



Supervisors' Safety Update

Ideas and Strategies for Leaders



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EXCAVATION CAVE-INS ARE THE PITS!

By SeaBright Insurance Loss Control

Trench accidents and fatalities, mostly due to inadequate or no excavation support, have remained at an even pace for fifteen years in the United States, killing an average of one person per week. No one intends to be injured on the job, but since moving soil is an everyday operation in construction, those who work in this industry often overlook the hazards and fail to take necessary precautions. Yet, with proper controls and training, these deaths are avoidable.

WHAT IS AN EXCAVATION?

To understand excavation hazards, we must first clarify what is meant by the term. In its simplest form, an excavation is nothing more than a man-made opening in the earth. Just as a wound on a worker's arm will heal over time, the earth will always attempt to close an injury on its surface. Even stable rock, if it is cut in any way that changes its stability, will move and change. Signs along mountain roads warn of falling rock because, over time and due to weather as well as natural and manmade events, changes in the stability of rock and soil take place. It is important to recognize that *every unsupported excavation will cave-in*—it is only a matter of time.

All work that deals with excavation and trenching—both terms generally referred to as “excavations”—must comply with safety codes. Federal OSHA standards must be followed when an excavation is deeper than *five* feet. Twenty states, Washington for example, have stricture requirements, where controls must be in place for any hole over *four* feet in depth. Excavations discussed in this article are those that measure no more than 20 feet in depth. Protective systems for excavations deeper than this must be designed by a Professional Engineer.

This article does not attempt to examine every aspect of the regulations or excavation hazards. Its goal is to discuss the overall concept of excavation safety. For further detailed information, refer to OSHA 29 CFR 1926 - Subpart P, upon which this article is based, look up your state-specific regulation, or contact your SeaBright Loss Control Consultant.

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ALL SOILS ARE NOT CREATED EQUAL

Cave-ins and collapses can occur without warning, but they are seldom-mysterious events. The place to begin understanding the hazards of the trench or hole being dug is to recognize its soil type. Soil is classified into four categories that determine the type of protection required when workers must enter the trench:

Stable Rock – Stable rock is a natural, solid mineral that can be excavated with vertical sides and remains intact during the period it is exposed. For purposes of excavation safety, many rock formations are not stable. For

instance, if rock is fractured, fissured or faulted it must usually be classified as Type “A” soil, not “stable rock.”

Type “A” Soil – Next to rock, this is the firmest soil. It is defined as a *cohesive* soil, which includes clay, sandy clay, and clay loam. Cemented soils, which are commonly called hardpan, are also classed as Type A soil. It is important to note that a number of conditions *exclude* soil from this category. A soil cannot be classified as type A if it is:

- Fissured
- Subject to vibration from heavy traffic, pile driving, etc.
- Disturbed or has been disturbed at any previous time;
- Trenched and the trench is built on sloping Type “A” soil that is sloped at a 4:1 (horizontal to vertical) or greater
- Subject to any other factor decreasing its stability.

Because of these restrictions, soil in most construction situations is categorized as Type “B” or Type “C.”

Type “B” Soil – This includes granular *cohesion less* soils, including angular gravel, silt, silt loam and sandy loam. It also includes all previously disturbed soils other than those classed in Type “C.” Type “B” also includes dry rock that is not stable. A majority of construction soils fall into this class.

Type “C” Soil – Granular soils including gravel, sand and loamy sand; submerged soils or soil from which water is freely seeping; and submerged rock that is not stable, are all classed as type C. Since this class is the least stable of all, materials which will not fit into the above three categories fall into the Type “C” classification.

TYPES OF CAVE-IN PROTECTION

Several methods of protection are available for excavations under 20 feet in depth that will increase worker safety. They are sloping, benching, shoring, and shielding. These are all efficient methods of protection, but their safe use depends upon the type of hole being dug, its depth, and the length of time that access into the excavation is needed.

Sloping / Benching – When sloping back the sides of an excavation, the slope starts at the bottom edge of the excavation. Benching is a stair-step version of sloping and is commonly combined with sloping to provide the most efficient use of equipment and sloped area. Fixed standards define the maximum degree of slope required for the four types of soil. The basic requirements to be maintained are listed in the table below. In some cases, variations to these are allowed, and are specifically defined in the governing standards:

Soil or Rock Classification	Maximum Allowable Vertical to Horizontal Slope (Ratio & Degrees)	
Stable Rock	Vertical	90°
Type A	¾ :1	53°
Type B	1:1	45°
Type C	1½ :1	34°

Shoring – Shoring is another common means of providing protection for workers in a trench. In this method, the sides of the excavation are braced against each other by structural components. The material used must have sufficient strength to prevent the soils from collapsing. Shoring systems can include timber, screw jacks, aluminum pneumatic and hydraulic shoring, steel sheet pile or a combination of these. There are two types of shoring systems, passive and active. Passive systems are installed after the trench has been excavated. Active systems is installed prior to or during the excavation process and protects existing and aboveground facilities. Some examples of active systems include beam and plate, slide rail, manhole brace systems, and sheet and brace systems.

Shields – Shielding in excavations is the third type of protection and is becoming the most common for trench work. Shields do not prevent cave-ins nor do they brace the excavated walls. Instead, they provide protection to the worker only. This equipment is *set into* or *pulled through* a trench when workers need to enter the excavation. The employee then works within the shield walls and is protected from cave-ins and spalling material by the shield. Always remember that the shields must be tall enough so that 18” of the top of the shield extends *beyond the top* of the cut. This extension provides protection from “spoil pile” sloughing off as well. Shields, or “trench boxes,” are designed and constructed by various vendors with no code requirements, so it is critical to deal with quality suppliers, when purchasing this form of protection. Shields are a passive system that will not prevent the earth from moving and will not protect nearby structures from earth moving damage.

Spoil Piles – Along with all these protection methods, the excavation material or spoil must be placed a minimum of 2 feet away from the edge of the excavation. In practical terms however, 2 feet is too close. Spoil piles often slough down and cover a portion of this width. The two-foot space is intended to reduce top surcharge pressure (the weight of nearby construction equipment, materials or existing buildings) and to allow workers access around the excavation. Providing a safer distance of 4 feet, measured from the edge of the cut to the bottom of the sloughing pile, permits greater access and reduces the surcharge pressure on the excavation walls.

PLANNING & MONITORING FOR SAFETY

Every successful job begins prior to the start of physical work. Digging trenches and excavations is no exception. Pre-planning can include holding a tailgate meeting prior to the start of work when hazards can be discussed. Alternatively, it can involve a detailed written plan, developed before this phase of the project, that requires considerable time and thought. The important factor is that the activity is well thought-out, with safety included as an integral part of the plan. Simple agreements such as where to place the spoil and where access points will be located will increase the project’s level of efficiency and safety.

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Pre-planning for excavation work can include many factors. Here are a few examples:

- Calling the utility companies and having their locator service identify any existing lines or wires buried in the area of the planned excavation.
- Determining the soil type and anticipating what worker protection will be required.
- Arranging to have ladders or other equipment on hand for access into the hole.
- Pre-determining the location or placement of the spoil pile.
- Setting out signage or barricades to warn and protect workers and the public.
- Creating and discussing an emergency plan, in the event of an incident.
- Locating and flagging overhead power lines to be avoided by heavy equipment.
- Pulling the crew together to review the work and the planned safety controls.
- Making sure a Competent Person is on the project to evaluate the soil and monitor the hazards.

THE COMPETENT PERSON

One of the more significant parts of the safety plan is to ensure that the designated safety person has adequate experience for accurately determining the soil type and required safety precautions. Safety codes name the person who is to be held accountable for this role a *Competent Person*.

A “competent person” must be able to identify existing and predictable hazards that relate directly to trenching and excavation. This means the person must know the difference between types of soils and must be able to accurately classify the soil. They must be able to recognize slopes, such as 4:1 (vertical to horizontal). This person must be able to observe moisture levels and their importance to the excavation’s stability or collapse. They must be able to recognize previously disturbed soils, since this material is commonly less stable than undisturbed soils.

The competent person must review the excavations in their charge at least daily, or more often if needed, to ensure the safety of those who enter. Their review must include such things as the effects of rain, freezing or thawing, surcharge loads, shock and vibration from other construction activities, nearby traffic, etc. These issues represent significant hazards and for this reason, a responsible person must have the ability to take thorough charge of the situation.

When a Competent Person recognizes a hazard it is critical that they also have the *authority* to stop the work, remove workers from the hazardous area, or arrange for safety controls in the excavation before letting anyone re-enter the area. If this person does not have such authority, he or she cannot be responsible for the safety of employees. Choose this person carefully. Be sure they have the necessary experience and adequate authority so their decisions will not be undermined by *any* other project personnel.

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Soil Type Tests: The Competent Person must make a least two tests to determine the soil type. One must be visual and the other a manual analysis in the field. Descriptions of the tests and how to interpret the results are found in the OSHA standard, Subpart P, Appendix A (d). Tests must be completed daily or as conditions (weather, surcharges, new traffic patterns, etc.) occur. If the excavation is long or large, multiple tests should be conducted to ensure that protection and controls are based on the excavation’s most hazardous soil type. Inspections are not required during periods when employees will not be exposed to a hazard.

SUPERVISOR RESPONSIBILITY—WORKER PROTECTION

The site supervisor has overall control of the site, and is assisted by the competent person to protect the workers from excavation and trenching hazards. Supervisors should actively participate in the training of employees to convey the importance of excavation safety and the authority of the Competent Person. Ensuring worker safety is the supervisor’s most important job. His or her excavation safety responsibilities should include such things as:

- Verifying that safety information is well understood by employees and that all questions are answered.
- Reviewing worksite conditions at least daily, to confirm that they are safe for employees.
- Determining means of protection that will be used for the excavation and having equipment ready.
- Determining if the excavation and its protective systems must be designed and/or approved by a registered professional engineer. This must be done when excavations are over 20’ in depth, or are unusually dangerous.

EMPLOYEE RESPONSIBILITIES:

Excavation workers must be adequately trained to become a responsible part of the team. Although it is the Competent Person who must monitor the excavation, workers must know the hazards, controls, and the emergency plan in the event of a crisis. Training sessions should clarify:

- Expected work practices, and what steps must be followed during general excavation activity.
- What PPE will be required in the excavation? Typical equipment may include safety shoes, hard-hats, eye protection and fall protection devices.

- Correct procedures to be followed if a hazardous atmosphere exists or could reasonably be expected to develop during excavation work.
- The company's plan for emergency and non-entry rescues. This includes identifying who will call the rescue services and who will report incidents to the office.

THE EXCAVATION SAFETY PLAN

All personnel involved in excavations must plan for their own safety and avoid costly incidents that delay the project. Everyone must understand the importance of the following:

- **Personal protective equipment (PPE):** Hard-hats must always be worn as protection from falling debris or spoil. Workers should never be allowed to walk beneath loads that are being handled by lifting or digging equipment. In addition, workers should stand away from any vehicle being loaded or unloaded, to avoid being struck by any material spillage. Safety shoes and eye protection are also typical equipment.
- **Fall Protection:** Any worker standing at the edge of an excavation which is *6 feet deep or more* must be protected from falling into the hole by a guardrail system, fence, barricade, set-back or other approved fall protection means. The hole is treated just as any other fall hazard in construction.
- **Walkways:** Walkways must be provided when employees or equipment must cross over an excavation. Guardrails must be provided on walkways that personnel use any time the walkways are located 6 feet or more above lower levels. When employees pass beneath a walkway, toe-boards must be provided. If walkways are for use by the public, it is appropriate to install guardrails, mid-rails and toe-boards—whatever the height may be above the lower level.
- **Worker Access:** One of the most important items of concern is to provide methods for employees to enter and exit the hole. Ladders, stairs or ramps, in any combination, must be provided when employees are required to enter excavations over 4 feet deep. If the trench or excavation is long or large and deeper than 4 feet, safe means of egress must be located to require no more than 25 feet of lateral travel for employees. If ladders are used, they must extend above the excavation a minimum of 3 feet, following the same rules that are applied to any construction ladder. Structural ramps used for access or egress of equipment must be designed by a person qualified in structural design.
- **Testing the Atmosphere:** In excavations over 4 feet deep, if a potential for a hazardous atmosphere exists, such as the existence of methane near a land fill, the excavation must be tested and ventilated prior to worker entrance. *Permit Required Confined Entry Procedures* may be required if a hazardous atmosphere exists.
- **Exposure to traffic:** Many excavations and trenches are located near public or private roads, or near construction access roads. When employees are exposed to traffic hazards, they must wear a warning vest or other high-visibility garment that is provided by the employer.

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DO NOT LET YOUR EXCAVATION BECOME AN EMPLOYEE GRAVE!

Excavations and trenches kill people every year in alarming numbers. Safety devices, regulations, and safe work practices have been developed so that employee injury or death need never take place from this avoidable exposure. Excavation safety must be taken seriously because, too often--excavations collapse. Take time to pre-plan the work and keep employee awareness high. Do not let your excavation become an employee grave!

Excavations Are Serious Business