

Trenching Is a Dangerous and Dirty Business!

by Jim Boom

Tragically, every year workers continue to lose their lives from trench or excavation cave-ins. What is even more tragic is that virtually all of the cave-in fatalities could have been prevented by following OSHA's excavation standard.¹ Newspaper articles reporting these tragedies are often accompanied by photos of coworkers or fire department rescue teams attempting to rescue the victims, sometimes placing the would-be rescuers in danger as well. These accidents happen because persons responsible for providing a safe workplace choose to ignore well-known safety requirements for trenches and excavations.

Trenching and excavating work is dangerous. In 1998, 33 workers lost their lives while doing excavation work, with cave-ins accounting for nearly 70 percent, or 23, of the fatalities.² Five deaths resulted from employee contact with backhoe buckets within an excavation. The remaining fatalities were due to electrocution and crushing incidents from dropped

loads and/or equipment rollovers into an excavation.

In light of OSHA's strong enforcement since the beginning of its special emphasis program³ in 1985, these fatality numbers are perplexing for anyone in the safety business. For example, from October 1997 through September 1998, the number of excavation inspections accounted for 8.2 percent⁴ of the total number of all construction inspections conducted in that year. The total amount of penalty proposed for excavation violations, however, represents 21 percent⁵ of the total penalties for all construction violations. In 1998, two out of the top 10 violations cited for all of the construction industry were for excavations.⁶

³ Special Emphasis Programs allow programmed inspections where there is a potential for high hazards resulting in injuries or illness. A programmed inspection targets a specific industry and related safety and health hazards. In the case of trenching, OSHA inspectors focus on trenching and excavating activities and their associated hazards to help prevent accidents and injuries. See also OSHA Compliance Directive CPL 2.69, *Special Emphasis: Trenching and Excavation*, September 19, 1985. Available on OSHA's website at www.osha.gov under **Compliance Directives** and **Regulations and Compliance**.

⁴ OSHA IMIS data base Fiscal Year 1998 (Federal Only).

⁵ Ibid.

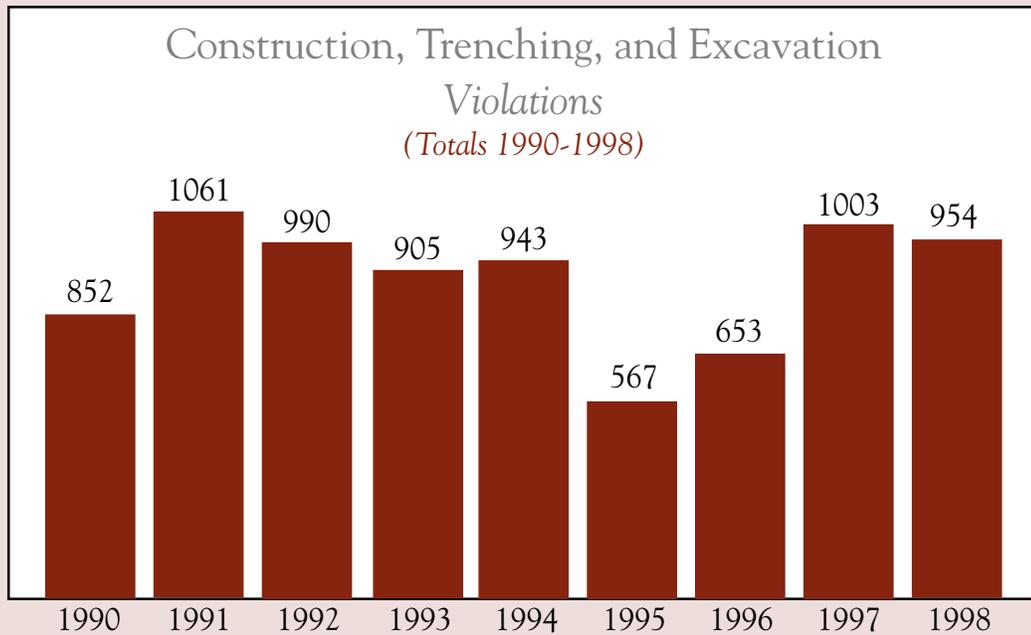
⁶ Ibid.

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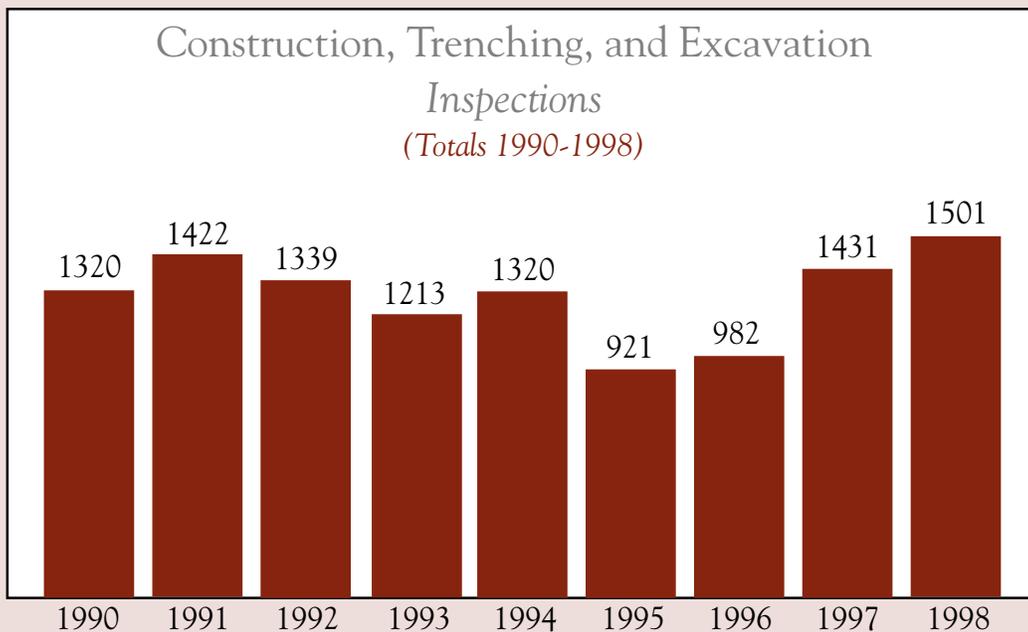
The weight of soil sloughing off the side of an unprotected trench can cause a crushing blow to an employee on the bottom, resulting in a serious injury or fatality. The financial consequences for an employer knowingly exposing employees to unprotected trenches and violating the excavation standard also can be devastating to a company or corporation.

Construction is one of five high-hazard industries OSHA is targeting to reduce injuries and illnesses.⁷ During Fiscal Year 1999, OSHA's Directorate of Construction reviewed more than 70 construction inspection cases each with proposed monetary penalties in excess of \$100,000. Thirty percent of the cases reviewed involved contractors that allegedly violated the excavation standard.

⁷ See OSHA's *Strategic Plan* for 1997-2002, dated September 18, 1998, under **About OSHA** at www.osha.gov.



Source: OSHA's Integrated Management Information System (IMIS) data base for Fiscal Year 1998 (Federal Only).



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This construction site has inadequate sloping, no shoring or trench shield, no safe egress, improper use of ladders, and cluttered walking and working surfaces. These hazards expose employees to potential broken bones and severe lacerations from slips, trips, and falls and to serious injuries or death from being crushed or suffocated from a cave-in.

Preventing Accidents in Excavations

What can be done to help prevent these tragic accidents? Key to prevention is the employer's leadership and commitment to a good safety and health program. Moreover, a crucial player in excavation safety is the company's designated competent person. "Competent person" is more than a title. OSHA defines a competent person as one who is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to employees, and who also has authorization to take prompt corrective measures to eliminate or control these hazards and conditions. A designated person who is unfamiliar with the excavation requirements, who is unable to recognize hazards, or who doesn't have the authority to make corrective measures may miss a life-threatening condition.

A "competent person" knows the requirements of the excavation standard and his or her safety role. The competent person is responsible for analyzing and classifying soil; selecting and installing appropriate protective systems; placing spoil piles; providing safe egress; determining the appropriate proximity of equipment or traffic that could cause vibrations

to excavation walls; being aware of changes in weather, water, or other conditions that may increase the risk of cave-in; and assessing dangerous atmospheres, water seepage, underground utilities, adjacent structures, dangerous work practices, deficiencies in protective systems, and much more.

How Much Dirt Is Too Much?

Training employees to recognize excavation hazards is very important. When OSHA compliance officers inspect unprotected trenches, they often find that employees who are exposed to the danger of cave-ins have not been adequately trained to recognize the hazards in their work environment. Sometimes workers don't realize how much dirt weighs and that a small amount of soil sloughing off in an unprotected trench can injure them.

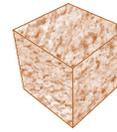
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Weight of Volkswagen



2,785 pounds

Weight of 1 Cubic Yard Soil



2,700 pounds

One cubic yard of soil can weigh 2,700 pounds or more. That's only 85 pounds lighter than a new Volkswagen Beetle.

As a training exercise, one can stress the weight of soil by comparing it to things people can relate to. For example, 1 cubic foot of soil can weigh 100 pounds or more. Compare the weight of a cubic foot bag of concrete mix to a cubic foot of soil. The concrete mix usually weighs about 60 pounds. A chunk of earth the size of a washing machine can weigh 1,500 pounds or more. One cubic yard of soil can weigh 2,700 pounds or more. That's only 85 pounds lighter than a new Volkswagen Beetle.

The world weightlifting record for the "press" is still held by the Russian Vasily Alexeyev at 521.5 pounds. The world record for the "clean-and-jerk" is 573 pounds, held by another Russian, Andrey Chemerkin. How many people do you know who can even press a

third of that weight? One cubic yard of soil weighs nearly five times the world weightlifting records. Could you push back 500 pounds of soil with your arms or legs or, more importantly, could you breathe or even survive under the weight?

Plain old dirt is so heavy that when you get caught under it, you do not have the strength to move or breathe as the dirt presses against your chest. Think about it! That's why trenching work needs special protective systems—so workers can go home safe and healthy at the end of the day.

Protective Systems

OSHA's excavation standard requires employers to provide sloping (or benching), shoring, or shielding to protect employees in excavations 5 feet or more in depth. The only exception is for a trench dug in stable rock, where there is no loose soil or likelihood of a cave-in. Excavations less than 5 feet deep need not be protected unless a competent person has determined there is a cave-in hazard.

At a minimum, companies should remember the three s's—sloping, shoring, or shielding—when protecting employees and follow the guidance given in the



A fire department rescue team helps a worker to safety after a trench cave-in.

OSHA excavation standard's⁸ appendices for sloping, shoring, and shielding.

Despite OSHA's ongoing efforts in outreach, voluntary compliance, training, and rigorous enforcement of the excavation standard, some contractors still choose to ignore excavation safety. Contractors willing to take risks to save time and money at the expense of protecting employees should consider the potential consequences. The ultimate consequences are the loss of lives or disabling injuries. Taking short cuts could also lead to damaged equipment, property or structure damage, loss of insurance or increased insurance premiums, law suits, public scrutiny from bad press, or an OSHA inspection resulting in monetary penalty or other legal or criminal consequences.

⁸Title 29 of the Code of Federal Regulations (CFR) Part 1926.650-652.

For those contractors who continue to take the "low road" in excavation safety, who believe that "it's such a short job, shoring or sloping is not worth the trouble," a word of advice—be aware of the public's heightened awareness of trenching and excavation hazards before you violate the law. More and more referrals for trenching inspections are from citizens, fire and rescue personnel, local and state police, consulting engineers, building officials, and others.

Contractors wishing to take the "high road," who want to learn more about protecting employees in excavations, and who believe that avoiding the risk of cave-in is always worth the trouble have many resources available to them, including OSHA's webpage at <http://www.osha.gov>. This Internet site includes topics such as safety standards, safety training centers, available courses,

materials and publications, and listings of non-OSHA resources nationally and worldwide. The site also has a **trenching** information page dealing with site evaluations, hazard recognition and control, compliance, training, and more.

Another electronic resource is the OSHA *Technical Manual* (TED 1-0.15A) Section V: Chapter 2, which summarizes the excavation standard and can assist safety and health consultants, OSHA field staff, and others in recognizing and preventing trenching and excavation hazards.

Employers also can contact their designated OSHA state or territory consultation office for guidance. Under Section 7(c)(1) of the *Occupational Safety and Health Act*,⁹ this program provides free onsite consultation to small employers. The program helps employers in evaluating their worksites for existing and potential hazards and in complying with OSHA regulations. Additionally, regional offices have designated compliance staff who are proficient in various disciplines such as trenching and excavation.

Partnerships

In addition to its strong enforcement, OSHA continues to stress the importance of outreach and partnership as a way to improve worker safety and health. One of OSHA's most recent initiatives is the Construction Accident Emphasis Program (CARE) in Florida. OSHA staff are building cooperative relationships with employers, educators, national and local trade groups, unions, insurance groups, state consultation staff, and others to focus on small employers within the state to help

reduce the number of fatalities in the construction industry.

CARE focuses on the top four hazards in construction: falls, struck-by (e.g., equipment or machinery), electrocution, and caught-in or between (e.g., equipment, buildings, and materials). This cooperative effort seeks innovative ways to prevent construction accidents through media, advocacy groups, religious organizations, Internet, town hall meetings, and special outreach materials. Similarly, OSHA's Philadelphia region is considering a special outreach effort with business and unions to heighten the awareness of the dangers of trenching work.

What's more, OSHA has its own Training Institute in Des Plaines, IL, which offers a variety of safety and health courses for federal and private sector employers and em-

ployees. A schedule of classes is available under **Outreach** on OSHA's website at www.osha.gov.

As statistics show, employers and contractors must do more to protect their employees working in excavations. OSHA is willing to help employers who need guidance, training, or information on trenching issues.

For more information on these and other available services, visit OSHA's website or contact your nearest OSHA Area Office or the Directorate of Construction in OSHA's National Office at (202) 693-2020. **JSHQ**

Boom is an occupational safety and health specialist in OSHA's Office of Construction Services, Directorate of Construction, in Washington, DC.



The workers shown here could suffer severe injuries or death from a potential cave-in. The trench has no sloping, shoring, shielding, or safe exit; the workers have no hard hats or personal protective equipment.

⁹ Public Law 91-596, December 29, 1970. As amended by P.L. 101-552, 3101, November 5, 1990; and P.L. 105-241, September 29, 1998.

Reminders for Trenching and Excavations

Competent Person

The designated competent person must have the authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required, and be able to demonstrate the following:

- Training, experience, and knowledge of:
 - Soil analysis;
 - Use of protective systems; and
 - Requirements of *Title 29 Code of Federal Regulations (CFR) Part 1926 Subpart P*.
- Ability to detect:
 - Conditions that could result in cave-ins;
 - Failures in protective systems;
 - Hazardous atmospheres, understand utilities, and other hazards as noted below.

Surface Crossing of Trenches

Surface crossing of trenches should be discouraged; however, if trenches must be crossed, such crossings are permitted only under the following condition:

- Vehicle crossings must be designed by and installed under the supervision of a registered professional engineer.

Walkways or bridges must be provided for foot traffic. These structures shall:

- Have a safety factor of 4;
- Have a minimum clear width of 20 inches (0.51 meters);
- Be fitted with standard guard rails; and
- Extend a minimum of 24 inches (.61 meters) past the surface edge of the trench.

Access and Egress

Access to and exit from the trench require the following conditions:

- Trenches 4 feet or more in depth must have a safe means of egress.
- Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 feet laterally to the nearest means of egress.
- Ladders must be secured and extend a minimum of 36 inches (0.9 meters) above the landing.
- Metal ladders must not be used when working around utilities where inadvertent contact could cause electrical shock or electrocution.

Exposure to Vehicles

Procedures to protect employees from being injured or killed by vehicle traffic include:

- Providing employees with and requiring them to wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility materials.
- Requiring a designated, trained flagperson as well as signs, signals, and barricades when necessary.
- Back up alarms where necessary.

Exposure to Falling Loads

Employees must be protected from loads or objects falling from lifting or digging equipment. Some procedures designed to ensure their protection include:

- Employees may not work under raised loads.
- Employees must stand away from equipment that is being loaded or unloaded.
- Equipment operators or truck drivers may only stay in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.
- Head protection.

Warning Systems for Mobile Equipment

One or more of the following steps must be taken to prevent vehicles from accidentally falling into the trench:

- Install barricades where necessary.
- Use hand or mechanical signals as required.
- Install stop logs if there is a danger of vehicles falling into the trench.
- Grade soil away from the excavation; this will assist in vehicle control and channeling of runoff water.

Hazardous Atmospheres

Employees shall not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with:

- Less than 19.5 percent or more than 23.5 percent oxygen;
- A combustible gas concentration greater than 20 percent of the lower flammable limit; and
- Concentrations of hazardous substances that exceed those specified in the Threshold Limit Values for Airborne Contaminants established by the American Conference of Governmental Industrial Hygienists.

All operations involving such atmospheres must be conducted in accordance with OSHA requirements for occupational health and environmental controls (see Subpart D of 29 CFR 1926) for personal protective equipment and for lifesaving equipment (see Subpart E, 29 CFR 1926). Engineering controls (e.g., ventilation) and respiratory protection may be required.

When testing for atmospheric contaminants, the following should be considered:

- Testing should be conducted before employees enter the trench and should be done regularly to ensure that the trench remains safe.
- The frequency of testing should be increased if equipment is operating in the trench.
- Testing frequency also should be increased if welding, cutting, or burning is done in the trench.

Employees required to wear respiratory protection must be trained, fit-tested, and enrolled in a respiratory protection program.

Emergency Rescue Equipment Inspections

Emergency rescue equipment is required when a hazardous atmosphere exists or can reasonably be expected to exist. Requirements are as follows:

- Respirators must be of the type suitable for the exposure. Employees must be trained in their use and a respirator program must be instituted.
- Lifelines must be provided and attended at all times when employees enter bell-bottom pier holes or other similar hazards.

Standing Water and Water Accumulation

Methods for controlling standing water and water accumulation must be provided and consist of one or more of the following if employees are permitted to work in the excavation:

- Use of special support or shield systems designed for additional loading.
- Water removal equipment, i.e. well pointing, used, and monitored by a competent person.
- Safety harnesses and lifelines used in conformance with 29 CFR 1926.104.
- Surface water diverted away from the trench.
- Employees removed from the trench during rainstorms.
- Trenches carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench.

Inspections must be made by a competent person and should be documented. The following guide specifies the frequency and conditions requiring inspections:

- Daily and before the start of each shift;
- As dictated by the work being done in the trench;
- After every rainstorm;
- After other events that could increase hazards, e.g. snowstorm, windstorm, freeze/thaw, earthquake;
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur;
- When there is a change in the size, location, or placement of the spoil pile; and
- When there is any indication of change or movement in adjacent structures.

Source: U.S. Department of Labor, Occupational Safety and Health Administration, *OSHA Technical Manual*, Section V, Chapter 2, *Excavations: Hazard Recognition in Trenching and Shoring*, "X. Special Health and Safety Considerations" (Washington, DC). See also *Subject Index* at www.osha.gov.