THE UNIVERSITY OF IOWA

COLLEGE OF PUBLIC HEALTH
Department of Occupational and Environmental Health

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

FROM: **Iowa FACE** **Case No. 2010 IA 054** **Report Date: 10 October 2012**

SUBJECT: **Construction laborer fell from ladder**

A 46-year-old employee of a small Amish-owned construction business was fatally injured when he fell from a ladder onto a concrete block foundation retaining wall. The victim worked as a driver and helper for his employer. On the afternoon of the incident, the three-man crew of the construction business was removing shingles to re-roof a private recreation facility. At the end of the work day, the victim carried a tarp up an extension ladder to the roof so the owner could cover the roof in anticipation of impending rain. The victim fell an estimated 10 to 12 feet to the foundation retaining wall located to the left of the ladder. The fall was not witnessed. A stabilizer bar attached to the ladder had come apart from the ladder, and a nylon tie-down strap used to secure the stabilizer bar to the roof had broken when the ladder slid sideways.

The owner of the business heard the victim fall and called 911. Local EMS responders arrived to find the victim unconscious with multiple blunt force injuries to the head, neck, torso, thorax, and abdomen. The victim was transported to a hospital approximately 30 miles away and died 4 hours later.

RECOMMENDATIONS

1. *Use a hoist or pulley to raise and lower the heavy or awkward objects to their destination. Do not carry any objects or loads up a ladder that would cause an employee to lose balance.*
2. *Set up non-self-supporting extension ladders on firm level footing so height-to-base ratio is 4:1. Assure both rails of the ladder maintain equal contact with the supporting structure. Tie or stake the ladder so the top and bottom are secure and unable to move laterally.*
3. *Train employees who use ladders to recognize all fall hazards at the worksite and the means to eliminate those hazards.*
4. *Regularly check ladders and ladder accessories, including straps, stabilizers, clips or bolts affixing stand-off bars or stabilizers – to assure they are intact and not missing, damaged, or worn.*
5. *Use ladders that are sized for the maximum load and capacity that will be needed. Do not load ladders beyond the manufacturer's rated capacity.*

6. *Wear slip-resistant footwear when on ladders. Keep the midline of the body between the side rails of the ladder. Keep "three points of contact" on the ladder at all times.*
7. *Identify effective ways to effectively provide occupational safety resources and training to small special population business owners that may not have access to traditional safety resources such as trade organizations, insurance carriers, or OSHA consultation services.*

INTRODUCTION

A 46-year-old helper in a small construction business was fatally injured when he fell from an extension ladder onto a concrete block foundation retaining wall. Iowa FACE investigators became aware of this incident through the state medical examiner's office two months after the incident, and began a preliminary investigation six months after the incident. Information from the State Medical Examiner's report and autopsy was used to develop this case study. There was no county law enforcement investigative report for this incident, because local EMS responded to a medical call for ambulance. Three telephone interviews were conducted with the owner of the construction business. The employer was unavailable for a personal interview and requested that no photographs would be taken. Iowa FACE staff did not visit the incident site at the time of our investigation because the foundation retaining wall had since been removed and the area had been finish-graded.

INVESTIGATION

The 46-year-old victim had been employed for one year as a part-time helper and driver in an Amish-owned construction business that employed three individuals, including the victim and the owner. The victim's main job was to drive the owner and construction equipment to jobsites since the business owner's religious order does not allow members to own or drive vehicles. The victim also helped on site as needed to bring equipment, tools, or materials where they would be used. The victim was a large man standing 6 feet tall and weighing 271 pounds.

In fall of 2010, the three-man crew was working on a project that involved renovating a semi-private recreation club four miles from the nearby town. An addition had already been removed from the building, and a concrete block foundation retaining wall remained adjacent to the clubhouse section of building where the crew was working.

On the afternoon of the incident, the crew was tearing off shingles from the intact section of clubhouse (next to the foundation retaining wall and section that had been razed), in preparation to reroof the building. Weather conditions were clear. Temperatures ranged from 50 to 80°F over the work day. At the time of the incident temperature was approximately 75°F with 5 mph winds. Rain was forecast for the evening, and the crew was preparing to finish the day's work and cover the exposed section of roof.

The roof peak of the structure was 24 feet high; the distance from grade to the eaves on the section being roofed was approximately 20 feet. A new 32-foot, 2-section non-self-supporting fiberglass extension ladder (Exhibit 1) was used to access the roof, and was extended an estimated 25 feet,

approximately 3 feet beyond the roof eaves. The ANSI duty rating of the ladder was not known. A stabilizer bar (Exhibit 2) was affixed to the upper section of the ladder with pins and clips. A nylon tie-down strap (Exhibit 3) attached to the stabilizer bar was screwed onto the roof deck to secure the top of the ladder in position. The type and size of the tie-down strap and the screw used to secure the strap to the roof was not known. The bottom of the cleated ladder rested on dry level ground of earth and gravel, but was not staked to the ground or secured to a permanent fixture.

Exhibit 1. *Example* of a 2-section fiberglass extension ladder

Exhibit 2. *Examples* of ladder stabilizers

Exhibit 3. *Examples* of tie-down straps, not specific to this investigation

Near the end of the work day, the helper announced to the owner that he was bringing a tarp up to the roof because rain was forecast for that evening. The owner, working on the opposite side of the roof gable where he could not see the ladder and victim, heard the clatter of the ladder falling after the tarp was brought to the roof. He quickly came over the gable roof to see the helper lying on the foundation retaining wall of the structure that was razed. The tarp was on the roof, and the bottom of the ladder had slid sideways and fallen to the ground. The nylon tie-down strap was broken, but the screwed-down section of strap was still affixed to the roof, and the stabilizer bar had come apart from the ladder. The business owner immediately called 911 on his cell phone at 1654. The victim had fallen an estimated minimum distance of 10 to 12 feet onto the elevated area of the foundation retaining wall located to the victim's left as he traversed the ladder.

The local town's EMS service arrived to find the victim unconscious. The victim suffered multiple blunt force injuries of the head, neck, torso, thorax, and abdomen. He was transported by ambulance to a regional hospital emergency room approximately 30 miles away and died 4 hours later.

Neither the owner nor the coworker witnessed the helper fall, but the owner noted that in the course of the fall, the nylon tie-down strap broke and that one end of the strap still remained screwed to the roof deck. The stabilizer bar had come free of the ladder. There were grooves in the earth approximately one-half inch deep and several inches long where the ladder cleats slid sideways. The ladder itself was not found to be faulty. The owner suspected the victim lost his balance as he put the tarp on the roof or shortly thereafter and may have tried to jump to the elevated area next to the foundation retaining wall. No information was available regarding the victim's footwear or whether his footwear played a part in the fall.

CAUSE OF DEATH

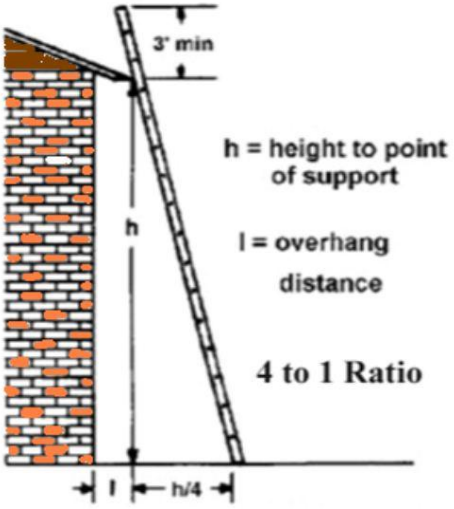
The state medical examiner reported the cause of death as *multiple blunt force injuries* and the manner of death as *accident*. The nature of victim's injuries indicated that he fell head-first.

RECOMMENDATIONS AND DISCUSSION

Recommendation 1. *Use a hoist or pulley to raise and lower the heavy or awkward objects to their destination. Do not carry any objects or loads up a ladder that would cause an employee to lose balance.*

Employees should not carry objects or loads: both hands must be kept free for climbing, with the climber maintaining three-point contact (two hands and one foot, or two feet and one hand) on the ladder at all times. Carrying objects could cause loss of balance while on a ladder. It is not known how the helper carried the tarp, or if both hands were free to grasp the ladder as he ascended. The unsafe action of carrying a tarp up the ladder, and placing or tossing on the roof may have contributed to the victim's loss of balance and fall. To carry heavy or large objects like a tarp to the rooftop, a hoist or pulley should be used only after the worker has reached the top (i.e., the roof in this case). If hoists are used, workers should make sure the ladder load rating is appropriate for the total weight of the load, including the hoist, when the hoist is affixed to the ladder. Small tools or objects should be carried in tool belts or pouches around the waist, keeping both hands free for climbing or descending the ladder.

Recommendation 2. *Set up non-self-supporting extension ladders on firm level footing so height-to-base ratio is 4:1. Assure both rails of the ladder maintain equal contact with the supporting structure. Tie or stake the ladder so the top and bottom are secure and unable to move laterally.*



Non-self-supporting extension ladders should be positioned at a proper angle and put on a firm level base. A ladder not perfectly level at the bottom will become unstable when a worker climbs on it: for example, a 20-foot ladder that is not level by ¾ inch at the bottom will be out of plumb 14 inches at the top, causing it to be unstable a worker reaches the top.

Non-self-supporting ladders leaned against a wall or other support should be positioned at an angle such that the horizontal distance from the support to the base of the ladder is one-quarter the distance of the vertical height of the ladder (i.e., the angle of the ladder should be about 75° to horizontal, Exhibit 4). If the ladder is too close to the building (too steep an angle) the ladder may tip backward; if it is too far from the building, the ladder may be put under greater stress than it was intended to handle, and ladder may slip out at the bottom.

Exhibit 4. Proper height-to-base ratio and ladder angle to set up portable extension ladders

In this fall, the stabilizer came free of the ladder when the single nylon tie-down strap broke. A more secure fixture would have been to use appropriate-strength rated nylon straps (selected according to safe load limit and breaking strength) to affix the top end of each ladder rail to the roof. The ladder should also have been secured at the bottom, by tying or staking both bottom rails to the ground or to fixed structures (Exhibit 5). Securing the ladder at the bottom as well as the top may have prevented this ladder from lateral movement if the victim reached or leaned to the side while climbing or placing the tarp.

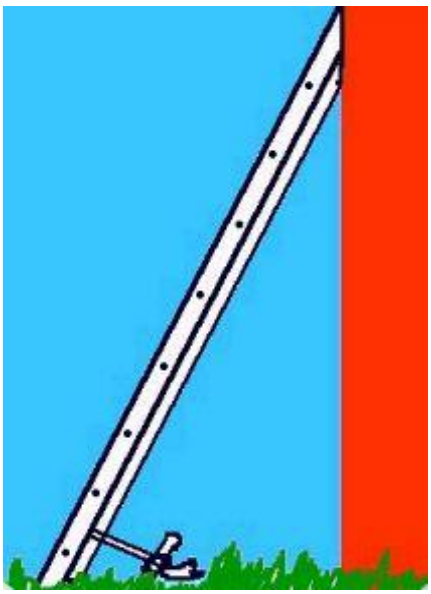


Exhibit 5. Bottom of ladder staked to ground

Recommendation 3. *Train employees who use ladders to recognize all fall hazards at the worksite and the means to eliminate those hazards.*

Falls in the workplace are now the second leading cause of workplace fatalities, with recent statistics indicating that about 2 workers die each day because of a fall from ladders, scaffolds, building or other elevations. NIOSH recommends that employers create comprehensive fall-prevention programs that include educating employees in recognizing fall hazards and avoiding unsafe conditions, providing protective equipment, and training employees in the appropriate use of this ladders and related safety equipment.

OSHA requires workers be trained in site-specific ladder safety, which would include evaluation of the environment in which the ladder is used. This should include a site survey to determine optimal placement of the ladder with respect to hard surfaces around the site to minimize risk of injury should the worker fall off the ladder. While Iowa FACE could not investigate the position of the retaining wall during due to the completion of the construction project at the time of this investigation (the foundation wall had been removed and the area was finish-graded), the consideration to maximize the distance between the concrete wall relative to the ladder position is appropriate during site survey prior to beginning work. Additional risk factors such as collision hazards, traffic, and unstable ground should be considered in the site survey.

Recommendation 4. *Regularly check ladders and ladder accessories, including straps, stabilizers, clips or bolts affixing stand-off bars or stabilizers – to assure they are intact and not missing, damaged, or worn.*

Before each use of a ladder, inspect the ladder for broken parts (rungs, steps, side rails, feet and locking positions), grease, or other contaminants that could cause slips or falls, and for paint or stickers that could hide possible defects and warning labels. Ladder accessories, such as straps, clips, and bolts to fasten a ladder against a wall or other support, must likewise be inspected before use to assure they are intact and not worn, cut or frayed.

Recommendation 5. *Use ladders that are sized for the maximum load and capacity that will be needed. Do not load ladders beyond the manufacturer's rated capacity.*

Ladders have a maximum capacity for weight and should not be loaded beyond this maximum load. The duty rating (load capacity) for the ladder involved in the incident was not known. Ladders with ANSI duty rating of Type IA (extra heavy duty industrial, capable of supporting 300 lbs.) or Type IAA (special duty, capable of supporting 375 lbs.) would have been appropriate for the victim's weight.

Recommendation 6. *Wear slip-resistant footwear when on ladders. Keep the midline of the body between the side rails of the ladder. Keep "three points of contact" on the ladder at all times.*

Wearing slip-resistant footwear, keeping one's belt buckle between the ladder side rails, and maintaining either two feet and one hand, or two hands and one foot in contact with the ladder at all times will help workers maintain balance on the ladder. In addition, ladders should be kept free of slippery material such as oil, grease or wet paint.

Recommendation 7. *Identify effective ways to effectively provide occupational safety resources and training to small special population business owners that may not have access to traditional safety resources such as trade organizations, insurance carriers, or OSHA consultation services.*

Occupational safety research on and outreach to Amish communities has focused on agricultural injuries, youth, and transportation. Little has been done to determine the occupational safety and health needs of, and effective delivery methods to, small Amish-owned businesses that are growing in number as families seek to support their agricultural income with construction or trades. These small businesses - which often include family members - and have limited, if any, access to current safety recommendations, updates, or consultation services that traditional non-Amish business do through their insurance carriers, trade organizations, state OSHA consultation services, and the internet. Efforts are needed to support these underserved communities by creating culturally sensitive materials and using participatory methods for training and education.

Keywords: construction, laborer, fall, ladder

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Fatality Assessment and Control Evaluation

Fatality Assessment and Control Evaluation (FACE) is a program of the National Institute for Occupational Safety and Health (NIOSH), which is part of the Centers for Disease Control and Prevention of the US Department of Health and Human Services. Nationally, the FACE program identifies traumatic work-related deaths, conducts in-depth studies of select cases, makes recommendations for prevention, and publishes reports and alerts. The goal is to prevent occupational fatalities across the nation.

The NIOSH head office in Morgantown, West Virginia, carries out an intramural FACE case surveillance and evaluation program and also funds state-based programs in several cooperating states. The Iowa FACE program is conducted by the Injury Prevention Research Center at the University of Iowa working in conjunction with the Iowa Department of Public Health and its Office of the State Medical Examiner.

NIOSH combines its and the state programs' information for wide dissemination, in a variety of forms, among the industries involved. NIOSH publications are available on the web at http://www.cdc.gov/NIOSH/FACE/ and from the NIOSH Distribution Center (1-800-35NIOSH).

Iowa FACE also publishes its case studies, issues precautionary messages, and prepares articles for trade and professional publications. In addition to postings on the national NIOSH website, the information is posted on the Iowa FACE website (www.public-health.uiowa.edu/FACE/) .

The Iowa FACE team at the University of Iowa includes Marizen Ramirez, Director; Corinne Peek-Asa, Co-Investigator; John Lundell, Co-Investigator; T. Renée Anthony, Co-Investigator; and Stephanie Leonard, Field Investigator. Additional expertise is provided from the Iowa Department of Public Health, including Rita Gergely, Principal Investigator; Kathy Leinenkugel, Surveillance Specialist; and John Kraemer, Director, Forensic Operations at Iowa Office of the State Medical Examiner.

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