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Trench Reference Guide

People

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Projects that take crews below ground or into confined spaces require special planning for safety and OSHA compliance.

- 2' Minimum spoil pile set back
  - Maximum distance shield may be above bottom of excavation.
  - Maximum top HVS from top of excavation.
- 3' Ladder above landing surface.
- 4' Access and egress mandatory
  - Maximum distance between HVS
  - Atmospheric testing needed if hazardous atmospheres is suspected.
  - Maximum height of first bench in cohesive B soil.
- 5' Trench Protection mandatory (4' in some states)
- 6' Fall protection may be required
- 10' Minimum distance from powerlines up to 50,000 volts
- 18" Minimum distance from top of trench shield to toe of slope when sloping with shields.
- 19.5% Oxygen deficiency
- 20' Maximum distance OSHA allows for sloping/ benching, timber shoring.
- 20.9% Normal oxygen reading
- 25' Maximum travel distance to access/egress.

To learn about Sunstate's onsite Competent Person & Confined Space Awareness training, contact us today.

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Trench Reference Guide

DEFINITIONS

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

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.

Intent: In order to be a "competent person" for the purpose of this standard, one must have had specific training in, and be knowledgeable about, soil analysis, the use of protective systems and the requirements of this standard, and must be designated by the employer.

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

GENERAL REQUIREMENTS

- Ensure the wearing of appropriate safety vest when exposed to public vehicular traffic.
- Locating underground installations by safe and acceptable means.
- Support/ Remove all surface encumbrances that could pose a hazard to employees.
- Ensure the stability of all adjacent structures.
- Ensure spoil tools and equipment are at 2' from edge of excavation.
- Daily Inspections of the excavation by a Competent Person
- Access and egress provided at 4'.
- Atmospheric testing at 4' if possibility of hazardous atmospheres.
- Protection of employees from hazards associated with water accumulation.
- Warning Systems for mobile equipment
- Eliminate exposure to falling loads.
- Appropriate fall protection when required.

REQUIREMENTS FOR PROTECTIVE SYSTEMS

Each employee in an excavation shall be protected from cave-ins by an adequate protective system except when excavations are less than five feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

SOIL CLASSIFICATION

Type A Soil

Cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

1) The soil is fissured.
2) The soil is subject to vibration from heavy traffic, pile driving, or similar effects.
3) The soil has been previously disturbed.
4) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater.
5) The material is subject to other factors that would require it to be classified as a less stable material.

Type B Soil

1) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa).
2) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
3) Previously disturbed soils except those which would otherwise be classified as Type C soil.
4) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration.
5) Dry rock that is not stable.
6) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C-60 Soil

1) Moist, cohesive soil or a moist dense granular soil that does not fit into Type A or Type B classification and is not flowing or submerged.
2) This material can be cut with near vertical sidewalls and will stand unsupported long enough to allow vertical shores to be properly installed.
3) The competent person must monitor the excavation for signs of deterioration of the soil as indicated by, but not limited to, freely seeping water or flowing soil entering the excavation around or below the sheeting.
4) An alternate design for less stable Type C soil will be required where there is evidence of deterioration.

Type C-80 Soil

1) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less.
2) Granular soils including gravel, sand, and loamy sand.
3) Submerged soil or soil from which water is freely seeping
4) Submerged rock that is not stable.
5) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

DISCLAIMER: For use by the trained and knowledgeable "competent person" only. Refer to the appropriate requirements of your local city, county, state, federal regulations and/or manufacturer's tabulated engineering for further clarification.

SOIL TESTING

Visual Tests

a) Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.
b) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.
c) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.
d) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

Visual Tests *(continued)*

e) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.
f) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.
g) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.
h) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

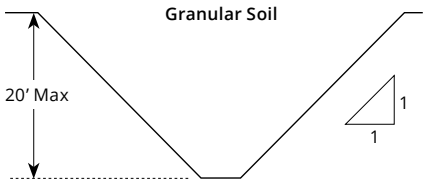
Manual Tests

Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

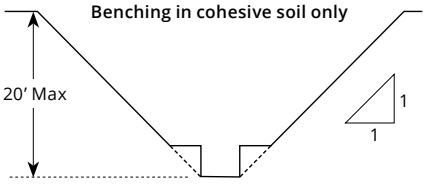
a) Plasticity: Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two-inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.
b) Dry strength: If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.
c) Thumb penetration: The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure.

SLOPING & BENCHING

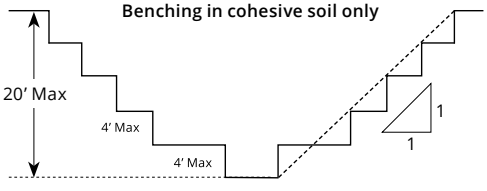
Type B Soil



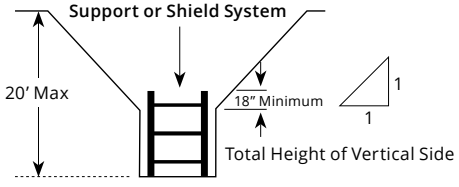
Simple Slope



Simple Bench

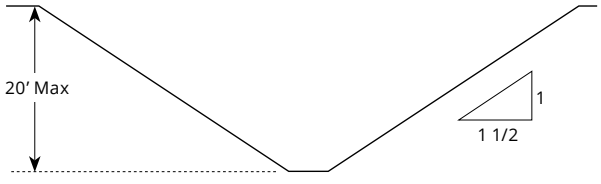


Multiple Bench

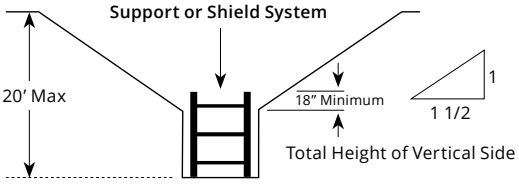


Vertically Sided Lower Portion

Type C Soil

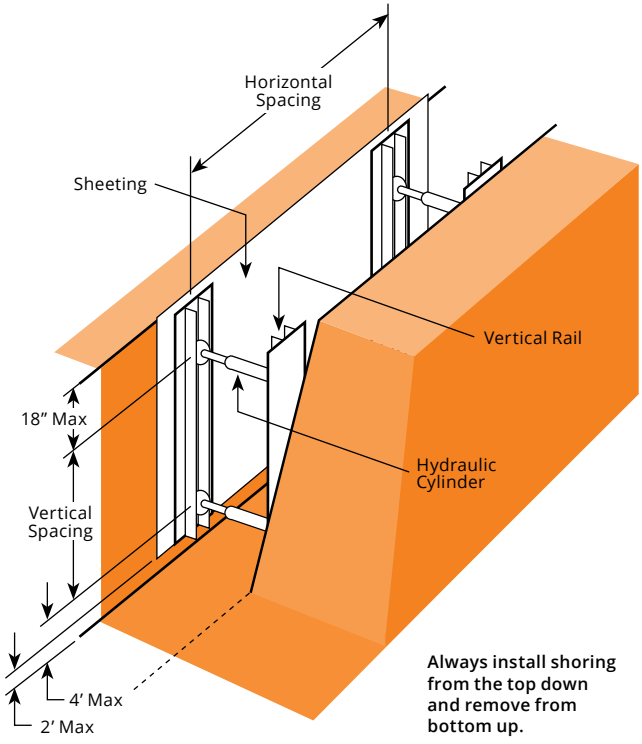


Simple Slope



Vertically Sided Lower Portion

ALUMINUM HYDRAULIC SHORING TYPICAL INSTALLATION



Always install shoring from the top down and remove from bottom up.

Table 1 - Type A Soil

Hydraulic Cylinders						
Depth of Trench (Feet)	Maximum Horizontal Spacing ***Note 6*** (Feet)	Maximum Vertical Spacing (Feet)	Width of Trench (Feet)			Sheeting
			Up to 8	Over 8 up to 12	Over 12 up to 15	***Note 3***
0-15	8	4	2′ Dia.	2′ Dia.	2′ Dia. ***(1)***	***Note 2***
0-25	8	4	2′ Dia.	2′ Dia. ***(1)***	2′ Dia. ***(1)***	***Note 2***

Table 2 - Type B Soil

Hydraulic Cylinders						
Depth of Trench (Feet)	Maximum Horizontal Spacing (Feet)	Maximum Vertical Spacing ***Note 6*** (Feet)	Width of Trench (Feet)			Sheeting
			Up to 8	Over 8 up to 12	Over 12 up to 15	***Note 3***
0-15	8	4	2′ Dia.	2′ Dia.	2′ Dia. ***(1)***	***Note 2***
0-20	6	4	2′ Dia.	2′ Dia. ***(1)***	2′ Dia. ***(1)***	***Note 2***
0-25	5	4	2′ Dia.	2′ Dia. ***(1)***	2′ Dia. ***(1)***	***Note 7***

Table 3 - Type C Soil

Hydraulic Cylinders						
Depth of Trench (Feet)	Maximum Horizontal Spacing (Feet)	Maximum Vertical Spacing ***Note 6*** (Feet)	Width of Trench (Feet)			Sheeting
			Up to 8	Over 8 up to 12	Over 12 up to 15	***Note 4***
0-10	6 ***Note 5***	4	2′ Dia.	2′ Dia.	2′ Dia. ***(1)***	***Note 2***
0-20	6	4	2′ Dia.	2′ Dia. ***(1)***	2′ Dia. ***(1)***	***Note 7***
0-25	5	4	2′ Dia.	2′ Dia. ***(1)***	NA	***Note 7***

Notes to Tables 1, 2 & 3

1) Two-inch diameter cylinders shall have a structural steel tube oversleeve 3.5 x 3.5 x .01875 inch extension (installed over the aluminum oversleeve extension) or a steel tube oversleeve 3 x 3 x 0.1875 inch extension (installed without the aluminum oversleeve) that extends the full retracted length of the cylinder.
2) The bottom of the sheeting shall extend within two feet of the bottom of the excavation. If there is an indication of a possible loss of soil from behind the excavation. If there is an indication of a possible loss of soil from behind the support system, sheeting must extend to the bottom of the excavation.
3) Four-foot wide sheeting is required at each vertical shore if raveling or sloughing of the excavation face appears likely to occur.
4) Four-foot wide sheet shall be used.
5) When four-foot horizontal spacing is exceeded, the open spaces between the sheeting must be monitored for sloughing and raveling of the excavation face.
6) The bottom hydraulic cylinder shall be a maximum of four feet above the bottom of the excavation.
7) Sheeting shall extend to the bottom of the excavation.

Hydraulic Shoring Cylinder Sizes						
17”-27”	22”-36”	28”-46”	34”-55”	42”-69”	52”-88”	Available up to 143” wide
Yellow	Red	Green	Blue	Brown	Black	

Hydraulic Shoring Rail Sizes With or Without Finn Boards							
2’	3’ 6”	5’	7’	9’	12’	16’	20’

TRENCH SHIELDS

- Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.
- Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
- Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
- Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.
- Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

HAZARDOUS ATMOSPHERES

- Oxygen Deficient 19.5%
- Normal Oxygen Level 20.9%
- Oxygen Enriched 23.5%
- Lower Explosive Limit/Lower Flammable Limit 10% LEL/LFL
- Carbon Monoxide (CO) 35ppm NIOSH
  50PPM OSHA
- Hydrogen Sulfide (H2S) 10ppm

Other Available Options Using Soil Reports

Blows Per Foot	**Cohesive Soil**	**Granular Soil**
0-4	C – Soft	C – Very Loose
4-8	B – Medium	C – Loose
8-15	B or A – Stiff	C- Medium Loose
15-30	A – Hard	C – Medium
>30	A – Very Hard	*B – Dense

*Could be Type A if hardpan or cementation exists.

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Sunstate Equipment helps increase jobsite efficiency by providing easy, fast, and reliable access to top-quality, well-maintained and ready-to-use construction equipment and tools. Since 1977, we've focused on superior service with on-time delivery, one-call reservations, 24/7 support, and innovative technology.

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