Brieser CONSTRUCTION

Section 24
Safety Health and Environmental Manual

2025

Excavation & Trenching

PURPOSE

Excavating is recognized as one of the most hazardous construction operations. The primary hazards associated with excavations are the potential for cave-ins and the accidental contact or displacement of existing underground installations, with the accompanying risk potential of personal injury and/or property damage. OSHA's Excavation & Trenching regulation found at 29 CFR 1926 Subpart P is the basis that Brieser Construction will utilize to provide a safe working environment while working in excavations or any kind.

This procedure applies to all Brieser Construction personnel and subcontractors working on Brieser Construction projects where excavation safety requirements are applicable.

DEFINITIONS

Accepted Engineering Practices – Are procedures compatible with the standards of practice required of a registered professional engineer.

Adjacent Structure Stability – Refers to the stability of the foundation(s) of adjacent structures whose location may create surcharges, changes in soil conditions, or other disruptions that have the potential to extend into the failure zone of the excavation or trench.

Competent Person – Is an individual who can identify existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to employees, and who *has authorization to take prompt corrective measures to eliminate or control these hazards and conditions.*

Confined Space – Is a space that, by design and/or configuration, has limited openings for entry and exit, unfavorable natural ventilation, may contain or produce hazardous substances, and is not intended for continuous employee occupancy.

Excavation – An Excavation is any man-made cut, cavity, trench, or depression in an earth surface that is formed by earth removal. A Trench is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth of a trench is greater than its width, and the width (measured at the bottom) is not greater than 15 ft (4.6 m). If a form or other structure installed or constructed in an excavation reduces the distance between the form and the side of the excavation to 15 ft (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Hazardous Atmosphere – is an atmosphere that by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen-deficient, toxic, or otherwise harmful may cause death, illness, or injury to persons exposed to it.

Ingress And Egress – Means "entry" and "exit," respectively. In trenching and excavation operations, they refer to the provision of safe means for employees to enter or exit an excavation or trench.

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

Registered Professional Engineer – Is a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer who is registered in any state is deemed to be a "registered professional engineer" within the meaning of Subpart P when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Support System – Refers to structures such as underpinning, bracing, and shoring that provide support to an adjacent structure or underground installation or to the sides of an excavation or trench.

Subsurface Encumbrances – Include underground utilities, foundations, streams, water tables, transformer vaults, and geological anomalies.

Surcharge – Means an excessive vertical load or weight caused by spoil, overburden, vehicles, equipment, or activities that may affect trench stability.

Tabulated Data – Are tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Underground Installations – Include, but are not limited to, utilities (sewer, telephone, fuel, electric, water, and other product lines), tunnels, shafts, vaults, foundations, and other underground fixtures or equipment that may be encountered during excavation or trenching work.

Unconfined Compressive Strength – Is the load per unit area at which soil will fail in compression. This measure can be determined by laboratory testing, or it can be estimated in the field using a pocket penetrometer, by thumb penetration tests, or by other methods.

Responsibilities

The Program Administrator – Safety Manager

These people are responsible for:

- Issuing and administering this program and making sure that the program satisfies the requirements of applicable Federal, State or Local requirements.
- Providing initial and annual training to employees that will serve as the site designated competent person for excavations.
- Maintaining the training records of all employees included in the training sessions.
- Reviewing and updating the program, as necessary.

Superintendent

These people are responsible for:

- Designating a competent person for all excavations
- Understanding the hazards of excavations at the construction site.
- What steps are necessary to ensure a safe excavation?
- Ensuring that all employees are evacuated from the excavation area and notify the fire department having jurisdiction. The emergency numbers will be identified on the site safety plan.
- Ensuring the Excavation Permit is completed by a designated competent person in excavation.
- Determining potential water hazards and the need for dewatering systems.
- Perform daily safety inspections of the work site and all excavations.
- Ensuring that access to emergency equipment on the construction site must be provided in the initial stage of site preparation and always maintained.
- All workers have been trained in the proper use of all personal protective equipment being use or required at the excavation site.
- All workers have been educated in the hazards associated with the specific excavation.

Designated Competent Person- Brieser trained personnel.

A competent person should have and be able to demonstrate the following:

Training, experience, and knowledge of:

- Soil analysis
- Use of protective systems
- Requirements of 29 CFR 1926 Subpart P

Ability to detect:

- Conditions that could result in cave-ins.
- Failures in protective systems
- Hazardous atmospheres
- Other hazards including those associated with confined spaces.

Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.

Performing inspections prior to the start of "each shift" as needed throughout the shift to ensure a safe operation.

Removing employees from the hazardous area when there is evidence of a possible cave-in.

Responsible for completing the Excavation Permit

Employees of Brieser Construction or Subcontractors Foremen

These people are responsible for:

- Upon recognition of an excavation hazard, immediately notifying employees in the immediate area to evacuate and then notify their foreman, Brieser Construction Superintendent, and or the fire department having jurisdiction. At the construction site emergency numbers will be listed adjacent to the telephones at the job trailer and emergency numbers will be identified on the site safety plan.
- Assisting in maintaining the workplace free of all fire hazards.

PRE-DIG PROCEDURE

1. When excavating or trenching becomes necessary for Brieser Construction or a subcontractor, the superintendent or engineer in charge of the work shall ascertain that all known maps and prints have been reviewed to determine the exact location of underground interferences prior to excavation. By law whenever digging into the ground is needed a call to 811 must completed a minimum 48 hours prior to the actual excavation. You can request the 811 in any state that you are working in by emailing julie@brieserconstruction.com
   If possible, the following information will be needed to complete the 811 requests.
   a. Project start date.
   b. Expected completion date.
   c. Provide the description of the work and what type of digging we will be performing (mechanical, vac truck, hand digging)
   d. Provide the exact address where the excavation will be performed. If not exact, the nearest address, or the closest intersection.
   e. Provide the precise location of excavation (i.e.: NW corner of property between fence and guardhouse)
   f. Provide the foreman you will have performing the work (if known)

   You must complete the Brieser Excavation Permit for excavations to be performed by Brieser Construction.

2. The superintendent or engineer shall “stake mark” the location, depth, and identity of all interferences. The superintendent shall also mark the ground directly above the interference by a suitable means. The “Excavation Permit” must be completed before any excavation can begin.

3. Where information is limited (no "as-builds" available) as to the exact location of possible interfering buried utilities, they shall be de-energized or shut off and locked and tagged before work begins.

4. Prior to the start of any excavation these following bullitt points should be followed:

   - Review 811 packet of information from HR Department.
     - This should be the ticket and all related utility responses.
     - Including a sheet of state laws and marking colors.
   - Walk entire job site including borders to see marked or un-marked utilities.
     - Verify with prints, dig ticket, PM, site manager.
   - Photograph all clear flags / marked utilities by using step photography leaving permanent to semi-permanent structures in background. Send to julie@brieserconstruction.com for record keeping.

- If utilities are missing or indistinguishable a call to the dig ticket caller must be made immediately. (Jim or Ken. Check ticket for caller) A No-Show or Incomplete will be made. (Both 2hr response emergency type ticket no digging can be done!)
- Complete Excavation Permit, TSTI to include the 811 information.
- Take daily progress photographs and send to julie@brieserconstruction.com
- Call in for a remark when crew has made marks indistinguishable.
    - No digging until ticket is valid again. (approx. 48 hrs.)
- When a utility damage has occurred:
    - Do NOT attempt to repair utility.
    - Remove all personnel immediately (if applicable)
    - Call utility company 1st!
    - Call Jim or Ken (They will call Kevin)
    - Call Mike Adermann.
- Jim or Ken will keep in communication with foreman to keep ticket open if a longer project. Otherwise, Foreman to communicate upon completion of ticket so it may be closed out.
- Any issues refer to new sub section of the excavation section of the Brieser Safety Manual
- Call ticket caller or email julie@brieserconstruction.com to notify that work is completed.

PROCEDURE

1. Known or questionable interferences shall be "hand-dug" or uncovered by non-destructive means before powered equipment digs within two (2) feet of the suspected interference. Hand digging and/or vacuum excavating with 18 inches on either side of a marked underground facility.

    a. "Hand-dug" shall imply hand shovels or post-hole diggers.
    b. Non-destructive methods include pneumatic soil picks and vacuum truck excavation. Please refer to Brieser SH&E Section 51 for Vacuum Truck Operations.

2. All pneumatic, gasoline or electric tools used for digging into an area of known or questionable hazardous interferences shall be grounded (in addition to the normal ground).

PROCEDURE continued

3. Heavy equipment shall not operate within five (5) feet of the slope of excavation without the approval of the superintendent**.**

4. Excavated or other materials shall not be stored nearer than two (2) feet from the edge of any excavation and shall be stored and retained to prevent its falling or sliding back into the excavation.

5. Each employee in an excavation shall be protected from cave-ins by an adequate "protective system". The competent person or responsible engineer shall refer to 29 CFR 1926.652 and appendices concerning design and determination applicable to soil classifications, sloping, benching, and shoring. The ***competent person*** shall complete the "Excavation Permit & Excavation Entry Permit."

6. The competent person will specify when sloping or shoring is required and shall review sloping, access, shoring, etc. before entry in an excavation or trench.

7. Inspection by the competent person shall be conducted daily before work begins and after rain, snow, freezing/thawing, or conditions which may affect the stability of the soil or shoring.

8. Where employees are required to be in trenches/excavations four (4) feet deep or more, ladders (or other acceptable means of ingress/egress) extending from the floor of the trench/excavation to at least three (3) feet above the top of the excavation shall be provided and so located as to provide means of exit with no more than 25 feet of lateral travel. Ladders shall be secured to prevent movement.

9. In excavations or trenches greater than four (4) feet in depth, where the possibility of oxygen deficiency or toxic/explosive conditions may exist, the atmosphere shall be tested in accordance with Confined Space Entry Procedure. Controls shall be established to assure acceptable atmospheric conditions. When hazardous gases are present, adequate ventilation shall be provided and sources of ignition eliminated. Attended emergency rescue equipment such as breathing apparatus, a safety harness and line, basket stretcher, etc., shall be readily available where adverse atmospheric conditions may exist or develop in an excavation or trench.

10. Employees shall not work underneath loads handled by lifting or digging equipment and shall stand away from vehicles being loaded or unloaded.

11. Walkways shall be provided where employees are required or permitted to cross over excavations. Walkways 6 feet or more above lower levels shall have guardrails per Brieser Construction SH&E Section 22.

OVERVIEW: SOIL MECHANICS.

Soil is heavy. A cubic foot can weigh as much as 110 pounds, and a cubic yard can weigh between 3,000 and 4,000lbs.—a little more than a small Pickup Truck. A person buried under only a few feet of soil can experience enough pressure in the chest area to prevent the lungs from expanding. Suffocation can take place in as little as three minutes while heavier soils can crush the body in a matter of seconds. And to know, for that moment you may never see your loved ones again.

The texture of the soil is a key to its stability. Cohesion is the ability of a soil to stick together instead of crumbling. The more cohesive a soil is, the safer. Soil is classified by its cohesive properties. Except for stable rock, the soil types are A, B, and C. Type A soil is the most cohesive of the three soils. Clay, silty clay, and clay loam are examples of type A. Type C is the least cohesive. Sand is type C soil. Sandy or loose grain soil have poor cohesive properties and are very dangerous and unstable. The cohesive property of type B lies between A and C.

Caution should be used when classifying soil. Other conditions may affect soil strength. Soil classification should be left up to the competent person. Moisture, vibration, and load affect the stability of the soil. What may be safe at one time may not be safe at another. These changes occur often without sufficient warning to protect the workers.

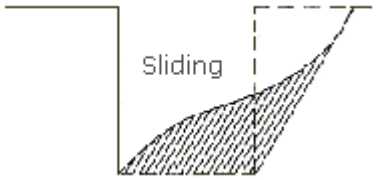
A number of stresses and deformations can occur in an open cut or trench. For example, increases or decreases in moisture content can adversely affect the stability of a trench or excavation. The following diagrams show some of the more frequently identified causes of trench failure.

A. **TENSION CRACKS**. Tension cracks usually form at a horizontal distance of 0.5 to 0.75 times the depth of the trench, measured from the top of the vertical face of the trench. See the accompanying drawing for additional details.

TENSION CRACK.

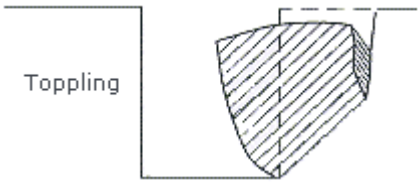
B. **SLIDING** or sluffing may occur as a result of tension cracks, as illustrated below.

SLIDING



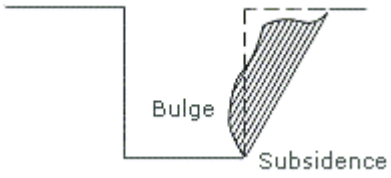
C. **TOPPLING**. In addition to sliding, tension cracks can cause toppling. Toppling occurs when the trench's vertical face shears along the tension crack line and topples into the excavation.

TOPPLING



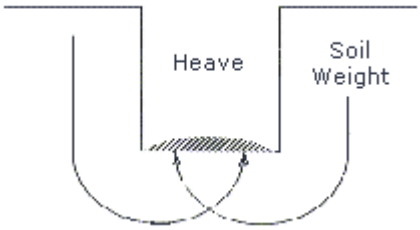
D. **SUBSIDENCE AND BULGING**. An unsupported excavation can create an unbalanced stress in the soil, which, in turn, causes subsidence at the surface and bulging of the vertical face of the trench. If uncorrected, this condition can cause face failure and entrapment of workers in the trench.

SUBSIDENCE AND BULGING



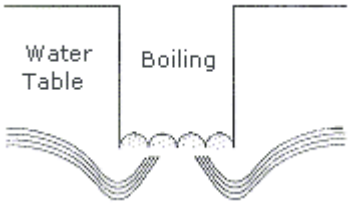
E. **HEAVING OR SQUEEZING**. Bottom heaving or squeezing is caused by the downward pressure created by the weight of adjoining soil. This pressure causes a bulge in the bottom of the cut, as illustrated in the drawing above. Heaving and squeezing can occur even when shoring or shielding has been properly installed.

HEAVING OR SQUEEZING



F. **BOILING** is evidenced by an upward water flow into the bottom of the cut. A high-water table is one of the causes of boiling. Boiling produces a "quick" condition in the bottom of the cut and can occur even when shoring or trench boxes are used.

BOILING



G. **UNIT WEIGHT OF SOILS** refers to the weight of one unit of a particular soil. The weight of soil varies with type and moisture content. One cubic foot of soil can weigh from 110 pounds to 140 pounds or more, and one cubic meter (35.3 cubic feet) of soil can weigh more than 3,000 pounds.

DETERMINATION OF SOIL TYPE

OSHA categorizes soil and rock deposits into four types, A through D, as follows:

A. **STABLE ROCK** is natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed. It is usually identified by a rock name such as granite or sandstone. Determining whether a deposit is of this type may be difficult unless it is known whether cracks exist and whether or not the cracks run into or away from the excavation.

B. **TYPE A SOILS** are cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) (144 kPa) or greater. Examples of Type A cohesive soils are often: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. (No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, is part of a sloped, layered system where the layers dip into the excavation on a slope of 4 horizontal to 1 vertical (4H:1V) or greater, or has seeping water.

C. **TYPE B SOILS** are cohesive soils with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa). Examples of other Type B soils are: angular gravel; silt; silt loam; previously disturbed soils unless otherwise classified as Type C; soils that meet the unconfined compressive strength or cementation requirements of Type A soils but are fissured or subject to vibration; dry unstable rock; and layered systems sloping into the trench at a slope less than 4H:1V (only if the material would be classified as a Type B soil).

D. **TYPE C SOILS** are cohesive soils with an unconfined compressive strength of 0.5 tsf (48 kPa) or less. Other Type C soils include granular soils such as gravel, sand and loamy sand, submerged soil, soil from which water is freely seeping, and submerged rock that is not stable. Also included in this classification is material in a sloped, layered system where the layers dip into the excavation or have a slope of four horizontal to one vertical (4H:1V) or greater.

E. **LAYERED GEOLOGICAL STRATA**. Where soils are configured in layers, i.e., where a layered geologic structure exists, 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.

TEST EQUIPMENT AND METHODS FOR EVALUATING SOIL TYPE.

Many kinds of equipment and methods are used to determine the type of soil prevailing in an area, as described below.

A. **POCKET PENETROMETER**. Penetrometers are direct-reading, spring-operated instruments used to determine the unconfined compressive strength of saturated cohesive soils. Once pushed into the soil, an indicator sleeve displays the reading. The instrument is calibrated in either tons per square foot (tsf) or kilograms per square centimeter (kPa). However, Penetrometers have error rates in the range of ± 20-40%.

1. **Shear vane (Torvane)**. To determine the unconfined compressive strength of the soil with a shear vane, the blades of the vane are pressed into a level section of undisturbed soil, and the torsional knob is slowly turned until soil failure occurs. The direct instrument reading must be multiplied by 2 to provide results in tons per square foot (tsf) or kilograms per square centimeter (kPa).

2. **Thumb Penetration Test**. The thumb penetration procedure involves an attempt to press the thumb firmly into the soil in question. If the thumb makes an indentation in the soil only with great difficulty, the soil is probably Type A. If the thumb penetrates no further than the length of the thumb nail, it is probably Type B soil, and if the thumb penetrates the full length of the thumb, it is Type C soil. The thumb test is subjective and is therefore the least accurate of the three methods.

3. **Dry Strength Test**. Dry soil that crumbles freely or with moderate pressure into individual grains is granular. Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can be broken only with difficulty) is probably clay in combination with gravel, sand, or silt. If the soil breaks into clumps that do not break into smaller clumps (and the soil can be broken only with difficulty), the soil is considered unfissured unless there is visual indication of fissuring.

EVALUATING SOIL TYPE Continued

B. **PLASTICITY OR WET THREAD TEST**. This test is conducted by molding a moist sample of the soil into a ball and attempting to roll it into a thin thread approximately 1/8 inch (3 mm) in diameter (thick) by 2 inches (50 mm) in length. The soil sample is held by one end. If the sample does not break or tear, the soil is considered cohesive.

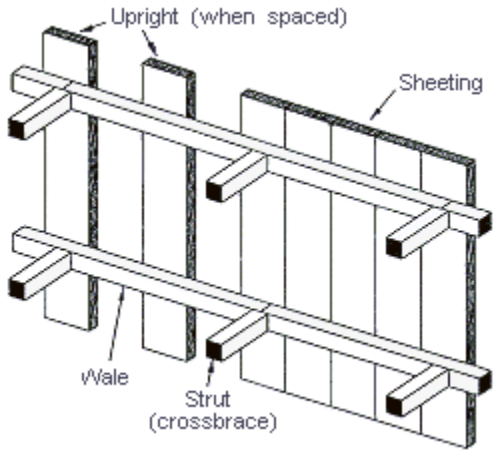
C. **VISUAL TEST**. A visual test is a qualitative evaluation of conditions around the site. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. If the soil remains in clumps, it is cohesive; if it appears to be coarse-grained sand or gravel, it is considered granular. The evaluator also checks for any signs of vibration.

During a visual test, the evaluator 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 previously been disturbed, and observe the open side of the excavation for indications of layered geologic structuring.

The evaluator should also look for signs of bulging, boiling, or sluffing, as well as for signs of surface water seeping from the sides of the excavation or from the water table. If there is standing water in the cut, the evaluator should check for "quick" conditions. In addition, 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.

SHORING TYPES

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

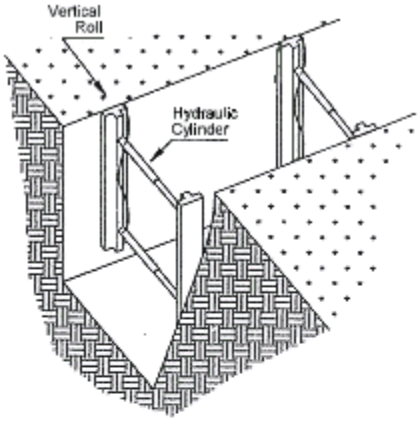


D. **HYDRAULIC SHORING**. The trend today is toward the use of hydraulic shoring, a prefabricated strut and/or wale system manufactured of aluminum or steel. Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install or remove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

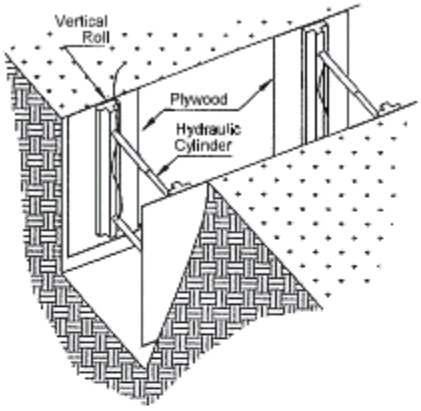
- Are light enough to be installed by one worker.
- Are gauge-regulated to ensure even distribution of pressure along the trench line.
- Can have their trench faces "preloaded" to use the soil's natural cohesion to prevent movement; and
- Can be adapted easily to various trench depths and widths.

All shoring should be installed from the top down and removed from the bottom up. Hydraulic shoring should be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.

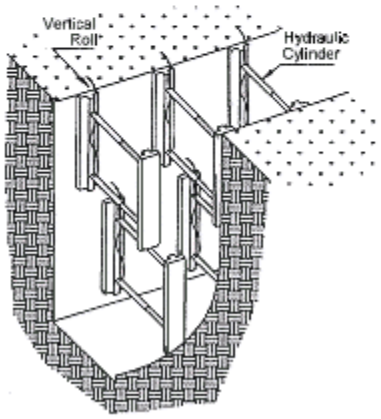
SHORING VARIATIONS: TYPICAL ALUMINUM HYDRAULIC SHORING INSTALLATIONS



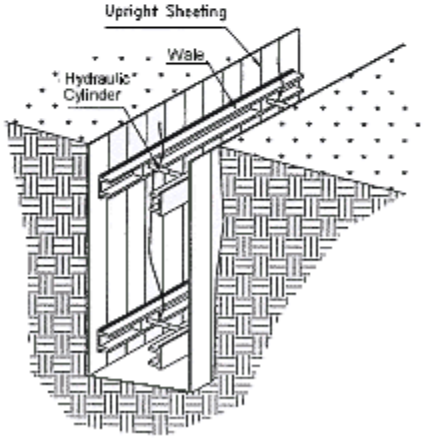
Vertical Aluminum Hydraulic Shoring (Spot Bracing)



Vertical Aluminum Hydraulic Shoring (With Plywood)



Vertical Aluminum Hydraulic Shoring (Stacked)



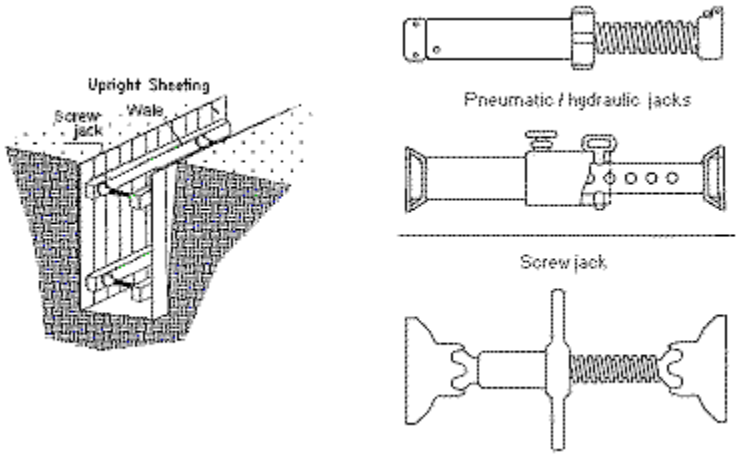
Aluminum Hydraulic Shoring Waler System (Typical)

PNEUMATIC SHORING works in a manner like hydraulic shoring. The primary difference is that pneumatic shoring uses air pressure in place of hydraulic pressure. A disadvantage to the use of pneumatic shoring is that an air compressor must be on site.

0. **Screw Jacks**. Screw jack systems differ from hydraulic and pneumatic systems in that the struts of a screw jack system must be adjusted manually. This creates a hazard because the worker is required to be in the trench in order to adjust the strut. In addition, uniform "preloading" cannot be achieved with screw jacks, and their weight creates handling difficulties.

1. **Single-Cylinder Hydraulic Shores**. Shores of this type are generally used in a water system, as an assist to timber shoring systems, and in shallow trenches where face stability is required.

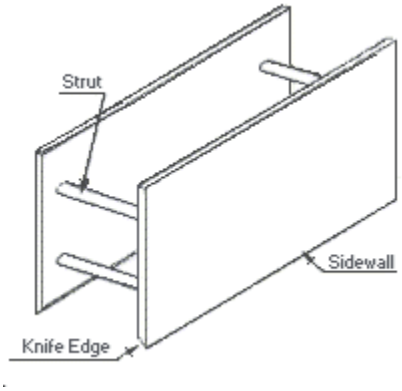
2. **Underpinning**. This process involves stabilizing adjacent structures, foundations, and other intrusions that may have an impact on the excavation. As the term indicates, underpinning is a procedure in which the foundation is physically reinforced. Underpinning should be conducted only under the direction and with the approval of a registered professional engineer. **FIGURE V:2-9. SHORING VARIATIONS.**



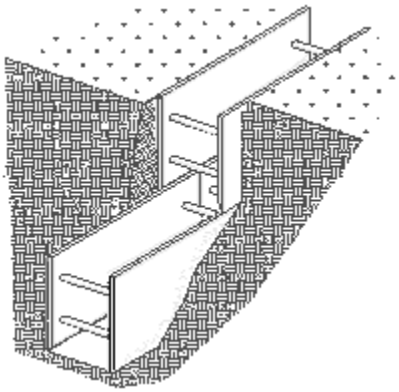
SHIELDING TYPES

B. **TRENCH BOXES** are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar incidents. 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 boxes and the excavation side are backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those which the system was designed to withstand.

TRENCH SHIELD.



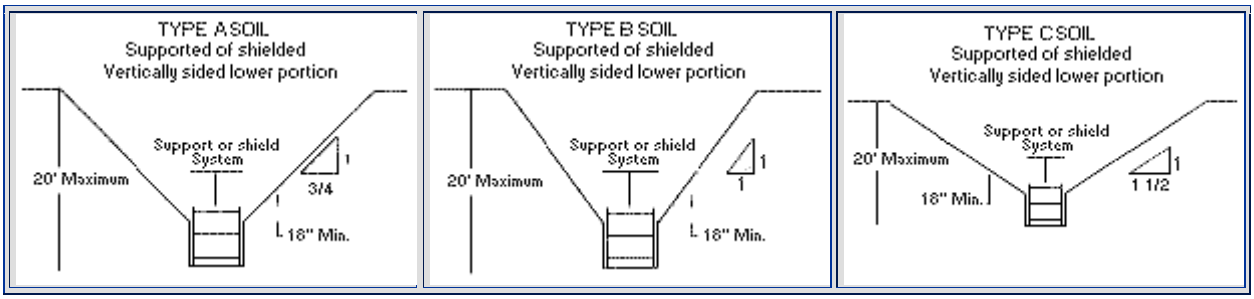
TRENCH SHIELD, STACKED.



B. **COMBINED USE**. Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching. The box should extend at least 18 in (0.45 m) above the surrounding area if there is sloping toward excavation. This can be accomplished by providing a benched area adjacent to the box.

Earth excavation to a depth of 2 ft (0.61 m) below the shield is permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of possible loss of soil from behind or below the bottom of the support system. Conditions of this type require observation on the effects of bulging, heaving, and boiling as well as surcharging, vibration, adjacent structures, etc., on excavating below the bottom of a shield. Careful visual inspection of the conditions mentioned above is the primary and most prudent approach to hazard identification and control.

SLOPE AND SHIELD CONFIGURATIONS



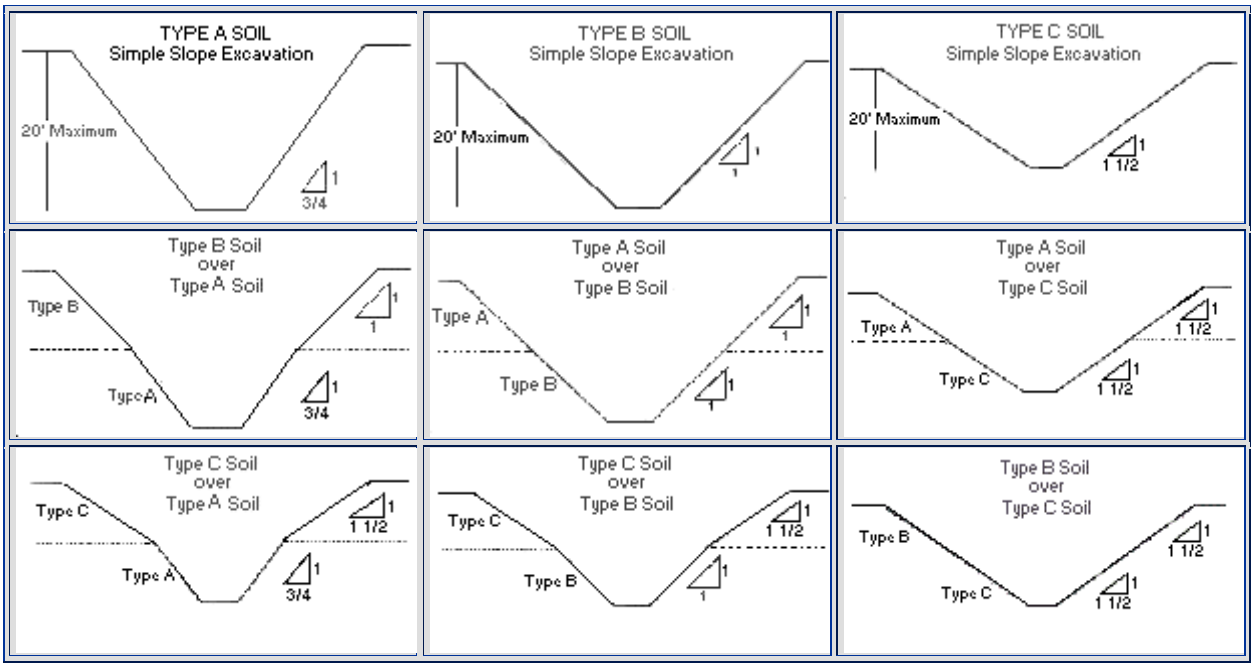
SLOPING AND BENCHING.

A. **SLOPING**. Maximum allowable slopes for excavations less than 20 ft (6.09 m) based on soil type and angle to the horizontal are as follows:

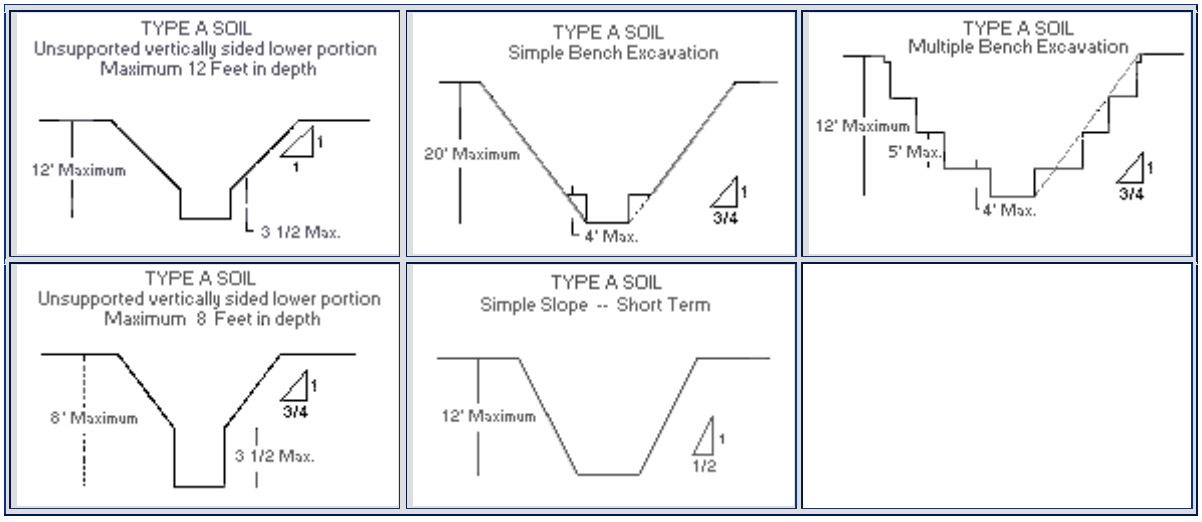
TABLE V:2-1. ALLOWABLE SLOPES.

Soil type	Height/Depth ratio	Slope angle
Stable Rock	Vertical	90°
Type A	¾:1	53°
Type B	1:1	45°
Type C	1½:1	34°
Type A (short-term)	½:1	63°
(For a maximum excavation depth of 12 ft)		

SLOPE CONFIGURATIONS: EXCAVATIONS IN LAYERED SOILS.



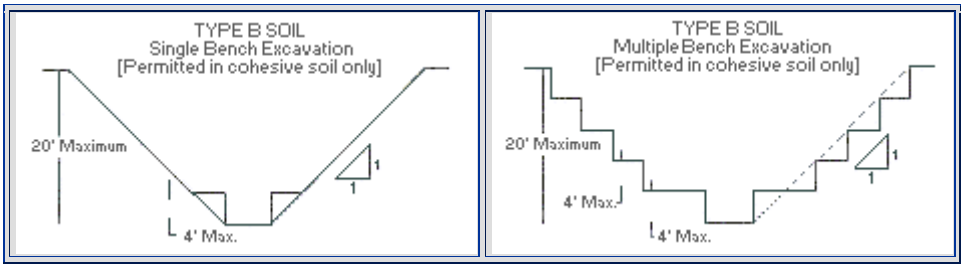
EXCAVATIONS MADE IN TYPE A SOIL.



BENCHING There are two basic types of benching, simple and multiple. The type of soil determines the horizontal to vertical ratio of the benched side.

As a general rule, the bottom vertical height of the trench must not exceed 4 ft (1.2 m) for the first bench. Subsequent benches may be up to a maximum of 5 ft (1.5 m) vertical in Type A soil and 4 ft (1.2 m) in Type B soil to a total trench depth of 20 ft (6.0 m). All subsequent benches must be below the maximum allowable slope for that soil type. For Type B soil the trench excavation is permitted in cohesive soil only.

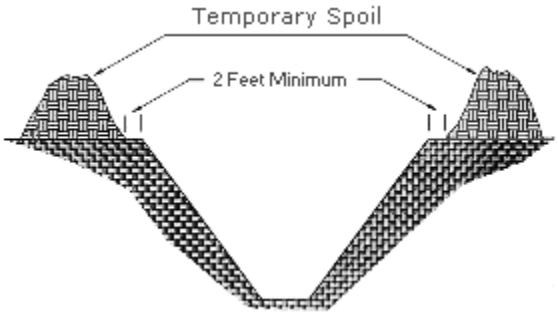
EXCAVATIONS MADE IN TYPE B SOIL.



SPOIL.

A. **TEMPORARY SPOIL**. Temporary spoil must be placed no closer than 2 ft (0.61 m) 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 will not fall on employees in the trench.

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. **TEMPORARY SPOIL.**



SPOIL continued

B. **PERMANENT SPOIL**. Permanent spoil should be placed at some distance from the excavation. Permanent spoil is often created where underpasses are built, or utilities are buried. The improper placement of permanent spoil, i.e., insufficient distance from the working excavation, can cause an excavation to be out of compliance with the horizontal-to-vertical ratio requirement for a particular excavation. This can usually be determined through visual observation. Permanent spoil can change undisturbed soil to disturbed soil and dramatically alter slope requirements.

SURFACE CROSSING OF TRENCHES Surface crossing of trenches should be discouraged; however, if trenches must be crossed, such crossings are permitted only under the following conditions:

- Vehicle crossings must be designed by and installed under the supervision of a registered professional engineer.
- Walkways or bridges must be provided for foot traffic. These structures shall:
  - have a safety factor of 4;
  - have a minimum clear width of 20 in (0.51 m);
  - be fitted with standard rails; and
  - extend a minimum of 24 in (.61 m) past the surface edge of the trench.

INGRESS AND EGRESS Access to and exit from the trench require the following conditions:

- Trenches 4 ft or more in depth should be provided with a fixed means of egress.
- Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 ft laterally to the nearest means of egress.
- Ladders must be secured and extend a minimum of 36 in (0.9 m) above the landing.
- Metal ladders should be used with caution, particularly when electric utilities are present.

EXPOSURE TO VEHICLES Procedures to protect employees from being injured or killed by vehicle traffic include:

- Providing employees with and requiring them to wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility materials.
- Requiring a designated, trained flag person along with signs, signals, and barricades when necessary.

EXPOSURE TO FALLING LOADS Employees must be protected from loads or objects falling from lifting or digging equipment. Procedures designed to ensure their protection include:

- Employees are not permitted to work under raised loads.
- Employees are required to stand away from equipment that is being loaded or unloaded.
- Equipment operators or truck drivers may stay in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.

FALLS Guardrails, fences, or barricades must be provided on excavations adjacent to any walking/working surface or vehicle passageways. Warning lights or other illumination shall be maintained as necessary for the safety of the public and employees as needed.

All excavations must be effectively barricaded or covered, and warnings posted as necessary to prevent unauthorized access. All temporary excavations of this type must be backfilled as soon as possible.

WARNING SYSTEMS FOR 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 a danger of vehicles falling into the trench.
- Soil should be graded away from the excavation; this will assist in vehicle control and channeling of run-off water.

HAZARDOUS ATMOSPHERES AND CONFINED SPACES. Employees shall not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with:

- Less than 19.5% or more than 23.5% oxygen.
- A combustible gas concentration greater than 10% 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 ACGIH (American Conference of Governmental Industrial Hygienists).

All operations involving such atmospheres must be conducted in accordance with OSHA requirements for occupational health and environmental controls (see Subpart D of 29 CPR 1926) for personal protective equipment and for lifesaving equipment (see Subpart E, 29 CFR 1926). Engineering controls (e.g., ventilation) and respiratory protection may be required.

When testing for atmospheric contaminants, the following should be considered:

- Testing should be conducted before employees enter the trench and should be done regularly to ensure that the trench remains safe.
- The frequency of testing should be increased if equipment is operating in the trench.
- Testing frequency should also be increased if welding, cutting, or burning is done in the trench.

Employees required to wear respiratory protection must be trained, fit-tested, and enrolled in a respiratory protection program. Some trenches qualify as confined spaces. When this occurs, compliance with the Confined Space Standard is also required.

EMERGENCY RESCUE EQUIPMENT Emergency rescue equipment is required when a hazardous atmosphere exists or can reasonably be expected to exist. Requirements are as follows:

- Respirators must be of the type suitable for the exposure. Employees must be trained in their use and a respirator program must be instituted.
- Attended (at all times) lifelines must be provided when employees enter bell-bottom pier holes, deep confined spaces, or other similar hazards.
- Employees who enter confined spaces must be trained.

STANDING WATER AND WATER ACCUMULATION Methods for controlling standing water and water accumulation must be provided and should consist of the following if employees are permitted to work in the excavation:

- Use of special support or shield systems approved by a registered professional engineer.
- Water removal equipment, i.e., well pointing, used, and monitored by a competent person.
- Safety harnesses and lifelines used in conformance with 29 CFR 1926.104.
- Surface water diverted away from the trench.
- Employees removed from the trench during rainstorms.
- Trenches carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench.

INSPECTIONS – Inspections shall be made by a competent person and should be documented. The following guide specifies the frequency and conditions requiring inspections:

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

UTILITIES Overhead and underground utilities create hazards. Brieser Construction must have their states One-Call (811) determine the estimated location of utility installations (Communication, electric, water, sewer, and any other possible underground utility installations). The utility companies or owners must be contacted. They are asked to find the exact location of underground installations. Private utility locates along with ground penetrating radar scans may be needed.

Excavation work must be conducted in a manner that does not endanger underground installations or employees engaged in the work. Utilities left in place must be protected by any means necessary to protect employees.

Brieser Construction
Excavation Permit

Company		**Date**		
Project Name		**Daily Inspection**	S M T W T F S	
Project Location		**Approx. Wind Dir. & Temp.**		
Job Number		**Julie Dig # Dial 811**		
Excavation Depth & Width		**Julie Date & Time Notified**		
Protective System Used		**Brieser Locate by: (Name)**		
Competent Person		**Soil Classification**	Class C	Soil Test Attached
Activities In Excavation				
Julie Boundaries				

YES	*NO*	*N/A*	*DESCRIPTION*
GENERAL			
			Trenches over 4 feet deep require proper access, e.g., ladder or ramp
			Distance from access/egress shall not exceed 25 of lateral travel
			Trenches over 4 feet deep require sloping/shoring or a trench box
			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 &/or manufacturer's data on trench box capabilities on site
			Adequate signs posted and barricades provided
			Training (toolbox meeting) conducted w/ employees prior to entering excavation
UTILITIES			
			One Call System contacted & given 48 hours notice &/or utilities already located & marked
			Brieser Locate Equipment used as verification to One-Call
			If a gas line is nearby, should I call NICOR's Watch & Protect? 1-888-NICOR-4-U Ask for Centralized Locating and then Watch & Protect.
			Brieser Locate Equipment used
			Overhead lines located, noted, and reviewed with the operator
			Walked area to determine possible unmarked underground
			Does this require the use of a Hydro-Excavator
			Underground Drawings & Utility locations reviewed with the operator, & precautions taken to ensure contact does not occur

Brieser Construction
Excavation Permit

			Utilities crossing the excavation supported, and protected from falling materials
			Underground installations protected, supported, or removed when excavation is open
			Julie Excavator Handbook Reviewed?
			Am I over my 28-day ticket life? (Calendar days from issued locate number)
			If I am digging for the first time on this dig number, am I within 14 calendar days? If over, you must call Julie for new dig #.
			Pictures of Julie Locate Taken
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, 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
			Is a Confined Space Permit needed due to Hazardous Atmospheres, Engulfment or Entrapment? Would any other recognized serious hazard deem this a permit space? If not, then no confined space paperwork is needed for this job.
			Supplied air necessary (if yes, contact safety department)
ENTRY & EXIT			
			Exit (i.e., ladder, sloped wall, or ramp)
			Ladders secured and extended 3 feet above the edge of the trench
			Wood ramps constructed of uniform material thickness, cleated together at the bottom
			Employees protected from cave-ins when entering or exiting the excavation

ROUTING	**CUSTOMER**	
	PER. MANAGER	
	SCAN	**SAFETY/PERMITS COMPLETED/EXCAVATION & TRENCHING/MMDDYY/LOCATION**

Brieser Construction
Soil Classification Form

VISUAL TEST					
Please indicate Excavation Permit date & location that matches this form					
Particle type	Fine Grained (Cohesive)		Granular (sand/silt or gravel)		Other:
Water Conditions	Wet	Dry	Seeping Water	Surface Water present	Submerged
Notes					

Yes	No	N/A	Description
			Layered Soils Dipping Into excavation? If yes, describe:
			Excavation exposed to vibrations? If yes, describe:
			Previously disturbed soils?
			Crack like openings or sprawling 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)		

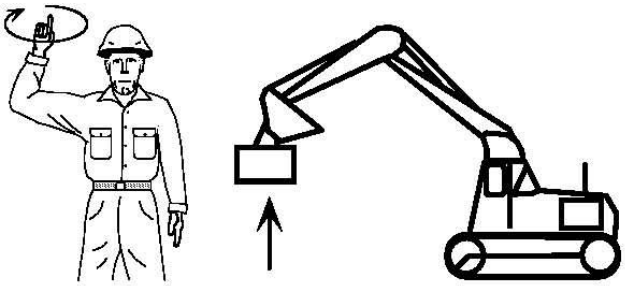
THUMB TEST Note: Used to estimate unconfined compression strength of cohesive soil.			
Test Performed	Yes	No	N/A, Explain:
Soil indented by thumb with very great effort?			Type A
Soil indent by thumb with some effort?			Type B
Soil easily penetrated several inches by thumb with little or no effort. NOTE: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

PENETROMETER or SHEARVANE TEST Note: 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 of 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

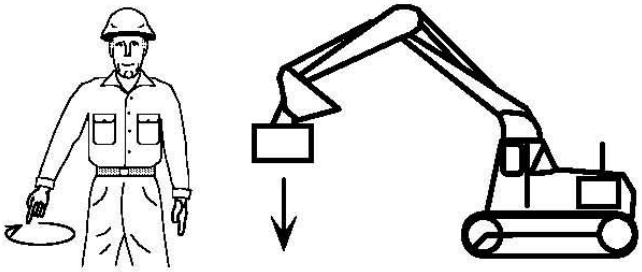
SOIL CLASSIFICATION			
Stable Rock	Type A	Type B	Type C

SELECTION OF PROTECTIVE SYSTEM (Refer to Appendix F of 29CFR1926)			
Sloping (Appendix B) Specify angle:	Timber Shoring (Appendix C)	Trench Shield Max depth in this soil:	Hydraulic Shoring (Appendix D)

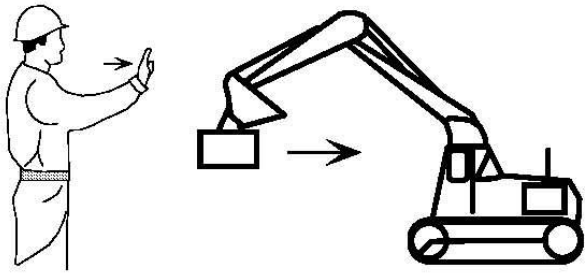
Brieser Construction
Excavator & Backhoe Hand Signals



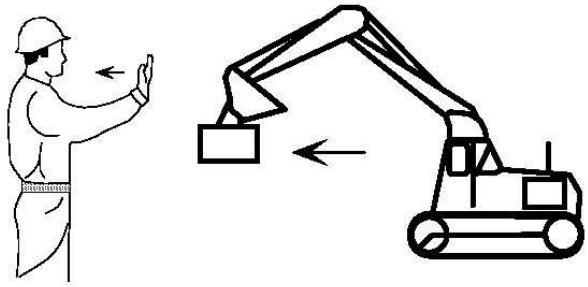
Raise Load Vertically
With forefinger vertical pointing up,
move hand in small horizontal circular motion



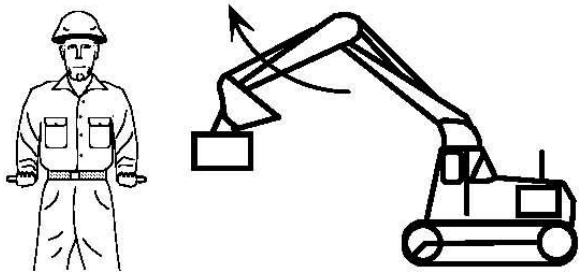
Lower Load Vertically
With forefinger vertical pointing down,
move hand in small horizontal circular motion



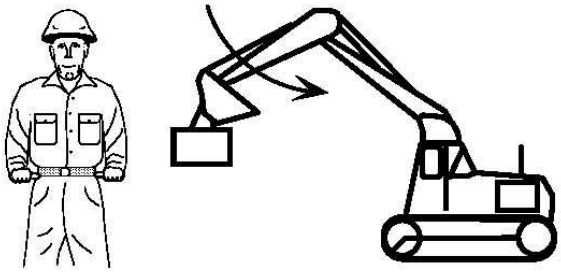
Move Load In Horizontally
With either arm extended, hand raised and open toward direction of movement, move hand in direction of required movement.



Move Load Out Horizontally
With either arm extended, hand raised and open toward direction of movement, move hand in direction of required movement.

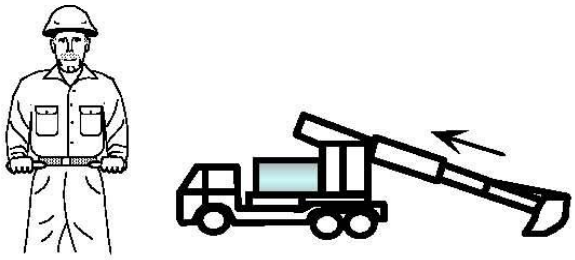


Move Arm Outward
With both hands clenched,
point thumbs outward

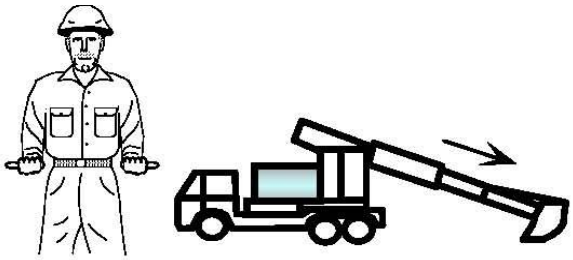


Move Arm Inward
With both hands clenched,
point thumbs inward

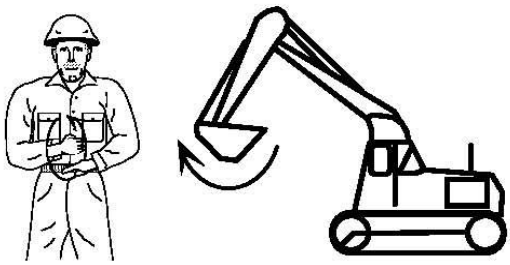
Brieser Construction
Excavator & Backhoe Hand Signals



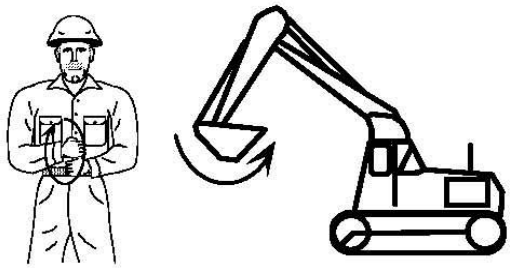
Retract Telescopic Boom
With both hands clenched, point thumbs in



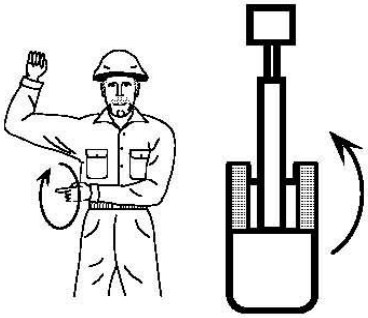
Extend Telescopic Boom
With both hands clenched, point thumbs out



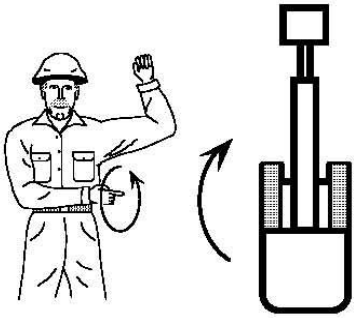
Open Bucket
Hold one hand open and stationary, Rotate other hand in small vertical circle with longfinger pointing horizontally at open hand



Close Bucket
Hold one hand closed and stationary, Rotate other hand in small vertical circle with longfinger pointing horizontally at closed hand

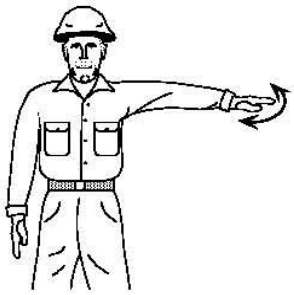


Turn
Raise forearm with closed hand indicating inside of turn. Move other other hand in circular motion point the direction of track or wheel rotation.



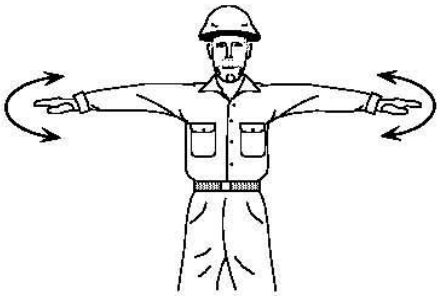
Turn
Raise forearm with closed hand indicating inside of turn. Move other other hand in circular motion point the direction of track or wheel rotation.

Brieser Construction
Excavator & Backhoe Hand Signals



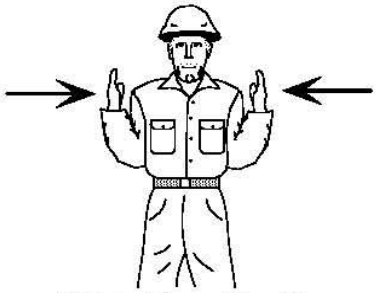
Stop

With either arm extended laterally, hands open downward, move arm back and forth



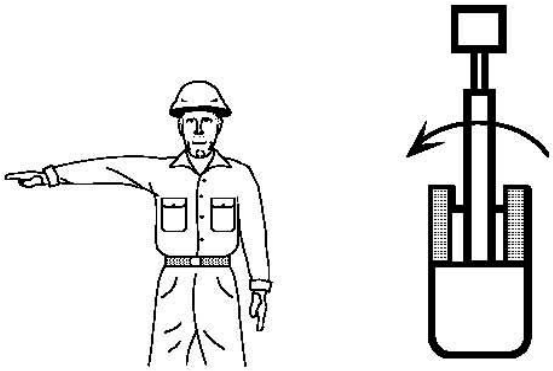
Emergency Stop

With both arms extended laterally, hands open downward, move arms back and forth



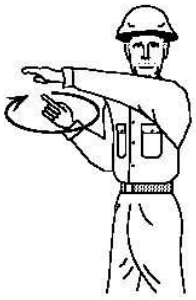
This Far To Go

With hands raised and open inward move hands laterally, indicating distance to go.



Swing (Left or Right)

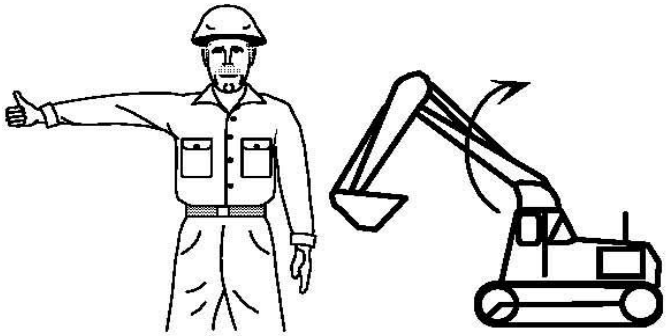
With either arm extended horizontally point with forefinger to direction of swing rotation. (Swing left shown)



Move Slowly

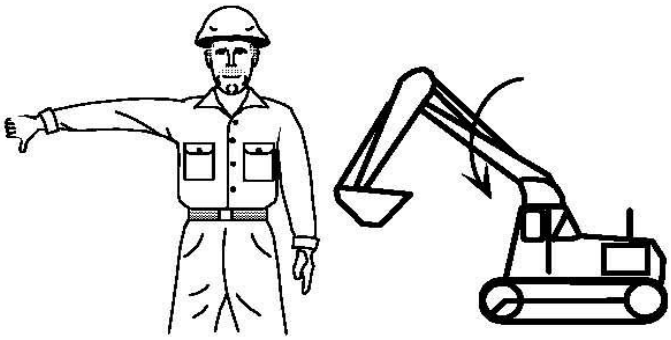
Place one hand motionless in front of hand giving motion signal. (Raise load slowly is shown)

Brieser Construction
Excavator & Backhoe Hand Signals



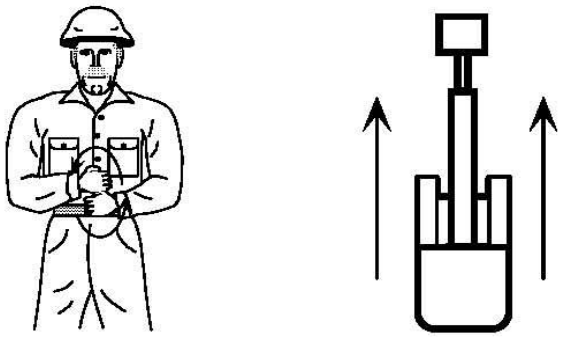
Raise Boom

With either arm extended horizontally, fingers closed, point thumb upward.



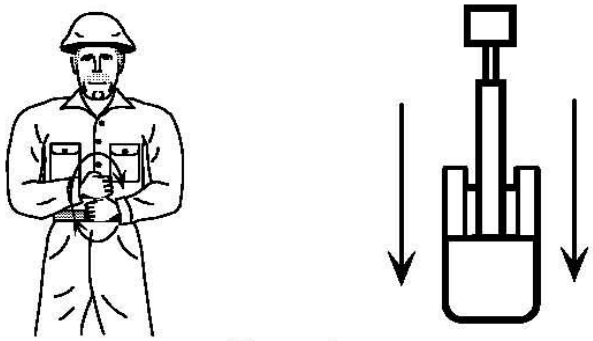
Lower Boom

With either arm extended horizontally, fingers closed, point thumb downward.



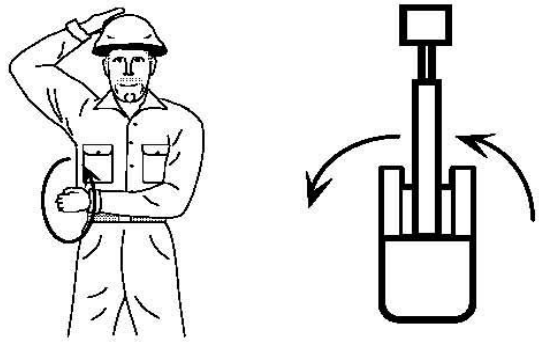
Travel

Move fists in vertical circle about each other in idrection of track or wheel rotation.



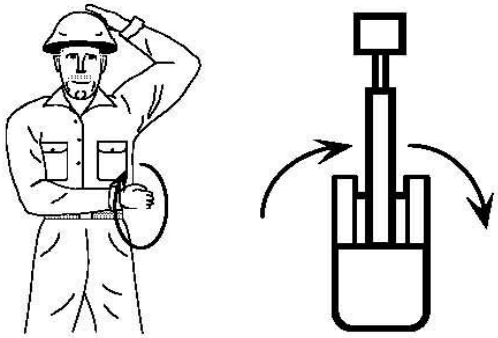
Travel

Move fists in vertical circle about each other in idrection of track or wheel rotation.



Counter Rotate

Place hand on head indicating side of reverse track or wheel rotation. Move other hand in vertical circle indicating forward rotation of other track or wheel.



Counter Rotate

Place hand on head indicating side of reverse track or wheel rotation. Move other hand in vertical circle indicating forward rotation of other track or wheel.

Excavating & Trenching Learning Exercise

Score: **%**

Employees Name:		**Date:**	
Company:		**Instructor:**	
Trade:		**Job Title:**	

Answer each of the following questions "True" or "False" by circling the appropriate letter.

T F 1. Whenever an excavation is planned it is the responsibility of the excavator to make sure an 811 ticket is called in for the planned excavation area.

T F 2. In the unlikely event that a utility would become damaged on your excavation site you should immediately repair it.

T F 3. Vacuum Truck Operations can be found in Brieser Construction SH&E Section 51.

T F 4. Heavy equipment shall not operate within five (3) feet of the slope of excavation without the approval of the superintendent.

T F 5. Excavated or other materials shall not be stored closer than two (2) feet from the edge of any excavation and shall be stored and retained to prevent its falling or sliding back into the excavation.

T F 6. Each employee in an excavation shall be protected from cave-ins by an adequate "protective system". The competent person shall refer to 29 CFR 1926.652 concerning design and determination applicable to soil classifications, sloping, benching, and shoring.

T F 7. Inspection by the competent person shall be conducted daily before work begins and after rain, snow, freezing/thawing, or conditions which may affect the stability of the soil or shoring.

T F 8. In excavations or trenches greater than four (4) feet in depth, where the possibility of oxygen deficiency or toxic/explosive conditions may exist, the atmosphere shall be tested in accordance with Confined Space Entry Procedure.

T F 9. Employees shall always work underneath loads handled by lifting or digging equipment and shall stand away from vehicles being loaded or unloaded.

T F 10. Walkways shall be provided where employees are required or permitted to cross over excavations. Walkways 6 feet or more above lower levels shall have guardrails per Brieser Construction SH&E Section 22.

Excavating & Trenching Learning Exercise

Answer Sheet

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