Excavation and Trenching Implementation Plan 360-IP

April 2008

Overview

Purpose

This document provides a sample excavation and trenching implementation plan that Devon Operating Divisions and Corporate Business Departments may utilize to comply with Devon's *Excavation and Trenching Standard*.

Scope

Excavation and trenching work can present a serious hazard to all workers involved. This document provides the practices and procedures necessary to adequately control the hazards associated with excavations to protect employees and contractors.

Important: If the Operating Division or Corporate Department's Program deviates from the Implementation Plan, the reason for change must be justified and approved by the Senior Vice President or their designee.

Reference: For additional information on implementing EHS Standards see the *Corporate Standard to Division Procedure Process* available on Access Devon.

Contents

This document contains the following topics:

Responsibilities

Competent Person Responsibilities

A Competent Person is assigned to all excavations 4 feet or greater in depth and, as determined by the PIC, to excavations less than 4 feet, that will be entered by personnel and is responsible for

- planning and supervising all excavation and trenching activities
- identifying soil types and benching, sloping, shoring, and shielding requirements
  Reference: For more information, see the topics, Soil Types, and Benching, Sloping, Shoring, and Shielding Requirements, later in this document.
- briefing excavation and trenching personnel on the hazards and methods of removing or controlling hazards as part of a Pre-Job Safety Meeting prior to entering an excavation or trench, and
- conducting and documenting
  – daily inspections of the work site and all excavations before the work starts to verify the necessary precautions have been taken, and
  – additional inspections when work scope and/or conditions change.

Document inspections on the *Excavation Inspection Report Form*.

Note: All excavation and trenching work associated with DOT lines will be done by qualified individuals or observed by an individual that is qualified.

Person In Charge Responsibilities

The Person In Charge (PIC) is responsible for conducting work site inspections with sufficient frequency to verify compliance with

- this implementation plan, and
- the Devon *Excavation and Trenching Standard*.

Contractor Responsibilities

Contractors will

- have a program that meets or exceeds Devon's *Excavation and Trenching Standard*
- provide their workers with all the necessary materials and training to comply with the Contractor's Excavation and Trenching program, and
- ensure that their subcontractors comply with Contractor's Excavation and Trenching program.

Pre-Job Hazard Assessment

Pre-Job Requirements

A Pre-Job Hazard Assessment shall

- be completed for all excavation and trenching activities
- identify if excavation activities will involve personnel entering an excavation 4 feet or greater in depth and require a Competent Person be assigned
- identify if excavation activities will involve personnel entering an excavation less than 4 feet in depth to perform tasks where the hazards and risks warrant the need for a Competent Person, and
- include a review of the Area Emergency Response Procedures and Emergency Contact List.
  Note: The Area Emergency Response Procedures and Emergency Contact List shall be available at the work site.

Conducting the Pre-Job Hazard Assessment

The Pre-Job Hazard Assessment should consider the following hazards:

- affects of nearby vehicle and mobile equipment traffic, both public and private
- affects of nearby surface encumbrances
  Example: Sidewalks, roads, buildings, trees, boulders, etc., may be unstable due to excavation and may cause a cave in or fall into the excavation.
- type of work to be performed, hazards, and risks if personnel are to enter an excavation
- soil stability and risk of cave-ins
  Reference: For more information, see Excavation Inspection and Briefing Prior to Entering an Excavation or Trench, later in this document.
- surface and ground water
- hazardous atmospheres
- overhead, underground utilities, and adjacent structures, and
- potential weather effects during the period of excavation.

Pre-Job Hazard Assessments shall be performed daily and when changes in work conditions warrant a re-assessment.

Note: Excavation being performed by dozer operations will be required to call local One-Call system and follow state specific procedures before beginning excavation work. A pre-job hazard assessment will determine the need to apply the other elements of this Excavation and Trenching Implementation Plan to dozer operations.

Pre-Job Safety Meeting Form

Use a *Pre-Job Safety Meeting Form* to document the

- completion of the Pre-Job Hazard Assessment, and
- review of the assessment with all employees and contractors involved.

Assignment of a Competent Person for Excavations 4 Feet or Greater in Depth

Competent Person Assignment	The PIC shall assign a Competent Person to all excavations 4 feet or greater in depth when personnel are to enter the excavation. **Note**: For dozer operations please see the note on page 3.

Assessment of Hazards and Risks for Excavations less than 4 Feet in Depth

Hazard and Risk Assessment for Shallow Excavations

For all excavations less than 4 feet in depth that will be entered by personnel, the PIC shall assess hazards and risks and make a determination that a Competent Person is not needed. This shall be documented by the PIC on the *Pre-Job Safety Meeting Form*.

Example: A trench or a relatively narrow excavation in unconsolidated soils of only 3 feet in depth may pose a cave in hazard for individuals that need to perform work in the excavation below ground level, such as laying or kneeling down to perform welding, cutting, or pipe-fitting. In this case, the PIC would determine that a Competent Person is necessary to determine that the work can safely be performed.

One-Call Notification

One-Call Notification Requirements

The Excavator must call the local One-Call system and following state-specific procedures before beginning excavation or trenching work.

Before all excavations the One-Call notification must be made at least 48 hours (i.e., 2 sequential days within a Monday thru Friday work week), except for emergencies where notice is made as soon as possible.

Devon personnel and other utilities notified through the One-Call process shall identify and mark underground hazards.

Example: Buried pipes, cables, foundations, etc.

Exposing Underground Pipelines and Installations

Expose underground pipelines and other installations by a safe and acceptable method and perform the following precautionary steps, where applicable:

No.	Topic	Description
1	Marking Preservation	The Excavator • shall protect and preserve the staking, marking, or other designations for underground facilities until no longer required for proper and safe excavation, and • stops excavating and notifies the one-call center for re-marks if any facility mark is removed or no longer visible.
2	Excavation Observer	The Excavator has an observer to assist the equipment operator when operating excavation equipment around known underground facilities.
3	Excavation Tolerance Zone	The Excavator observes a tolerance zone which is comprised of the width of the facility plus 18 inches on either side of the outside edge of the underground facility on a horizontal plane. **Note**: This practice is not intended to preempt any existing state/provincial requirements that currently specify more than 18 inches.
4	Excavation within Tolerance Zone	When excavation is to take place within the specified tolerance zone the Excavator exercises such reasonable care as may be necessary for the protection of any underground facility in or near the excavation area based on certain climate or geographical conditions, methods to consider include • hand digging when practical (pot holing) • soft digging • vacuum excavation methods • pneumatic hand tools • other mechanical methods with the approval of the facility owner/operator, or • other technical methods that may be developed. **Note:** Hand digging and non-invasive methods are not required for pavement removal.

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One-Call Notification, Continued

No.	Topic	Description
5	Miss-Marked Facilities	The Excavator • notifies the facility owner/operator directly or through the one-call system if an underground facility is not found where one has been marked or if an unmarked underground facility is found, and • may continue to work following this notification, if the excavation can be performed without damaging the facility, unless specified otherwise in state/provincial law.
6	Exposed Facility Protection	While the excavation is open, underground installations shall be properly supported or removed to safe guard personnel and prevent damage.
7	Locate Request Updates	The Excavator calls the One-Call center to refresh the ticket when excavation continues past the life of the ticket (sometimes, but not always, defined by state/provincial law). **Note**: This recognizes that it is a best practice to define ticket life. If not currently defined in state/provincial law, ticket life would best be 10 working days but not to exceed 20 working days.
8	Facility Damage Notification	An Excavator discovering or causing damage to underground facilities • notifies the facility owner/operator and the One-Call center, and • reports all breaks, leaks, nicks, dents, gouges, groves, or other damages to facility lines, conduits, coatings or cathodic protections.
9	Notification of Emergency Personnel	If the damage results in the escape of any flammable, toxic, or corrosive gas or liquid or endangers life, health, or property, the excavator must immediately shut down the excavation work and is responsible to • immediately notify 911 and the facility owner/operator, and • take reasonable measures to protect themselves and those in immediate danger, general public, property, and the environment until the facility owner/operator or emergency responders have arrived and completed their assessment.
10	Emergency Excavation	In the case of an emergency excavation, maintenance or repairs may be made immediately provided that the Excavator notifies the One-Call center and facility owner/operator as soon as reasonably possible. **Note**: This includes situations that involve danger to life, health or property, or that require immediate correction in order to continue the operation of or to assure the continuity of public utility service or public transportation.
11	Backfilling	The Excavator protects all facilities from damage when backfilling an excavation. **Important**: Do not bury in the excavation any trash, debris, coiled wire, or other material that could damage existing facilities or interfere with the accuracy of future locates.
12	As-Built Documentation	Contractors installing underground facilities notify the Facility Owner/Operator if the actual placement is different from expected placement.
13	Trenchless Excavation	All Stakeholders adhere to all Best Practices and the general guidelines included in the practice description prior to, during, and after any trenchless excavation (as applicable).

Provisions for Identifying & Mitigating Overhead or Adjacent Hazards

Overhead Hazards

All overhead lines in the vicinity of the trenching and excavation activity must be identified and hazard assessed. Except where electrical distribution and transmission lines have been de-energized and visibly grounded at the point of work or where insulating barriers, not part of or an attachment to equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

- For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet
- For lines rated over 50 kV., minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1kV. over 50 kV or twice the length of the line insulator, but never less than 10 feet, and
- A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.

All powered overhead electrical lines shall be considered to be an energized line until authorities indicate that it is not an energized line and it is has been visibly grounded.

Adjacent Structures

Excavations adjacent to structures, such as buildings or concrete slabs, will be planned or reviewed by a registered professional engineer before work begins.

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 protection of the employees.

Elimination of Exposure to Vehicles or Falling Loads

Elimination of Exposure to Vehicles or Falling Loads

Use the table below to eliminate exposure to vehicles or falling loads.

No.	Topic	Action
1	Exposure to Vehicles	• Keep all heavy equipment as far from the excavation as reasonably possible (especially when personnel are in the excavation), and • Provide and require personnel exposed to vehicular traffic on public roadways with – reflective vests, or – other suitable garments marked with or made of highly visible materials.
2	Warning Systems for Mobile Equipment	• Install barricades, cones, warning flashers, and signs where necessary in public areas or near roadways, and • Use hand or mechanical signals, as required.
3	Exposure to Falling Loads	All personnel on an excavation site must • wear the required hard hats, safety toed footwear, and safety glasses • not work under loads being lifted or moved by heavy equipment used for digging or lifting, and • stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.

Provisions for Ingress/Egress of Personnel

Provisions for Ingress/Egress of Personnel

All trenches, 4 feet or more in depth, shall be provided with a means of ingress/egress including

- spacing between ladders, ramps 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
- ramps must be sloped so that entry and exit can be accomplished standing upright without using your hands for assistance, and
- ladders must be stable and extend a minimum of 36 inches above the landing.

Important: Do not use metal ladders when electric utilities are present.

Procedures for Gas or Water Accumulation

Gas Accumulation

Some work situations may result in gas, crude oil, or condensate being present in the excavation. The following actions should be taken:

- take appropriate measures to reduce the risk of accidental ignition of flammable gases by providing for
  - adequate ventilation in the excavation, and
  - the proper containment and disposal of condensate/crude spills and/or iron sulfide released, and
- determine if confined space procedures must be utilized.

Reference: For additional detail, review the topic, Procedures to Meet Atmospheric Testing Requirements, next in this document.

Actions to be Taken for Oxygen Deficient or Hazardous Atmospheres

The following actions shall be taken where there is the risk of an oxygen deficient (<19.5% oxygen) or hazardous atmosphere in any 4-foot deep or greater trench or excavation before any person may enter:

- adequate precautions such as ventilation or respiratory protection shall be taken to address the atmosphere concerns,
- testing shall be conducted as often as necessary to ensure personnel safety,
- rescue equipment shall be readily available during work in a trench or excavation where there are atmosphere concerns, and
- life lines shall be worn by personnel entering bell-bottom pier holes, or other deep and confining footing excavations.

Standing Water and Water Accumulation

Personnel shall not work in excavations in which there is accumulated water, unless adequate precautions have been taken to protect the person.

Use 1 or more of the following methods to control standing water and water accumulation if personnel must work in the excavation:

Method	Description
1	Remove personnel from the trench during rainstorms.
2	Have a Competent Person carefully inspect trenches after each rain and before personnel are permitted to re-enter the trench.
3	Use water removal or diversion equipment during operations to prevent and/or remove water accumulation in excavations. **Examples:** Water removal/diversion equipment includes pumps, ditches, dikes, sand pits, and other methods. **Important:** Water removal and diversion equipment must be used and monitored by a Competent Person.
4	Use special support or shield systems approved by a Registered Professional Engineer if significant water accumulation cannot be otherwise controlled.

Procedures to Meet Atmospheric Testing Requirements

Hazardous Atmospheres and Confined Spaces

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

Such atmospheres include those with

- less than 19.5 percent oxygen
- a combustible gas concentration greater than 10 percent of the lower flammable limit, or
- hazardous substances exceeding the Permissible Exposure Limit (PEL).
  Example: H_2S

When to Test for Hazardous Atmospheres

If there is any possibility that a 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 crossed by, adjacent to, or contained pipelines containing a hazardous material (for example, natural gas lines).

Conduct testing

- before personnel enter the trench, and
- continuously while occupying the trench.

Reason: Testing ensures the trench remains safe.

Excavation Inspection and Briefing Prior to Entering an Excavation or Trench

Who Performs Inspections and Briefings

A Competent Person performs inspections for any excavations 4 feet or greater in depth that will be entered by personnel and briefs excavation and trenching personnel on the hazards and methods of removing or controlling hazards. A Competent Person may also be required to inspect excavations less than 4 feet in depth that will be entered by personnel.

Reference: For details of a Competent Person, see the topic Responsibilities, earlier in this document.

When to Perform Inspections

Perform excavation inspections

- daily and before the start of each shift
- as dictated by the work being done in the trench
- after every rainstorm
- after other events that could increase hazards, such as 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, and
- when there is
  - a change in the size, location, or placement of the spoil pile, and
  - any indication of change or movement in adjacent structures.

Spoil

Follow the requirements in the table below for placement of the excavation spoil.

No.	Requirements
1	Place the temporary spoil no closer than 2 feet from the surface edge of the excavation (measure from the nearest base of the spoil to the cut). **Note**: This distance should not be measured from the crown of the spoil deposit, and requirement ensures that loose rock or soil from the temporary spoil will not fall on personnel in the trench.
2	Place spoil so that it • channels rainwater and other run-off water away from the excavation, and • cannot accidentally run, slide, or fall back into the excavation.

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Excavation Inspection and Briefing Prior to Entering an Excavation or Trench, Continued

Surface Crossing of Trenches

Surface crossing of trenches should not be made unless absolutely necessary.

If necessary, they are only permitted under the following conditions:

- design and install vehicle crossings under the supervision of a Registered Professional Engineer
- provide walkways where personnel or equipment are required or permitted to cross over excavations, and
- provide guardrails where walkways are 6 feet or more above lower levels.

Safety Conditions

The following safety conditions shall be observed when excavating and/or working in excavations:

- prior to the start of work
  - faces of the excavation shall be scaled to remove any loose material, and
  - other material shall be effectively stored and retained at least 2 feet or more from the edge of the excavation, and
- personnel are not allowed under loads handled by digging or lifting equipment.

Important: Personnel shall not be in the trench when digging with heavy equipment is taking place nearby.

Briefings

The Competent Person assigned to the excavation will brief personnel following the excavation inspection on the hazards and methods of removing or controlling them. This briefing will be conducted as part of the Pre-Job Safety Meeting prior to entering an excavation or trench.

Excavation Inspection Report

Use an *Excavation Inspection Report Form* to document excavation inspections.

Keep completed inspection forms for 1 year and available for annual review.

Excavation and Trenching Training

Devon Excavation Training Requirements	Personnel who work near/in excavations must successfully complete Devon Excavation Safety training.
Competent Person Training Program	Individuals designated as Competent Person must successfully complete a Company approved Competent Person training program designed to instruct the employee on • OSHA excavation regulations • State-specific one-call regulations • planning, conducting, monitoring, and overseeing excavations • identifying and classifying soil conditions, and • recognizing safety and environmental hazards relating to excavation activities.
Contractors	Contractors and their subcontractors must ensure their personnel are trained to safely perform the tasks assigned to them.

Compliance Verification

Compliance Verification	Compliance with Devon's *Excavation and Trenching Standard* and this implementation plan will be verified annually during the Supervisor or PIC annual EHS review.
Person in Charge Responsibilities	The PIC is responsible for conducting work site inspections with sufficient frequency to verify compliance with • this implementation plan, and • the Devon *Excavation and Trenching Standard*.

Competent Person Responsibilities – Planning and Supervising

Competent Person Responsibilities

A Competent Person assigned to excavation is responsible for

- planning and supervising all excavation and trenching activities
- identifying soil types and benching, sloping, shoring, and shielding requirements
- briefing excavation and trenching personnel on the hazards and methods of removing or controlling hazards as part of a Pre-Job Safety Meeting prior to entering an excavation or trench, and
- conducting and documenting
  - daily inspections of the work site and all excavations before the work starts to verify the necessary precautions have been taken, and
  - additional inspections when work scope and/or conditions change.

Document inspections on the *Excavation Inspection Report Form*.

Note: A Competent Person may be required for excavations relatively shallow in depth depending on the work to be performed and the hazards that may exist.

Competent Person Responsibilities - Soil Types and Soil Testing

Stable Rock

Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed.

Type A Soil

Cohesive soil with an unconfined compression strength of 1.5 tons/ft^2 (tsf) or greater.

Examples: Type A Soil includes clay, silty clay, sandy clay, clay loam, caliche and hardpan.

Exceptions: Not Type A Soil if
- the soil is fissured
- the soil is subject to vibration
- the soil has been previously disturbed
- the soil is a layered system in which layers dip into the excavation at a slope of 4 horizontal to 1 vertical or greater, or
- other factors would classify it as a less stable material.

Type B Soil

Cohesive soil with an unconfined compressive strength greater than .5 tsf but less than 1.5 tsf.

Examples: Type B Soils are listed below
- angular gravel (crushed rock), silt, silt loam, sandy loam
- previously disturbed soil except when it is determined to be Type C soil
- soils subjected to vibration and fissures
- dry rock which is not stable, or
- layered systems in which layers dip into an excavation on a slope less than 4 horizontal to 1 vertical, but only if the material would be classified as a Type B soil.

Type C Soil

Cohesive soil with an unconfined compressive strength of 0.5 tsf or less.

Examples: Type C Soils are listed below
- granular soils including gravel, sand and loamy sand
- submerged soil or soil from which water is freely seeping
- submerged rock that is not stable, or
- layered systems in which the layers dip into an excavation or a slope of 4 horizontal to 1 vertical or greater.

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Competent Person Responsibilities - Soil Types and Soil Testing, Continued

Competent Person Responsibilities

The Competent Person supervising the excavation will be responsible for determining whether the soil is type A, B or C.

If the Competent Person wants to classify the soil as

- Type A or B, tests must be conducted using a visual test coupled with 1 or more manual tests, and
- Type C, they do not need to do any test.

Visual Test

The Competent Person follows the steps in the table below to perform a visual test to evaluate the conditions around the site.

Step	Action
1	Checks the items on the *Excavation Inspection Form*.
2	Observe the entire excavation site including the soil adjacent to the site and the soil being excavated.
3	Check for any signs of vibration.
4	Check for crack-line openings along the failure zone that would indicate tension cracks.
5	Look for existing utilities that indicate that the soil has been previously disturbed, and if so, what sort of backfill was used.
6	Observe the open side of the excavation for indications of layered geological structuring.
7	Look for signs of • bulging, boiling, or sloughing, and • surface water seeping from the sides of the excavation or from the water table.
8	Check the area adjacent to the excavation for • signs of foundations, or • other intrusions into the failure zone.
9	Check for surcharging and the spoil distance from the edge of the excavation.

Manual Test

The table below describes the various manual tests to be conducted by a Competent Person.

Test Type	Description
Compression Strength Test	Estimate the unconfined compressive strength of the soil by using • a pocket penetrometer, or • a hand operated shear vane.
Plasticity Test	Take a moist sample of soil • mold it into a ball • attempt to roll it into thin threads approximately 1/8 inch in diameter by 2 inches in length, and • if the soil sample does not break when held by 1 end, it may be considered Type B.

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Competent Person Responsibilities - Soil Types and Soil Testing, Continued

<table>
<tr><th>Test Type</th><th>Description</th></tr>
<tr><td>Dry Strength Test</td><td>Take a sample of dry soil, and use the table below to determine the soil type.
<table>
<tr><th>If the dry soil …</th><th>Then the soil …</th></tr>
<tr><td>crumbles freely or with moderate pressure into individual grains</td><td>is considered granular (Type C).</td></tr>
<tr><td>falls into clumps, but the smaller clumps can only be broken with difficulty</td><td>is probably clay in combination with gravel, sand, or silt (Type B).</td></tr>
<tr><td>breaks into clumps but does not break into smaller clumps, and the soil is not fissured</td><td>may be considered unfissured.</td></tr>
</table></td></tr>
<tr><td>Thumb Penetration Test</td><td>• Take an undisturbed soil sample (a large clump of soil) as soon as practicable after the excavation to keep to a minimum the effects of exposure to drying influences press the thumb into the clump of soil, and use the table below to determine the soil type.
<table>
<tr><th>If the soil sample can be …</th><th>Then the soil is …</th></tr>
<tr><td>indented by the thumb, but only penetrated with a great effort</td><td>Type A.</td></tr>
<tr><td>penetrated several inches by the thumb and can be molded by light finger pressure</td><td>Type C.</td></tr>
</table>
Important: If the excavation is later exposed to wetting influences, the classification of the soil must be changed accordingly.</td></tr>
</table>

After Completing Visual or Manual Testing

Upon completion of the visual and manual testing of the soil, compare the results to the definitions for determination of the soil type.

Competent Person Responsibilities - Benching, Sloping, Shoring, and Shielding Requirements

Benching, Sloping, Shoring, and Shielding Requirements

The table below describes benching, sloping, shoring, and shielding requirements.

Note: Install support systems from the top down and remove from the bottom up.

Excavation Type	Description of Requirements
All excavations or trenches 4 feet or greater in depth	Requires benching, shoring, or sloping 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	Requires a protective system designed by a Registered Professional Engineer.
Excavations under the base of footing of a foundation or wall	Requires a support system designed by a Registered Professional Engineer.
Sidewalks and pavement	Do not undermine unless a support system or another method of protection is provided to protect personnel from their possible collapse.

Benching

The 2 types of basic benching are single and multiple. They can be used in conjunction with sloping.

The table below describes benching requirements based on soil type.

Soil Type	Description of Requirements
Type B	The vertical height of the benches must not exceed 4 feet and benches must be below the maximum allowable slope. **Example:** A 10-foot deep trench must be benched back 10 feet in each direction, and with the maximum of a 45-degree angle.
Type C	Benching is not allowed.

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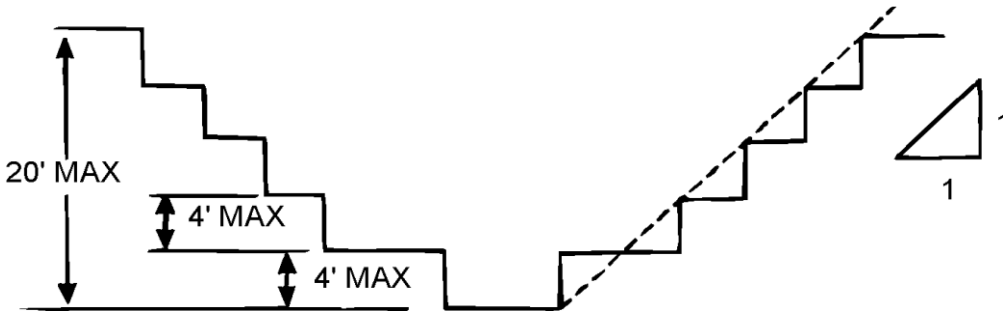
Competent Person Responsibilities - Benching, Sloping, Shoring, and Shielding Requirements, Continued

Type B Benching Example

This bench allowed in cohesive soil only.



Multiple Bench, Type B Soil

Sloping

The table below describes the maximum allowable slopes for excavations less than 20 feet based on soil type and angle to the horizontal.

Soil Type	Height/Depth Ratio	Slope Angle
Type A	¾ : 1	53 degrees
Type B	1 : 1	45 degrees
Type C	1 ½ : 1	34 degrees

Sloping Example for Type B Soil

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, and
- total distance across would be 20 feet, plus the width of the bottom of the trench itself.

Sloping Example for Type C Soil

A 10 foot-deep trench in Type C soil

- would be sloped to a 34-degree angle or sloped 15 feet back in both directions, and
- total distance across would be 30 feet, plus the width of the bottom of the trench itself.

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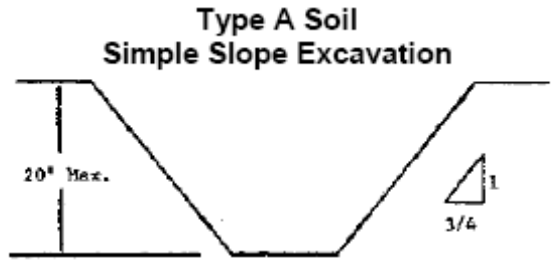
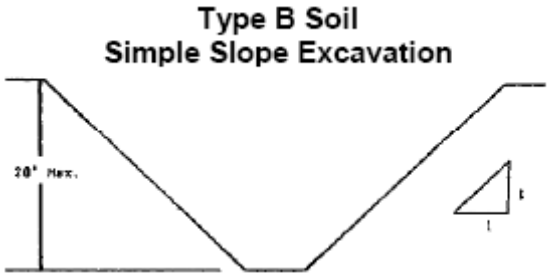
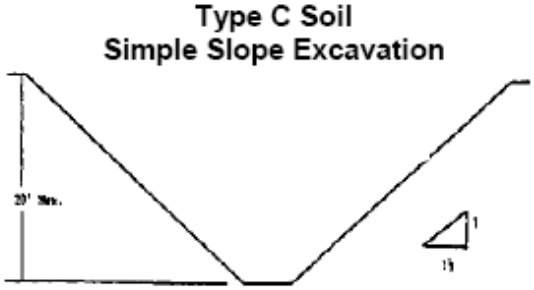
Competent Person Responsibilities - Benching, Sloping, Shoring, and Shielding Requirements, Continued

Simple Slope Excavation Examples

The table below provides examples of simple slope excavations by soil type.

Slope Criteria	Example
A simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.	
A simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 1:1.	
All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.	

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Competent Person Responsibilities - Benching, Sloping, Shoring, and Shielding Requirements, Continued

Shoring

The 2 types of shoring are hydraulic and timber. Use shoring or shielding when the location or depth of the cut makes sloping back to the maximum allowable slope impractical.

Hydraulic shoring is preferred over timber shoring in that it

- provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install them
- is light enough to be installed by 1 worker
- is gauge-regulated to ensure even distribution of pressure along the trench line, and
- can be adapted easily to various trench depths and widths.

Important: If timber shoring is used, it must meet the requirements of 29 CFR 1926.650, .651, and .652.

Use the table below for shoring requirements and limitations.

No.	Requirements/Limitations
1	Install all shoring from the top down, and remove from the bottom up.
2	For hydraulic shoring, check at least once per shift for • leaking hoses and/or cylinders • broken connections • cracked nipples • bent bases, and • any other damaged or defective parts.
3	Verify that the top cylinder of hydraulic shoring is no more than 18 inches below the top of the excavation.
4	Verify that the bottom of the cylinder is no higher than 4 feet from the bottom of the excavation. **Note**: 2 feet of trench wall may be exposed beneath the bottom of the rail or plywood sheeting, if used.

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Competent Person Responsibilities - Benching, Sloping, Shoring, and Shielding Requirements, Continued

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.

Use the table below for shielding requirements and limitations.

No.	Requirements/Limitations
1	Keep the excavated area between the outside of the trench box and the face of the trench as small as possible
2	Backfill the space between the trench box and the excavation side to prevent lateral movement of the box.
3	Verify that shields are not subjected to loads exceeding those which the system was designed to withstand.
4	Trench boxes may be used in combination with sloping and benching.
5	Extend the box at least 18 inches above the surrounding area if there is sloping toward the excavation. **Note**: This can be accomplished by providing a benched area adjacent to the box.
6	Do not modify trench boxes or shields without the approval from the manufacturer.
7	Shields may ride 2 feet above the bottom of an excavation, provided • there is no caving under or behind the shield, and • they are calculated to support the full depth of the excavation.
8	Workers must • enter and leave the shield in a protected manner, such as by a ladder or ramp, and • exit from the shield while it is being moved.

Competent Person Responsibilities – Briefing Personnel

Competent Person Briefing Personnel	The Competent Person assigned to the excavations shall brief excavation and trenching personnel on the hazards and methods of removing or controlling hazards. This briefing will be conducted as part of the Pre-Job Safety Meeting prior to entering an excavation or trench.

Competent Person Responsibilities – Inspections

Competent Person Inspections

A Competent Person assigned to the excavations shall conduct and document

- daily inspections of the work site and all excavations before the work starts to verify the necessary precautions have been taken, and
- additional inspections when work scope and/or conditions change.

Document inspections on the *Excavation Inspection Report Form*.

When to Perform Inspections

Perform excavation inspections

- daily and before the start of each shift
- as dictated by the work being done in the trench
- after every rainstorm
- after other events that could increase hazards, such as 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, and
- when there is
  - a change in the size, location, or placement of the spoil pile, and
  - any indication of change or movement in adjacent structures.

Terms and Definitions

Aluminum Hydraulic Shoring	An engineered shoring system • comprised of aluminum hydraulic cylinders (cross braces) • used in conjunction with vertical rails (uprights) or horizontal rails (walers), and • designed specifically to support the sidewalls of an excavation and prevent cave-ins.
Competent Person	A person who • is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to personnel • has the authorization to take prompt corrective measures to eliminate them, and • has documentation of training received which enables them to accomplish the above tasks.
Excavation	Any man-made cut, cavity, trench or depression in the earth's surface, formed by earth removal.
Shield (Shield System)	A structure that is able to withstand the forces imposed on it by a cave-in and thereby protects personnel with the structure. Shields • can be a permanent structure, or • can be designed to be portable and moved along as work progresses, and • are 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 personnel 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.

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Terms and Definitions, Continued

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.

Soils

Soil Type	Definition
Stable Rock	Natural solid mineral material that • can be excavated with vertical sides, and • will remain intact while exposed.
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.