TRENCHING AND EXCAVATION

The following guide is an aid intended for students who have completed the ClickSafety training course or module associated with Trenching and Excavation. This guide is a resource of basic occupational safety and health information and is not a substitute for standards issued by the U.S. Department of Labor’s Occupational Safety and Health Administration (OSHA) or its state equivalents. This course is also not a substitute for the kind of intensive, site-specific, hands-on training and information that is necessary to ensure a safe and healthful workplace. This guide is not to be reproduced or used without the express permission of ClickSafety.

INTRODUCTION

OVERVIEW
OSHA Excavation Standard 1926.650, subpart P
Trenching and Excavation:
- Specific Excavation Requirements
- Soil classification system
- Requirements for protective systems

History of OSHA Excavation Standard
- 1969 -- Construction Safety Act passed by Congress
- 1970 -- OSHA becomes a federal agency
- 1971 -- Adoption of Construction Standards in the Code of Federal Regulations (CFR)
- 1990 -- Revisions made to Excavations/CFR delays final rule and final print date

Definitions
Competent Person
A Competent Person must:
- be capable of identifying hazards
- Have specific knowledge regarding specific Excavation Requirements, Soil Classification, and Requirements for Protective Systems, AND have the authority to take prompt corrective measures to eliminate hazards.

Excavation
- any man-made cut, cavity, trench,
- any man-made depression in the earth’s surface
- any earth removal

Trench
- a narrow excavation that is deeper than it is wide
- no more than 15 feet wide at bottom
- walls will eventually fail

SPECIFIC EXCAVATION REQUIREMENTS:
Surface Encumbrances
- Surface Encumbrances include:
  - Trees, utility poles
  - Curbs, gutters, and sidewalks
  - Spoil piles, trucks, etc.
The Zone of Influence
• Defined as sum of two areas:
  • Width of trench, plus
  • Adjacent Area
• Adjacent Area defined as:
  • Area on each side of cut equal to its depth
• All surface encumbrances must be removed or supported within Zone of Influence

Underground Installations
• Must be located and marked prior to digging
• At least 24-72 hour notice must be given to utilities
• All underground installations must be protected, supported, or removed

Access and Egress
• Structural Ramp
• Ladder or other safe means must be:
  • Within 25 feet of all workers
  • Extend 3 feet above cut
  • Have a 4-to-1 angle
  • Secured to prevent movement

Exposure to Vehicular Traffic
• Wear highly visible and/or reflective clothing
• Make sure traffic controls are in place to protect workers

Exposure to Falling Loads
• Dangerous proximity to falling loads is NOT allowed
• Stand away from equipment to avoid spillage or falling material

Warning Systems for Mobile Equipment
• Barricades
• Hand Signals
• Stop Logs
• General Safety principles
• Work outside the working radius
• Make your presence known
• Establish eye contact with operator
• Maintain a safe distance

Hazardous Atmospheres
See other ClickSafety courses for detailed discussion of:
• Lack of oxygen
• Combustible or flammable vapors
• Poisons
• Asbestos-containing rock formations
• Atmosphere must be determined to be safe BEFORE entry: see ClickSafety’s “Confined Spaces”

Protection from water accumulation hazards
• Protection requirements
• Special support or shields
• Water removal (dewatering)
• Equipment must be monitored by a Competent Person to ensure proper operation
• Ensure compliance with local storm water discharge regulations

**Plan for Water Accumulation Hazards**
• Surface Water and Natural Drainage
• Control with diversion ditches and/or dikes
• Controls **MUST** provide adequate drainage to both the excavation and adjacent areas
• Excavations subject to heavy rains need to be inspected by a Competent Person before workers are allowed in the trench

**Stability of adjacent structures**
• Adjoining structures must be supported:
  • Underpinned
  • Cribbed
  • Verified by Professional Engineer

**Spoils Protection**
• Spoils must be kept at least 2 feet from the trench necessary
• Barriers may be necessary
• Falling debris hazards
• Trench collapse hazards may result from sideloading

**Inspections**
Inspections **MUST** be completed by a Competent Person:
• before work begins
• throughout the shift
• when conditions change
• when a hazardous event occurs
• All excavation workers should be trained to recognize hazards

**Walkways**
• Must be used when crossing trenches
• Must have handrails when at least
  • 6 feet above lower level
• Never take shortcut across trench

**SOIL CLASSIFICATION SYSTEM:**

**Stable Rock**
• Natural solid mineral matter that can be excavated and remain intact while exposed

**Type A**
• Usually clays: silty, sandy, loam, silty clay loam or sandy clay loam
• Cemented soils: caliche and hardpan
• **Not** Type A if:
  • Fissured soil
  • Subject to vibration
  • Previously disturbed
  • Other factors

**Type B**
Granular soils:
• angular gravel
• silt
• silt loam
- sandy loam
- silty clay loam
- sandy clay loam

**Type C**
Granular soil:
- gravel
- sand
- loamy sand
- Submerged soil
- Submerged soil with water seepage

**Requirements for Protective Systems**

**Worker Protection**
- OSHA requires protective system except when excavations:
  - Are made in stable rock
  - Are less than 5 feet in depth with inspection by competent person and deemed safe
  - Any risk of employee injury warrants protection

**Minimal Soil Integrity**
- Unclassified soil can be considered no better than “C”
- Destabilizing effect of soil removal

**Protective systems:**
- First Option:
  - Designs using the “OSHA Standard”
  - Buy it off the shelf from a manufacturer
  - Build it yourself for multiple uses as approved by a professional engineer
  - Site Specific systems designed by professional engineer

**DESIGNS USING THE OSHA “STANDARD”**

**Sloping and Benching: Measurements**
- Toe of slope measured at the point side meets the bottom of cut
- 6’ deep excavation at one and one-half to one ratio equals:
  - 9’ out of each side of trench

**Sloping Guidelines**
- Competent Person refers to OSHA Excavations Standard
- Appendix B allows for reducing slope
- 1-to-1 for Type B soils
- 3/4-to-1 for Type A soils
- Vertical Side for stable rock
- Check your state’s requirements first

**Sloping Layers**
- Deepest Soil Type Controls Slope

**Benching**
- Benching: a Set of vertical rises up to 4’ high
- Slope must be measured from toe and must not exceed allowable slope for soil type
- Benching can only occur when soil is type A or B
- Limited to trench depth of 20’
Trench Shield
- Slope begins 18 inches below the top of the trench shield
- All ejected spoils no less 2’ from edge of slope at top

SUPPORT SYSTEMS, SHIELD SYSTEMS, AND OTHER PROTECTIVE SYSTEMS
Protective Devices
- Trench shields
- Trench jacks
- Manhole boxes
- Competent Person must be familiar with manufacturer’s performance data

Trench Shields
- Designed for worker protection
- Follow engineer specifications for
  - gap between trench face and shield

Trench Shields: Exposure
- In some cases, trench shields will have unprotected ends
- These open ends must have engineered protection
- Trench Shields: Stacking
- Use manufacturers’ specifications
- No exposure to suspended load overhead--ever!
- Shields rated for full depth may be:
  - Raised 2’ from bottom of cut, provided there is no possible loss of material

Trench Shields: Modifications
- Know manufacturer’s performance data
- Modifications must be approved in writing by manufacturer or P.E.
- Designs using manufacturer’s data: the Kingdome
- Top hydraulic cylinder
- Max. 2’, min. 1’ from top of trench
- Bottom Cylinder
- No more than 4’ from trench bottom
- Specified sheeting within 2’ of bottom
- Horizontal spacing between hydraulic shores up to 6’ apart

Designs using manufacturers data: Timber Shoring
- Refer to written local standards for acceptable shoring uses

Designs: Other Tabulated Data
- copy of performance data must be available on-site

Manufacturer’s Recommendations
- Engineering performance data
- Observe for all protective systems

Inspect system for damage
- If damaged, the Competent Person must evaluate suitability for continued use
- No major structural repairs without permission from manufacturer or engineer
MATERIALS AND EQUIPMENT

Remove from Service
Defective Systems:
- If unsuitable for use, the system must be removed from service
- Repair by authorized person or facility
- Returned only upon approval from a Registered Professional Engineer

Installation and Removal
Prevent Failure!
- Surely connect all components
- Don’t be sloppy or hasty
- Ensure all connections are secure

Safeguards
- Protect Employees!
- No one under suspended load
- Keep hands and feet clear
- Never go into hole to install or remove system

System Overloads
- Watch Out!
- Look for pieces bending or deflecting under load
- Caused by excessive tension or compression
- Ensure components are straight
- Do not climb on cross braces
- Do not extend length or height of system with additional sheeting

General Guidelines
- Protect Work Area!
- Secure top of excavation
- Then continue digging inside protection
- Add support on way down
- Removal is the reverse
- Work from bottom to top

Backfilling
- Backfill and compact as system removed
- This reestablishes equilibrium and stabilizes the heavy loads
COURSE NOTES: