

Excavation and Trenching Safety

Excavation and trenching work is performed thousands of times daily in all types of conditions. Increasing your awareness of the hazards associated with excavation work and understanding the laws, regulations, and company safety policies and procedures associated with your work will help keep you safe.

Soil Dynamics

Soil is extremely heavy. It can weigh more than 100 pounds per cubic foot, and a cubic yard may weigh more than 2,700 pounds (1,600 kilograms per cubic meter). That is more than 1 ton, the equivalent weight of a pickup truck, in less space than an average office desk!

A collapse doesn't have to completely cover a worker to be fatal. The typical point of failure in most excavations is within the **bottom third** of the excavation. Under pressure from the soil above, this part of the wall will break off from the side wall. This creates an undercut area at the base of the excavation. **Gravity** then brings down overhead soil.

Soil Conditions

Moisture plays a major role in the cohesiveness of the soil. Hazardous soil conditions can be created by having either too much or too little moisture. Weather conditions change soil stability. Do not go into trenches/excavations if water has accumulated or is freely seeping in.

Vibration caused by equipment and processes or nearby traffic can also change soil stability.

Weight from equipment, excavated soil or other materials can contribute to collapse if placed near the unsupported face of an open excavation or trench. Soil, tools and materials must be kept at least 2 feet (0.6 meters) from the excavation or trench edge (keep them further away if required/reasonable).

Loose material that is subject to falling should be removed from the side walls.

Remove or support **large items** near the excavation (e.g., sidewalks, buildings).

Soil Classifications

Soil is classified as stable rock, Type A soil, Type B soil and Type C soil, or combinations of these four classifications. The A, B and C classifications relate to the cohesiveness of soil.

Stable rock is natural, solid mineral. It is more stable than any type of soil.

Type A (the most cohesive) is mostly stable, usually consisting of clay, silty clay and hardpan.

Type B soils can consist of previously disturbed soils, except those that would be classified as Type C, or soil that meets strength requirements of Type A but is fissured or subject to vibration. Type B soil has medium stability and can consist of silt, sandy loam, medium clay and unstable dry rock.

Type C soil is the least stable and can contain sand, gravel and soft clay. It can consist of submerged rock or soil or soil that is freely seeping water.

Protective Systems

Sloping and **benching** are protective measures that cut the walls of an excavation back at an angle to its floor. Benching describes a method where soil is stepped back to meet sloping ratios. The angle is determined by the soil classification. Generally, the flatter the angle, the wider the excavation at the top and the greater the protection provided for workers. Benching is not used for Type C because of the instability of the soil.

Sloping ratios:

Type A – $\frac{3}{4}$ to 1

Type B – 1 to 1

Type C – $1\frac{1}{2}$ to 1

Shoring is a mechanical support system used when appropriate sloping is not possible.

Shielding involves portable or permanent protective structures. Shields used in trenches are often referred to as **trench boxes**. Trench boxes should extend at least 18 inches (0.5 meters) above the surrounding area to prevent soil, tools or other material from falling on workers. The area between the trench box and the face of the trench should be as small as possible to prevent unexpected movement. When trench boxes are being installed or moved vertically, no one should be allowed in the trench.

Access

A ladder, stairway or ramp must be located in excavations that are at least 4 feet (1.2 meters) deep. Workers should not have to walk more than 25 feet (7.5 meters) to use a ladder. Ladders must be secured and extend 3 feet (1 meter) beyond grade level. When ladders are used with trench boxes, they need to be placed within the box and extend out the necessary 3 feet (1 meter). If a ramp is used, it must allow workers to walk upright out of the excavation.

Fall protection is needed when an excavation presents fall hazards of 6 feet (1.8 meters) or greater (when possible, barriers and signage should mark the area of a fall hazard). Walkways with guardrails must be provided if workers are required or permitted to cross over excavations that are 6 feet (1.8 meters) or greater.

Underground Interferences

Competent persons must contact utility companies or owners at least 48-72 hours prior to digging so the location of underground line locations can be marked. All states have a one-call hotline for this purpose. Marked locations are approximations of utility locations. Care must be used and the exact location determined by hand-digging or other safe means, such as hydro excavation or daylighting in which equipment is used to make and vacuum slurry to create trenches without digging.

Exposed underground pipe needs to be protected and supported to prevent damage.

Site supervision must be notified if utilities are disturbed. If you make contact with any underground casing or pipe, have your supervisor contact the utility owner immediately.

Competent Person

Every jobsite that has an excavation should have a competent person. The competent person must be capable of identifying existing and predictable hazards and have the authorization to take prompt corrective measures to eliminate problems. The competent person must perform inspections of excavations, adjacent areas and protective systems prior to the start of work daily and as needed after rain showers and any other event which changes the conditions of the excavation.

Hazardous Atmospheres

Excavations can potentially contain hazardous atmospheres that are oxygen-deficient (less than 19.5% oxygen) or that have accumulation of toxic gases. Unsafe air is usually due to work activities and/or contaminated soil.

Work activities that can contribute to hazardous atmospheres include welding, cutting, application of coatings or adhesives, use of cleaning solvents, abrasive blasting or use of internal combustion engines.

Contaminated soil may be due to a location that is near past or present oil or gas fields, chemical plants, gasoline stations, landfills, wastewater treatment facilities or other locations where chemical contamination of the soil may have occurred.

Hierarchy of Controls

Use the hierarchy of controls to avoid collapses and other dangers. It identifies the controls, starting with the most effective, that protect you. Use all the required controls, as directed by your employer.

- Eliminate (ex: choose alternative construction methods that do not require excavation, such as directional drilling or boring)
- Substitute (ex: use prefabricated components or sections that can be assembled without the need for extensive excavation)
- Engineering controls (ex: shielding, shoring, benching, sloping, ventilation, pumps, hydro excavation)
- Administrative/Work practices (ex: training, signs, written programs/procedures, competent person program, reporting)
- Personal protective equipment (PPE) (ex: respirators, hard hats, fall protection, electrical protection)

Emergency Procedures

Employers should have a site-specific emergency plan on-site, and they should train all employees who will be exposed to excavation and trenching hazards about this plan.

Collapse happens quickly. Initial collapses may lead to secondary collapses, making rescue difficult or unsafe.

Evacuate the excavation, get to safety, call emergency services and secure the area. Rescues should be undertaken by specially trained medical or emergency rescue personnel **only**.