Trenching and Excavation

Virginia Department of Labor and Industry
VOSH Cooperative Programs

Excavation and Trenching are among the most hazardous construction operations. On average 25 people die each year in trenching incidents, many more seriously injured.

Dirt is heavy. One cubic yard equals about 3,000 pounds or more, about the same as a mid-sized car. A person trapped in a cave-in, has little chance for survival.

Injury Prevention

An injury-free mindset will help make a safer work environment.

Hazard recognition is the first step in having a safe workplace.

Once you recognize the hazard, you must do something about it.

By controlling or eliminating the hazard, you have made the workplace safer.

Injury Free Culture

Ask yourself the question “What IF I could go my entire career injury free?”

Injury Free is a cultural attitude. It is a way of thinking that prevents injuries, making safety a high priority at both the personal and organizational levels.

https://doli.virginia.gov/what-if/

What is a Trench vs an Excavation

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

Excavation
Any man-made cut, cavity, trench or depression in the earth’s surface formed by earth removal.

Hazards

- Cave-ins or collapses that can trap workers.
- Equipment or excavated soil falling on workers.
- Falling into the trench or excavation.
- Flooding or water accumulation.
- Exposure to a hazardous atmosphere (e.g., gas, vapor, dust, or lack of oxygen).
- Contact with buried service lines such as electrical, natural gas, water, sewage, telecommunications, etc.
- Contact with overhead electrical lines.
- Slips, trips and falls as workers climb on and off equipment, or from inappropriate access and egress methods.

How to Stay Safe

Ensure that there's a safe way to enter and exit

Ensure trenches have cave-in protection

Look for standing water and test for atmospheric hazards

Keep materials away from the edges of the trench

Never enter a trench that has not been inspected by a competent person

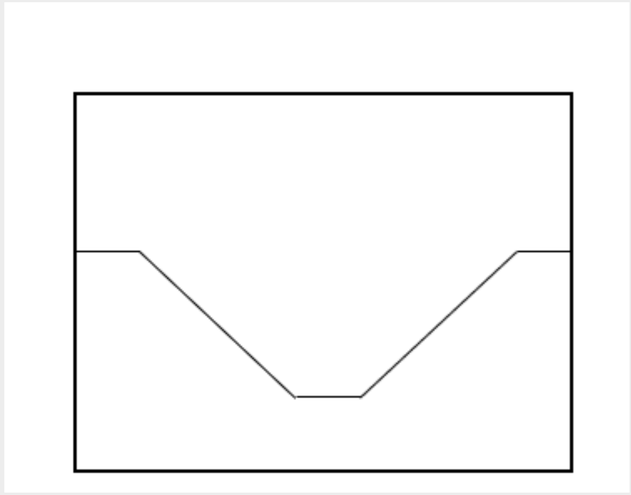
Safe Entry

- Employers are responsible for providing ladders, stairways ramps or other ways to ensure safe egress.
- In hazardous circumstances employee survival could depend on how quickly they can escape from a trench or excavation.

Safe Egress

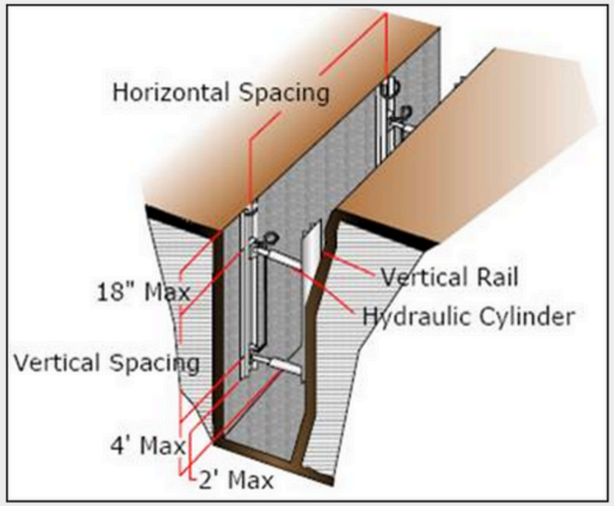
- Provide stairways, ladders, ramps, or other safe means of egress in all trenches that are 4 feet deep or more.
- Means of egress need to be within 25 lateral feet of workers.
- Ensure means of entering and exiting the trench is within the protective system.

Types of Protection



Sloping

Sloping is when you cut away the trench wall at an angle to prevent cave-ins. The angle of your slope will be determined by the soil type



Shoring

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

Shielding Systems

Shields, often called trench boxes, are structures that are able to withstand the forces of a cave-in and thereby protect employees within the structure. For Shields to be effective workers must stay inside them at all times.

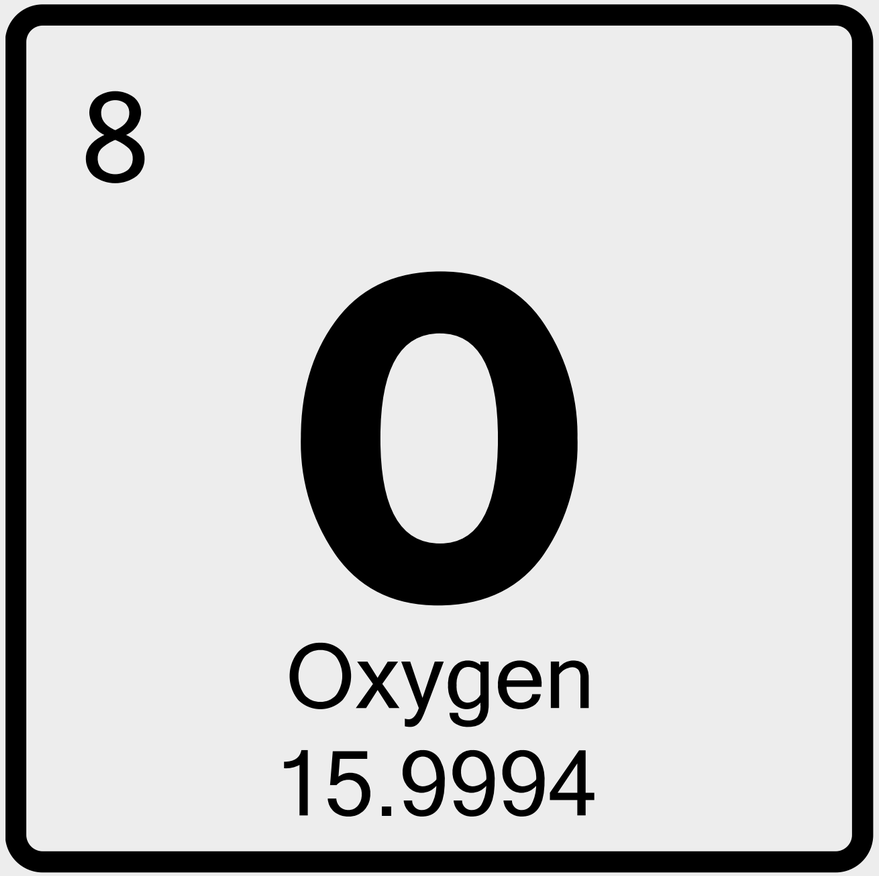
Standing Water and Atmospheric Hazards

Excavations may present risks of hazardous atmosphere and water accumulation.

Workers could be exposed to the possibility of suffocating, inhaling toxic materials, being burned or engulfed by fire, or drowning

To ensure employee safety when water accumulates or there is a hazardous atmosphere, inspections should be performed by a competent person:

- Before construction begins.
- Daily before each shift.
- As needed throughout the shift.
- Following rainstorms or other hazard-increasing events (such as a vehicle or other equipment approaching the edge of an excavation).



Hazardous Atmospheres

Hazardous atmospheres:

- gas
- vapor
- dust
- or lack of oxygen

Atmosphere sampling must be performed

- before workers enter the excavation
- as often as necessary to ensure that the atmosphere remains safe

Keep Materials Away from the Edge

Excavated material (spoils) at your site are hazardous if they are set too close to the edge of a trench/excavation.

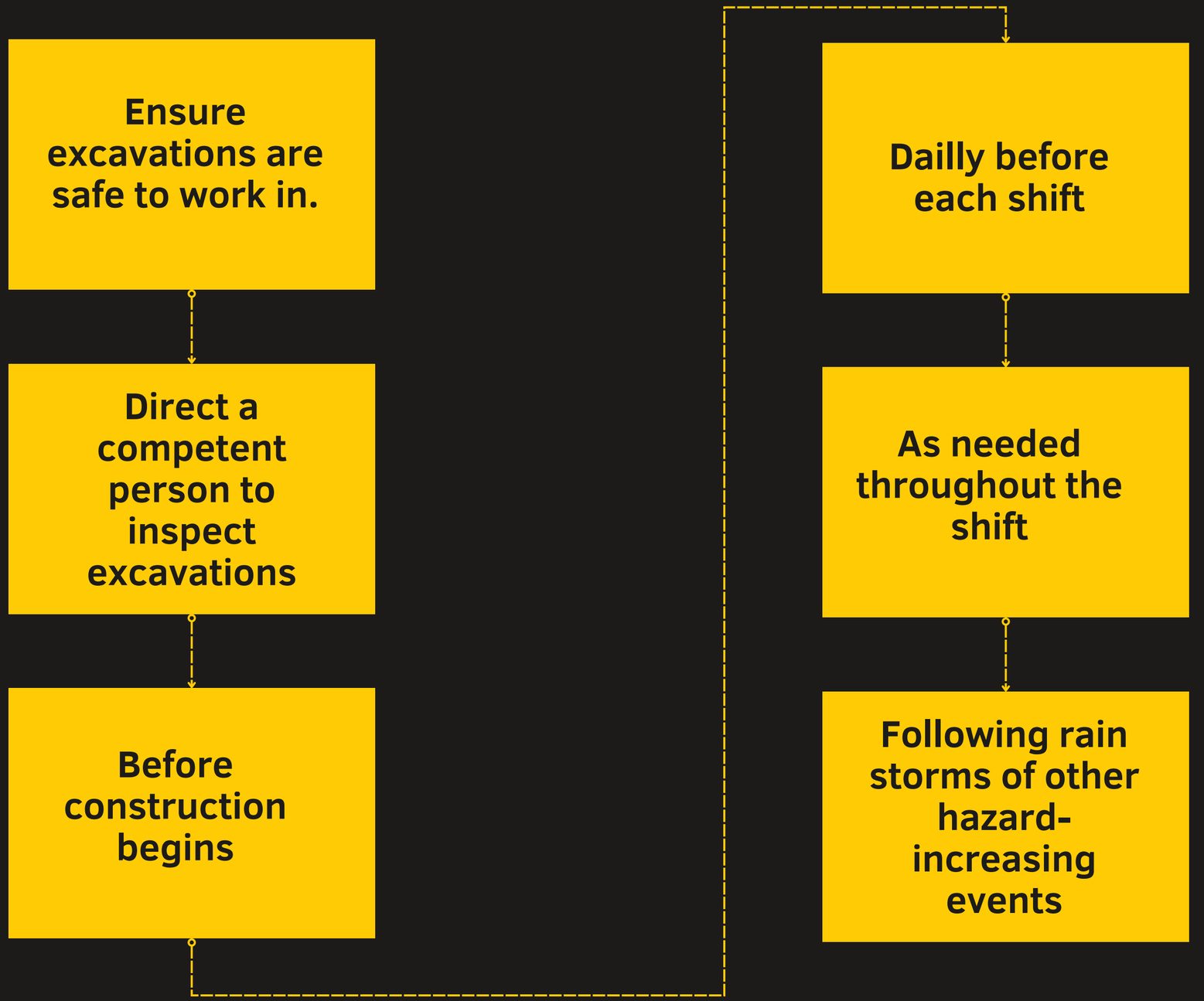
The weight of the spoils can cause a cave-in, or spoils and equipment can roll back on top of workers, causing serious injuries or death.

Keep Materials Away from the Edge

Set spoils and equipment at least two feet back from an adequately protected excavation.

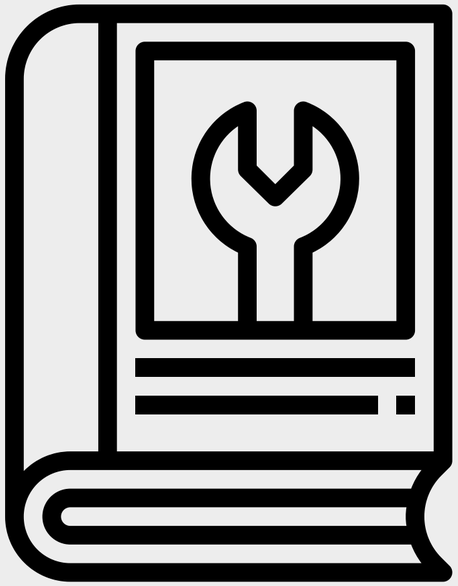
Use retaining devices, such as a trench box that will extend above the top of the trench to prevent equipment and spoils from falling back into the excavation.

Where the site does not permit a two-foot setback, spoils may need to be temporarily hauled to another location.

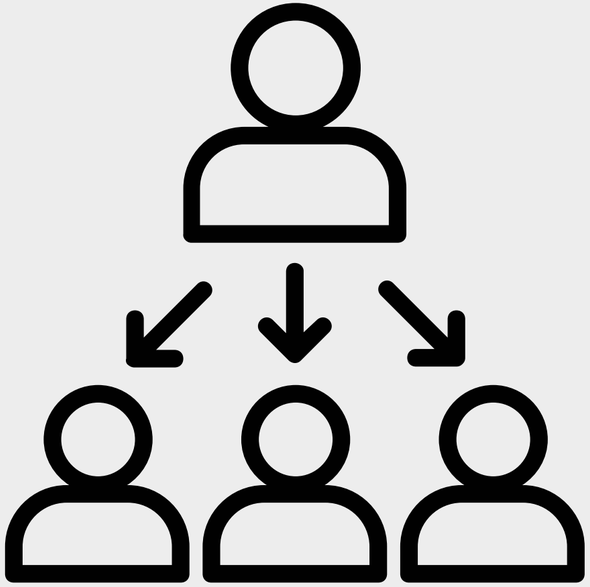


Inspections

Has training in the use of protective systems.

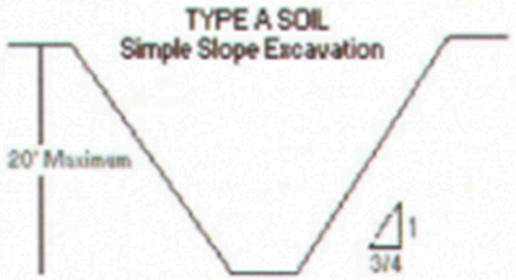
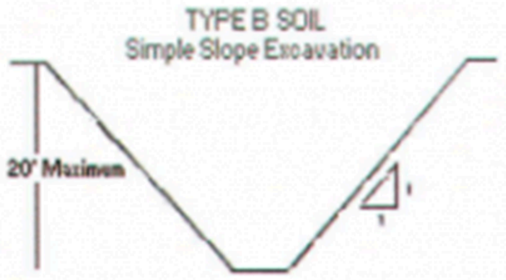
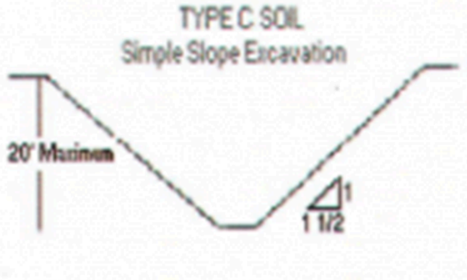


Is knowledgeable about OSHA requirements



Has authority to immediately evacuate workers from the excavation and ensure that hazardous conditions are addressed.

Competent Person

Soil Type	Height/Depth ratio	Slope Angle
Stable Rock	Vertical	90 deg.
Type A	¾ : 1	53 deg.
Type B	1 : 1	45 deg.
Type C	1½ : 1	34 deg.
		

OSHA regulations soil classifications consist of four categories.

Stability is greatest in stable rock and decreases through type A and B to type C.

Type C is the least stable.

Soil Classifications

Soil Classifications

Stable Rock

A natural solid mineral that can be excavated with vertical sides and remain intact while exposed. (Examples: granite or sandstone)

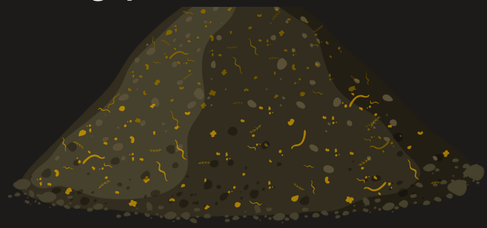
Type A Soil

- Cohesive with high unconfined compressive strength
- 1.5 tons per square foot or greater
- No fissures
- Not previously disturbed
- No water seeping through it
- (Examples: clay, silty clay, sandy clay, and clay loam)

Type B Soil

- Cohesive and has often been cracked or disturbed
- Pieces that don't stick together as well as Type A soil. Medium unconfined compressive strength
- Between 0.5 and 1.5 tons per square foot
- (Examples: angular gravel, silt, silt loam, and soils that are fissured or near sources of vibration, but could otherwise be Type A)

Type C Soil



- The least stable type of soil
- Granular soils
- Particles don't stick together
- 0.5 tons per square foot or less.
- (Examples: gravel, sand and loamy sand)
- Soil with water seeping through it is automatically classified as Type C soil

Equipment and methods to determine the type of soil:

- Visual Test: If the excavated soil is in clumps, it is cohesive. If it breaks up easily, it is granular.
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- Pocket Penetrometer: Penetrometers are direct reading, spring operated instruments used to determine the unconfined compressive strength of saturated cohesive soils.

- Thumb Penetration Test: An attempt to press the thumb firmly into the soil in question. If the thumb makes an indentation in the soil only with great difficulty, the soil is probably type A. If the thumb penetrates no further than the length of the thumb nail, it is probably type B. If the thumb penetrates the full length of the thumb it is type C.

- Wet Manual Test: Wet your fingers and work the soil between them. Clay is a slick paste when wet, meaning it is cohesive. If the clump falls a part in grains it is granular.

Soil Test and Identification

Other Hazards

- Locate all unground utilities before digging.
- Underground installations must be protected, supported or removed when excavation is open.
- Never allow workers outside of protected areas in a trench.
- Never allow workers to be under raised loads.

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