New Paltz STATE UNIVERSITY OF NEW YORK **POLICIES AND PROCEDURES**	
DEPARTMENT: ENVIRONMENTAL HEALTH AND SAFETY **SUBJECT: Trenching and Shoring Procedures**	

Original Date of Issue: 06/12/2012

REVIEWED:	01/2016							
REVISED:	01/2016							

Developed in accordance with the OSHA Safety & Health Regulations for Construction Standard, Excavations subpart, 29 CFR 1926.0650

Scope and Application

This policy sets forth the official practices required for excavations made by SUNY New Paltz University employees on property owned by SUNY New Paltz University.

Definitions

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

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 them. All competent persons must complete the training provided. 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.

Excavation

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

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 protect 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.

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.

General Requirements:

All excavations shall be made in accordance with the rules, regulations, requirements, and guidelines set forth in the Occupational Safety and Health Administration's standard on Excavations, 29 CFR 1926.650, .651, and .652, except where otherwise noted below.

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 while heavy equipment is digging.

Inspections
The competent person shall conduct inspections:

- Daily and before the start of each shift.
- As dictated by the work being done in the trench.

- After every rain storm.
- 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.

For excavations 4 feet or greater in depth, a Trench Inspection form shall be filled out by the competent person for each inspection one for each day the trench is occupied. Copies of Trench Inspection form shall be forwarded to EHS, and a copy kept at FOC. See Appendix A for Form in this document

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

Because most excavations on SUNY NEW PALTZ 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.**

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, 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.

Spoils

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.

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.

Permanent spoil should be placed some distance from the excavation.

Surface Crossing of Trenches

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

- **Vehicle crossings** must be designed by and installed under the supervision of a registered professional engineer.
- **Walkways or bridges** must:
    - have a minimum clear width of 20 inches,
    - be fitted with standard rails, and
    - extend a minimum of 24 inches past the surface edge of the trench.

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.

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.

Exposure to Falling Loads

All workers on an excavation site must wear hard hats.

Workers are not allowed to work under raised loads.

Workers are not allowed to work under loads being lifted or moved by heavy equipment used for digging or lifting.

Workers are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.

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.

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,
- **Trenches left open overnight** shall be fenced and barricaded.

Hazardous Atmospheres and Confined Spaces

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

- less than 19.5% oxygen,
- a combustible gas concentration greater than 20% of the lower flammable limit, and
- concentrations of hazardous substances that exceed those specified in the Threshold Limit Values for airborne contaminants established by the ACGIH.

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.

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. Conditions that might warrant atmospheric testing would be if the excavation was made in a landfill area or if the excavation was crossed by, was adjacent to, or contained pipelines containing a hazardous material (for example, natural gas lines).

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.

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

Workers 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 SUNY NEW PALTZ's Confined Space Program is also required.

Standing Water and Water Accumulation

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

- Use of special support or shield systems approved by a registered professional engineer.
- 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.

Benching, Sloping, Shoring, and Shielding Requirements

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 must 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.

Benching

Benching is not allowed in Type C soil So therefore is not allowed on SUNY New Paltz grounds since we have assumed all land has been previously disturbed and therefore is Typr C soil.

Sloping

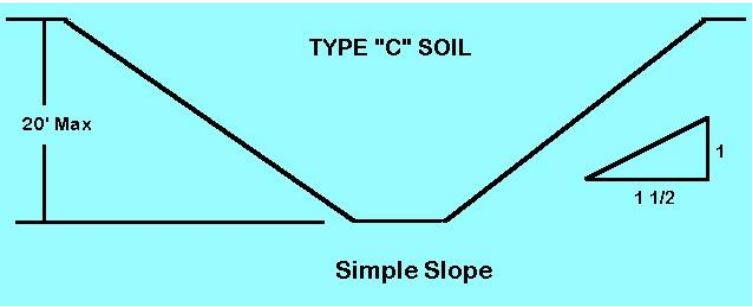
Maximum allowable slopes for excavations less than 20 feet based on soil type and angle to the horizontal are as follows:

Soil Type	Height/depth ratio	Slope angle
Type C	1 1/2:1	34 degrees

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.

Illustration of Simple Slope Trenching in C Type Soils

Type C Soil - 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.

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.

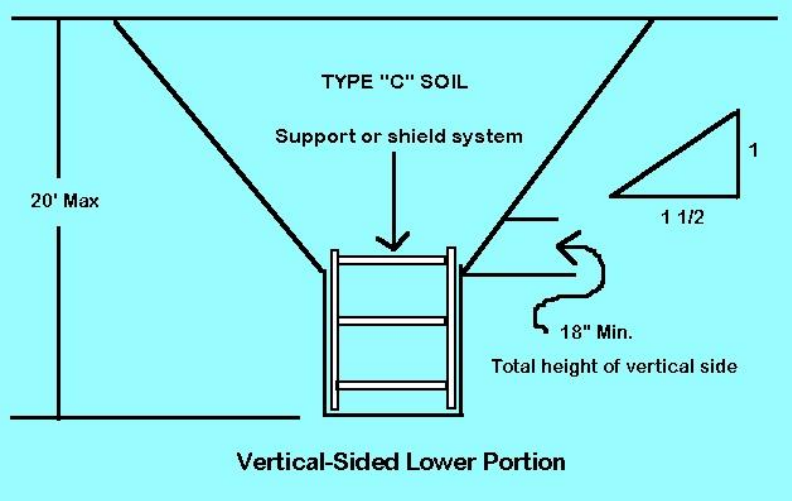
Shields may ride two feet above the bottom of an excavation, provided they are calculated to support the full depth of the excavation and there is no caving under or behind the shield.

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 moved.

Illustration of Shielding Systems in Type C Soils

Type "C" Soil



Appendix A

Excavation Checklist

EXCAVATION CHECKLIST

(To be completed by a Competent Person *Daily (*each day trench is occupied))

SITE LOCATION:		
DATE:	TIME:	COMPETENT PERSON:
EXCAVATION DEPTH:		EXCAVATION WIDTH:
WEATHER:		PROJECT:
Protective system: Trench shield (box) _____ Wood shoring _____ Sloping _____ Other _____		
Purpose of trenching: Drainage _____ Water _____ Sewer _____ Gas _____ Other _____		
Soil is assumed to be Type C at SUNY New Paltz		
Type of soil: Type C _____		
Water conditions: Wet _____ Dry _____ Submerged _____		
Hazardous atmosphere exists: Yes _____ No _____ ***(If yes, follow confined space entry procedures policy; complete Confined Space Entry Permit; monitor for toxic gas(es))***		

Is trenching or excavation exposed to public vehicular traffic (exhaust emission): Yes _____ No _____ ***(If yes, refer to confined space entry procedures; complete Confined Space Entry Permit; monitor for toxic gas(es))***
Measurements of trench: Depth _____ Length _____ Width _____
Is ladder within 25 feet of all workers: Yes _____ No _____
Is excavated material stored two feet or more from edge of excavation: Yes _____ No _____
Are employees exposed to public vehicular traffic: Yes _____ No _____ ***(If yes, warning vests required)***
Are other utilities protected: Yes _____ No _____ ***(Water, sewer, gas or other structures)***
Are sewer or natural gas lines exposed: Yes _____ No _____ ***(If yes, refer to confined space entry procedures policy; complete Confined Space Entry Permit; monitor for toxic gas(es))***
Periodic inspection: Yes _____ No _____
Did employees receive training in excavating: Yes _____ No _____

Indicate for each item: YES - NO - or N/A for not applicable

1. General Inspection of Jobsite:	
A. Excavations, adjacent areas, and protective systems inspected by a competent person daily before the start of work.	
B. Competent person has the authority to remove employees from the excavation immediately.	
C. Surface encumbrances removed or supported.	
D. Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.	
E. Hard hats worn by all employees.	
F. Spoils, materials, and equipment set back at least two feet from the edge of the excavation.	
G. Barriers provided at all remotely located excavations, wells, pits, shafts, etc.	

H. Walkways and bridges over excavations four feet or more in depth are equipped with standard guardrails and toeboards.	
I. Warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic.	
J. Employees required to stand away from vehicles being loaded or unloaded.	
K. Warning system established and utilized when mobile equipment is operating near the edge of the excavation.	
L. Employees prohibited from going under suspended loads.	
M. Employees prohibited from working on the faces of slopes or benched excavations above other employees.	
2. Utilities:	
A. Utility companies contacted and/or utilities located.	
B. Exact location of utilities marked.	
C. Underground installations protected, supported, or removed when excavation is open.	
3. Means of Access and Egress:	
A. Lateral travel to means of egress no greater than 25 feet in excavations four feet or more in depth.	
B. Ladders used in excavations secured and extended three feet above the edge of the trench.	
C. Structural ramps used by employees designed by a competent person.	
D. Structural ramps used for equipment designed by a registered professional engineer (RPE).	
E. Ramps constructed of materials of uniform thickness, cleated together on the bottom, equipped with no-slip surface.	
F. Employees protected from cave-ins when entering or exiting the excavation.	
4. Wet Conditions:	
A. Precautions take to protect employees from the accumulation of water.	
B. Water removal equipment monitored by a competent person.	
C. Surface water or runoff diverted or controlled to prevent accumulation in the excavation.	
D. Inspections made after every rainstorm or other hazard-increasing occurrence.	

5. Hazardous Atmosphere:	
A. Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible or other harmful contaminant exposing employees to a hazard.	
B. Adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/or to other hazardous atmospheres.	
C. Ventilation provided to prevent employee exposure to an atmosphere containing flammable gas in excess of 10% of the lower explosive limit of the gas.	
D. Testing conducted often to ensure that the atmosphere remains safe.	
E. Emergency equipment, such as breathing apparatus, safety harness and lifeline, and/or basket stretcher readily available where hazardous atmospheres could or do exist.	
F. Employees trained to use personal protective and other rescue equipment.	
G. Safety harness and lifeline used and individually attended when entering bell bottom or other deep confined excavations.	
6. Support Systems:	
A. Materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads.	
B. Materials and equipment used for protective systems inspected and in good condition.	
C. Materials and equipment not in good condition have been removed from service.	
D. Damaged materials and equipment used for protective systems inspected by a registered professional engineer (RPE) after repairs and before being placed back into service.	
E. Protective systems installed without exposing employees to the hazards of cave-ins, collapses, or threat of being struck by materials or equipment.	
F. Members of support system securely fastened to prevent failure.	
G. Support systems provided in ensure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.	
H. Excavations below the level of the base or footing supported, approved by an RPE.	
I. Removal of support systems progresses from the bottom and members are released slowly as to note any indication of possible failure.	
J. Backfilling progresses with removal of support system.	

K. Excavation of material to a level no greater than two feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.	
L. Shield system placed to prevent lateral movement.	
M. Employees are prohibited from remaining in shield system during vertical movement.	