

Excavation and Trenching Program	
Tampa Electric Company	
Energy Supply	
Creation Date: 12/11/00	Maintained by:
Date of last Modification: 05/07/02	
Audience: All employees	

PURPOSE: The following guidelines for excavation and trenching are in compliance with the Federal OSHA Construction Standards For Excavation - 29CFR 1926.650-652. Refer to this standard when determining soil types, sloping designs and specific details.

I. RESPONSIBILITIES:

A. Site Superintendent

At any Energy Supply jobsite where trenching excavations exceed 4 feet, the site Tampa Electric Energy Supply contractor supervisor will designate a competent person. The competent person will be a jobsite supervisor who has been trained in OSHA Trenching Requirements, including:

- Determination of soil types.
- Documentation requirements.
- Monitoring for hazardous atmospheres.
- Means of access/egress.
- Sloping, benching, and shoring.

Where excavations exceed 20 feet in depth at any point, protective systems must be designed by a registered professional engineer.

II.

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1. Shall provide compliance information to contractors performing excavation work.

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2. Shall assist jobsites in identifying soil types to determine OSHA compliance.

GENERAL REQUIREMENTS:

A. Surface Encumbrances

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All surface encumbrances, i.e., boulders, buildings, trees, roadbeds, etc., that are located so as to create a hazard to contract workers shall be removed or supported, as necessary, to

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safeguard contract workers.

B. Underground Installations

The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations expected to be within fifty feet of excavation work, shall be determined prior to opening an excavation. When excavations are performed outside of the confines of the immediate secured property of the facility or the activities are within fifty feet of any marked right-of-way, easement or other utility operator permitted use property the utility operators shall be contacted.

Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the underground installations prior to the start of actual excavation. In Florida, call 800-432-4770 two (2) business days in advance and no more than five (5) business days of such planned excavation. The following website can be referenced for further information <http://www.callsunshine.com/SSOCOF/default.htm>. When utility companies or owners cannot respond to a request to locate underground utility installations within 48 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, excavation may proceed, provided caution is used and detection equipment or other acceptable means to locate utility installations are used.

Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, excavation may proceed, provided caution is used and detection equipment or other acceptable means to locate utility installations are used.

When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard contract workers.

C. Access and Egress

Means of egress from trench excavations - A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel from contract workers.

Structural ramps - Structural ramps (built of steel or wood) that are used solely by contract workers as a means of access or egress from excavations are to be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a person qualified in structural 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 on the top surface to prevent slipping.

D. Exposure to Vehicular Traffic

Contract workers exposed to vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

E. Exposure to Falling Loads

No contract worker shall be permitted underneath loads handled by lifting or digging equipment. Contract workers 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.

F. Warning System for Mobile Equipment

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 shall be away from the excavation.

G. Hazardous Atmospheres - Testing and Controls

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 contract workers enter excavations greater than 4 feet in depth.

Adequate precautions shall be taken to prevent contract worker exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation.

Adequate precaution shall be taken, such as providing ventilation, to prevent contract worker exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe. Refer to the Energy Supply locations Confined Space Entry Policy contained in this manual.

H. Emergency Rescue Equipment

Emergency rescue equipment shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation.

Contract workers entering bell-bottom pier holes, or other similar deep and confined spaces, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be attended at all times while the contract worker wearing the lifeline is in the excavation.

I. Protection From Hazards Associated with Water Accumulation

Contract workers are not to 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 contract workers against the hazards posed by water accumulation. The precautions necessary to protect contract workers adequately vary with each situation, but may include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person.

J. Stability 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 to ensure the stability of such structures for the protection of contract workers.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to contract workers shall not be permitted unless:

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

Sidewalks, pavements, and adjacent structures shall not be undermined unless a support system or other method of protection is provided.

K. Protection for Contract workers from Loose Rock or Soil

Adequate protection shall be provided to protect contract workers from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

Contract workers shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

L. Inspections

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a hazardous condition. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when contract worker exposure can be reasonably anticipated. Daily inspections shall be documented using the Tampa Electric Energy Supply Excavation and Trenching Compliance Checklist.

Where the competent person finds evidence of a hazardous condition, exposed contract workers shall be removed from the area until the necessary precautions have been taken to ensure their safety.

M. Fall Protection

Where contract workers or equipment are required or permitted to cross over excavations, walkways or bridges with standard guard rails shall be provided.

Adequate physical barrier protection shall be provided at all excavations.

III. PROTECTIVE SYSTEMS:

A. Protection of Contract workers in Excavations

Each contract worker in an excavation shall be protected from cave-ins by an adequate protective system, unless:

- Excavations are made entirely in stable rock; or,
- Excavations are less than 4 feet in depth.

Protective systems shall have the capacity to resist all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

B. Design of Sloping and Benching Systems

The slopes and configurations of sloping and benching systems shall be selected and constructed using one of the four options below.

- Option 1 - Allowable configurations and slopes - Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.
- Option 2 - Determination of slopes and configurations - Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in the OSHA standard. Allowable slope is determined by soil classification as type A, B, or C.
- Option 3 - Designs using other tabulated data - Designs of sloping or benching systems shall be selected from, and be in accordance with, tabulated data such as tables and charts.

The tabulated data shall be in written form and shall include all of the following:

- Identification of the parameters that affect the selection of a sloping or benching system drawn from such data.

- Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe.
 - Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
 - At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system.
- Option 4 - Design by a registered professional engineer - Sloping and benching systems not utilizing Options 1-3 shall be approved by a registered professional engineer.

Designs shall be in written form and shall include at least the following:

- The magnitude of the slopes that were determined to be safe for the particular project;
- The configurations that were determined to be safe for the particular project; and
- The identity of the registered professional engineer approving the design.

At least one copy of the design shall be maintained at the jobsite while the slope is being constructed.

C. Design of Support Systems, Shield Systems, and other Protective Systems

Designs of support systems, shield systems, and other protective systems shall be selected and constructed as follows:

- Option 1 - Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in the OSHA standard.
- Option 2 - Designs using manufacturer's tabulated data - Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

Designs by a registered professional engineer shall be in written form and shall include the following:

- A plan indicating the sizes, type, and configurations of the materials to be used in the protective system; and
- The identity of the registered professional engineer approving the design.

At least one copy of the design shall be maintained at the jobsite during construction of the protective system.

D. Materials and Equipment

Materials and equipment used for protective systems shall be properly maintained and free from damage or defects that might impair their proper function.

When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

E. Installation and Removal of Supports

Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of contract workers.

Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

Backfilling shall progress together with the removal of support systems from excavations.

Installation of a support system shall be closely coordinated with the excavation of trenches.

F. Sloping and Benching Systems

Contract workers shall not be permitted to work on the faces of sloped or benched excavations at levels above other contract workers except when contract workers at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

G. Shield Systems

Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

Contract workers shall not be allowed in areas protected by shields when the shields are being installed, removed, or moved vertically.

H. Additional Requirement for Shield Systems Used in Trench Excavation

Excavations of earth material to a level not greater than 2 feet below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are not indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

IV. PROTECTIVE SYSTEMS FOR EXCAVATIONS, TRENCHES, AND HOLES/CAISSONS

Protective systems for excavations, trenches, and holes/caissons include:

- Warning systems
- Barricades
- Protective covers

A. Warning Systems

Warning systems may be used alone only when a warning is sufficient to prevent hazard exposure, and only when an excavation/trench is less than six feet in depth.

- Barricade Tape - When using barricade tape, it is to be placed 6 feet from the edge of an excavation or trench to warn of the hazard.
- Flashers - Flashing lights shall be placed along the perimeter of the hazard as an additional indication of the hazard.

Both a warning system **and** a physical barricade/cover shall be required to adequately protect against hazards when excavation takes place within the operating station, including all supportive areas, such as coal fields.

B. Barricades

Physical barricades or covers are to be used when an excavation or trench exceeds six feet in depth or when a warning system alone is not sufficient to prevent a hazard exposure. Physical barricades shall be used within the operating station. All holes/caissons require physical barricades or covers.

A physical barricade shall be constructed to protect against access by unauthorized personnel and/or to protect against accidental hazard exposure. Barricades are to be constructed of rigid materials and meet the OSHA standard 1926.502.

Typically, barricades are built of plywood, wire rope, fencing, wood, or metal, but may be made of any material meeting the above specifications. Barricades must be secured, and completely surround the hazard.

C. Covers

Covers shall be made of any material which is able to support twice the intended load, i.e., personnel or equipment. Typically, hole covers are made of plywood, wire fence, or expanded metal mesh. Covers must be secured from removal or displacement, and flagged with red utility locate flags. All hole covers are to be clearly labeled: "DANGER - HOLE COVER - DO NOT REMOVE".

D. Training

All Energy Supply contract workers working on projects where excavation/trench/hole hazards exist are to be trained in the installation, identification, and maintenance of warning systems, barricades, and/or covers.

GRANULAR SOILS - FINE TO COARSE SANDS

Unconfined Compressive Strength (UCS) of soft cohesive soil is less than $.5T / SF$ and shall be treated similar to granular soils.

Relative Density of Sands According to Results of Standard Penetration Tests

Blows Per Ft.	Relative Density	Soil Type
0-4	Very Loose	C
4-10	Loose	C
10-30	Medium	C
30-50	Dense	B
Over 50	Very Dense	*B

* Very dense sand may be Type "A" if solidly cemented.

Test For Granular Soils

1. Granular soil cannot be molded when moist and crumbles easily when dry.
2. Moist granular soils that contain some cohesive material will exhibit signs of cohesion between particles.
3. Penetrometer does not work on granular soils.
4. Granular soil has no cohesive strength.

Warning

1. Excessive moisture or drying may cause changes in the soil classification.
2. Granular soils are susceptible to shock and/or vibration failure.
3. Granular material that would exhibit cohesive properties when moist will lose those properties when either saturated or dried.

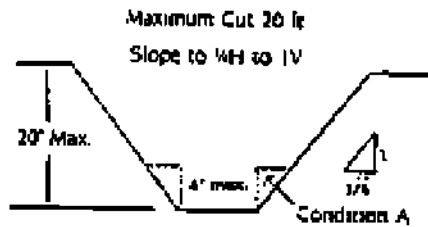
MINIMUM STANDARDS - TYPE A SOIL

Includes:

1. Cohesive soils with an unconfined compressive strength exceeding 1.5 T/SF.
2. Cemented granular soils or caliche may be included.

Excludes:

1. Fissured soils or areas subject to vibration from heavy traffic or similar effects.
2. Sloped layered system dipping onto excavation areas on 4 horizontal: 1 vertical or greater.
3. Other factors requiring a less stable classification such as excessive moisture or free running or standing water.
4. Previously disturbed soil.
5. Cuts in excess of 20 feet.

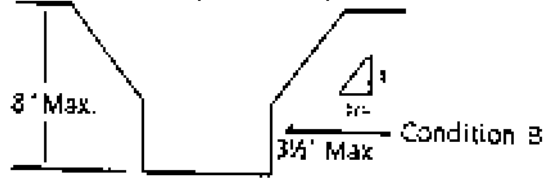


Top width = (1.5 x depth) + bottom width. If bottom width is 4 ft., then:

<i>Depth</i>	<i>Width</i>
8 ft.	16 ft.
10 ft.	19 ft.
12 ft.	22 ft.
14 ft.	25 ft.
16 ft.	28 ft.
18 ft.	31 ft.
20 ft. Max	34 ft.

MINIMUM STANDARDS – TYPE A SOIL

**Unsupported Vertically Sided
Lower Portion
Max. Depth - 8 ft.**



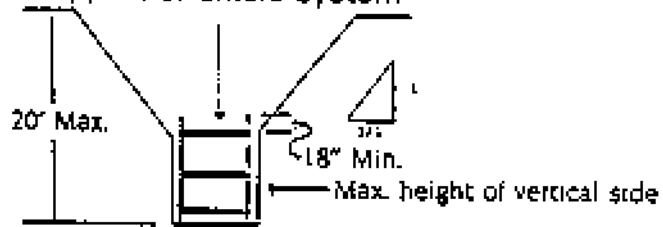
Excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet.

**Unsupported Vertically Sided
Lower Portion
Max. Depth - 12 ft.**



Excavations more than 8 feet but not more than 12 feet in depth which have unsupported vertically sided lower portions shall have a maximum allowable slope of 1H: 1V and a maximum vertical side of 3 1/2 feet.

Support or shield system



All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded have a maximum allowable slope of 3/4 H: 1V. The support or shield system must extend at least 18 inches above the top of the vertical side.

- Condition A 4 Ft. maximum vertical height bench is allowable for Type A and Type B soils.
- Condition B 3.5 maximum vertical height is allowable for Type A.
- Condition A & B Applies to cohesive soils only – not granular.

MINIMUM STANDARDS – TYPE B SOIL

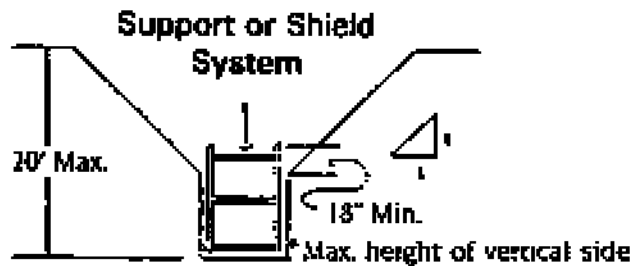
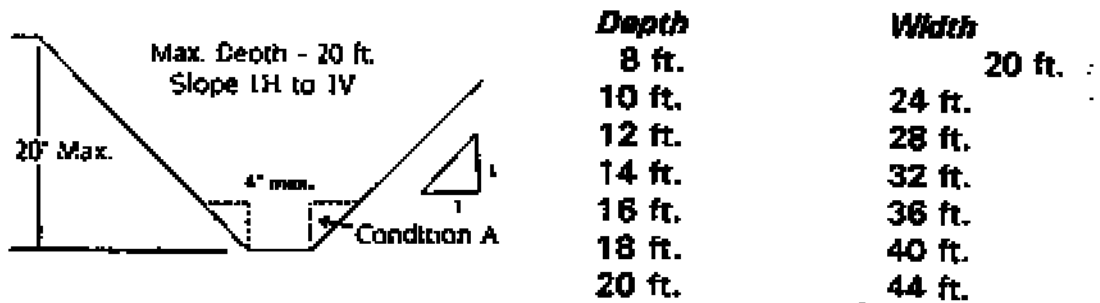
Includes:

1. Cohesive soils with UCS of .5T / SF min. to 1.5 T/SF max.
2. Type A soils subject to external vibrations or loading.
3. Type A soils that are fissured.
4. Type A soils previously disturbed, but well compacted.

Excludes:

1. Cuts in excess of 20 ft.
2. Soils with free running or standing water.

Top width = (2 x depth) + bottom width. If bottom width is 4 ft. then:



All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1H: 1V.

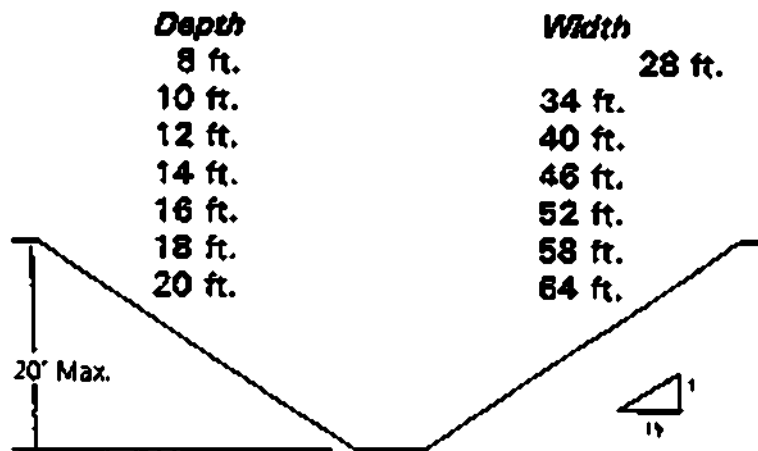
MINIMUM STANDARDS – TYPE C SOIL

Includes:

1. Cohesive soil with UCS less than .5T/SF. Granular
2. soils including gravel, sand and loamy sand.
3. Saturated or submerged soils. Type A and B soils
4. when using option 1.
 - Recommended specific written safety plan
 - May require additional protective equipment.

**Max. cut - 20 ft.
Slope 1 1/2H:1V**

**Top width = (3 x depth) + bottom width.
If bottom width is 4 ft., then:**



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

Support or shield system

or less in depth which lower portions shall be to a height at least 18 inches above the top of the vertical side. All excavations shall have a maximum

All excavations 20 feet or less in depth which have vertically sided shall be shielded or supported to a height at least 18 inches above the top of such excavations shall have an allowable slope of 1 1/2 horizontal: 1 vertical.

**TAMPA ELECTRIC
ENERGY SUPPLY
EXCAVATION AND TRENCHING COMPLIANCE CHECKLIST
TO BE COMPLETED DAILY & "AS NEEDED"**

Date & Time:

W.O.#

Contractor:

Station or Location:

Competent Person:

Reclass Yes No

Reason

VISUAL

Water – Surface, Seeping, Water Table

Backfill – Cohesive, Granular

Trench Banks Cohesive/Granular, Crack/Spall, Fissures

Previously Disturbed Yes No

Layered Soil Yes No

Vib Potential Yes No

MANUAL

Plasticity – Cohesive, Granular

Dry Strength – Cohesive, Granular

Estimated Strength – Thumb, Penitrometer, Shear Van

Atmospheric Check: Yes No Values

CLASSIFICATION/PROTECTION

Soil Type – Rock A B C

 Trench Box, Shoring, Sloping

