of the Construction Safety and Health Division General Rules, Part 1, Rule 114(2)(d): The company’s accident prevention program did not address the recognition and avoidance of hazards. The requirement to work around and near heavy equipment, large trucks and jobsite conditions create serious hazards to the health and well being of exposed employees.

INVESTIGATION

A private developer was building a road and the city was overseeing the road-building project. The road being built ran east-west, and an existing intersecting road ran north-south. The city inspector overseeing the project subcontracted the victim’s employer and the firm was called whenever necessary to provide services including field work, such as the concrete testing, and laboratory tests. There had been several months of preparatory work. At this point in the project, the road surface was compacted aggregate and crushed

limestone. The road was approximately 28-30 feet wide. The curb being laid was on the north side of the road and was approximately two and one-half feet wide.

The firm received a call from the inspector indicating concrete testing was necessary. The victim's work shift began at 8:00 a.m. The victim collected his equipment and supplies from the company's laboratory, put them in his pickup truck, and drove to the site.

Curbs were being laid by a slip form paving machine or "mule." This machine is an extrusion-type of machine, and does not use a permanent form for the concrete. Concrete is discharged from the mixer via the chute directly into the mule. The mule lays the curb at approximately 2000 feet/day and must stay moving. Therefore, when a cement mixer is empty, it moves out of the way and another mixer takes its place. The mule and mixer #1 were laying curb on the north side of the road. They were moving east – this required mixer #1 unloading the cement into the mule to be traveling in reverse. The backup alarm was operational. A cement mixer that had previously unloaded its cement, cement mixer #2, had moved to the south side of the road and was being washed out by the driver.

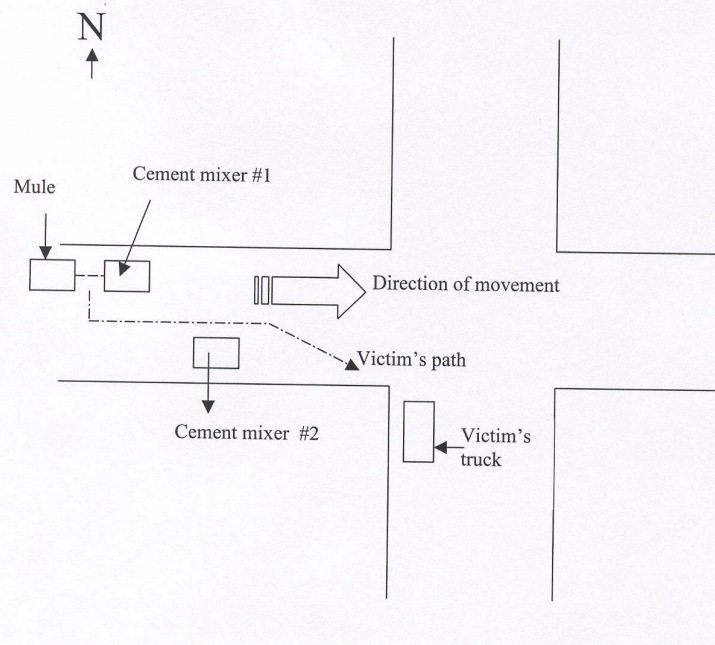


Figure 1. Drawing of incident scene

The incident occurred around 11:00 a.m. The victim parked his truck on the southwest corner of the existing crossroad, at the base of the incline of the road under construction. This allowed him to push the empty wheelbarrow up the incline and take the full wheelbarrow down the incline. He took the wheelbarrow to cement mixer #1 and asked for the load ticket. After he gathered the information, he unloaded approximately 600 pounds of concrete from the chute. The victim proceeded back to his truck so he could conduct the quality checks. See Figure 1. The victim pushed the wheelbarrow past the driver side of the mixer #1, and as he came to the rear of mixer #2, he turned sharply south, to his right, to get to his truck. At approximately the same time, the driver of mixer #2 finished washing out his mixer, entered the cab, activated his backup alarms and began to move in reverse to leave the job site.

The driver of cement mixer #2 stated he looked in both mirrors and backed up very slowly with his foot on the brake. All safety features of mixer #2 were in good operating order. According to the police report, a witness thought that the victim heard the backup alarm because he quickened his pace in what looked like an attempt to get out of the way of the mixer. The victim either lost his balance or tripped and fell toward the wheelbarrow. The passenger side rear tire of mixer #2 struck the victim on his right side, and ran over him and the wheelbarrow.

The driver of mixer #2 heard someone yell over his radio that he should stop. Emergency response was called, and the victim was transported to a nearby hospital where he died. When police checked the location of the cement mixer #2 door-mounted mirrors, they found them to be properly adjusted.

An alternate route, although construction vehicles would have to be moved, was available for mixer #2 to leave the jobsite. The unpaved road under construction continued to the west. After the vehicles were moved, mixer #2 could have driven forward to the west, and followed the road to exit the jobsite instead of exiting the jobsite in reverse.

After this incident, the victim's company has mandated the use of reflective vests when their employees are on road construction projects.

CAUSE OF DEATH

The cause of death as listed on the death certificate was multiple injuries. Toxicological tests indicated that the victim was negative for alcohol in his blood and positive for cannabinoids in his urine.

RECOMMENDATIONS/DISCUSSION

- Employers should ensure that workers on foot remain clear of moving equipment by developing and utilizing an "Internal Traffic Control Plan" for each highway and road work zone project.

The "Internal Traffic Control Plan" (ITCP) defines processes and procedures for worker safety within the work zone. The elements of the ITCP should indicate where and how construction equipment, vehicles, and workers on foot interact within the work zone. The plan must also take into consideration the changing aspects of a work site and possible emergency situations that might occur.

Due to the size of the road area, it would have been difficult for the driver of mixer #2 to pull forward and turn his mixer around so that he could drive out of the area instead of back out of the area. Although there was an alternate route that would have allowed him to drive out instead of back out, possibly due to construction vehicles in the way, the mixer driver did not take it.

In order to conduct the quality checks, the victim needed to park his vehicle in an area where he would not have to move to get out of the way of the construction activity. Parking the vehicle on an adjacent road provided an uninterrupted location, but he parked his truck in the direction of flow for the curb-paving operation. Although it was certainly easier to move a full wheelbarrow downhill, it also placed him in the flow pattern for exiting construction vehicles. The victim's truck, if parked in a different location would have enabled him to gather the concrete sample and take the sample from the mixer chute and not be in the flow of traffic.

- Ensure appropriate communication methods for workers on foot and equipment operators; equipment operators should use trained spotters.

MIFACE did not interview the driver of cement mixer #2 but according to the investigator that contacted MIFACE, the driver did not see the victim walking either alongside or behind the truck with his wheelbarrow and the victim did not communicate his presence to the driver of cement mixer #2 prior to walking past or behind the mixer. Workers on foot and equipment operators in a construction zone must communicate with each other in an effective manner, for example, using hand signals or making visual contact. Agreed upon signals should be reviewed before each shift by all equipment/truck operators and workers on foot.

Equipment operators should take special care when backing out to ensure the area behind them is clear. MIFACE recommends that, prior to backing out, (a) the operator walk around his vehicle before entering the cab to determine the conditions around the vehicle and, (b) recruit a trained "spotter".

Equipment operators and spotters should receive safety training that includes, at a minimum, the following items:

Training for equipment/driver operators should include:

- Window rolled down.
- Radio off.
- No cell phone or similar distraction while backing.
- Foot on brake.
- If you lose sight of the spotter in your mirror, STOP.
- Use only one spotter, do not allow persons to congregate around the spotter.

Training for the "spotter" should include:

- Stand alone, do not allow anyone to congregate around you.
- No cell phone or similar distractions.
- If you cannot see the driver's face in the mirror, have him STOP until you do.
- Use both hands to spot/direct the driver with large exaggerated motions.
- Watch for pinch points behind you such as other vehicles, equipment, utility poles, trees, etc.
- Always have an escape route.
- Never turn your back on traffic, including construction equipment.

- Always wear a retro reflective vest, visible at 360 degrees in a wide range of body motions in accordance with MIOSHA Construction Standard Part 22-Signals, Signs, Tags and Barricades.
- Ensure employees wear appropriate personal protective equipment.

The National Institute for Occupational Safety and Health (NIOSH) in their April 2001 document, *Building Safer Highway Work Zones, Measures to Prevent Worker Injuries from Vehicles and Equipment*, states that “all workers exposed to the risk of moving roadway traffic or construction equipment should wear high-visibility safety apparel meeting the requirements of ISEA “American National Standard for High-Visibility Apparel (section 1A.11) or equivalent revisions and labeled as ANSI 107-1999 standard performance for Class 1,2, or 3 risk exposure.” Although this was not a highway work zone, the victim was exposed to moving heavy equipment in a limited travel area. The victim was not wearing safety apparel meeting this standard at the time of the incident. His employer now mandates the use of high visibility clothing meeting the ANSI standard when employees are on any road construction site.

- Review options for equipment-warning devices for both construction equipment and employees.

The concrete mixer that struck the victim had a functional audible warning device. However, there was another mixer whose audible warning was sounding because it too was traveling in reverse. Although it appeared that the victim heard the warning alarm from mixer #2, the fatal incident still occurred. There are several options available for retrofitting construction equipment and also “warning devices” for employees that could decrease the likelihood of a worker on foot being struck by a vehicle backing up. For example,

- *Hard hat mounted mirrors.* These are similar to those worn by bicyclists. They allow the worker to have some rear vision to possibly see approaching hazards.
- *Changing the audible tone on equipment.* This can be done using either mechanical or electrical warning devices. Workers that are exposed to the same warning tones every day may tend to become complacent when these audible signals are used. Changes “every so often” may help to alleviate this complacency and increase awareness.
- *Parabolic mirrors.* The use of parabolic mirrors on construction equipment and vehicles, similar to those used on school buses, allows the operator to view what is directly behind their vehicle. These mirrors normally produce a “fish eye” type view, which must be taken into consideration when judging distances between a vehicle and the obstacle.
- *Ultrasonic backup sensing system.* These devices attach to the left and right rear of the mixer, and are wired to either the left or right back up light, allows it to

function when the vehicle is in reverse. The device emits an audio warning and sends a wireless signal to a video display to indicate in feet and in tenths of feet how close the vehicle is getting to the obstacle. The audio alerts and the red-flashing video display warning begin at about 6 feet and continue as the distance decreases to the obstacle. The audio warning becomes continuous when the video display indicates the distance to be one foot and/or less from the obstacle.

- *Reverse camera systems.* These are normally mounted near a rear license plate and have a wide-angle lens (up to 120 degrees cone of vision), and a visibility range of 165 feet. These are similar to ones used on larger recreational vehicles. The company that owned the mixer that struck the victim has launched a program to equip all of their mixers with rear-viewing cameras and cab-mounted monitors.

REFERENCES

MIOSHA standards cited in this report may be found at and downloaded from the MIOSHA, Michigan Department of Labor and Economic Growth (DLEG) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Labor and Economic Growth, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

DLEG MIOSHA Construction Safety and Health Standard Part 1. General Rules

DLEG MIOSHA Construction Safety and Health Standard Part 22-Signals, Signs, Tags and Barricades.

Nebraska FACE NE 2004-07. Subject: Engineering Technician Run Over and Killed by Backing Dump Truck. Internet address:

<http://www.dol.state.ne.us/nwd/center.cfm?PRICAT=4&SUBCAT=4F&ACTION=face>

Pratt SG, Fosbroke DE, Marsh SM [2001]. Building Safer Highway Work Zones” Measures to prevent Worker Injuries from Vehicles and Equipment. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (pub. No. 2001-128)

Internet address: <http://www.cdc.gov/niosh/2001128.html>

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11/09/05

MIFACE

Investigation Report #04 MI 107

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