**Objective:** To reinforce awareness of soil mechanics and conditions that may lead to a cave-in.

For purposes of excavation planning and safety, soil is classified as one of the following:

1. Stable rock (most stable)
2. Type A
3. Type B
4. Type C (least stable)

To assure maximum safety, many contractors plan trenching operations under the assumption that **all soil is type C**.

**Maximum Safe Angle of Repose**

A soil’s maximum angle of repose is the steepest angle at which it remains stable. No trench slope should exceed a soil’s maximum angle of repose without adequate shoring systems in place.

|  |  |  |
| --- | --- | --- |
| **Soil Type A****53**° (3/4:1) | **Soil Type B****45**° (1:1) | **Soil Type C****34**° (1-1/2:1) |

* Any soil that is fissured, seeping water, or was previously disturbed **cannot** be classified as Type A.

**Cave-In Danger Signs**

**Failure zone:**

The failure zone is a distance around the trench which is 50-75% of the trench’s depth. Signs of soil stress, such as tension cracks found in this area, indicate a risk of a cave-in.

**Tension cracks:**

Tension cracks run parallel to the trench. If found in the failure zone, chances of a cave-in significantly increase.

|  |  |
| --- | --- |
|  |  |

|  |  |  |
| --- | --- | --- |
| **Sliding:**Sliding, or **sloughing,** can occur when the soil is weakened by tension cracks.  | **Toppling:**Toppling is another potential consequence of tension cracks. The trench’s wall splits along the tension crack line and falls into the trench. | **Bulging:** Insufficiently supported excavations can lead to uneven stress in the soil. Subsidence, or sinking, in the surface and bulges in the trench’s walls may result.  |

**Never** enter an un-shored trench exhibiting any of the conditions listed above!

**Cave-In Danger Signs** (continued)

|  |  |
| --- | --- |
| **Bottom heaving or squeezing:**Bottom heaving or squeezing occurs when downward pressure from the weight of the adjacent soil causes a bulge in the bottom of the trench.**Soil weight**These conditions can be dangerous if your trench is not properly shored. | **Boiling:**Boiling refers to water flowing up into the bottom of the trench, usually due to a high water table. Boiling can create quick conditions in the trench.**Water table** |

|  |  |
| --- | --- |
| red-arrow | **Discussion**Use the remaining time to engage your training group in a discussion about soil mechanics.* Has anyone observed any of the danger signs discussed above? If so, was the trench adequately shored? How did your crew respond?
 |

This form documents that the training specified above was presented to the listed participants. By signing below, each participant acknowledges receiving this training.

Organization: Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Trainer: Trainer’s Signature: \_\_\_\_\_

**Class Participants:**

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_ \_\_\_\_\_\_\_ Signature: \_\_\_\_\_\_\_\_\_\_\_