

**TO: Director, National Institute for Occupational Safety and Health**

**FROM: California Fatality Assessment and Control Evaluation (FACE) Program**

**SUBJECT: Welder dies when crushed by a falling structural steel beam tipped over by a crane in California.**

***SUMMARY***  
**California FACE Report #96CA008**

A 30-year old male welder (victim) died after being crushed by a structural steel I-beam at a fabrication facility. The victim had just finished welding brackets onto the beam and a crane operator had moved it onto the edge of a number of metal saw horses. The victim was standing near the beam, to take over the crane's pendant (suspended, floor-level remote) controls for another job. The crane operator began to raise the load hook and attached chain slings so he could relinquish the controls. The hooks of the two chain slings, which were used as chokers, had not been placed in the oblong master link (connecting ring for the slings) hanging from the load hook. When the crane operator began to raise the dangling slings, one of its hooks turned toward the beam and caught it on the bottom. This caused the beam, which had been placed on the saw horses lengthwise with the "I" upright, to topple toward the victim. The beam knocked him down and he was crushed between the beam and the concrete floor. Two employees working in the same area escaped by jumping onto a stack of beams. Company training was on-the-job and was not documented. The CA/FACE investigator concluded that, in order to prevent future occurrences, employers should:

- Assure that before the load line of the crane is raised, the operator moves the line to the side so it and any attached slings are clear of obstructions.
- Make certain that crane operators or riggers place the hooks of the slings in the oblong master link before raising the load line.
- Ensure workers always stand clear of the load until it has been properly placed and the rigging and load line are clear.
- Assure that the areas in which lifts are made, transported the lowered are free of materials or other obstructions.
- Ensure workers refrain from placing beams near the edge of the supporting sawhorses.
- Implement a written, formal training program for crane operators and riggers which also provides for refresher training.

## INTRODUCTION

On May 28, 1996 at 2:45 p.m., a 30-year old male welder was crushed by a large structural steel beam and declared dead at 3:05 p.m. The victim was standing near the I-beam when a sling hook caught the bottom and it toppled onto him. The CA/FACE investigator learned of the incident on May 30, 1996 through the local California Division of Occupational Safety and Health (Cal/OSHA) district office. The CA/FACE investigator responded to the site of the incident on May 31, 1996 and met with the president and vice-president of the company. A copy of Cal/OSHA form 36, Cal/OSHA report, coroner's report, police report, paramedics report were obtained by the CA/FACE investigator.

The company has been in business 14 years fabricating and erecting structural steel. There are 64 employees in the company, 38 of whom work at the site of the incident. Safety responsibilities were shared by the president and vice-president who, in turn, assigned safety responsibilities to a foreman in charge of a particular job. The company had an Injury and Illness Prevention Program (IIPP), including site specific IIPP's for each erection site. Most employee training provided was on-the-job. New employees were paired with more experienced workers and given increasing responsibilities until management was satisfied they were ready for a specific task. Safety meetings were held weekly and any discussion was documented in writing. The decedent was a certified welder who had worked for the company since September 7, 1994. The crane operator had worked for the company for one year and had been operating their cranes for nine months. He worked for three months before being allowed to operate any crane, and was given on-the-job training thereafter.

## INVESTIGATION

The site is a large commercial building having offices on one side and a fabrication facility on the other. The fabrication area contained many different types of structural steel and several pendant-operated overhead bridge cranes. The job the decedent was working on involved the fabrication of structural steel for a prison under construction. The beams he was working on at the time of the incident were of the I-beam type and were 72 feet long, 33 inches tall, 11 5/8 inches wide, and weighed 10,152 pounds (141 pounds per linear foot).

Fabrication of the beams was done by a crew including a foreman, several helpers and a welder. For transport, the beams were marked at the center of balance (see exhibit 1). Two chain slings, which hung from an oblong master link (connecting ring for the slings) in the load hook (see exhibit 2), were attached at either side of the center of balance by wrapping them around the beam and placing each sling's grab hook over the hanging chain to "choke" the beam. The beams were moved by an overhead bridge crane to a particular area so the welder could weld attaching brackets (see exhibit 3) all along the beam. When stationary, the beam was supported by a number of metal sawhorses (see exhibit 4).

When the decedent had finished welding all of the brackets on the beam involved in the incident, he called for the crane operator to bring the 10-ton overhead bridge crane to the welding area. They rigged the beam and moved it about 60 feet across the shop to an area where the welds were cleaned and attaching holes drilled. All employees in the shop are notified when a lift is being made so it does not pass over anyone.

The decedent walked to an area about 20 feet west of where the beam was to be placed. He talked to the foreman for the job, who left the area, and then walked back to the area where the beam had been placed on several 28-inch tall sawhorses near one edge. Two helpers, one of whom was the crane operator, were assigned the task of cleaning up the welds on the brackets. The decedent and two helpers were standing just east of the beam which had been set down lengthwise and upright so when looking at the end, it appeared to be an "I" (see exhibit 5).

The helper, who was also operating the crane, was located just south of the center line of the beam; the other helper was standing near the center line; and the decedent was just north of the center line. All three were standing a few feet east of the beam. The decedent was trying to gain control of the crane so he could use it on another beam. The crane operator began to raise the load line of the crane to which the chain slings were attached. The slings had been left hanging with the hooks near the floor. The decedent had turned slightly to his left and was not watching the lift.

As the load line was lifted, the hook of one of the chain slings turned and caught the bottom of the beam near the center line. The beam fell to the east in the direction of the three employees. The crane operator and the helper saw it happening and the crane operator yelled in Spanish to "watch out." The crane operator and the helper jumped up onto a two-foot high stack of finished beams which were located several feet east of their position. The decedent tried to move out of the way as the helper was trying to pull him by the arm, but the beam struck him. He was knocked down and crushed between the beam and the concrete floor.

Employees responded by rigging the beam and lifting it off the decedent. This process took several minutes. It was obvious that the decedent was horribly injured and no first aid was performed. The paramedics were dispatched at 2:50 p.m. and arrived at 2:56 p.m. He was determined to have no pulse or spontaneous respirations and was pronounced dead at 3:05 p.m. at the scene.

## CAUSE OF DEATH

The coroner's report stated the cause of death to be multiple blunt force trauma resulting in a skull fracture and extrusion of the brain; fracture of all ribs; severed cervical spine; fractures of the sternum, clavicles, thoracic vertebrae and pelvis; ruptured bladder, transection of the trachea, esophagus and thoracic aorta; laceration of the heart, both lungs, diaphragm and liver.

## RECOMMENDATIONS/DISCUSSION:

**Recommendation #1: Employers should assure that before the load line of the crane is raised, the operator moves the line to the side so it and any attached slings are clear of obstructions.**

Discussion: Whenever a crane's load line is lifted and no load is attached, the crane operator should move the load line away from the load or other obstructions before the load line is raised. In this case, the pendant control could have been used to move the load line west of the beam until it was in the clear. If the load line and the attached chain slings were fully clear of the beam before the load line was raised, this incident may not have happened.

**Recommendation #2: Employers should make certain that crane operators or riggers place the hooks of the slings in the oblong master link before raising the load line.**

Discussion: Part of load rigging procedures includes the removal of the rigging. When unhooking the load, the chains should be fastened back into the oblong master link or otherwise secured before the load line is raised or crane repositioned. The crane operator and the rest of the crew should be alert for situations which may foul the rigging and cause the load to turn over. Had the slings been properly secured before the load line was raised, this fatality may not have occurred.

**Recommendation #3: Employers should ensure workers always stand clear of the load until it has been properly placed and the rigging and load line are clear.**

Discussion: There is always a danger from the time a load is lifted until it has been properly placed and the rigging and lifting apparatus are clear. During those times, employees should stand away from the load so that if it swings, slips, spills or turns over they will not be injured. Employees should always face the material being lifted or placed so any problems that arise are apparent. Although a crane operator or rigger may have to be close to the load, it should only be when absolutely necessary. If all the crew members had been observing the operation and been out of the area of potential danger, this incident may not have happened.

**Recommendation #4: Employers should assure that the areas in which lifts are made, transported and lowered are free of materials or other obstructions.**

Discussion: When employees must deal with material which is heavy enough to cause crushing injuries, space should be cleared in the area of such material for employee access and egress. The two surviving employees in this incident had to jump onto a pile of beams in order to escape the falling beam. The decedent was unable to jump onto the stack of beams before he was struck. Had there been a clear space, the decedent may have had just enough time to get out of harm's way.

**Recommendation #5: Employers should ensure workers refrain from placing beams near the edge of the supporting sawhorses.**

Discussion: Whenever possible, the load should not be placed near the edge of any support. If the material were to fall, it would fall to the ground or floor. If it were placed near the middle of its supports, when falling it would most likely remain on its supports. If the beam were placed near the center of the supporting sawhorses, it probably would have not fallen to the floor and this incident may not have happened.

**Recommendation #6: Employers should implement a written, formal training program for crane operators and riggers which also provides for refresher training.**

Discussion: If employees must work in an inherently dangerous job, it is paramount that formal training is conducted. When the program is written and followed for every affected employee, it assures that each employee is getting the correct information about the hazards of the job and the correct procedures to avoid those hazards. On-the-job training relies on the more experienced workers who may fail to tell the newer employee everything he needs to know or inadvertently

leave out a step of a procedure. Formal training assures that the newer employee is given all the steps necessary for the job. It also assures that coworkers, if similarly trained, can recognize an improper procedure and take corrective action before harm comes to his fellow workers. Refresher training helps reinforce any prior training. If formal training had been conducted for all workers in the crew, they may have recognized the failure to move the load line aside and to place the sling hook into the oblong master link. Had any worker halted the procedure until corrective action was taken, this incident most likely would not have happened.

**References:**

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**Rick Tibben, CSP**  
**FACE Investigator**

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**Robert Harrison, MD, MPH**  
**FACE Project Officer**

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**Janice Westenhause, MPH**  
**Research Scientist**

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**Marion Gillen, RN, PhD**  
**Research Scientist**

**September 11, 1996**

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**FATALITY ASSESSMENT AND CONTROL EVALUATION PROGRAM**

The California Department of Health Services, in cooperation with the Public Health Institute and the National Institute for Occupational Safety and Health (NIOSH), conducts investigations of work-related fatalities. The goal of this program, known as the California Fatality Assessment and Control Evaluation (CA/FACE), is to prevent fatal work injuries in the future. CA/FACE aims to achieve this goal by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact. NIOSH-funded, state-based FACE programs include: Alaska, California, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, New Jersey, New York, Oklahoma, Oregon, Washington, West Virginia, and Wisconsin.

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**Additional information regarding the CA/FACE program is available from:**

**California FACE Program  
California Department of Health Services  
Occupational Health Branch  
850 Marina Bay Parkway, Building P, 3<sup>rd</sup> Floor  
Richmond, CA 94804**