The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

22 Year-Old Construction Worker Dies When Excavation Collapses

FACE-8510

INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), is currently conducting the Fatal Accident Circumstances and Epidemiology (FACE) Project, which is focusing primarily upon selected electrically-related fatal injuries and confined space fatalities. By scientifically collecting data from a sample of fatal accidents, it will be possible to identify and rank factors which influence the risk of fatal injury for selected employees.

On February 28, 1985, a 22 year-old worker was hand digging a dry well at a house, when one wall of the approximately 8-feet deep excavation collapsed trapping him beneath 6 feet of earth. The collapse occurred sometime between 9:30 a.m. and 11:30 a.m.; the precise time of the wall collapse is unknown since the victim was working alone. The owner of the house where the victim was working notified the fire department that the excavation had caved in, and the worker was not in sight. The fire department responded and recovered the body from the excavation. The county medical examiner attributed the worker's death to mechanical impairment of respiration (suffocation).

Contacts/Activities

On March 6, 1985, DSR was notified of the incident by a NIOSH Region IV consultant. The Georgia Environmental Health Section of the Department of Human Resources requested technical assistance from NIOSH in evaluating this fatality. On March 12, 1985, a DSR research team consisting of a safety engineer and a safety specialist, met with the general contractor, who provided information about the fatal incident, and referred the researchers to the subcontractor who was the victim's employer and the County Department of Public Safety which coordinated the rescue efforts.

Additional interviews were held with the Director of the County Department of Public Safety, a member of the fire department's Emergency Medical Team that responded to the call, the subcontractor who employed the victim, and the owner of the house where the incident occurred. A site survey was not possible since work had been completed and the work area had been cleaned up. Pictures taken by the fire department of the house and excavation site subsequent to the rescue were provided by the Director of Public Safety, who also authorized release of the medical examiner's autopsy report.

SYNOPSIS OF EVENTS

The general contractor specializes in repairing storm or fire damage to property in a large metropolitan area, and employs between 15 and 20 workers. The house had been struck by lightning during an electrical storm, resulting in damage to its foundation. The general contractor had dug out around the foundation of the house, completed repairs, backfilled the foundation, and was cleaning up the work area when the owner of the house noticed damp spots on an interior wall. The general contractor subcontracted to a masonry company to extend the footer drainage line to a dry well. In order to perform this work, the subcontractor had to excavate (hand dig) the trench for the drainage line and the hole for the dry well. The location of this excavation work was beyond the previously backfilled area. The general contractor characterized the soil as “loose, sandy-type clay,” while the subcontractor said it was ‘Georgia red clay.”

The subcontractor, who had been in the masonry business for over 20 years, had dug only 2 or 3 trenches in his career. The victim had been employed as his only helper for about 3 months prior to the accident, and had no previous experience in the type of work performed. The victim had been digging the trench by hand for approximately 2 days, and by the morning of the cave-in had nearly reached the desired depth. The owner of the house, who had not gone to work that morning due to illness, reported that he saw the victim working in the trench at approximately 9:30 a.m. and briefly talked with him. At approximately 11:30 a.m., the owner of the house walked to his mailbox, and noticed that the victim’s shirt was hanging on the fence, and that his truck was still there, but the victim was not in sight. He saw that a wall of the trench had caved in, and called the general contractor to find out if the victim had left. When he received a negative reply, he immediately called the fire department and reported the cave-in and the possibility that a worker was trapped beneath the collapsed earth.

The fire department received a telephone call from the owner of the house at 12:12 p.m. At 12:18 p.m., the first fire department unit arrived at the house, and by 12:26 p.m. rescue personnel had begun digging. Approximately 6 feet of material had to be removed to reach the victim, who was located at approximately 12:43 p.m. Due to the position of the body, the wall appeared to have caved in around the victim’s feet. The victim’s arm was above his head as if he had attempted to climb out, but the further collapse of the wall had pressed him down into a “hunched” position. The earth near the bottom of the trench was very wet, and looked like packed mud. In fact, rescue personnel working in the bottom of the trench had mud near the tops of their boots. At 12:54 p.m., the victim was extricated from the collapsed earth. Emergency medical personnel immediately began administering CPR, but enroute to the hospital reported that the victim was apparently dead (1:22 p.m.).

CONCLUSIONS/RECOMMENDATIONS

The following factors contributed to this fatality:

1. Neither the general contractor nor the subcontractor had an established, documented safety program.

According to the general contractor on the job, the company safety program was the responsibility of the field foreman and consisted primarily of a ‘hard hat and safety shoes` approach. The general contractor admitted that although this safety equipment was provided and its use was encouraged, it was only worn when a boss was on-site. The foreman was expected to outline the rules and procedures in the field based on his experience. The company did insist that no one work alone, since in a previous incident the foreman’s brother had been injured on a job, and had bled to death before help arrived. The subcontractor also relied on his own experience for safety in work activities. He reported that he hired non-experienced workers who were trained on the job. The subcontractor’s work crew at the time of the accident consisted only of himself and a helper (the victim).

RECOMMENDATION: **Safety programs should be developed which include criteria for employee selection which include written safe work procedures, including specific procedures for hazardous activities (such as excavation work) and which provide appropriate equipment/techniques as are required to mitigate such hazards.**

2. **Both employers lacked experience in shallow excavation work (from, 5 to 24 feet deep in Class A and B soils, and from 5 to 15 feet in Class C soils. See Table 1 [1]).**

Although the general contractor and subcontractor had considerable experience in foundation/footer work, which typically involves excavations of a maximum of 2 to 3 feet in depth, neither had experience in deeper excavations. Although in the business for 30 years, the general contractor had only been associated with one other excavation of comparable depth. During a career spanning over 20 years, the subcontractor had only dug two or three previous trenches of comparable dimensions. The victim had no experience In excavation work.

RECOMMENDATION: **Contractors, subcontractors, and all other industrial operators and workers, particularly in smaller companies, should approach work activities with which they are unfamiliar or in which they are inexperienced, with extreme caution. An effort should be made to contact available sources of information regarding potential hazards and methods of mitigating those hazards. Federal OSHA and NIOSH, as well as many State and local safety and health organizations, provide consultation services to the private sector, and should be contacted in such circumstances.**

3. Given the condition/type of soil and the depth of the excavation, safeguards were not utilized to protect the worker

The loose, sandy-type clay involved in this fatal accident would be considered, according to NIOSH/NBS recommended soil classification system, as at best a Type B, and possibly, due to saturation with water from the drainage line, a Type C soil (See Table 1) . Due to the potential instability of these soil types, NIOSH/NBS has recommended that the walls of excavations in such soil be either braced with shoring, trench shields, or trench boxes, or be sloped back to protect workers in the “zone of exposure’ from being injured due to mass movement of rock or soil. In this particular case, the vertical walls of the excavation should have been sloped at an angle of 1/2:1 (horizontal/vertical) ratio. If a portion of the wall was saturated with water, as may have been the case according to witness reports, the slope should have been at least 1:1 (see Figure 1).

RECOMMENDATION: **Any excavation (other than in stable rock) which is greater than 5 feet in depth, should be shored, shielded, and/or sloped in accordance with the NIOSH/NBS recommended draft construction safety standards for excavations. (1) Excavations at depths of less than 5 feet may require shielding, shoring, or sloping “when examination of the ground by a competent person indicates that hazardous ground movement may occurred.**

A. The subcontractor employed hand digging to excavate the drainage line and dry well area.

Sloping and sharing requirements are difficult to attain without appropriate mechanical excavation equipment or shielding/sharing systems. Lack of appropriate equipment, such as backhoes or commercially available shoring systems, trench shields, or trench boxes, can place a small subcontractor at a competitive disadvantage. However, prime contractors should require subcontractors to have appropriate equipment to accomplish the work safely.

RECOMMENDATION: **Although tools and equipment which enhance safety may be considered as additional economic burdens to small contractors, minimum safety requirements must be met. The requirements to either slope or shore excavations should be implemented.**

5. The worker was working alone at the time of the wall collapse.

The presence of another worker in a safe location at the job site may have enhanced the victim’s chance of survival.

RECOMMENDATION: **When workers must work in excavations, at least one person should be standing by in an unexposed area to respond or seek help in case of emergency.**

REFERENCE

1. Yokel, F.Y.; Stanevich, R.L. Development of Draft Construction Safety Standards for Excavations, Vol. 1. An NBS/NIOSH Publication. NBSIR 83-2693, DHHS NIOSH) Publication No. 83-103. Washington, DC: May 1983.

Table 1. Soil Classification System [1]

Soil Type	Description	Wt. 1b/ft^3	Steepest Allowable Slope (horizontal:vertical)	
			Depth 12 ft. or less	Greater than 12 ft.
A	Intact Hard	20	1/2:1	1/2:1
B	Medium	40	1/2:1	3/4:1

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Notes:

1. Type A: Intact Hard Soils include stiff clays and clayey (cohesive) sands and gravels (hardpan, till) above the ground water table which have no fissures, weak layers, or inclined layers that dip toward the bank of the excavation. Stiff clays included have an unconfined compressive strength q_u =1.5 tons per square foot (tsf) or more. Intact hard soils subject to vibrations by heavy traffic, pile driving or similar effects are Type B.

2. Type B: Medium Soils are all soils which are not Type A or C.

3. Type C: a. Soft Soils include cohesive soils with an unconfined compressive strength of 0.5 tsf or less and soils that cannot stand on a slope of 3 horizontal: 1 vertical without slumping (muck).

4. Layered Systems (two or more distinctly different soil or rock types or micaceous seams in rock) which dip toward the bank of the excavation with a slope of 4 horizontal: 1 vertical or steeper are considered Type C. Layered soils are classified in accordance with the weakest layer.

5. Rock: Unstable rock shall be considered Type B when it is dry and Type C when it is submerged. Stable rock is exempt from shoring and sloping requirements.

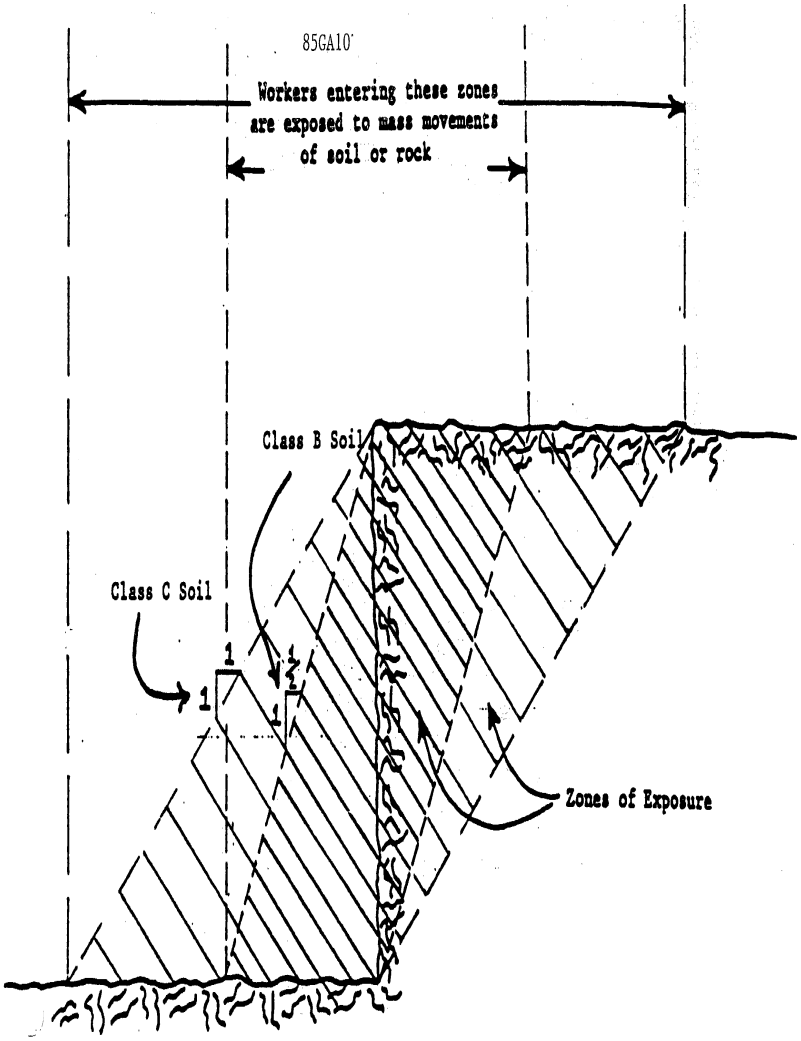

Figure 1. Zones of Exposure Relative to Type/Condition of Soil
Adapted from [1].

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Last Reviewed: November 18, 2015