Excavation Safety Field Training

What is an excavation?

Depending on what you are doing you could be digging an excavation, or you could be digging a trench. Both excavations and trenches are similar in some ways and very different in others.

Definition of an excavation: An excavation is defined as any man-made cut, cavity trench, or depression in the earth's surface formed by earth removal.

Definition of a trench: A trench is defined as a narrow excavation made below the surface of the ground. Typically, a trench is deeper than it is wide. A trench is not greater than 15 feet wide but can be any length.

Trench and Excavation Hazards

Trenches have many of the same hazards as an excavation but in a trench, you are confided to a smaller area and in general you have limited means to escape. In a large excavation, if something like a piece of the side starts to fall you can just move away from the wall (if time allows). In a trench you may only have one way to escape or at the most two directions. The trench is so narrow that moving from the wall may be impossible.

Trenches are so narrow that air flow can be a problem. An excavation can be large enough that they do not restrict the normal flow of air.

Trenches can become heat exhaustion hazards because of the limited space, high humidity, and lack of air circulation.

Water seepage into the trench can also be deadly. Water seeping into a trench can undermine the walls and cause cave-ins. Water seeping into a larger excavation seldom causes a problem. Water seeping into a trench could also trap an unsuspecting worker if the flow was fast enough.

In the event of a water leak or water flowing because of a weather event, a trench can fill up quickly trapping employees or causing cave-ins. In a larger excavation it would not fill up as fast.

Inspecting Excavations

Because of all the hazards associated with excavations and trenches they should be inspected regularly.

A competent person must inspect the excavation or trench every day before work starts. It must be in written form. You must reinspect anytime there is a condition change. An example would be if the weather goes from dry to rain, soils start to dry out and become unstable or if you noticed water seepage.

This inspection process is so important that most employers will require an inspection in the morning and one after the crew returns from lunch.

Who is responsible for taking precautions?

Ultimately the company is responsible but who is the company – its you. Who on site is responsible for identifying hazards and taking precautions – **The Competent Person**. A competent person must be designated by the employer and that person must be capable of identifying existing and predictable hazards in the area. He must also be capable of predicting potential changes in conditions which are unsanitary, hazardous or dangerous to workers. This person must have the authority to take prompt action to eliminate the hazards.

You must be trained in excavation safety to be a competent person. Just having experience excavating is not enough. The experience may help you understand the requirements, but the training is necessary to comply. By default, the Supervisor on our project, is the competent person unless another is assigned specifically for the area or task.

OSHA Definition for Competent Person

A competent person is an individual, designated by the employer, who can identify existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to workers, and who is authorized to take prompt corrective measures to eliminate them.

Under the excavation standard that person would:

a. Classify soil type.
b. Inspect protective systems (bench, slope, shore).
c. Design ramps.
d. Monitor water removal, if required.
e. Conduct site inspection for potential hazards and eliminate them.
f. Monitor air quality in the trench.

When is a ladder needed or other form of egress? Trench Excavations

The short answer is at 4 feet. OSHA tells us that at 4 foot deep any trench must have a ladder, ramp, steps, or other form of safe entry and exit.

How many ladders? The short answer is every 25 feet. Keep in mind that OSHA tells us that a worker must never travel more than 25 feet to any ladder or exit/entry. So, for example, if you had a 50-foot trench you could put a ladder in the center at 25 foot and that would meet the requirement. Again, if you had a 40-foot trench and had one at the approximate center that would meet the requirement, but if the trench was 51 feet long you would be in violation with one ladder. They will absolutely measure the distance so be safe and have enough ladders.

Ladders must be secured from movement. The most common way to secure a ladder is to drive a stake at the top of the trench and tie the ladder to the stake.

When must you test the atmosphere?

The short answer is at 4 foot deep. OSHA tells us atmospheric testing is required before workers enter an excavation greater than 4 foot deep (not just a trench). This is required where an oxygen deficiency or a hazardous atmosphere is present or could reasonably be expected, such as if you were excavating near a landfill area or near where hazardous substances are stored or have been stored. Simple 4 gas meters do the trick. Remember OSHA tells us, you should always check first for oxygen.

When must a protective system be used?

The OSHA Standard tells us a protective system is needed when the excavation is 5 foot deep or deeper and not in stable rock. Keep in mind the standard said when the excavation is 5 foot deep, it did not say trench. So, you must protect workers in any excavation at 5 feet deep from cave-in. If you have workers near the wall of an excavation (any size excavation) the wall can slump or cave-in trapping an employee.

Several examples of protective systems can be found in the OSHA standards. We typically think of benching, sloping, trench boxes, and shoring as protective systems for trenches but excavations deeper than 5 feet would need edge protection also. Most large excavations are protected by sloping or benching the sides.

The key is planning your excavation before digging. Know your depth and potential hazards associated with the soil types, possible vibration from equipment and traffic along with weather conditions.

Other considerations when excavating.

OSHA requires all spoils, materials, equipment, and anything else to be kept at least 2 foot back from the edge of a trench or excavation. That rule is to protect workers from not only items that may fall into the excavation but also to help reduce the loading weight on the soil near the edge. Loading the edge with spoils is a good way to cause a cave-in or collapse of the sides.

Think about other conditions.

a. Traffic around the excavation causing vibrations which could cause a collapse.
b. Traffic around the excavation that could end up with a vehicle in the trench.
c. Structures or items near the excavation that could become unstable.
d. Look for power poles, fences, sidewalks, water lines in the immediate area.
e. Surface water or ground water. Many cave-ins are caused by water.
f. Overhead power lines.
g. Underground Utilities.
h. Weather
i. Fall protection.
j. How many ladders do I need?
k. Protection from equipment or other vehicles near the edge.
l. Pedestrian traffic protection.
m. Do I need orange fencing or other protection?

While we are talking about orange fence, it is important to know, OSHA does not require orange fence unless the excavation can not be easily seen. Should you use orange fence anyway YES. Orange fencing will reduce your liability, it will help to keep kids, pedestrians, or anyone else from falling into the excavation or trench. It should be a consideration even if it is not an OSHA requirement. Weigh the cost of orange fencing against the minimal cost of a lawsuit.

Other protections to take if necessary.

OSHA requires employers to provide support systems such as shoring, bracing or underpinning when necessary to ensure that adjacent structures (buildings, walls, sidewalks, pavements, poles, and such) remain stable for the protection of workers. The standard also prohibits excavation below the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard. You are required to provide this support unless a Registered Professional Engineer gives you a written report that the structure or item does not cause a hazard.

Additional hazards OSHA has in various standards.

Provide warning systems, barricades or stop logs to keep equipment or vehicles from approaching the edge of an excavation ("If the operator does not have a clear view of the edge").

Ensure everyone wears a hardhat in an excavation. OSHA is concerned about falling dirt and such other items that may be on the edge.

Ensure workers never walk under a loaded excavator bucket or load.

Ensure workers do not stand next to trucks being loaded. Drivers should stay in the vehicle or move far enough away that falling material from the loading process will not be a hazard.

Soil Classification.

Look at the OSHA 1926 standards in Appendix A to Subpart P and you will find OSHA's take on soil classification. OSHA has placed all potential soils into 4 classes.

Stable Rock Type A Soil Type B Soil Type C Soil

This is important to you because you can do some things in one classification that you can not do in others. For example, you can not bench in Type C Soil. You can only slope Type C Soil.

Stable Rock: Solid rock material natural in place not fractured or loose.

Type A: Cohesive Soils with no fissures or has not been previously disturbed. Compressive strength of 1.5 tons per sq foot or more.

Type B: Cohesive soil with compressive strength greater than 0.5 tons per sq foot or more. In some cases, rock, silt, silt loam, sandy loam, and others may qualify.

Type C: Granular soils like sands, loamy sand, gravel, wet soils with compressive strength of 0.5 tons per sq foot or less.

Slope requirements for soil types.

Type A or stable rock allows for a straight side cut – no protection devices required. Keep in mind this is after it is inspected for possible fracturing etc.

Type B soil will allow a 1 to 1 slope, benching or engineered trench protection such as shoring or trench boxes. Keep in mind a competent person must first inspect the site and designate the soil as Type B.

Type C soil will not allow any benching. You have only two selections, you can slope at the 1.5 to 1 slope or use an engineered system for trench protection.

NOTE: slopes are measured from the edge at the bottom, not the center of the trench.

Engineered Systems – Trench Boxes

If you are going to use a trench box or other engineered shore system, it should stick up above the ground 18 inches. This is to protect the workers from items rolling into the trench or dirt falling on the workers. OSHA notes this is anywhere you have a slope area leading to the protection, but it is a great idea to do it anytime they are used. Its that liability thing again.

Trench boxes can not be moved at all when workers are in the box. Workers can not walk out of the trench box into an unprotected area of the trench while the box is moved. So, if you are using a box, have the employees leave the trench by ladder before you move it.

Ladders in a trench box protected trench must be in the box. They can not be outside the box protected area.

Fall Protection

This is not something we think about when it comes to excavations and trenches but, OSHA tells us in the fall protection standard that if an employee is going to be at the edge of a drop off and can fall a distance of 6 feet to the next level, that employee must be protected with some type of fall protection.

Supervisors can not walk up to the edge of the trench and look to see how the men are doing. Even with a trench box in place. You must have handrails, guardrails, a cable, or some type of fall protection in place to protect the worker who is exposed to the hazard. Its just like walking up to the edge of a roof deck or bridge without rails.

Maximum Depth of an excavation

OSHA tells us the maximum depth of any excavation may not exceed 20 feet deep without a Registered Professional Engineer stamped design. ANY EXCAVATION: The engineer must design, inspect and sign-off on the excavation if it is 20 foot or more in depth. This includes any type of protection of slopes.

The OSHA excavation standards have many examples, sketches and drawings of what is allowed in different soils.

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