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Section I
Introduction

Introduction

In the construction industry, excavation work such as trenching can be extremely hazardous. A trench is defined as a narrow excavation made below ground in which the depth is greater than the width, which is 15 feet or less.

The most common type of trenching accident, cave-in, is also the most deadly. Cave-ins are usually the result of unsafe work practices:

- Not using shoring;
- Using inadequate shoring;
- Excavating too close to a building or utility pole;
- Misjudging the stability of the soil;
- Vibrations caused by construction work; or
- Weather conditions that change the soil around the excavation.

This program outlines procedures and guidelines for the protection of employees working in and around excavations and trenches. This program requires compliance with OSHA Standards for General Industry (29 CFR 1910.146) and OSHA Standards for Construction Industry (29 CFR 1926.650).

Compliance is mandatory to ensure employee protection when working in or around excavations. This policy and procedure pertains to all Hilscher-Clarke *(herein referred to as Hilscher-Clarke)* projects that require any excavations or trenches.

Section II
Training Requirements
&
Specific Responsibilities

The President shall be responsible for the following:

- Review and update of Hilscher-Clarke's Trenching & Shoring Program to conform to current CFR standards.
- Insure compliance with standards set forth in this program and policies by periodic inspection of work sites.
- Provide prompt assistance to the Safety Manager and Supervisory Personnel, Competent Persons or others on any matter concerning this Policy.
- Ensuring that standard operating procedures, described in this supplement, are included in specifications and contract documentation for work to be performed by subcontractors.
- The President may delegate the responsibility of various aspects of the Excavation, Trenching & Shoring Program to a Qualified Organization. However, the President's ultimate responsibility for his/her aspects of the program cannot be delegated.

The Safety Manager shall be responsible for the following:

- Audit protective systems and atmospheric monitoring equipment.
- Assure that a supply of replacement parts for soil and atmospheric testing equipment is available at all times.
- Coordinating training, with the Supervisor, and enrolling employees as required in this program.
- Conduct Competent Person training, in accordance with the guidelines as set forth in the applicable standards and this policy and procedure.
  - Ensuring that sufficient employees will be trained to provide a "Competent Person" at each excavation or trench covered by this standard.
- Ensuring that necessary testing equipment and shoring or shielding is acquired and maintained as required by the level of excavation activity within their areas of responsibility.
- With the approval of the President, the Safety Manager may delegate the responsibility of various aspects of the Excavation, Trenching & Shoring Program to a Qualified Organization (as approved by the President). However, the Safety Manager's ultimate responsibility for his/her aspects of the program cannot be delegated.

Supervisory Personnel shall be responsible for the following:

- Ensuring that a "Competent Person" is in charge of each trench or excavation covered by this policy and procedure.
- Enforcing the use of appropriate Personal Protection Equipment through disciplinary action as prescribed in Hilscher-Clarke' Disciplinary Program.
- With the approval of the Safety Manager, the Supervisor may delegate the responsibility of various aspects of the Trenching, Excavating & Shoring Program to another qualified person, competent person, or Qualified Organization (as approved by the Safety Manager and/or President). However, the Supervisor's ultimate responsibility for his/her aspects of the program cannot be delegated.

Training Requirements & Specific Responsibilities (cont.)

All Employees shall be responsible for the following:

- Complying with all applicable guidelines contained in this safety policy and procedure.
- Reporting suspected unsafe conditions or equipment to the "Competent Person".
- Complying with all applicable guidelines contained in this safety policy and procedure.
- Reporting suspected unsafe conditions or equipment to the "Competent Person".
- Employees must immediately evacuate any trench or excavation when they suspect a collapse is imminent or when directed to do so by the "Competent Person".

All Hilscher-Clarke employees and subcontractors shall receive, at a minimum, the following training:

- Project specific excavation hazards.
- Class "C" Soil.
- Safe slopes for different soil types and conditions.
- Types of protective systems.
- Recognition of hazardous conditions caused by machinery, traffic, utilities, and weather conditions.
- Basic PPE requirements.
- Employee's roles in excavation safety systems.

All Hilscher-Clarke employees and subcontractors shall receive retraining when:

- Changes in Excavation Protective Systems.
- Changes in Workplace or Environment.
- Lack of Understanding & Skill After Initial Training.

For training requirements and Specific Responsibilities of the "Competent Person" please refer to Section IV of this policy and procedure.

Aluminum Hydraulic Shoring – An engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces), used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell Bottom Pier Hole – A type of shaft or footing excavation, the bottom of which is made larger than the cross section above, results in a bell shape.

Benching – A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-In – The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by failing or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent Person – One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross Braces – The horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Duration of Exposure – The longer an excavation is open, the longer the other factors have to work on causing it to collapse.

Excavation – Any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.

Faces or Sides – The vertical or inclined earth surfaces formed as a result of excavation work.

Hard Compact Soil – All earth materials not classified as unstable.

Hazardous Atmosphere – An atmosphere, which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickouts – Accidental release or failure of a shore or brace.

Protective System – A method of protecting employees from cave-ins, from material that could fall or roll from an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide necessary protection.

Ramp – An inclined walking or working surface that is used to gain access to one point from another and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer – An individual who is registered as a professional engineer.

Shaft – An excavation made from the surface of the ground the longer axis of which forms an angle with the vertical of no more than forty-five degrees.

Sheet Pile – A pile, or sheeting, that may form one of a continuous interlocking line, or a row of timber, concrete, or steel piles, driven in close contact to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials.

Shield (Shield System) – A structure that is capable of withstanding the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. All shields must be in accordance with 29 CFR 1926.652(c)3 or (c)4.

Shoring (Shoring System) – A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sloping (Sloping System) – A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable Rock – Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against cave-in or movement by rock bolts or by another protective system that has been designed by a Registered Professional Engineer (RPE).

Support System – A structure such as underpinning, bracing, or shoring the sides of an excavation.

Surcharge Loads – Generated by the weight of anything in proximity to the excavation, push starts for a cave-in (anything up top pushing down). Common surcharge loads would be: weight of spoil pile; weight of nearby buildings, poles, pavement, or other structural objects; weight of material and equipment.

Tabulated Data – Tables and charts approved by a Registered Professional Engineer and used to design and construct a protective system.

Trench (Trench Excavation) – A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less, the excavation is also considered to be a trench.

Trench Boxes (Safety Cages, Trench Shields) – A shoring system composed of steel plates and bracing, welded or bolted together, which support the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.

Trench Jack – Screw or hydraulic type jacks used as cross bracing in a trench shoring system.

Undermining – Undermining can be caused by such things as leaking, leaching, caving or over-digging. Undermined walls can be very dangerous.

Uprights – The vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with, or interconnected to each other are often called “sheeting.”

Unstable Soil – Earth material, that because of its nature or the influence of related conditions, cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.

Uprights – The vertical members of a shoring system.

Wales – Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members or earth.

Section III
General Provisions

1.1 Surface Encumbrances – All surface encumbrances, such as trees, boulders, adjacent structures, utility poles, large equipment, etc. that are located so as to create a hazard to employees will be removed or supported as necessary to safeguard employees against cave-ins. *(See Section 7.0 Superimposed Loads)*

1.2 Underground Installations – Before any excavation, underground installations must be determined. This can be accomplished by either contacting the local utility companies or the local "one-call" center for the area. All underground utility locations must be documented on the proper forms. All overhead hazards (surface encumbrances) that create a hazard to employees must be removed or supported to eliminate the hazard.

1.2.1 If underground installations are uncovered, they will be properly supported to protect employees.

1.3 Access & Egress – A stairway, ladder, ramp or other means of egress will be located in any trench that is 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees.

1.3.1 ***Ladders*** must be secured at the top and extend a minimum of 36 inches above the top of the excavation.

1.3.2 ***Metal ladders*** should be used with extreme caution, particularly when electrical utilities are present.

1.3.3 ***Structural ramps*** may be designed by a "Competent Person" unless they are used by equipment. If this is the case, the design will be developed by a "Competent Person" qualified in structural design.

1.4 Vehicular Traffic – Employees exposed to vehicular traffic shall be provided with and required to wear reflective vests or other suitable garments marked with or made of reflectorized or high-visibility materials.

1.4.1 ***Trained flag persons*** signs and barricades must be utilized to ensure the safety of employees, vehicular traffic, and pedestrians.

1.5 Exposure to Falling Loads – All employees, subcontractors, and visitors on a Hilscher-Clarke excavation site, must wear hard hats. (See Hilscher-Clarke' Personal Protective Equipment Policy).

- Employees are not allowed to work under raised loads.
- Employees are not allowed to work under loads being lifted or moved by heavy equipment used for digging or lifting.
- Employees are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.

1.6 Mobile Equipment – The following steps should be taken to prevent vehicles from accidentally falling into the trench:

- **Barricades** must be installed where necessary.
- **Hand or mechanical signals** must be used as required.
- **Stop logs** must be installed if there is danger of vehicles falling into the trench. Or a warning system shall be utilized (i.e., barricades, hand or mechanical signals)
- **Soil should be graded away** from the excavation; this will assist in vehicle control and channeling of run-off water.
- **Trenches left open overnight** shall be fenced and barricaded.

1.7 Stability of Adjacent Structures – Support systems such as shoring, bracing or underpinning will be used to provide stability whenever the stability of adjoining buildings, walls or other structures is endangered by excavation operations.

1.8 Employees should be spaced out in a trench unless there is a necessity of working together. They should also stay out of the immediate area of excavating equipment, and not work ahead of the shoring.

1.9 When employees are working on hard surface roads, where a flow of traffic is being maintained, it is important that small stones be removed off the road. Stones are sometimes thrown with great speed by the tires of passing cars and can cause serious accidents.

1.10 Broken arms and legs and other injuries can result when workers fall into construction trenches. They result because they fail to look where they are going, when they walk too close to the edge, or when they attempt to leap across the trench.

1.11 Rocks and tools thrown near the edge of a trench are not only a hazard to employees working in the trenches, but can cause falls into the trench by employees working on the surface.

1.12 Employees should use extra care when venturing near the edges of trenches and other excavations when the weather is bad and there are icy or muddy conditions.

2.0 Soil Classification & Identification

The OSHA Standards define soil classifications within the Simplified Soil Classification Systems, which consists of four categories: Stable rock, Type A, Type B, and Type C. Stability is greatest in stable rock and decreases through Type A and B to Type C, which is the least stable. Appendix A of the Standard provides soil mechanics terms and types of field tests used to determine soil classification

2.1 **Stable Rock –** Natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

2.2 **Type A Soil –** Most Stable:

- Cohesive soils with an unconfined compression strength of 1.5 tons per square foot (TSF) or greater.
- Cemented soils like caliche and hardpan are considered Type A.

2.2.1 Soil is not type A if:

- If is fissured;
- The soil is subject to vibration form heavy traffic, pile driving or similar effects;
- The soil has been previously disturbed;
- The material is subject to other factors that would require it to be classified as a less stable material;
- The exclusions for Type A most generally eliminate it from most construction situations.

2.3 **Type B Soil –** Medium Stability:

- Cohesive soil with an unconfined compressive strength greater than .5 TSF, but less than 1.5 TSF.
- Granular cohesionless soil including angular gravel, silt, silt loam, and sandy loam.
- The soil has been previously disturbed except that soil classified as Type C soil.
- Soil that meets the unconfined compressive strength requirements of Type A soil, but is fissured or subject to vibration.
- Dry rock that is unstable.

2.4 **Type C Soil –** Least Stable:

- Cohesive soil with an unconfined compressive strength of .5 TSF or less.
- Granular soils including gravel, sand and loamy sand.
- Submerged soil or soil from which water is freely seeping.
- Submerged rock that is not stable.

2.5 **Layered Geological Strata (where soils are configured in layers) –** The soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer (i.e., where a Type C soil rests on top of stable rock).

2.6 Only the "Competent Person" in charge of the excavation may classify the soil as other than a type C, according to the Testing Methods outlined in Section 3.0 of this policy and procedure.

3.1 The "Competent Person" will classify the soil in accordance with the definitions in Section 2.0 on the basis of at least one visual and one manual analysis.

3.1.1 These tests should be run on freshly excavated samples from the excavation and are designed to determine stability based on a number of criteria:

- The cohesiveness;
- The presence of fissures;
- The presence and amount of water;
- The unconfined compressive strength;
- The duration of exposure;
- Undermining;
- Presence of layering; and
- Prior excavation and vibration

3.2 Visual Test – The "Competent Person" should perform a visual test to evaluate the conditions around the site. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. The "Competent Person" should also check for vibration.

3.2.1 During the visual test, the "Competent Person" should check for crack-line openings along the failure zone that would indicate tension cracks, look for existing utilities that indicate that the soil has been previously disturbed, and observe the open side of the excavation for indications of layered geologic structuring.

3.2.2 This person should also look for signs of bulging or sloughing, as well as for signs of surface water seeping from the sides of the excavation or from the water table.

3.2.3 The area adjacent to the excavation should be checked for signs of foundations or other intrusions into the failure zone, and the evaluator should check for surcharging and the spoil distance from the edge of the excavation.

3.3 Manual Tests:

3.3.1 Thumb Penetration Test – Attempt to press the thumb firmly into the soil in question. If the thumb penetrates the full length of the nail, it is probably Type B soil. If the thumb penetrates the full length of the thumb, if is Type C soil. It should be noted that the thumb penetration test is the least accurate testing method.

3.3.2 Dry Strength Test – Take a sample of dry soil. If it crumbles freely or with moderate pressure into individual grains it is considered granular (Type C). Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can only be broken with difficulty) it is probably clay in combination with gravel, sand, or silt (Type B).

3.3.3 Plasticity or Wet Thread Test – Take a moist sample of the soil. Mold it into a ball and then attempt to roll it into a thin thread approximately 1/8 inch in diameter by 2 inches in length. If the soil sample does not break when held by one end, it may be considered Type B.

3.3.4 Pocket Penetrometer Test – This instrument is most accurate when soil is nearly saturated. This instrument will give unconfined compressive strength in tons per square foot.

Pocket Penetrometer Test (cont.) – The spring operated device uses a piston that is pushed into a coil up to a calibration groove. An indicator sleeve marks and retains the reading until it is read. The reading is calibrated in tons per square foot (TSF) or kilograms per cubic centimeter.

3.3.5 Shearvane Test – Measures the approximate shear strength of saturated cohesive soils. The blades of the vane are pressed into a flat section of undisturbed soil, and the knob is turned slowly until soil failure. The dial is read directly when using the standard vane. The results will be in tons per square foot or kilograms per cubic centimeter.

3.4 The "Competent Person" will perform several tests of the excavation to obtain consistent, supporting data along its depth and length. The soil is subject to change several times within the scope of an excavation and the moisture content will vary with weather and job conditions. The "Competent Person" must also determine the level of protection based on what conditions exist at the time of the test, and allow for changing conditions.

4.1 All excavations or trenches 5 feet or greater in depth shall be appropriately benched, shored, or sloped according to the procedures and requirements set forth in OSHA's Excavation Standard, 29 CFR 1926.650, .651, and .652.

4.2 Excavations or trenches 20 feet deep or greater must have a protective system designed by a Registered Professional Engineer.

4.3 Excavations under the base of footing of a foundation or wall require a support system designed by a Registered Professional Engineer.

4.4 Sidewalks and pavement shall not be undermined unless a support system or another method of protection is provided to protect employees from their possible collapse.

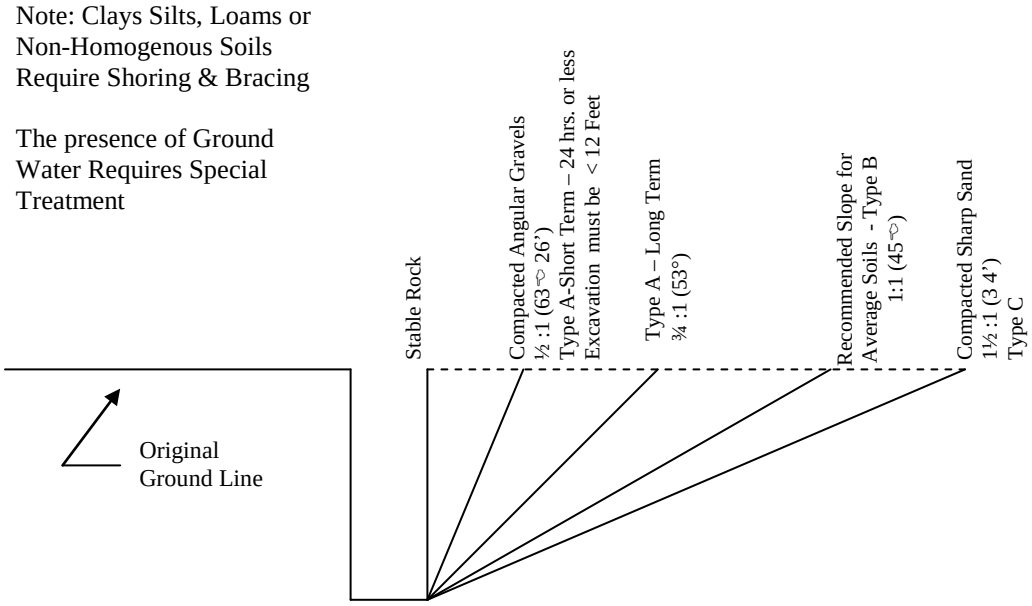
4.5 **Sloping –** Maximum allowable slopes for excavations less than 20' based on soil type and angle to the horizontal are as follows:

Soil Type	Height/Depth Ratio	Slope Angle
Type B	**1:1**	**45 degrees**
Type C	**1½ : 1**	**34 degrees**

4.5.1 A 10-foot-deep trench in Type B soil would have to be sloped to a 45-degree angle, or sloped 10 feet back in both directions. Total distance across a 10-foot-deep trench would be 20 feet, plus the width of the bottom of the trench itself.

4.5.2 In Type C soil, the trench would be sloped at a 34-degree angle, or 15 feet back in both directions for at least 30 feet across, plus the width of the bottom the trench itself. *(See Illustration 1)*

Illustration 1: Approximate Angle of Repose for Sloping of Sides of Excavations



All sloping systems for excavations 5 to 20 feet in depth must be constructed under the instruction of the designated "Competent Person".

4.6 Benching – Benching ***is not*** allowed in Type C soil.

4.6.1 In Type B soil, the vertical height of the benches must not exceed 4 feet. Benches must be below the maximum allowable slope for that soil type. In other words, a 10-foot deep trench in Type B soil must be benched back 10 feet in each direction, with the maximum of a 45-degree angle.

4.6.2 Benching systems for excavations 5 to 20 feet in depth must be constructed under the instruction of the designated "Competent Person".

4.7 Shoring/Shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. Shoring utilizes a framework of vertical members (uprights), horizontal members (whales), and cross braces to support the sides of the excavation to prevent a cave-in. Metal (aluminum) Hydraulic, mechanical or timber shorings are common examples.

4.7.1 All shoring shall be installed from the top down and removed from the bottom up.

4.7.2 When bracing or shoring of trenches is required, such bracing and shoring shall be carried along with the excavation.

4.7.3 Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling, or kickouts.

4.7.4 Shoring Timbers, or whales, should not be used as supports for platforms to carry concrete mixtures or other heavy equipment. If it is necessary for a mixer to be over a trench, vertical supporting members should be cut in-between the wales, and the load transmitted to the ground through additional vertical members from the bottom wale.

4.7.5 Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly, and, in unstable soil, employees shall clear the trench before pulling out the jacks or braces with ropes.

4.7.6 Timber Shoring - Minimum requirements for trench bracing and shoring shall be in accordance with Appendix B to this rule.

- The vertical planks in the bracing system shall extend at least to the top of the trench face.
- Braces and diagonal shores in a wood shoring system shall not be subjected to compressive stress in excess of values given by the following formula:

$$S = 1300 - \frac{20L}{D} \qquad \text{Maximum Ratio: } \frac{L}{D} = 50$$

Where: L = Length, unsupported, in inches.
D = Least side of the timber in inches.
S = Allowable stress in pounds per square inch of cross section.

4.7.7 Hydraulic (Aluminum) Shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install them. They are also light enough to be installed by one worker; they are gauge-regulated to ensure even distribution of pressure along the trench line; and they can be adapted easily to various trench depths and widths.

- The top cylinder of hydraulic shoring shall be no more than 18 inches below the top of the excavation.

- The bottom of the cylinder shall be no higher than 4 feet from the bottom of the excavation. (2 feet of trench wall may be exposed beneath the bottom of the rail or plywood sheeting, if used.)
- 3 vertical shores, evenly spaced must be used to form a system.
- Wales are installed no more than 2 feet from the top, no more than 4 feet from the bottom, and no more than 4 feet apart, vertically.
- Hydraulic shores must be installed with sheeting in accordance with Appendix C.

4.8 Shielding (Trench Boxes) – Unlike sloping and shoring, shielding does not prevent cave-in. Shields are designed to withstand the soil forces caused by a cave-in and protect the employees inside the structure. Most shields consist of two flat parallel metal walls that are held apart by metal cross braces.

4.8.1 Shielding design and construction is not covered by OSHA Standards. Shields must be certified in design by a registered professional engineer and must have either a registration plate on the shield or registration papers from the manufacturer on file at the worksite. ***Any repairs or modifications must be approved by the manufacturer.***

4.8.2 The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench box and the excavation side must be backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those, which the system was designed to withstand.

4.8.3 Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching.

4.8.4 Shields must not have any lateral movement when installed.

4.8.5 The shield must extend at least 18 inches above the point where proper sloping begins (the height of the shield must be greater than the depth of the excavation).

4.8.6 Shields may ride 2 feet above the bottom of an excavation, provided they are calculated to support the full depth of the excavation and there is no caving under or behind the shield.

4.8.7 Employees will be protected from cave-ins when entering and exiting the shield (i.e., ladder within the shield or a properly sloped ramp at the end).

4.8.8 Employees are not allowed in the shield during installation, removal, or during any vertical movement.

4.8.9 The open end of the shield must be protected from the exposed excavation wall. The wall must be sloped, shored, or shielded. Engineer designed end plates can be mounted on the ends of the shield to prevent cave-ins.

5.1 Employees shall not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with:

- Less than 19.5% oxygen;
- A combustible gas concentration greater than 20% of the lower flammable limit; and
- Concentrations of hazardous substances that exceed those specified in the Threshold Limit Values for airborne contaminants established by the American Conference of Governmental Industrial Hygienists (ACGIH).

5.1.1 All operations involving such atmospheres must be conducted in accordance with OSHA requirements for occupational health and environmental controls for personal protective equipment and for lifesaving equipment. Engineering controls (i.e., ventilation) and respiratory equipment may be required.

5.2 When **internal combustion engines** are used in or near trenches, precautions should be taken against exhaust gases entering the trenches. Where necessary, ducts should be attached to the exhaust to conduct the gases away from the trench.

5.3 **Testing for Atmospheric Contaminants –** If there is any possibility that the trench or excavation could contain a hazardous atmosphere (i.e., trenching in the vicinity of gasoline storage tanks, underground pipelines or sewer lines, a landfill area), atmospheric testing must be conducted, by a "Competent Person" prior to entry.

5.3.1 Testing should be conducted not only before employees enter the trench, but regularly to ensure that the trench remains safe. The frequency of testing should be increased if equipment is operating in the trench.

5.3.2 Testing frequency should also be increased if welding, cutting, or burning is done in the trench.

5.3.3 Employees required to wear respiratory protection, must be trained, fit-tested, and enrolled in Hilscher-Clarke' respiratory protection program.

5.3.4 Some trenches qualify as confined spaces. When this occurs, compliance with Hilscher-Clarke Confined Space program is required.

6.0 Standing Water and Water Accumulation

6.1 Methods for controlling standing water and water accumulation must be provided and should consist of the following, if employees must work in the excavation.

- **6.1.1** Use of special support or shield systems approved by a registered professional engineer.
- **6.1.2** Water removal equipment, such as well pointing, used and monitored by a "Competent Person".
- **6.1.3** Safety harnesses and lifelines, used in accordance with Hilscher-Clarke' Fall Protection program.
- **6.1.4** Employees removed from the trench during rainstorms.
- **6.1.5** Trenches carefully inspected by a "Competent Person" after each rain and before employees are permitted to re-enter the trench.

6.2 **Working below the water line** – In these conditions, in order to guard against an unstable excavation bottom, sheeting may have to be driven below the bottom of such an excavation to add to the soil stability.

6.3 **Diversion Dikes and ditches** or other suitable means will be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water causes soil erosion and softening and should not be allowed to accumulate in a trench or excavation.

7.0 Superimposed Loads and Vibrations

7.1 Superimposed loads in the vicinity of a trench or excavation will increase the pressure on excavation walls. Heavy equipment and materials such as pipes or timbers will be kept as far back from the excavation as possible.

7.2 When heavy loads must be located near an excavation, the walls must be braced, sheet-piled, or shored to safely support the extra weight. In some cases it may be necessary to lessen the pressure of these loads.

7.3 Buildings, curbs trees, utility poles and other structures adjoining the excavation area also can place more stress on a trench side than it can safely accommodate. In these instances, Hilscher-Clarke requires that shoring, bracing, or underpinning be provided as necessary not only to protect workers, but also to prevent the dislocation of the soil beneath the structures in the vicinity.

7.4 **Spoil –** Temporary Spoil**,** the excavated material, can exert great pressure on the excavation walls.

7.4.1 Temporary spoil shall be placed no closer than 2 feet from the surface edge of the excavation, measured from the nearest base of the spoil to the cut. This distance should not be measured from the crown of the spoil deposit. This distance requirement ensures that loose rock or soil from the temporary spoil pile will not fall on employees in the trench.

7.4.2 Spoil should be placed so that it channels rainwater and other run-off water away from the excavation. Spoil should be placed so that it cannot accidentally run, slide, or fall back into the excavation.

7.4.3 **Permanent Spoil** should be placed at a much greater distance from the excavation. ***This distance will be determined by the "Competent Person".***

7.5 **Vibrations** or sudden shock from passing vehicles or railways, blasting, equipment such as trucks or pile drivers, and some tools can create enough vibration to endanger a shoring system. If these conditions exist near an excavation site, stronger support is vital.

8.0 Surface Crossing of Trenches

8.1 Surface crossing of trenches should not be made unless absolutely necessary. However, if necessary, they are only permitted under the following conditions:

8.1.1 **Vehicle crossings** must be designed by and installed under the supervision of a Registered Professional Engineer.

8.2 **Walkways or bridges** must:

8.2.1 Have a minimum clear width of 20 inches.

8.2.2 Be fitted with standard guardrails (as outlined in Hilscher-Clarke' Fall Protection Plan).

8.2.3 Extend a minimum of 24 inches past the surface edge of the trench.

8.3 **"Jump-Overs"** of trenches are strictly prohibited on any Hilscher-Clarke worksite.

9.0 Inspections

9.1 **Daily Inspection** of excavations, the adjacent areas and protective systems shall be made by the "Competent Person" for evidence of a situation that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres or other hazardous conditions.

9.2 **The "Competent Person"** shall conduct inspections:

- **9.2.1** Daily and before the start of each shift.
- **9.2.2** As dictated by the work being done in the trench.
- **9.2.3** After every rainstorm.
- **9.2.4** After other events that could increase hazards, such as snowstorm, windstorm, thaw, earthquake, dramatic change in weather, etc.
- **9.2.5** When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur.
- **9.2.6** When there is a change in the size, location, or placement of the spoil pile.
- **9.2.7** When there is any indication of change or movement in adjacent structures.

9.3 **Whenever a possible hazardous condition** is detected, the "Competent Person" will instruct exposed employees to immediately leave the excavation or trench until an adequate means of protection is provided.

9.4 A **"Daily Excavation Inspection Form"** shall be completed for excavations 4 feet or greater in depth.

- **9.4.1** All documented inspections will be kept on file in the worksite safety files and forwarded to the Safety Manager weekly.

Section IV
Competent Person

10.1 The OSHA Standards require that the ***"Competent Person"*** must be capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and have authorization to take prompt corrective measures to eliminate them and if necessary, to stop the work.

10.2 A "Competent Person" is required to:

- Have a complete understanding of the applicable safety standards and any other data provided (29 CFR 1926 Subpart P).
- Assure the proper locations of underground installations or utilities, and that the proper utility companies have been contacted.
- Conduct soil classification tests and reclassify soil after any condition changes.
- Determine adequate protective systems (sloping, shoring, and shielding systems) for employee protection.
- Conduct all air monitoring for potential hazardous atmospheres and have the ability to detect and deal with other hazards associated with confined spaces .
- Conduct daily and periodic inspections of excavations and trenches.
- Approve design of structural ramps, if used.
- Have the authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.

10.3 Each site covered in this procedure will have a Competent Person who will evaluate conditions and remain at the site as long as employees are working in the trench or excavation (See Illustration 3 & 4 – *in this section*)

10.4 The Competent Person will evaluate the work site prior to excavation and determine what utilities will be affected. Utility companies will be notified at least 48 hours prior to starting work unless emergency conditions exist.

10.5 The Competent Person will choose either sloping or shielding/shoring as the protective system.

10.6 The Competent Person will inspect and document the condition of the trench or excavation and protective system prior to each workshift, throughout each workshift, and after a rainstorm or other hazard-increasing event.

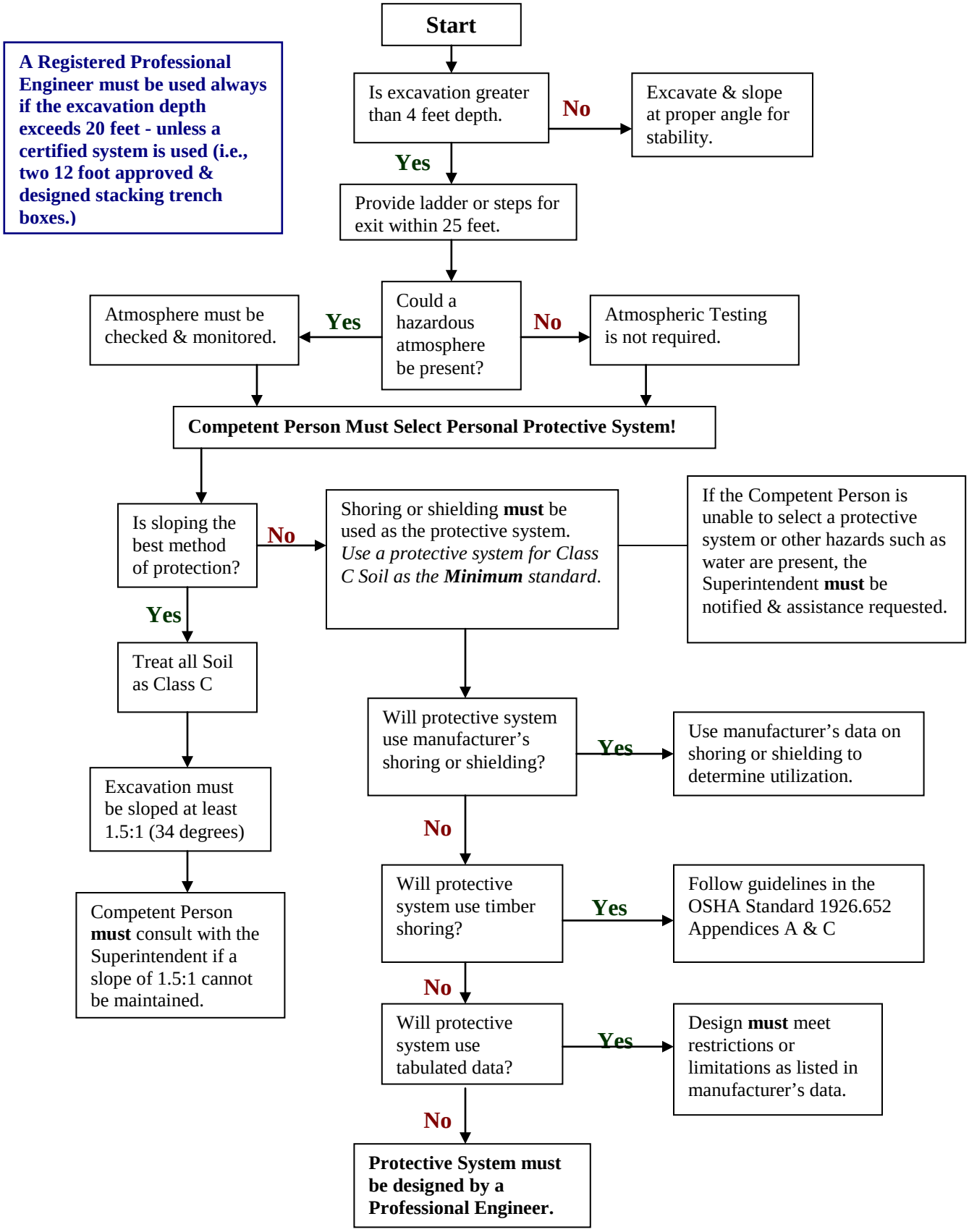
10.7 If a hazard is detected, the Competent Person will not permit employees to enter or will immediately remove employees from the trench or excavation until proper protective measures have been taken.

10.8 The Competent Person will ensure mobile equipment working near the edge of a trench or excavation has a positive warning system such as stop logs or hand signals.

10.9 The Competent Person will ensure that testing with a multigas meter is conducted whenever the possibility of atmospheric hazards in the trench or excavation exists.

10.10 The Competent Person will ensure that information on the site evaluation and protective system selected is available on-site.

Illustration 2 - Competent Person Decision Page



Hilscher-Clarke
Job Reminder Checklist

Date	Name of Competent Person	Name of RPE (If Applicable):
Project I.D. No./Name	Physical Location of Project	

Pre-Inspect Jobsite	
What is the best protection method? (i.e., sloping, shoring, shielding)	
How likely are utilities?	
What additional equipment is necessary?	
Is water removal needed?	
Will air monitoring be required?	
Ladders?	
Soil Testing?	
Stop logs?	
Employee and Equipment Access	
Employee ramp designed by Competent Person.	
Equipment ramp designed by person qualified in structural design.	
Exit means located within 25' of employees and securely attached.	
Determine Soil Conditions	
All soil is to be classified as type "C" and proper protection used based on "C".	
Record results on testing record.	
Inspect excavation for changing soil conditions.	
Protection Systems	
Appropriate protection system selected.	
Installed according to manual or tabulated data.	
Inspect equipment at start of shift	
Remove employee(s) working outside protected area(s).	
Monitor Environment Conditions	
Remove employees from trench where water is accumulating.	
Monitor use of water removal equipment.	
Monitor air quality levels if hazardous atmospheres are suspected.	
Required to Consult w/Registered Professional Engineer (RPE) When:	
Trenches are over 20' deep.	
Specifically designed shoring or bracing is required.	
Excavation or trench endangers nearby structure.	
Standard protection measures cannot be used.	
May Consult With RPE When:	
Unusual or changing soil conditions exist or are anticipated.	
Soil is unusually good and shoring reduction is required.	
Soil is unusually poor and may require going to a more protective system.	

Notes:

Hilscher-Clarke
Detailed Evaluation

Date	Name of Competent Person	Name of RPE (If Applicable):
Project I.D. No./Name	Physical Location of Project	

"✓" or N/A	Question
	All open trenches have been inspected?
	All excavated soil was located at least 2 feet away from the edge of trench?
	Were any tension cracks observed along top of any slopes?
	Were slopes cut at the proper angle for stability?
	Was any water seepage noted in trench walls or trench bottom?
	Was bracing system installed in accordance with design?
	Was there evidence of shrinkage cracks in trench walls?
	Was there any evidence of caving or sloughing of soil since the last field inspection?
	Were there any zones of unusually weak soils or materials not anticipated?
	Was there any evidence of significant fracture planes in soil or rock?
	Were there any noted dramatic dips in bedrock?
	All short-term trench(s) covered within 24 hours?
	Trench box(s) certified? Shield Capacity in pounds per square foot?
	Were hydraulic shores pumped to design pressure?
	Type shoring being used _____, is secure?
	Did shoring plan include adequate safety factor to allow for equipment actually being used?
	Traffic in area adequately away form trenching operations with barricades?
	Trees, boulders, or other hazards in the area?
	Vibrations from equipment or traffic too close to trenching operation?

Notes:

Illustration 5 – Competent Person Guide to an OSHA Inspection

As a Competent Person for a Hilscher-Clarke excavation site, you should be prepared to discuss the trench configuration and associated information with an OSHA Inspector should one visit your worksite. The following information is provided as guidance. Feel free to use this document and any other documentation during your conversation with the Inspector.	
1.	The OSHA Inspector must show his/her credentials.
2.	You will be asked about your length of experience in this occupation.
3.	You will be asked about your training as a Competent Person. *Be prepared to identify when your last Competent Person training was completed.*
4.	You will be asked about your expertise in soil analysis. *You should inform the OSHA inspector of Hilscher-Clarke' position that all soils are treated as Class C soils unless determined by supervision trained in soils classification. Use Appendix A of this policy and procedure to demonstrate the decision process used in determining how to make the excavation a safe working environment.*
5.	You may be questioned about the protective systems especially if you are working with a trench box or are utilizing shoring at the work site. *Explain the configuration and how the type protection was chosen.*
6.	You may be asked if you as the Competent Person have authority to take immediate corrective measures to eliminate existing and predictable hazard as well as the authority to stop work. *As the Competent Person, you have this authority and should so state.*
7.	You will be asked about inspections of the excavation you have performed. *It is recommended that you maintain a log of all inspections performed as well as of any actions you have taken to reduce hazards. Inspections should be not only of the excavation but also of the adjacent areas and protective systems if they are being used for the specific job.*
8.	You may be asked specific questions regarding 29 CFR 1926.650, the OSHA Standard on Excavation, Trenching, and Shoring. *Utilize this procedure as your reference for any questions that might arise.*
9.	If water is present, you will be asked about it. *Explain what precautions have been taken to preclude water form creating a hazard. This may consist of de-watering equipment, repetitive inspection of de-watering operations or, where de-watering equipment is not used, constant monitoring of water/soil conditions.*
10.	If a structural ramp is in place for employees, you will be asked about it. *Explain who designed the ramp and their qualifications.*
11.	If an equipment ramp is in place, you will be asked if it was designed by a person qualified in structural design. *Explain who designed the ramp and their qualifications.*
12.	You may be asked about air monitoring for oxygen deficiency or toxic gases. ❑ If you are using air monitoring equipment, explain your rationale for doing so. If not, explain why air monitoring is not required.

Appendix

Hilscher-Clarke
Soil Analysis Checklist

Date	Name of Competent Person	Weather Conditions		
Project I.D. No./Name	Physical Location of Project			
Where was sample taken from?	Excavation length, depth & width	L:	D:	W:

Visual Test			
Particle Type	Fine Grained (Cohesive)	Granular (Sand/Silt or Gravel)	Other (Describe)
Notes:			

Water Conditions	Wet	Dry	Seeping Water	Surface Water Present	Submerged
Notes:					

Yes	**No**	**N/A**	**Description**
			Layered Soils Dipping excavation? If yes, describe:
			Excavation exposed to vibrations? If yes, describe:
			Previously disturbed soils?
			Crack like openings or sprawlings observed?
			Underground Utilities? If yes, what type?
			Layered Soils? (Note: The least stable layer controls the soil type)

Manual Test					
Plasticity	Cohesive	Non-Cohesive	Dry Strength	Cohesive (broken w/difficulty)	Granular
Wet Shake	Water comes to surface (granular material)		Surface remains dry (clay material)		

Thumb Test (Used to estimate unconfined compression strength of cohesive soil)			
Test Performed	Yes	No	N/A, Explain:
Soil indented by thumb with very great effort?			Type A
Soil indent by thumb with some effort?			Type B
Soil easily penetrated several inches by thumb with little or no effort. NOTE: If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.			Type C

Penetrometer or Shearvane Test (Used to estimate unconfined compressive strength of cohesive soils.)			
Test Performed	Yes	No	Device Used/Serial Number:
Soil with unconfined compressive strength of 1.5 tsf or greater.			Type A
Soil with unconfined compressive strength of greater than 0.5 tsf and less than 1.5 tsf.			Type B
Soil with unconfined compressive strength of 0.5 tsf or less. NOTE: If the soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.			Type C

Soil Classification			
Stable Rock	Type A	Type B	Type C

Selection of Protective System (Refer to Appendix F of 29 CFR 1926)			
Sloping (Appendix B) Specify Angle:	Timber Shoring (Appendix C)	Trench Shield Max. depth in this soil:	Hydraulic Shoring (Appendix D)
Additional Notes or Comments:			

Keep one copy of each Soil Analysis Checklist on site for project duration
Forward original to the Safety Manager

Vertical Shores
For Soil Type A

Depth Of Trench (Feet)	Hydraulic Cylinders				
	Maximum Horizontal Spacing (Feet)	Maximum Vertical Spacing (Feet)	Width of Trench (Feet)		
			Up to 8	Over 8 Up to 12	Over 12 Up To 15
Over 5 Up To 10	8		2 Inch Diameter	2 Inch Diameter Note (2)	3 Inch Diameter
Over 10 Up To 15	8	4			
Over 15 Up To 20	7				
Over 20	Note (1)				

Footnotes to tables, and general notes on hydraulic shoring are found in Appendix D, Item (g).

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Vertical Shores
For Soil Type B

Depth Of Trench (Feet)	Hydraulic Cylinders				
	Maximum Horizontal Spacing (Feet)	Maximum Vertical Spacing (Feet)	Width of Trench (Feet)		
			Up to 8	Over 8 Up to 12	Over 12 Up To 15
Over 5 Up To 10	8		2 Inch Diameter	2 Inch Diameter Note (2)	3 Inch Diameter
Over 10 Up To 15	6.5	4			
Over 15 Up To 20	5.5				
Over 20	Note (1)				

Footnotes to tables, and general notes on hydraulic shoring are found in Appendix D, Item (g).

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Waler Systems
For Soil Type B

Depth Of Trench (Feet)	Wales		Hydraulic Cylinders						Timber Uprights		
	Vertical Spacing (Feet)	Section Modulus (in^3)	Width of Trench (Feet)						Max. Horiz. Spacing (On Center)		
			Up to 8		Over 8 Up to 12		Over 12 Up To 15				
			Horiz. Spac.	Cyldr. Diam.	Horiz. Spac.	Cyldr. Diam.	Horiz. Spac.	Cyldr. Diam.	Solid Sheet	2 ft.	3 ft.
Over 5 Up To 10	4	3.5	8.0	2 in.	8.0	2 in. (Note 2)	8.0	3 in.			3x12
		7	9.0	2 in.	9.0	2 in. (Note 2)	9.0	3 in.			
		14	12.0	3 in.	12.0	3 in.	12.0	3 in.			
Over 10 Up To 15	4	3.5	6.0	2 in.	6.0	2 in. (Note 2)	6.0	3 in.		3x12	
		7	8.0	3 in.	8.0	3 in.	8.0	3 in.			
		14	10.0	3 in.	10.0	3 in.	10.0	3 in.			
Over 15 Up To 20	4	3.5	5.5	2 in.	5.5	2 in. (Note 2)	5.5	3 in.	3x12		
		7	6.0	3 in.	6.0	3 in.	6.0	3 in.			
		14	9.0	3 in.	9.0	3 in.	9.0	3 in.			
Over 20	Note (1)										

Footnotes to tables, and general notes on hydraulic shoring are found in Appendix D, Item (g).

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

Waler Systems
For Soil Type C

Depth Of Trench (Feet)	Wales		Hydraulic Cylinders						Timber Uprights		
	Vertical Spacing (Feet)	Section Modulus (in^3)	Width of Trench (Feet)						Max. Horiz. Spacing (On Center)		
			Up to 8		Over 8 Up to 12		Over 12 Up To 15				
			Horiz. Spac.	Cyldr. Diam.	Horiz. Spac.	Cyldr. Diam.	Horiz. Spac.	Cyldr. Diam.	Solid Sheet	2 ft.	3 ft.
Over 5 Up To 10	4	3.5	6.0	2 in.	6.0	2 in. (Note 2)	6.0	3 in.	3x12		
		7	6.5	2 in.	6.5	2 in. (Note 2)	6.5	3 in.			
		14	10.0	3 in.	10.0	3 in.	10.0	3 in.			
Over 10 Up To 15	4	3.5	4.0	2 in.	4.0	2 in. (Note 2)	4.0	3 in.	3x12		
		7	5.5	3 in.	5.5	3 in.	5.5	3 in.			
		14	8.0	3 in.	8.0	3 in.	8.0	3 in.			
Over 15 Up To 20	4	3.5	3.5	2 in.	3.5	2 in. (Note 2)	3.5	3 in.	3x2		
		7	5.0	3 in.	5.0	3 in.	5.0	3 in.			
		14	6.0	3 in.	6.0	3 in.	6.0	3 in.			
Over 20	Note (1)										

Footnotes to tables, and general notes on hydraulic shoring are found in Appendix D, Item (g).

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

Minimum Requirements*
Soil Type A P_2 = 25 x H + 72 psf (2 ft. Surcharge)

Depth Of Trench (feet)	Size (actual) and Spacing of Mmbrs **													
	Cross Braces							Wales		Uprights				
	Horiz.	Width of Trench (feet)					Vertical	Size	Vertical	Max.	Allow.	Horiz.	Spacing	(ft.)
	Spacing (ft)	Up to 4	Up to 6	Up to 9	Up to 12	Up to 15	Spacing (ft.)	(in.)	Spacing (ft.)	Close	4	5	6	8
5 To 10	Up to 6	4x4	4x4	4x6	6x6	6x6	4	Not Req'd	---				2x6	
	Up to 8	4x4	4x4	4x6	6x6	6x6	4	Not Req'd	---					2x8
	Up to 10	4x6	4x6	4x6	6x6	6x6	4	8x8	4			2x6		
	Up to 12	4x6	4x6	6x6	6x6	6x6	4	8x8	4				2x6	
10 To 15	Up to 6	4x4	4x4	4x6	6x6	6x6	4	Not Req'd	---				3x8	
	Up to 8	4x6	4x6	6x6	6x6	6x6	4	8x8	4		2x6			
	Up to 10	6x6	6x6	6x6	6x8	6x8	4	8x10	4			2x6		
	Up to 12	6x6	6x6	6x6	6x8	6x8	4	10x10	4				3x8	
15 To 20	Up to 6	6x6	6x6	6x6	6x8	6x8	4	6x8	4	3x6				
	Up to 8	6x6	6x6	6x6	6x8	6x8	4	8x8	4	3x6				
	Up to 10	8x8	8x8	8x8	8x8	8x10	4	8x10	4	3x6				
	Up to 12	8x8	8x8	8x8	8x8	8x10	4	10x10	4	3x6				
Over 20	See Note 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Minimum Requirements*
Soil Type B P_2 = 45 x H + 72 psf (2 ft. Surcharge)

Depth Of Trench (feet)	Size (actual) and Spacing of Mmbrs **													
	Cross Braces							Wales		Uprights				
	Horiz. Spacing (ft)	Width of Trench (feet) Up to 4	Up to 6	Up to 9	Up to 12	Up to 15	Vertical Spacing (ft.)	Size (in.)	Vertical Spacing (ft.)	Max. Close	Allow. 2	Horiz. 3	Spacing (ft.)	
5 To 10	Up to 6	4x6	4x6	6x6	6x6	6x6	5	6x8	5			2x6		
	Up to 8	6x6	6x6	6x6	6x8	6x8	5	8x10	5			2x6		
	Up to 10	6x6	6x6	6x6	6x8	6x8	5	10x10	5			2x6		
	See Note 1													
10 To 15	Up to 6	6x6	6x6	6x6	6x8	6x8	5	8x8	5		2x6			
	Up to 8	6x8	6x8	6x8	8x8	8x8	5	10x10	5		2x6			
	Up to 10	8x8	8x8	8x8	8x8	8x10	5	10x12	5		2x6			
	See Note 1													
15 To 20	Up to 6	6x8	6x8	6x8	8x8	8x8	5	8x10	5	3x6				
	Up to 8	8x8	8x8	8x8	8x8	8x10	5	10x12	5	3x6				
	Up to 10	8x10	8x10	8x10	8x10	10x10	5	12x12	5	3x6				
	See Note 1													
Over 20	See Note 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Minimum Requirements*
Soil Type C P_2 = 80 x H + 72 psf (2 ft. Surcharge)

Depth Of Trench (feet)	Size (actual) and Spacing of Mmbrs **												
	Cross Braces						Wales		Uprights				
	Horiz. Spacing (ft)	Width of Trench (feet)				Vertical Spacing (ft.)	Size (in.)	Vertical Spacing (ft.)	Max. Allow. Horiz. Spacing (ft.)				
		Up to 4	Up to 6	Up to 9	Up to 12	Up to 15			Close				
5 To 10	Up to 6	6x8	6x8	6x8	8x8	8x8	5	8x10	5	2x6				
	Up to 8	8x8	8x8	8x8	8x8	8x10	5	10x12	5	2x6				
	Up to 10	8x10	8x10	8x10	8x10	10x10	5	12x12	5	2x6				
	See Note 1													
10 To 15	Up to 6	8x8	8x8	8x8	8x8	8x10	5	10x12	5	2x6				
	Up to 8	8x10	8x10	8x10	8x10	10x10	5	12x12	5	2x6				
	See Note 1													
	See Note 1													
15 To 20	Up to 6	8x10	8x10	8x10	8x10	10x10	5	12x12	5	3x6				
	See Note 1													
	See Note 1													
	See Note 1													
Over 20	See Note 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Minimum Requirements*
Soil Type A P_2 = 25 x H + 72 psf (2 ft. Surcharge)

Depth Of Trench (feet)	Size (S4S) and Spacing of Mmbrs **													
	Cross Braces							Wales		Uprights				
	Horiz. Spacing (ft)	Width of Trench (feet)					Vertical Spacing (ft.)	Size (in.)	Vertical Spacing (ft.)	Max. Allow. Horiz. Spacing (ft.)				
		Up to 4	Up to 6	Up to 9	Up to 12	Up to 15				Close	4	5	6	8
5 To 10	Up to 6	4x4	4x4	4x4	4x4	4x6	4	Not Req'd	Not Req'd				4x6	
	Up to 8	4x4	4x4	4x4	4x6	4x6	4	Not Req'd	Not Req'd					4x8
	Up to 10	4x6	4x6	4x6	6x6	6x6	4	8x8	4			4x6		
	Up to 12	4x6	4x6	4x6	6x6	6x6	4	8x8	4				4x6	
10 To 15	Up to 6	4x4	4x4	4x4	6x6	6x6	4	Not Req'd	Not Req'd				4x10	
	Up to 8	4x6	4x6	4x6	6x6	6x6	4	6x8	4		4x6			
	Up to 10	6x6	6x6	6x6	6x6	6x6	4	8x8	4			4x8		
	Up to 12	6x6	6x6	6x6	6x6	6x6	4	8x10	4				4x10	
15 To 20	Up to 6	6x6	6x6	6x6	6x6	6x6	4	6x8	4	3x6				
	Up to 8	6x6	6x6	6x6	6x6	6x6	4	8x8	4	3x6	4x12			
	Up to 10	6x6	6x6	6x6	6x6	6x8	4	8x10	4	3x6				
	Up to 12	6x6	6x6	6x6	6x8	6x8	4	8x12	4	3x6	4x12			
Over 20	See Note 1													

* Douglas Fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Minimum Requirements*
Soil Type B P_2 = 45 x H + 72 psf (2 ft. Surcharge)

Depth Of Trench (feet)	Size (S4S) and Spacing of Mmbrs **													
	Cross Braces							Wales		Uprights				
	Horiz. Spacing (ft)	Width of Trench (feet)					Vertical Spacing (ft.)	Size (in.)	Vertical Spacing (ft.)	Max. Allow. Horiz. Spacing (ft.)				
		Up to 4	Up to 6	Up to 9	Up to 12	Up to 15				Close	2	3	4	5
5 To 10	Up to 6	4x6	4x6	4x6	6x6	6x6	5	6x8	5			3x12 4x8		4x12
	Up to 8	4x6	4x6	6x6	6x6	6x6	5	8x8	5		3x8		4x8	
	Up to 10	4x6	4x6	6x6	6x6	6x8	5	8x10	5			4x8		
	See Note 1													
10 To 15	Up to 6	6x6	6x6	6x6	6x8	6x8	5	8x8	5	3x6	4x10			
	Up to 8	6x8	6x8	6x8	8x8	8x8	5	10x10	5	3x6	4x10			
	Up to 10	6x8	6x8	8x8	8x8	8x8	5	10x12	5	3x6	4x10			
	See Note 1													
15 To 20	Up to 6	6x8	6x8	6x8	6x8	8x8	5	8x10	5	4x6				
	Up to 8	6x8	6x8	6x8	8x8	8x8	5	10x12	5	4x6				
	Up to 10	8x8	8x8	8x8	8x8	8x8	5	12x12	5	4x6				
	See Note 1													
Over 20	See Note 1													

* Douglas Fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Minimum Requirements*
Soil Type C P_2 = 80 x H + 72 psf (2 ft. Surcharge)

Depth Of Trench (feet)	Size (S4S) and Spacing of Mmbrs **												
	Cross Braces						Wales		Uprights				
	Horiz. Spacing (ft)	Width of Trench (feet)				Vertical Spacing (ft.)	Size (in.)	Vertical Spacing (ft.)	Max. Allow. Horiz. Spacing (ft.)				
		Up to 4	Up to 6	Up to 9	Up to 12	Up to 15			Close				
5 To 10	Up to 6	6x6	6x6	6x6	6x6	8x8	5	8x8	5	3x6				
	Up to 8	6x6	6x6	6x6	8x8	8x8	5	10x10	5	3x6				
	Up to 10	6x6	6x6	8x8	8x8	8x8	5	10x12	5	3x6				
	See Note 1													
10 To 15	Up to 6	6x8	6x8	6x8	8x8	8x8	5	10x10	5	4x6				
	Up to 8	8x8	8x8	8x8	8x8	8x8	5	12x12	5	4x6				
	See Note 1													
	See Note 1													
15 To 20	Up to 6	8x8	8x8	8x8	8x10	8x10	5	10x12	5	4x6				
	See Note 1													
	See Note 1													
	See Note 1													
Over 20	See Note 1													

* Douglas Fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

Note (1): Appendix D, Item (g) (1) – For applications other than those listed in the tables, refer to 1926.652 (c) (2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to 1926.652 (c) (2) and 1926.652 (c) (3).

Note (2): Appendix D, Item (g) (2) – 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

Trenching, Excavating & Shoring

General Industry 29 CFR 1910.146 and Construction Industry 29 CFR 1926.650

Physical Site Location of Training:		Time of Training:
Instructor Name (please print):	Instructor's Signature:	Date of Training:

Training Roster

Employee I.D. #	Name (Please Print)	Signature	Job Title

Summary of Training Session

(Check all categories presented during training/retraining)

	Classification of employees (authorized, affected and competent)
	Specific terms and definitions outlined in this plan.
	OSHA Standard and its requirements.
	Project specific excavation hazards.
	Class "C" type soil.
	Safe slopes for different soil types and conditions.
	Types of protective systems.
	Recognition of hazardous conditions caused by machinery, traffic, utilities, and weather conditions
	Types of protective systems.
	Basic PPE requirements.
	Employee's role(s) in excavation safety systems.
	Questions and answers.

Please list materials passed out, media and video presented, and any pertinent lectures or materials:

Public Safety

On a construction site, you expect to walk across broken bricks or climb over ditches. You automatically keep a lookout for crane counterweights, things falling from scaffolds, and equipment and materials in your path. But what about people who are just walking past your worksite and don't expect safety hazards?

The safety of the general public is as important as the prevention of accidents to employees. People are curious and are capable of many thoughtless actions in their attempts to observe construction operations. Fences and barricades provide a small measure of protection, but should never be relied upon as the sole means of keeping the public safe. The problems of protecting the public become most difficult during the weekends and other times during which job operations are not in progress. Children, in particular, seem to find construction irresistible. Therefore every extra precaution should be taken to protect them. Barricades, grounding buckets and blades, disconnecting electricity and covering holes are a few typical safeguards.

Watch Out For The Public:

- Keep sidewalks clean.
- Be sure not to leave anything, from a loose nail to a load of bricks, on a sidewalk or walkway used by pedestrians.
- Mend or report cracks to sidewalks immediately. Pedestrians may not be on the lookout for a new crack in the sidewalk. Also is the sidewalk safe for persons with impaired eyesight, hearing, reflexes or balance?
- Trenches involving motor vehicle traffic must be covered where traffic is permitted to continue. Substantial metal plates are the most practical for covering these areas.
- Sometimes trenches are open during the day but closed at night. In such a case, steel plates should be used to cover the trench at night. Lighting aids and appropriate barriers should be placed to indicate the type of hazards.
- Covered walkways are needed when falling objects and weather conditions contribute to sidewalk and/or walkway safety.
- Lighting, signs and maintenance must be provided for any pedestrian passageway.
- Movement and storage of materials, equipment, or supplies must not be allowed to encroach upon designated walkways and/or sidewalks being used by the general public.
- All trenches, excavations, the open sides of all floors, floor-openings, stairwells, roofs, platforms and walkways, from which a person could fall any distance, will be adequately barricaded.
- Ideally the barricading will be kept at least 3 feet from the edge of an open trench or excavation and will provide a clear visual warning and be of contrasting colors.

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Daily Excavation Safety

NOTE: Trenches over 4 feet in depth are considered excavations. Any items marked NO on this form MUST be remediated prior to any employees entering the excavation.

Date	Name of Competent Person	Weather Conditions Approx. Temp. Approx. Wind Dir.		
Project I.D. No./Name	Physical Location of Project			
Soil Classification	Excavation length, depth & width	L:	D:	W:
Protective System Used				
Activities in Excavation				
Excavation > 4 feet deep? ☐Yes ☐ No If **Yes**, fill out a Confined Space Permit **Prior** to **Any** person entering the excavation.				

Yes	No	N/A	Description
			General
			Employees protected from cave-ins & loose rock/soil that could roll into the excavation.
			Spoils, materials & equipment set back at least 2 feet from the edge of the excavation.
			Engineering designs for sheeting and/or manufacturer's data on trench box capabilities of site.
			Adequate signs posted and barricades provided
			Training (toolbox meeting) conducted w/employees prior to entering excavation.
			Utilities
			Utility company contacted and given 24 hours notice and/or utilities already located & marked.
			Overhead lines located, noted and reviewed with operator.
			Utility locations reviewed with the operator, & precautions taken to ensure contact does not occur.
			Utilities crossing the excavation supported, and protected from falling materials.
			Underground installations protected, supported or removed when excavation is open.
			Wet Conditions
			Precautions taken to protect employees from water accumulation (continuous dewatering).
			Surface water or runoff diverted/controlled to prevent accumulation in the excavation.
			Inspection made after every rainstorm or other hazard increasing occurrence.
			Hazardous Atmospheres
			Air in the excavation tested for oxygen deficiency, combustibles, and other contaminants.
			Ventilation used in atmospheres that are oxygen rich/deficient &/or contains hazardous substances.
			Ventilation provided to keep LEL below 10%
			Emergency equipment available where hazardous atmospheres could or do exist.
			Safety Harness and lifeline used.
			Supplied air necessary (if yes, contact Safety Manager).
			Entry & Exit
			Exit (i.e., ladder, sloped wall) no further than 25 feet from **ANY** employee.
			Ladders secured and extend 3 feet above the edge of the trench.
			Wood ramps constructed of uniform material thickness, cleated together at bottom.
			Employees protected from cave-ins when entering or exiting the excavation.

Trenching Safety

In the construction industry, excavation work such as trenching, can be extremely hazardous. A trench is defined as a narrow excavation made below ground in which the depth is greater than the width, which is 15 feet or less.

The most common type of trenching accident, cave-in, is also the most deadly. Cave-ins are usually the result of unsafe work practices; not using shoring, using inadequate shoring, excavating too close to a building or utility pole, misjudging the stability of the soil, vibrations caused by construction work, or weather conditions that change the soil around the excavation.

Before You Dig

Locate any underground installations - sewers, telephone, water, fuel and electric lines - that may be encountered when the digging begins. If underground installations are uncovered they must be properly supported.

Remove or secure any surface objects that may create a hazard, such as rocks, trees, poles and sidewalks.

Exit - In case of emergency, workers must be able to leave the trench quickly. If the trench is 4 feet deep, or more, a ladder or steps (in good condition) must be provided and located so as to require no more than 25 feet of lateral travel.

Classify the soil structure and rock deposits. Excavations in wet soil, sandy soil or areas that have been backfilled are relatively unstable and must have strong support. Even hard rock sometimes can be hazardous; faults in the strata can make it unstable when cut. Soil and rock deposits fit into 4 categories:

- Stable Rock - natural solid mineral material that can be excavated with vertical sides and will stay intact while exposed.
- Type A Soil - examples include clay, silty clay, sandy clay and clay loam.
- Type B Soil - examples include silt, silty loam, and sandy loam.
- Type C Soil - examples include granular soils such as gravel, sand, loamy sand, submerged soil, soil from which water is freely seeping and submerged rock that is not stable.

Apply shoring starting from the top of the trench or excavation and working down. The placement of the cross beams or trench jacks must be in true horizontal position and spaced vertically at appropriate intervals. Braces must be secured to prevent sliding, falling or kickouts. Do not use timbers with large or loose knots when shoring.

A trench box, is a prefabricated moveable trench shield composed of steel plates welded to a heavy steel frame. OSHA standards permit the use of a trench box as long as the protection it provides is equal to or greater than the protection that would be provided by the appropriate shoring system.

Work Safely

- Always wear the proper PPE (Hard Hats & Safety Shoes.)
- Know how & where to exit the trench. Remember, if a trench is 4 feet deep or greater, an exit must be provided within 25 feet of each worker.
- Employees should be safely spaced out in the trench unless there is a necessity of working together.
- Employees should stay out of the immediate area of excavating equipment, and never work ahead of shoring.
- Keep trenching machines level to prevent undercutting the soil and keep the shoring as close as possible to the trenching machine.
- All excavated soil must be placed at least 2 feet from the edge of the trench.
- When there's been a change in weather, such as heavy rain or thawing after a freeze, check with your supervisor before going into the trench. Trench walls that were safe when dry or frozen can collapse when saturated with water or thawed out.
- In excavations deeper than 5 feet or where hazardous atmospheres exist or could exist, the air must be tested by a "competent person" before allowing any employee to enter the excavation.
- Before entering any trench, make sure that the cross-bracing is in place and tight. Cross-bracing may be screw jacks, hydraulic jacks or cleated and rigidly jacked or wedged timbers.
- Make sure the sheeting that forms the walls of the shored trench extends at least 18 inches above the top of the trench.
- Use extra caution when walking around or moving equipment around trenches. Equipment, tools or even soil (which could contain rocks), when dropped into a trench could injure workers below.
- If equipment such as wheelbarrows and cement mixers must be used over a trench, be sure to provide extra vertical supporting members between the stringers of shoring.
- Use extra caution in venturing near the edges of trenches when the weather has caused icy or muddy conditions.
- As soon as the work is completed, the trench should be backfilled as the shoring is dismantled. After the trench has been cleared, workers should remove the shoring from the bottom up, taking care to release jacks or braces slowly. In unstable soil, ropes should be used to pull out the jacks or braces from above.

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