

**The Collapse of Trench Safety**  
Common Mistakes in Excavation

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**RETTEW Firm Overview**

- ▶ An *Engineering News-Record* magazine top design firm
- ▶ More than 350 dedicated professionals
- ▶ Offering more than 100 different services
- ▶ Serving clients for more than 45 years
- ▶ Ten office locations across five states

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**Safety Third?**

**Dirty Jobs**

- > Accident free 2004-2008
- > Followed by 11 incidents and several "close calls".
- > Worker crushed by a coke oven door and killed.
- > All crew members attended a safety meeting the day the employee died.

So what is "First and Second"?

1. Common Sense
2. Personal Responsibility

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### Trench Fatality – Case Study

Worker trapped in ditch at midstate feed mill dies - Jun 22, 2016

(Lebanon) Monday morning, the fire department crews from worked for shaped trench. Part of the said. The rescue him. Crews for this type arrived, Marrey said.



The worker, who was conscious and alert during the rescue, was transported by a First Aid & Safety Patrol ambulance to Hershey Medical Center.



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#### What are the hazards?

#### Type of Trench Collapses

- Approx 54 fatalities a year.
- 64% of Fatalities Occur less than 10' deep (NIOSH)
  - Why?
- How much does a cubic yard of dirt weigh?
  - 3000lbs cyd

- Belly Slough (Slough-in)
- Wall Shear Collapse
- Lip Slide
- Spoil Pile Collapse



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### Trench Collapse Types

#### Spoil Pile Collapse

The excavated soil (spoil) is piled on the lip. This soil is loose and has a tendency to slide. If it is not placed far enough away from the lip it will slide into the trench and bury workers.



#### Wall Shear Collapse

The collapse of an entire section of wall from lip to floor.



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### Trench Collapse Types

**Slough-In**

A collapse that occurs near the bottom of the wall leaving the potential for the collapse of an overhanging ledge.



**Lip Shear Collapse**

Lip slide collapses are similar to shear wall collapses, but on a smaller scale. A fracture occurs at the top of the trench and results in the breaking and sliding of the trench lip.





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### Time for Some Math! How Much Does that Weigh?

Your crew is working in a trench that is 8' deep, 22' long and 6' wide. Your competent person notices a fissure along the outside of the trench wall that is 2' back from the trench edge and 5' long. If there was a shear wall collapse that occurred at that crack (assuming it extended to the bottom of the trench)...

**How much would the soil that collapses into the trench weigh?**

**4.44 TONS**



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### What is a "Competent Person"

How do you get to be a "Competent Person"?

1. Experience
2. Training
3. Authority







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### What Must a Competent Person Do / Know?

- Must be
  - Ensure d
  - **should b**
  - Ensure a
  - Re-inspe
  - Monitor v
  - Determin
  - atmosph
- 1926.651(k)(2)** - Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

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### Who is Competent?



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### OSHA Soil Classification

- Simple
- Soil Types
  - Stable Rock
  - A, B & C
- Based on at least one visual and one manual test.



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## OSHA Soil Types

Type A	Type B	Type C
Cohesive soil UCS > 1.5 TSF Clay/Silty Clay/ Sandy Clay/ Loam Cemented Soils Vertical side slope Never Type A if: <input type="checkbox"/> Fissured <input type="checkbox"/> Vibration <input type="checkbox"/> Fill Material <input type="checkbox"/> Sloped/Layered 4:1 or >	Cohesive soil UCS = .5 – 1.5 TSF Silt/Silt Loam/ Sandy Loam Dry unstable rock Fill – Except type C Type A w/tension cracks or subject to vibration Sloped/Layered < 4:1	Weak cohesion or cohesionless soil UCS < .5 TSF Granular soils/ sand/gravel Submerged soil or water entering Sloped/Layered > 4:1

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## What Are Your Options?

Visual	Manual
Particle size & amount	Plasticity: thread or ribbon test
Clumping or breaks up	Dry strength
Fissures / Crack-like openings / Spalling / Bulging	Thumb penetration
Previously disturbed soil	Unconfined compressive strength (i.e.pocket penetrometer)
Slope of layered systems	Others
Water	Settlement test
Vibration influence	Bite test

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## 12 General Requirements of Trenching

1. Surface Encumbrances
2. Underground Installations
3. Access & Egress
4. Exposure to Vehicular Traffic
5. Exposure to Falling Loads
6. Warning Systems for Mobile Equipment



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### 12 General Requirements of Trenching

7. Hazardous Atmospheres		
8. Water Accumulation		
9. Stability of Adjacent Structures		
10. Loose Rock & Soils		
11. Inspections		
12. Walkways & Fall Protection		

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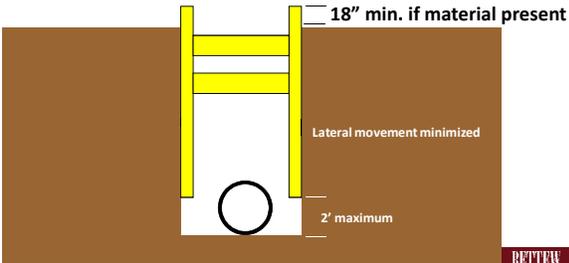
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### System Installation



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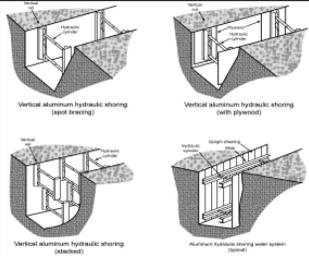
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### System Installation



- Installation / removal from outside trench
- Excavation face near vertical
- At least two / three shores in place prior to entry
- Spreader not more than 4' from bottom of trench 4-4-2
- Plywood 2' max from bottom
- Plywood to top of trench

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### Tabulated Data

Understand  
Serialize  
C-60 vs  
Spoil Pile  
Lateral

4.2 Tables VS-1, VS-2 and VS-3 are not considered adequate when loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by 3 feet of soil. The term "area within a horizontal distance equal to the depth of the excavation but not limited to 7.6 The side walls of the excavation shall be no wider than the width of the shield plus 12 inches.



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### Trench Boxes

### Vertical Hydraulic Shores



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