PowerPoint Slides

TRENCH SAFETY TRAINING

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HARD HAT TRAINING SERIES

TRENCH SAFETY TRAINING

- TRENCHING ACCIDENTS ACCOUNT FOR MORE THAN 100 DEATHS A YEAR ON U.S. SOIL.
- 11 TIMES MORE WORKERS ARE INJURED
- 1% OF ALL CONSTRUCTION ACCIDENTS
- INJURY RATE FOR TRENCHING WORK 112% HIGHER THAN CONSTRUCTION WORK IN GENERAL
- CRIMINAL PENENLTIES ARE FREQUENTLY ASSESSED FOR NON-COMPLIANT COMPANIES WHEN SOMEONE IS KILLED OR INJURED

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CAVE-IN!

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CAVE-IN!

What went wrong?

- Employee outside the box
- Second slide possibly precipitated by the rescue effort causing the death
- Safety imperative during a rescue
- 60% of confined space deaths are the “rescuers”

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CAVE-IN!

August 25, 1999

Contractor fined for willful violations in Lynnwood worker death

TUMWATER -- The Department of Labor and Industries has fined an Arlington contractor more than $172,000 for willful violations of safety rules in connection with the death of a 28-year-old utilities worker in a trench last March.

The agency cited DLR Utilities of Arlington for six willful, four serious and four general violations of regulations intended to protect workers from hazards found at trenching and excavation worksites. Penalties totaling $172,640 were assessed.

Guy R. Daggett of Arlington suffered fatal injuries Mach 1, 1999 when he was caught between the wall of a trench and the bucket of an excavator that he was using for access into the 12-foot-deep trench. The trench was part of a sewer installation project in a residential section of Lynnwood.

Willful violations indicate that the employer knowingly or intentionally [illegible] worker-protection rules, or exhibited plain indifference tha[illegible]olation wa[illegible] occurring and failed to take corrective action.

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VE-IN!

- Fa[illegible]ure that employees working in trenches up to 13 feet deep were protected from the collapse of undermined sidewalks, pavements and other overhead hazards. In one instance, workers attempting to fix a natural gas leak in a trench were exposed to potential serious or fatal injuries from an overhanging pavement that was undermined and in danger of breaking loose and falling on them. **($24,000)**

- Failed to provide training to improve the skill and ability of employees to safely work on underground utility construction projects. Workers were left to independently determine safe methods based on experience. As a result, employees routinely were exposed to hazardous conditions, including trench-wall collapse, falls, hazardous atmospheres, overhead hazards, objects falling into trenches and motor vehicle traffic. **($28,000)**

- Failed to meet multiple requirements when workers are exposed to the hazards of confined spaces. Confined-space hazards include engulfment, asphyxiation, electrocution, and creation of flammable atmosphere. **($28,000)**

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The employer also was cited for four **general violations** relating to deviating from manufacturer's specifications, accident prevention programs and hazardous chemicals.
No penalties were assessed for these violations.

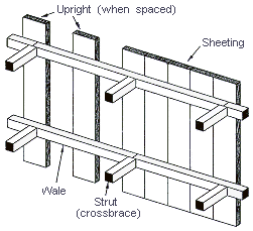
The employer has 15 working days from receipt of the violation report to appeal.

THE CAVE-IN!

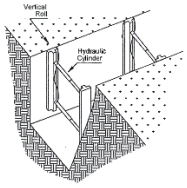
PROTECTIVE SYSTEMS

PROTECTIVE SYSTEMS

SHORING **is the provision of a support system for trench faces used to prevent movement of soil, underground utilities, roadways, and foundations. Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. Shoring systems consist of posts, wales, struts, and sheeting. There are two basic types of shoring, timber and aluminum hydraulic.**



TIMBER SHORING



HYDRAULIC SHORING

PROTECTIVE SYSTEMS

SHIELD

Shield means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

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For which [illegible] depth does federal OSHA require a protective system to be used?

a. [illegible]er than 5 ft
b. Greater than 20 ft
c. Depends on the type of work being done

Which type of protective system protects the worker from a collapse .

a. Shielding
b. Shoring
c. Sloping

Which type of protective systems prevent a collapse from starting?

a. Shielding
b. Shoring
c. Sloping

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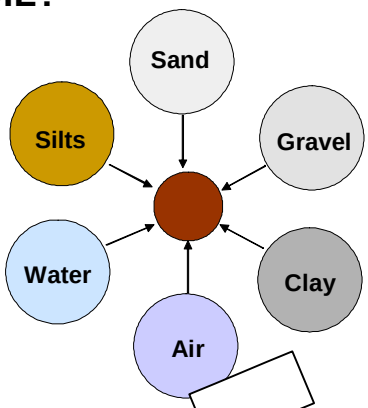
SOIL CLASSIFICATION

WHAT IS SOIL?

Cohesiveness depends on the mix of ingredients.



Typically, the more cohesive the soil, the stronger the trench wall.

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SOIL CLASSIFICATION

BASIC SOIL TYPES

- ***Type B Soils:*** **Cohesive soils made up of angular gravel, silt, silt loam, or previously disturbed soils not classified as type C.**

- ***Type C Soils:*** **Cohesive soils made up of granular soils such as gravel, sand, loamy sand, soil with seeping water or unstable rock.**

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SOIL CLASSIFICATION

TEST METHODS

- ***Thumb Penetration Test:*** **Procedure used to determine compressive soil strength of cohesive soils by using the thumb.**
  - **Makes indentation only with great difficulty, probably Type A**
  - **Makes penetration the length of the thumb nail, probably Type B**
  - **Makes penetration the length of the thumb, probably Type C**

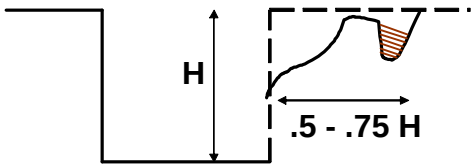
LEAST ACCURATE OF TEST METHODS

MECHANICS

All excavations will eventually slough until they reach their natural slope. The angle of the slope and the time to achieve this is dependent on several factors.

SOIL MECHANICS

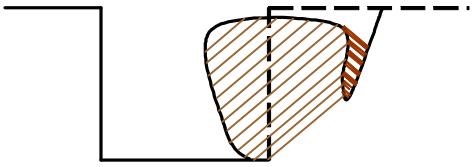
TENSION CRACK



Cracks usually appear horizontally .5 - .75 times the trench depth from the edge of the

MECHANICS

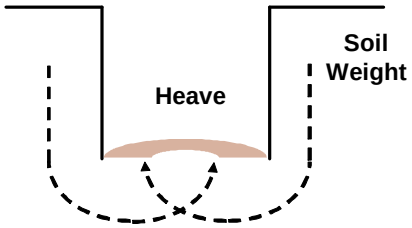
TOPPLING



Caused by tension cracks toppling can occur when the trench's vertical face shears along a tension crack line and topples into the trench.

SOIL MECHANICS

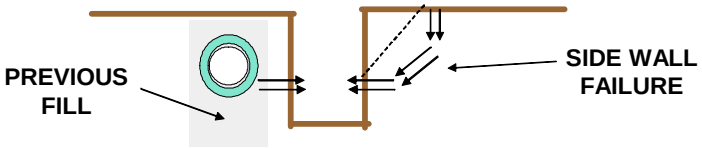
HEAVING OR SQUEEZING

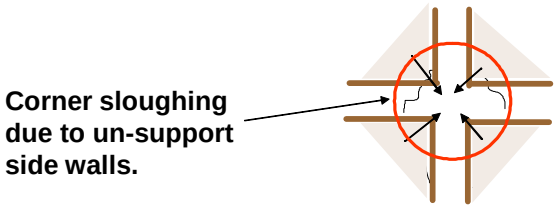


Caused by downward pressure created by weight of adjoining soil. May occur after shoring or shielding has been properly installed.

N H AILURE

E CAVATION HAZARDS

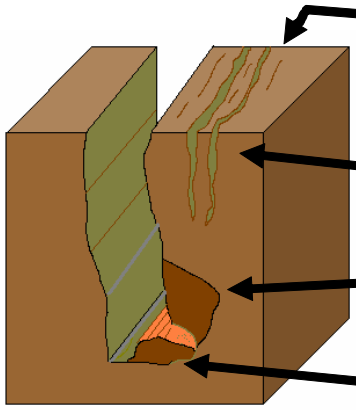




Trench Intersections

TRENCH FAILURE

STAGE TWO



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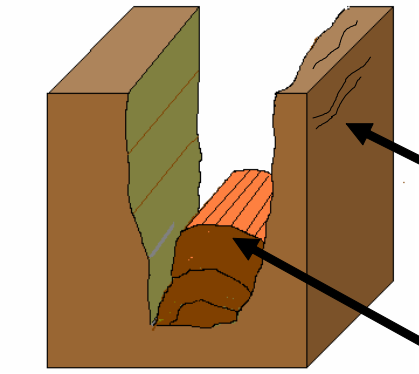
TRENCH FAILURE

STAGE FOUR



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TRENCH FAILURE

Water in trench will weaken the bottom of t at increasing the chance of ca -in.

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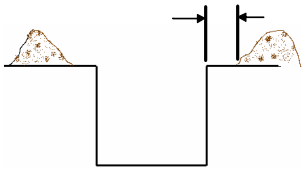
GEN R TRENCH PRECAUTIONS

2 ft min.



- **Keep material & equipment 2 ft from edge of excavation.**
- **Provide barricades or equivalent to prevent people from falling into trench.**

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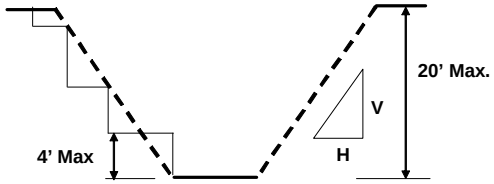
GENERAL TRENCH PRECAUTIONS

- Workers in un-protected trench
- Machinery operating with workers in tre
- Vibrations from machinery incre e chan of trench failure

TR N SLOPING & BENCHING

SLOPING AND BENCHING



Sloping and bench are not widely used because of the amount of space required. Also, backfill and compaction are greatly increased.

ASSEMBLING TRENCH SHIELDS

- Lay on side wall flat with connectors up.
- Insert spreader bars & plates and secure.
- Lift second side wall level using tag lines.
- Set side wall on spreader bars and secure.
- Use extreme caution when turning the shield upright.

LIFTING TRENCH SHIELDS

Know the weight of the shield

Know the lifting capacity of the mac[illegible]

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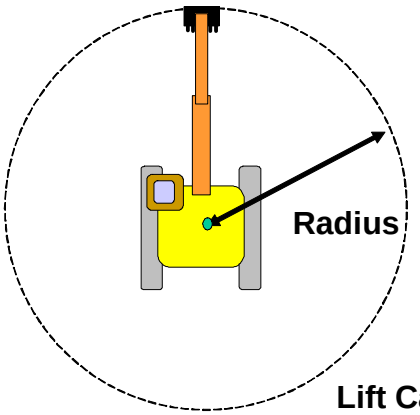
LIFT[illegible]TR[illegible]N[illegible]H SHIELDS



LIFT CAPACITY CHART

Radius	Capacity
10 ft	14000 lbs
15 ft	12000 lbs
20 ft	9000 lbs
25 ft	6000 lbs

Lift Capacity of Excavator

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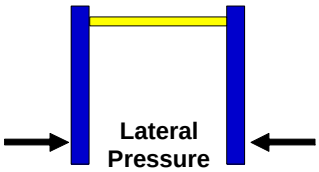
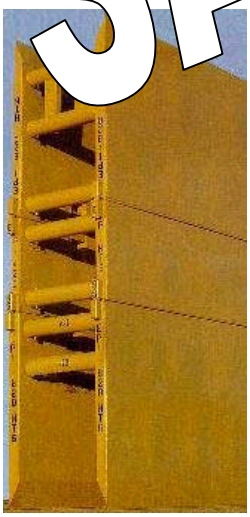
TRENCH SHIELDS



Shields are designed to withstand certain lateral force. *Refer to manufacturers tabular information on proper use.*

The weaker the soil, the greater the lateral pressure. The depth that a shield can be used is dependent on the type of so

TRENCH SHIELDS



When stacking shields, refer to the manufacturer's tabulated data information sheet.

Shields set a deeper depths will have greater lateral pressure exerted on them.

A trench shield:

a. Prevents the trench wall from collapsing
b. Protects the worker in case a collapse occurs

When using a trench shield, workers:

a. Can be one foot outside of the shield
b. Can be five feet if equipped with a harness & lanyard
c. Should never should be outside the shield

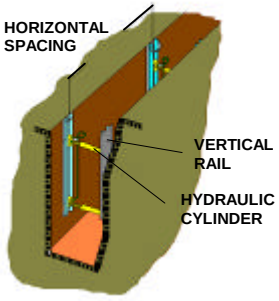
The depth of a trench for which a shield can be used is determined from:

a. Past experience
b. Manufacturer's tabulated data information
c. The shields are good for all depths

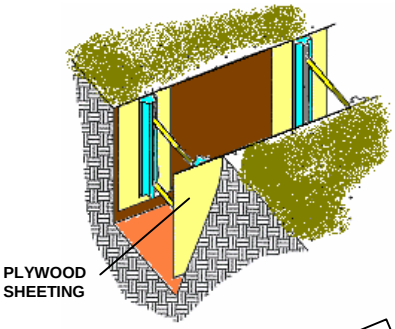
HYDRAULIC SHORING

HYDRAULIC SHORING **The trend today is toward the use of hydraulic shoring, a prefabricated strut and/or wale system manufactured of aluminum or steel. Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install or remove hydraulic shoring.**

TRENCH SHORING



Vertical Aluminum Hydraulic Shoring



Vertical Alumi
Hydr ic Shor
w wood

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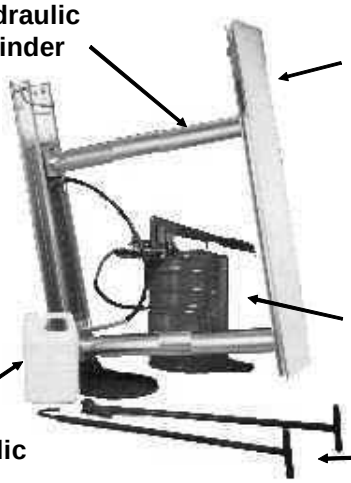
IC HORING

INSPEC

- Dents & bends
- Crack welds
- Missing or damaged fasteners
- Damage or leaking hydraulic hoses
- Pump operation
- Proper hydraulic fluid
- Handling tools available



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TRENCH SHORING

INSTALLING VERTICAL ALUMINUM SHORING

- Connect hydraulic hoses to the pump.
- Place shoring at pre-determined intervals
- Place shoring using the installation tools from the top of the trench

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TRENCH SHORING

INSTALLING VERTICAL ALUMINUM SHORING

- With shoring in place, use the release tool to disconnect the hydraulic hose.

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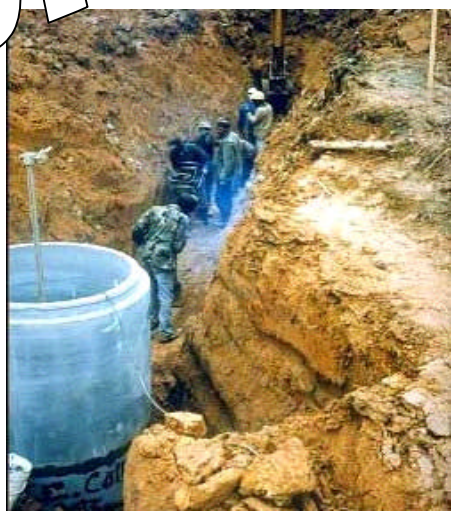
TRENCH SHORING

REMOVING VERTICAL ALUMINUM SHORING

- Pull the shore from the trench with the removal hook.

ATMOSPHERES



HAZARDOUS ATMOSPHERES

The competent person is responsible for determining the quality of the air in the trench.

Observe all precaution signs and requirements

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HAZARDOUS ATMOSPHERES

CONTROL METHODS

- Provide fresh air exchange
- Use exhaust ventilation
- Locate gas powered equipment downwind
- Minimize the use of hazardous materials
- Isolate workers from hazardous areas
- Use respiratory protection for oxygen deficiency or toxic contaminants

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