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Purpose

The purpose of this training program is to protect employees from safety hazards that may be encountered during work in trenches and excavations.

Scope

When work is performed on a jobsite and there is a Controlling Contractor, the Controlling Contractor's program shall take precedence; however, this document covers SESAC employees and shall be complied with on all jobsites

Definitions

Accepted engineering practices means the standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a manufactured shoring system consisting of aluminum hydraulic cylinders (crossbraces) used with vertical rails (uprights) or horizontal rails (wales).

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) is a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or more horizontal steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the movement of soil or rock into an excavation, or the loss of soil from under a trench shield or support system, in amounts large enough to trap, bury, or injure and immobilize a person.

Cross braces mean the horizontal members of a shoring system installed from side to side of the excavation. The cross braces bear against either uprights or Wales.


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

Faces or sides mean the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the movement or damage of a structural member or connection that makes it unable to support loads.

Hazardous atmosphere means an atmosphere that is explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, which may cause death, illness, or injury.

Kickout means the accidental movement or failure of a cross brace.

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Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face 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.

Ramp means an inclined walking or working surface that is used to gain access to one point from another. A ramp may be constructed from earth or from structural materials such as steel or wood.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure used in an excavation to withstand cave-ins and which will protect employees working within the shield system. Shields can be permanent structures or portable units moved along as work progresses. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure that is built or put in place to support the sides of an excavation to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means sloping the sides of the excavation away from the excavation to protect employees from cave-ins. The required slope will vary with soil type, weather, and surface or near surface loads that may affect the soil in the area of the trench (such as adjacent buildings, vehicles near the edge of the trench and so forth).

Stable rock means natural solid mineral material that can be excavated with vertical sides that will remain intact while exposed.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.


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 (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground.

Trench box or shield. See "Shield".

Uprights mean the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

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Wales are horizontal members of a shoring system placed in the direction of the excavation face whose sides bear against the vertical members of the shoring system or earth (the uprights or sheeting).

Key Responsibilities

Supervisor

Supervisors must be trained as Competent Persons in trenching and excavating.

Supervisors shall conduct a visual and manual inspection of all trenches and excavations and document this daily or after any weather event, prior to allowing employees to enter.

Supervisors will ensure an adequate emergency action and rescue plan has been developed prior to beginning work.

Supervisors will determine if there is the potential for an atmospheric and if so, develop remediation plan prior to allowing employees to enter.


Supervisors shall be responsible for the implementation of this policy and regularly monitor employees to ensure compliance.

Supervisors will ensure that all equipment needed is available as necessary.

Only trained personnel can be involved in working in trenches or excavations. SESAC personnel DO NOT initiate trenching or excavation operations.

Reference Documents

- 1926.650 Scope, application, and definitions
- 1926.651 General trenching and shoring requirements
- 1626.652 Requirements for protective systems
- Appendix A Soil classification
- Appendix B Sloping and benching
- Appendix C Timber shoring for trenches
- Appendix D Aluminum hydraulic shoring for trenches
- Appendix E Alternatives to timber shoring
- Appendix F Selection of protective systems

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General

Prior to SESAC opening an excavation or trench, the location of all underground utilities must be determined. The number for underground utility locations is 811.

Any excavation greater than 5 feet must be properly sloped or shored under the direction of the contractor's designated competent person. (Less than 5 feet if there is a potential for cave-in)

All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

If possible, the electricity or the flow through the pipeline should be shut off by the contractor during the time of excavation and work within the confines of the trench/hole.

Red concrete or tape is often used to identify buried electrical cable/duct banks, but this is not always the case.

While the excavation is open, underground installations shall be protected, supported or removed as necessary by the contractor to safeguard employees.

Competent Person

A competent person is defined as one who is qualified to determine and identify existing and predictable hazards in the workplace, and has the authority to take corrective action as needed. This person must be qualified to determine soil types, determine maximum allowable slopes, and evaluate stability of excavations and encumbrances, and the proper selection and use of shoring systems.

The competent person must be fully familiar with this procedure and the applicable OSHA standards, particularly CFR 29 Part 1926 Subpart P.


Contractors must give notice of their competent person selection to SESAC prior to the start of work.

The competent person must be on-site any time employees are working in an excavation greater than 5 feet or if other hazards directly related to employee safety and the excavation exists.

The competent person must inspect at least daily the excavation and adjacent areas plus other protection systems.

Anytime employee exposure can be reasonably expected, the competent person shall inspect the excavation and adjacent areas plus other protection systems:

- At the start of work and as needed throughout the shift.
- After every rain storm or other hazard increasing occurrence.

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- Evidence of a situation that could result in a possible cave-in, or failure of a protective system.
- Whenever a possible hazardous atmosphere could develop.

Underground Installations

Prior to opening any excavation, the Regional Notification Center, Underground Alert, etc., will be informed and requested to assist in locating utility installations.

All owners of utility installations, including those that are not members of the Regional Notification Center or the Underground Alert system, must be notified at least 48 hours before any excavation is opened, except in the case of emergency repair work.

Once all underground lines have been located and it has been determined that these lines are within six (6') feet of the proposed excavation, exploratory excavation will be conducted to identify and protect any underground lines.

Exploratory excavation is defined as the utilization of back hoe type equipment with a smooth bladed bucket, digging in layers of approximately one (1') foot increments while probing at a minimum of two (2') foot increments, or hand digging once the excavation is within one foot of the underground line.


Vehicular Traffic

The contractor shall provide employees exposed to public vehicular traffic warning vests or other suitable garments marked with or made of reflective or high-visibility material.

No employee shall be permitted underneath loads handled by lifting or digging equipment.

Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

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Access and Egress

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person.

Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design. Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

Structural members used for ramps and runways shall be of uniform thickness.

Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments to prevent slipping.

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

Employees required to enter bell bottom pier holes shall be equipped with a body harness and attached lifeline. This lifeline shall not be used for any other purpose such as raising or lowering material. The lifeline shall be manned topside by an attendant. The attendant shall have no other duties other than to observe and communicate with the entrant(s).


Daily inspections of excavations, the adjacent areas, and protective systems shall be made by the contractor's designated competent person for evidence of a situation that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the day. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably expected.

Fall Protection

Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

Adequate physical barricades must be provided at all remotely located excavations

Wooden 2" X 4" barricades, approximately 42" in height shall protect any excavation open for more than 48 hours or cuts an accepted or established walkway, sidewalk, or aisle way. Any excavation cutting into an accepted or established non-public roadway or walkway, or temporary roadway where vehicles may travel, require saw horse-type barricades with flashing lights.

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All excavations on public streets require that they be completely covered prior to leaving the site at the end of the work shift. If natural cover is not possible, steel plates anchored to the street with asphalt nosing must be employed.

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. Water removal equipment shall be monitored by the competent person.

Diversions, ditches, dikes, or other suitable means will be used to prevent surface water from entering an excavation and to provide adequate drainage.

Stabilization of Adjacent Structures

Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided by the contractor to ensure the stability of such structures for the protection of employees. All support systems must be inspected by the competent person each day.

Loose Soil and Rock

Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations.

Excavated and other material must be placed at least 2 feet from the edge of the excavation, or by other retaining means adequate to protect employees from falling material.

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.

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:

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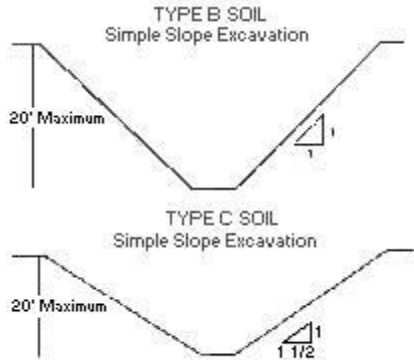
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Type B soil must have walls sloped to a maximum angle of 45-degrees (1:1 slope) from horizontal in all directions.

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

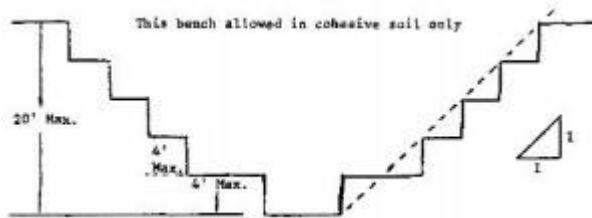
Type B Soil



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.



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.

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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

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.

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

Spoils 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.

Surface Crossing of Trenches

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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 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.

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.

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.

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 respiratory protection program.

Hazardous Atmospheres

A competent person will assure good atmospheric conditions and/or will provide adequate ventilation or respiratory protection under the guidelines of SESAC Respiratory Protection policy.

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Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet in depth.

The acceptable range for atmospheric oxygen content is a minimum of 19.5% and a maximum of 22.5%.

The acceptable range for explosive atmosphere is < 10% of the Lower Explosive Limit (LEL).

The competent person will be responsible for determining what toxic contaminants, if any, will need to be tested for their presence and quantity.

The competent person must be trained in the proper use and calibration of the test equipment used.

Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be available if needed, as determined by the competent person. Persons expected to affect rescue with the above mentioned equipment shall be trained in its use.

Training

All personnel involved in trenching or excavation work shall be trained in the requirements of this program and regulatory requirements.

Training shall be performed before the employee is assigned duties in excavations.

Retraining will be performed whenever jobsite inspections conducted by the competent person or Health Safety Officer indicate that an employee does not have the necessary knowledge or skills to safely work in or around excavations.

Training records shall include the date(s) of the training program, the instructor(s) of the training program, a copy of the written material presented, and the names of the employee(s) to whom the training was given.