

Advice to keep in mind before your crew begins to dig.



According to the Occupational Safety and Health Administration (OSHA), two workers are killed every month in trench collapses, or cave-ins.¹ Trenching is among the most dangerous activities in construction, and cave-ins are rarely survived. Other potential dangers during excavations include falls, falling loads, hazardous atmospheres and incidents involving mobile equipment. However, cave-ins pose the greatest risk, and the most common causes of those are:

- Inadequate planning
- Misjudgment of soil type
- Incorrect installation of protective devices
- Defective protective devices
- Failure to adjust for changing conditions

Choosing a responsible party.

The first step in managing a site is to choose a competent person to oversee operations. OSHA defines a competent person as one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who is authorized to take prompt corrective measures to eliminate them.² The person will inspect the trenches before each shift and monitor them as conditions change. He or she should be readily available, familiar to employees and able to:

- Determine soil classifications
- Identify hazardous conditions
- Decide the appropriate access and egress
- Monitor hazardous atmospheres
- Understand protective systems, trench boxes, benching and sloping
- Anticipate and remediate hazards associated with water accumulation
- Recognize exposures from falling loads, equipment issues and vehicular traffic
- Consider the impact of adjacent structures and underground or overhead utilities

Among potential excavation dangers, cave-ins pose the greatest risk to your workers.

¹“OSHA® Fact Sheet: Trenching and Excavation Safety,” (September 2011), p. 1.

²“OSHA - Competent Person: Overview,” [osha.gov/SLTC/competentperson/index.html](https://www.osha.gov/SLTC/competentperson/index.html) (downloaded Feb. 20, 2018).



Classifying the soil helps to choose the right protective system for an excavation.

Preplanning.

Before beginning work on any site, it's critical to examine the area and preplan your operations. Conducting tests and using your knowledge to consider what could potentially be a hazard will help to make safe preparations for the day's work. Here are a few things to keep in mind:

- Current and upcoming weather conditions
- Surrounding roads and traffic patterns
- Location of underground and overhead utilities; call 811 for assistance
- Classification of the soil type on site
- Depth of the water table and water run-off issues
- Loads imposed by surrounding structures
- Effects of vibrations caused by equipment
- Size and quantity of shoring systems or trench boxes
- Supply of personal protective equipment (PPE) and safety gear
- Safe forms of access and egress to exit the excavation

Soil classifications and testing.

Before any excavation, the competent person is responsible for classifying the soil. This will determine the most effective protective system to help reduce the likelihood of a collapse. Below are OSHA's four soil classifications, from most to least stable.³

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

Type A soil is cohesive and has a high unconfined compressive strength; 1.5 tons per square foot or greater. Examples of Type A soil include clay, silty clay, sandy clay and clay loam. Soil cannot be classified as Type A if it is fissured, if it has been previously disturbed, if it has water seeping through it, or if it is subject to vibration from sources such as heavy traffic or pile drivers.

Type B soil is cohesive and has often been cracked or disturbed, with pieces that don't stick together as well as Type A soil. Type B soil has medium unconfined compressive strength; between 0.5 and 1.5 tons per square foot. Examples of Type B soil include angular gravel, silt, silt loam, and soils that are fissured or near sources of vibration, but could otherwise be Type A.

Type C soil includes granular soils in which particles don't stick together and cohesive soils with a low unconfined compressive strength; 0.5 tons per square foot or less. Examples include gravel and sand. Because it is not stable, soil with water seeping through it is also automatically classified as Type C soil, regardless of its other characteristics.

³ "OSHA: 1926 Subpart P Appendix A - Soil Classification," [osha.gov/pls/oshaweb/owa-disp.show_document?p_table=STANDARDS&p_id=10931](https://www.osha.gov/pls/oshaweb/owa-disp.show_document?p_table=STANDARDS&p_id=10931) (downloaded Feb. 20, 2018).

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When identifying the types of soil, there are several tests that the competent person can perform:

- **Drying test** — Involves drying a sample of soil that is 1 inch thick and 6 inches in diameter
- **Thumb penetration** — Uses thumb pressure to determine the soil's compressive strength
- **Dry strength** — Observation of dry soil and how it crumbles and clumps
- **Plasticity or wet thread** — Performed by molding a wet sample of soil into a thread
- **Pocket penetrometer** — One of several devices used to measure compressive soil strength

Measures to help protect your workers.

Providing safe egress, PPE and protective systems are all vital to help prevent injuries on the job. For any excavation 4 feet deep or greater, OSHA requires safe access and egress for employees to exit easily. Any ladders, steps, ramps or other safe means must all be located within 25 feet of workers. Depending on the location or depth of the trench, PPE could include reflective safety vests and fall arrest systems.

OSHA requires that any trench 5 feet deep or greater needs a protective system unless the excavation is entirely in stable rock. If trench depth is 20 feet or greater, the protective system must be designed by or based on data prepared by a registered professional engineer.

To help prevent cave-ins, there are several ways a trench can be supported, depending on its size and conditions:

- **Sloping and benching** are methods of cutting the sides of the excavation to accommodate support. Sloping cuts at an angle not steeper than 1 1/2:1 (see Figure 1), while benching creates one or a series of horizontal levels or steps.

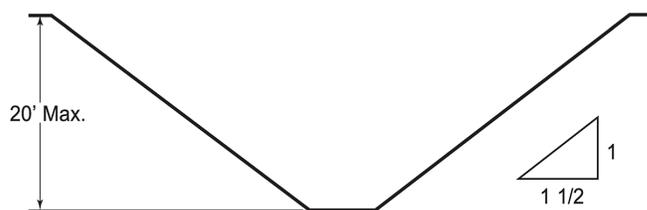


Figure 1. Slope of 1 1/2:1

- **Shoring** requires the installation of supports (often hydraulic or pneumatic) to prevent soil movement.
- **Shielding** protects workers by using trench boxes (see photo at right) or other supports designed by a registered professional engineer, or in accordance with tabulated data approved by an engineer.



Trench boxes are commonly used to protect workers from cave-ins. Since one cubic yard of soil can weigh as much as a car,⁴ your employees should never enter an unprotected trench.

⁴ "OSHA: Trenching and Excavation Safety, [osha.gov/Publications/osha2226.pdf](https://www.osha.gov/Publications/OSHA2226.pdf) (downloaded Feb. 20, 2018).

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Safety tips for every workday.

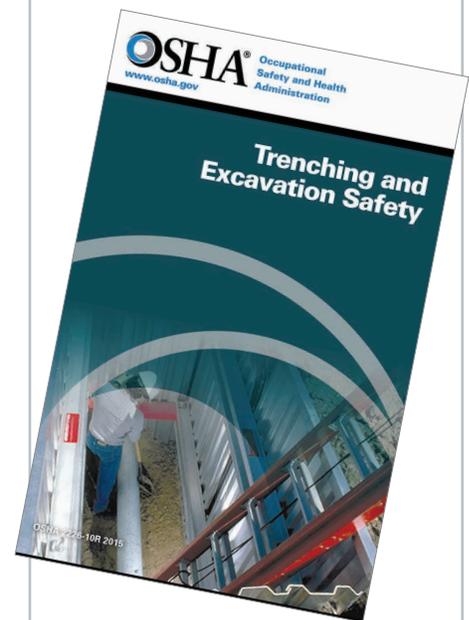
Aside from preplanning, vigilant safety should be a priority throughout the workday. The competent person should monitor the site regularly for any hazards created by changes in conditions and pause or halt operations for necessary corrections. Other safety precautions include:

- Keep excavated soil and any materials at least 2 feet from the edge of the trench
- Inspect equipment for functional backup alarms
- Train equipment operators regarding potential hazards and ensure they remain aware through regular refresher training
- Train employees how to spot signs of imminent trench collapse, including tension cracks, bulging and toppling
- Identify equipment or operations that could make the trench unstable
- Develop an emergency response plan and have rescue equipment available when hazardous conditions exist or may arise during work
- Test the air when there's any possibility that an oxygen-deficient or hazardous atmosphere exists
- Secure walkways with guards/handrails wherever employees travel across an excavation that's 6 feet or greater in depth, in accordance with local laws
- Provide proper PPE for workers such as reflective vests, hard hats or full-body harnesses for anyone entering an excavation where a bell-bottom pier hole exists
- Monitor soil conditions, especially after rain or any other potential hazards that could shift soil and increase the likelihood of a collapse
- Protect excavations overnight or backfill them at the end of the day
- Make sure workers stay clear of overhead loads coming into the excavation and do not work under suspended or raised loads
- Maintain and use materials that make up protective systems according to the manufacturer's recommendations
- Remove any damaged materials until a registered engineer approves them for use again



Look to OSHA for additional resources.

To review OSHA guidelines and access additional helpful materials on trenching and excavating, go to osha.gov/SLTC/trenchingexcavation/. You can download OSHA's Trenching and Excavation Safety booklet at osha.gov/Publications/osha2226.pdf.



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