Facilities Management
Occupational Health and Safety

Excavation Safety—6ES00-2.0

Associated OHS Process: General Industry and Construction Safety

The master copy of this document resides in electronic format. Printed copies of this document are for convenience only. Verify that the revision of this printed document matches the current revision of the electronic master before use. Ownership of this document may be determined by viewing the electronic master.

Table of Contents

1. Summary

1.1 Objective

This Excavation Safety Program provides policies and procedures to ensure the safety of University of Virginia (UVA) Facilities Management (FM) employees.

The purpose of this program is to establish work practices and procedures that are in compliance with federal and state laws to prevent damages to underground utilities and protect employees from hazards originating from excavations, as well as ensuring that excavation projects are reviewed as required, all permits are submitted before work begins, and all records are updated after work is completed.

1.2 Scope

This program applies to excavation work on all University of Virginia properties, as well as excavation work being performed by University of Virginia FM employees, regardless of jobsite location. This program applies to all FM employees and persons who are involved with excavations and trenching activities.

2. Regulations & Other Requirements

These rules delineate procedures used by the State Corporation Commission to enforce the provisions of Chapter 10.3 (§ 56-265.14 et seq.) of Title 56 of the Code of Virginia, also known as the Underground Utility Damage Prevention Act. The rules further detail certain standards and requirements for the protection of underground utility lines to facilitate the Commission's enforcement of the act.

2.1 Occupational Safety & Health Administration (OSHA)

This Excavation Safety Program complies with OSHA 29 CFR 1926 Subpart P, *Excavations*.

2.2 University of Virginia

This Excavation Safety Program complies with UVA-FM requirements.

3. Roles and Responsibilities

This Excavation Safety Program for FM personnel is a cooperative effort between Facilities Management Occupational Health and Safety (FM-OHS), supervisors, and employees. Specific responsibilities relating to this Excavation Safety Program are outlined below.

3.1 Facilities Management Occupational Health & Safety

a) Develop, administer, and review this program
b) Provide site inspections periodically and upon request

3.2 Supervisors

a) Supervise all excavation projects involving his or her personnel
b) Ensure all Competent Persons are trained and knowledgeable regarding Competent Person-specific duties
c) Identify all other persons responsible for excavation activities and ensure that they have attended the required Excavation Training
d) Ensure that all personnel are trained and knowledgeable regarding the Virginia Underground Utility Damage Prevention Act and the Commission’s rules for enforcement of the act
e) Ensure a valid excavation VA811 ticket has been submitted and is available on site for the duration of the excavation and maintained for recordkeeping purposes
f) Ensure that equipment operator is performing work in an appropriate manner

g) Ensure that equipment operator is performing equipment inspections before beginning work
h) Ensure that employees have, and use, the proper personal protective equipment
i) Ensure that employees conduct themselves in a manner according to the policies and procedures in this program and any other applicable federal, state, or UVA policy

3.3 Competent Person

The designated Competent Person must have training, experience, and knowledge of the following:

a) Requirements of 29 CFR 1926, Subpart P
b) Performing daily inspections of excavations, including:

    1) Testing air quality prior to entering excavations
    2) Monitoring water removal
    3) Completing shift inspection checklist

c) Authority to take prompt protective measures to remove individuals exposed to possible cave-ins or other hazardous conditions until necessary precautions have been taken to ensure their safety

    1) One crew member shall be designated as the site competent person

d) Conducting both visual and manual test/analysis
e) Classifying and reclassifying soil as necessary
f) Application, requirements, and failure identification of protective systems
g) Recognizing conditions that could result in cave-ins

3.4 Equipment Operators

Equipment operators include any personnel operating any machinery involved in excavation activities, at any time.

a) Receive documented instruction on the type of equipment being used
b) Be able to demonstrate proficiency in basic equipment operation
c) Ensure that excavation equipment is in safe operating condition before beginning work
d) Ensure safe and appropriate operation of equipment at all times
e) Be able to recognize and avoid unsafe conditions
f) Must have knowledge of the regulations applicable to this program

3.5 Employees

Employees include, but are not limited to, personnel working in and around excavations, and are required to:

a) Follow policies stated in this program
b) Attend all required training
c) Wear assigned personal protective equipment
d) Adhere to all warning, advice, and information provided by the designated Competent Person
e) Exercise Stop Work Authority if needed

3.6 University Contractors

University contractors must follow requirements set forth in the Virginia Underground Utility Damage Prevention Act-Title 56 of the Code of Virginia-Chapter 10.3 (§ 56-265.14 et seq.), and requirements set forth in the FM Contractor Safety Guidelines.

4. Excavation Safety Program

4.1 Inspections

4.1.1 Frequency and Conditions

A competent person must conduct and document inspections. The following specifies the frequency and conditions requiring inspections:

a) At the start of each shift
b) As dictated by the work being done in the trench
c) After replacement of damaged protective systems
d) After every rainstorm
e) After other events that can increase hazards, such as a snowstorm, windstorm, thaw, earthquake, etc.
f) When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom or other similar conditions occur
g) When there is a change in the size, location, or placement of the spoil pile
h) When there is an indication of change or movement in adjacent structures

4.1.2 Inspection Focus

a) The Competent Person must inspect excavations and adjacent areas for possible cave-ins and failures of protective systems and equipment, hazardous atmospheres, standing water, and any other hazardous conditions.
b) If these conditions are encountered, exposed employees must be removed from the hazardous area until the necessary safety precautions have been implemented and the area has been reinspected.

4.2 Excavations and Underground Utilities

Prior to all excavations on UVA property, underground utilities must be marked in accordance with FM's Damage Prevention Program. Requirements are set forth in the VA Damage Prevention Act, and include the following:

a) The excavator shall ensure that all personnel are trained and knowledgeable regarding the Virginia Underground Utility Damage Prevention Act and the Commission's rules for enforcement of the act
b) All excavation areas must be white lined before VA 811 ticket is called in
c) Call in a valid VA 811 ticket before excavation is to start
d) Allow the required time for utility marking
e) Have a valid VA 811 ticket on the job site
f) Read and understand all response codes from VA 811 tickets before excavation
g) Know and understand the difference between an emergency ticket, a 3-hour notice ticket, and a normal ticket per the Professional Excavator's Manual
h) Do a site walk through before excavation to understand utility markings and note any potentially unmarked utilities within excavation area
i) Respect and preserve the utility marks
j) Pothole and protect all utility crossings and exposed utilities
k) Do not excavate within two feet of a utility with mechanized equipment
l) Call VA 811 for a utility re-mark when utility marks are disturbed by weather or construction

4.2.1 Trenchless Excavations

All trenchless excavation shall conform to the Virginia Damage Prevention Act (See Rule 20VAC5-309-150). Special consideration should be given to the following provisions of that rule:

a) Verify that all utility lines in the area are marked (See Rule 20VAC5-309-150)
b) Ensure that bore equipment stakes are installed at a safe distance from marked utility lines
c) When grounding rods are used, the excavator shall ensure that they are installed at a safe distance (at least 24 inches plus the width of the utility line, if known) away from the marked or staked location of utility lines
d) Ensure sufficient clearance is maintained between the bore path and any underground utility lines during pullback
e) Give special consideration to water and sewer system within the area that cannot be located accurately
f) Unless prohibited by other laws, ordinances, regulations, or rules of governmental and regulatory authorities having jurisdiction, the excavator shall expose all utility lines which will be in the bore path by hand digging to establish the underground utility line's location prior to commencing bore
g) For a parallel type bore, unless prohibited by other laws, ordinances, regulations, or rules of governmental and regulatory authorities having jurisdiction, the excavator shall expose the utility line by hand digging at reasonable distances along the bore path
h) Ensure the drill head locating device is functioning properly and within its specification
i) Visually check the drill head as it passes through potholes, entrances, and exit pits

If the depth indicated by the locating device is lower than the bottom of the pothole or pit, the excavator shall cease boring until the hole/pit can be hand-dug to maintain a visual inspection of the drill head

4.2.2 Jack and Bore Excavations

a) When performing jack and bore excavation, the excavator shall take all reasonable steps necessary to protect all underground utility lines
b) The excavator shall ensure that all personnel are trained and knowledgeable regarding the Virginia Underground Utility Damage Prevention Act and the Commission's rules for enforcement of the act
c) All jack and bore excavations shall be engineered by a Virginia licensed engineering firm
d) The excavator shall verify the location and depth of all underground utility lines within the bore path by means of hand or soft excavation methods. This may be accomplished by the use of Subsurface Utility Engineering ("SUE")
e) Utility operators having utility lines in the excavation area shall be included in the preplanning and engineering phase of the project involving the jack and bore excavation
f) If there is any deviation in the approved bore path due to complications during the excavation process, the excavator shall contact the engineering firm for approval before excavation continues
g) The excavator shall use jack and bore equipment that incorporates a leveling and guidance system to ensure accuracy in the direction of the bore
h) The excavator shall not install a casing within 2 feet of any underground utility line

4.3 Personal Protective Equipment

a) Personal Protective Equipment (PPE) should be worn by all persons involved with excavation and trenching operations. The minimum level of PPE required for working in and around excavations include the following:

- Hard hat
- Safety-toe boots
- Eye protection
- Gloves
- High-visibility vest

4.4 Access and Egress

There must be a safe means of access and egress to all excavations by way of ladders, steps, ramps, or other means of exit for employees working in trench excavations 4 feet or deeper. All access and egress devices must be located within 25 feet of all workers. All ladders must be ANSI approved, extend at least 3 feet above the top surface of the excavation, and be tied off if possible.

4.5 Protective Support Systems

a) When working in excavations, employees must be protected from cave-ins by one of the following:

- Sloping or benching the sides of the excavation
- Supporting the sides of the excavation (shoring)
- Placing a shield between the side of the excavation and the work area

b) Trenches 5 feet or greater in depth will require protective systems. If less than 5 feet in depth, a Competent Person may decide whether a protective system is required.

c) Excavations of 20 feet or greater in depth will require protective systems designed by a professional engineer.

4.6 Sloping

a) The maximum allowable slopes are indicated in the figure below. Additional requirements apply in the event of layered soil or for specific excavation depths.

Soil or Rock Type	Maximum Allowable Slopes (Horizontal : Vertical) for Excavations Less Than 20 Feet Deep
Stable Rock (*not applicable at UVA)*	Vertical (90°)
Type A *(not applicable at UVA)*	0.75 : 1 (53°)
Type B	1 : 1 (45°)
Type C	1.5 : 1 (34°)

b) The maximum allowable depth for a sloped or benched excavation is 20 feet.

4.7 Benching

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

a) The trench's bottom vertical height must not exceed 4 feet for the first bench.

b) Subsequent benches may be up to a maximum of 5 feet vertically in Type A soil and four feet in Type B soil. All subsequent benches must be below the maximum allowable slope for that type of soil.

4.8 Shoring

Shoring is the provision of a support system for trench faces used to prevent movement of soil, underground utilities, roadways, and foundations.

a) Use shoring or shielding when location of the cut or depth of the cut makes sloping back to the maximum allowable slope impractical.

b) Shoring systems consist of uprights and horizontal members that should be installed by a competent person according to regulatory requirements.

4.9 Shielding

Shielding, or trench boxes, are different from shoring because instead of shoring up or otherwise supporting the trench face, they primarily protect workers from cave-ins and similar incidents. It is important that the tabulated data that accompanies all trench boxes is consulted to ensure that the shield is appropriate for the excavation depth, soil type, and other applicable conditions.

Requirements for use of shielding include the following:

a) Design, construct and maintain portable trench boxes or sliding trench shields used in place of shoring and sloping to provide protection at least equal to the required sheeting and shoring
b) Ensure a registered professional engineer designs the shields
c) Install shields to restrict lateral or other hazardous movement
d) Make sure trench boxes and shields extend to the bottom of the trench and no less than 6 inches above the vertical part of the trench face, except in certain cases (see OSHA 196.6)
e) Do not allow employees in shields during their installation, removal or relocation

4.10 Walkways

Walkways shall be provided where employees or equipment are required or permitted to cross over or around excavations. Guardrails shall be provided where walkways are 4 feet or more above lower levels.

4.11 Lighting

Sufficient lighting must be available for excavation operations occurring at night or during low-light conditions.

4.12 Environmental Considerations

4.12.1 Atmospheric Hazards

a) Atmospheric testing is required before workers enter an excavation greater than 4 feet in depth where oxygen deficiency or a hazardous atmosphere is present or could reasonably be expected and must be performed by a Competent Person.
b) Air monitor equipment used for testing atmospheric conditions must be readily available. If hazardous conditions exist, provide controls such as proper respiratory protection or ventilation.
c) In addition, when controls are used to reduce the level of atmospheric contaminants to acceptable levels, testing must be conducted as often as necessary to ensure that the atmosphere remains safe.
d) Hazardous atmospheres include:

- Less than 19.5% or more than 23.5% oxygen
- A combustible gas concentration greater than 10% of the lower flammable limit
- Concentrations of hazardous substances that exceed specified permissible exposure limits

4.12.2 Confined Spaces

a) Confined space requirements apply to excavations that meet the criteria for a confined space, which includes:

1) Large enough to bodily enter
2) Provides limited or restricted means of entry or exit
3) Not designed for continuous human occupancy

b) Excavations 4 feet or deeper at any point may potentially be considered a confined space.

c) Ladders, steps, ramps, or other safe means of egress must be provided for workers in trench excavations 4 feet or deeper. The means of egress must be located so as not to require workers to travel more than 25 feet laterally within the trench to access it.

- Any structural ramps used solely for worker access or egress must be designed by a competent person. Structural ramps used for access or egress of equipment must be designed by a competent person qualified in structural design.

4.12.3 Water Accumulation

a) Water in a trench or excavation is an extreme hazard and it should be planned for and controlled.
b) Workers should not work in excavations where water is accumulating unless a means of water removal is in place. Consider using the following to remove accumulated water away from any excavation:

- Channels
- Berms
- Dikes
- Water pumps

c) A Competent Person must inspect the excavation before the start of any project or after conditions change, such as a rainstorm.

4.13 Worksite Safe Practices

a) Employees shall not work under suspended or raised loads and materials.
b) Excavation equipment operators should stay inside of their vehicles during loading or unloading.
c) All mobile equipment should be equipped with a backup alarm, if possible. When they are not possible, ground guides and hand/arm signals should be utilized.
d) Vehicle and equipment operators should seek help when visibility is obstructed.
e) Equipment operators must maintain communication with ground workers at all times, by any means.
f) All trenches must be backfilled when work is complete.
g) Backfill trenches as the work progresses.
h) Avoid jumping into or across trenches.
i) Make sure employees working in trenches 4 feet deep or more have an adequate and safe means of exit, such as ladders, steps or ramps available at no more than 25 feet of lateral travel. In excavations more than 20 feet deep, equip ladders with ladder platforms at 20-foot intervals.
j) Ensure that trenches more than 5 feet deep have shoring or are laid back to a stable slope. In unstable soil, you must protect trenches less than 5 feet deep.
k) Provide a means of attaching trench boxes when they are stacked to prevent them from separating.
l) Do not work outside of trench shields or shoring protection in unprotected trenches.
m) Do not ride buckets to enter or leave a trench.
n) Place trench jacks or cross braces in true horizontal position, spaced vertically and secured to prevent sliding, falling, or kick outs.
o) Use ropes to pull out jacks or braces after employees have vacated the trench.
p) Perform backfilling and trench support removal together from the bottom of the trench. Release jacks and supports slowly.
q) Make sure qualified personnel design and install piling, sheeting, shoring, shields and support systems. Ensure the shoring system can withstand all loads imposed upon it.
r) Ensure that material and equipment used for sheeting, sheet piling, bracing, shoring and underpinning are in good serviceable condition. Use timbers that are sound and free of defects.
s) Install additional underpinning shoring or bracing when required in cases where adjoining utility lines, foundations, walks and footings are endangered.

t) Extend vertical supports in the bracing system to an elevation no less than one foot above the top of the trench face.
u) Erect standard guard railing or solid sheeting no less than 39 inches above ground level around all tunnel shafts and bore pits.
v) Protect employees in bellbottom pier holes by removable type steel casings and individually manned lifelines and harnesses. Follow confined space entry procedures.
w) Protect each employee from falling by using guardrail systems, fences, barricades or covers at the edge of a well, pit, shaft and similar excavation 6 feet or more in depth.
x) Install standard guardrail systems along ramps, runways, or bridges over excavations that are more than 6 feet deep.

4.13.1 Jobsite Barriers

a) Keep excavating soil (spoils or spoil piles) at least 2 feet away from trench edges.
b) Keep heavy equipment at least 2 feet away from trench edges.
c) Unattended excavations should have barriers or some type of physical protection to prevent people from falling into the excavation.

4.14 Soil Mechanics

4.14.1 Soil Stability

The following are several stresses and deformations that can affect soil stability:

a) Moisture content
b) 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.
c) Sliding or sloughing may occur as a result of tension cracks. 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.
d) 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.
e) The downward pressure created by the weight of adjoining soil causes bottom heaving or squeezing, causing a bulge in the bottom of the cut. Heaving and squeezing can occur even when shoring or shielding is properly installed.
f) Boiling is evidenced by an upward water flow into the bottom of the cut. A highwater table is one of the causes of boiling. Boiling produces a quick condition in the bottom of the cut and can occur even when you use shoring or trench boxes.

4.14.2 Soil Types

OSHA categorizes soil and rock deposits into four types: Stable Rock, Type A, Type B, and Type C.

4.14.2.1 Stable Rock

Stable rock is natural solid mineral matter that you can excavate with vertical sides, remaining intact while exposed. It is usually identified by a rock name, such as granite or sandstone. Determining this type may be difficult unless you know whether cracks exist and whether or not the cracks run into or away from the excavation.

4.14.2.2 Type A Soil

Type A soils are cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (TSF) 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. Examples of Type A soils:

a) clay
b) silty clay
c) sandy clay
d) clay loam
e) silty clay loam and sandy clay loam, in some cases

Soil is not classified as Type A if it:

a) is fissured
b) is subjected to vibration of any type
c) has previously been disturbed
d) is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater
e) is seeping water

Note: Soil on UVA property shall **not be treated as Type A.**

4.14.2.3 Type B Soil

Type B soils are cohesive soils with an unconfined compressive strength greater than 0.5 TSF, but less than 1.5 TSF. Examples of Type B soils:

a) Angular gravel
b) Silt
c) Silt loam
d) Previously disturbed soils unless otherwise classified as Type C
e) Soils that meet the unconfined compressive strength or cementation requirements of Type A soils but are fissured or subject to vibration

4.14.2.4 Type C Soil

Type C soils are cohesive soils with an unconfined compressive strength of 0.5 TSF or less, as well as granular soils. Examples of Type C soils include:

a) Gravel;
b) Sand;
c) Submerged soil;
d) Soil from which water is freely seeping;
e) 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 or greater.

4.14.3 Soil Determination

4.14.3.1 Layered Soils

Where soils are configured in layers, you must classify the soil on the basis of the soil classification of the weakest soil layer. However, each layer may be classified individually if a more stable layer lies below a less stable layer, such as if a Type C soil rests on top of stable rock.

4.14.3.2 Soil Testing Methods and Equipment

The following methods and equipment may be used to determine the type of soil prevailing in an area:

a) Pocket Penetrometer: A direct reading, spring-operated instrument 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 tons per square foot (TSF).
b) Thumb Penetration Test: A procedure that involves pressing the thumb firmly into the soil. 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 thumbnail, it is probably Type B soil. If the thumb penetrates the full length of the thumb, it is Type C soil. The thumb test is subjective and therefore, is the least accurate of the three methods.
c) Dry Strength Test: A procedure that determines if dry soil crumbles into individual grains freely or with moderate pressure. Dry soil that falls into clumps that subsequently break into smaller clumps, and you can break the smaller clumps 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 you can break the soil only with difficulty, the soil is considered unfissured, unless there is visual indication of fissuring.
d) Plasticity or Wet Thread Test: A test conducted by molding a moist sample of the soil into a ball and attempting to roll it into a thin thread, approximately one-eighth inch in diameter in length. Hold the soil sample by one end. If the sample does not break or tear, the soil is considered cohesive.

4.14.4 Visual Test

a) A visual, qualitative evaluation of soil conditions must be conducted around the site. Observe the entire excavation site, including the soil adjacent to the site and the soil you are excavating. If the soil remains in clumps, it is cohesive; if it appears to be coarse-grained sand or gravel, it is considered granular.
b) The competent person checks for any signs of vibration. During a visual test, the competent person checks for crackline openings along the failure zone that indicates tension cracks, looks for existing utilities that indicate that the soil has previously been disturbed and observes the open side of the excavation for indications of layered geologic structuring.
c) It is the responsibility of the competent person to 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. If there is standing water in the cut, the competent person checks these conditions.
d) The competent person checks the area adjacent to the excavation for signs of foundations or other intrusions into the failure zone, and for surcharging and the spoil distance from the edge of the excavation.

4.15 Equipment Requirements

4.15.1 Excavating Equipment

The following requirements apply to earthmoving equipment, including:

a) Scrapers
b) Loaders
c) Crawlers
d) Wheel tractors
e) Bulldozers
f) Off-highway trucks
g) Graders
h) Tractors (agricultural and industrial)
i) Other similar equipment

4.15.2 Equipment Safety Features

a) Seat belts shall be provided on all equipment covered by this section and shall meet the requirements of the Society of Automotive Engineers.

- Seat belts need not be provided for equipment which does not have rollover protective structure (ROPS) or adequate canopy protection.

b) All earthmoving equipment shall have a service braking system capable of stopping and holding the equipment fully loaded, as specified by the Society of Automotive Engineers.
c) All bidirectional machines, such as earthmoving or compacting equipment, and similar equipment, shall be equipped with a signal alarm at an audible level, distinguishable from the surrounding noise, which is operational when the machine is moving in either direction. The signal alarm shall be maintained in an operative condition.
d) Unauthorized personnel shall not be permitted to ride on powered industrial trucks. A safe place to ride shall be provided where riding of trucks is authorized.

4.15.3 Emergency Equipment

a) If hazardous conditions exist, or have the potential to exist, emergency rescue equipment must be readily available. UVA shall utilize 911 emergency response services.
b) When excavation or demolition is required during an emergency, all reasonable precautions shall be taken to protect underground utility lines that may be located at the site of the excavation. These precautions include, but are not limited to:
c) Dispatched personnel or crews responding to the emergency* shall notify VA811 and request an emergency locate of the underground utility lines at the earliest reasonable opportunity;
d) After arriving at the site, the person responding to the emergency shall determine the need for immediate action;
e) If immediate action is required, all reasonable precautions shall be taken to protect the underground utility lines. These actions shall include, but are not limited to:

1) Conduct a thorough site assessment to determine the location of underground utility lines
2) Locate the underground utility lines with acceptable equipment, if possible
3) Hand dig around the underground utility lines
4) Directly notify the utility line operators, if necessary
5) If prudent, wait for the utility operators to mark their utility lines before proceeding with the excavation

f) For emergency excavations in the vicinity of utility lines owned and/or operated by the Virginia Department of Transportation (“VDOT”) contact VDOT’s Situation Room at 8046920180 for assistance.

4.15.4 Equipment Operators

a) Equipment must be inspected carefully at the beginning of each shift. Defects must be reported immediately.
b) Mounting/dismounting machines must be done in the manner the manufacturer intended (jumping is not permitted).
c) Equipment operators must know the limitations of operating machines on slopes and rough terrain.
d) Equipment malfunctions must be reported to the supervisor or master mechanic.
e) Equipment must be secured in order to prevent tampering by unauthorized persons.
f) Turns on steep grades must be made in an uphill direction.
g) Established traffic patterns on haul roads must be followed.

h) Confirm that equipment brakes are operative before moving equipment.
i) Equipment engines must be shut off before making adjustments or repairs.
j) Horseplay is prohibited.
k) Equipment lights, reflectors, and accessories must be maintained.
l) Do not travel with the bucket of an endloader raised above the top of the radiator of the machine, since it will obstruct the operator's view.
m) Look in the direction that the equipment is traveling.
n) Before loading a truck, find out what is on the other side of it.
o) Lower loader buckets to the ground when not in use.
p) Keep reverse alarms operable and free of anything that will muffle the sound.
q) Wear seat belts on equipment with a rollover protection system.
r) Make sure equipment used in site-clearing operations has substantial overhead guards, shields, canopies and grills.
s) Do not use the blade to brake bulldozers on downhill runs except in emergencies.
t) Do not allow passengers on a machine while it is in use.
u) Be certain everyone is out of the way before pushing over trees, rolling logs or dozing rocks.
v) Remain clear of the towrope when towing a machine.
w) Read the operator's manual. It contains important information on the equipment being operated.
x) Ensure other workers are out of the way before starting the machine.
y) Place a warning tag on the steering wheel or ignition switch of all unsafe equipment being repaired.
z) Guard or insulate all hot surfaces of the equipment, including exhaust pipes or other lines, to prevent injury or fire.
aa) Make sure that exhaust or discharges from the equipment are directed so they do not endanger people or obstruct the operator's view.

4.16 Training

a) Documentation for Equipment Operator Training is maintained by the responsible party and FM-OHS.
b) Every employee working in excavations shall be trained as a Competent Person.
c) All employees involved in excavation activities shall have received basic Damage Prevention Act and 811 Training.

5. Review and Recordkeeping

5.1 Program Review

This Excavation Safety Program shall be reviewed and updated at least annually and whenever necessary to reflect changes in UVA FM policies or procedures, industry standards, or government regulations.

5.2 Program Recordkeeping

Records of the Excavation Safety Program will be considered obsolete when the new version is issued. Obsolete versions will be destroyed after three years.

Appendix A: Definitions

Commission means State Corporation Commission

Competent Person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. In order to be a competent person, for the purpose of this standard, one must have had specific training in, and be knowledgeable about soil analysis, the use of protective systems, and the requirements of this standard, and must be designated by the employer.

Emergency means a sudden or unexpected occurrence involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services.

Excavate or excavation means any operation in which earth, rock, or other material in the ground is moved, removed, or otherwise displaced by means of any tools, equipment, or explosives and includes, without limitation, grading, trenching, digging, ditching, dredging, drilling, augering, tunneling, scraping, cable or pipe plowing and driving, wrecking, razing, rendering, moving, or removing any structure or mass of material. "Excavate" or "excavation" shall not include installation of a sign that consists of metal, plastic, or wooden poles placed in the ground by hand or by foot without the use of tools or equipment.

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

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

Subsurface Utility Engineering means a process of verifying and mapping the location of existing underground utilities.

Support System means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

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

Trench means 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 (measured at the bottom) is not greater than 15 feet.

Pocket Penetrometer means a device used to measure the unconfined soil compressive strength, measured in TSF.

Thumb Penetration Test means a procedure that involves pressing the thumb firmly into the soil in question, and measuring the depth of penetration, used to determine soil classification.

Dry Strength Test means a procedure that determines if dry soil crumbles into individual grains freely or with moderate pressure, used to determine soil classification.

Plasticity or Wet Thread Test means a procedure that tests soil cohesion, conducted by molding a moist sample of soil into a ball and attempting to roll it into a thin thread, used to determine soil classification.

Visual Test means a qualitative evaluation of conditions around the excavation site, including the soil adjacent to the site, focusing on soil clumping versus granular tendencies.

Appendix B: Acronyms

ANSI	American National Standards Institute
FM	Facilities Management
JSA	Job Safety Analysis
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
SUE	Subsurface Utility Engineering
TSF	Tons per Square Foot
UVA	University of Virginia

Appendix C.1: Soil Classifications