

APPENDIX B – 1926 SUBPART P

SLOPING AND BENCHING

(a) **Scope and application.** This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in §1926.652(b)(2).

(b) **Definitions.**

ACTUAL SLOPE means the slope to which an excavation face is excavated.

DISTRESS means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

MAXIMUM ALLOWABLE SLOPE means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

SHORT TERM EXPOSURE means a period of time less than or equal to 24 hours that an excavation is open.

(c) **Requirements.**

- (1) **Soil classification.** Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.
- (2) **Maximum allowable slope.** The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.
- (3) **Actual slope.**
 - (i) The actual slope shall not be steeper than the maximum allowable slope.
 - (ii) The actual slope shall be less steep than the maximum allowable slope, when there are

signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

- (iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).
- (4) **Configurations.** Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1
MAXIMUM ALLOWABLE SLOPES

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°)

Footnote (1): Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from horizontal. Angles have been rounded off.

Footnote (2): A Short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67m) in depth shall be 3/4H:1V (53 degrees).

Footnote (3): Sloping or benching for excavation greater than 20 feet deep shall be designed by a registered professional engineer.

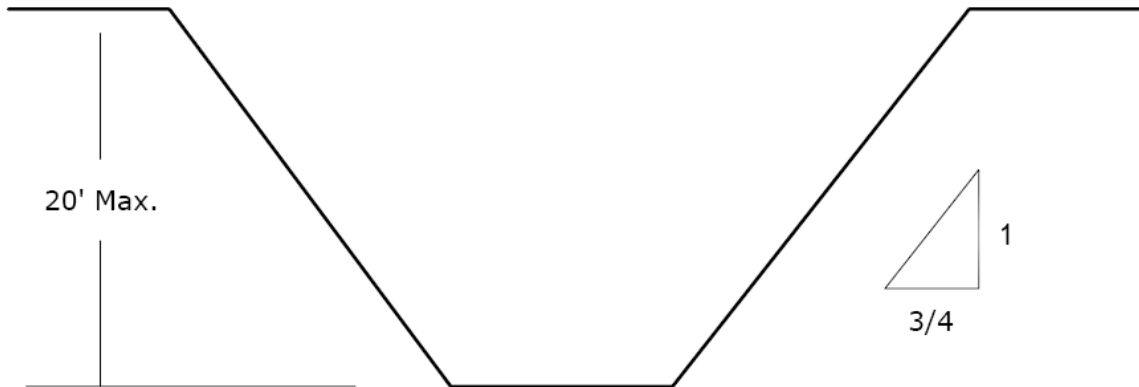
FIGURE B-1
SLOPE CONFIGURATIONS

(All slopes stated below are in the horizontal to vertical ratio)

B-1.1 Excavation made in Type A soil

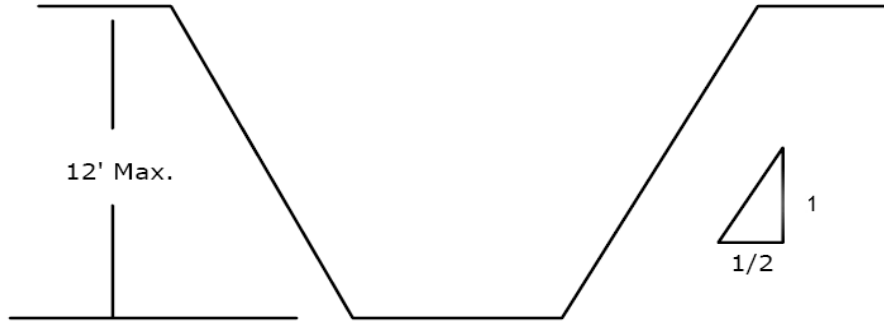
SIMPLE SLOPE – GENERAL

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



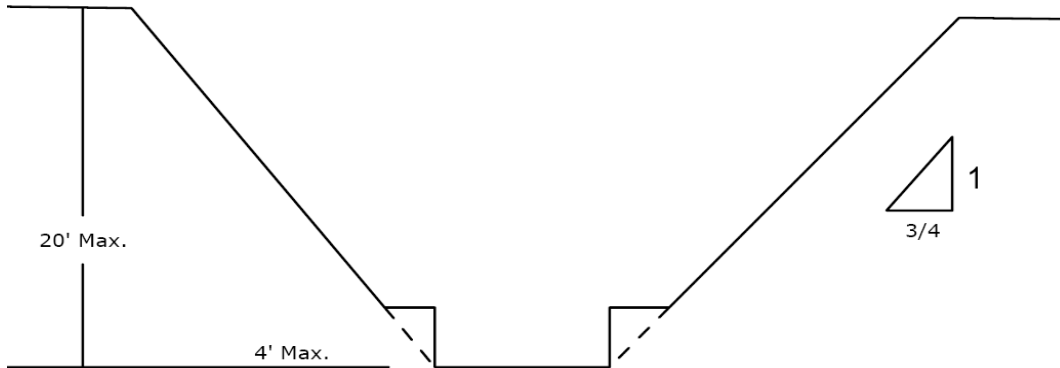
SIMPLE SLOPE – SHORT TERM

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 1/2:1.

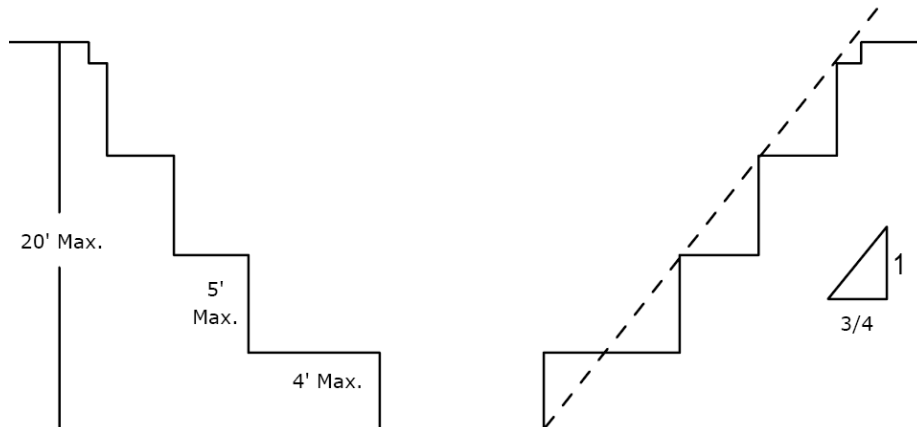


SIMPLE BENCH

- All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:

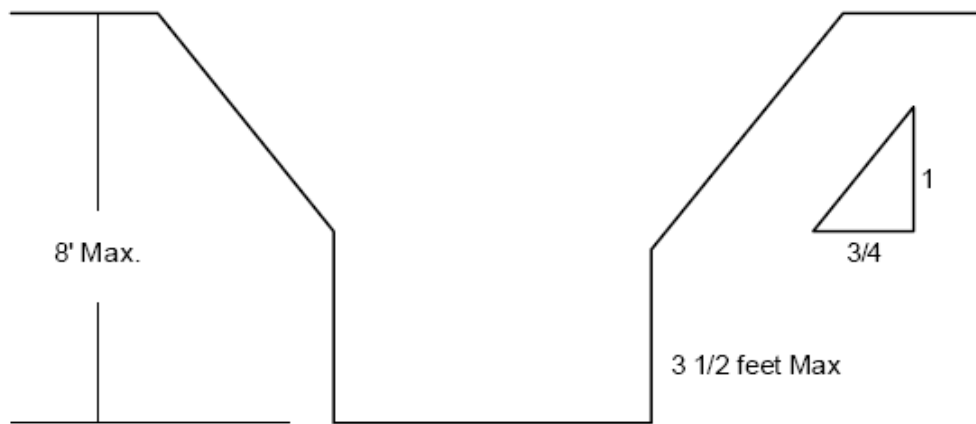


MULTIPLE BENCH

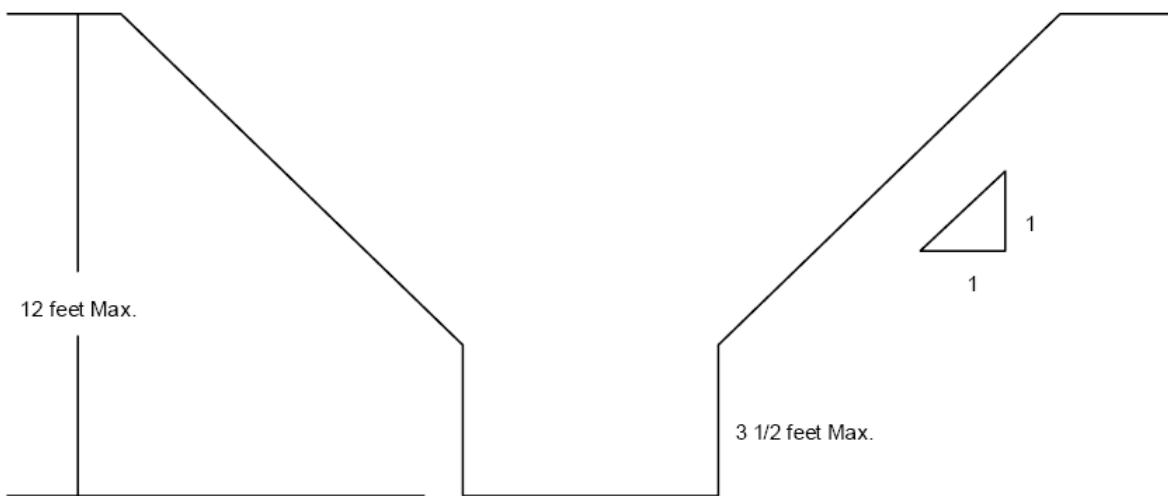


UNSUPPORTED VERTICALLY SIDED LOWER PORTION – MAXIMUM 8 FEET IN DEPTH

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

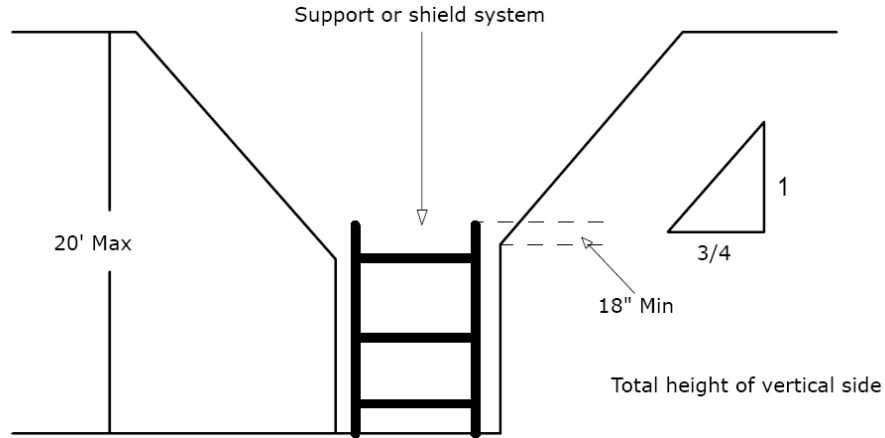


UNSUPPORTED VERTICALLY SIDED LOWER PORTION – MAXIMUM 12 FEET IN DEPTH



SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

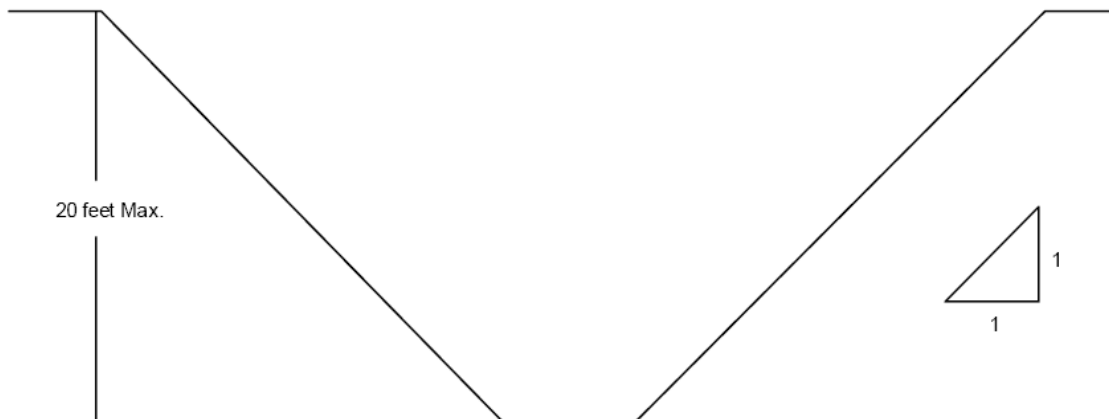
All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.



4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1926.652(b).

FIGURE B-1.2
Excavations Made in Type B Soil
SIMPLE SLOPE

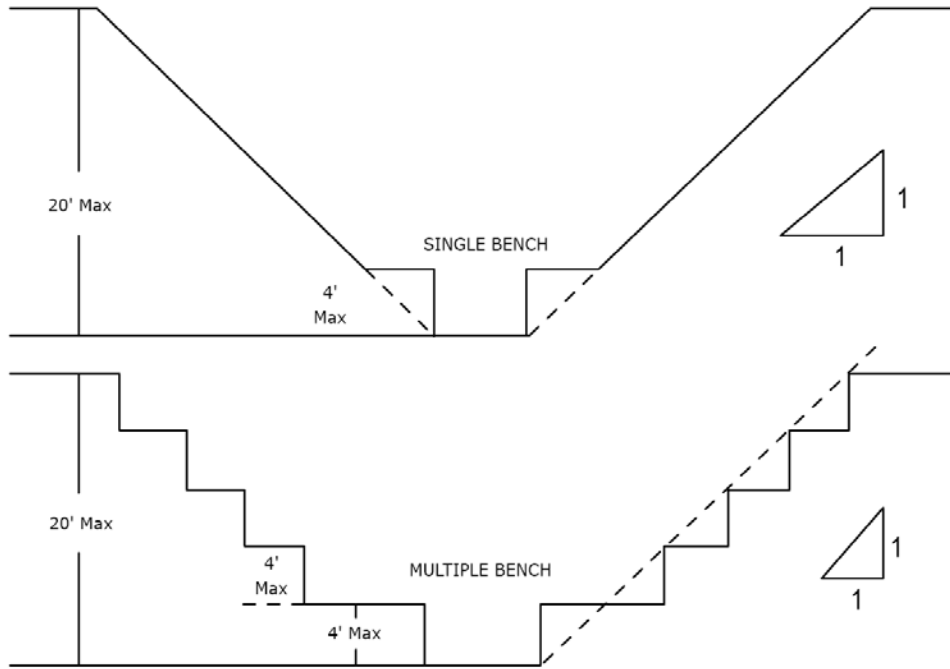
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



SINGLE BENCH AND MULTIPLE BENCH

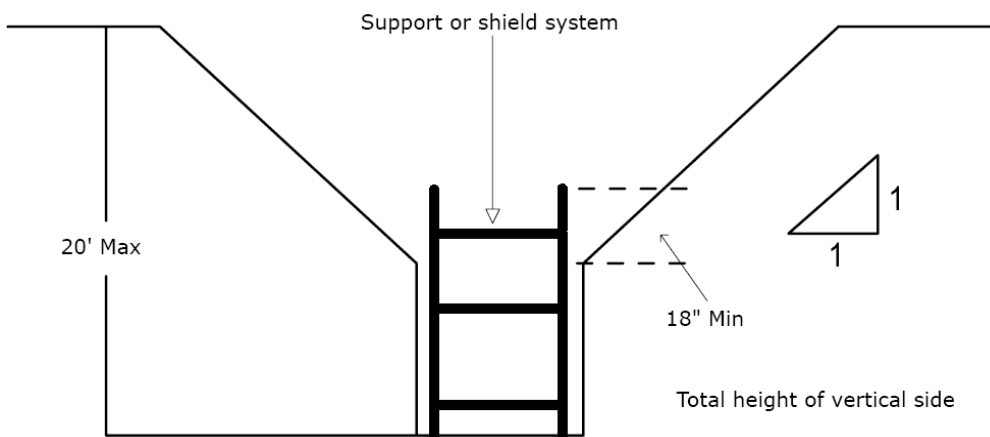
(These benches allowed in cohesive soil only)

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



VERTICALLY SIDED LOWER PORTION

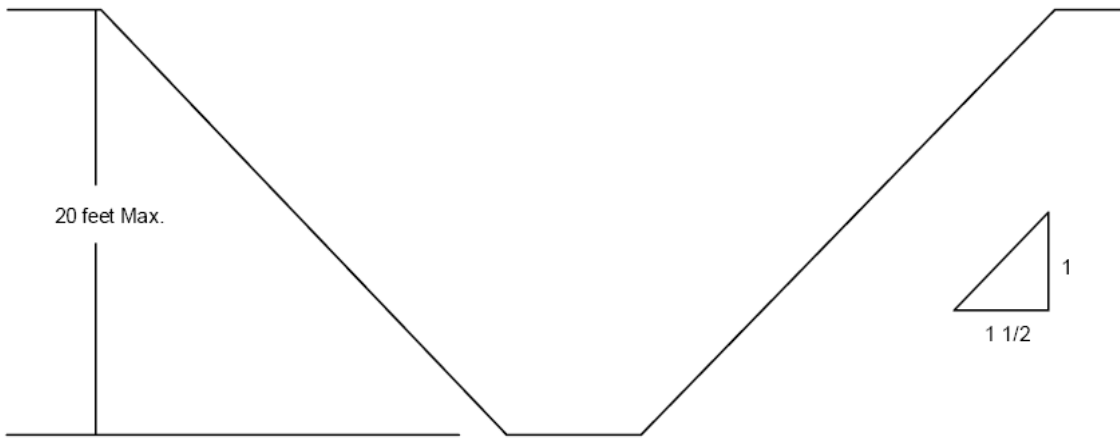
- All excavations 20 feet or less in depth which have a vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.



- All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

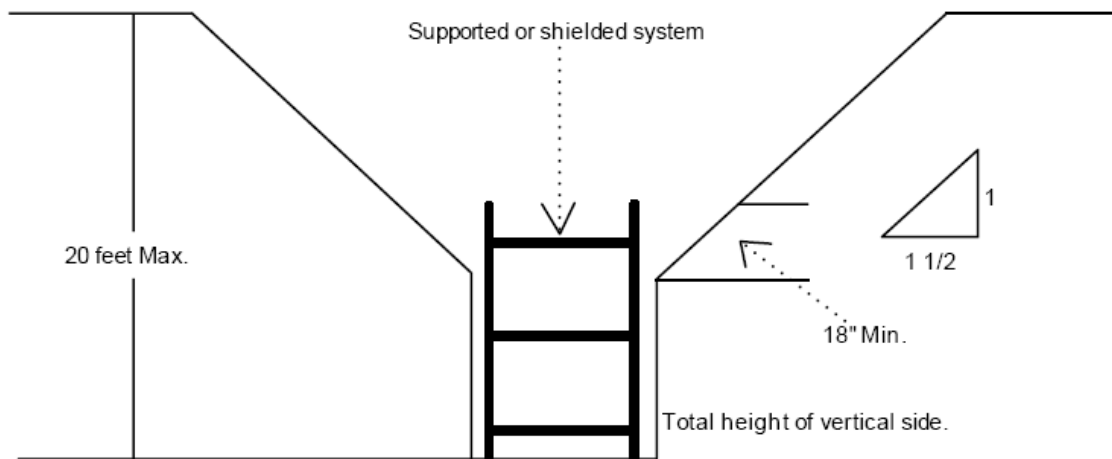
FIGURE B-1.3
EXCAVATION MADE IN TYPE C SOIL
SIMPLE SLOPE

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



VERTICAL SIDED LOWER PORTION

2. All excavations 20 feet or less in depth which have a 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 1/2:1.



3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

FIGURE B - 1.4
EXCAVATIONS MADE IN LAYERED SOILS

1. 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.

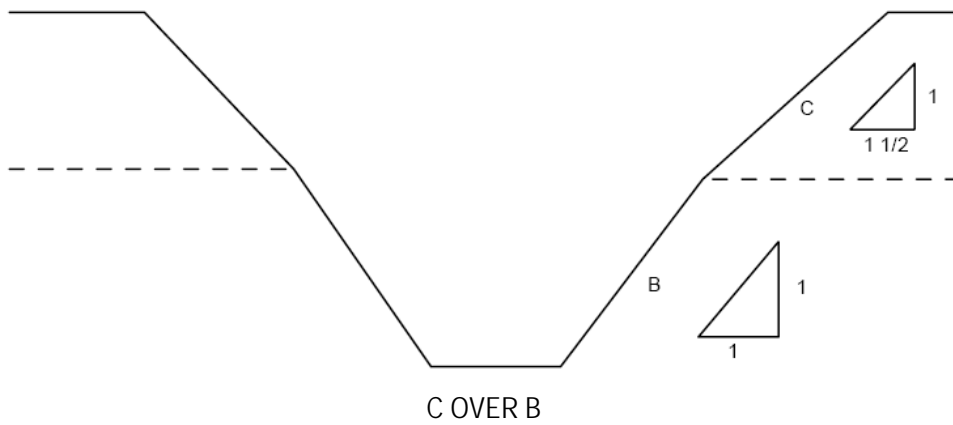
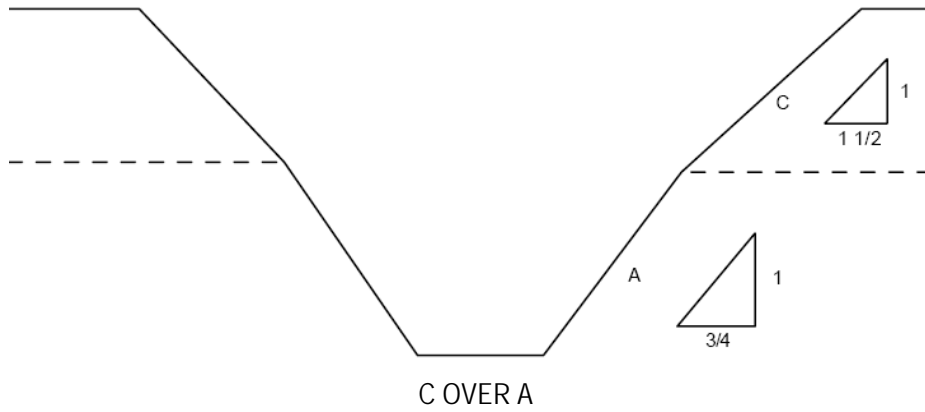
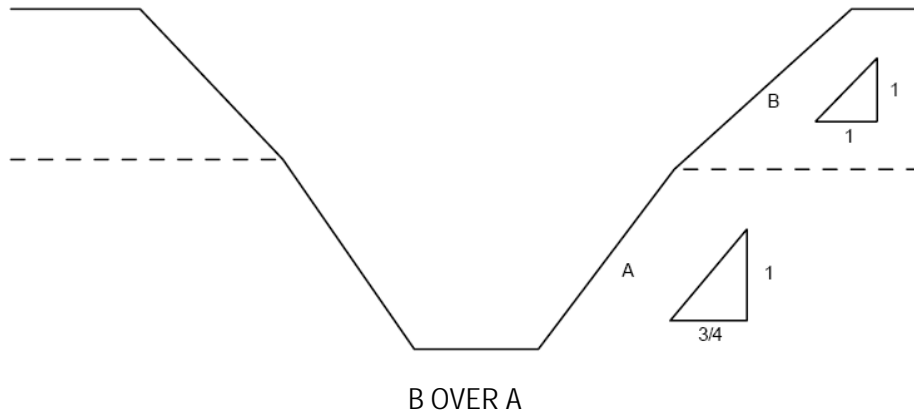
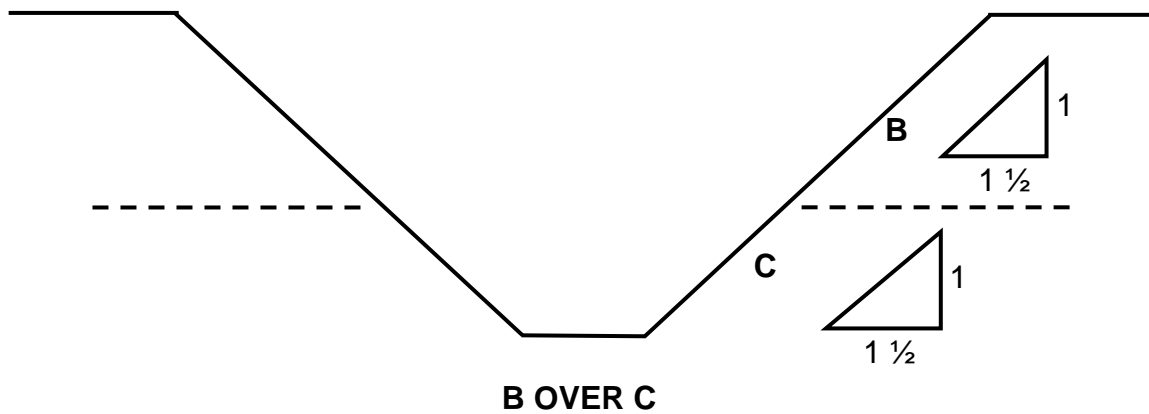
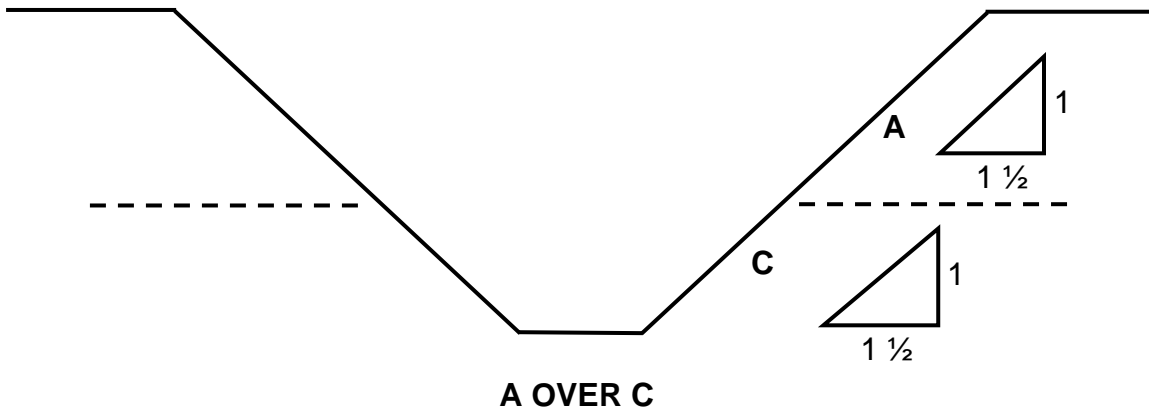
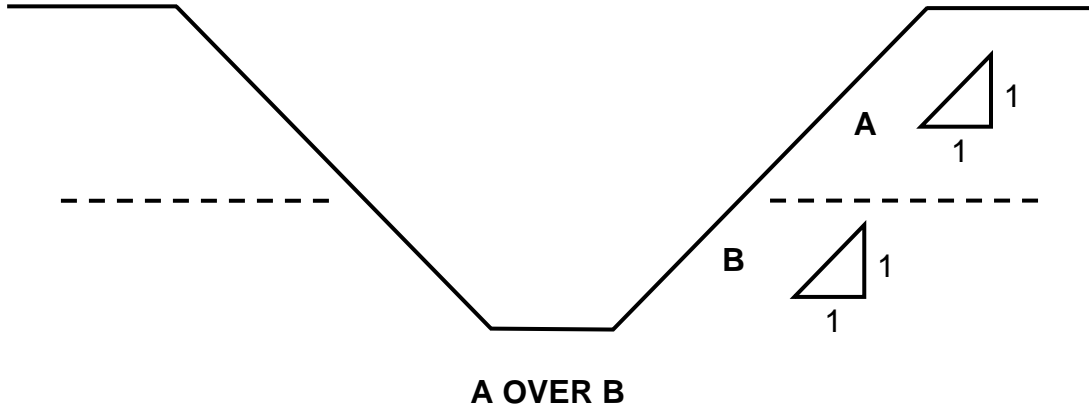


FIGURE B - 1.4 (CONTINUED)

Excavations Made in Layered Soils

1. 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.



2. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b)