

MARYLAND DIVISION OF LABOR AND INDUSTRY

MARYLAND FACE PROGRAM

CASE: 94MD004

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To: Project Officer, State FACE Project, Division of Safety
Research, NIOSH, CDC

From: Maryland FACE Program, Division of Labor & Industry

Subject: Carpenter Dies Following 13-Foot Fall From a Scaffold
Collapse While Setting Trusses on a Barn Construction in
Maryland.

SUMMARY

A 37 year old male carpenter died from head injuries sustained when he fell 13 feet from a carpenters' bracket scaffold that collapsed when a bracket failed.

The victim and co-workers were engaged in erecting a barn and were in the process of positioning prefabricated roof truss assemblies on the partially completed structure. The victim and two co-workers were on a carpenter's bracket scaffold mounted on the north side of the barn structure positioning and fastening the truss assemblies along with three other co-workers who were located on a similar scaffold attached to the south side of the structure. The scaffold brackets had been fabricated by the contractor using 1/2 inch angle iron and had been attached to the barn posts with dual head nails and chains wrapped around the posts above the topmost horizontal structural member, or wall girt. The barn posts were spaced 10 feet on center and the scaffold working surface was wooden planks. A truss assembly had been lifted into place by a truck crane. While the victim was using a sledgehammer to position the truss assembly, the bracket directly under him failed and the scaffold collapsed. The victim and a co-worker fell to the ground. During the fall, the co-worker was able to slow his descent by grabbing onto a wall girt. Following the collapse two co-workers went to the aid of the victim and began CPR. Another co-worker went to a nearby farmhouse and notified the emergency medical service. The victim was transported by ambulance to a local hospital where he was pronounced dead 57 minutes after the incident.

The Maryland FACE investigator concluded that, to prevent similar occurrences employers should:

**ensure that scaffolding used on the jobsite is in compliance with safety regulations that specify their design, strength, condition, materials, and supports.*

**should establish safety programs that will instruct employees in safe work practices and the recognition of safety hazards including regular and careful inspection of all scaffold components and attachment.*

INTRODUCTION

On February 3, 1994 a 37 year old male carpenter died from head injuries sustained after he fell 13 feet to frozen compacted soil when the scaffold he was working on collapsed. Maryland Occupational Safety and Health (MOSH) officials notified the FACE investigator several hours after the event to conduct an investigation. The investigator went to the site and reviewed the incident with MOSH Occupational Safety and Health Inspectors and made an initial contact with company representatives. Police and Medical Examiner reports and photographs of the site were requested and reviewed. Design specifications supplied by the building manufacturer for the construction of the scaffolding system were also reviewed. Subsequent interviews were conducted with the manager of the construction company and an uninjured worker who had been on the collapsing scaffold.

The employer was a construction contractor primarily involved in the sale and erection of pre-engineered buildings. The company functioned as a regional dealer for the manufacturer's national distribution network. The company employed eight people, including the owners. Six of these workers and the operator of a rented truck crane were on the site the day of the incident. Four of the employees of the company were carpenters. The company had been in business for five years, and a dealer for four years.

The company did not have written safety policies or a designated safety officer. Unwritten safety rules for commonly performed tasks were communicated to employees orally. Safety issues pertinent to each job were discussed prior to beginning work and tailgate meetings were conducted to address specific issues as required. Safety instruction materials were provided by the building manufacturer. Task specific training and training for new hires was performed on the job. The stability of the work-force was cited by management as an asset contributing to the excellent safety record of the company. The victim had been with the company during its entire five year history and had six years of carpentry experience prior to this job. The scaffolding system being used at the time of the incident had been used for most of the buildings erected by the company and all of the employees, including the victim, were familiar with its use.

INVESTIGATION

The victim was one of six employees engaged in securing pre-fabricated roof truss assemblies to the posts of a barn under construction. The day was cold and windy with partial cloud cover. The ground surface at the building site was frozen compacted earth. The framing of the 60 by 90 foot wooden barn was nearly complete. The crew was securing the third and final truss section to be placed on the morning of the incident.

Access to the work area was provided by two carpenter's bracket scaffolds. One scaffold was attached to the south side of the barn structure and one to the north side of the structure. The scaffolds consisted of planks supported by 37 1/2 by 34 by 44-inch triangular shaped brackets. The brackets had been fabricated by the contractor from 1/2 inch angle iron (figure). Each bracket was attached to the barn structure by two 12d dual head nails driven through the bracket into a barn post and a thirty-two inch (32") length of chain wrapped around the post above the top wall girt. The design specifications for the bracket, which had been supplied to the contractor by the building manufacturer, called for one end of the chain to be welded to the vertical member of the bracket and the other to be secured by a hook welded onto the horizontal bracket member.

The truss assemblies consisting of three roof trusses and connecting purlins were being lifted from the ground by a truckcrane to the top of the barn structure where they were moved into final position by the workmen using sledgehammers.

Three workers, the victim and two co-workers, were on the north side scaffold while on the south side scaffold three other workers were also fastening the trusses to the posts. The employees were wearing hard hats. No fall protection was used and guardrails were not installed. A truss assembly had been lifted and swung into place and the victim was engaged in positioning the truss on a post. The victim was using the sledgehammer, or had just finished and had begun fastening the bottom chord of the truss to the post when the bracket directly under him failed and two scaffold planks which overlapped at the bracket collapsed. The victim fell 13 feet to the ground striking his head on the frozen soil. The co-worker nearest the victim on the scaffold also fell however, he was able to slow his descent by grabbing on to a wall girt which then collapsed. He injured his lower extremities when he struck the ground. A third co-worker on the north side scaffold was able to keep from falling by grabbing on to a wall girt. He then climbed down to the ground and joined the other co-workers in aiding the victim and the injured worker.

Two co-workers went to the victim and began CPR when they realized he was not breathing. One co-worker ran to the nearby farmhouse to notify the EMS and then went to the roadway to wait for the paramedics. The EMS unit responded in approximately ten minutes. The EMS spent about five minutes preparing the victim for transport, meanwhile continuing CPR. The victim was transported to a local hospital where he was pronounced dead on arrival. According to the information on the death certificate fifty-seven minutes elapsed between the time of the incident and the time of death.

Investigation revealed that collapse of the scaffold occurred when the chain link welded to the bracket broke allowing the weight of the workers to pull the bracket away from the building.

CAUSE OF DEATH

The medical examiner listed the cause of death as head injuries.

RECOMMENDATIONS/DISCUSSION

Recommendation #1Employers should ensure that scaffold components conform to safe design specifications and are maintained in safe condition.

Discussion: 29 CFR 1926.451 addresses the use of scaffolds in general and includes safety requirements for carpenter's bracket scaffolds used during construction. The requirements state that scaffolds should be capable of supporting without failure at least four times the maximum intended load; damaged or weakened accessories such as braces, brackets, etc. should be replaced or repaired immediately; carpenter's brackets should be attached with "metal stud attachments"; and brackets should be attached no more than 8 feet apart. The brackets used for the scaffold had been fabricated by the employer according to specifications supplied by the building manufacturer. Brackets of this design had been load tested by the manufacturer and had withstood a load of 1,420 pounds before the attaching nails had failed by pulling out of the wooden supports. During the test, the chain had successfully supported the load after 3/4 inch of nail pullout. The tested bracket had been secured by four 16d nails as opposed to the two 12d nails used to secure the bracket involved in the incident. During the investigation, the chains of some of the brackets used at the site were observed to be taut, apparently supporting scaffold loads, while others were slack. The Uniform Building Code rates a 12d common nail with 1 5/8 inches of penetration as capable of supporting 94 pounds in Douglas Fir, Larch, or Southern Pine when driven perpendicular to the grain.

The specifications of the load test performed by the building manufacturer used four 16d nails. The Uniform Building Code rates a 16d common nail with 1 3/4 inches of penetration as capable of supporting 107 pounds under the conditions described above.

Examination of the failed bracket showed that the failure occurred in the chain link welded to the vertical member of the bracket and that the link had been cracked sometime prior to the incident. The cross-sectional area of the parent metal of the chain link at this location had also been significantly reduced during welding. This bracket was unique in relation to other brackets in use in that the chain link was welded to the vertical member of the bracket while the other brackets had the chain link welded to the horizontal bracket member.

Placement of the link on the vertical member differed from the design specifications supplied by the building manufacturer.

The brackets used in this incident were attached to the posts of the building which by design are placed on 10 foot centers. The design of the carpenter's bracket scaffold requires attachment to the building. CFR 1926.451(m)(3) states the brackets must not be more than eight feet apart. In this case, the posts of the building are the only members strong enough to support the load of the scaffold, but they were separated by ten foot intervals. The additional

two feet of scaffold supported between brackets may not be an important factor in the failure of this scaffold, but did add to the load each bracket was supporting. When the recommended 8 foot spacing cannot be adhered to, an alternative scaffolding system could be used to provide reduced spacing between supports or offer increased load carrying ability. Scaffolding systems should be selected that fit the requirements of the job and conform to the applicable safety standards.

Recommendation #2Employers should establish safety programs that will instruct employees in safe work practices and the recognition of safety hazards including regular and careful inspection of all scaffold components and attachment.

Discussion: A safety and health program as required by 1926.20(b)(2) would "...provide for frequent and regular inspections of the job sites, materials, and equipment by competent persons...." A competent person for the purposes of this regulation is an individual "... who is capable of identifying existing hazards in the surroundings or working conditions which are...hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." Regular and careful inspection of scaffold components and attachment could ensure that hazards are identified and corrected before workers are exposed.

REFERENCES

29 CFR 1926, Code of Federal Regulations, Office of the Federal Register, Washington, D.C.

Huntington, W.C. & R.E. Mickadeit (1981). Building construction materials and types of construction 5th ed.. New York: John Wiley and Sons.

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Fatality Assessment and Control Evaluation

The Maryland Division of Labor and Industry administers the Fatality Assessment and Control Evaluation (FACE) Program under a cooperative agreement with the National Institute for Occupational Safety and Health, Division of Safety Research (NIOSH/DSR). The Maryland FACE Program performs investigations of selected occupational fatalities, prepares summary reports, and engages in prevention activities. The goal of our program is to prevent fatal work injuries in the future by studying the the working environment, the worker, the task being performed, the tools employed, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

NIOSH/DSR developed the FACE research protocol in the early 1980s and continues to perform FACE investigations. To increase the research and prevention activities of NIOSH/DSR, states across the nation have been invited to participate in the State FACE Project. Maryland and the fourteen states listed below currently participate in the State Based FACE Project: Alaska, California, Colorado, Georgia, Iowa, Indiana, Kentucky, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Wisconsin, and Wyoming.

Additional information regarding this report or the Maryland Face Program is available from:

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