Protective Systems for Excavations

Basic Definitions

**Excavation** – Any man-made cut, cavity, trench or depression in an earth surface, formed by earth removal.

**Trench (trench excavation)** – A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.

**Shoring (shoring system)** – A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

**Ingress and Egress** – Ingress and egress is an "entry" and "exit," respectively. In trenching and excavation operations, they refer to the provision of safe means for employees to enter or exit an excavation or trench.

**Competent Person** – One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. All competent persons must complete the 4-hour Physical Plant trenching and shoring class, successfully pass the exam and be certified for successful completion of the class.

**Sloping** – Sloping consists of angling the cut of a crevice into the earth. Basic Guidelines for Sloping:

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Height/Depth Ratio</th>
<th>Slope Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable Rock</td>
<td>Vertical</td>
<td>90°</td>
</tr>
<tr>
<td>Type A</td>
<td>¾:1</td>
<td>53°</td>
</tr>
<tr>
<td>Type B</td>
<td>1:1</td>
<td>45°</td>
</tr>
<tr>
<td>Type C</td>
<td>1½:1</td>
<td>34°</td>
</tr>
<tr>
<td>Type a (short-term)</td>
<td>½:1</td>
<td>63°</td>
</tr>
</tbody>
</table>

For a maximum excavation depth of 12 ft.

When these guidelines cannot be met, a shoring system is needed for workers’ protection.

**Shoring**

**What is shoring?**

Shoring is the provision of a support system for trench faces used to prevent movement of soil, underground utilities, roadways, and foundations.

**When is shoring needed?**

- Location or depth of cut makes sloping impractical
- Excavation or trench is 4 feet or greater in depth

**For a more detailed explanation please refer to OSHA standard 29 CFR 1926.650, .651, and .652**

Note: Excavations or trenches 20 feet deep or greater must have a protective system designed by a registered professional engineer.
Types of Shoring

Hydraulic Shoring (Speed Shoring)

Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install or remove hydraulic shoring.

Advantages:
- Are light enough to be installed by one worker
- Are gauge-regulated to ensure even distribution of pressure along the trench line
- Can have their trench faces "preloaded" to use the soil's natural cohesion to prevent movement
- Can be adapted easily to various trench depths and widths

Limitations - hydraulic shoring should not be used if any of the following are true:
- Vertical loads imposed on cross braces exceed 100 pound gravity load distributed on a one foot section of the center of the hydraulic cylinder
- Surcharge loads are present from equipment weigh in excess of 20,000 pounds.
- When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched.

Pneumatic Shoring

Works in a manner similar to hydraulic shoring. The primary difference is that pneumatic shoring uses air pressure in place of hydraulic pressure. A disadvantage to the use of pneumatic shoring is that an air compressor must be on site.

NOTE: All shoring should be installed from the top down and removed from the bottom up. Hydraulic shoring should be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases and any other damaged or defective parts.

Type of shoring needed

The size and type of shoring is dependent on the soil type and the depth of the trench or excavation. To determine what types of shoring you need please see OSHA’s website at www.osha.gov.

Shoring Examples:
Safe Shoring Procedures

- Shoring materials must be installed from the top down and removed in reverse order.
- Workers must not enter an excavation to remove shoring materials if ground conditions have deteriorated so as to make entry for shoring removal unsafe.
- Shoring support systems must be installed in firm contact with the faces of the excavation, and in a manner that ensures no loss of soil from behind or below the bottom of the shield or shoring while the excavation is open.
- Unless otherwise indicated by the manufacturer or a professional engineer, in writing, voids between the shoring and the excavation face must be backfilled or blocked.

Trench Boxes

They are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar incidents.

Trench boxes can be stacked, but must be 1½ feet above grade level and can be two feet short at the base.

What to look for when making trenches/ excavations:

- Is the cut, cavity or depression more than 4 FT (1.2 m) in depth?
  - If yes, you need to either slope or add shoring

- Is there water in the cut, cavity or depression?
  - If yes, you need to empty it as best as possible

- Are there adequate means of access and egress?
  - All excavations 4 feet or more in depth require ladders, steps, or ramps as a mans of exit

- Is a competent person in charge of the operation?
- Is equipment operating in or around the cut, cavity or depression?
  - If yes, pay closer attention for cave in since vibrations from equipment can cause soil and equipment to loosen

- Is the depth 20 feet (6.1 m) or more for the cut, cavity or depression?
  - If yes, then a registered professional engineer must approve the procedure.

- Are means of egress from the cut, cavity or depression no more then 25 ft (7.6 m) from the work?

**These rules do not apply to housing foundations if certain conditions are met.

Temporary Spoil

Temporary spoil must be placed no closer than 2 ft from the surface edge of an excavation. This distance should not be measured from the crown of the spoil deposit but from the bottom edge. This distance requirement ensures that loose rock or soil from the temporary spoil will not fall on employees in the trench.
Spoil should be placed so that it channels rainwater and other run-off water away from the excavation. Spoil should be placed in a way that eliminates the possibility of the soil from accidentally running, sliding or falling back into the excavation.

**Competent Person**
The competent person in charge must be able to or have experience in the following:

Training, experience and knowledge of:
- soil analysis
- use of protective systems
- OSHA requirements of 29 CFR Part 1926

Ability to detect:
- conditions that could result in cave-ins
- failures in protective systems
- hazardous atmospheres
- other hazards including those associated with confined spaces.

Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.