Trenching and Excavation Safety Program

Description

Scope and Application

This program sets forth the practices required for trenches or excavations with a depth of four feet or greater along any portion of its length that will be entered by University of Florida employees or students. All excavations or trenches 4 feet or greater in depth shall be appropriately benched, shored, or sloped according to the procedures and requirements set forth in this policy. Excavations or trenches 20 feet deep or greater must have a protective system designed by a registered professional engineer.

Responsibilities

[su_spoiler style="fancy" icon="chevron" title=" Environmental Health and Safety (EH&S) "] EH&S has the primary responsibility for assisting departments in implementation of this policy through coordinating training and consultation. This includes:

- On site evaluation to monitor use of safe work practices and procedures
- Assisting with atmospheric testing and equipment selection as needed
- Providing or identifying appropriate training for Competent Persons and staff
- Providing technical assistance as needed
- Reviewing and updating the program at least annually.

[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Departments "] Departments have the primary responsibility for providing training, trench protection systems, effective barricades and supporting the use of other protective measures deemed prudent and necessary by the competent person.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Supervisors "] Supervisors have the primary responsibility for the implementation of the Trenching and Excavation Safety Policy in their work area. The supervisor has ultimate responsibility for the safety of the employees and general public affected by the excavation. This includes evaluation of the work to be performed, determination of the means of protection that will be used and adherence to the provisions of this policy as appropriate. The supervisor must ensure daily, or more often as required, that site conditions are safe for employees to work in excavations. The supervisor or a member of the work group must be a "competent person" as defined by OSHA.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Employees "] Employees have the primary responsibility for working in accordance with the provisions of this policy. No employees should enter an excavation meeting the scope of this policy until authorized by the competent person.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Training "] Any employee required to dig or enter an excavation shall attend, at a minimum, trenching and excavation safety awareness training prior to beginning related work. The training is provided by EH&S and covers the potential hazards encountered when working in and around excavations and the procedures that need to be followed in

order to avoid these hazards.
Additional training is required for any employee designated to be the competent person for a trenching and excavation job. Competent person training covers the following areas in detail:

- Hazards related to excavation work
- Work practices and selection of appropriate protective systems
- Methods of evaluating soil and the site
- Inspection procedures
- Specific requirements of the policy and of related policies
- Emergency procedures

Both the designated competent person and any other employee involved in trenching and excavating activities shall attend relevant health and safety training at least every two years or more often if necessary due to an observed disregard of the noted safety procedures.
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Definitions

[su_spoiler style="fancy" icon="chevron" title=" 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.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" 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.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Competent Person "] One who is capable to identify existing and predictable hazards in the surroundings or working conditions that may affect employees and the general public, and who has authority to take prompt corrective measures to eliminate them. The Competent Person(s):

- Must be trained in and knowledgeable of excavation and trenching standard, and other programs that may apply (Hazard Communication, Confined Space, Respiratory Protection)
- Must be capable of recognizing hazardous conditions and must have authority to stop work and ensure that hazards are corrected
- Performs and documents the 'Daily Excavation Inspection', and knows when inspections should be performed
- Must assure that the location of underground installations or utilities have been properly located.
- Must identify and ensure the use of adequate protective systems, work methods and personal protective equipment (PPE) on the excavation site.

[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Excavation "] Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Fissured "] Refers to soil that has a tendency to break along definite planes of fracture with little resistance or a material that exhibits open cracks such as tension cracks in an exposed surface.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Hazardous Atmosphere "] Atmosphere that is oxygen deficient, potentially explosive, flammable, poisonous, corrosive, oxidizing, irritating, toxic or

otherwise harmful in a manner that may result in death or serious injury.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Protective Systems “] Methods for protecting personnel working in excavations from cave-in, material falling or rolling in from the exterior or from collapse of adjacent structures. Protective systems include the use of support systems, sloping and benching systems, shield systems and other systems that provide the necessary protection.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Registered Professional Engineer (RPE) “] A person who is registered as a professional engineer.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” 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 a permanent structure or can be designed to be portable and moved along as work progresses. Also known as trench boxes or trench shields.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” 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.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” 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 exposure conditions, and application of surcharge loads.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Soil 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. As most soils in areas where work will be conducted at UF have been disturbed, no UF soils will be considered Type A.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Soil Type B “] Medium stability: silt, sandy loam, medium clay and unstable dry rock; previously disturbed soils unless otherwise classified as Type C.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Soil Type C “] Least stable: gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock, and soil from which any water is seeping.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Soil “] Mixed Types (Layered Geological Strata) – 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.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” 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.
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PROCEDURES

[su_spoiler style=”fancy” icon=”chevron” title=” Dig Permit “] A UF PPD Dig Permit must be issued for each excavation on the UF campus. Underground utilities must be located and marked before excavation begins (UF Dig Permit Process) by PPD or local authority (areas outside of Gainesville). A competent person shall be identified by name on the dig permit for all excavations with a depth of four feet or greater at any portion that personnel may enter.

The location of sewers, telephone, fuel, electric, water lines, or any other underground installations that may be encountered during excavation work must be determined and marked prior to opening an excavation. The Project Manager shall make arrangements as necessary with the appropriate utility agency for the protection, removal, shutdown, or relocation of underground installations.

If it is not possible to establish the exact location of these installations, the work may proceed with caution if detection equipment or other safe and acceptable means are used to locate the utility.

Excavations must not endanger the underground installations or the employees engaged in the work. Utilities left in place should be protected by barricades, shoring, suspension or other means as necessary to protect employees.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Protection of the Public "] Excavations must be isolated from public access by a substantial physical barrier. Barricades, lighting and posting shall be installed as appropriate prior to the start of excavation operations. All temporary excavations of this type shall be backfilled as soon as possible

Guardrails, fences, or barricades shall be installed around excavations adjacent to walkways, roads, paths or other traffic areas. Use of barricade tape alone is not considered a sufficient method of isolation when the excavation is unattended. Warning lights or other illumination shall be used as necessary for the safety of the public at night.

Wells, holes, pits, and similar excavations must be effectively barricaded or covered and posted.

Walkways or bridges used by the general public to cross excavations must be equipped with standard guardrails.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Surface Encumbrances "] All equipment, materials, supplies, buildings, roadways, trees, utility vaults, boulders, etc. that could present a hazard to employees working in the excavation must be removed or supported as necessary to protect employees.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Soil Classification "] The competent person in charge of the excavation shall be responsible for determining the soil type. All previously disturbed soil is automatically considered Type B or C soil. Because most excavations on UF 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 B or C soils only, as appropriate. Soil may be considered Type C by default and no additional tests required.

To classify soil as type B the competent person shall use a visual test coupled with one or more manual tests.

Visual test: Evaluate the conditions around the site including the soil adjacent to the site and the soil being excavated.

Identify any signs of vibration. Check for crack-line openings along the failure zone, look for existing utilities that indicate that the soil has been previously disturbed, and observe the open side of the excavation for indications of layered geologic structuring.

Look for signs of bulging, boiling, or sloughing, as well as signs of water seepage from the sides or

bottom of the excavation.

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

Any one of the following will cause soil to be classified as Type C

- Water seepage into excavation
- Vibration from road traffic or equipment
- Signs of bulging, boiling, or sloughing
- Crack lines along failure zone

[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Manual Tests “] Thumb penetration test: Attempt to press the thumb firmly into the soil in question. 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, shearvane, or torvane may also be used to determine the unconfined compression strength of soils.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Protective Systems “] In excavations greater than 4 feet in depth a method to protect people entering the excavation from cave in must be employed. Acceptable protective methods include sloping, benching, shielding and shoring.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Benching, Sloping, Shoring, and Shielding Requirements “] General: Excavations under the base of the footing of a foundation or wall require a support system designed by a registered professional engineer. Sidewalks, pavement, utility vaults or other similar structures shall not be undermined unless a support system or another method of protection is provided to protect employees from their possible collapse. Sloping or benching are often the preferred methods of protection; however, shoring or shielding is used when the location or depth makes sloping to the allowable angle impractical.

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

Type B soil must have walls sloped to a maximum angle of 45-degrees (1:1 slope) from horizontal in all directions.

Type C soil, must have walls sloped at a maximum angle of 34-degrees (1:1.5 slope) from horizontal in all directions.

Type B Soil
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Benching “] In Type B soil, the vertical height of the benches must not exceed 4 feet. Benches in increments of 2 feet or less is preferred. The

angle developed by the edge of the benches must not exceed the maximum allowable slope for that soil type (Type B soil 45-degrees).

Benching is not permitted in Type C soil.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Shielding “] Trench boxes or trench shields are intended to protect workers from cave-ins and similar incidents. The trench shield is lowered into the excavation and workers may then enter the protected area within the shield. Only trench shields designed or certified by a registered professional engineer may be used. The use is limited to those trenches for which the shield is certified (e.g. maximum depth and material). The manufacturer must approve any modifications to the shields. 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 should be backfilled to prevent lateral movement of the box.

Trench boxes 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.

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 shielded area in a protected manner, such as by a ladder or ramp. Workers may not remain in the shielded area while it is being moved.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Shoring “] Timber shoring shall not be used by University of Florida personnel. Hydraulic shoring is permitted as workers do not have to enter the trench to install it. It is gauge-regulated and ensures even distribution of pressure along the trench line and can be adapted to various trench depths and widths. 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.
[/su_spoiler] [su_spoiler style=”fancy” icon=”chevron” title=” Inspections “] Frequent inspection of the excavation and surrounding area by the Competent Person is critical to ensure the safety of the workers involved in work within the trench. An excavation inspection form is included as Appendix A in this document. The Competent Person must conduct inspections of the entire excavation site:

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

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

The 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.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" 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.

[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Ingress and Egress "] Trenches 4 feet or more in depth shall be provided with ladders or other fixed means of egress. Spacing must be such that a worker will not have to travel more than 25 feet to the nearest means of egress. Ladders must be secured and extend a minimum of 36 inches above the landing. Metal ladders should be used with caution, particularly when electric utilities are present.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Exposure to Vehicles "] Employees exposed to vehicular traffic shall be provided with and required to wear reflective vests or other suitable garments marked with or made of reflectorized or high-visibility materials. Trained flag persons, signs, signals, and barricades shall be used when necessary.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Exposure to Falling Loads "] Employees are not allowed in the excavation while heavy equipment is digging. Employees must not work under loads being lifted or moved by heavy equipment used for digging or lifting. Employees are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Hazardous Atmospheres and Confined Spaces "] 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 is adjacent to sources of contamination (e.g. sewage or fuel leaks).

Testing should be conducted before employees enter the trench and should be done regularly to ensure that the trench remains safe. The frequency of testing should be increased if equipment is

operating in the trench that could produce airborne contaminants.

Employees required to wear respiratory protection must be trained, fit-tested, and enrolled in the UF respiratory protection program.

Trenches and excavations with hazardous concentrations of airborne contaminants or oxygen deficient atmospheres qualify as confined spaces. When this occurs, compliance with the UF Confined Space Program is also required.

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

- less than 19.5% oxygen,
- a combustible gas concentration greater than 20% of the lower flammable limit,
- concentrations of hazardous substance that exceed those specified in the Threshold

Limit Values for airborne contaminants established by the ACGIH.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Standing Water and Water Accumulation "] Workers must not enter or work in excavations with standing water or in which water is accumulating unless adequate protection is provided.

Protective methods for these circumstances must include:

- Use of special support or shield systems approved by a registered professional engineer.
- Water removal equipment used and monitored by a competent person.
- Safety harnesses and lifelines used in conformance with 29 CFR 1926.104.

During rainstorms employees must exit the trench. The excavation must be carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench. Protective measures such as diversion ditches and dikes should be used to limit surface runoff water from entering the excavation.
[/su_spoiler] [su_spoiler style="fancy" icon="chevron" title=" Emergencies "] UF personnel are not training to perform trench rescues and should not place themselves at risk in order to attempt the rescue of someone trapped due to a cave-in.

In the event of a serious injury or trapped worker requiring specialized rescue, 911 must be called immediately. UPD should be notified after the call to 911.

While waiting for emergency response personnel to arrive, workers at the site should take measures to support the rescue team and to further protect personnel on site.

- If the victim is not visible, try to identify the area where the victim is located
- Hand digging, if the excavation is stable and can be approached safely, can be carried out. No mechanical digging should be done due to the potential for inflicting additional injury to the victim.
- Assemble material that can assist in rescue operations such as shovels, plywood, ladders and buckets.

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