OREGON State FACE Program
Fatality Assessment & Control Evaluation
Oregon Institute of Occupational Health Sciences • Oregon Health & Science University
3222 SW Research Dr. L606 • Portland, OR 97239 • 503-494-2281

REPORT#: 2019OR01 **REPORT DATE:** June 29, 2023

Two Workers Killed in Boom Lift Rollover - Oregon

INCIDENT HIGHLIGHTS

DATE:
August 8, 2019

TIME:
~4:40 PM

VICTIMS: 27-year-old White male; 35-year-old White male

INDUSTRY/NAICS CODE:
Foundation, Structure, and Building Exterior Contractor/NAICS 238190

EMPLOYER:
Aerial fabric design and installation

SAFETY & TRAINING:
Insufficiencies in supervisor oversight and training in safe boom lift operation.

SCENE:
Hillside of music festival venue

LOCATION:
Oregon

EVENT TYPE:
Caught in/between

SUMMARY

On August 8th, 2019, two workers were operating a boom supported elevating work platform, also commonly referred to as a boom lift to remove hardware and cables anchored to trees after a music festival. They were working on a sloped hillside, with the boom extended and the counterweight on the downslope side. The boom lift tipped over and rolled down the hill with the two workers in the basket. Others witnessed the incident. Emergency responders pronounced both workers dead at the scene. Blunt-force trauma due to a fall from a moving object was ruled as the cause of death. READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Deviation from equipment manufacturer's safe operation instructions:
  - Disabling safety alarms on machinery.
  - Operating a boom lift on a slope.
  - Moving a boom lift with the telescopic boom extended.
- Insufficient worksite-specific communication to the workers and supervisors regarding the hazards of operating equipment on a sloping terrain. LEARN MORE> (p. 7)

RECOMMENDATIONS

Oregon FACE investigators concluded that, to help prevent similar occurrences, employers should:

- Ensure manufacturer instructions regarding equipment operation are followed through adequate supervision.
- Ensure boom lift operators know not to move the boom lift with the boom extended by providing training and supervision.
- Maintain and regularly inspect equipment for its operational safety.
- Implement pre-task planning for jobs that include varying conditions or environments.
- Train employees to operate equipment safely. Verify training completion and check knowledge and skill level.

LEARN MORE> (p.8)

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Oregon Fatality Assessment and Control Evaluation 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 #U60OH012411) 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.

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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 August 8th, 2019, at an outdoor music festival venue, two workers were operating a Genie S-85 boom lift after the music festival had ended to remove the cables used to suspend fabric sails so that the area could be turned back over to the farm owners. The aerial fabric was part of an art installation near the stage and provided shade in the venue's audience seating area (***See Image 1***). The boom lift was on a hillside with the wheels parallel to the slope. The first-stage boom arm was extended approximately 40 feet uphill, while the counterweight was oriented on the downhill side of the slope. Two safety alarms, a tilt hazard alarm, and a crush hazard alarm, had been disabled. The workers were moving the boom lift perpendicular to the hill slope with the boom arm extended when the boom lift tipped over in the downhill direction, catapulting the basket to the ground, where the two workers received fatal blunt force trauma injuries. Other workers on site attempted to render aid and called 911. Emergency responders arrived within 10 minutes and declared the workers dead at the scene.

Image 1. Image of a fabric sails installation at the music festival venue. Note the cables attached to the sails are secured to trees in the background.

EMPLOYERS

The music festival had been occurring for over twenty years and primarily managed by volunteers until the prime employer was formed as a company ten years at the time of the incident. The prime employer contracts with sub-contractors, including lighting, sound, video, and aerial fabric installation sub-contractors, to prepare, manage, and break down music festival venues. The prime employer hired an event superintendent to coordinate sub-contractor activities and to order supplies and equipment requested by sub-contractors, such as boom lifts and scaffolding so that the sub-contractors could complete their assigned tasks. Prior to working for the prime employer, the superintendent had worked for six years with the second employer and was familiar with the fabric installation process, as well as many of the crew members working for the second employer on the day of the incident. The prime employer had overall responsibility for the supervision of sub-contractors to ensure work was completed safely and in accordance with design and operation plans.

The second employer (subcontractor) is an Oregon-based aerial fabric design, fabrication and installation enterprise that had been in business for 13 years at the time of the incident and had 16 permanent employees. The subcontractor hired

temporary employees during music festival season, which is usually from late spring to early fall in Oregon. The subcontractor had a written contract with the prime employer for the aerial fabric installation and removal work. The second employer had been a previous sub-contractor at the music festival for ten years before the incident, performing the tasks of installing, maintaining, and removing fabric sails at the venue.

At the music festival each year, the prime employer and subcontractor allowed a set number of volunteers to donate their time in exchange for free access to the music festival for themselves and their family or friends and food provided at the venue.

At the time of the incident, the subcontractor (aerial fabric design company) directly employed the younger decedent. The older decedent was working for the subcontractor as a volunteer to connect/disconnect fabric tension cables to the trees at the west and north edge of the music venue, in exchange for free access to the music festival. The older decedent was acting in the capacity as lead on the two-man crew on the boom lift at the time of the incident.

WRITTEN SAFETY PROGRAMS and TRAINING

The subcontractor provided records of an operator training log where the topics covered included general operation of the boom lift, areas of the site with sloped terrain, general best practices, and a statement that employees should not drive with the boom extended on a slope. The subcontractor also had a fall protection plan signed by employees, including the younger decedent.

There is some lack of clarity on the overall boom lift certification and training program provided by the employer. The younger decedent, that worked directly for the fabric sail installation employer, had a boom lift operator certification card in his possession at the time of the incident. The older decedent, hired as a volunteer, was a certified arborist with the state of Oregon, owner of a tree care service company, and was also certified as a boom lift operator. However, a previous employee of the fabric sail installation company interviewed during the OR-OSHA investigation reported that the employer never verified his training on the boom lift, other than to ask if he had experience on the equipment.

WORKER INFORMATION

The younger decedent (decedent 1), a 27-year-old male, had many years of experience as an arborist but was not licensed as an arborist in the state of Oregon. He had been directly employed by the second employer for three years prior to the incident, and represented the second employer as the liaison with fabric sail volunteers, which included the older decedent.

The older decedent (decedent 2), was a 35-year-old male and certified arborist in the state of Oregon with approximately 10 years of experience. He had worked as an independent contractor for the subcontractor for seven years, and specifically for three years as a volunteer worker at the music festival, prior to the incident. He is referred to as a volunteer because he was hired as an independent contractor with compensation provided as free admission to the music festival.

Although both decedents had experience working as arborists, they were not performing arborist work at the time of the incident. The work they were hired to do did not include any tree pruning/trimming or taking down trees for the music festival job site. However, their experience as arborists were skills that were desired by the employer for any work that required climbing trees to install or remove the rigging for the fabric sails.

EQUIPMENT

The workers were using a Genie S-85 four-wheel drive telescopic boom lift manufactured in 2015. They were using this equipment to remove the hardware and cables that were attached to trees to suspend fabric sails. The equipment had been rented through a local equipment rental company. The last documented annual inspection for the boom lift occurred on March 29th, 2019.

The boom lift was being used on a sloped surface with the boom extended. The platform was positioned uphill with the counterweight positioned downhill. According to the equipment specifications, the maximum slope rating for the lift with the counterweight positioned downhill and the boom stowed is 30% or 17°. With the counterweight uphill and the boom stowed, the maximum slope rating is 45% or 24°. The operator's manual instructions indicate that the boom should only be raised or extended on a firm, level surface. The operator's manual was located in the platform compartment of the boom lift at the time of the incident.

The Genie S-85 boom lift was equipped with a tilt alarm, which is an audible alarm that will sound if the lift exceeds its tilt angle. If the tilt alarm sounds when the platform is raised, the operator's manual recommends first retracting the boom and then lowering the platform. Extreme caution should be used if this occurs. At the time of the incident, the tilt alarm had been disabled by disconnecting the alarm cables. The lift guard contact alarm or crush protection system had also been disabled. This alarm uses an activation cable to stop boom movement and sound an alarm if the operator makes contact with the platform control panel. It is intended to protect the operator if pinned between an object and the platform. There was no indication that pre-operation inspections of the equipment were being performed, as required by the manufacturer.

The workers were using fall protection as required by the equipment manufacturer. They were each wearing a harness and lanyard and were connected to the anchor point provided on the lift platform.

WEATHER

On the day of the incident, the weather was clear and sunny, with a WNW wind of 10 mph and no precipitation. The temperature was about 77°F at the time of the incident. The wind direction and speed cannot be ruled out as a contributing factors in this incident (Weather Underground, 2019).

INCIDENT SCENE

The incident occurred on a sloping hillside of a private farm field bordered by tall trees on the west and north side (***See Image 2***). The trees are used to anchor cables that suspend fabric over the audience seating area, the event stage, and other event areas. The highest elevation of the field is on the west side, sloping downward approximately 10° to the east, where it flattens out, creating a bowl shape. The field is made available as a music venue for about two weeks during the summer, including set-up and tear-down of equipment and effects.

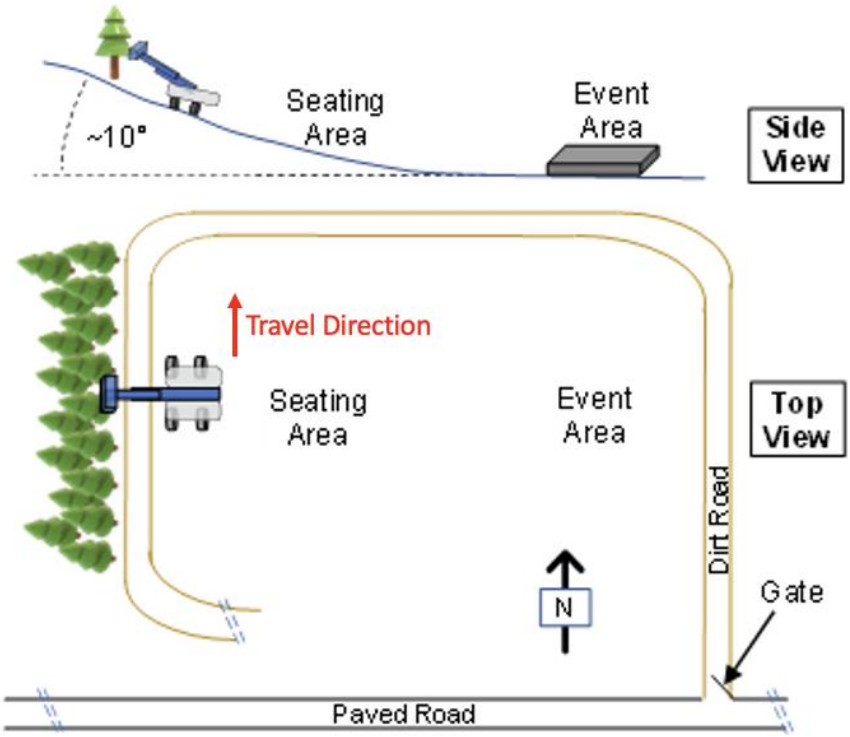

Image 2. Side and top view of the incident scene. Wheels on boom lift are parallel to the dirt road to the west. Not to scale.

INVESTIGATION

Site prep for the music festival began on July 15th, 2019. The employer was contracted by the music venue management company (VMC) for site preparation. The employer provided the VMC with a list of vehicles and equipment needed to complete the site prep, and the VMC contracted with the vehicle and equipment rental companies. Decedent 1 was directly employed by the employer and was told to work with decedent 2, a volunteer hired by the employer, to install cables that would suspend the fabric sails above the stage and seating area. The two workers had worked together before at the same music festival in previous years and were friends.

The music festival took place from August 1st through August 4th, 2019. After the music festival, the two workers were tasked with removing the cables and hardware attached to trees that suspended the fabric sails. They were among the last trades to remove their items from the venue.

The boom lift was a Genie S-85 four-wheel drive diesel engine and a straight boom. Prior to the incident, the boom lift was being operated on the west side of the hill near the tree line and just east (below) a dirt road. The wheels of the boom lift were parallel to the dirt road. The first stage of the boom was extended approximately 40 feet westward toward the trees. The basket where the operators were standing was approximately 60 feet in the air. The counterweight was on the downhill slope of this hillside. Just before the incident, operators (decedents) moved the boom lift to the north, extending the boom.

The wheels on the west side lifted off the ground, rolling the boom lift eastward down the hill, where it came to rest (***See Image 3***).

Image 3. Incident Scene. Location and orientation of boom lift post-incident. Still image taken from video recorded by the OR-OSHA Safety Compliance Officer.

According to documentation and interviews during the OR-OSHA investigation, the employer management representatives were present for the installation of the fabric sails, but were not onsite during the breakdown process after the festival. During the installation process, there is evidence that they communicated with employees about using the boom lift on sloped terrain with the counterweight uphill, and they also communicated not to drive with the boom elevated. However, there was a lack of evidence that this same information was communicated during the breakdown process.

The OR-OSHA investigation interviews with employees, previous employees, and volunteers indicated that the practice of disabling the tilt alarm on lifts had been going on since at least 2012. The management of the fabric sail installation company was familiar with the layout of the farm and knew that it included uneven terrain. They stated that the alarms were going off during the installation process and were aware of the practice of disabling alarms. A volunteer for this company stated that the alarms were disabled because they made communicating over the alarm sound difficult. A previous employee also stated that she left the company because of issues with employees disabling the alarms on the boom lifts. Another equipment rental company used in previous years reported that they stopped renting equipment for this event in 2016 because they found an alarm disabled and an illegal substance on the returned rental equipment.

CAUSE OF DEATH

According to the Medical Examiner report, the cause of death was blunt force trauma.

CONTRIBUTING FACTORS

The unrecognized hazards or inadequately controlled exposures that contributed to this incident include:

- Accepted practices of disregarding the equipment manufacturer's safe operation instructions by:
  - Operating the boom lift on a slope.
  - Moving the boom lift while the telescopic boom arm is extended.
  - Disabling safety alarms.

- Insufficient worksite-specific communication to the worker and supervision regarding the hazards of operating equipment on a sloping terrain.

Occupational injuries and fatalities are typically the result of one or more immediate contributing factors or key events that are part of a larger context or sequence of events. While the direct cause of death was being crushed when the extended boom lift rolled over and the basket holding the two decedents struck the ground with force, there were several indirect or upstream contributing factors that led to the employees being exposed to the fatal hazard. In addition to exposure to mechanical, chemical, and environmental hazards, there were several training insufficiencies. Recognizing and controlling exposure to these hazards may have prevented this tragedy.

RECOMMENDATIONS/DISCUSSION

- ***Recommendation #1*: Ensure manufacturer instructions regarding equipment operation are followed, including providing adequate supervision.**

Discussion: The employer should identify and mitigate workplace hazards and ensure employees (especially employees who are new to a worksite) have adequate training on limiting exposure to hazards associated with each task they perform. Training must be provided by a competent person who can instruct employees on how to recognize hazards and ways to prevent or limit exposure. In addition to providing training, employers should perform knowledge or task demonstration checks to verify employees have understood the training, can recognize worksites and task hazards (especially new worksites and tasks), and perform tasks safely. Knowledge and skill verification should include the employee demonstrating the new or familiar task under supervision in a new work site. Employers should also ensure employees know they have the right to stop work if they feel it has become dangerous (29 CFR 1977.12).

In this incident, the worksite included sloping terrain, and the equipment instruction manual specified not to use the lift on sloping terrain with wheels parallel to the slope. In addition, the equipment instruction manual specified that the boom should only be extended when the equipment is on a firm level surface.

The sloping terrain of the hillside was known as an occupational hazard of this particular worksite. However, the worksite was not assessed for hazards by a competent person, nor were the hazards mitigated by the employer through policies and procedures. Further, the weather may have posed an additional potential hazard of the wind exacerbating the instability of the extended boom lift. The primary responsibility belongs with the employer to assess and suspend operations when weather conditions might require it. The employer should also ensure employees understand they can stop work on the task and contact a supervisor if the employee feels the working conditions are, or have become, unsafe.

- ***Recommendation #2*: Do not move the boom lift equipment with the boom extended.**

Discussion: Moving the boom lift with the boom extended destabilizes the equipment, especially if operating the boom lift on sloping ground. The Oregon Administrative Rule (OAR) for the Construction Industry (Division 3), incorporating federal OSHA standard on Aerial Lifts by reference, states that "An aerial lift truck shall not be moved when the boom is elevated in a working position with men in the basket, except for equipment which is specifically designed for this type of operation in accordance with the provisions of paragraphs (a)(1) and (2) of this section". (OAR 437-003, Section L, adopting 1926.453(b)(2)(viii) by reference).

The employees using the boom lift should have been trained on the safe operation of the equipment, including not moving the lift with the boom extended. Additional oversight or supervision of the job site during the breakdown process could have also identified this unsafe practice.

- ***Recommendation #3***: **Maintain and regularly inspect equipment for its operational safety.**

Discussion: The condition of any vehicle or equipment is a critical factor for worker safety. The National Institute for Occupational Safety and Health (NIOSH) recommends establishing "operating and maintenance policies that follow manufacturer's terrain guidelines" (NIOSH, 2012). Routine maintenance schedules, lockout/tagout procedures for vehicles and equipment, and maintenance/repair records are part of the recommended practices for employers to ensure a safe working environment.

Following the equipment manufacturer's instructions on safe use is another critical factor of operator safety. In this incident, the employer did not have a written procedure for reporting issues with vehicles/equipment. Employers should also have rules or other means in place to prevent the removal or disabling of any safety device associated with equipment (OAR 437-001-0760(1)(b)(D)).

In the current case, the tilt alarm and crush alarm had been disabled at some time prior to the incident. The investigation interviews provide evidence that this may have been a common practice at the particular worksite. Pre-operation inspections were not performed to verify the function of alarms or to check for other maintenance issues.

- ***Recommendation #4*: Implement pre-task planning to identify site-specific safety hazards and communicate appropriate control plans.**

Discussion: The goal of a pre-task plan is to meet with employees prior to starting work in order to review the tasks to be completed and identify any hazards or potential hazards. This process is similar to a Job Hazard Analysis, where each step in the process is assessed for hazards, and controls are implemented. While it is similar, pre-task planning is often used in the construction industry or in work where conditions and tasks change. In these types of work environments, hazards or hazardous conditions would need to be assessed more frequently. When hazards are identified, then a plan is developed and controls implemented to protect employees from the hazards. Pre-task meetings should also include time for the participation of workers to ask questions or bring up concerns.

In this situation, a pre-task plan should have included surveillance of the terrain and weather and the development of a plan to take these conditions into account. It should have also included an assessment of the appropriate equipment for the tasks. While the sub-contractor did provide Job Hazard Analysis checklists for the days of set-up prior to the festival, the process failed to control for the hazards encountered adequately. An adequate pre-task plan could have identified the need for appropriate equipment for this particular task. Because the work needed to take place on sloped terrain and the tilt alarms had been sounding, this is an indication that the Genie S-85 was not the appropriate equipment for this particular task in this location. Other equipment should have been considered for this work, including an aerial boom lift with outriggers for stability.

- ***Recommendation #5*: Train employees to operate equipment safely. Verify training completion and check knowledge and skill level.**

Discussion: Employers are responsible for ensuring that employees know how to operate equipment while on the job safely. Employers must also maintain training records and renew training at least annually, or when it is warranted, due to equipment upgrade/replacement or when the equipment is used for the first time in a new area.

To operate equipment in Oregon, employers are required to:

1) "... instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury." (OAR 437-003, Subdivision C, adopting 1926.21, by reference).
2) "See that workers are properly instructed and supervised in the safe operation of any machinery, tools, equipment, process, or practice that they are authorized to use or apply" (OAR 437-001-0760 (1)(a); and
3) "[ensure that] Only trained and authorized employees may operate any vehicle." (OAR 437-003-3410(3)(a)(B)). Employers are required to provide training to employees in a language they understand so they know how to safely operate equipment. Employers should also have written procedures in place to confirm the knowledge transfer, skill, and ability of employees who are new to a task or worksite.
4) When specifically operating a boom aerial work platform, the operating manual must be kept with the equipment, and employees must follow operating and maintenance instructions and recommendations of the manufacturer (OAR 437-003-0073(1)).

Because of the complex nature of multiemployer worksites, there is also the need to specify the details of providing training to employees and volunteers. The responsibility of training should be clearly outlined with the names or positions that are responsible for providing training and the specifics of verification of the operator's knowledge and skills.

ADDITIONAL RESOURCES

Oregon Institute of Occupational Health Sciences Resource Directory. https://apps.ohsu.edu/oregon-institute-occupational-health-sciences/resources/

Oregon Healthy Workforce Center. https://www.ohsu.edu/oregon-healthy-workforce-center.

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REFERENCES

29 CFR 1977.12 Discrimination Against Employees Exercising Rights Under the Williams Steiger Occupational Safety and Health Act of 1970. https://www.osha.gov/laws-regs/regulations/standardnumber/1977/1977.12

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OAR 437-001-0760 (1)(a). Rules for All Workplaces: Employers' Responsibilities. Oregon Administrative Rules for General Administration, Order 3-2019. https://osha.oregon.gov/OSHARules/div1/437-001-0760.pdf

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FACE INVESTIGATION INFORMATION

This investigation was conducted by Barbara Hanley, MPH, PhD, Research Associate, Fatality Investigations Team, Oregon FACE (OR-FACE) at Oregon Institute of Occupational Health Sciences at Oregon Health and Science University (OHSU). The report was peer-reviewed by Jackie Boyd, OR-FACE Project Coordinator, Dr. David Hurtado, OR-FACE Principal Investigator, and Rachel Madjlesi, OR-FACE Fatality Investigator.

ACKNOWLEDGEMEMENT

The OR-FACE Program would like to acknowledge the staff of the Oregon Department of Consumer and Business Servicesfor providing assistance and information for this investigation. The Oregon FACE Program would also like to acknowledge Renée Stapleton and Byron Snapp for their review of the investigation report.