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| Author:      | P. Roberts    | Revision #:   | 3          |
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**SAFETY POLICY & PROCEDURE**

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# Excavation, Trenching and Shoring      **SPP# 1926.650**

## Quick Reference

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## **SAFETY POLICY & PROCEDURE**

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### **1.0 Purpose**

The purpose of this safety policy and procedure is to ensure that each North Carolina Department of Transportation (NCDOT) employee has the training and information needed to perform his or her job safely and effectively when working in or near trenches or other excavations.

### **2.0 Scope and Applicability**

This safety policy and procedure affects any NCDOT employee whose job duties require entrance into trenches or excavation sites or inspections of such sites.

### **3.0 Reference**

This safety policy and procedure is established in accordance with Occupational Safety and Health Standards for Construction Industry (29 CFR 1926.650) Subpart P - Excavations.

### **4.0 Policy**

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards. This shall be accomplished through proper training and education of its workers and by eliminating as many hazards as possible from the jobsite. Employees working in or near trenches and excavations shall be provided training in recognizing and controlling unsafe conditions. All trenches and excavations shall be evaluated and monitored by a “competent” person prior to employees entering and continuously while employees work within. **The “Competent Person” must be a Supervisor or Transportation Worker designated by the Supervisor having the authority to take prompt corrective measures to eliminate unsafe conditions if the Supervisor has to leave the jobsite.**

### **5.0 General Responsibilities**

It is the responsibility of each manager/unit head, supervisor, and employee to ensure that all phases of this procedure are implemented as prescribed in section 6.

### **6.0 Procedure**

This section provides definitions, establishes general provisions and identifies specific responsibilities required by NCDOT’s safety policy and procedure on Excavations, Trenching and Shoring. (Reference Appendix A for Procedure Flow Diagram.)

#### **6.1 Definitions**

##### **Bell Bottom Pier Hole**

A type of shaft or footing excavation, the bottom of which is made larger than the cross section above, resulting in a bell shape.

### **Benching**

A method of protecting workers 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. **Benching cannot be done in Type C soil.**

### **Competent Person**

Employee who is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to workers, soil types and protective systems required, and who is authorized to take prompt corrective measures to eliminate these hazards and conditions.

### **Cross Braces**

The horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

### **Faces or Sides**

The vertical or inclined earth surfaces formed as a result of excavation work.

### **Protective System**

A method of protecting employees from trench 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.

### **Ramp**

An inclined walking or working surface that is used to gain access to one point from another and is constructed from earth or from structural materials such as steel or wood.

### **Registered Professional Engineer**

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.

### **Shield System**

A structure that is able to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

### **Shoring**

Protective system which consists of installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins.

### **Sloping**

A method of protecting employees from cave-ins by excavating all sides of an excavation to a stable incline. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads. DOT shall slope all trenches for Type C soil at 1 ½:1 (34°).

### **Spoil Pile**

Excavated materials, topsoil, rocks, etc., temporarily stored next to excavation must be at least 2' from edge of trench.

### **Stable Rock**

Natural solid mineral material that can be excavated with vertical sides and shall remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against cave-in or movement by rock bolts or by another protective system that has been designed by a Registered Professional Engineer (RPE).

### **Support System**

A structure such as underpinning, bracing, or shoring the sides of an excavation.

### **Surcharge Load**

The weight of spoils or equipment exerting pressure on the surface of the soil near an excavation.

### **Tabulated Data**

Tables and charts approved by a Registered Professional Engineer and used to design and construct a protective system.

### **Trench**

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 at the bottom is not greater than 15 feet.

### **Uprights**

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."

### **Wales**

Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members or earth.

## **6.2 General Provisions**

The general elements of this program are found in OSHA standard 29CFR 1926.650 (Excavations), 651 (Special Excavation Requirements), 652 (Requirements for Protective Systems), and associated appendices. These elements are adopted for use by NCDOT as follows:

### **6.2.1 Surface Encumbrances**

Identify all surface encumbrances that may put a surcharge load affecting trench stability, and remove or support as necessary to safeguard employees against cave-ins.

**6.2.2 Underground Installations**

The estimated location of utility installations that may be encountered during excavation work shall be determined prior to opening an excavation. Dial 811 during business hours Monday thru Friday more than 72 hours excluding weekends and State Holidays prior to the excavation for the NC Utility Location Service to mark underground lines.



If underground installations are uncovered, they shall be properly supported to protect employees.

**Underground utilities will be marked by color coded paint, stakes or flags APWA**

- RED** – Electric Power Lines, Cables, Conduit, and Lighting Cables
- YELLOW** – Gas, Oil, Steam, Petroleum, or Gaseous Material
- ORANGE** – Communication, Alarm or Signal Lines, Cables, or Conduit
- BLUE** – Potable Water
- GREEN** – Sewers and Drain Lines
- WHITE** – Proposed Excavation Limits or Route
- PINK** – Temporary Survey Markings, Unknown / Unidentified Facilities
- PURPLE** – Reclaimed Water, Irrigation, and Slurry Lines

**Utility Tolerance Zone**

- When digging in Tolerance Zone:
- Hand dig only with shovels or post hole diggers
- Avoid use of picks or mattocks
- Keep face of shovel toward side of facility fig. 1
- Post hold diggers, keep blade opening going same direction as facility fig. 2

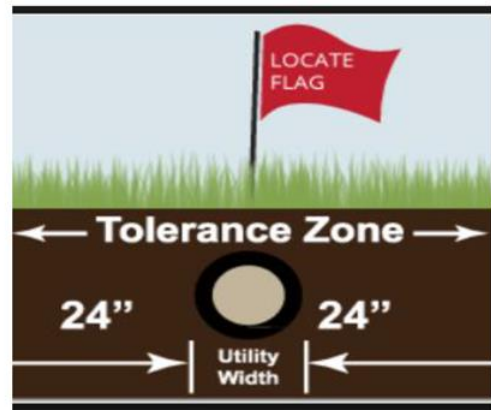


Figure 1 Shovel

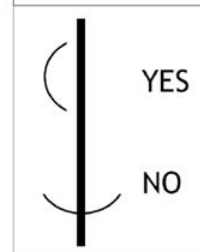
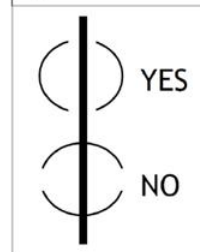


Figure 2 Post hole



### **6.2.3 Access and Egress**

A stairway, ladder, ramp or other means of egress shall be located in any trench that is 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees.

Structural ramps that are used solely by employees as a means of egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed person qualified in structural design and shall be constructed in accordance with the design.

### **6.2.4 Vehicular Traffic**

Employees exposed to public vehicular traffic in a work area shall wear a safety vest or other high visibility clothing meeting ANSI 107-2010 requirements for high visibility apparel. If flagger is utilized, they should wear an orange hat.

### **6.2.5 Falling Loads**

Employees are not permitted under any loads handled by lifting or digging equipment.

Employees shall stand away from any vehicle being loaded or unloaded.

### **6.2.6 Mobile Equipment**

A warning system such as barricades, hand or mechanical signals or stop logs shall be used when mobile equipment is operated near the edge of an excavation and the operator does not have a clear and direct view of the edge.

### **6.2.7 Hazardous Atmosphere**

Air quality tests shall be performed before employees enter any excavation where a hazardous atmosphere exists or could reasonably be expected to exist.

Excavations or trenching in the vicinity of gasoline storage tanks, underground pipelines or sewer lines could reasonably be expected to cause a hazardous atmosphere.

Employees shall not enter any excavation that tests as having a hazardous atmosphere.

### **6.2.8 Water Accumulation**

Employees shall not be allowed to enter excavations where water has accumulated unless precautions have been taken to protect employees against the water hazards.

### **6.2.9 Stability of Adjacent Structures**

Support systems such as shoring, bracing or underpinning shall be used to provide stability whenever the stability of adjoining buildings, walls or other structures is endangered by excavation operations.

### 6.2.10 Employee Protection

Whenever loose rock or soil could pose a hazard to employees by falling or rolling into an excavation, an adequate means of protection shall be provided. Such protection shall consist of scaling to remove loose material, installation of protective barricades, or other means of equivalent protection.

Excavated material or equipment that could pose a hazard to employees by falling or rolling into an excavation shall be kept at least 2 feet from the edge or by the of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations..

Walkways or bridges with standard guard rails shall be provided whenever employees are required to cross over excavations. “Jump-overs” are prohibited.

### 6.2.11 Inspections

Prior to commencement of trenching and excavation, a job hazard assessment including a drawing of the planned slope of trench or excavation will be conducted. See Appendix C for examples of acceptable drawings which may be used. The job hazard assessment must be signed by the competent person on-site.

Excavations and trenches shall be inspected by a competent person prior to the start of work and monitored continuously while employees are working within.

The competent person shall conduct an inspection whenever a hazard increasing event (such as a rainstorm) occurs.

Whenever a possible hazardous condition is detected, the competent person shall instruct exposed employees to immediately leave the excavation or trench until an adequate means of protection is provided.

### 6.2.12 Audits

Audits will be conducted by the on-site competent person. Feedback on number and results of these audits will be provided to Division Engineer at monthly safety meeting. The audit results will be utilized to fine tune future training and should be retained for 3 years. See Appendix E for Audit Form.



## 6.2.13 Training

Transportation Supervisors or Workers selected to be “competent” persons for NC DOT projects shall receive training on all sections of this procedure. Detailed training shall also be provided on:

- Hazards associated with trenching and excavation
- Class “C” soil
- Safe slopes for different soil types and conditions
- Proper installation of shielding and shoring
- Recognition of hazardous conditions caused by machinery, traffic, utilities and weather conditions

Annual competent person refresher training regarding updates or modifications of procedures, equipment, or policy shall be provided.

Trench hazard awareness training will be provided for all employees who encounter trenching and excavation. Refresher training on trenching and excavation will be provided on a periodic basis as needed. The training will be documented and retained for minimum period of 5 years.

## 6.3 Specific Responsibilities

### 6.3.1 Managers/Unit Heads

Managers/Unit Heads are responsible for coordinating required training with Safety and Risk Management.

Sufficient employees shall be trained to provide a “competent” person at each excavation or trench covered by this standard.

Managers/Unit Heads shall ensure that the necessary testing equipment and shoring or shielding is budgeted for, acquired, and maintained as required by the level of excavation activity within their areas of responsibility.

### 6.3.2 Supervisors

Supervisors shall ensure that a “competent” person is in charge of each trench or excavation covered by this procedure. Specifically, each Bridge Crew, Maintenance Crew, Equipment Unit Crew, and Resident Engineer operation that involves a trench or excavation covered by this procedure shall have at least one competent person on site while work is being done.

### 6.3.3 Competent Persons

Each site covered in this procedure shall have a competent person who shall evaluate conditions and remain at the site as long as employees are working in the trench or excavation.

Competent persons shall be thoroughly familiar with this procedure.

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The competent person shall evaluate the work site prior to excavation and determine what utilities shall be affected. Utility companies shall be notified at least 48 hours prior to starting work unless emergency conditions exist (811).

The competent person shall choose either sloping or shielding/shoring as the protective system. A slope of 1-1/2:1 or flatter shall be used if sloping is the protective system used. (Reference Appendices Table B-1)

The competent person shall inspect and document the condition of the trench or excavation and protective system prior to each work shift, throughout each work shift, and after a rainstorm or other hazard increasing event.

If a hazard is detected, the competent person shall not permit employees to enter or shall immediately remove employees from the trench or excavation until proper protective measures have been taken.

The competent person shall ensure that mobile equipment working near the edge of a trench or excavation has a positive warning system such as stop logs or hand signals.

The competent person shall ensure that testing with a multigas meter is conducted whenever the possibility of atmospheric hazards in the trench or excavation exists.

The competent person shall ensure that information on the site evaluation and protective system selected is available on-site.

### 6.3.4 Employees

Employees shall be responsible for reporting suspected unsafe conditions or equipment to the competent person.

Employees shall immediately evacuate any trench or excavation when they suspect a collapse is imminent or when directed to do so by the competent person.

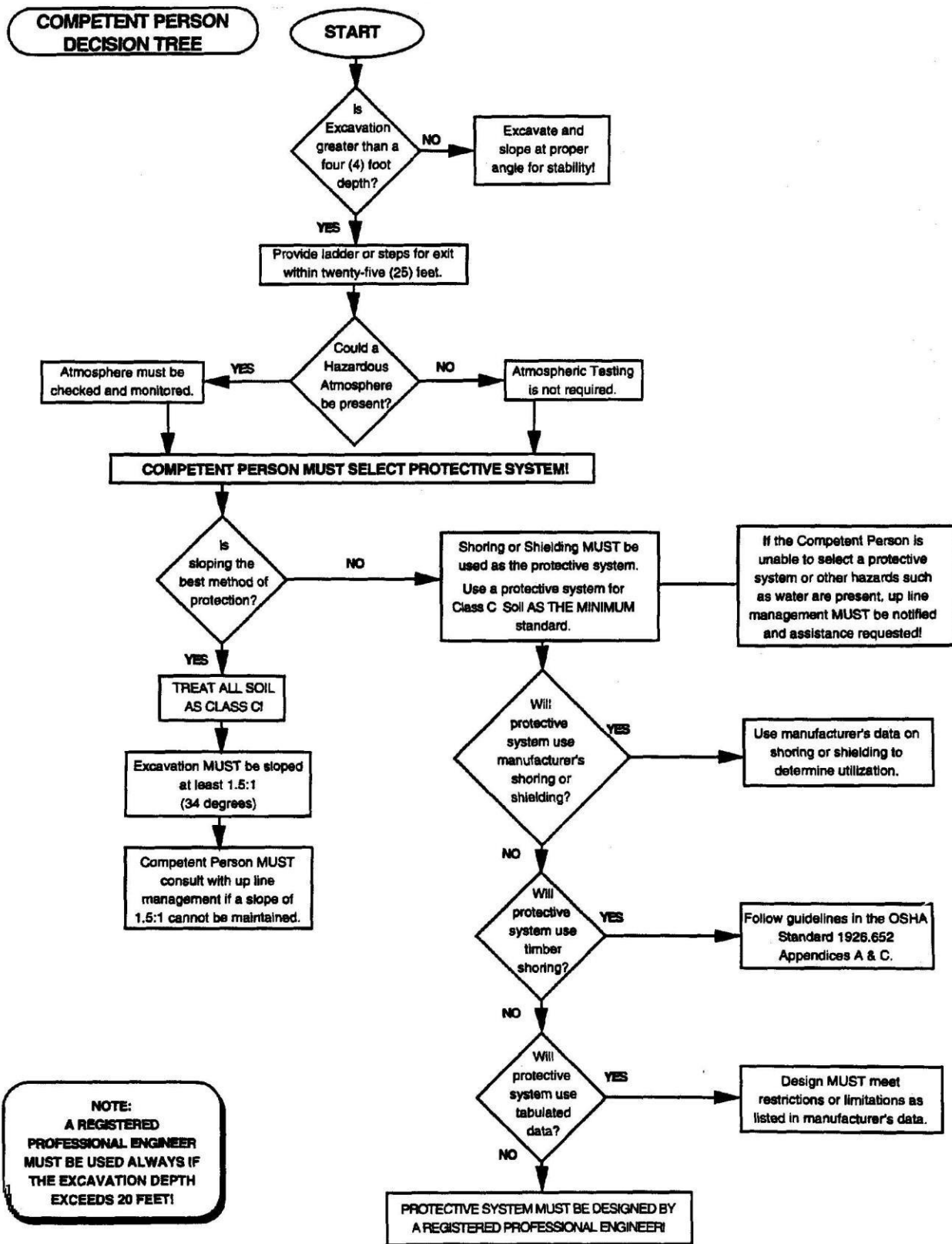
### 6.3.5 Safety and Risk Management

Safety and Risk Management shall conduct competent person training and coordinate related training.

Safety and Risk Management shall audit protective systems and atmospheric monitoring equipment.

Safety and Risk Management shall provide prompt assistance to managers/unit heads, supervisors, competent persons, the Central Equipment Unit, or others on any matter concerning this procedure.

**APPENDIX A: Competent Person Decision Tree**



## APPENDIX B: Job Reminder Checklist

### 1. **Pre-Inspect Jobsite**

What is the best protection method?(sloping/shoring/shielding)  
How likely are utilities?  
What additional equipment is necessary?  
Water removal? Air Monitoring? Ladders? Soil testing? Stop logs?

### 2. **Employee and Equipment Access**

Employee ramp designed by Competent Person  
Equipment ramp designed by person qualified in structural design  
Exit means located within 25' of employees

### 3. **Determine Soil Conditions**

All soil is to be classified as type "C" and proper employee protection used based on "C"  
Inspect excavation for changing soil conditions

### 4. **Protection Systems**

Appropriate protection system selected  
Installed according to manual or tabulated data  
Inspect equipment at start of shift  
Remove employee working outside protected area

### 5. **Monitor Environmental Conditions**

Remove employees from trench where water is accumulating  
Monitor use of water removal equipment  
Monitor air quality levels if hazardous atmosphere is suspected

### 6. **Required to Consult with Registered Professional Engineer (RPE)**

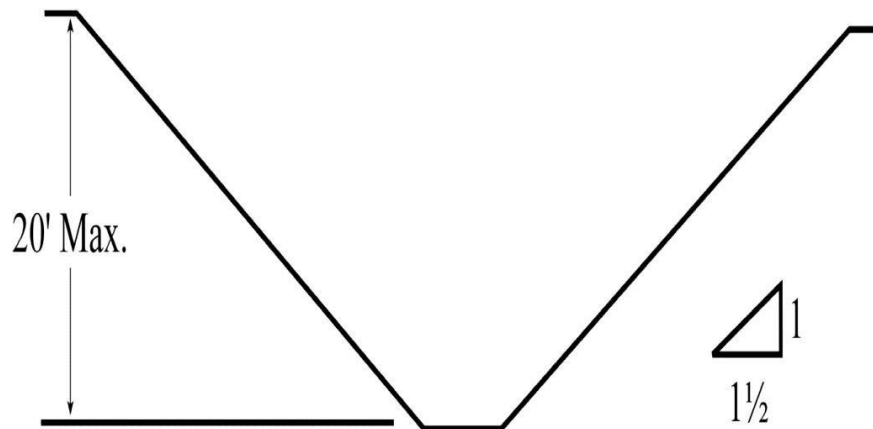
#### **When:**

Trenches are over 20' deep  
Specifically designed shoring or bracing is required  
Excavation or trench endangers nearby structure  
Standard protection measures cannot be used

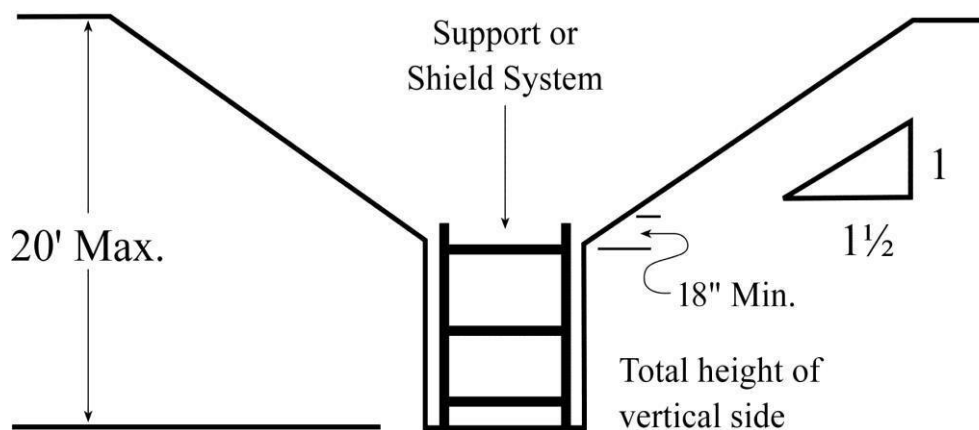
#### **May Consult with RPE When:**

Unusual or changing soil conditions exist or are anticipated  
Soil is unusually good and shoring reduction is required  
Soil is unusually poor and may require going to more protective system

**APPENDIX C: Slope Configurations; OSHA Type "C" Soil**



**Simple Slope**



**Support or Shield System**

**APPENDIX D: Excavation Evaluation**

**Detailed Evaluation**

1. All open trenches have been inspected?
2. All excavated soil was located at least 2 feet away from the edge of the trench?
3. Were any tension cracks observed along top of any slopes?
4. Were slopes cut at the proper angle for stability?
5. Was any water seepage noted in trench walls or trench bottom?
6. Was bracing system installed in accordance with design?
7. Was there evidence of shrinkage cracks in trench walls?
8. Was there any evidence of caving or sloughing of soil since the last field inspection?
9. Were there any zones of unusually weak soils or materials not anticipated?
10. Was there any evidence of significant fracture planes in soil or rock?
11. Were there any noted dramatic dips in bedrock?
12. All short-term trench(s) covered within 24 hours?
13. Trench box(s) certified?  
Shield Capacity in pounds per square foot?
14. Were hydraulic shores pumped to design pressure?
15. Type shoring being used \_\_\_\_\_ secure?
16. Did shoring plan include adequate safety factor to allow for equipment actually being used?
17. Traffic in area adequately away from trenching operations with barricades?
18. Trees, boulders, or other hazards in area?
19. Vibrations from equipment or traffic too close to trenching operation?

**APPENDIX E: Trenching / Excavation Audit Form**

| NCDOT TRENCHING/EXCAVATION AUDIT FORM                  |                                 |   |                      |   |   |
|--|---------------------------------|---|----------------------|---|---|
| <b>Date:</b>   | <b>Time:</b>                    |   | <b>Auditor Name:</b> |   |   |
| <b>Division - County:</b>                              | <b>Unit:</b>                    |   |                      |   |   |
| <b>Worksite Location:</b>                              | <b>Operation Being Audited:</b> |   |                      |   |   |
| Category   | Rating                          |   |                      | Observations/Corrective Actions<br>S=Satisfactory, U=Unsatisfactory, N/A=Not Applicable | Abatement Date<br>If corrective action required |
|  | S                               | U | N/A                  |   |   |
| <b>Excavation</b>                                      |                                 |   |                      |   |   |
| Inspected by Competent Person                          |                                 |   |                      |   |   |
| Excavated Soil 2' Away from Edge                       |                                 |   |                      |   |   |
| Slopes Cut Properly for Class C Soil (1 ½: 1)          |                                 |   |                      |   |   |
| No Visible Tension Cracks @ top of Excavation          |                                 |   |                      |   |   |
| No Evidence of Cracks in Trench Walls                  |                                 |   |                      |   |   |
| No Evidence of Caving or Sloughing of Soil             |                                 |   |                      |   |   |
| Water Removal in Bottom of Trench Acceptable           |                                 |   |                      |   |   |
| <b>Hazards</b>   |                                 |   |                      |   |   |
| Vibration from Equipment, Pile Driving, or Traffic Too |                                 |   |                      |   |   |
| Traffic in Area adequately away from Excavation        |                                 |   |                      |   |   |
| Overhead Hazards                                       |                                 |   |                      |   |   |
| Trees, Boulders, or Loose Rock                         |                                 |   |                      |   |   |
| Water Removal in Bottom of Trench Acceptable           |                                 |   |                      |   |   |
| <b>Egress</b>  |                                 |   |                      |   |   |
| Means of Egress every 25'                              |                                 |   |                      |   |   |
| If Ladder used for Egress; extends 3' above surface    |                                 |   |                      |   |   |
| <b>Trench Box/Shoring</b>                              |                                 |   |                      |   |   |
| Trench Box Certified                                   |                                 |   |                      |   |   |
| Trench Box Shield Capacity Identified in Lbs./Sq. Ft.  |                                 |   |                      |   |   |
| Trench Box extends 18" above vertical wall of trench   |                                 |   |                      |   |   |
| Hydraulic Shores Pumped to Design Pressure             |                                 |   |                      |   |   |
| <b>ORM Tailgate Safety Meeting</b>                     |                                 |   |                      |   |   |
| Identify Task  |                                 |   |                      |   |   |
| Assess Hazards   |                                 |   |                      |   |   |
| Identify Controls                                      |                                 |   |                      |   |   |
| Perform Work w/ Controls                               |                                 |   |                      |   |   |
| Re-Assess  |                                 |   |                      |   |   |

**APPENDIX F: Shoring Tables**

**TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS\***

SOIL TYPE C P<sub>a</sub> - 80 X H + 72 psf (2 ft. Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (ACTUAL) AND SPACING OF MEMBERS ** |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
|------------------------|---|------------------------|---------|---------|----------|----------|----------------------|------------|----------------------|---|--|--|--|--|
|                        | HORIZ. SPACING (FEET)                   | CROSS BRACES           |         |         |          |          | VERT. SPACING (FEET) | WALES      |                      | UPRIGHTS                                    |  |  |  |  |
|                        |   | WIDTH OF TRENCH (FEET) |         |         |          |          |                      | SIZE (IN.) | VERT. SPACING (FEET) | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) |  |  |  |  |
|                        |   | UP TO 4                | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 |                      |            |                      | CLOSE                                       |  |  |  |  |
| 4<br>TO<br>10          | UP TO 6                                 | 6 X 8                  | 6 X 8   | 6 X 8   | 8 X 8    | 8 X 8    | 5                    | 8 X 10     | 5                    | 2 X 6                                       |  |  |  |  |
|                        | UP TO 8                                 | 8 X 8                  | 8 X 8   | 8 X 8   | 8 X 8    | 8 X 10   | 5                    | 10 X 12    | 5                    | 2 X 6                                       |  |  |  |  |
|                        | UP TO 10                                | 8 X 10                 | 8 X 10  | 8 X 10  | 8 X 10   | 10 X 10  | 5                    | 12 X 12    | 5                    | 2 X 6                                       |  |  |  |  |
|                        | See Note 1                              |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
| 10<br>TO<br>15         | UP TO 6                                 | 8 X 8                  | 8 X 8   | 8 X 8   | 8 X 8    | 8 X 10   | 5                    | 10 X 12    | 5                    | 2 X 6                                       |  |  |  |  |
|                        | UP TO 8                                 | 8 X 10                 | 8 X 10  | 8 X 10  | 8 X 10   | 10 X 10  | 5                    | 12 X 12    | 5                    | 2 X 6                                       |  |  |  |  |
|                        | See Note 1                              |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
|                        | See Note 1                              |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
| 15<br>TO<br>20         | UP TO 6                                 | 8 X 10                 | 8 X 10  | 8 X 10  | 8 X 10   | 10 X 10  | 5                    | 12 X 12    | 5                    | 3 X 6                                       |  |  |  |  |
|                        | See Note 1                              |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
|                        | See Note 1                              |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
|                        | See Note 1                              |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
| OVER 20                | SEE NOTE 1                              |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |

\* Mixed oak or equivalent with a bending strength not less than 850 psi.

\*\* Manufactured members or equivalent strength may be substituted for wood.

Note 1: Must be designed and approved by a Professional Engineer



**APPENDIX F: Shoring Tables (Continued) 2**

TABLE N-7  
 TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS\*  
 SOIL TYPE C P<sub>a</sub> - 80 X H + 72 psf (2 ft. Surcharge)

| DEPTH OF TRENCH (FEET) | SIZE (SIZES) AND SPACING OF MEMBERS ** |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
|------------------------|--|------------------------|---------|---------|----------|----------|----------------------|------------|----------------------|---|--|--|--|--|
|                        | HORIZ. SPACING (FEET)                  | CROSS BRACES           |         |         |          |          | VERT. SPACING (FEET) | WALES      |                      | UPRIGHTS                                    |  |  |  |  |
|                        |  | WIDTH OF TRENCH (FEET) |         |         |          |          |                      | SIZE (IN.) | VERT. SPACING (FEET) | MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) |  |  |  |  |
|                        |  | UP TO 4                | UP TO 6 | UP TO 9 | UP TO 12 | UP TO 15 |                      |            |                      | CLOSE                                       |  |  |  |  |
| 4<br>TO<br>10          | UP TO 6                                | 6 X 6                  | 6 X 6   | 6 X 6   | 6 X 6    | 8 X 8    | 5                    | 8 X 8      | 5                    | 3 X 6                                       |  |  |  |  |
|                        | UP TO 8                                | 6 X 6                  | 6 X 6   | 6 X 6   | 8 X 8    | 8 X 8    | 5                    | 10 X 10    | 5                    | 3 X 6                                       |  |  |  |  |
|                        | UP TO 10                               | 6 X 6                  | 6 X 6   | 8 X 8   | 8 X 8    | 8 X 8    | 5                    | 10 X 12    | 5                    | 3 X 6                                       |  |  |  |  |
|                        | See Note 1                             |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
| 10<br>TO<br>15         | UP TO 6                                | 6 X 8                  | 6 X 8   | 6 X 8   | 8 X 8    | 8 X 8    | 5                    | 10 X 10    | 5                    | 4 X 6                                       |  |  |  |  |
|                        | UP TO 8                                | 8 X 8                  | 8 X 8   | 8 X 8   | 8 X 8    | 8 X 8    | 5                    | 12 X 12    | 5                    | 4 X 6                                       |  |  |  |  |
|                        | See Note 1                             |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
| 15<br>TO<br>20         | UP TO 6                                | 8 X 8                  | 8 X 8   | 8 X 8   | 8 X 10   | 8 X 10   | 5                    | 10 X 12    | 5                    | 4 X 6                                       |  |  |  |  |
|                        | See Note 1                             |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
|                        | See Note 1                             |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
|                        | See Note 1                             |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |
| OVER 20                | SEE NOTE 1                             |                        |         |         |          |          |                      |            |                      |   |  |  |  |  |

\* Douglas fir or equivalent with a bending strength not less than 1500 psi.  
 \*\* Manufactured members of equivalent strength may be substituted for wood.

Note 1: Must be designed and approved by a Professional Engineer

**APPENDIX F: Shoring Tables (Continued) 3**

ALUMINUM HYDRAULIC SHORING  
WALER SYSTEMS  
FOR SOIL TYPE C

| DEPTH OF TRENCH (FEET) | WALES                   |                                      | HYDRAULIC CYLINDERS    |                   |                 |                   |                  |                   | TIMBER UPRIGHTS                 |       |       |
|------------------------|-------------------------|--------------------------------------|------------------------|-------------------|-----------------|-------------------|------------------|-------------------|---------------------------------|-------|-------|
|                        | VERTICAL SPACING (FEET) | * SECTION MODULUS (IN <sup>3</sup> ) | WIDTH OF TRENCH (FEET) |                   |                 |                   |                  |                   | MAX. HORIZ. SPACING (ON CENTER) |       |       |
|                        |                         |                                      | UP TO 8                |                   | OVER 8 UP TO 12 |                   | OVER 12 UP TO 15 |                   | SOLID SHEET                     | 2 FT. | 3 FT. |
|                        |                         |                                      | HORIZ. SPACING         | CYLINDER DIAMETER | HORIZ. SPACING  | CYLINDER DIAMETER | HORIZ. SPACING   | CYLINDER DIAMETER |                                 |       |       |
| OVER 5 UP TO 10        | 4                       | 3.5                                  | 6.0                    | 2 IN              | 6.0             | 2 IN NOTE(2)      | 6.0              | 3 IN              | 3x12                            | -     | -     |
|                        |                         | 7.0                                  | 6.5                    | 2 IN              | 6.5             | 2 IN NOTE(2)      | 6.5              | 3 IN              |                                 |       |       |
|                        |                         | 14.0                                 | 10.0                   | 3 IN              | 10.0            | 3 IN              | 10.0             | 3 IN              |                                 |       |       |
| OVER 10 UP TO 15       | 4                       | 3.5                                  | 4.0                    | 2 IN              | 4.0             | 2 IN NOTE(2)      | 4.0              | 3 IN              | 3x12                            | -     | -     |
|                        |                         | 7.0                                  | 5.5                    | 3 IN              | 5.5             | 3 IN              | 5.5              | 3 IN              |                                 |       |       |
|                        |                         | 14.0                                 | 3.0                    | 3 IN              | 8.0             | 3 IN              | 8.0              | 3 IN              |                                 |       |       |
| OVER 15 UP TO 20       | 4                       | 3.5                                  | 3.5                    | 2 IN              | 3.5             | 2 IN NOTE(2)      | 3.5              | 3 IN              | 3x12                            | -     | -     |
|                        |                         | 7.0                                  | 5.0                    | 3 IN              | 5.0             | 3 IN              | 5.0              | 3 IN              |                                 |       |       |
|                        |                         | 14.0                                 | 6.0                    | 3 IN              | 6.0             | 3 IN              | 6.0              | 3 IN              |                                 |       |       |
| OVER 20                | NOTE (1)                |                                      |                        |                   |                 |                   |                  |                   |                                 |       |       |

Note 1: Must be designed and approved by a Professional Engineer

## APPENDIX G: Competent Person Guide to an OSHA Inspection

**As a Competent Person for a NCDOT excavation, you should be prepared to discuss the trench configuration and associated information with an OSHA Inspector should one visit your operation. The following information is provided as guidance. Feel free to refer to this document and any other documentation during your conversation with the Inspector.**

1. The OSHA Inspector must show his credentials.
2. You shall be asked about your length of experience in this occupation.
3. You shall be asked about your training as a competent person.

*Be prepared to identify when your last Competent Person training was conducted.*

4. You shall be asked about your expertise in soils analysis.

*You should inform the OSHA Inspector of NCDOT's position that all soils are treated as Class C soils unless determined by supervision trained in soils classification. Use Appendix A of this procedure to demonstrate the decision process used in determining how to make the excavation a safe working environment.*

5. You may be questioned about the protective systems especially if you are working with a trench box or are utilizing shoring at the work site.

*Explain the configuration and how the type protection was chosen.*

6. You may be asked specific questions regarding 29CFR 1926.650, the OSHA standard on Excavation, Trenching and Shoring.

*Utilize this procedure as your reference for any questions which might arise.*

7. You shall be asked if you as the Competent Person have the authority to take immediate corrective measures to eliminate existing and predictable hazard as well as the authority to stop work.

*As the Competent Person, you have this authority and should so state.*

8. You shall be asked about inspections of the excavation you have performed.

It is recommended that you maintain a log of all inspections performed as well as of any actions you have taken to reduce hazards. Inspections should be not only of the excavation but also of the adjacent areas and protective systems if they are being used for the specific job. Utilize Appendices B and C for these inspections.

to an OSHA  
Inspection (Continued) 2

## APPENDIX G: Competent Person Guide to an OSHA Inspection (Continued) 2

9. If water is present, you shall be asked about it.

*Explain what precautions have been taken to preclude water from creating a hazard. This may consist of de-watering equipment, repetitive inspection of de-watering operations or, where de-watering equipment is not used, constant monitoring of water/soil conditions.*

10. If a structural ramp is in place for employees, you shall be asked about it.

*Explain its function, who designed and installed it, and how it was determined where it would be located.*

11. If an equipment ramp is in place, you shall be asked if it was designed by a person qualified in structural design.

*Explain who designed the ramp and their qualifications.*

12. You may be asked about air monitoring for oxygen deficiency or toxic gases.

*If you are using air monitoring equipment, explain your rationale for doing so. If not, explain why air monitoring is not required.*

**There are a variety of other questions that may arise during a conversation with an OSHA Inspector. Be sure you understand his questions and answer them truthfully. If asked questions which you cannot answer, try to find the answer for him/her.**

**Always attempt to notify your supervisor immediately when you are visited by an OSHA Inspector. Make detailed notes about any conditions or potential hazards the Inspector identifies to you. The quality of your notes at this time plays an important part in our being able to address any hazards identified in a timely manner.**