

TO: Director, National Institute for Occupational Safety and Health

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

SUBJECT: Journeyman iron worker dies after falling from a freeway bent cap in California.

SUMMARY
California FACE Report #95CA016

A 33-year old white, male journeyman iron worker died after falling 60 feet from a bent cap (freeway support) onto the engine cover of a manlift and then onto the ground. The victim was walking along the top of the bent cap carrying a bucket of used bolts back to the manlift basket when he apparently stumbled and fell. The victim was wearing a safety belt which had "D" rings located at each hip. Both ends of his lanyard were clipped into one of the "D" rings when his body was found. There was no catenary line or other fall protection on the bent cap. The policy was for the workers to clip the one end of their lanyard into a "D" ring and the other end onto one of the existing structural steel members, but only when working, not when moving along the top of the bent cap. The victim's co-workers heard the clatter of bolts dropping and discovered that he had fallen. The victim had no specific fall protection training and no initial hazard assessment of the job site was performed. The CA/FACE investigator concluded that, in order to prevent similar future occurrences, employers should:

- . Assure employees have and use proper personal fall arrest equipment when working at heights requiring fall protection.
- . Provide appropriate fall protection such as catenary lines, railings or scaffolding for employees working at heights.
- . Perform an initial hazard assessment of the job prior to beginning work.
- . Train employees, including periodic refresher training, to be aware of and understand the hazards of the job.

INTRODUCTION

On September 22, 1995 at 8:00 a.m., a 33-year old white, male journeyman iron worker fell 60 feet from the top of a bent cap (freeway support) and was declared dead on September 24, 1995 at 1:17 a.m. The victim fell onto the engine cover of the manlift he had used to access the bent cap and then onto the ground. The CA/FACE investigator was notified of this incident by the Cal/OSHA Bureau of Investigations (BOI) on October 23, 1995 and responded to the incident location on November 8, 1995 at 1:00 p.m. The site is a number of bents (concrete girders, called bent caps, supported by columns) below sections of a freeway. The bent caps and

their connections to the freeway sections were being upgraded during seismic retrofitting. The CA/FACE investigator responded to the site of the incident on November 8, 1995. A copy of the police report, death certificate, coroner's report, autopsy, paramedics report, and Cal/OSHA report were obtained, and photographs of the site were taken.

The construction company had been in business for 27 years and employed twenty people, six at the site of the incident. They had been working on the seismic retrofitting project for nine months. The victim had been working on this job site and for this construction company for two weeks.

INVESTIGATION

An initial meeting was held at the site of the incident with the project superintendent for the general contractor, and, for the company being investigated, the structural foreman and an iron worker, who was also the shop steward, and the decedent's co-worker. At the conclusion of the initial meeting, this group and the CA/FACE investigator walked to the site of the incident.

The overall site is an area underneath a network of freeway overpasses and transitions at the junction of three freeways. The particular site is an east bound freeway section as it transitions to a north bound freeway. In this area the freeway is supported by a number of bents (concrete girders, called bent caps, supported by columns). The particular bent involved consisted of a bent cap supported by two columns with the north side column appearing somewhat shorter due to the banking of the freeway transition (**Exhibit 1**). The ground underneath the scene of the incident was smooth, fairly level and appeared to be of older asphalt pavement covered with dirt, apparently due to the construction activity.

The work at the location of the incident was on-going freeway seismic retrofitting. It involved replacing or adding structural steel; adding concrete shear walls; adding reinforcing bar and concrete to existing columns; excavating and properly compacting the soil around the base of the columns; and adding wire rope connectors which pass through the bent caps and attach to type "A" brackets located on the underside of the freeway section. The decedent was first employed for this job on September 8, 1995. He was hired out of the union hall, an Iron Workers local. He was a journeyman iron worker which indicates that he had passed a three-year apprenticeship. The decedent had been an iron worker for approximately fourteen years. He had recently been reinstated with the union after paying his dues. On the day of the incident, the job which involved the fall was the addition of structural steel reinforcing pieces to the area between the bent cap and the freeway section above. Work usually started at 6:30 a.m. On the morning of the incident, a safety meeting was held which delayed the start of the day until about 6:50 a.m. The first task was to load tools and materials needed for the work.

Prior to the incident, the decedent and his co-worker had accessed the middle bay of the bent cap (see **Exhibit 2**) from a man basket of an aerial lift. Employees at the site call it a "zoom boom." This aerial lift has an articulating boom with a maximum reach of approximately 66 feet. The man basket (platform) is five feet long and three feet wide with a top guard rail at the 42-inch height and a mid-rail. The man basket has a maximum capacity of 600 pounds. The lift has an overall size of 25 feet, 11 inches long by 7 feet, 6 inches wide. They made two trips with the zoom boom. The first trip was to deliver tools such as a gas torch and its leads, an air hose,

an impact wrench and extension cords for electric tools. On the second trip they transferred materials such as bolts, braces and channel iron to the top of the bent cap.

When they were using the zoom boom, they were both wearing safety belts with one end of a lanyard tied to the D-ring of the belt and the other end hooked to a square bracket located at the rear of the basket at the mid-rail level. They turned off the aerial lift after the man basket was up against the bent cap. The top rail of the man basket was approximately even with the top of the bent cap. Both men had gotten out of the basket by stepping up three to three and one-half feet and onto the bent cap itself. The bent cap is four-feet wide overall. This particular cap had a two-foot step down. The leading edge that the workers first stepped onto is two-feet wide. The stepped-down section on the opposite side is an additional two-feet wide.

At the same time the second trip was made, a second zoom boom was used from the opposite side of the bent cap to deliver a large stiffener plate. Three people were in the second zoom boom man basket, an iron worker foreman and two iron workers. While the decedent stayed in the first zoom boom man basket, his co-worker got onto the bent cap to help get the stiffener plate out of the second zoom boom basket and onto the bent cap. When the second zoom boom was ready to descend, the decedent had come onto the bent cap and was opposite his co-worker. The decedent handed a 7/8-inch socket for the impact wrench to his co-worker who was preparing to back off on some existing bolts on one of the existing structural steel braces.

One of the iron workers in the second zoom boom man basket lifted a bucket of "dead" (used) bolts, which weighed about 35 pounds and appeared to be the size of a metal five-gallon paint bucket, and a spud wrench to the decedent. The iron worker noticed the decedent was moving to the other side of the bent cap and was not tied off at the time. The decedent was carrying the bucket of bolts close to his body about waist high. He was moving to place the "dead" bolts in the man basket of the first zoom boom and to retrieve a bucket of new bolts.

The iron worker foreman in the second zoom boom was facing away from the bent cap, operating the boom's controls. The two iron workers were facing the bent cap as they started to descend with the decedent on their left and his co-worker on their right. As they were descending, all three men in the man basket heard the clatter of a falling bucket of bolts on top of the bent cap. The decedent's co-worker also heard the clatter. One of the iron workers heard the decedent shout at the same time. The decedent's co-worker turned around on the bent cap and saw the bucket of bolts just going over the side of the bent cap. He did not see the decedent.

The co-worker assumed that the decedent had fallen, put down his tools, and went to the first zoom boom to go to the decedent's aid. The three men in the second zoom boom continued to descend. They could see the decedent on the ground. When they got to ground level, the iron worker foreman rushed to the decedent who had severe head and chest injuries and had a partially amputated hand. The iron worker foreman covered the decedent with a blanket. Since none of the decedent's co-workers actually saw what happened prior to the fall, there are three possible scenarios to explain the victim's fall. The first is that the decedent bumped into one of the structural members of the bent cap and lost his balance. Secondly, he could have stumbled and fell. Lastly, he could have been trying to step down into the man basket to place the bucket of dead bolts into it, missed his step, and fell over the top guard rail.

The paramedics were called at 8:10 a.m. and arrived at 8:17 a.m. They gave emergency treatment to the decedent. They transported the decedent to the local medical center a short distance away. The decedent went into respiratory arrest during transport. The decedent was pronounced dead at 1:17 a.m. on September 24, 1995. An investigation subsequent to the fall revealed that the decedent had fallen on the engine cover of the first zoom boom, bounced off and landed on the ground. He was still wearing his safety belt. This type of safety belt has a "D" ring located at each hip and has no fall arrest feature. The safety belt had a lanyard attached with both ends snapped into one of the "D" rings. The lanyard also did not have any fall arrest feature.

There was no catenary line or other type of lifeline on top of this particular bent cap. Workers tied off to existing structural steel supports only while they were working. According to witness statements of several of the iron workers, it was common practice when moving on top of the bent cap or when getting in and out of the man basket, to unhook and walk around without fall protection.

The company's Injury and Illness Prevention Program (IIPP) consisted of a two-page document. A safety manager was listed, but his term, according to the IIPP, expired on November 30, 1992. Although the IIPP stated that the Safety Project Manager, or his designee, was responsible for conducting bi-monthly inspections of the worksite, with the first inspection to be carried out within the first month of starting at a worksite, the company had not performed a hazard assessment, site inspection, or job specific inspection of the site. There was no site specific addendum to the IIPP.

The company has a five-page *Field Operation Practices and Safety Code*. This is an all-inclusive document, not specifically for this job. It indicates that safety meetings will be conducted by every foreman before starting work on Monday. Specific job problems could be added to the discussions. One section also required approved safety belts and lanyards to be worn in specific work areas. It also required each worker to inspect his safety belt. Outlines of the weekly safety meetings showed that the issues addressed were general safety issues, although two outlines did have added notes about tying off while working at heights. There was no documentation about the specific discussion regarding tying off. The decedent had signed a roster documenting his attendance at both of the meetings which discussed tying off.

CAUSE OF DEATH

Death was caused by cardiac arrest due to blunt injuries accompanied by intra-abdominal hemorrhage, multiple liver lacerations, right fronto-parietal injury and inferior vena cava tearing. There was also a fracture and dislocation of the right wrist and a fracture of the right femur.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Assure employees have and use proper personal fall arrest equipment when working at heights requiring fall protection.

Discussion: Neither the safety belt nor the lanyard had any proper fall arrest feature. The "D" rings were attached at each hip on the safety belt. This "D" ring arrangement is appropriate for a Linemen's Body Belt, not for arresting a fall. For proper fall arrest, the "D" ring must be located in the area of the back along the spine. The lanyard had no shock absorbing feature to help prevent injury if a fall occurred. Under Title 8 of the California Code of Regulations (CCR's), Section 1670(c): "Lanyards shall be secured to a substantial member of the structure or to securely rigged lines, using energy absorbing devices or methods." If the decedent had his lanyard attached to a member of the structure or to securely rigged lines and fell, he would have been seriously injured using the type of belt and lanyard he was wearing at the time of the incident. Employees must have and use approved safety belts, or, better yet, harnesses, and lanyards when in danger of falling in excess of 7 1/2 feet.

Recommendation #2: Provide appropriate fall protection such as catenary lines, railings or scaffolding for employees working at heights.

Discussion: The policy concerning the use of personal fall protection, as stated by employees, was to tie off to a structural member when actually performing work, but not when moving across the bent cap. Hooking the lanyard itself around an I-beam or truss is inappropriate because it could reduce the lanyard strength by up to 50 percent. Since no catenary line (lifeline) or other means of tying off when moving along the bent cap was provided, moving along the bent cap while not tied off was an unavoidable behavior on the part of the employees. Section 1670(e) of Title 8 of the California Code of Regulations states: "If an employee's duties require horizontal movement, rigging shall be provided so that the attached lanyard will slide along with the employee. Such rigging shall be provided for all suspended staging, outdoor advertising sign platforms, floats, and all other catwalks, or walkways 7 1/2 feet or more above the ground or

level beneath." In lieu of catenary lines, drop lines or other suitable tie offs; railings, scaffolding or the equivalent may be provided to protect from a fall. A railing is defined as "a barrier consisting of a top rail and a midrail secured to uprights and erected along the exposed sides and ends of platforms." Safety nets would have been less appropriate in this situation.

Recommendation #3: Perform an initial hazard assessment of the job prior to beginning work.

Discussion: No initial hazard assessment of the worksite was performed. It was the safety manager's responsibility to do such an assessment. The IIPP stated that such an inspection was to be carried out by the safety manager or his designee within the first month of starting at a worksite, and bi-monthly thereafter. The term of the safety manager had expired according to the IIPP, although the CA/FACE investigator was told that the named individual still had the responsibility. Under Title 8 of the California Code of Regulations, Section 1511(b): "Prior to the presence of its employees, the employer shall make a thorough survey of the conditions of the site to determine, so far as practicable, the predictable hazards to employees and the kind and extent of safeguards necessary to prosecute the work in a safe manner in accordance with the relevant parts of Plate A-2-a and b of the Appendix." Pre-planning projects for fall protection must address a complete system. By setting priorities, fall exposure protection comes into perspective, allowing the hazards to be evaluated and proper protection selected. Had the employer done this, noted the necessity for, and installed catenary lines or other protection, the incident most likely would not have occurred.

Recommendation #4: Train employees, including periodic refresher training, to be aware of and understand the hazards of the job.

Discussion: It was stated that it was unknown if the decedent had any prior training specific to the task he was expected to perform. It was believed that he had such training because he passed his apprenticeship through his union. The CA/FACE investigator was provided with a document which was discussed at a safety meeting on September 11, 1995. It listed eight general safety items with a short discussion of each. Under Employee Safety Recommendations was listed "safety belts/tie off." What was actually discussed was not documented. Section 1510(a) of Title 8 of the California Code of Regulations states: "When workers are first employed they shall be given instructions regarding the hazards and safety precautions applicable to the type of work in question and directed to read the Code of Safety Practices. Additionally, Section 1510(c) states: "Where employees are subject to known job site hazards, such as...they shall be instructed in the recognition of the hazard, in the procedures for protecting themselves from injury, and in the first aid procedures in the event of injury."

Prior to his beginning work, had the decedent received specific training concerning proper types of belts and lanyards, tying off which is consistent with the standards, and that it was necessary for him to comply, this incident most likely would not have occurred.

References

Barclays Official Code of Regulations, Vol. 9, Title 8, Industrial Relations. South San Francisco, CA., 1990.

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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.

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

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