



The National Institute for Occupational Safety and Health (NIOSH)

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Roofer Dies After Being Struck by a Falling Counterweight—Virginia

FACE 9237

SUMMARY

28-year-old male roofer (the victim) died after being struck on the head by a 94-pound counterweight. The counterweight had been catapulted from a swing hoist located on a roof 30 feet above the victim. The victim was one of six roofers who had finished replacing a 9,600-square-foot built-up asphalt roof. Four of the roofers, including the victim, were on the ground placing equipment on the trucks, while the other two roofers were on the 30-foot-high roof lowering the equipment to the ground using a 400-pound capacity swing hoist. The swing boom of the hoist had been welded in place, eliminating the function of the swing hoist. The last piece of equipment to be lowered from the roof was a 55-gallon tar drum mounted on a rubber-tired cart. The four men on the ground pulled on the hoist rope to lift the cart, but as the cart raised, the right front tire caught on the edge of the 12-inch-high roof parapet. The men on the roof asked for, and received, 3 feet of slack in the hoist rope. The two men on the roof then pushed the cart over the edge of the roof. The force created by the 3-foot free fall of the cart and drum caused the swing hoist to tip forward and catapult all six counterweights over the edge of the roof. As the men on the ground began to run away from the building, a 94-pound wooden counterweight struck the victim on the head, causing the fatal injury. NIOSH investigators concluded that, to prevent future similar occurrences, employers should:

- **ensure that equipment is used according to manufacturers' specifications and evaluate any modifications made to equipment to ensure that no potential hazards have been created by such modifications**
- **conduct a jobsite survey to identify potential hazards and implement appropriate control measures for these hazards**
- **provide and require the use of personal protective equipment.**

INTRODUCTION

On September 4, 1992, a 28-year-old male roofer (the victim) died after being struck on the head by a 94-pound counterweight. On September 16, 1992, officials of the Virginia Occupational Safety and Health Administration (VAOSHA) notified the Division of Safety Research (DSR) of this fatality, and requested technical assistance. On September 22, 1992, a DSR safety specialist conducted an investigation of the incident. The incident was reviewed with the company owner, the VAOSHA compliance officer, and the county coroner. Photographs of the site, taken immediately following the incident, were reviewed during the investigation.

The employer was a roofing contractor that had been in operation for 14 years and employed 15 workers. The employer had a written safety program and safety policy detailing the proper techniques for installing warning lines on roofs, for lifting, for ladder inspection and other industry-related tasks. The owner administered the safety program as a collateral duty and crew supervisors were responsible for safety at the worksite. Scheduled monthly safety meetings were held for all employees. Training was accomplished on the job and all workers were trained to operate any new equipment. This was the employer's first fatality.

INVESTIGATION

The employer was contracted to remove and replace an existing 9,600-square-foot built-up asphalt roof. A crew of six roofers was sent to the site to perform the work. The workers accessed the 30-foot-high roof with ladders, and they used a swing hoist, whose boom was welded in place, to transport materials between the ground and the roof. The front of the hoist was placed against a 12-inch-high parapet around the entire perimeter of the roof. The hoist had a lifting capacity of 400 pounds and manufacturer's specifications called for 100 pounds of counterweight to be used for every 200 pounds being lifted. The hoist was equipped with a counterbalance weight rest on which the counterweights were placed. One concrete counterweight weighing 70 pounds and five wooden counterweights, two weighing 107 pounds, and three weighing 109, 135, and 94 pounds each had been placed on the weight rest.

Work on the roof was completed in approximately 1 month. On their final day at the jobsite the workers were lowering the unused materials and equipment to the ground and loading it on the company trucks. Four workers (including the victim) worked on the ground, while the remaining two workers stayed on the roof to hook the loads to the hoist rope. The last piece of equipment to be lowered to the ground was a 55-gallon drum tar dispenser mounted on a 4-wheel, rubber-tired cart. The tar dispenser and cart had been raised to the roof individually at the start of the job; however, tar had accumulated on the latches securing the dispenser to the cart and the latches could not be released. The workers decided to lower the cart and dispenser together. The total weight of the cart and dispenser, measured after the incident, was 266 pounds. The cart weighed 190 pounds, and the dispenser, 76 pounds. Since the boom was welded in place, it projected over the edge of the building and therefore could not be positioned directly over the load. The hoist could not lift the load high enough to clear the 12-inch-high parapet before swinging the load over the edge of the building and lowering it. As a result, the workers on the roof assisted in lifting the dispenser and cart unit from the roof. As they began to push the drum and cart over the parapet, the right front tire caught on the parapet. The workers told the four-man ground crew to give them about 3 feet of slack in the hoist line. When they received the slack line, the workers began to push and lift the right side of the cart. When the right front tire cleared the parapet, the dispenser and cart unit fell over the edge of the roof. The force created by the unit's 3-foot free fall, and the abrupt tightening of the hoist rope, pulled the swing hoist forward off the roof and catapulted all six counterweights over the edge. The workers on the roof yelled to the men on the ground to stand clear. As the four workers on the ground began to run away from the building, the victim was struck on the head by the 94-pound wooden counterweight. The emergency medical service was summoned and transported the victim to the local hospital where he was pronounced dead on arrival.

CAUSE OF DEATH

The coroner listed the cause of death as skull fracture.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that equipment is used according to manufacturers' specifications and evaluate any modifications made to equipment to ensure that no potential hazards have been created by such modifications.

Discussion: In this incident, the boom of the swing hoist was welded in place even though it was equipped with a gravity latch to hold it in place while raising or lowering material. Because of this modification, the boom could not be positioned directly over the load for a straight vertical lift that would have enabled the load to clear the parapet. Instead, because the swing boom projected over the edge of the roof, the tar drum and cart had to be pulled forward and upward

simultaneously. This not only increased the strain on the hoist and counterweight, but made it impossible to lift the load clear of the roof edge before swinging the load out away from the roof to allow it to be lowered. The weight of the tar drum and cart was 266 pounds, and the amount of counterweight used would have been sufficient under normal operating conditions; however, the act of lifting the load with the boom well in front of the load (due to the boom being welded in place) greatly increased the load on the hoist and the counterweights. When the load fell freely for 3 feet, then suddenly tightened the hoist rope, the force exceeded the counterweight, causing the counterweights to be catapulted over the edge of the roof, and the hoist to be pulled forward off the roof. Before making equipment modifications, such as welding the swing boom in place in this case, the equipment manufacturer should be consulted to determine if the proposed modifications will adversely affect the equipment or create any potential hazards. The manufacturer’s design engineers would be best qualified to make this assessment.

Recommendation #2: Employers should conduct a jobsite survey to identify potential hazards and implement control measures for these hazards.

Discussion: Before beginning work at any site, a competent person(s)¹ should evaluate the site to identify any potential hazards and ensure appropriate control measures are implemented. In this incident, the workers on the ground were exposed to the hazard from falling material while the material was being lowered to the ground. The workers holding the hoist rope could have been stationed farther away from the area to which the materials were being lowered to lessen the exposure to falling objects. Additionally, one worker on the ground could have been designated as an observer to give as early warning as possible to the workers if material fell from the roof.

¹ Competent person – one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate them.

Recommendation #3: Employers should supply and require the use of personal protective equipment (PPE).

Discussion: Although it is unlikely that a hard hat would have protected the worker in this incident, PPE such as hard hats, safety-toed shoes and safety glasses provide the worker with protection against falling objects such as hand tools or construction materials. To provide the worker with a safe work environment, employers should provide necessary PPE and require its use.

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