Trench Rescue
NFPA 1670 Awareness Level

Kansas Search & Rescue Response System

General Training Requirement

NFPA 1670
Trench Rescue

- (1) Recognizing the need for a trench and excavation rescue
- (2) Identifying the resources necessary to conduct safe and effective trench and excavation emergency operations
- (3) Initiating the emergency response system for trenches and excavations
- (4) Initiating site control and scene management

NFPA 1670
Trench Rescue

- (5) Recognizing general hazards associated with trench and excavation emergency incidents and the procedures necessary to mitigate these hazards within the general rescue area
- (6) Recognizing typical trench and excavation collapse patterns, the reasons trenches and excavations collapse, and the potential for secondary collapse

NFPA 1670
Trench Rescue

- (7) Initiating a rapid, non-entry extrication of non-injured or minimally injured victim(s)
- (8) Recognizing the unique hazards associated with the weight of soil and its associated entrapping characteristics

WHAT IS A TRENCH?

- O.S.H.A. defines a trench as
  - **Excavations that are deeper than they are wide, however no more than 15 feet wide and 20 feet deep.**
  - **O.S.H.A. only recognizes the need for worker protection in trenches that are in excess of 5 feet**
  - **The O.S.H.A. standard for trenches is 29CFR 1926**
  - **Trenches that exceed 20 feet deep and 15 feet in width require a Registered Professional Engineer (RPE)**

HIDDEN HAZARDS

- 65% of deaths that occur in trenches are “would be rescuers”
- A second hazard is the “Secondary Collapse”
- Initial collapses weaken the trench side walls
- Buried utilities
- Bad air quality

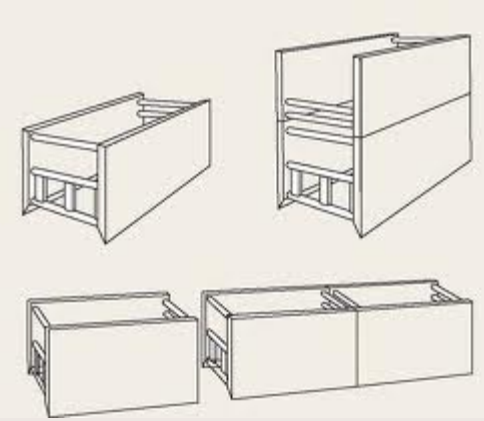
O.S.H.A. Worker Protection

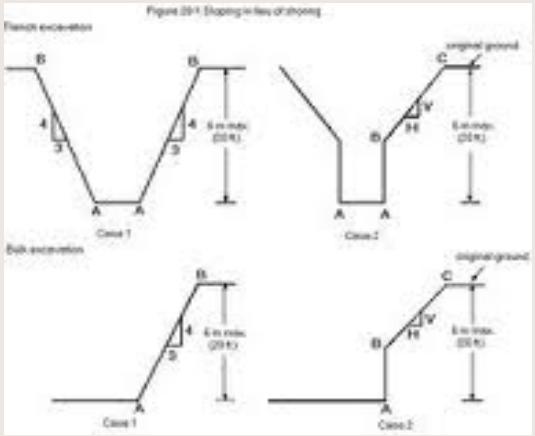
- O.S.H.A. prohibits entry into trenches over 5 feet deep unless one of the following conditions are met:
  - The walls are properly sloped back so they cannot fall in
  - The worker is properly protected by a properly designed and positioned trench shield
  - The worker is protected by properly designed and constructed shoring

Digging their own grave

3 TYPES OF WORKER PROTECTION

- Sloping
- Shielding
- Shoring





TYPES OF COLLAPSES

- 4 Types
  - Slough-in or slide-in: below grade section collapses
  - Side wall-in: entire side collapses
  - Shear-in: top portion collapses
  - Spoil-in: excavated soil collapses

FACTS ON SOIL

- The speed of dirt
  - Trench walls often collapse in less than 1/10 of a second
- Weight of dirt
  - A single cubic foot of dirt weighs approx. 100 lbs.
  - A cubic yard weighs 1.5 tons (3000 Lbs.)

RESCUE OPERATIONS

- Long term operations – 4 to 10 hours
- Victims must be entirely uncovered prior to attempting a rescue
- Backhoes and other hydraulic equipment MUST never be used

SOIL CLASSIFICATIONS

- Class A Soil
  - Most stable
  - Soil has clumps and clumps are difficult to break apart
  - Thumb test can only dent the clump
- Class B Soil
  - Soil has clumps
  - Clumps break apart with minimal effort
  - Thumb can penetrate or mold soil
- Class C Soil
  - Soil is granular
  - Trench is wet

METHODS FOR CLASSIFYING SOILS

- Thumb penetration method
  - Simplest and easiest
  - Soil that is removed from the spoil pile, is granular or wet = Class C Soil
  - Soil that is removed from the spoil pile is, difficult to break apart or only dents = Class A
  - Anything in between = Class B

ADJUSTMENTS TO SOIL CLASSIFICATIONS

- Once the basic soil classification has been determined, other environmental factors must be considered
- In many cases the soil must be lowered, if the soil is being effected by dangerous environmental conditions
- The longer a trench remains open and exposed to the elements, the more affected it will be.

SOIL ADJUSTMENTS

- Layered Soils
- Fissured Soils
- Previously Disturbed Soil
- Vibration
- Wet soils or standing water in the trench
  - Any wet soil is automatically considered Class C Soil

O.S.H.A. ADJUSTEMNTS TO SOIL CLASSIFICATION

- Wet Soil = Class C
- Adjust Soil Class DOWN one level for the following:
  - Trench involves SLOPED-LAYERED SOIL
  - Trench involves FISSURED (Cracked) SOIL
  - Trench involves PREVIOUSLY DISTRUBED SOIL
  - Trench is subject to VIBRATION

OTHER FACTORS THAT EFFECT TRENCH STABILITY

- Water Removal
- Underground Utilities
  - ***O.S.H.A. requires that all utilities or other structures exposed in trenches be properly supported***
- Surface Encumbrances
  - Items that cannot be moved and have to be supported
- Superimposed Loads
  - ***O.S.H.A. requires that all superimposed loads, including the spoil pile, be placed more than two feet from the edge of the trench***
- Exposure to the elements
  - ***O.S.H.A. requires that trenches be analyzed for safety and stability at least daily, and after any event which may have effected the stability of the trench or of the protection system***

ADDITIONAL REGULATIONS FOR WORKER SAFETY

- Personal Protective Equipment
  - Hard Hats
  - Shoes or Boots
  - In areas of traffic workers should wear reflective vests
  - In trenches with water accumulation, drowning precautions must be taken

PROTECTIVE SYSTEMS

- O.S.H.A. provide three methods for protecting workers in trenches
  - Sloping
  - Shielding
  - Shoring
    - **No worker is to enter a trench greater than 5 feet deep unless one of these protections is in place**

ADDITIONAL REGULATIONS FOR WORKER SAFETY

- Escape Routes
  - No more than 25 Feet travel distances
  - Ladders are usually used
  - Ladders must extend a “few feet” above the lip of the trench and MUST be secured
- Air Quality Monitoring
  - Care should be taken with the sick or unconscious patient
  - Ventilation may be required
  - “Bad Air”
    - Oxygen deficient
    - Carbon Monoxide
    - Hydrogen Sulfide


CONTACT WITH UTILITIES CAN BE DANGEROUS &
CAUSE DISRUPTION TO SERVICE
ROADWAY UNDERMINING
GAS SERVICE

SLOPING

- Involves the cutting back of the side of the trench to an angle at which the earth will no longer slide.
- ANGLE OF REPOSE – is defined as the angle at which soil will no longer slide
- Class A = 1 ft. down ½ ft. back
- Class B = 1 ft. down 1ft. back
- Class C = 1 ft. down 1 ½ ft. back
- Safest form of protection, however is time consuming and takes a significant amount of space

SHIELDING / TRENCH BOXES

- Extremely strong steel boxes
- Assembled on site and moved into place
- Trench boxes should be placed so to extend above the lip of the trench and not more than 2 feet off the bottom of the trench

SHORING

- Shoring is designed to be strong enough to stop the walls from starting to move, but is not designed to be strong enough to stop moving dirt.
- Several types of shoring
  - Air shores
  - Hydraulic Shores
  - Dimensional Lumber Shoring

SHORING Continued

Timber Shoring

Shoring members

- **Uprights**
  - **4”x6”x 14’**
- **Cross braces**
  - **8”x8”x 4’**
- **Whalers**
  - **8’x8’x14’**
- **Sheeting**
  - **1 1/8” plywood**
  - **¾” 14 ply thin forms**

- Screwjack Shoring
- Uses up rights and whales
- Not O.S.H.A. approved

SHORING Continued

- Pneumatic Shoring
- Use of air pressure
- Locking collar and pin assembly
- Working range is limited
- Cost extensive due to the need to purchase different sizes

- **Hydraulic Shoring**
- **Assembled with cross braces and uprights in place**
- **Pumped with a hydraulic pump**
- **Very heavy**
- **Not easy to store**
- **Shores can be placed without entering the trench**

SHORING INSTALLATION

- Of the four shoring systems, only the hydraulic shoring can be installed without entering the trench
- Shoring systems must be installed from the top of the trench down, and removed in the reverse order.

INITIAL COMPANY OPERATIONS

- Initial response personnel can still perform tasks which will serve to speed-up the rescue, protect the victim, and eliminate the need for rescue or recovery of additional personnel
  - Establish a Trench Rescue Training Program
  - Preplan and Activate a Trench Rescue Team Quickly

OPERATIONS TO BE CONDUCTED ON ARRIVAL

- DO NOT allow personnel into an unprotected trench
- DO NOT allow the use of heavy equipment
- Set up control zones
  - Hot, warm, cold
- Stop all sources of vibration
  - Stop all vibrations within 300 ft. of the trench
- Establish a Incident Action Plan

OPERATION CONTINUED

- Try to locate the victim
- Lay ground pads if available
- Place a ladder for victim to self rescue
- Test the air and Set-Up ventilation
- Prepare for injuries
- Notify O.S.H.A.

SUMMARY

- Recognize the need for trench rescue
- Initiate emergency response
- Establish control zones
- Recognize hazards
- Recognize collapse patterns
- Initiate IAP
- Initiate rapid non-entry rescue(Ladder)

This completes the general requirement for NFPA 1670
Trench Rescue Awareness Level

Click the box below to take a quiz
and
receive a Certificate of Completion.

FINAL QUIZ