ENVIRONMENTAL HEALTH AND SAFETY

TRENCHING AND SHORING PROGRAM MANUAL

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Status

Contact(s)	Implementation Date	Comments
Brooks Beall, EHS	December 2017	Manual updated.
Brad Enis and Sharlie Doty, EHS	March 2019	Made grammatical/formatting revisions.
Alex Christy, EHS	January 2023	Reformatted to fit branding standards.
Cooper Decker, EHS	February 2023	Manual verified and updated.

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A: INTRODUCTION

The requirements set forth in this manual apply to all open excavations made in the earth's surface into which employees are expected to enter. An excavation is defined as, "any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal" (29 CFR 1926.650, .651, and .652).

A trench (trench excavation) is defined as, "a narrow excavation made below the surface of the ground where the depth is greater than the width, but the width of a trench (measured at the bottom) is less than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured as the bottom of the excavation), the excavation is also considered to be a trench" (OSHA 1926.650).

B: ADMINISTRATIVE ROLES

ENVIRONMENTAL HEALTH AND SAFETY

The specific responsibility for developing and implementing Oklahoma State University's (OSU) programs for health and safety resides with the Environmental Health and Safety (EHS) department. In fulfillment of this responsibility, EHS has prepared the OSU Trenching and Shoring Manual and will assist other departments in the development and implementation of trenching and shoring operations and training for their areas.

FACILITIES MANAGEMENT

Facilities Management (FM) is a key partner in determining location and hazards associated with all trenching and excavation projects performed at OSU. FM supervisors are responsible for ensuring their employees are properly trained to do the jobs they are sent to do. No FM employee should be sent on a job that potentially involves trenching and shoring unless they have been properly trained.

Any pit or trench with a depth equal to or greater than 4 feet must have one or more specific characteristics to be considered a permit required confined space, the first being that it contains hazardous gases or has the potential to be a hazardous space. No employee or contractor shall enter a pit or trench meeting the classification of a confined space without first meeting all criteria outlined by the OSU Confined Space Program.

DEPARTMENTS

Each department is responsible for ensuring employees working in trenches have been properly trained before operating any lift. Maintaining written records of employee training is essential.

MANAGERS AND SUPERVISORS

Managers and supervisors play a key role in the implementation of the Trenching and Shoring Program. They are responsible for coordinating employee training and certifying that all employees receive annual training. Verifying employee compliance with the principles and practices outlined in the Trenching and Shoring Manual is essential.

PROGRAM REVIEW

EHS will review the Trenching and Shoring Manual annually. When the manual requires updating, all affected employees must be trained on the revisions. EHS will provide the general safety training requirements for the program in addition to training upon request from university departments. EHS will monitor the effectiveness of the program by receipt of copies of inspection checklists. Upon request, EHS will evaluate work areas and employee work practices.

APPLICABLE REGULATIONS AND STANDARDS

- OSHA 29 CFR 1926.20 (General Safety and Health Provisions)
- OSHA 29 CFR 1926.21 (Safety Training and Education)
- OSHA 29 CFR 1926.451 (General Requirements)
- OSHA 29 CFR 1926.650, .651, .and 652 (Excavations)

C: GENERAL REQUIREMENTS

PROCEDURES

A competent person shall be placed in charge of all excavations. Underground utilities must be located and marked before excavation begins. Employees are not allowed in the excavation area while heavy equipment is digging.

PERMITS

All excavations on OSU property require a valid Okie Locate Request, as well as a valid OSU Excavation Permit. Failure to possess a valid Locate and Excavation Permit will result in immediate suspension of excavation until the proper permits are obtained. OSU Excavation Permit Procedures can be found on the OSU Energy Services website.

COMPETENT PERSON

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

- Training, experience, and knowledge of soil analysis, use of protective systems, and requirements of 29 CFR Part 1926 Subpart P – Excavations.
- Ability to detect conditions that could result in cave-ins, failures in protective systems, hazardous atmospheres, and 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 in the event of possible cave-in, indications of failure of protective systems, hazardous atmosphere, or other hazardous conditions.

INSPECTIONS

The competent person shall conduct inspections under each of the following circumstances:

- 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, such as a snowstorm, windstorm, thaw, earthquake, dramatic change in weather, 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.
- When there is any indication of change or movement in adjacent structures.
- Indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions.

For excavations 4 feet or greater in depth, a trench inspection form shall be filled out for each inspection.

D: SOIL TYPES

- **Type A (most stable):** Clay, silty clay, and hardpan (resists penetration). No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, or has seeping water.
- **Type B (medium stability):** Silt, sandy loam, medium clay and unstable dry rock; previously disturbed soils unless otherwise classified as Type C; soils that meet the requirements of Type A soil but are fissured or subject to vibration.
- **Type C (least stable):** Gravel, loamy sand, soft clay, submerged soil or dense, heavy, unstable rock, and soil from which water is freely seeping.
- **Layered Geological Strata:** Soil 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.

Because most excavations on OSU property will be conducted in order to repair/replace existing pipelines or equipment (i.e., the soil has been previously disturbed), excavations shall be made to meet the requirements for Type C soils only, as appropriate.

E: TESTING METHODS

The competent person in charge of the excavation shall be responsible for determining whether the soil is Type A, B or C. The competent person shall use a visual test coupled with one or more manual tests.

VISUAL TEST

In addition to checking the items on the trench inspection form, 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 also checks for any signs of vibration.

During the visual test, the competent person should check for crack-line openings along the failure zone that would indicate tension cracks and look for existing utilities that indicate that the soil has been previously disturbed, and if so, what sort of backfill was used and observe the open side of the excavation for indications of layered geologic structuring.

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

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.

THUMB PENETRATION TEST

Attempt to press the thumb firmly into the soil in question. If the thumb readily indents the soil, however the soil can be penetrated with great effort, it is probably Type A soil. If the thumb penetrates no further than the length of the nail, it is probably Type B soil. If the thumb penetrates the full length of the thumb, it is Type C. It should be noted that the thumb penetration test is the least accurate testing method.

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).

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 two inches in length. If the soil sample does not break when held by one end, it may be considered Type B.

A pocket penetrometer, shear vane, or torvane may also be used to determine the unconfined compression strength of soils.

F: SPOIL

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 will not fall on workers in the trench. Permanent spoil should be placed some distance from the excavation.

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

G: SURFACE CROSSING TRENCHES

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

- Minimum safety factor of 4.
- Minimum clear width of 20 inches.
- Be fitted with standard rails.
- Extend to a minimum of 24 inches past the surface edge of the trench.
- Vehicle crossings must be designed by and installed under the supervision of a registered Professional Engineer.

H: INGRESS AND EGRESS

Trenches 4 feet or more in depth shall 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 feet laterally to the nearest means of egress. Ladders must be secured and extend a minimum of 36 inches above the landing. Metal ladders should not be used when electric utilities are present.

I: EXPOSURE TO VEHICLES

Workers 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. Trained flag persons, signs, signals, and barricades shall be used when necessary.

J: EXPOSURE TO FALLING LOADS

Workers are not allowed to work under raised loads or under loads that are being lifted or moved by heavy equipment. Workers are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage. Because of the risk of falling loads, all workers on an excavation site must wear hard hats.

Equipment operators or truck drivers may remain in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.

K: 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 should be used as required.
- Trenches left open overnight shall be fenced and barricaded.

L: HAZARDOUS ATMOSPHERES

Workers shall not be permitted to work in hazardous and/or toxic atmospheres.

Such atmospheres include those containing:

- Less than 19.5% oxygen, or more than 23.5% oxygen.
- A combustible gas concentration greater than 20% of the lower flammable limit.
- 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.

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 (such as ventilation) and respiratory equipment may be required.

M: TESTING FOR ATMOSPHERIC CONTAMINANTS

If there is any possibility that the trench or excavation could contain a hazardous atmosphere, atmospheric testing must be conducted prior to entry. Atmospheric testing would be required if the excavation was made in a landfill area or if the excavation was crossed by, was adjacent to, or contained pipelines with hazardous materials such as natural gas.

Testing should be conducted before workers 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 or if the work being done includes welding, cutting, or burning.

Workers required to wear respiratory protection must pass a medical evaluation, be fit-tested, receive appropriate training, and be enrolled in a respiratory protection program.

Some trenches qualify as confined spaces. When this occurs, compliance with OSU's Confined Space Program is also required.

N: STANDING WATER AND WATER ACCUMULATION

Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation.

If employees must work in the excavation, methods for controlling standing water and water accumulation must be provided and should consist of the following:

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

O: ADJACENT STRUCTURES

Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as bring, shoring, or underpinning shall be provided to ensure the stability to such structures for the protection of the employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could pose a hazard to employees shall not be permitted except when one of the following conditions are present:

- A support system is provided to ensure the safety of employees and the stability of the structure.
- The excavation is in stable rock.
- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation to be unaffected by excavation activity.
- A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

P: BENCHING, SLOPING, AND SHIELDING

Each employee shall be protected from cave-ins by adequate protective system designed except when the excavations are made entirely of stable rock or excavations are less than 5 feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

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.

Excavations or trenches 20 feet deep or greater shall have a protective system designed by a registered Professional Engineer. Excavations under the base of footing of a foundation or wall require a support system designed by a registered Professional Engineer. 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.

A protective system is not required when an excavation is made entirely in stable rock or when an excavation is less than 5 feet and a competent person has examined the ground and found no indication of a potential cave-in. Materials and equipment used for the protective system shall be free from damage or defects. When damaged, a

competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure that the material or equipment is able to support the intended loads or is otherwise suitable for safe use, the material or equipment shall be removed from service.

Members of the support systems connections shall be secure to prevent sliding, falling, kickouts, or other predictable failures. Support systems shall be installed and removed in a manner to protect the employees from cave-ins, structural collapses, or from being struck by members of the support systems.

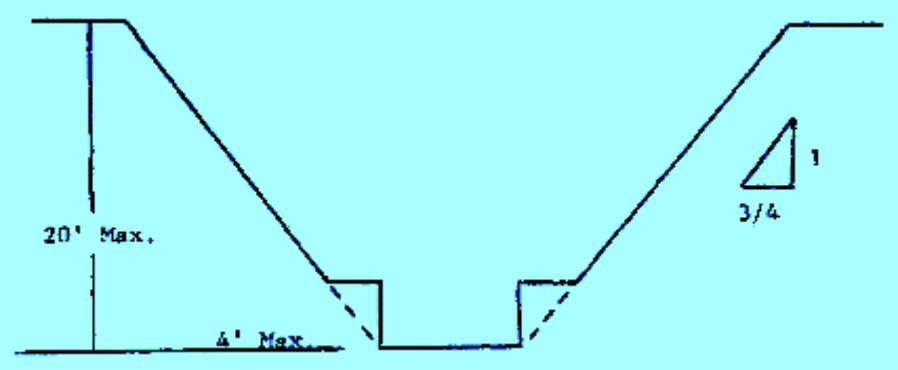
In shoring and benching systems, employees are not permitted to work on faces of sloped or benched excavations at levels above other employees except when the employees at the lower levels are protected from falling, rolling, or sliding material or equipment.

BENCHING

All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

Single Bench

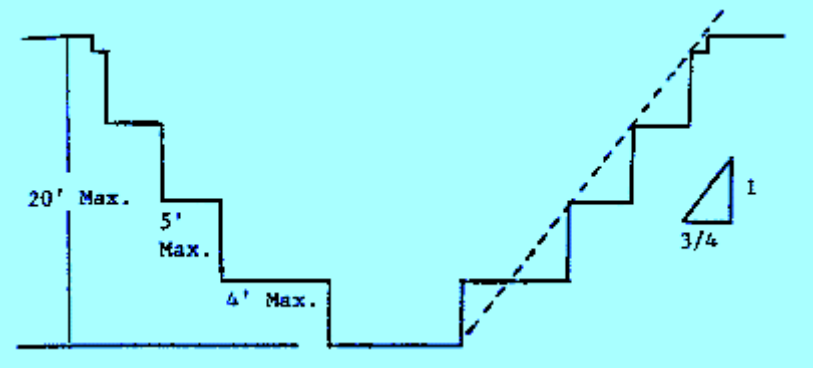
Type "A" Soil



Single Bench

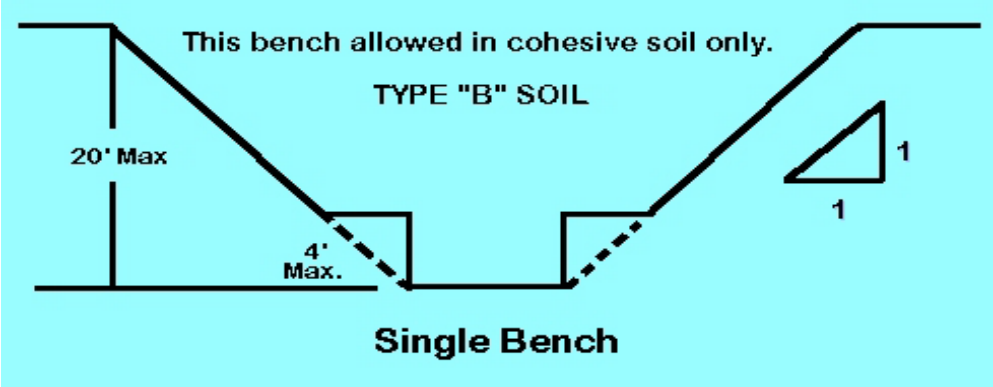
Multiple Bench

Type "A" Soil

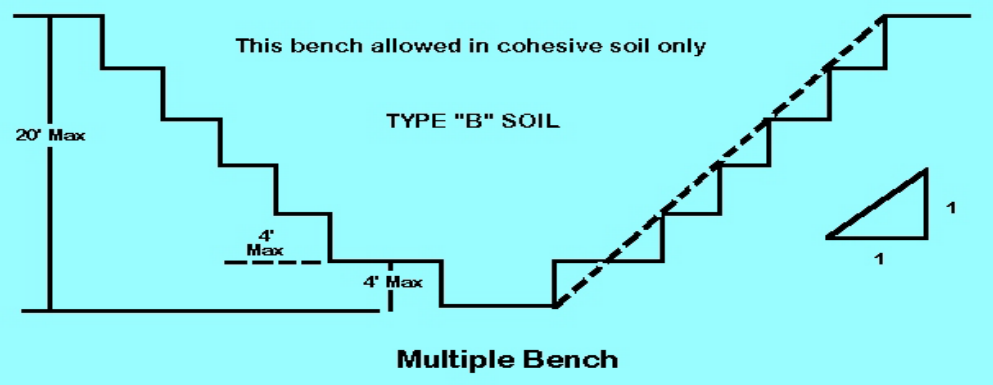


Multiple Bench

Single Bench



Multiple Bench



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.

Benching is not allowed in Type C soil.

SLOPING

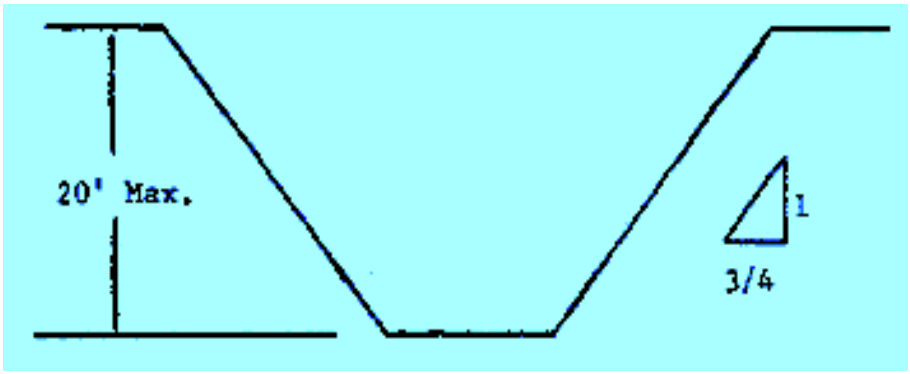
Maximum allowable slopes for excavations less than 20 feet based on soil type and angle to the horizontal are as follows:

Soil Type	Height/Depth Ratio	Slope Angle
Type A	**¾:1**	**53 degrees**
Type B	1:1	45 degrees
Type C	1 1/2:1	34 degrees

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. 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 of the trench itself.

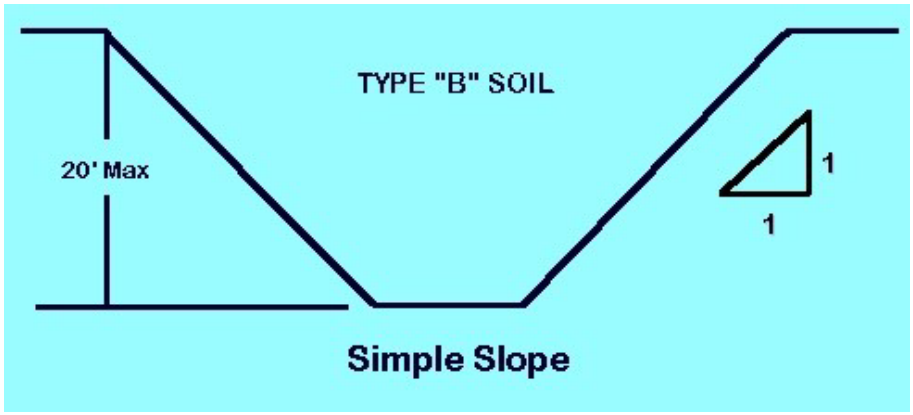
Type A Soil Simple Slope Illutsration

Type "A" Soil



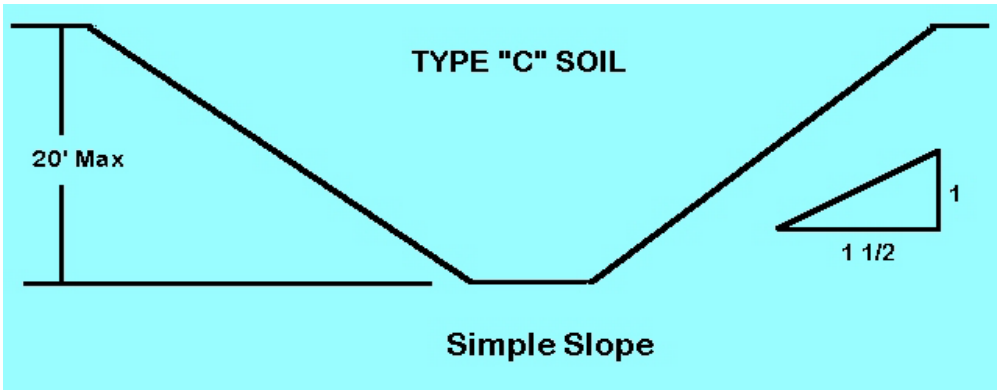
Simple Slope

Type B Soil Simple Slope Illustration



Type C Soil Simple Slope Illustration

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.



SHORING

Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. There are two basic types of shoring: timber and aluminum hydraulic.

Hydraulic 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. This shoring is gauge-regulated to ensure even distribution of pressure along the trench line and can be adapted easily to various

trench depths and widths. However, if timber shoring is used, it must meet the requirements of 29 CFR 1926.650, .651, and .652.

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

Hydraulic shoring shall 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.

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 four feet from the bottom of the excavation. (Two feet of trench wall may be exposed beneath the bottom of the rail or plywood sheeting, if used.)

Three vertical shores, evenly spaced, must be used to form a system.

Wales are installed no more than two feet from the top, no more than four feet from the bottom, and no more than four feet apart, vertically.

Hydraulic shores must be installed in accordance with Table D - 1.1 in soil type A.

Table D-1.1 - Aluminum Hydraulic Shoring
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	4	2-INCH DIAMETER	**2-INCH DIAMETER	3-INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	For applications other than those listed in the tables, refer to CFR 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to CFR 1926.652(c)(2) and CFR 1926.652(c)(3).				

** 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.

Hydraulic shores must be installed in accordance with Table D - 1.2 and Table D - 1.3 in soil Type B.

Table D-1.2 - Aluminum Hydraulic Shoring
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	4	2-INCH DIAMETER	**2-INCH DIAMETER	3-INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	For applications other than those listed in the tables, refer to CFR 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to CFR 1926.652(c)(2) and CFR 1926.652(c)(3).				

** 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.

Table D-1.3 - Aluminum Hydraulic Shoring
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		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN.	8.0	2 IN.	8.0	3 IN.	---	---	3x12
		7.0	9.0	2 IN.	9.0	2 IN.	9.0	3 IN.			
		14.0	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.	6.0	3 IN.	---	3x12	---
		7.0	8.0	3 IN.	8.0	3 IN.	8.0	3 IN.			
		14.0	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.	5.5	3 IN.	3x12	---	---
		7.0	6.0	3 IN.	6.0	3 IN.	6.0	3 IN.			
		14.0	9.0	3 IN.	9.0	3 IN.	9.0	3 IN.			
OVER 20	For applications other than those listed in the tables, refer to CFR 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to CFR 1926.652(c)(2) and CFR 1926.652(c)(3).										

Hydraulic shores must be installed with sheeting in accordance with Table D - 1.4 in soil Type C.

Table D-1.4 - Aluminum Hydraulic Shoring Waler Systems for Soil Type C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	*SECTION MODULUS (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN.	6.0	**2 IN.	6.0	3 IN.	3x12	---	---
		7.0	6.5	2 IN.	6.5	**2 IN.	6.5	3 IN.			
		14.0	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.	4.0	3 IN.	3x12	---	---
		7.0	5.5	3 IN.	5.5	3 IN.	5.5	3 IN.			
		14.0	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.	3.5	3 IN.	3x12	---	---
		7.0	5.0	3 IN.	5.0	3 IN.	5.0	3 IN.			
		14.0	6.0	3 IN.	6.0	3 IN.	6.0	3 IN.			
OVER 20	For applications other than those listed in the tables, refer to CFR 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to CFR 1926.652(c)(2) and CFR 1926.652(c)(3).										

SHIELDING

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.

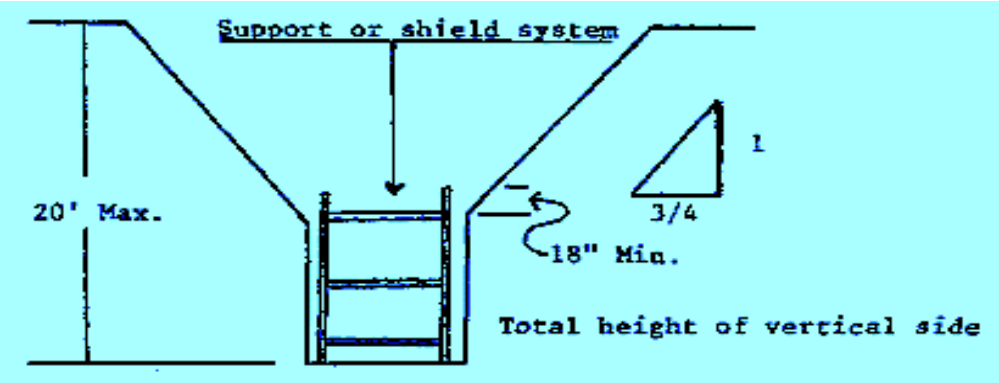
The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench box and the excavation side must be backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those which the system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

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

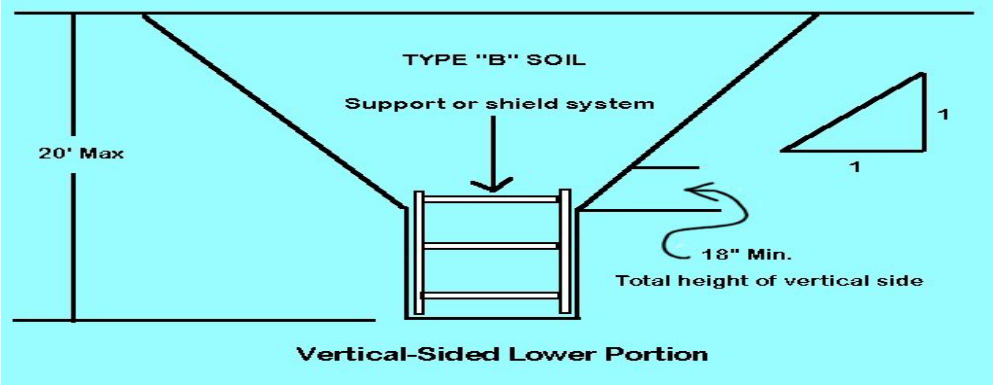
Any modifications to the shields must be approved by the manufacturer.

Shields may be placed two 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. Workers must enter and leave the shield in a protected manner, such as by a ladder or ramp. Workers may not remain in the shield while it is being installed, removed, or moved vertically.

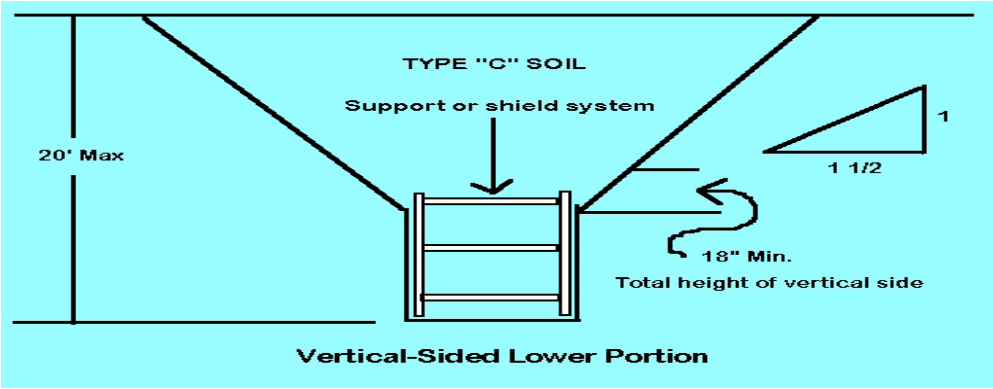
Type A Soil Shielding System Illustration



Type B Soil Shielding System Illustration



Type C Soil Shielding System Illustration



Q: DIRECTORY

Environmental Health and Safety

1202 West Farm Road, Suite 002 / (405) 744-7241

University Health Services

1202 West Farm Road / (405) 744-7665

Facilities Management

402 North Willis / (405) 744-7154

City of Stillwater, Oklahoma

Emergency - ambulance, fire, police / 911

For damage to natural gas lines or other pipeline systems containing flammable, toxic, or corrosive gas or liquid:

- 911, fire and police response
- (405) 744-7154, OSU Work Control
- 811, Emergency Okie Notification

For damage to other utilities:

- (405) 744-7154, OSU Work Control
- 811, Emergency Okie Notification

OSU CONTACTS

Available during business hours, Monday through Friday, 8 a.m. to 5 p.m.

Division	Office	Cell
Work Control	(405) 744-7154	N/A
Utilities Supervisor	(405) 744-4412	(405) 747-8961
Electric Supervisor	(405) 744-7768	(405) 338-8348
Campus Surveyor	(405) 744-7856	(405) 334-6160
Sr. Locator	(405) 744-3867	(405) 338-5261
Locator	(405) 744-3868	(405) 385-4205
OSU IT Locator	(405) 744-2225	N/A
Irrigation Locator	(405) 744-3214	(405) 707-0569

APPENDIX A: DEFINITIONS

Accepted Engineering Practices: Procedures compatible with the standards of practice required of a Registered Professional Engineer.

Adjacent Structures Stability: The stability of the foundation(s) of adjacent structures whose location(s) 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.

Aluminum Hydraulic Shoring: An engineered shoring system comprised of aluminum hydraulic cylinders (cross braces), 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.

Benching: Benching is 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 falling 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 the hazard. All competent persons must complete the 4-hour Physical Plant trenching and shoring class, successfully pass the exam, and be certified for successful completion of the class. A competent person should have and be able to demonstrate the following:

- Training, experience, and knowledge of soil analysis, use of protective systems, and requirements of 29 CFR 1926 Subpart P.
- Ability to detect conditions that could result in cave-ins, failures in protective systems, hazardous atmospheres, and 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.

Confined Space: 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: Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Hazardous Atmosphere: 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: An "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: 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: A person who is registered as a Professional Engineer.

Shield (Shield System): A structure that is able to withstand the forces imposed on it by a cave-in and thereby protects employees with the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Also known as trench box or trench shield.

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.

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

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

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.

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.