

**Tarleton State University**  
**Excavation Safety Program**

July 21, 2009

**Authorized Approval Signatures  
For Programs and Procedures**



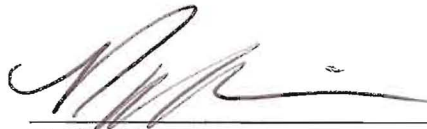
Jerry W. Graham  
Vice President for Finance and Administration



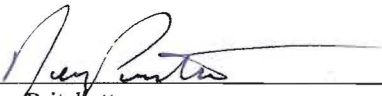
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Associate Vice President for Physical Facilities



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Health and Safety Officer



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Director of Planning, Design and Construction



# Excavation Safety Program

## 1.0 PURPOSE

The purpose of this program is to ensure the safety of the campus community, protect university property, and to comply with state and national regulations and standards. Tarleton State University is not a member of the Texas Excavation Safety System (TESS). Therefore, no person or company shall engage in excavation\* in the approximate location of Tarleton State University owned utility facilities without first notifying Tarleton State University. The Planning, Design and Construction Department will provide campus utility maps to those authorized to excavate on Tarleton State University property.



## 2.0 MARKING OF UNDERGROUND UTILITIES

The person/contractor or department performing underground work will submit an Underground Project Permit, Appendix B, to the Director of Facilities Maintenance for review. The Director of Facilities Maintenance will determine if the proposed work is an “exempt activity” based on the definition of an excavation. The Director of Facilities Maintenance will approve of the exempt activity and contact the requestor. If not, the Director of Facilities Maintenance will then request an underground utility plan from the Planning, Design, and Construction Department. When served notice, the Planning, Design, and Construction Department will provide the Director of Facilities Maintenance a campus utility map of the area to be excavated (within 48 hours) or longer if otherwise agreed upon by the person or company performing the work and the Planning, Design, and Construction Department. This excludes Saturday, Sunday, and University holidays. Upon receiving a copy of the utility map it is the responsibility of the department contact or company to contact the Director of Facilities Maintenance to perform the actual marking out of the utilities. The approximate location (*see Definitions in Section 5.0*) of the underground utilities shall be marked with stakes, flags, paint, or other physical means in accordance with the American Public Works Association (APWA) Uniform Color Code, Appendix A.

## 3.0 PROCEDURES AT THE WORK SITE

Any person or company excavating or tunneling shall exercise reasonable care when working in close proximity to the underground utilities of any Tarleton State University or public utility. Further, when the utilities are to be exposed; only non-mechanical means (hand digging with shovels) shall be employed to locate the utility and to provide for such support, as may be reasonably necessary for the protection of the utilities. If the excavated site is to remain opened longer than one (1) working day,

contact Facilities Maintenance 2 hours prior to close of business day for guidance on barricading the excavated site. All applicable excavation/trench activities shall be performed under the supervision of a “competent person” as defined in accordance with Tarleton’s Excavation Safety Plan, Appendix C, and each competent person shall have the certification on file with the Office of Risk Management and Safety (RMS).

Upon the occurrence of any contact with or damage to any pipe, cable or its protective coating, or any other underground facility or utility, Tarleton State University Control Center (254-968-9265) shall be notified immediately by the person or company responsible for the operation causing the contact or damage, prior to back filling the excavation or continuing with further excavating. Upon the receipt of the notice, Tarleton State University shall immediately dispatch personnel to the subject location to support temporary or permanent repair of the damage. Under no circumstances shall the excavator back fill or conceal the damaged area until Tarleton State University personnel arrives at the subject location. The person or company responsible for the operation causing the contact or damage shall repair said damage, at their own expense, and in accordance with Owner’s directives. RMS will complete Incident Report, Section III, Underground Project Permit.

The contractor or excavator shall be responsible for the maintenance of the designated markings until the project is complete. Sidewalks will be marked with a brass bolt signifying a sleeve or utility location. Utility markings will be updated/painted/marked every 10 business days after project start date. Written notice of updated markings will be given to the Director of Facilities Maintenance and RMS.

#### **4.0 EMERGENCY PROCEDURES**

- In the event of any emergency posing a threat to life, health, service, or property, which may require immediate correction to provide either a safe environment or for the continued operation of a utility, whether or not owned by Tarleton State University, notify Tarleton State University Control Center (254) 968-9265 as soon as it is determined that an emergency exists.
- The Control Center will notify and dispatch the appropriate Tarleton State University personnel as soon as possible.
- The Project Submitter shall then initiate the Tarleton State University Underground Project Permit, Appendix B noting that the dig is an “**EMERGENCY**”. These sections are A, B, D, and E and are marked with an \* (asterisk). The Director of Facilities Maintenance must evaluate the circumstances and can make the decision to whether an emergency project can be performed immediately and if the necessary resources are available to proceed in a safe manner. If the Director of Facilities Maintenance is unavailable the Associate Vice President for Physical Facilities, the Director of Planning, Design and Construction, or the Director of Risk Management and Safety may serve as a designee in this capacity.



## 5.0 DEFINITIONS

**Competent person** - one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

**Excavation** - an operation for the purpose of movement or removal of earth, rock, or other materials in or on the ground, or otherwise disturbing the subsurface of the earth, by the use of powered or mechanized equipment, including but not limited to digging, blasting, auguring, back filling, test boring, drilling, pile driving, grading, plowing in, hammering, pulling in, trenching, and tunneling. Exempt activities potentially include superficial work in flower beds, sprinkler head and turf repair, etc.

**Approximate Location** - means utilities will be marked using the “BEST AVAILABLE” information at time of marking. determining the “Quality Level” of the location of the utilities in the specific area to be excavated.

# Appendix A

## Utility Mark-Out Colors

PMS 806\*

PMS 1795\*

PMS 108


PMS 144\*









13.5 parts process

2.5 parts reflex

PMS 253

PMS 3415

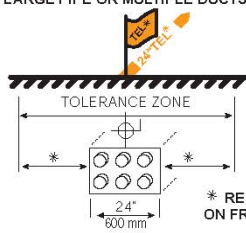


	<b>WHITE</b> - Proposed Excavation
	<b>PINK</b> - Temporary Survey Markings
	<b>RED</b> - Electric Power Lines, Cables, Conduit and Lighting Cables
	<b>YELLOW</b> - Gas, Oil, Steam, Petroleum or Gaseous Materials
	<b>ORANGE</b> - Communication, Alarm or Signal Lines, Cables or Conduit
	<b>BLUE</b> - Potable Water
	<b>PURPLE</b> - Reclaimed Water, Irrigation and Slurry Lines
	<b>GREEN</b> - Sewers and Drain Lines

### TYPICAL MARKING

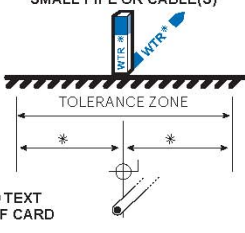
**LARGE PIPE OR MULTIPLE DUCTS**



TOLERANCE ZONE

24"  
600 mm

**SMALL PIPE OR CABLE(S)**



TOLERANCE ZONE

\* REFER TO TEXT ON FRONT OF CARD

Customize with your center's phone and address information

## GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

### ONE-CALL SYSTEMS

The One-Call damage prevention system shall be contacted prior to excavation.

### PROPOSED EXCAVATION

Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

### USE OF TEMPORARY MARKING

Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

### TOLERANCE ZONE

Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

### ADOPT UNIFORM COLOR CODE

The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

## Appendix B

### Tarleton State University Underground Project Permit



# Tarleton State University Underground Project Permit

\*Denotes Required Sections For Emergency Dig

## SECTION I – GENERAL INFORMATION

### Part A – Who is Submitting This Information?

**\*Who is providing this information:**

Name of the person providing the information: \_\_\_\_\_

Name of Organization: \_\_\_\_\_

Primary Contact Phone Number: \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

Secondary Contact Phone Number : \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

Description of Project Activities: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Project Submitter: \_\_\_\_\_ Date: \_\_\_\_\_

**Part B - Date and Location of Dig** (It is the responsibility of the Submitter to notify the University Control Center in the event that utilities are damaged)

### \* Is This Dig an Emergency?

- Yes. If Yes, contact Director of Facilities Maintenance for Emergency Procedures. Emergency Procedures indicate the need to expedite **Parts A - E – 1 hour maximum turn-around time!**
- No. If no, continue with Permit .

**\*Date of Dig:** (MM/DD/YYYY)

**Location/Street address**

**Nearest Intersection**

### \*Right of Way where dig will occur

- |         |  |   |  |   |                                       |
|---------|--|---|--|---|---------------------------------------|
| Public: | <input type="checkbox"/> City Street               | <input type="checkbox"/> State Highway    | <input type="checkbox"/> County Road                       | <input type="checkbox"/> Interstate Highway | <input type="checkbox"/> Railroad     |
|         | <input type="checkbox"/> Private Land Owner        | <input type="checkbox"/> Private Business | <input type="checkbox"/> Private Easement                  | <input type="checkbox"/> Pipeline           | <input type="checkbox"/> Federal Land |
|         | <input type="checkbox"/> Power / Transmission Line |   | <input type="checkbox"/> Dedicated Public Utility Easement |   |                                       |
|         | <input type="checkbox"/> Data not collected        |   | <input type="checkbox"/> Unknown/Other                     |   |                                       |

**Was the project part of a joint trench/excavation?**

- Unknown
- Yes
- No

Is this an "Exempt Activity"? If so, approval provided by Director of Facilities Maintenance. If not, continue to SECTION II.

Authorized By: \_\_\_\_\_  
Director of Facilities Maintenance

## SECTION II – MARKING AND EXCAVATION

### Part C – Routing Data

#### \*Signatures and Completion Dates.: Initials and Date of Completion

1.  Facilities Maintenance request of underground plans from Construction and Planning:

**Init:** \_\_\_\_\_ **Date:** \_\_\_\_\_

2.  Planning, Design, and Construction Drawings submitted to Facilities Maintenance:

**Init:** \_\_\_\_\_ **Date:** \_\_\_\_\_

3. Facilities Maintenance

Has marked the following site utilities:

Domestic Water

Irrigation

Natural Gas/LP

Electrical/Primary

Lighting

Data/Phone/Fiber/Network

Steam

Sanitary Sewer/septic

Storm Drains

Central Loop Lines

Has NOT marked the following utilities:

Domestic Water.

Reason: \_\_\_\_\_

Irrigation

Reason: \_\_\_\_\_

Natural Gas/LP

Reason: \_\_\_\_\_

Electrical/Primary

Reason: \_\_\_\_\_

Lighting

Reason: \_\_\_\_\_

Data/Phone/Fiber/Network.

Reason: \_\_\_\_\_

Steam

Reason: \_\_\_\_\_

Sanitary Sewer/septic

Reason: \_\_\_\_\_

Storm Drains

Reason: \_\_\_\_\_

Central Loop Lines

Reason: \_\_\_\_\_

#### Locate Completion:

**Init:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**\*Did Facilities Maintenance notify the One Call notification center @ 1-800-545-6005? (Texas Law requires contacting the One Call Notification Center if digging more than 16" (inches).**

Yes

No

If No, explain why:

Not Deeper than 16 inches.

If Yes, please provide the One Call ticket number:

Date: \_\_\_\_\_

Time: \_\_\_\_\_

#### \*Will One Call mark Utilities?

Yes

No

If No, provide reason:-

#### \*If Yes, Were facilities marked correctly?

Yes

No

Unknown/other

Date completed: \_\_\_\_\_

#### \*Were facility marks visible in the area of excavation?

Yes

No

**Part D – Purpose of Dig/Excavation**

**\*What Department of Tarleton State University is this for?**

IT/Telecommunications Services     Facilities Maintenance     Utilities/Control Center     Construction

Athletics     Other: List here \_\_\_\_\_

**\*Type of Excavator**

Contractor     Facilities     Municipality     Athletics     Architects     State  
 City     Utility     Engineering Firm     Data not collected      
 Unknown/Other

**\*Type(s) of Excavation Equipment**

Auger     Backhoe/Track hoe/Skid Steer     Boring     Drilling  
 Directional Drill     Explosives     Farm Equipment     Grader/Scraper  
 Hand Tools     Vacuum Equipment     Probing Device     Trencher  
 Data Not Collected     Unknown/Other

**\*Type(s) of Work Performed**

Agriculture     Blading and Lot Grade     Cable Television  
 Building Construction     Curb/Sidewalk     Building Demo  
 Drainage     Driveway     Electric  
 Engineering/Surveying     Fencing     Gas  
 Irrigation     Landscaping     Petroleum Pipeline  
 Pole Placement     Public Transit Authority     Railroad Maintenance  
 Road Work     Sewer     Site Development  
 Steam     Storm Drain/Culvert     Street Light  
 Phone     Traffic Signal     Traffic Sign  
 Fiber Optic     Water     Waterway Improvements  
 Transmission Pipeline     Data Not Collected     Unknown/Other

**Part E – Project Initiation Signatures**

**\*All Signatures required prior to dig –**

Facilities Maintenance: \_\_\_\_\_ Date: \_\_\_\_\_

TSU Risk Management: \_\_\_\_\_ Date: \_\_\_\_\_

**\*Project may commence after last signature has been received.**

**Upon signature RMS returns to Facilities Maintenance.**

**Completed form to be electronically emailed to:**

**Energy and Utilities Operations, Telecommunications, Planning, Design and Construction**

## SECTION III – INCIDENT REPORT

Contact University Control Center if utilities are damaged. This form to be completed by the Office of Risk Management and Safety.

### Part F – Excavator Downtime: Fill out this portion if necessary.

#### Did Excavator incur down time?

Yes  No  N/A

#### If yes, how much time?

Unknown  Less than 1 hour  1 to 2 hours  2 to 3 hours  More than 3 hours Exact Value \_\_\_\_\_

#### Estimated cost of down time?

Unknown  \$0 to 5000  \$5000 to 25,000  \$25,000 to 50,000  Over \$50,000 Exact Value \_\_\_\_\_

### Part G – Project Completion Section

#### \*Was there damage to a facility?

Yes (if Yes, contact RMS Immediately – Campus Ext. 9898 or 9237)  No If No, skip to section J.

(i.e. near miss)

Explanation \_\_\_\_\_

#### \*Did the damage cause an interruption in service?

Yes  No If No, skip to section J.

#### If yes, duration of interruption

Data Not Collected  Less than 1 hour  1 to 4 hrs  5 to 8 hrs  1 to 2 days  2 to 3 days

more than 3 days  Unknown Exact Value \_\_\_\_\_

#### Approximately how many customers were affected?

Zero  One  2 to 10  10 to 50  50 or more  Unknown Exact Value \_\_\_\_\_

#### Estimated cost of repair/restoration

\$ 0 to 5,000  \$5,000 to 25,000  \$25,000 to 50,000  \$50,000 or more

Unknown Exact Value \_\_\_\_\_

#### Number of people injured

Unknown  Zero  One  2 to 9  10 to 19  20 to 49  50 to 99

100 or more Exact Value \_\_\_\_\_

### Part H – Description of the Root Cause

#### \*Please choose one

Facility was not located or marked

Facility marking or location not sufficient

One call notification center error

No notification made to the one call center

Facility could not be found or located

Abandoned facility

Incorrect facility records/maps

Wrong information provided

Deteriorated facility

Notification to one call center made but not sufficient

Excavation practices not sufficient

Previous damage

Data Not Collected

None of the above. Explain: \_\_\_\_\_

# SECTION IV – UPDATE PLANS AND DRAWINGS

## Part J – Completion Data

**\*Utility Drawings were accurate:**

Yes       No. If No: Please submit original drawings and updated sketches to Director of Facilities Maintenance.

**\*\*Project Completion Signatures:**

Project Submitter: \_\_\_\_\_ Date: \_\_\_\_\_

TSU Risk Management: \_\_\_\_\_ Date: \_\_\_\_\_

Director of Facilities Maintenance/Rep: \_\_\_\_\_ Date: \_\_\_\_\_

**\*\*Project Complete when all signatures are received.**

**CC: Project Submitter, Director of Risk Management, Director of Facilities Maintenance, Director of Planning, Design, Telecommunications and Construction, & Director of Energy and Utility Operations.**

## Appendix C

### Tarleton State University Excavation Safety Plan



# TARLETON STATE UNIVERSITY

## Excavation Safety Plan

**Developed in accordance with the OSHA Safety & Health Regulations for Construction Standard, Excavations subpart P, 29 CFR 1926. 650**

### **Scope and Application**

This policy sets forth the official practices required for excavations made by Tarleton State University employees on property owned/leased by Tarleton State University.

### **Definitions**

#### **Aluminum hydraulic shoring**

An engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces), used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins for trenches that do not exceed 20 ft in depth.

#### **Benching**

A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

#### **Cave-in**

The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

#### **Competent person**

One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. A competent person should have and be able to demonstrate the following:

Training, experience, and knowledge of:

- soil analysis,
- use of protective systems, and
- requirements of 29 CFR 1926 Subpart P.

Ability to detect:

- conditions that could result in cave-ins,
- failures in protective systems,
- hazardous atmospheres, and
- other hazards including those associated with confined spaces.

Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.

### **Excavation**

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

### **Registered Professional Engineer**

A person who is registered as a professional engineer.

### **Shield (shield system)**

A structure that is able to withstand the forces imposed on it by a cave-in and thereby protects employees with the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Also known as trench box or trench shield.

### **Shoring (shoring system)**

A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

### **Sloping (sloping system)**

A method of protecting employees from cave-ins by excavating to form sides of an excavation that is inclined away from the excavation so as to prevent cave-ins. The angle of incline varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

## **Surcharging**

An excessive vertical load or weight caused by spoil, overburden, vehicles, equipment, or activities that may affect trench stability.

## **Trench (trench excavation)**

A narrow excavation (in relation to its length) made below the surface of the ground, in general, the depth is greater than the width, but the width of a trench is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less, the excavation is also considered to be a trench.

## **General Requirements:**

All excavations shall be made in accordance with the rules, regulations, requirements, and guidelines set forth in the Occupational Safety and Health Administration's standard on Excavations, 29 CFR 1926.650, .651, and .652, except where otherwise noted below.

## **Procedures**

A competent person will be placed in charge of all excavations. Underground utilities must be located and marked before excavation begins. Employees are not allowed in the excavation while heavy equipment is digging.

## **Inspections**

The competent person shall conduct inspections and be on-site when personnel will enter the excavation:

- Daily and before the start of each shift.
- As dictated by the work being done in the trench.
- After every rain storm.
- After other events that could increase hazards, such as a snowstorm, windstorm, thaw, earthquake, dramatic change in weather, etc.
- 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.

(For excavations 4 feet or greater in depth, an Excavation Safety Site Inspection Form, Appendix D shall be filled out for each inspection.)

## Soil Types

**Type A (most stable)** - Clay, silty clay, and hardpan (resists penetration). No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, or has seeping water.

**Type B (medium stability)** - Silt, sandy loam, medium clay and unstable dry rock; previously disturbed soils unless otherwise classified as Type C; soils that meet the requirements of Type A soil, but are fissured or subject to vibration.

**Type C (least stable)** - Gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock, and soil from which water is freely seeping.

**Layered geological strata (where soils are configured in layers)** - The soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e., where a Type C soil rests on top of stable rock.

Because most excavations on Tarleton property will be conducted in order to repair / replace existing pipelines or equipment (i.e., the soil has been previously disturbed), **excavations shall be made to meet the requirements for Type B or Type C soils only**, as appropriate.

## Testing Methods

The competent person in charge of the excavation shall be responsible for determining whether the soil is Type B or C. If the competent person wants to classify the soil as Type C, no testing is needed. However, tests must be conducted to determine if the soil can be classified as Type B. To do this, the competent person shall use a visual test coupled with one or more manual tests.

- **Visual Test**

In addition to checking the items on the trench inspection form, the competent person should perform a **visual test** to evaluate the conditions around the site. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. The competent person also checks for any signs of vibration.

During the visual test, the competent person should check for crack-line openings along the failure zone that would indicate tension cracks, look for existing utilities that indicate that the soil has been previously disturbed, and if so, what sort of backfill was used and observe the open side of the excavation for indications of layered geologic structuring.

This person should also look for signs of bulging, boiling, or sloughing, as well as for signs of surface water seeping from the sides of the excavation or from the water table.

In addition, the area adjacent to the excavation should be checked for signs of foundations or other intrusions into the failure zone, and the evaluator should check for surcharging and the spoil distance from the edge of the excavation.

- **Manual Tests**

### **Thumb Penetration Test**

Attempt to press the thumb firmly into the soil in question. If the thumb penetrates no further than the length of the nail, it is probably Type B soil. If the thumb penetrates the full length of the thumb, it is Type C. It should be noted that the thumb penetration test is the **least accurate testing method.**

### **Dry Strength Test**

Take a sample of dry soil. If it crumbles freely or with moderate pressure into individual grains, it is considered granular (Type C). Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can only be broken with difficulty), it is probably clay in combination with gravel, sand, or silt (Type B).

### **Plasticity or Wet Thread Test**

Take a moist sample of the soil. Mold it into a ball and then attempt to roll it into a thin thread approximately 1/8 inch in diameter by two inches in length. If the soil sample does not break when held by one end, it may be considered Type B.

A pocket penetrometer, shearvane, or torvane may also be used to determine the unconfined compression strength of soils.

### **Spoil**

**Temporary spoil** shall be placed no closer than 2 feet from the surface edge of the excavation, 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 workers in the trench.

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.

**Permanent spoil** should be placed some distance from the excavation.

### **Surface Crossing of Trenches**

Surface crossing of trenches should not be made unless absolutely necessary. However, if necessary, they are only permitted under the following conditions:

**Vehicle crossings** must be designed by and installed under the supervision of a registered professional engineer.

**Walkways or bridges must:**

- have a minimum clear width of 20 inches,
- be fitted with standard rails, and
- extend a minimum of 24 inches past the surface edge of the trench.

**Ingress and Egress**

Trenches 4 feet or more in depth shall be provided with a fixed means of egress.

Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 feet laterally to the nearest means of egress.

Ladders must be secured and extend a minimum of 36 inches above the landing.

Metal ladders should not be used when electric utilities are present.

**Exposure to Vehicles**

Workers 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**

All workers on an excavation site must wear hard hats.

Workers are not allowed in the excavation while heavy equipment is digging.

Workers are not allowed to work under raised loads.

Workers are not allowed to work under loads being lifted or moved by heavy equipment used for digging or lifting.

Workers are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.

Equipment operators or truck drivers may remain in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.

## **Warning Systems for Mobile Equipment**

The following steps should be taken to prevent vehicles from accidentally falling into the trench:

- **Barricades** must be installed where necessary,
- **Hand or mechanical signals** must be used as required,
- **Trenches left open overnight** shall be fenced and barricaded.

## **Hazardous Atmospheres and Confined Spaces**

Workers shall not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with:

- less than 19.5% oxygen,
- a combustible gas concentration greater than 20% of the lower flammable limit, and
- concentrations of hazardous substances that exceed those specified in the Threshold Limit Values for airborne contaminants established by the ACGIH.

All operations involving such atmospheres must be conducted in accordance with OSHA requirements for occupational health and environmental controls for personal protective equipment and for lifesaving equipment. Engineering controls (such as ventilation) and respiratory equipment may be required.

## **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 was crossed by, was adjacent to, or contained pipelines containing a hazardous material (for example, natural gas lines).

Testing should be conducted before workers 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.

Testing frequency should also be increased if welding, cutting, or burning is done in the trench.

Workers required to wear respiratory protection must be trained, fit-tested, and enrolled in a respiratory protection program.

Some trenches qualify as confined spaces. When this occurs, compliance with Tarleton's Confined Space Program is also required.

## **Standing Water and Water Accumulation**

Methods for controlling standing water and water accumulation must be provided and should consist of the following if employees must work in the excavation:

- Use of special support or shield systems approved by a registered professional engineer.
- Water removal equipment, such as pumps, used and monitored by a competent person.
- Workers removed from the trench during rainstorms.
- Trenches carefully inspected by a competent person after each rain and before workers are permitted to re-enter the trench.

## **Benching, Sloping, Shoring, and Shielding Requirements**

**All excavations or trenches 4 feet or greater in depth shall be appropriately benched, shored, or sloped according to the procedures and requirements set forth in OSHA's Excavation standard, 29 CFR 1926.650, .651, and .652.**

**Excavations or trenches 20 feet deep or greater must have a protective system designed by a registered professional engineer.**

Excavations under the base of footing of a foundation or wall require a support system designed by a registered professional engineer.

Sidewalks and pavement shall not be undermined unless a support system or another method of protection is provided to protect employees from their possible collapse.

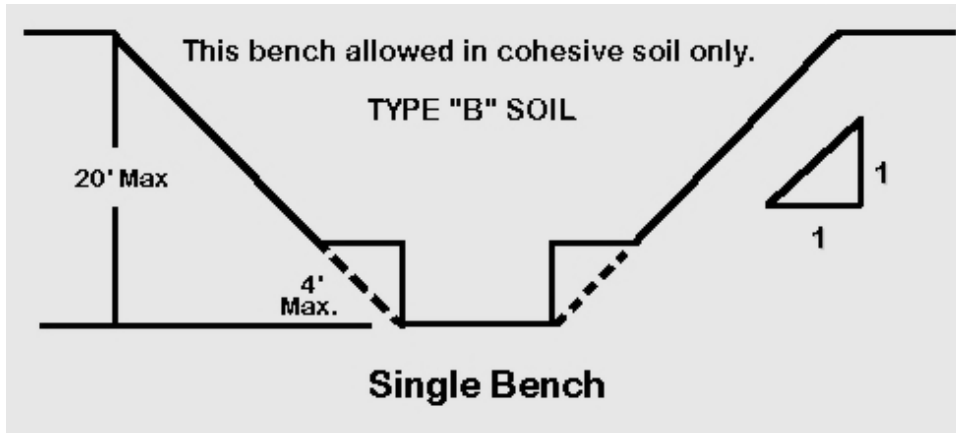
### **Benching**

There are two basic types of benching: single and multiple, which can be used in conjunction with sloping.

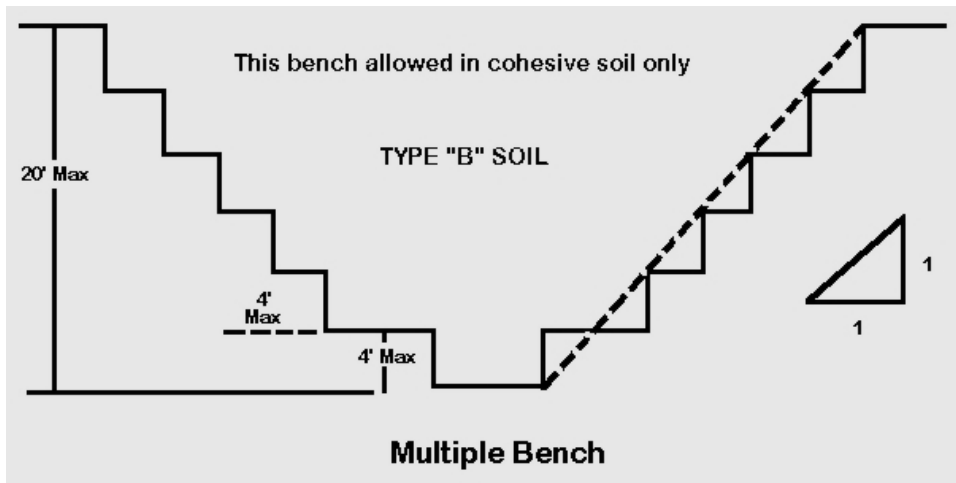
[See example of benching in Type B soil:](#)

All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

### Single Bench



### Multiple Bench



In Type B soil, the vertical height of the benches must not exceed 4 feet. Benches must be below the maximum allowable slope for that soil type. In other words, a 10-foot deep trench in Type B soil must be benched back 10 feet in each direction, with the maximum of a 45-degree angle.

***\*\*\*Benching is not allowed in Type C soil\*\*\****

### Sloping

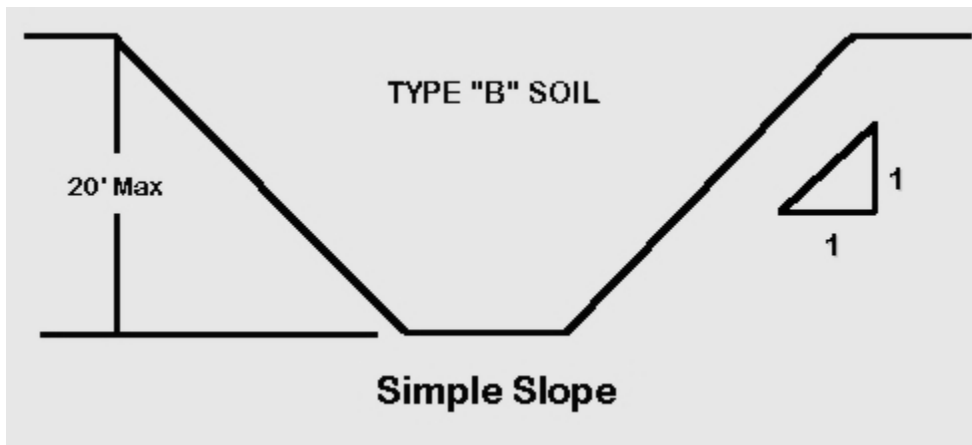
Maximum allowable slopes for excavations less than 20 feet based on soil type and angle to the horizontal are as follows:

<u>Soil Type</u>	<u>Height/depth ratio</u>	<u>Slope angle</u>
Type B	1:1	45 degrees
Type C	1 1/2:1	34 degrees

A 10-foot-deep trench in Type B soil would have to be sloped to a 45-degree angle, or sloped 10 feet back in both directions. Total distance across a 10-foot-deep trench would be 20 feet, plus the width of the bottom of the trench itself. In Type C soil, the trench would be sloped at a 34-degree angle, or 15 feet back in both directions for at least 30 feet across, plus the width of the bottom of the trench itself.

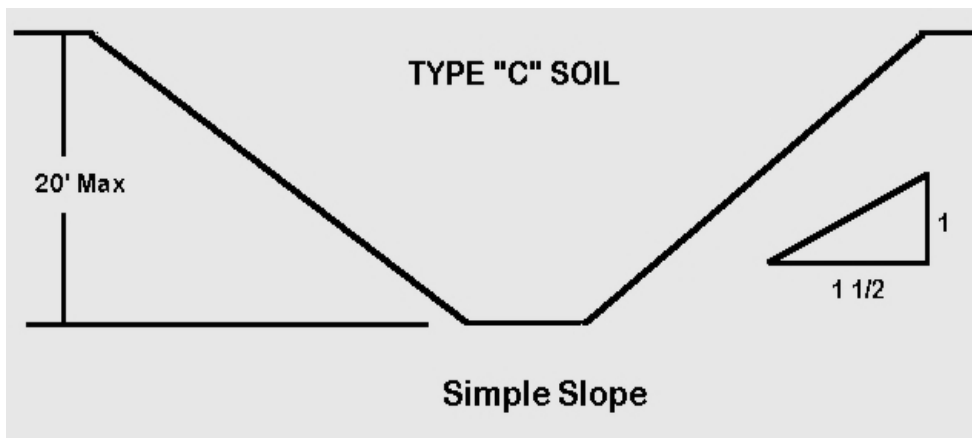
See examples of simple slope trenching in B and C type soils:

### Type B Soil



### Type C Soil

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



## Shoring

Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical.

Because the TSU Physical Plant has access to aluminum hydraulic shores, they will be the focus of this section. Hydraulic shoring provides a critical safety advantage because workers do not have to enter the trench to install them. They are also light enough to be installed by one worker. This shoring is gauge-regulated to ensure even distribution of pressure along the trench line and can be adapted easily to various trench depths and widths. All shoring shall be installed from the top down and removed from the bottom up.

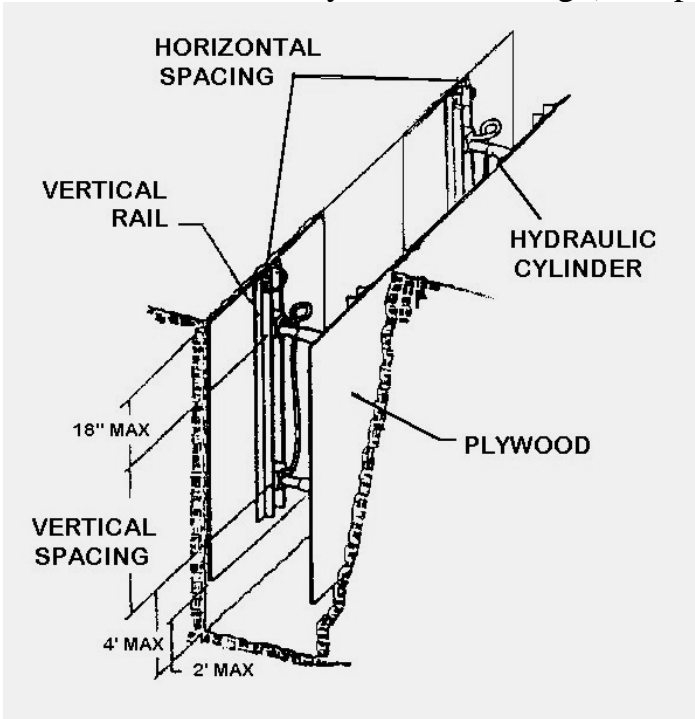
Hydraulic shoring shall be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.

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.)*

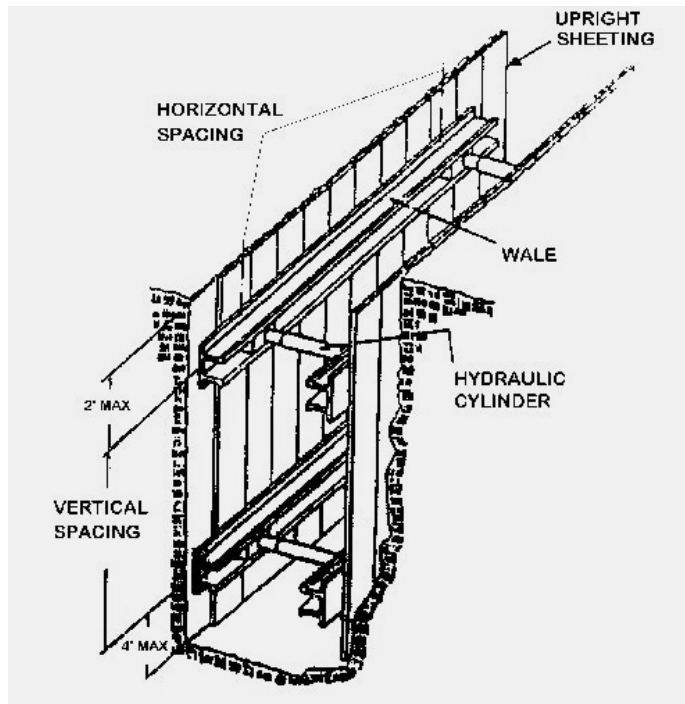
Wales (horizontal cross beams) are installed no more than two feet from the top and no more than four feet from the bottom. When placed vertically, beams (uprights) must no more than four feet apart. When using three or more vertical shores, they must be evenly spaced and must be used to form a system of shores.

**Examples of aluminum hydraulic shoring:**

**Vertical Aluminum Hydraulic Shoring (with plywood)**



## Horizontal (wales) Aluminum Hydraulic Shoring--typical system



### Shielding

Trench boxes are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar incidents.

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 must be backfilled to prevent lateral movement of the box.** Shields may not be subjected to loads exceeding those which the system was designed to withstand.

Trench boxes are generally used in open areas, but they also 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.

Any modifications to the shields must be approved by the manufacturer.

Shields may ride 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 shield in a protected manner, such as by a ladder or ramp.

Workers may not remain in the shield while it is being moved.

**Examples of shielding systems:**



## Appendix D

### Tarleton State University Excavation Safety Site Inspection Form

## EXCAVATION SAFETY INSPECTION FORM

LOCATION:				DATE:	
TIME OF INSPECTION(S)					
WEATHER CONDITIONS:				APPROX. TEMP.:	
SUPERVISOR:			COMPETENT PERSON:		
<b>DIMENSIONS:</b>		<b>DEPTH =</b>		<b>Yes No HAZARDOUS CONDITIONS</b>	
	TOP =	W	L	<input type="checkbox"/>	<input type="checkbox"/> Saturated soil / standing or seeping water
	BOTTOM =	W	L	<input type="checkbox"/>	<input type="checkbox"/> Cracked or fissured wall(s)
<b>SOIL TYPE:</b>		<b>TESTED:</b>		<input type="checkbox"/>	<input type="checkbox"/> Bulging wall(s)
<input type="checkbox"/> Solid rock (most stable)		<input type="checkbox"/> Yes		<input type="checkbox"/>	<input type="checkbox"/> Floor heaving
<input type="checkbox"/> Average soil		<input type="checkbox"/> No		<input type="checkbox"/>	<input type="checkbox"/> Frozen soil
<input type="checkbox"/> Fill material				<input type="checkbox"/>	<input type="checkbox"/> Super-imposed loads
<input type="checkbox"/> Loose sand				<input type="checkbox"/>	<input type="checkbox"/> Vibration
				<input type="checkbox"/>	<input type="checkbox"/> Depth greater than 10'
<b>PROTECTION METHODS:</b>			<b>PLACEMENT OF SPOILS &amp; EQUIPMENT</b>		
<i>(Walls MUST be vertical—NO voids)</i>			<input type="checkbox"/>	<input type="checkbox"/>	Spoils at least 2 feet from edge of trench
<b>SHORING</b>			<input type="checkbox"/>	<input type="checkbox"/>	Equipment at least 2 feet from edge
<input type="checkbox"/> Timber			<input type="checkbox"/>	<input type="checkbox"/>	Backhoe at end of trench
<input type="checkbox"/> Pneumatic			<input type="checkbox"/>	<input type="checkbox"/>	Compressor, etc. at remote location
<input type="checkbox"/> Hydraulic			<b>LADDER LOCATION</b>		
<input type="checkbox"/> Screw Jacks			<input type="checkbox"/>	<input type="checkbox"/>	Located in protected area
<input type="checkbox"/> Trench Shield			<input type="checkbox"/>	<input type="checkbox"/>	Within 25 feet of safe travel
<b>UNEVEN, IRREGULAR WALLS</b>			<input type="checkbox"/>	<input type="checkbox"/>	Secured
<input type="checkbox"/> Trench Box			<input type="checkbox"/>	<input type="checkbox"/>	Extends 36 inches above the landing
Sloping: q 1:1 (45°)      q 1 ½:1 (34°)			<input type="checkbox"/>	<input type="checkbox"/>	Leads to safe landing
<b>Yes No ENVIRONMENTAL CONDITIONS:</b>			<b>OTHER:</b>		
<input type="checkbox"/>	<input type="checkbox"/>	Gas detector used?		<input type="checkbox"/>	<input type="checkbox"/> Shoring equipment inspected prior to use?
<input type="checkbox"/>	<input type="checkbox"/>	Confined space permit issued?		<input type="checkbox"/>	<input type="checkbox"/> Is trench SAFE to enter?
COMMENTS:					
				Work Order #	
<b>N O T E</b>	All unsafe conditions must be corrected prior to trench entry. If any hazardous conditions are observed, the trench must be immediately evacuated and no one allowed to re-enter until corrective action has been taken.			TO BE FILLED OUT BY RMS PERSONNEL	
				Excavation Entry Authorized By: _____ RMS Inspector	