EXCAVATIONS

Refer to Cal/OSHA, Title 8, Subchapter 4, Article 6, Sections 1539 trough 1547 for the complete Cal/OSHA Standards governing excavations.

GENERAL SAFETY

Before excavation work begins, you must notify the nearest Cal/OSHA District office by faxing a completed Activity Notification form.

All excavations 5 feet or deeper or less than 5 feet in unstable soil shall be sloped, shored, or shielded to prevent cave-ins. The slope, shore, or shield system used must be identified on the Trench and Excavation Permit.

All excavations 4 feet or deeper shall have a ladder for access into the excavation with no more than 25 feet of travel in any direction.

All excavated and available material shall be retained 2 feet or more from the edge of the excavation.

All excavations shall be barricaded with appropriate barrier tape and other protective devices are required.

When entering an excavation that may be considered a hazardous environment, proper personal protective equipment must be worn. Atmosphere testing must be obtained and documented before an employee may enter excavation.

Prior to starting any excavation, efforts shall be made to locate any anticipated underground installations in cooperation with utility companies or other owners, who shall be notified of proposed work.

For any deviation from the minimum State or Federal Regulations, and for all excavations deeper than 20 feet, detailed plans for shoring, sloping, benching, or other means of protection shall be prepared by a Registered Professional Engineer and shall be available at the worksite.

All manufactured shielding systems must be accompanied by tabulated data, which outlines the conditions and configurations the device may be used in. The tabulated data is to be available on the jobsite.

Trench shields shall be installed so that a sudden lateral load will not be hazardous to employees.

The designated excavation competent person shall be responsible for collecting or conducting the following:

- Conduct test for soil classification
- Understand standards and any data provided.
- Determine proper sloping, shoring, or shielding system.
- Recognize and reclassify soil after changing conditions.
- Determine if damaged shoring, sloping, or shielding systems are adequate for employee protection.
- Conduct air test for hazardous atmosphere if requiered.
- Locate underground installations or utilities.
- Monitor water control devices to ensure proper operation.
- Perform daily inspections of excavations and adjacent areas.

Excavations and excavating operations will be monitored by a competent person. The competent person will have had training in and be knowledgeable about soil analysis, the use of protective systems, and the requirements of Cal/OSHA standards relating to excavations. The competent person must also have the capability to identify existing and predictable hazards in excavation work and have the authority to take prompt corrective measure to abate these hazards.

The competent person will:

- Have authority to stop the work.
    - Perform daily inspections for evidence of:
    - Possible cave-ins.
    - Failure of protective systems.
    - Hazardous atmospheres.
    - Other hazardous conditions.
- Perform inspections:
    - Prior to the start of work.
    - As needed during the shift.
    - After rainstorms.
    - After any other hazard increasing occurrence.
- Test for hazardous atmospheres if required.
- Inspect shoring and sheeting material for damage.

conditions. Inspections are also required after the occurrence of any natural (such as rain) or man-made events (such as blasting) that could increase the potential for hazards.

- A warning system should be used to alert operators of the edge of an excavation.
- Adequate protection must be provided to protect people working in the excavation from falling rock, soil, or other materials and equipment.
- No one is permitted under loads that are handled by lifting or digging equipment. No one should be allowed to work in the excavation above others unless the workers on the lower level are adequately protected.
- While the excavation is open, underground installations must be protected, supported or removed as necessary to safeguard workers. Adjacent structures must be supported to prevent possible collapse.
- No one should be permitted to work in excavations where water has accumulated or is accumulating unless adequate precautions have been taken. Diversion ditches, dikes, or other means must be used to prevent surface water from entering an excavation and to provide drainage to the adjacent area.
- Before any one enters an excavation greater than 4 feet in depth, a competent person must test the atmosphere where oxygen deficiency or a hazardous atmosphere exists or could reasonably exist. Emergency rescue equipment must be readily available and must be attended when hazardous atmospheric conditions exist or may develop.
- Sufficient means for exiting excavations 4 feet deep or more must be provided and must be within 25 feet of lateral travel for employees.
- Where employees or equipment are required or permitted to cross over excavations over 6-feet in depth and wider than 30 inches, walkways or bridges with standard guardrails shall be provided.

SLOPING & BENCHING

Sloping, benching and shoring will be done in accordance with the attached tables.

Maximum Allowable Slopes

Table B-1	
Soil Or Rock Type	Maximum Allowable Slopes (H:V) [1] For Excavations Less Than 20 Feet Deep[3]
Stable Rock	Vertical (90°)
Type A [2]	¾:1 (53°)
Type B	1:1 (45°)
Type C	1 ½:1 (34°)

NOTES

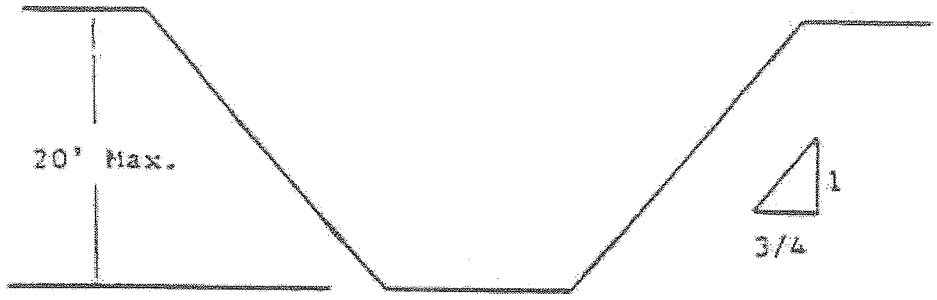
1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

Excavations Made in Type A Soil

All slopes stated below are in the horizontal to vertical ratio

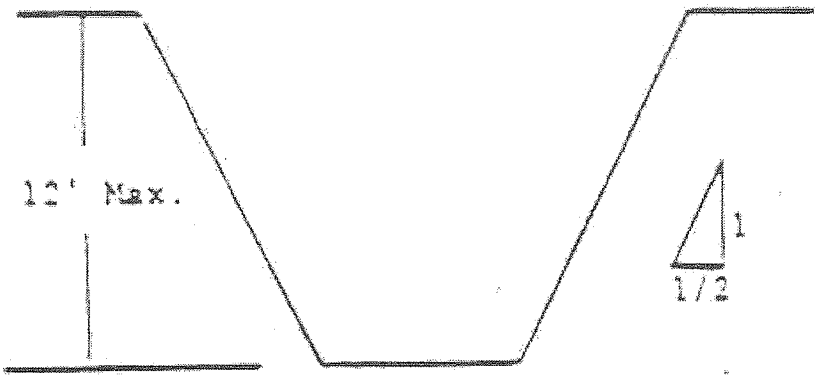
All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of ¾:1.

Simple Slope – General



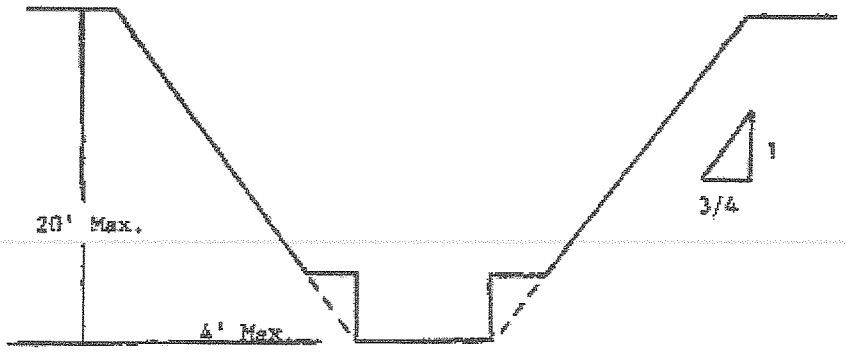
Exception: Simple slope excavations, which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

Simple Slope – Short Term

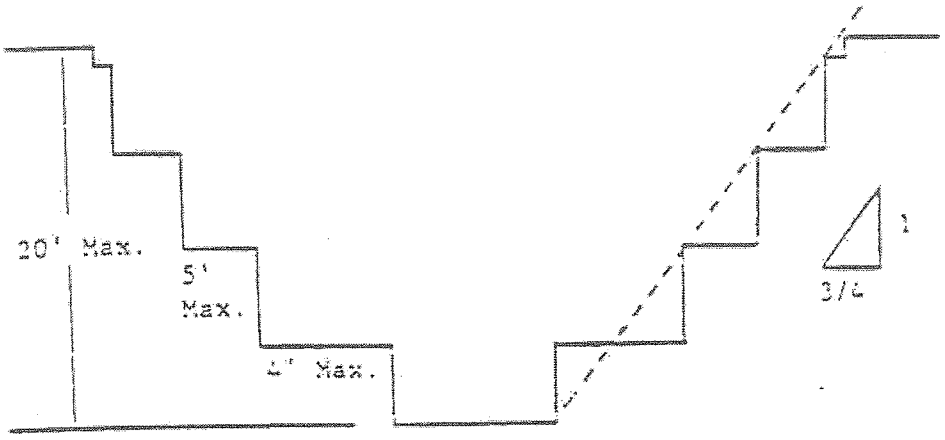


All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as allows.

Simple Bench

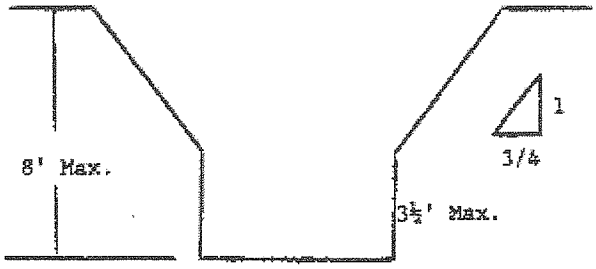


Multiple Bench

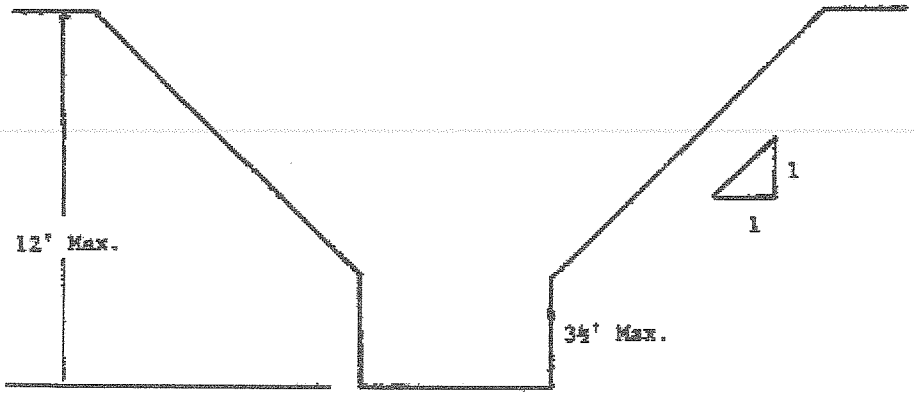


Unsupported Vertically Sided Lower Portions

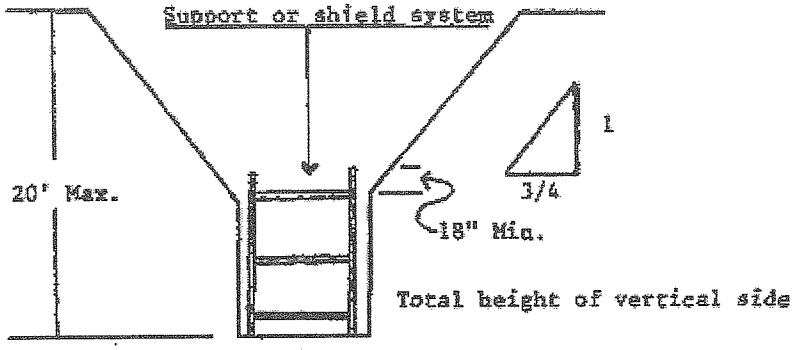
All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 ½ feet.



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



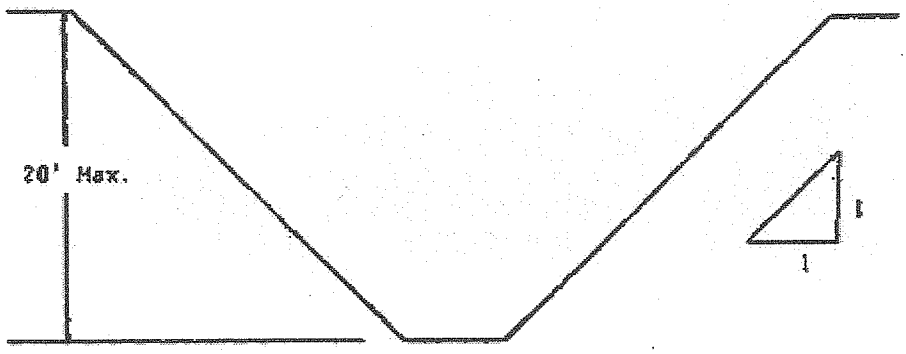
Supported or Shielded Vertically Sided Lower Portions



Excavations Made in Type B Soil

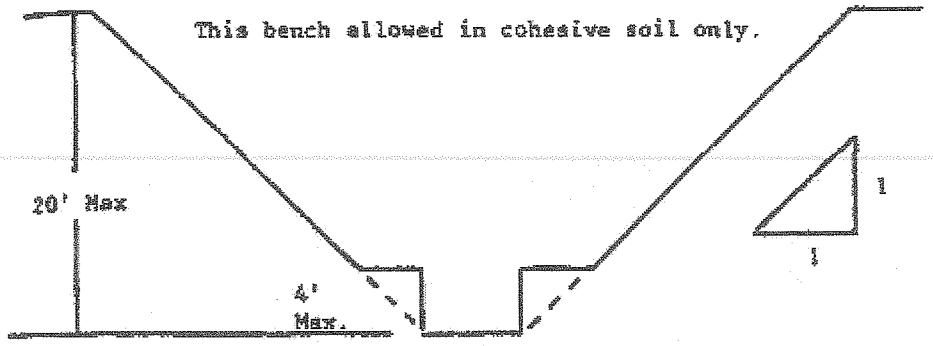
All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

Simple Slope

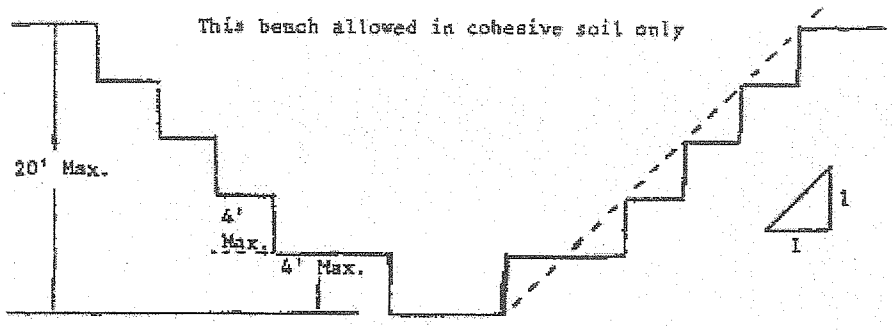


All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

Single Bench

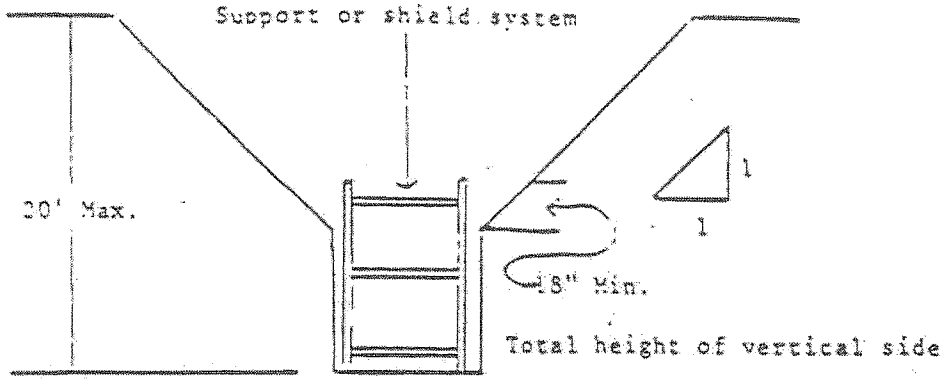


Multiple Bench



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

Vertically Sided Lower Portion

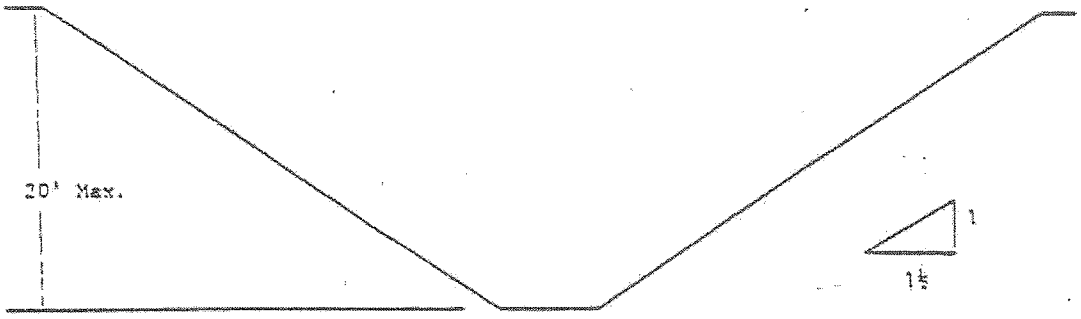


All other sloped excavations shall be in accordance with the other options permitted in 1541.1(b).

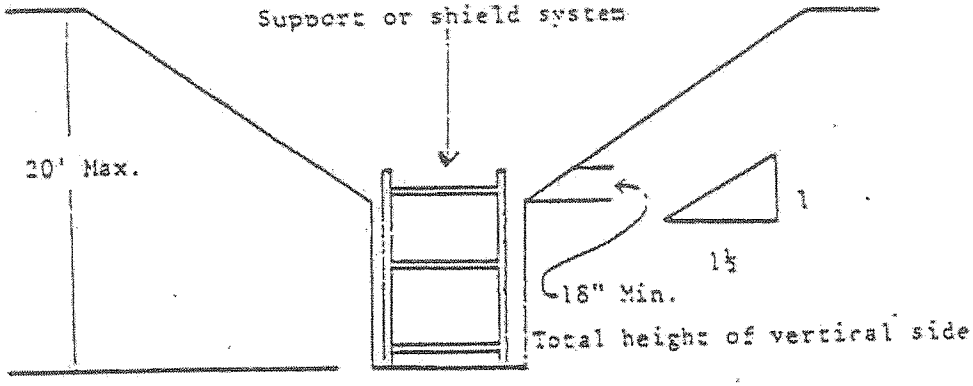
Excavations Made in Type C Soil

Simple Slope

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 ½:1.



Vertical Sided Lower Portion



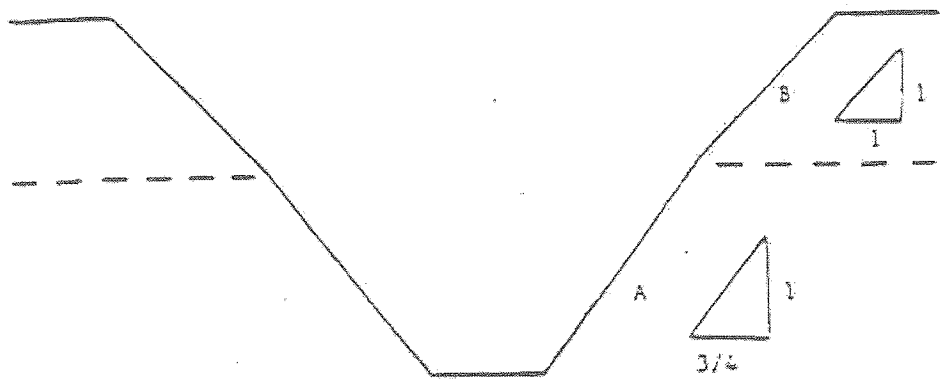
All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 ½:1.

All other sloped excavations shall be in accordance with the other options permitted in 1541.1(b).

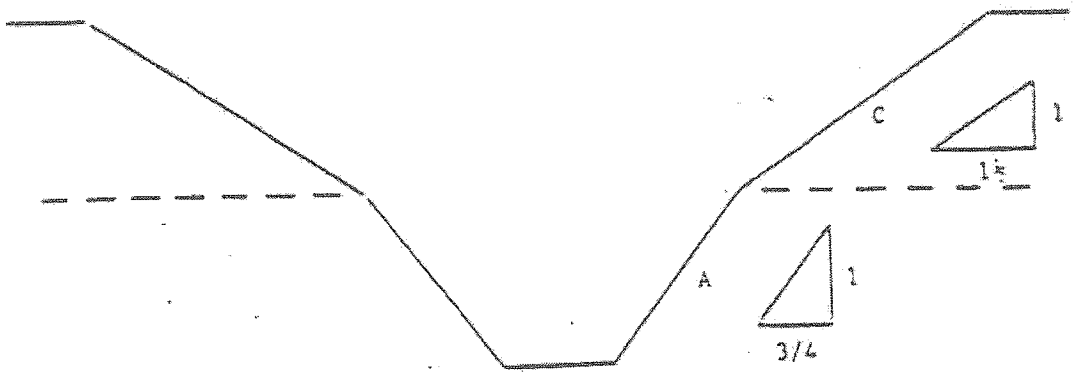
Excavations Made in Layered Soils

All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

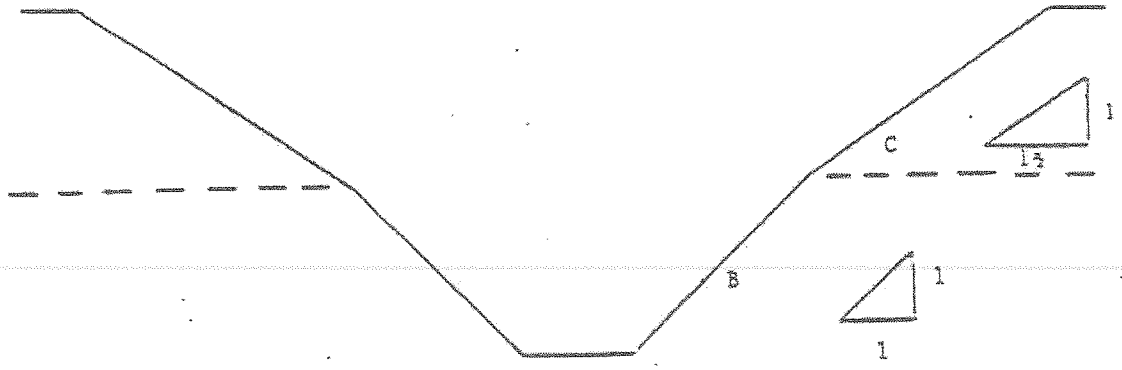
B Over A



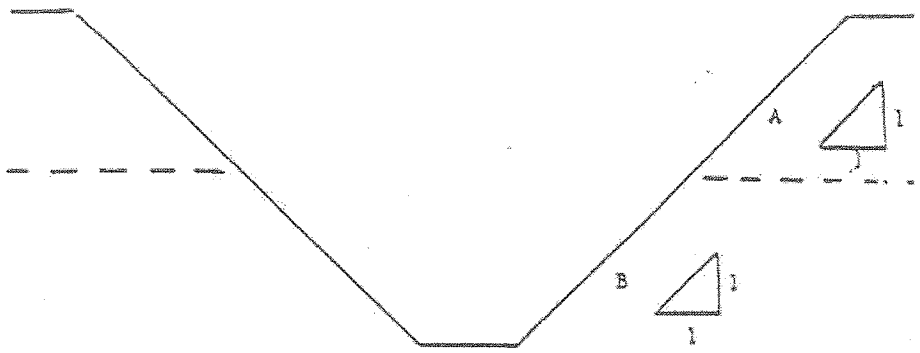
C Over A



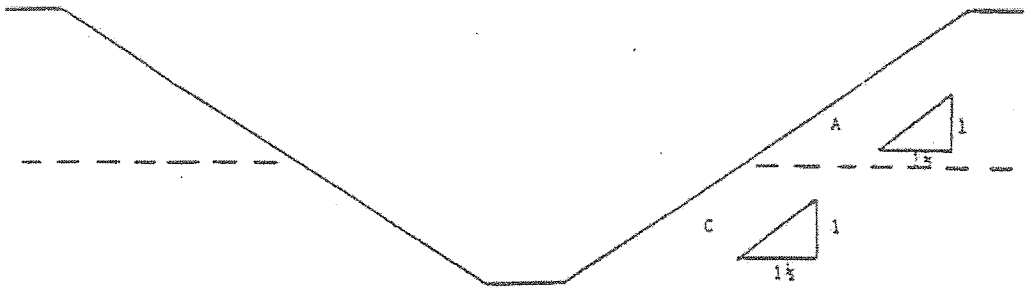
C Over B



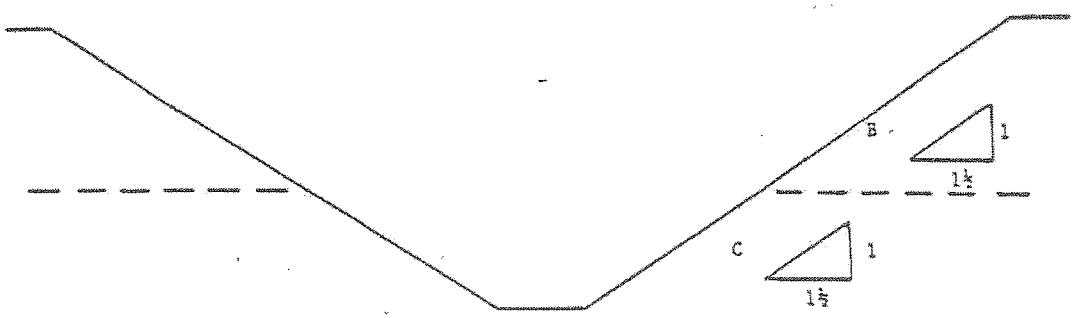
A Over B



A Over C



B Over C



All other sloped excavations shall be in accordance with the other options permitted in 1541.1(b).

Timber Shoring for Trenches

Timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. 1541.1 Appendix C must be used when design of timber shoring protective systems is to be performed in accordance with 1541.1(c)(1). Other timber shoring configurations, other systems of support such as hydraulic and pneumatic systems, and other protective systems such as sloping, benching,

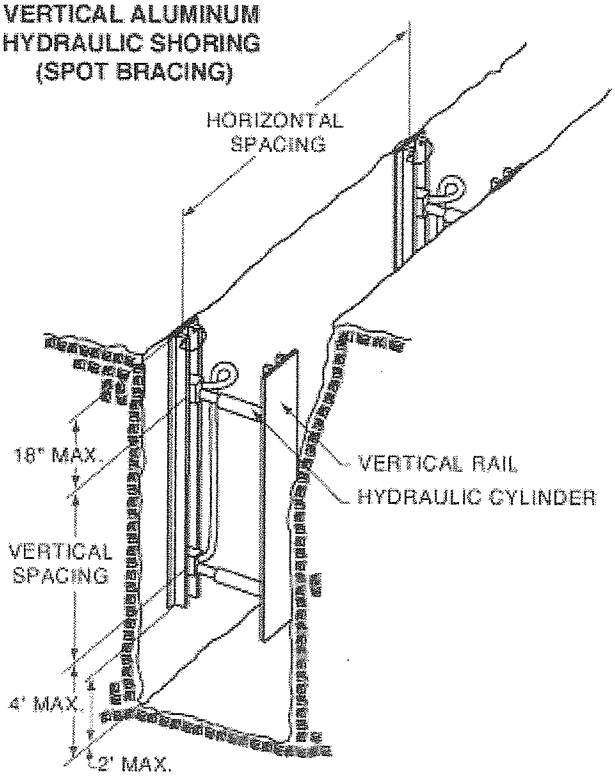
shielding, and freezing systems must be designed in accordance with the requirements set forth in 1541.1(b) and 1541.1(c).

In order to use the data presented in this appendix, the soil types in which the excavation is made must first be determined using the soil classification method set forth in Article 6 of the Cal/OSHA Construction Work Orders.

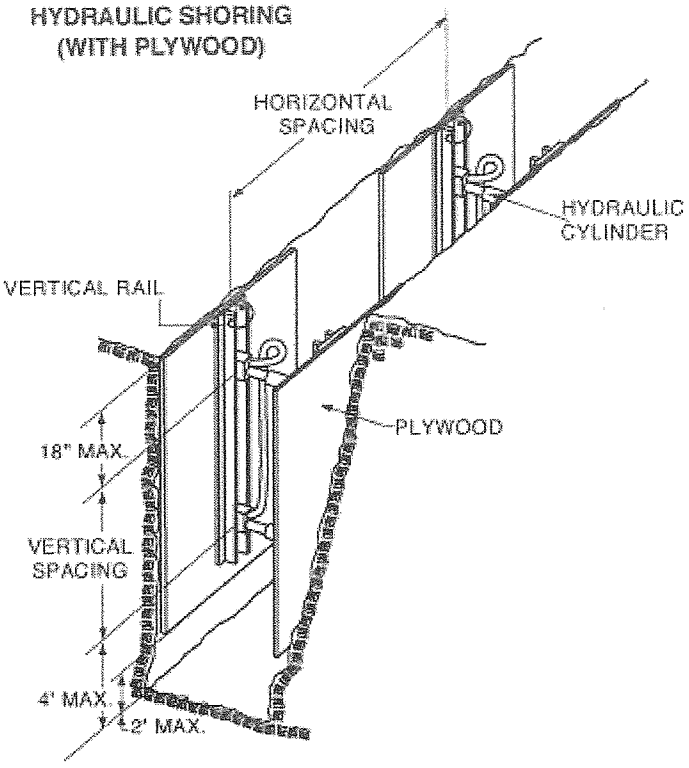
Hydraulic Shoring

When aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet in depth, designs for aluminum hydraulic shoring shall be in accordance with Section 1541.1(c)(2), but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with 1541.1 Appendix D. The following charts are from 1541.1 Appendix D.

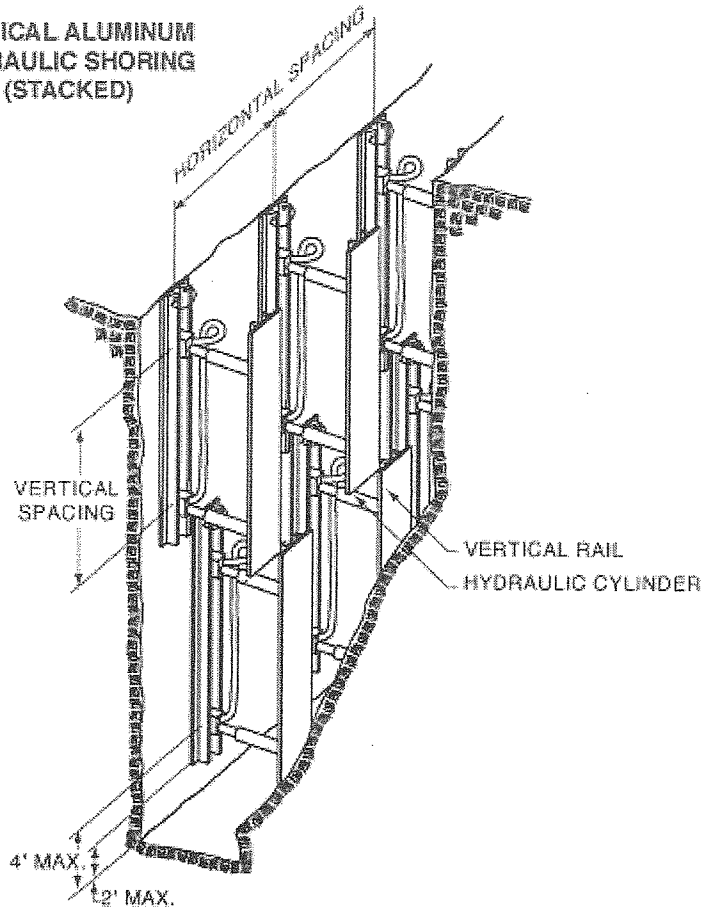
VERTICAL ALUMINUM HYDRAULIC SHORING (SPOT BRACING)



VERTICAL ALUMINUM HYDRAULIC SHORING (WITH PLYWOOD)



VERTICAL ALUMINUM HYDRAULIC SHORING (STACKED)



ALUMINUM HYDRAULIC SHORING
WALER SYSTEM (TYPICAL)

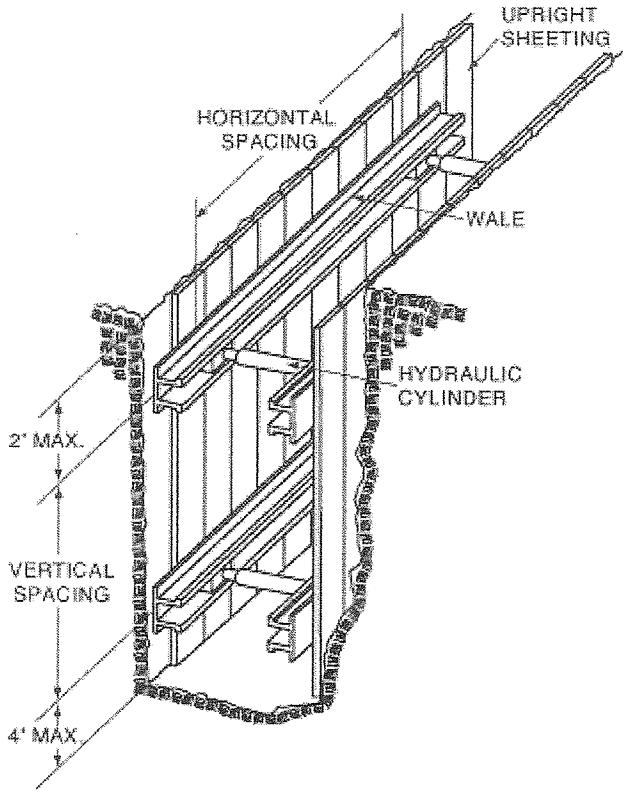


TABLE D - 1.1

ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8				
OVER 10 UP TO 15	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE(2)	3 INCH DIAMETER
OVER 15 UP TO 20	7				
OVER 20	NOTE(1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g)(1)
Note (2): See Appendix D, Item (g)(2)

TABLE D - 1.2

ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8				
OVER 10 UP TO 15	6.5	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE(2)	3 INCH DIAMETER
OVER 15 UP TO 20	5.5				
OVER 20	NOTE(1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g)(1)
Note (2): See Appendix D, Item (g)(2)

TABLE D - 1.3

ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS			
	VERTICAL SPACING (FEET)	* SECTION MODULUS (IN(3))	WIDTH OF TRENCH (FEET)			
			UP TO 8		OVER 8 UP TO 12	
			HORIZ SPACING	CYLINDER DIAMETER	HORIZ SPACING	CYLINDER DIAMETER
OVER 5	4	3.5	8.0	2 IN	8.0	2 IN NOTE (2)
		7.0	9.0	2 IN	9.0	2 IN
UP TO 10		14.0	12.0	3 IN	12.0	3 IN
OVER 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE (2)
		7.0	8.0	3 IN	8.0	3 IN
UP TO 15		14.0	10.0	3 IN	10.0	3 IN
OVER 15	4	3.5	5.5	2 IN	5.5	2 IN NOTE (2)
		7.0	6.0	3 IN	6.0	3 IN
UP TO 20		14.0	9.0	3 IN	9.0	3 IN

OVER 20	NOTE (1)

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Note (1): See Appendix D, Item (g)(1)

Note (2): See Appendix D, Item (g)(2)

*Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

**Douglas fir or equivalent with a bending strenth not less than 1500 psi.

TABLE D - 1.3

ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

[Continued]

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS		TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)		MAX. HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	* SECTION MODULUS (IN(3))	OVER 12 UP TO 15		SOLID SHEET	2 FT	3 FT
			HORIZ SPACING	CYLINDER DIAMETER			
OVER 5	4	3.5	8.0	3 IN			
		7.0	9.0	3 IN	---	---	3x12
UP TO 10		14.0	12.0	3 IN			
OVER 10	4	3.5	6.0	3 IN			
		7.0	8.0	3 IN	---	3x12	---
UP TO 15		14.0	10.0	3 IN			
OVER 15	4	3.5	5.5	3 IN			
		7.0	6.0	3 IN	3x12	---	---
UP TO							

20		14.0	9.0	3 IN			
OVER 20	NOTE (1)						

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g)(1)
Note (2): See Appendix D, Item (g)(2)
*Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.
**Douglas fir or equivalent with a bending strenth not less than 1500 psi.

TABLE D - 1.4

ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

	WALES		HYDRAULIC CYLINDERS			
DEPTH OF TRENCH	VERTICAL SPACING	* SECTION MODULUS	WIDTH OF TRENCH (FEET)			
			UP TO 8		OVER 8 UP TO 12	
			HORIZ	CYLINDER	HORIZ	CYLINDER
(FEET)	(FEET)	(IN(3))	SPACING	DIAMETER	SPACING	DIAMETER
OVER 5	4	3.5	6.0	2 IN	6.0	2 IN NOTE (2)
		7.0	6.5	2 IN	6.5	2 IN
UP TO 10						NOTE (2)
		14.0	10.0	3 IN	10.0	3 IN
OVER 10	4	3.5	4.0	2 IN	4.0	2 IN NOTE (2)
		7.0	5.5	3 IN	5.5	3 IN
UP TO 15						
		14.0	8.0	3 IN	8.0	3 IN
OVER 15	4	3.5	3.5	2 IN	3.5	2 IN NOTE (2)
		7.0	5.0	3 IN	5.0	3 IN
UP TO 20						
		14.0	6.0	3 IN	6.0	3 IN

OVER 20	NOTE (1)

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g)(1)
Note (2): See Appendix D, Item (g)(2)
*Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.
**Douglas fir or equivalent with a bending strenth not less than 1500 psi.

TABLE D - 1.4

ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

[Continued]

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

20		14.0	6.0	3 IN			
OVER 20	NOTE (1)						

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g)(1)
Note (2): See Appendix D, Item (g)(2)
*Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.
**Douglas fir or equivalent with a bending strenth not less than 1500 psi.