OREGON State FACE Program
Fatality Assessment & Control Evaluation

Oregon Institute of Occupational Health Sciences • Oregon Health & Science University
3181 SW Sam Jackson Park Rd. L606 • Portland, OR 97239 • 503-494-3940

FATALITY INVESTIGATION REPORT

INCIDENT HIGHLIGHTS

DATE:
March 30, 2018

TIME:
2:30 p.m.

VICTIM:
36-year-old male skid-steer operator

INDUSTRY/NAICS CODE:
Construction/23

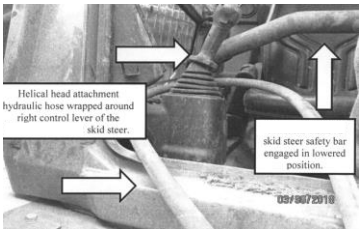
EMPLOYER:
Foundation support, excavation and site preparation

SAFETY & TRAINING:
Safety meetings & training facilitated by employer

SCENE:
Construction, site preparation

LOCATION:
Oregon

EVENT TYPE:
Caught-in or -between



Skid-steer operator crushed while controlling the skid-steer from outside the cab.

REPORT#: 2018-08-1 **REPORT DATE:** September 2019

SUMMARY

On March 30, 2018, a 36-year-old male skid-steer (track loader) operator was caught between the cab and lift arm. Nearby security video captured the event. Installation of helical piers, foundation support anchors, had been completed. The operator was attempting to disconnect the employer fabricated helical hydraulic head attachment from the last installed helical pier. He was controlling the skid-steer while standing in front of the cab in between the lift arms front frame rail cross member. A hydraulic hose that had been wrapped around the right control lever of the skid-steer pulled the control lever forward and when the operator pulled the safety bar down, the right lever was engaged causing the lift arms to lower, crushing the operator. The operator was pronounced dead at the scene. (Full report begins on p. 3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Operating a skid steer outside the cab and bypassing a safety feature
- Not following manufacturer's instructions
- Inadequate knowledge of hazards
- Inadequate training and communication

(Contributing factors continued on p. 5)

RECOMMENDATIONS

Oregon Fatality Assessment and Control Evaluation (OR-FACE) investigators concluded that to help prevent similar occurrences, employers should:

- Employers should ensure that employees operate a skid-steer inside of the cab and should not bypass its safety features.
- Employers/employees should review and adhere to equipment manufacturer operating manual.
- Employers should train employees to identify hazards such as caught-in/between hazards and methods to mitigate or eliminate hazards.

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Oregon Fatality Assessment and Control Evaluation (FACE) Program

The Oregon Fatality Assessment and Control Evaluation (OR-FACE) Program is a project of the Oregon Institute of Occupational Health Sciences at Oregon Health & Science University (OHSU). OR-FACE is supported by a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH) (grant #U60OH008472) through the Occupational Public Health Program (OPHP) of the Public Health Division of the Oregon Health Authority. OR–FACE reports are for information, research, or occupational injury control only. Safety and health practices may have changed since the investigation was conducted and the report was completed. Persons needing regulatory compliance information should consult the appropriate regulatory agency.

OR-FACE supports the prioritization of safety interventions using a hierarchy of safety controls, where top priorities are hazard elimination or substitution, followed by engineering controls, administrative controls (including training and work practices), and personal protective equipment.

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INTRODUCTION

On Friday, March 30, 2018, a 36-year-old construction worker was operating a skid-steer (track loader) with an employer-fabricated helical pier hydraulic head attachment. The worker and his foreman were on site installing helical piers (also known as anchors, piles or screw piles) to provide support for a new building's foundation. A review of footage recorded by a security camera from a nearby business showed that the worker was operating the skid-steer standing outside of the cab. He was attempting to release the pressure from the pin connecting the skid-steers helical pier head attachment to the helical pier that was previously installed.

BACKGROUND

According to OSHA, "Control Interlock Systems and/or operator seats used on some machines typically activate a safety interlock system that is intended to prevent inadvertent movement of the machine's controls when the operator is not in the proper operating position (i.e., seated). Review of OSHA's Integrated Management Information System (IMIS) reveals that between 1997 and 2007, 100 accidents were recorded specifically involving skid-steer loaders. The deliberate bypassing of safety features (such as seatbelts and control interlock systems) was identified as the direct cause of 20% of these incidents, with all but one resulting in a fatality" (see reference #1-US Department of Labor, OSHA).

Photo 1: Seat bar (control interlock) of a skid-steer shown in raised position. (*Photo from Department of Labor, OSHA, see Reference*

Helical piles and piers are used to repair building foundation or as a ground anchoring system used when deep foundations are required. They are made of steel and contain helices just like screws. They are driven into the soil by use of a hydraulic system to bedrock or other stable strata. They are designed to limit stress on the surrounding soil, reducing environmental impact. They typically do not require cure time or excavation.

The skid steer and other heavy equipment are made versatile with different attachments. Several manufacturers market attachments specific for skid-steers and can vary from augers, bale handlers to concrete breakers. Helical pier hydraulic head attachments to drive helical piers into the soil are available from several manufacturers.

EMPLOYERS

The skid-steer operator worked for a small company of 5 employees. The company specialized in deep foundation support, excavation and site preparation and had been in business for approximately five years.

WRITTEN SAFETY PROGRAMS and TRAINING

A written accident prevention program that included a disciplinary policy was provided to all employees. According to the company trainer, equipment operator training included a review of: (1) all safety functions, (2) operation functions, (3) equipment manual to ensure understanding of limitations/capacities and how to conduct daily inspection and testing to ensure good working conditions prior to start of the job.

WORKER INFORMATION

The operator worked for the employer approximately one year. He had been operating a skid-steer for seven months.

INCIDENT SCENE

The incident occurred at a site where a new building was being constructed. Helical piers were installed to support the foundation of the new building and transfer the weight below the neighboring building basement.

WEATHER

Weather did not appear to be a factor. According to Weather Underground – Historical Weather, the high temperature on the day of the incident was 58 degrees Fahrenheit (F) and zero precipitation. The temperature at the time of the incident was approximately 57 degrees F. Wind speed was CALM, 0 mph.

INVESTIGATION

The two-day project of installing helical piers (also known as anchors, piles or screw piles) for support of a new building's foundation and transfer the weight below the neighboring building basement began on March 29, 2018. On the second day, Friday, March 30 the foreman and equipment operator arrived at the worksite around 8:00 am to finish the installation of remaining helical piers. Twelve were installed approximately five feet apart to a depth of approximately 32 feet. At 2:30 pm the foreman instructed the operator to stop work and take a break. Only one more helical pier remained to be installed. The foreman left the site to use the facilities at a restaurant next door.

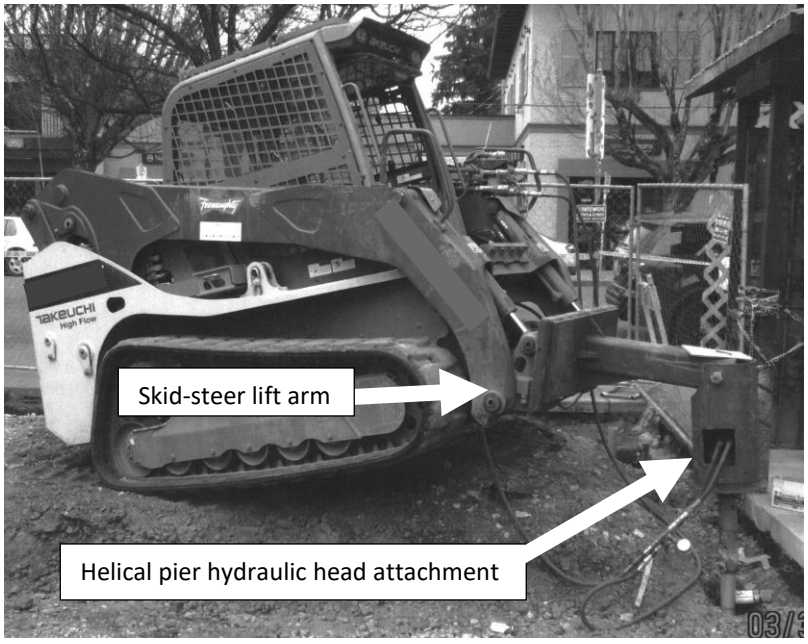

Photo 2: Skid-steer at the site; *(Photo courtesy of OR-OSHA)*

Video surveillance camera at a nearby business recorded the event. The operator stepped outside of the cab, left it running while attempting to release the pressure from the pin connecting the skid-steer's helical head attachment (which drives the helical pier to appropriate depth) to the installed helical pier. He positioned himself in front of the cab and in between the lift arms front frame rail cross member.

A hydraulic hose connected to the head attachment had been wrapped around the right control lever and pulled the control lever towards the front of the skid-steer (see Photo 3). When the operator pulled the safety bar (also known as seat bar-see photo 1) down it engaged the functions of the equipment and the right control lever caused the lift arms to lower, crushing the operator.

When the foreman returned to the site he saw a bystander yelling and pointing to the skid-steer. As he approached the skid-steer he saw the operator caught between the cab and the lift arms cross member. The foreman then entered the skid-steer, raised the lift arms and pulled the operator out and onto the ground next to the skid-steer.

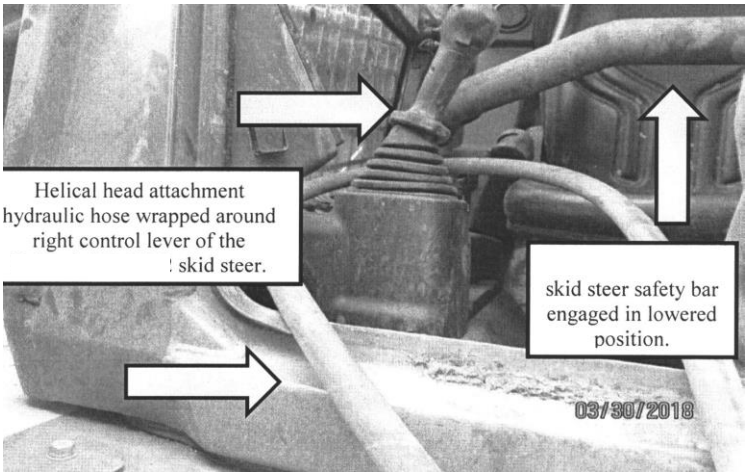

Photo 3: Hydraulic hose wrapped around control lever; *(Photo courtesy of OR-OSHA*

Several bystanders and a physician assistant provided medical attention at the scene until First Responders arrived. The operator was pronounced deceased at the scene.

As reported by the trainer, operator training included a review of: (1) all safety functions, (2) operation functions, (3) equipment manual to ensure understanding of limitations/capacities and how to conduct daily inspection and testing to ensure good working conditions prior to start of the job. The trainer was present on the first day of the project and observed the operator. He did not notice any actions that were concerning.

Documents and interviews revealed that the helical pier hydraulic head attachment was fabricated by the employer. The Oregon OSHA investigator noted that a thread bolt used to stabilize the attachment was worn and bent, and hydraulic hose sleeves were worn. Documents were not provided on the limits and specifications of the helical pier hydraulic head attachment. During the review of the manufacturer's skid-steer equipment manual, pages, 1-10, the following statements were found, "*Consult with manufacturer before installing an optional attachment*," and "*Do not use attachments that have not been approved by manufacturer. Doing so may compromise safety or adversely affect the machine's operation or service life.*" According to interview documents, the skid-steer manufacturer was not consulted in the design or approval of the attachment. Neither was it certified by an engineer.

Company policy and working procedures for installing helical piers required a minimum of two employees on site at all times. This was to ensure that the depth of installation and the correct pressures were logged throughout the installation process. It was stated during the interview that "one operator cannot do all the work without exposing himself to hazards."

CAUSE OF DEATH

According to Oregon Vital Records data, the cause of death was asphyxia.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. OR-FACE investigators identified the following factors that may have contributed to this incident:

- Operating a skid-steer from outside the cab and bypassing the safety feature
- Not following manufacturer's instructions
- Inadequate knowledge of hazards
- Inadequate training and communication

RECOMMENDATIONS/DISCUSSION

- ***Recommendation #1: Employers should ensure that employees operate a skid-steer inside of the cab and should not bypass its safety features.***
  Discussion: "Review of OSHA's Integrated Management Information System (IMIS) reveals that between 1997 and 2007, 100 accidents were recorded specifically involving skid-steer loaders. The deliberate bypassing of safety features (such as seatbelts and control interlock systems) was identified as the direct cause of 20% of these incidents, with all but one resulting in a fatality" (see Reference #1).

  NIOSH report (see Reference #2) stated that fatal skid-steer incidents suggest that employers and workers may not fully appreciate the potential hazards associated with operating or working near skid-steer loaders, the need to follow safe work procedures, and the consequences of bypassing interlocks and other safety features. Regarding the hazard associated with the lift arms, NIOSH recommends: "Lift-arm support—Use the lift-arm support device provided by or recommended by the manufacturer any time it is necessary to work or move around the machine with the lift arm in a raised position. Machines now being manufactured have either pin-type support devices (which can be operated from inside the operator's cab) or strut-type support devices (which may also be operated from inside the cab or may require the help of a coworker)."

  The operator exited the cab and positioned himself below the raised lift arm without the use of a support device. NIOSH further recommends that, -"If the machine is not equipped with a lift-arm support device or it is damaged, contact the equipment dealer or manufacturer's representative for help in determining proper support procedures or for replacement parts. Never use concrete blocks or simple metal angle irons because they can shift or collapse under even light loads."

- ***Recommendation #2: Employers and employees should review and adhere to equipment manufacturer operating manual.***
  Discussion: The helical pier hydraulic head attachment was fabricated by the employer who failed to follow the manufacturer's operating manual that stated, "*Consult with manufacturer before installing an optional attachment*," and "*Do not use attachments that have not been approved by manufacturer."* An OR-FACE Alert was published (see Reference #3) after fatalities occurred in Oregon because manufacturer instructions were disregarded.

  There was difficulty removing the helical pier hydraulic head attachment from the installed pier. It appears that this prompted the operator to exit the cab, place himself in a hazardous situation while attempting to separate the installed helical pier and the attachment. The condition of the attachment (worn and bent thread bolt) may have indicated problems with the design and may have contributed to the problem.

Research of skid-steer attachments revealed that there are several manufacturers of many different attachments. Some specify compatibility with a model of skid-steer and many do not. Prior to purchasing or fabricating an attachment, employers should consult the skid-steer manufacturer. If purchased, the employer should ensure that the attachment manufacturer obtained approval from the equipment manufacturer.

- ***Recommendation #3: Employers should train employees to identify hazards such as caught-in/between hazards and methods to mitigate or eliminate hazards.***
  Discussion: According to CPWR's Fourth Quarter Report (see Reference #4) "Caught-in/between hazards are one of the major causes of fatal and nonfatal injuries in construction. During the period of 2011 to 2015, 275 construction workers died from caught-in/between injuries, more than in any other major industry. Construction also had an elevated risk of nonfatal caught or compressed by injuries among all industries. Hazards leading to fatal and nonfatal caught-in/between injuries in construction were quite different. More than two in three (68.6%) of caught-in/between fatalities occurred when workers were caught or crushed in collapsing materials, while about 93% of nonfatal caught-in/between injuries were a result of workers being caught or compressed by objects or equipment."

  It was the afternoon at the end of the workweek, and the job was almost complete (i.e., one helical pier left to install). Perhaps, in the operator's haste to complete the job and start the weekend, he failed to take the time to think about the consequence of what he was about to do. The employer was aware that "one operator cannot do all the work without exposing himself to hazards." It was not evident that employees were trained on these hazards or methods to mitigate them.

  Caught-in/between accidents in construction are part of OSHA's Focus Four initiative. As a result, OSHA Directorate of Education and Training has published an Instructor Training Guide on caught-in/between hazards (see Reference #5).

DISCLAIMER

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INVESTIGATOR INFORMATION

This investigation was conducted by Illa Gilbert-Jones, OR-FACE Program. The report was reviewed and received input from Ryan Olson, PhD, Director, OR-FACE Program, and the OR-FACE Publications Review Panel.

ACKNOWLEDGEMENT

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