

Let's discuss excavation and trenching hazards which include cave-ins, fires, explosions, electrocutions and engulfing due to utilities, struck by falling objects, falls and equipment rollovers, asphyxiation, toxic exposures, and explosions due to hazardous atmospheres. All of these can lead to property damage, injury, or death.

The primary hazard of trenching and excavation work is employee injury from a cave-in. Before workers enter a trench, a soil analysis should be conducted to determine the appropriate employee protection methods such as sloping, benching, shoring, or shielding.

### **Soil Classifications**

Some of the compliance methods permitted under the Excavation standards require a competent person to classify soil and rock deposits as stable rock, Type A soil, Type B soil; or Type C soil

**Stable Rock** is a natural, solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

**Type A soils** are cohesive soils with an unconfined compressive strength of one and-a-half tons per square foot or greater. Examples of Type A soil would be clay, silty clay, , and clay loam. Certain conditions disqualify soil from being classified as Type A. For example, no soil is Type A if it is fissured or has been previously disturbed.

**Type B soil** includes cohesive soil with an unconfined compressive strength greater than 0.5 tons per square foot but less than 1.5 tons per square foot and granular cohesionless soils, such as angular gravel, similar to crushed rock, silt, silt loam, sandy loam, and, in some cases, silty clay loam and sandy clay loam.

**Type C soil** is a cohesive soil with an unconfined compressive strength of 0.5 tons per square foot or less, granular soils such as gravel, sand, loamy sand, submerged soil, or soil from which water is freely seeping, submerged rock that is not stable, or material in a sloped, layered system where the layers dip into the excavation or with a slope of four horizontal to one vertical or steeper.

Employers must also consider potential struck-by hazards associated with heavy equipment, falling loads, and public vehicular traffic near the excavation operations.

Another thing to consider is the potential hazards which may arise from undermining or damaged sidewalks and buildings. In addition, we can't forget about hazardous atmospheres and electrical hazards from overhead and underground power lines.

### **Cave-In Protection is Mandatory**

Select appropriate protective systems based on existing soil conditions and soil analysis.  
All excavations are hazardous because soil can be unstable.

If workers are not using protective systems or equipment while working in trenches or excavations that are five feet or greater in depth, they are in danger of being crushed by a cave-in.

A cave in where soil or rock suddenly falls or slides into an excavation with enough quantity to entrap, bury, injure, or immobilize workers. Soil Gravitates downward pressure pushes the soil inward towards the trench. The bottom third of the wall typically fails first. Soil above the collapsed lower wall then follows.

### **Pre-Job Planning**

Managing hazards to excavations and trenching through Pre-job planning is vital to incident-free excavation work; safety cannot be compromised as work progresses. The following concerns must be addressed by a competent person:

Evaluate soil conditions and select appropriate protective systems. [29 CFR 1926 Subpart P Appendix A and 29 CFR 1926 Subpart P Appendix F].

Construct protective systems in accordance with the standard requirements. [29 CFR 1926.652]  
Contact utilities such as gas, electric, water, and sewage to locate underground lines.

Plan for traffic control if necessary and be prepared to support utilities like pipes and ducts passing through excavations when necessary.

### **Underground Utility Lines and Pipes**

Before starting work, the Excavation standards require employers to determine the approximate location(s) of utility installations including sewer, telephone, fuel, electric, and water lines. One common industry practice is to call 811, the “Call Before You Dig” number, to establish the location of any underground utility installations in the work area.

Contact and notify the utility companies or owners involved to inform them of the proposed work within established or customary local response times.

Ask the utility companies or owners to establish the location of underground installations prior to the start of excavation work. If they cannot respond within 24 hours (unless the period required by state or local law is longer) or cannot establish the exact location of the utility installations, employers may proceed with caution, which includes using detection equipment or other acceptable means to locate utility installations.

Determine the exact location of underground installations by safe and acceptable means when excavation operations approach the approximate location of the installations.  
Ensure that while the excavation is open, underground installations are protected, supported or removed as necessary to safeguard workers.

And determine proximity to structures that could affect choice of protective system.

### **Hazardous Atmosphere**

The competent person should test for hazardous atmospheres such as low oxygen, hazardous fumes, and toxic gases, especially when gasoline engine-driven equipment is running, or when the soil has been contaminated by leaking lines or storage tanks.

When necessary, there must be adequate ventilation or respiratory protection for workers. Appropriate protection must also be provided if water accumulation is, or becomes a problem. For example, will the water be removed? Or will it be diverted?  
Safe access into and out of the excavation must always be provided and inspected.

### **Excavation Inspection**

The Competent Person must inspect the excavation, adjacent areas, and protective systems daily at the start of the shift, after a rainstorm or after any other hazard increasing event. The Competent Person will look for evidence of a situation that could result in a possible cave-in, indication of failure of the protective system, hazardous atmospheres or other hazardous conditions.  
Keep excavations open only for the minimum amount of time needed to complete operations.

### **Look for standing water and test for atmospheric hazards**

Ensure a trench with an accumulation of water is inspected by a competent person before entering. Excavations may present risks of hazardous atmosphere and water accumulation. If any of these conditions exist, workers could be exposed to the possibility of suffocating, inhaling toxic materials, being burned or engulfed by fire, or drowning.

Don't enter a trench until it's been properly inspected by a competent person. Because the conditions of an excavation can change during the course of work, even a properly protected excavation or trench can become compromised. So, even if all the inspections are conducted, workers may still be in danger due to changing conditions.

### **Avoid Unsafe Conditions**

Workers must be trained to report changes to the competent person or supervisor immediately. Your employer is responsible for instructing you, and all employees on how to recognize and avoid unsafe conditions as well as the regulations applicable to the work you're doing. This will assist you in avoiding unsafe conditions.

### **Protective Systems**

In many cases, the type of protective system needed is well-known and straightforward. At other times employers will undertake the more complex process of designing a protective system. Designing a protective system requires considering many factors, including soil classification, depth of cut, soil water content, weather and climate, and other operations in the vicinity.

Employers can choose the most practical design to provide the necessary protections. Any system used must meet the required performance criteria. The Excavation standards describe various methods and approaches that can be used to design protective systems.

Examples of protective systems that can be used to comply with the Excavation standards include sloping and using a trench box.

Or sloping the sides of the excavation to an angle no steeper than one and a half to one. So, for every foot of depth, the trench must be excavated back 1 and a half feet. A slope of this gradation is safe for any type of soil.

Another option is to design a sloping and benching system in accordance with tabulated data, such as tables and charts, approved by a registered professional engineer. This data must be in writing and must include enough explanatory information. This must include the criteria used for selecting a system and the limits on using the data for the user to choose an appropriate protective system.

At least one copy of the data, which identifies the registered professional engineer who approved it, must be kept at the worksite during construction of the protective system. After the system is completed, the data may be stored away from the jobsite, but a copy must be provided upon request to an OSHA compliance officer.

The Excavation standards don't require a protective system when an excavation is made entirely in stable rock or when an excavation is less than 5 feet deep as long as a competent person has examined the ground and found no indication of a potential cave-in.

In addition to cave-ins and related hazards, workers involved in excavation work are exposed to hazards involving falling loads and mobile equipment. To protect workers from these hazards, OSHA requires employers to take certain precautions. For example, employers must:

1. Protect workers from excavated materials or equipment that could fall or roll inside the excavation. A retaining device or placing materials and equipment at least 2 feet from the edge should keep the materials or equipment from falling or rolling into the excavation.
2. Provide some type of warning system, such as barricades, hand or mechanical signals, or stop logs when mobile equipment is operated adjacent to an excavation, or when equipment must approach the edge of an excavation, and the operator does not have a clear and direct view of the edge.
3. Protect workers from loose rock or soil that could fall or roll from an excavation face. This is normally done by scaling, which removes loose material. Protective barricades are an option, and a good idea. Barricades should be installed at appropriate intervals.
4. Prohibit workers from working on faces of sloped or benched excavations or at levels above other workers unless the workers are adequately protected from falling, rolling, or sliding material or equipment.
5. Prohibit workers from standing or working under loads being handled by lifting or digging equipment.
6. Require workers to stand away from vehicles being loaded or unloaded to protect them from being struck by any spillage or falling materials. Operators, of course, may remain inside the cab of a vehicle being loaded or unloaded if the vehicle is equipped, with adequate protection for the operator.
7. Ensure that any worker who enters a bellbottom pier hole, wears a harness with a lifeline. The lifeline must be attached securely to the harness and must be separate from any line used to handle materials. Also, the lifeline must be individually attended by an observer at all times when the worker wearing the lifeline is in the excavation.

When employers share the details of their safety and health programs with workers, they should emphasize the critical role workers play in keeping the job site safe. Employers also need to emphasize specific practices that will help reduce the risk of on-the-job injuries at excavation sites.

**These practices are to know where underground utilities are located before digging.**

- Keep excavated soil and other materials at least 2 feet from trench edges.
- Keep heavy equipment away from trench edges.
- Identify any equipment or activities that could affect trench stability.

**Test for atmospheric hazards such as low oxygen, fumes, and toxic gases when workers are more than 4 feet deep.**

- Inspect trenches at the start of each shift.
- Inspect trenches following a rainstorm or other water intrusion.
- Inspect trenches after any occurrence that could have changed conditions in the trench.
- Do not work under suspended or raised loads and materials.
- Ensure that personnel wear high-visibility or other suitable clothing when exposed to vehicular traffic.

A plan for evacuating personnel and equipment in case of emergency and for controlling flooding should continuously be developed and posted. In government projects, this is a requirement before project start.

**In wrapping up**

Use safe means to determine the exact location for utilities and if required, obtain a digging permit. Classify soil and install properties of protection prior to entry of the trench or excavation. Provide fall protection for employees exposed to falls of 6-feet or greater. And, don't overlook that the public must also be protected.