

# 11. Excavating, Trenching and Shoring

## Overview

This section discusses the following topics:

- General Guidelines for Excavating and Trenching Operations
- Excavation Safety
- Trenching and Shoring Safety
- Heavy Equipment Safety

## References

OSHA 29CFR1910.268(a)(3) and 29CFR1926 Subpart P (Excavations)

## General Guidelines for Excavating and Trenching Operations

General guidelines for the following operations are discussed:

- Before Excavating and Trenching
- During Excavating and Trenching
- After Excavating and Trenching

## **Before Excavating and Trenching**

Follow the guidelines below before beginning excavation and trenching operations:

1. Ensure general public safety.
2. Evaluate soil conditions or other material to be dug.
3. Evaluate the water table level and percolation conditions.
4. Evaluate proximity to underground utility, cable, and pipelines.
5. Mark all underground utilities, cables, and pipelines.
6. Evaluate proximity to buildings, roads, railroad tracks, and public right-of-way.
7. Contact owners of utilities, right-of-ways, transmission piping, etc.
8. Ensure all employees receive proper training, including first aid and CPR, and are competent in excavation and trenching operations.
9. Ensure there is adequate equipment, including personal protective equipment, shoring materials, signs, fire extinguishers, barricades, and machinery, before starting the job.
10. Check the location of heavy equipment, power shovels, backhoes, trenchers, trucks, and spoil pile to ensure they are at least two feet from the opening edge.
11. Ensure shoring equipment or trench boxes/shields are adequate for the job at hand.

After evaluating and completing the above tasks, additional precautionary measures may need to be taken before starting any excavation or trenching operations.

## During Excavating and Trenching

Follow the guidelines below during excavation and trenching operations:

1. Continue to evaluate soil conditions, especially after a rainfall and after passing trains or heavy vehicles.
2. When vehicles, internal combustion engines, or heavier-than-air gases (like propane) are used in or near trenches, take precautions to ensure exhaust gases don't enter trenches. Continue to evaluate possible oxygen deficiency or gaseous conditions.
3. Continue to evaluate adequacy of shoring and/or sloping as work progresses, as well as sheeting, bracing, shoring, and underpinning stability.
4. Hand dig around underground utilities, cables, and pipelines, if necessary, to avoid damage.
5. **Note in job records any damage resulting from erroneous information received from utility companies.**
6. Maintain proper and adequate entrance and exit facilities.
7. Install shoring support/braces from the top down and remove them from the bottom up.
8. Observe changes in vehicle and machinery operational patterns, size of materials, and equipment near trench.
9. Ensure employees working in trenches wear hard hats, safety glasses, and appropriate footwear.
10. Keep workers out of the immediate area of excavating equipment and do not allow workers to work ahead of the shoring.
11. Place tools and rocks either on the outer slope of the excavated materials or on the other side of the trench if the surface is flat.
12. When working on hard surface roads where traffic flow is maintained, stones are often thrown with great speed by passing vehicle tires and can cause serious injury. Place work area protection signs and barricades when work interferes with vehicle traffic.

13. Be aware of fall hazards around construction trenches. Serious personal injuries can occur when workers fall into construction trenches. Falls can result from workers attempting to leap across or into the trench. Rocks and tools near the trench edge can fall into the trench and should be kept far away.

## **After Excavating and Trenching**

Follow the guidelines below after excavation and trenching operations:

1. Barricade any excavation left unattended with warning devices for the protection of employees and the general public.
2. Reevaluate the depth of the trench or excavation, its sloping and/or shoring, sloping of banks, sides, and walls in relation to depth of cut, water content, and vibrations.
3. Provide a ladder for exit from the excavation.
4. Ensure correct positioning of cross braces or the trench jack to prevent sliding, falling, or kick outs.

## **Excavation Safety**

The following guidelines apply to excavation safety:

1. Follow the machine guidelines below:
  - a. Never oil, grease, or refuel a machine while the motor is running.
  - b. Operators must keep employees and bystanders a safe distance from a machine in operation.
  - c. Never attempt to clear buckets, blades, scoops, chutes, etc. while a machine is in operation.
2. Never stand under loads handled by power shovels, derricks, and hoists. To avoid being struck by spillage, stand away from vehicles being loaded.

3. Inspect excavations daily. If evidence of possible cave-ins or slides is apparent, cease all work in the excavation until necessary precautions are taken to safeguard employees. After a rainstorm or other event occurs that increases the likelihood of a hazard, make additional inspections of the excavation and provide additional protection if necessary.
4. Take special precautions to slope or shore the sides of an excavation adjacent to a previously backfilled excavation.
5. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow excess amounts of water to accumulate in trenches.
6. If it is necessary to place and operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, brace the side of the excavation as necessary to resist the extra pressure due to such superimposed loads.
7. When mobile equipment is allowed or used adjacent to excavations, install substantial stop logs or barricades. If possible, the grade should be away from the excavation.
8. Provide adequate physical barrier protection at all excavations. Barricade or cover all wells, pits, shafts, etc. Backfill temporary wells, pits, shafts, etc. upon completion of exploration and similar operations.

## **Trenching and Shoring Safety**

The following guidelines apply to trenching and shoring safety:

1. Trenches over 5 feet deep in compact or hard soils or in ground with hazardous soil conditions must be shored, braced or sloped to the angle of repose. Refer to Figure 11-1.

**Note:** Clays, silts, loams or non-homogenous soils require shoring and bracing. The presence of ground water requires special treatment.

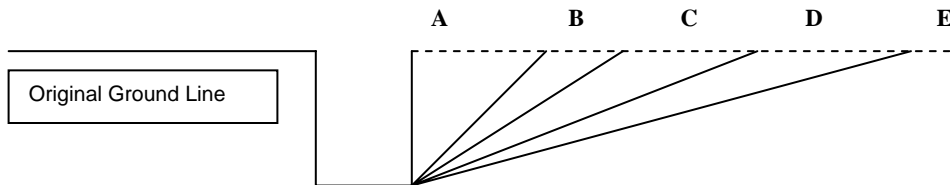
A-Solid rock, shale, or cemented sand and gravels 90%

B-Compacted angular gravels 1/2:1 63, 23 degrees

C-Recommended slope for average soils 1:1 45 degrees

D-Compacted sharp sand 1 1/2:1 33, 41 degrees

E-Well rounded loose sand 2:1 26, 34 degrees



**Figure 11-1. Approximate Angle of Repose for Sloping of Excavation Sides**

2. Sides of trenches in unstable or soft material, less than 5 feet deep, should be shored, sheeted, braced, sloped or otherwise supported with sufficient strength to protect employees working within them.
3. Place all spoil, tools, and other materials removed from trenches and excavations at least 24" from the edge of the excavation.
4. Never jump over a trench.
5. A backhoe bucket or suspended materials can strike men in a trench. Control of equipment and materials requires continuous attention by the supervisor.
6. When working in a trench over 5 feet deep, ensure an employee is always available in the immediate vicinity to provide emergency assistance if necessary.
7. When employees are required to be in trenches 4 feet or more deep, provide an adequate means of exit, such as a ladder or steps. Place them so it requires no more than 25 feet of lateral travel to exit.
8. Never work under pipe that is only supported on skids over a trench.
9. Release pressure on air tools before equipment is left unattended.
10. Always make sure connections to air tools are secure before turning on air pressure. Before making any adjustments, close air valves.

11. Materials used for sheeting and sheet piling, bracing, shoring, and underpinning should be in good serviceable condition. Timbers used should be sound and free from large or loose knots. All materials must be designed and installed to be effective to the bottom of the excavation.
12. Always take additional precautions through the use of shoring and bracing to prevent slides or cave-ins when excavations or trenches are made adjacent to back-filled excavations. Also, take precautions when excavations are subject to vibrations from railroad or highway traffic, machinery operations, or any other source.
13. Do not flatten the angle of repose when an excavation has water conditions, silt materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
14. Place cross braces or trench jacks in a true horizontal position, spaced vertically, and secured to prevent sliding, falling or kick outs.
15. Portable trench boxes or sliding trench shields may be used for protection of personnel instead of a shoring system or sloping. If trench boxes or shields are used, they should be designed, constructed, and maintained to provide protection equal to or greater than the sheeting or shoring required for the trench.

## **Heavy Equipment Safety**

The following guidelines apply to heavy equipment safety:

1. When an end-loader is loaded by hand, the machine operator should keep his hands and feet free of all controls.
2. Do not use ditching machines on slopes or inclines without first preparing the right-of-way to prevent overturning.
3. When parking equipment on streets or highways, use adequate warning devices.
4. When it is necessary to leave excavating equipment unattended, lower the blade, bucket or scoop to the ground and lock the ignition system.