Trenching and Excavation Basics

On average, two workers are killed every month in trench collapses. Trenching and excavation work presents serious hazards to all workers involved. Cave-ins pose the greatest risk and are much more likely than other excavation-related accidents to cause worker fatalities. Other potential hazards include falls, falling loads, hazardous atmospheres, and incidents involving mobile equipment. A few precautions can take most of the risk out of trench construction.

Numbers to Remember

- Trenches five feet deep or greater are required to have a protective system unless the excavation is made entirely in stable rock.
- If trenches are less than five feet deep, a Competent Person may determine that a protective system is not required.
- Trenches 20 feet deep or greater are required to have a protective system designed by a registered professional engineer (PE).

Planning Before You Dig

Planning reduces the chance that something will go wrong when you start a job. Consider the following before you start excavating:

- Debris near the excavation site that could create a hazard
- How employees will get in and out of the excavation
- How to protect people from falling into the excavation
- Location of overhead power lines and underground utility lines
- Possibility of atmospheric hazards in the excavation
- Possibility of water in the excavation
- Stability of soil at the excavation site and structures adjacent to the excavation site
- Vehicles and other mobile equipment that will operate near the excavation

Competent Person

OSHA requires that Competent Persons inspect trenches daily and as conditions change. The OSHA Construction Standard defines a Competent Person as someone who is:

- Capable of identifying existing and predictable hazards in the surroundings
- Capable of identifying working conditions which are unsanitary, hazardous, or dangerous to employees, soil types, and protective systems required
- Someone who has authorization to take prompt corrective measures to eliminate the hazards mentioned above

Soil and Stability

A Competent Person must conduct visual and manual soil tests before anyone enters an excavation.

- **Visual testing** involves looking at the soil and the area around the excavation site for signs of instability.
- **Manual testing** involves evaluating a sample of soil from the excavation to determine qualities such as cohesiveness; granularity; and unconfined compressive strength, which is the load per unit area at which soil will fail in compression.

OSHA categorizes soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C in decreasing order of stability.

- **Stable Rock** is natural, solid mineral matter that can be excavated with vertical sides and remain intact while exposed. It is usually identified by a rock name such as granite or sandstone. Determining whether a deposit is of this type may be difficult, unless it is known whether cracks exist and whether or not the cracks run into or away from the excavation.
- **Type A Soils** are cohesive soils with an unconfined compressive strength of 1.5 tsf or greater. Examples of Type A cohesive soils include clay, silty clay, sandy clay, clay loam, and, in some cases, silty clay loam and sandy clay loam. (No soil is Type A if it is fissured; subject to vibration of any type; has previously been disturbed; is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or has seeping water.)
- **Type B Soils** are cohesive soils with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf. Examples of other Type B soils include angular gravel; silt; silt loam; previously disturbed soils unless otherwise classified as Type C; soils that meet the unconfined compressive strength or cementation requirements of Type A soils but are fissured or subject to vibration; dry, unstable rock; and layered systems sloping into the trench at a slope less than 4H:1V (only if the material would be classified as a Type B soil).
- **Type C Soils** are cohesive soils with an unconfined compressive strength of 0.5 tsf or less. Type C soils include granular soils such as gravel, sand and loamy sand, submerged soil, soil from which water is freely seeping, and submerged rock that is not stable. Also included in this classification is material in a sloped, layered system where the layers dip into the excavation or have a slope of 4H:1V or greater.

Protective Systems

There are different types of protective systems, including:

Benching means a method of protecting workers from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels. (Benching cannot be done in Type C soil.)

Sloping involves cutting back the trench wall at an angle inclined away from the excavation.
Sloping requires installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins.

Shielding protects workers by using trench boxes or other types of supports to prevent soil cave-ins.

Designing a protective system can be complex because you must consider many factors, such as soil classification, depth of cut, water content of soil, changes caused by weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench), and other operations in the vicinity.

References

OSHA standard 1926 Subpart P - Excavations