STATE OF NEW YORK
DEPARTMENT OF HEALTH

FATALITY ASSESSMENT AND CONTROL EVALUATION

Crane Boom Collapse Kills Man during Disassembling

Case Report: 08NY011

SUMMARY

In March 2008, an adult male (the victim) sustained fatal injuries when the crane boom he was disassembling buckled and crushed him. The truck-mounted lattice boom crane belonged to the owner of a construction company (the owner), who was a friend of the victim. The victim was not an employee of the construction company. At the time of the incident, the victim was at the owner's yard assisting him in disassembling the boom. The boom was 55 feet long and composed of four sections: a base (15 feet), boom extension I (20 feet), boom extension II (10 feet) and a tip with the hook (10 feet). Adjacent sections were connected with eight bolts and four connecting pins. With the pendants (hoist cables) attached to the upper end or tip of the boom, the owner and the victim lowered the boom until the tip was approximately 4 ½ feet above the ground. According to the owner, no connecting pins were to be removed until the pendants were moved from the tip to extension II and the tip section was cantilevered. The victim started removing the bolts while the owner was disassembling the hook block assembly near the tip end. In addition to removing the bolts, the victim also removed four lower connecting pins while positioning himself under the boom: two between the tip and extension II and two between extensions I and II. As the victim drove the last pin out with a 12-pound sledgehammer, the boom buckled and fell on him. The owner called 911 to summon paramedics who arrived within minutes. The victim was transported to a hospital where he was pronounced dead.

New York State Fatality Assessment and Control Evaluation (NY FACE) investigators concluded that to help prevent similar incidents from occurring in the future, employers should:

- ***ensure that all personnel assigned to assemble/disassemble or assist in assembling/disassembling a crane boom receive training on safe assembly/disassembly procedures;***
- ***ensure that all personnel who are assigned to assemble/disassemble crane booms strictly follow the manufacturer's assembly/disassembly procedures and use blocking to support all boom sections;***
- ***consult the manufacturer for updated operating and maintenance procedures and safe work practices when using older crane models; and***
- ***instruct workers to insert the connecting pins with the cotter pins placed on the outside of the boom during crane assembly so that no worker has to get under the boom to remove the cotter pins during disassembly.***

INTRODUCTION

In March 2008, an adult male (the victim) sustained fatal injuries when the crane boom he was disassembling buckled and crushed him. NY FACE staff learned of the incident from newspaper articles. On March 27, 2008, a NY FACE investigator traveled to the incident site to collect information about the fatal incident. The investigator interviewed the owner of the crane who was disassembling the crane with the victim at the time of the incident. The case was reviewed with the compliance officer of the Occupational Safety and Health Administration (OSHA) who investigated the incident. The Police Incident Report filed by the County Sheriff and the death certificate were also reviewed.

The truck-mounted lattice boom crane that was involved in the incident belonged to the owner of a construction company (the owner) that employed five workers. The owner started his business in 1991 and had worked on several town municipal drainage and utility projects.

At the time of the incident, the victim was employed full time as a machinist at a federal manufacturing facility; he was not an employee of the construction company. He and the owner were close friends and were former business partners. The victim had previously worked intermittently for the construction company and had last been on the company payroll in the fall of 2006.

INVESTIGATION

The owner had purchased the crane from a local used equipment dealer on December 31, 2007. The crane was delivered to the owner's yard and had been parked there since its purchase. The crane, a 1967 model with 4,000 service hours, was previously owned by a large manufacturing corporation. The owner received a copy of the operating manual as well as detailed crane maintenance records, indicating that regular preventive maintenance had been performed on the crane. The owner assessed that the crane was in good condition except for a couple of minor leaks; he planned on repairing the crane and having it inspected before using it for his construction business.

For the crane to be repaired and inspected, the boom had to be disassembled into individual sections. The boom was 55 feet long and composed of four sections: a base (15 feet), boom extension I (20 feet), boom extension II (10 feet) and a tip with the hook (10 feet). Adjacent sections were connected with eight bolts and four connecting pins (Photo 1). Each connecting pin was secured with a cotter pin at its tapered end (Photo 2). The connecting pins were inserted from outside the boom; the cotter pins were inside the boom.

Photo 1. The photo illustrates the connecting ends of the two adjacent boom sections. There were eight bolts and four connecting pins connecting the two boom sections (Photograph courtesy of OSHA).

Photo 2. A connecting pin with the arrow showing where the cotter pin was inserted. (Photo courtesy of OSHA)

The owner had no formal training on the disassembling of a crane. He had once assisted an experienced crane operator in disassembling the boom of a modern truck-mounted lattice boom crane. The victim had no experience in disassembling a crane boom.

The operating manual specified how to assemble the boom step by step. To disassemble the boom, the manual directed the operator to reverse the assembly procedure. According to the owner, he had studied the manual and worked out a verbal disassembly plan. The plan included the following steps:

1. lower the boom with the hoist cables attached to the tip;
2. remove the bolts between the tip and extension II and between extensions II and I;
3. lower the tip to the ground;
4. move the pendants from tip to extension II to cantilever the tip section;
5. raise the boom and remove the two lower connecting pins between the tip and extension II;
6. lower the boom tip to the ground; and
7. remove the two upper connecting pins last to separate the tip section.

The owner indicated that he and the victim planned to follow the same procedure to disassemble the remaining three sections. Per the owner, the plan had been discussed by the owner and the victim.

On the morning of the incident, the victim arrived at the owner's yard to assist him in disassembling the boom. With the pendants attached to the tip, they first lowered the boom to the side of the crane until the tip was approximately 4 ½ feet above the ground. With the boom suspended at the tip by the pendants, the victim started removing the bolts between the tip and extension II and between extensions II and I. He lubricated the bolts before removing them with a wrench and a ratchet. Meanwhile, the owner was disassembling the hook block assembly near the tip end. The owner recalled that at one point the victim noted that the connection between the tip and extension II appeared to be stuck.

According to the owner, he momentarily turned away from where the victim was and did not see the boom fall. He turned back and saw that extension II was on the victim's back and the victim was bent forward and crushed.

The post incident investigation revealed that in addition to the removal of the sixteen bolts, the victim had also removed four lower connecting pins: two between the tip and extension II and two between extensions I and II. A 12-pound sledgehammer was found lying next to the victim. The victim positioned himself under and inside the boom so that he could remove the connecting cotter pins that were inserted inwards and drive the pins out. It was postulated that the victim first removed the two lower pins connecting the tip and the extension II and the two sections were "stuck"; this resulted in the boom remaining connected initially. When the victim used the sledgehammer to drive the last pin out, the boom buckled at two locations: between the tip and extension II and between extensions II and I (Photo 3). The victim was under and between extensions II and I; he was crushed by the extension II (Figure 1). The owner called 911 to summon emergency medical services (EMS), who arrived within minutes. The victim was transported to a hospital where he died of severe head and torso injuries.

Photo 3. The boom assembly buckled at two locations: between the tip and extension II and between extensions I and II. The victim was crushed by extension II. Blocking under the boom was placed after the incident. (Photo courtesy of OHSA)

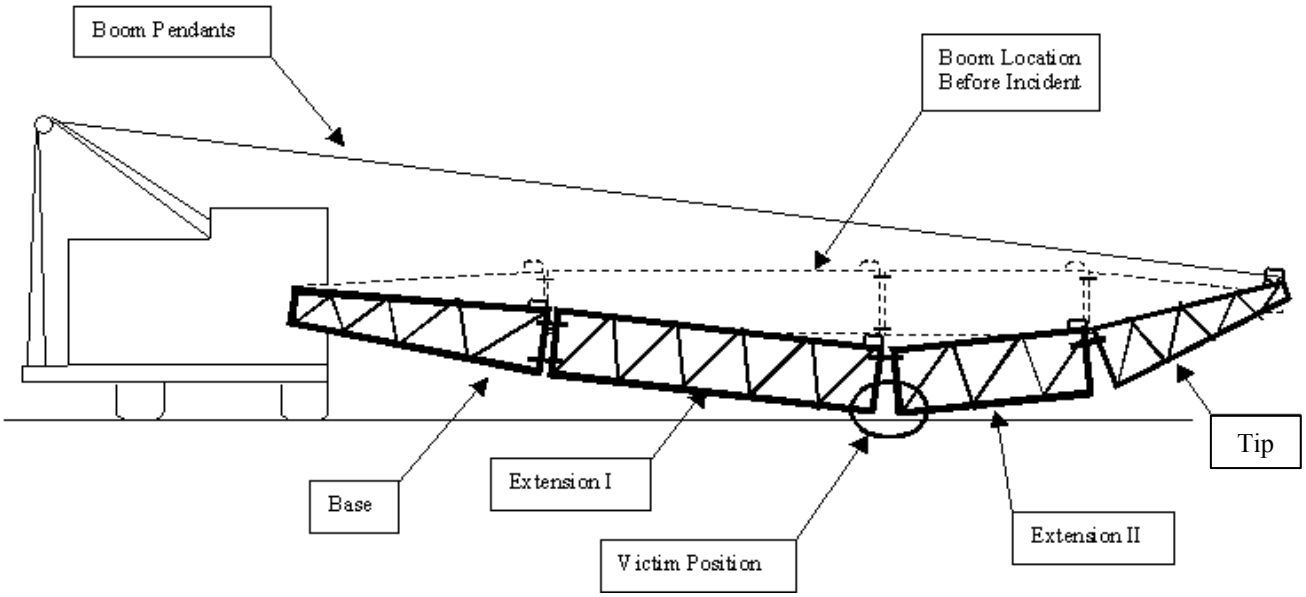

Figure 1. The collapsed the boom and the location of the victim during the incident.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: ***Employers should ensure that all personnel assigned to assemble/disassemble or assist in assembling/disassembling a crane boom receive training on safe assembly/disassembly procedures. Individuals not trained should never attempt this assembly/disassembly work.***

Discussion: Many serious or fatal injuries have occurred during crane assembly and disassembly. Due to the boom's weight and size, the assembly/disassembly procedures can be extremely hazardous. Removing the wrong connecting pins or removing the pins before properly positioning the pendants can cause the boom to buckle and collapse when the boom sections are not properly blocked or supported. The victim, in this case, was not trained and never performed the work before. He positioned himself under the boom, a dangerous location. He apparently did not realize that the boom could collapse when he removed the pins on the sections behind the pendants. Employers should provide training for all personnel who are assigned to assemble/disassemble or assist in assembling/disassembling a crane boom on the correct and safe procedures, including pinning and unpinning. A written work plan should be prepared and reviewed. All personnel should be knowledgeable of the procedures and fully recognize and appreciate the potential life-threatening consequences associated with this phase of crane operation.

Recommendation #2: ***Employers should ensure that all personnel who are assigned to disassemble crane booms strictly follow the manufacturer's assembly/disassembly procedure and use blocking to support each section of the boom.***

Discussion: When assembling/disassembling a crane boom, all personnel should strictly follow the manufacturer's specified procedures. The direct cause of this fatality was that the victim did not follow the disassembly procedure sequence and positioned himself under the boom to remove the connecting pins on the sections behind the pendants. The failure to use blocking to support the boom sections also contributed to the fatal incident, as blocking can stabilize the boom and prevent the boom movement (collapse) that can cause fatal injuries.

Employers should ensure that workers use proper blocking to support each boom section to prevent boom sections from moving when dissembling cranes. Hazard warning signs should be posted at or near all pin connections.

Recommendation #3: ***When using older model of cranes, employers should always consult the manufacturer for updated operating and maintenance procedures and safe work practices.***

The crane involved in this incident was a 1967 model. The operating manuals for older models may not contain the current accepted industry practice. When assembling/disassembling older model cranes, employers should always consult with the manufacturer for updated operating and maintenance procedures and safe work practices. The following boom disassembling methods (described in IPT's Crane and Rigging Training Manual) may be used as additional guidelines to be incorporated into the disassembly procedure:

1. Lower the boom until it is horizontal with the ground and rest the boom tip on blocking until the pendants are slack.
2. Move the pendants back no farther than the cantilever length allowed in the crane manual.
3. Raise the boom up slightly and remove all lower pins on the sections ahead of the pendants.
4. Use a longer bar to drive the pins out if the cotter pins are inside the boom. Do not climb under the boom to remove pins.
5. Make sure that every boom section is supported, then lower onto the blocking. Remove the upper pins on the sections ahead of the pendants and then remove the sections.

Recommendation #4: ***When assembling a crane boom, workers should be instructed to insert the connecting pins with the cotter pins placed on the outside of the boom so that no worker has to get under the boom to remove them during disassembly.***

Discussion: During boom assembly, with all boom sections blocked and fully supported, workers should be instructed to insert the connecting pins with the cotter pins on the outside of the boom frame without positioning themselves under the boom. This will enable a worker to remove the pins from outside the boom during boom disassembly. Some boom types are designed to allow the pins to be installed from the outside with cotter pins inside the boom to avoid pendant line snag. When dismantling this type of boom, it is especially important to use blocking to support all boom sections and prevent sudden boom movement. Workers should use the appropriate tool, such as a long bar, to drive the pins out from outside the boom. No worker should ever get under the boom to remove pins.

Keywords: crane, boom, truck-mounted lattice boom crane, boom dismantling, boom disassembling, connecting pins, cotter pins.

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The New York State Fatality Assessment and Control Evaluation (NY FACE) program is one of many workplace health and safety programs administered by the New York State Department of Health (NYSDOH). It is a research program designed to identify and study fatal occupational injuries. Under a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), the NY FACE program collects information on occupational fatalities in New York State (excluding New York City) and targets specific types of fatalities for evaluation. NY FACE investigators conduct fatality investigations to identify the causal and contributing factors. Findings are summarized in narrative reports that include recommendations for future prevention. These recommendations are distributed to employers, workers, and other organizations interested in promoting workplace safety. The NY FACE program does not determine fault or legal liability associated with a fatal incident. Names of employers, victims and/or witnesses are not included in written investigative reports to protect the confidentiality of those who voluntarily participate in the program.

Additional information regarding the NY FACE program can be obtained from:

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www.nyhealth.gov/nysdoh/face/face.htm