

Excavation & Trench Safety

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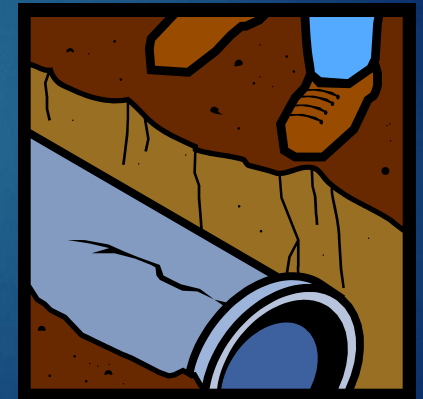
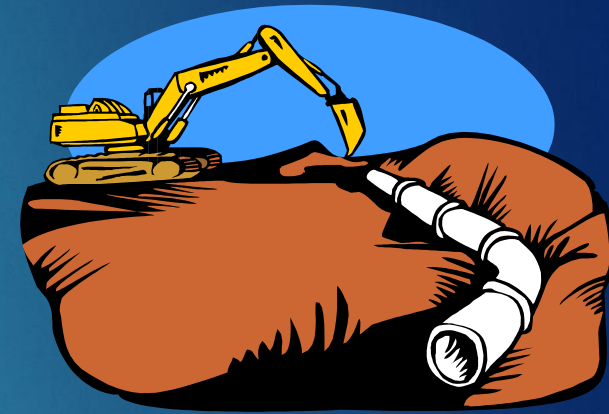
Excavation Hazards

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Cave-ins are the greatest risk

Other hazards include:

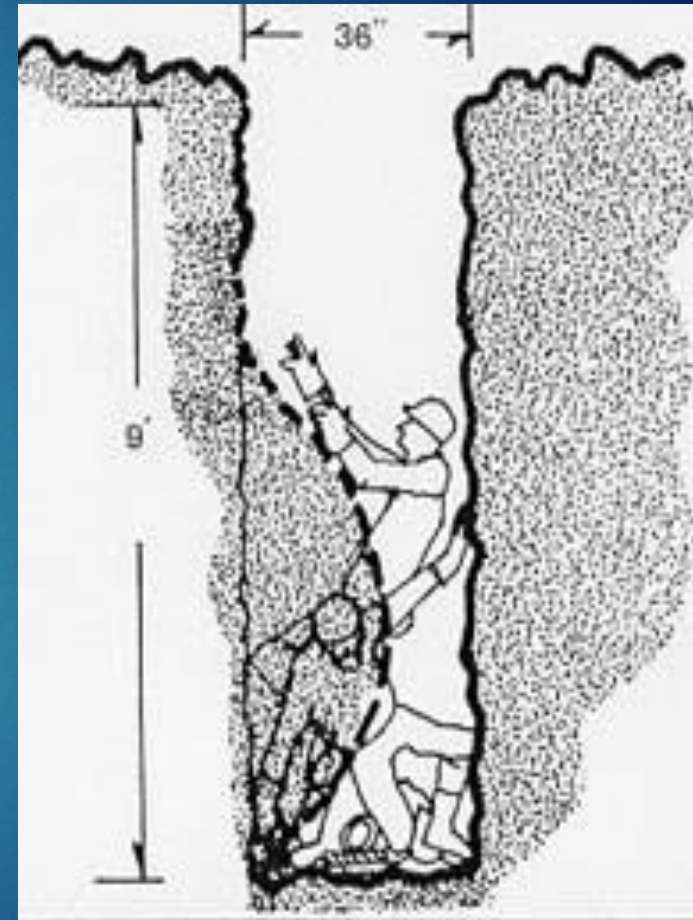
- **Asphyxiation due to lack of oxygen**
- **Inhalation of toxic materials**
- **Fire**
- **Moving machinery near the edge of the excavation can cause a collapse**
- **Accidental severing of underground utility lines**



Injury and Death

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- Excavating is one of the most hazardous construction operations
- Most accidents occur in trenches 5-15 feet deep
- There is usually no warning before a cave-in



Definitions

- Excavation – a man-made cut, cavity, trench, or depression formed by earth removal.
- Trench – a narrow excavation. The depth is greater than the width, but not wider than 15 feet.
- Shield - a structure able to withstand a cave-in and protect employees
- Shoring - a structure that supports the sides of an excavation and protects against cave-ins
- Sloping - a technique that employs a specific angle of incline on the sides of the excavation. The angle varies based on assessment of impacting site factors.

Focus of Training

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- **The greatest risk at an excavation**
- **How to protect employees from cave-ins**
- **Factors that pose a hazard to employees working in excavations**
- **The role of a competent person at an excavation site**

Protection of Employees

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Employees should be protected from cave-ins by using an adequately designed protective system.

Protective systems must be able to resist all expected loads to the system.

Requirements for Protective Systems

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A well-designed protective system

- Correct design of sloping and benching systems
- Correct design of support systems, shield systems, and other protective systems

Plus

Appropriate handling of materials and equipment

Plus

Attention to correct installation and removal

Equals Protection of employees at excavations

Design of Protective Systems

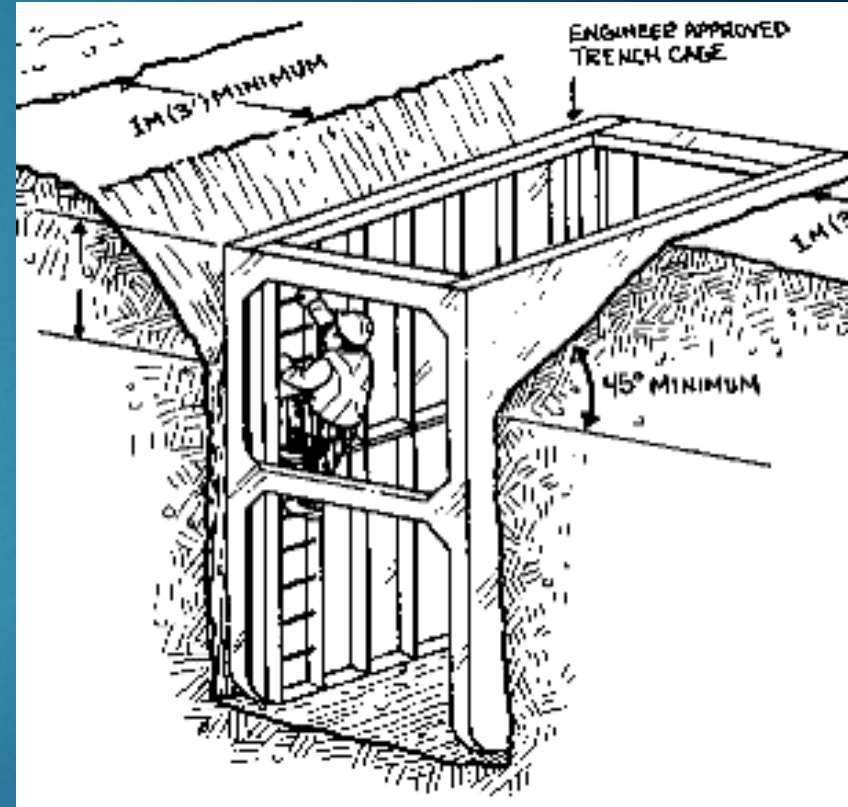
The employer shall select and construct :

- ▶ slopes and configurations of sloping and benching systems
- ▶ support systems, shield systems, and other protective systems
- Shield - can be permanent or portable. Also known as trench box or trench shield.
- Shoring - such as metal hydraulic, mechanical or timber shoring system that supports the sides
- Sloping - form sides of an excavation that are inclined away from the excavation

Protect Employees Exposed to Potential Cave-ins

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- ▶ Slope or bench the sides of the excavation,
- ▶ Support the sides of the excavation, or
- ▶ Place a shield between the side of the excavation and the work area



Cave-in Hazard

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This excavation has improperly installed aluminum hydraulic shoring.

Inadequate protective system

Inadequate Protective System

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This worker is in a trench with no protective system; no shoring, shield, or sloping.



Factors Involved in Designing a Protective System

- ▶ Soil classification
- ▶ Depth of cut
- ▶ Water content of soil
- ▶ Changes due to weather and climate
- ▶ Other operations in the vicinity



Shoring

- **General**
 - ▶ Provides a framework to work in
 - ▶ Uses wales, cross braces and uprights
 - ▶ Supports excavation walls
- **OSHA tables provide shoring data**
 - ▶ Must know soil type
 - ▶ Must know depth and width of excavation
 - ▶ Must be familiar with the OSHA Tables

Trench Shield/Box

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A trench shield/box was installed to protect this work area.

Hydraulic Trench Shoring

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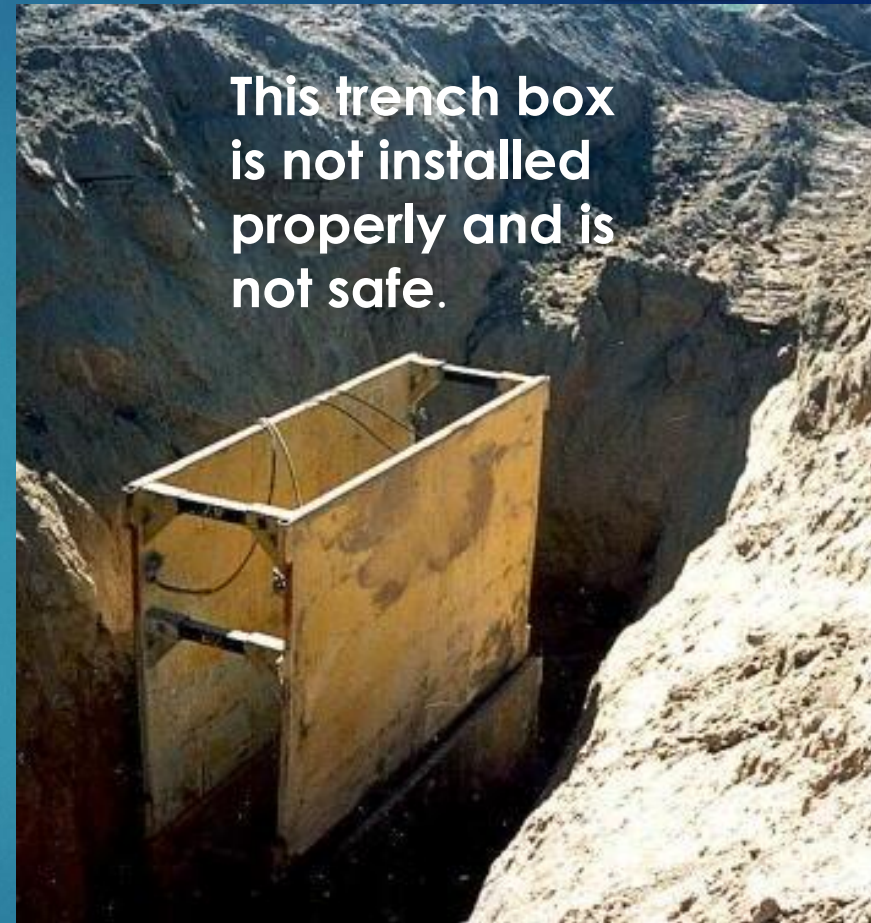


- Using hydraulic shoring the worker can easily drop the system into the hole.
- Once in place, hydraulic pressure is increased to keep the shoring in place and support the trench walls.

Materials and Equipment

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- **Equipment** used for protective systems must not have damage or defects that impair function.
- **If equipment is damaged**, the competent person must examine it to see if it is suitable for continued use.
- **If not suitable**, remove it from service until a professional engineer approves it for use.



Protection from Vehicles

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- Install barricades
- Hand/mechanical signals
- Stop logs
- Grade soil away from excavation
- Fence or barricade trenches left overnight



Hazardous Conditions

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There should be a protective system installed.

The weight and vibrations of the crane make this a very hazardous condition.

Working under the crane is also very dangerous.

Spoils

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- Don't place spoils within 2 feet from edge of excavation
- Measure from nearest part of the spoil to the excavation edge
- Place spoils so rainwater runs away from the excavation
- Place spoil well away from the excavation



Other Excavation Hazards

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Water accumulation

Oxygen deficiency

Toxic fumes

Access/Egress

Falls

Mobile equipment

Water is Hazardous

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Note that there is no protective system, worker is using a shovel to create steps, and they are not wearing hardhats.

When water is present in an excavation it is extremely hazardous to enter

Water = Cave-in Hazard

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These workers must be protected from a cave-in. Note the water in the bottom of the trench. This is a very hazardous condition!

Hazardous Atmosphere

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Test excavations before an employee enters the excavation if there is a reasonable possibility of a hazardous atmosphere.
Test for:

- ▶ Oxygen deficiency
- ▶ High combustible gas concentration
- ▶ High levels of other hazardous substances



Means of Egress

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A stairway, ladder, or ramp must be provided within 25 feet of all employees in excavations that are 4 or more feet deep.



The ladder should extend 3 feet above the excavation

Access and Egress

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These two ladders which are lashed together are dangerous and not an adequate means of egress.

The ladder should extend 3 feet above the top of the excavation

Protection from Falls, Falling Loads, and Mobile Equipment

- Install barricades
- Use hand / mechanical signals
- Grade soil away from excavation
- Fence or barricade trenches left overnight
- Use a flagger when signs, signals and barricades are not enough protection

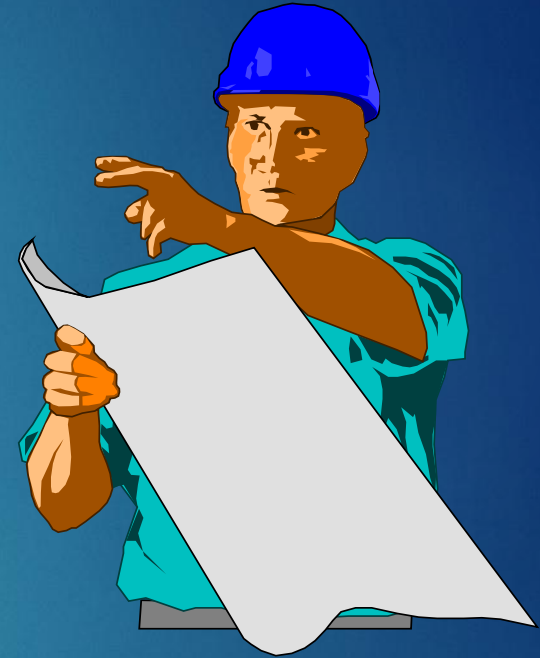
Competent Person

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Must have had specific training in and be knowledgeable about:

- **Soils classification**
- **The use of protective systems**
- **The requirements of the standard**

Must be capable of identifying hazards, and authorized to immediately eliminate hazards

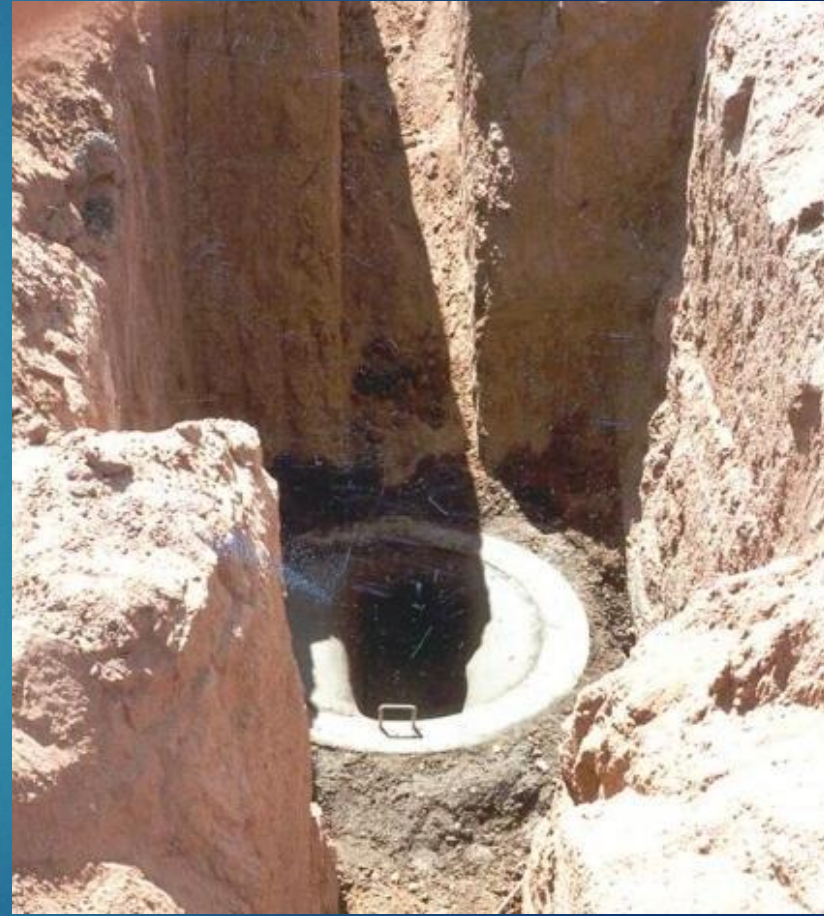


Inspections of Excavations

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A competent person must make daily inspections of excavations, areas around them and protective systems:

- Before work starts and as needed,
- After rainstorms, high winds or other occurrence which may increase hazards, and
- When you can reasonably anticipate an employee will be exposed to hazards.



Inspections of Excavations

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If the competent person finds evidence of a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions:

- ▶ Exposed employees must be removed from the hazardous area
- ▶ Employees may not return until the necessary precautions have been taken



Site Evaluation Planning

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Before beginning excavation:

- Evaluate soil conditions
- Construct protective systems
- Test for low oxygen, hazardous fumes and toxic gases
- Provide safe means to enter and exit trench
- Contact utilities
- Determine the safety equipment needed



Summary

- **The greatest risk in an excavation is a cave-in.**
- **Employees can be protected through sloping, shielding, and shoring the excavation.**
- **A competent person is responsible to inspect the excavation.**
- **Other excavation hazards include water accumulation, oxygen deficiency, toxic fumes, falls, and mobile equipment.**