MIFACE INVESTIGATION: #02MI157

SUBJECT: Hispanic Laborer Dies When Dump Mechanism of Lift Truck Activates and Crushes Him Between the Truck Bed Bulkhead and Bridge Beam

Summary

On November 21, 2002, a 20-year old Hispanic laborer and coworker were removing bridge formwork while working from an elevated truck bed. They had previously been patching a road when the foreman instructed them to begin the removal of bridge formwork. The truck used was designed so the truck bed may act as an aerial lift or as a dump truck. The victim and coworker were in a raised position, approximately 10 feet off the ground in the truck bed and had been working for approximately one hour. The control to raise and lower the truck bed was located near the bulkhead of the truck bed. They attempted to lower the raised truck bed, but it wouldn't move. They called down to another coworker, who told them to try to raise the bed a little, and then try to lower the truck bed. The victim and coworker were standing near the bed's bulkhead when one of them tried to raise the truck bed. When they attempted to raise the bed, the truck bed bulkhead was thrust upward and the rear of the truck bed dropped quickly toward the ground (See Figure 1). The victim and coworker were crushed between the bulkhead and a bridge beam, and then slid off the angled truck bed to the ground. 911 was called and emergency responders arrived. Both individuals were taken to a local hospital, where the victim died of the injuries sustained in the incident. The coworker survived.

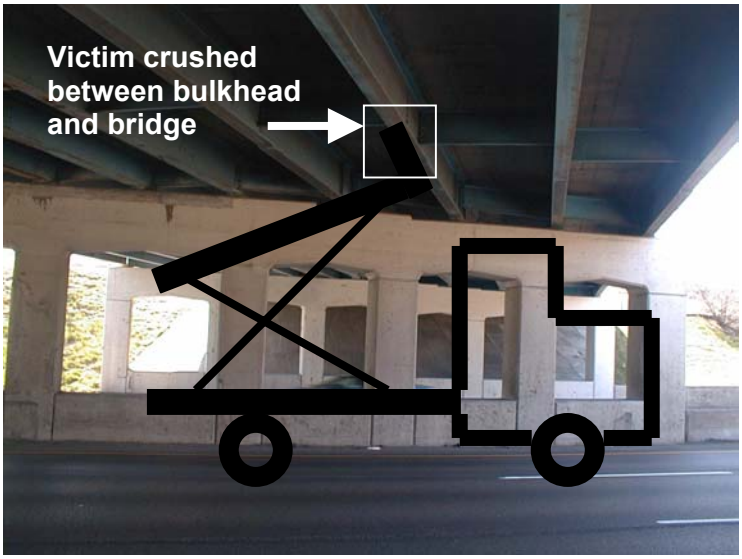


Figure 1. Position of Truck Bed Under Bridge

RECOMMENDATIONS

- Manufacturers of dual use truck beds should consider using separate interlocked control systems to reduce or eliminate the risk of worker injury from unexpected machine motion.
- Pre-operation safety checklists should be developed for equipment used in work operations.
- Employers should ensure only trained operators operate aerial lift equipment.

RECOMMENDATIONS, cont.

- Employers should ensure that all aerial lift controls are properly labeled in a language understood by the operator.
- Employers should conduct a job hazard analysis for existing and new work procedures, and provide employees job hazard analysis training.
- A health and safety committee should be developed and implemented that includes representatives from both management and union.
- Ensure that workers who are part of a multilingual workforce comprehend instructions in safe work procedures for the tasks to which they are assigned.

INTRODUCTION

On Thursday, November 21, 2002, a 20-year old Hispanic male laborer died of multiple injuries when he was pinned between a lift truck bulkhead and a bridge support beam. On Friday, November 22, 2002, MIFACE investigators were informed by the Michigan Occupational Safety and Health Act (MIOSHA) personnel, who had received a report on their 24 hour-a-day hotline, that a work-related fatal injury had occurred on November 21, 2002. On Thursday, February 27, 2003, one of the MIFACE researchers interviewed the Vice-President of the firm who was also the Safety Director. He agreed to permit a second inspection, occurring on Thursday, March 6, 2003 with both MIFACE researchers to view and operate the lift truck. On April 23, 2003, the Vice President accompanied one of the MIFACE researchers to view the incident site. During the course of writing the report, the autopsy results, death certificate, police report, and the MIOSHA citations were obtained.

The MIOSHA investigation resulted in nine serious rule violations concerning aerial lift platforms and one serious violation for not having a certified first aid provider on the work site. The alleged aerial lift rule violations are as follows: Directional controls were not marked as to their intended function, there was no information about the platform permanently marked on the platform, the platform was found not to be in a safe operating condition and was not removed from service, no operator permits to operate the platform, employees were not trained by a qualified person or did not read and understand the manufacturer's or owner's operating instruction or safety rules, the manufacturer's operating instructions were not provided and maintained in a legible manner, a visual inspection of the platform was not made by the operator before use, platform gates were left open while the platform was in an elevated position, and allowing personnel to be in the platform while trying to get the platform to move properly.

The nearly 40-year-old company is a general highway contractor, performing marine and bridgework, sign fabrication, sign erection and road building and resurfacing. The company does have a written health and safety program, with disciplinary action taken when its approximately 100 employees do not follow safety rules. A copy of the safety program is given to every supervisor and job superintendent. All employees go through a safety program orientation; they must read and provide a signature indicating that they have read and understand all company policies, including the health and safety policy. The company does not have a health and safety committee.

Jobsite safety is the responsibility of the superintendent assigned to oversee the work and he/she keeps a copy of the company safety program on the jobsite in their truck. The foreman is responsible for ensuring his/her crewmembers work safely. He/she is responsible to ensure that unsafe conditions do not exist at the worksite. A trade group, in conjunction with company personnel, provides a significant portion of the health and safety training offered to company employees. The person responsible for the company safety program has both on-the-job training and has attended several MIOSH health and safety training classes. Supervisors and foremen have on-the-job training and receive yearly supplemental training by the company. The company does not have a joint health and safety committee. The foreman conducts weekly "tailgate" safety talks with employees using a safety meeting outline provided by an outside source. Employee attendance at the weekly safety meeting is documented.

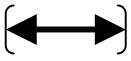
INVESTIGATION

The company was in the final stages of a highway contract, performing clean-up activities during nighttime hours. It was 43 degrees Fahrenheit and was raining that evening, although it was dry under the bridge. Artificial lighting was used to provide illumination under the bridge. At approximately 7:30pm, the work crew began to close down both the east- and west- bound lanes on either side of the highway median. The jobsite had two foremen, four laborers and one operator. The victim had been working for the company for approximately 3 months. His primary language was Spanish. There were other Spanish-speaking employees on the job site; none of the supervisory employees could speak Spanish. It is unknown how much English was understood by the victim. The company had been working at the job site for 10 months performing highway and bridge maintenance. The victim was a full-time hourly, general laborer and had been performing the same type of work on a daily basis for the company for the length of his employment. He was a union member. He did not have an operator's permit for an aerial lift.

The truck, built in 1985 was purchased used in 1996 in another state and driven back to Michigan. It did not come equipped with an operator's and/or maintenance manual. The truck was stationary when the incident occurred; its outriggers were deployed. The truck bed is usually raised and lowered when employees are in the truck bed, although it can be raised and lowered by controls from within the cab. The truck bed is 16 feet long and 8 feet wide. The truck bed has a 4-foot safety rail installed on the 2 sides; it did not have a safety gate on the back of the truck.

Figure 2. Truck bed in raised position

The truck is designed so the truck bed may act as an aerial lift and as a dump truck. At the base of the truck bed are scissor arms. One scissor arm has rollers on each side of the arm that moves horizontally along a rail mounted on the truck frame. The rail on the truck frame that is on the driver's side of the truck is identified as the "driver's side rail" and the rail on the passenger side of the truck is identified as the "passenger side rail" in this report. The other scissor arm is permanently attached to the truck frame. The scissor arm with the roller provides the mechanism that raises and lowers the truck bed, and permits dumping of a load. The double-sided arrow indicates roller movement along the rail.



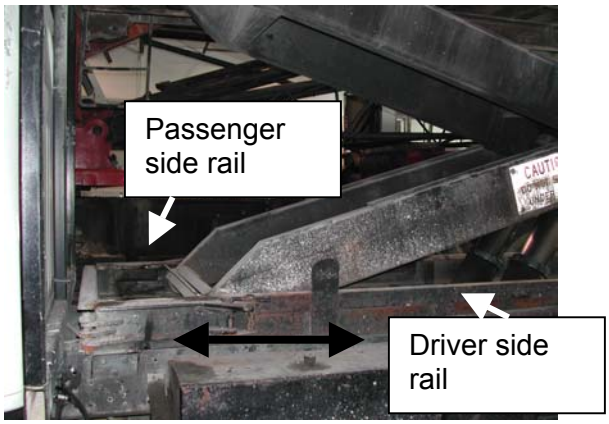


Figure 3. Truck frame/scissor arm configuration

On each side of the truck frame near the cab is a hinge that allows the “doors” on the rail to be in an open or closed position. (See Figure 4). When the rail “doors” are closed and pinned, the rollers move horizontally along the rail on the truck frame and the truck bed will only raise and lower. As the rollers move toward the rear of the truck, the truck bed raises; when the rollers return toward the truck cab, the truck bed lowers. There is an audible alarm as the truck bed lowers to truck frame level.

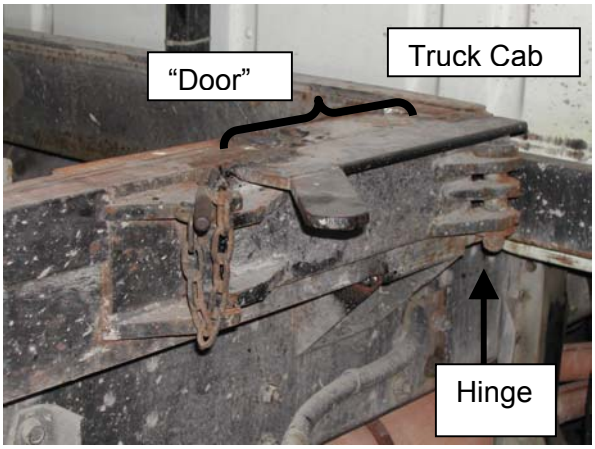


Figure 4. Rail “door” in closed, pinned position

The rail "doors" must be in the open position to allow the dump mechanism to operate. To open the rail "doors," a locking pin is removed and the "door" handle is moved toward the truck cab. A toggle switch initiates the dump sequence. The rollers at the base of the scissors move along the rail until they reach the open "door" position and leave the rail track. With the rollers stopped outside the rail, instead of lifting the whole truck bed levelly, the truck bed bulkhead starts to rise while the rear of the truck bed remains stationary. This causes the truck bed to incline and dump. See Figure 5.

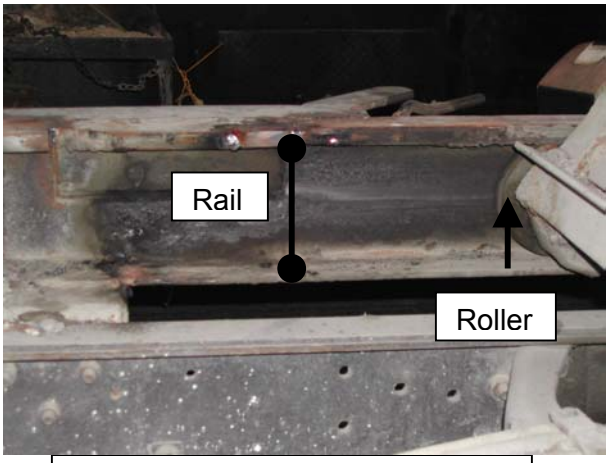


Figure 5. Close-up of roller, rail

Either of two sets of controls raise and lower the truck bed. One control is located at the truck bed’s bulkhead on the passenger side of the vehicle; the other control is located within the truck cab. The controls are toggle switches that must be held in the up position to raise the bed and held in the down position to lower the bed. If the switch is not held in position, bed movement ceases. The up and down positions were not labeled on the control at the bulkhead. Most often, the employee, while standing on the truck bed, initiates truck bed movement.

On the night of the incident, the victim and coworker were patching a section of road when asked by a foreman to strip forms from the underside of a bridge. The work crew had been working for about one hour. The truck was parked under the bridge in the closed eastbound lane, with the parking brakes engaged and the outriggers down. The victim and coworker did not perform a preoperational inspection of the truck. The victim and coworker were in the truck bed and had raised the bed to approximately 10 feet to allow them to remove the formwork.

After completing the task, the victim and his coworker tried to lower the truck bed, but the bed would not lower. One of the workers called down to the foreman saying that the truck bed was

stuck in the raised position and would not lower. One of the foremen instructed the victim and coworker to try to raise the truck bed to see if that would help. The crew heard a bang as the bulkhead tilted upward, crushing the victim and coworker between the bulkhead and bridge beam. At this point, the truck bed dumped, causing the victim and his coworker to slide down the truck bed and fall off the rear of the truck, approximately 3 feet to the ground. There was very little debris in the truck bed, and that which they encountered did not significantly contribute to any injuries the workers sustained.

After the incident, company personnel discovered that the driver's side rail "door" was closed and pinned and the passenger side rail "door" was open. The following sequence of events is proposed: When the truck bed was raised, the driver's side roller continued toward the rear of the truck on the inside of the rail as designed to raise the truck bed. But, when passenger side roller reached the open rail "door" position, it entered the open "door" as it was designed to do to dump. This exerted pressure on the passenger side roller causing it to leave the rail and "ride" on top of the rail. When the employees were trying to lower the truck bed after completing their task, the passenger side roller was on top of the rail and the driver side roller was within the rail. The action of trying to lower the truck bed exerted additional pressure on the roller within the rail. When the employees tried to raise the truck bed, further pressure was exerted on the driver's side roller causing it to jump out of the rail. With both rollers outside of the rail, the truck bed dumped. The sudden action caused the truck bulkhead to slam the workers against the bridge beam and they subsequently slid down the truck bed to the ground.

Another employee called 911 and emergency response arrived. Both injured individuals were transported to local hospitals. The victim died at the hospital, the other individual is currently recovering from the injuries sustained in the incident.

The safety manager stated that the truck did not sustain damage. Following the incident, company personnel welded the "doors" in the closed position so the truck bed could only be raised and lowered; no dumping motion is allowed (See Figure 6).

Figure 6. Welded rail "door"

CAUSE OF DEATH

The cause of death as stated on the death certificate was multiple injuries. The results of all toxicological tests were negative.

RECOMMENDATIONS/DISCUSSION

- Manufacturers of dual use truck beds should consider using separate interlocked control systems to reduce or eliminate the risk of worker injury from unexpected machine motion.

As previously described, the truck involved in this incident was equipped with a dual function truck bed, convertible for use as either an aerial lift or a dump body. Although the truck had two control stations the bed hoist was activated by a single toggle switch at either station. Conversion of the truck bed from one use to the other depended on the activation of a mechanical device in each truck-bed rail that changed the motion of the bed hoist mechanism. The device, called a rail door by the manufacturer, operated independently of the bed's hoist control system. On the day of the incident, one rail door inadvertently remained open while the other remained closed. This ultimately cased the truck bed to malfunction and act as a dump body while workers were on board. The brunt bulkhead raised and crushed the victim between it and the underside of the bridge. To protect against the bed inadvertently operating as a dump body, the bed hoist controls could be interlocked with the bed rail doors so that the aerial lift control only functioned when both doors were closed. Bed rail door interlocks could also be used to activate a visual or audible alarm to warn workers that the bed was being dumped.

- Pre-operation safety checklists should be developed for equipment used in work operations.

Equipment owners should have the equipment owner/operators manual for the piece of equipment to assist in the development of the equipment's pre-operation safety inspection checklist. Pre-operation checklists complement existing health and safety programs by identifying safety risks and corrective actions that can be taken to minimize the identified risks. Pre-operation checklists provide many benefits, such as providing a uniform procedure to check for specific equipment items in a logical order to ensure that the equipment to be used will function correctly and safely.

Checklists should be easy to use and document the required inspection points. The pre-operation checklist should have the equipment's make and models identified as well as have a section for required corrective actions if an equipment defect is found.

After the incident, the company developed a pre-operation checklist for the truck and truck lift mechanism. MIFACE recommends that the company consider developing pre-operational checklists for other equipment used by company personnel

- Employers should ensure only trained operators operate aerial lift equipment.

MIOSHA Construction Safety Standard, Part 32, Aerial Work Platforms, defines an "aerial device" or "aerial work platform" as an entire device that is designed and manufactured to raise personnel to an elevated work position on a platform supported by scissors, masts, or booms. MIOSHA requires that operators of aerial lift equipment receive training and be issued an operator's permit specifying the aerial lift equipment he/she is authorized to operate. A qualified person must train the employee in the intended purpose and function of each of the aerial lift controls. The employee may be trained by a qualified person or he/she reads and understands the

manufacturer's or owner's operating instructions and safety rules. The employee understands by reading or by having a qualified person explain all decals, warnings and instructions displayed on the aerial work platform. Operators should be trained not only to operate the piece of equipment, but also to identify mechanical problems affecting the safe operation of the equipment. The employees working in the aerial lift did not have the required operator training and did not have a permit to operate the aerial lift.

- Employers should ensure that all aerial lift controls are properly labeled in a language understood by the operator.

Part 32, Aerial Work Platforms requires the aerial lift to have directional controls clearly marked as to their intended function. On the day of the MIFACE site visit, the controls that were intended to raise and lower the lift, both at the work platform and within the truck cab were not marked as to their function. Because of the nature of the company's multilingual workforce, controls should be marked so no matter the language spoken, all employees can understand the control's function.

- Employers should conduct a job hazard analysis for existing and new work procedures, and provide employees job hazard analysis training.

The employer had a written health and safety program that contained MIOSHA required written programs as well as the general safe work practices and procedures. The company did not have written work procedures for the tasks performed on the night of the incident. Job hazard analysis helps to identify possible workplace hazards so an employer can correct these hazards. Job hazard analysis training should be conducted so employees can recognize unsafe work practices and potentially hazardous work conditions when performing a task. The employer (or outside consultant) can provide hazard analysis training as an additional component of the company's existing health and safety program and employee safety training.

A copy of the OSHA Job Hazard Analysis publication is included with this report as Attachment A. This document may also be found and downloaded from the OSHA website: www.osha.gov/. Click on the Newsroom Publications link, and scroll down the OSHA publications until the "Job Hazard Analysis" document is found. A job hazard analysis may have identified the potential for employee injury if both "doors" were not closed and pinned if the employee was trying to raise and/or lower the truck bed.

- A health and safety committee should be developed and implemented that includes representatives from both management and union.

The main incentive for developing a Health and Safety (H&S) committee is to encourage and heighten employee involvement in the company safety program. Employee input is a critical part of a successful safety program. An H&S Committee is one way to obtain that input. The level of involvement by employees and degree of management commitment will determine if an H&S Committee is successful.

H&S committees have many benefits; identify safety and health concerns that both workers and management consider most critical, help find creative solutions, shows a good faith effort toward health and safety regulations, boosts coworker loyalty, morale and enthusiasm by getting involved in an issue that's important to everyone, and if new safety rules are needed, an H&S committee can help make sure employees accept and follow them.

- Employers should ensure that workers who are part of a multilingual workforce comprehend instructions in safe work procedures for the tasks to which they are assigned.

Companies that employ workers who do not understand English or have limited understanding of the English language should identify the languages spoken by their employees and design, implement, and enforce a multi-language safety program. To the extent feasible, the safety program should be developed at a literacy level that corresponds with the literacy level of the company workforce. Companies may need to consider providing special safety training for workers with low literacy to meet their safety responsibilities. The program should also include a competent interpreter to explain worker rights to protection in the workplace, safe work practices workers are expected to adhere to, specific safety protection for all tasks performed, ways to identify and avoid hazards, and who they should contact when safety and health issues arise in the employee's primary language. Employers should also develop or obtain safety posters and signs in the appropriate languages and post them in conspicuous places.

REFERENCES

MIOSHA Standards cited in this report can be found at the Consumer and Industry Services, Bureau of Safety and Regulation Standards Division website at www.michigan.gov/cis. Follow the links *Workplace Safety & Health* then *Standards & Legislation* to locate and download MIOSHA Standards.

The Standards can also be obtained for a fee by writing to the following address: Department of Consumer and Industry Services, MIOSHA Standards Division, P.O. Box 30643, Lansing, MI 48909-8143. MIOSHA phone number is (517) 322-1845.

1. MDCIS Construction Safety Standards, Part 32, Aerial Work Platforms.

2. Occupational Safety and Health Administration (OSHA) website: http://www.osha.gov

MIFACE (Michigan Fatality and Control Evaluation), Michigan State University (MSU) Occupational & Environmental Medicine, 117 West Fee Hall, East Lansing, Michigan 48824-1315. This information is for educational purposes only. This MIFACE report becomes public property upon publication and may be printed verbatim with credit to MSU. Reprinting cannot be used to endorse or advertise a commercial product or company. MSU is an affirmative-action, equal opportunity employer. 7/29/03

APPENDIX A

OSHA JOB SAFETY ANALYSIS

MIFACE
Investigation Report # 02 MI 0157
Evaluation

To improve the quality of the MIFACE program and our investigation reports, we would like to ask you a few questions regarding this report.

Please rate the following on a scale of:

Excellent	Good	Fair	Poor
1	2	3	4

What was your general impression of this MIFACE investigation report?

Excellent	Good	Fair	Poor
1	2	3	4

Was the report…	**Excellent**	**Good**	**Fair**	**Poor**
Objective?	1	2	3	4
Clearly written?	1	2	3	4
Useful?	1	2	3	4

Were the recommendations …	**Excellent**	**Good**	**Fair**	**Poor**
Clearly written?	1	2	3	4
Practical?	1	2	3	4
Useful?	1	2	3	4

How will you use this report? (Check all that apply)

- o Distribute to employees and/or family members
- o Post on bulletin board
- o Use in employee training
- o File for future reference
- o Will not use it
- o Other (specify) _____

Thank You!

Please Return To:

MIFACE
Michigan State University
117 West Fee Hall
East Lansing, MI 48824
FAX: 517-432-3606

If you would like to receive e-mail notifications of future MIFACE work-related fatality investigation report summaries, please complete the information below:

Name: _____

e-mail address: _____

I would like to receive summaries for reports involving:

___ Construction ___ Agriculture
___ Manufacturing ___ All

Comments:

_____

_____