

TRENCH RESCUE

N.C OSFM Technical Rescuer

Rescue North Carolina

OBJECTIVES

- demonstrate supporting a non-intersecting trench to minimize soil movement.
- Correctly demonstrate supporting an intersecting trench to minimize soil movement.
- demonstrate installing supplemental sheeting and shoring below an existing shoring system to minimize soil movement.
- Identify the rules for cutting a trench wall to the appropriate angle of repose in order to minimize soil movement and reduce the risk of entrapment.

- Causes of a trench collapse
 - Previously disturbed soil.
 - Excessive vibration.
 - Heavily saturated soil.
- Following a collapse, it may become necessary to create an artificial foundation using other materials.
- Safety procedures must be communicated prior to actual shoring any type of the trench.
- Implement IMS system and accountability control system.

Initial Actions

MAKING THE SCENE SAFE

1. Area around trench should be cleared of all debris and unstable structures should be secured.
2. Moving spoil piles away should be done with a shovels in a careful manner.
3. Level the ground between the edge of the trench and the spoil pile.
4. Establish a safety observer at the end of the trench throughout the operation.
5. Establish Hot, Warm and Cold zones

- Place ground distribution pads (4'x8'x1 1/8") sheets of plywood (planking) on the non-spoil pile side.
- Place 2"x12"-12' boards for the spoil pile side.
- Anywhere the trench end is less than 4' wide it can be made safe by using the 2"x12" x 12' boards.
- If greater than 4' it should be treated as a face or wall.
- Although 2x12"x12' boards are recommended, the use of plywood cut to 2'x8' is permitted

- Monitor & document atmospheric conditions surrounding & within the trench on a continual basis.
- Ventilation should be established.
- Stabilize all unstable structures adjacent to the trench work area.
- Establish the vibration zone around the work area (300 feet)
- Shut down or detour all equipment or machinery creating vibrations.

- Establish collapse zone within the trench.
- It is the horizontal distance equal to $1\frac{1}{2}$ times the vertical depth of the trench.
- 10' deep = 15' collapse zone
- Identify signs of a potential secondary collapse such as cracks adjacent to the trench

TRENCH STABILIZATION TECHNIQUES

- Sheeting shoring is the preferred method
 - Most commercial systems are designed for pre-collapse conditions requiring near vertical walls for the system to be effective.
- Sheeting and shoring panels can be lowered into the trench at any degree that allows for shores (cross braces) to be secured from one side of the trench to the other, without the risk of kick-out.



Place Ropes



Place Opposite Panel



TRENCH STABILIZATION TECHNIQUES

- The methods of setting panels is dependent upon the condition of the trench and victim location.
- Strong backs will face each other in the trench and act as a bearing plate for the shores.
- An exception for attaching strongbacks to the panels is when hydraulic shores (Speed Shores) are used.
 - These devices have metal strongbacks (uprights) already attached to the hydraulic shore.

TRENCH STABILIZATION TECHNIQUES

- For a non-intersecting trench:
 - a minimum of 6 panels will be needed (3 on each side) to provide 12' of safe work area.
- A stairway, ladder, ramp or other means of safe egress must be installed in trenches with a depth of 4 feet or greater with a travel distance no less than 25 feet, (OSHA CFR 1926.651 (c) (2).
- A minimum of 2 ladders are recommended for rescue operations to be installed in close proximity to rescue personnel.

TRENCH STABILIZATION TECHNIQUES

- If a person is within the collapse zone of an exposed end wall, the end wall must be shored.
- 4' or wider..the end wall must be shore and treated as another wall.
- Skip-shoring or spot-shoring is not acceptable for trench rescue operations.



PROCEDURES FOR INSTALLING SHORING

- Timber and screw jack shoring operations
 - Refer to [OSHA CFR 1926 Subpart P Appendix C Table C 2-3](#) for Type C soil, to determine:
 - types of timber
 - dimension of timber
 - vertical and horizontal spacing requirements.

TIMBER SHORING

- Timber and screw jack shoring operations
 - Per OSHA CFR 1926 Appendix C; The minimum dimension for a timber shore in Type C soil will vary from a 6"x8" to an 8"x 10" for depths up to 10 & 20 feet with a maximum allowable vertical spacing of 5 feet.
 - Timbers & Screw jacks have to be manually set by rescuers working from the top of the trench to the bottom and taken out in the reverse manner.

INSTALLING TIMBER SHORING

- Measure the height of both vertical walls.
- Measure from the bottom of the strong back on the first two panels to be installed to the top the location where the top shore middle and bottom shores should be installed.
- Nail a 2x4 wooden scab or a metal cleat hanger at each location.

INSTALLING TIMBER SHORING

- The two side cleats can be added at this time making sure the spacing fits the dimension of the timber shore.
- Or...attach two 2"x4" x 12'foot rails onto the strong backs spaced apart to receive a scab block and timber shore; the interior rescuer would only have to attach the top cap.



INSTALLING TIMBER SHORING

- Insert first set of panels
- A rescuer measures the distance between the top strong backs.
- Relay the measurements to the cutting team.
- Cutting team cuts the top timber shore according to the measurement taken.

INSTALLING TIMBER SHORING



- Rescuer enters trench to waist level by ladder.
- Installs the timbers from top to bottom and cap the tops with a 2x4 wooden scab around timber.
- Stay in the safe zone (waist level of the previously installed shore)
- If timber is cut & insert a short a shim and nail to fill the void space before the top cap is secured



SCREW JACKS

- Screw jacks are good for spanning horizontal distances of 5-7 feet depending on the manufacturer.
- Cheater bars are acceptable to use when tightening.

PNEUMATIC SHORING

- Refer to the specific manufacturer's tabulated data sheet for proper horizontal and vertical spacing requirements. .

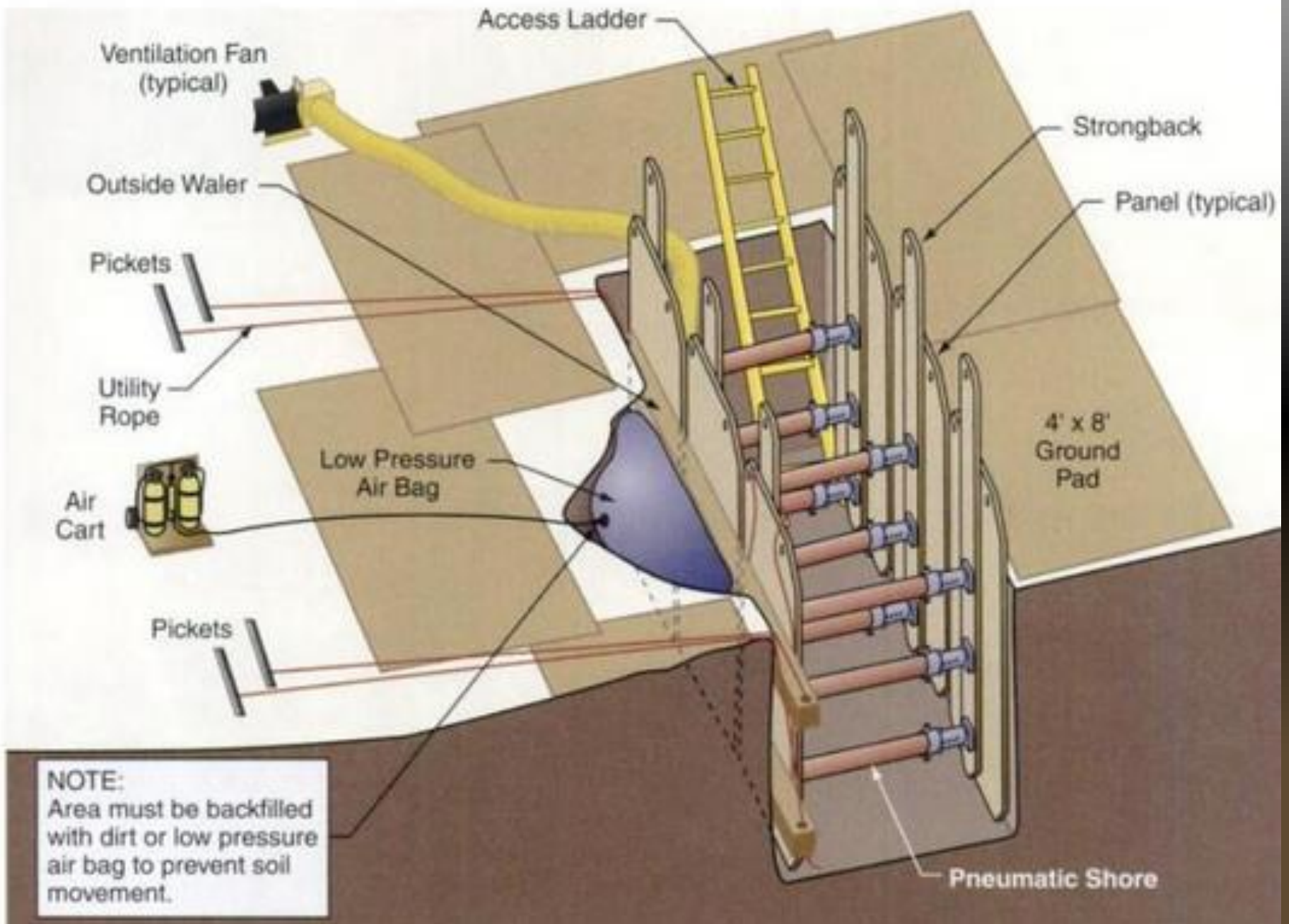


Attach Air System to Strut
116 psi. for Airshore Trench









HYDRAULIC SHORING

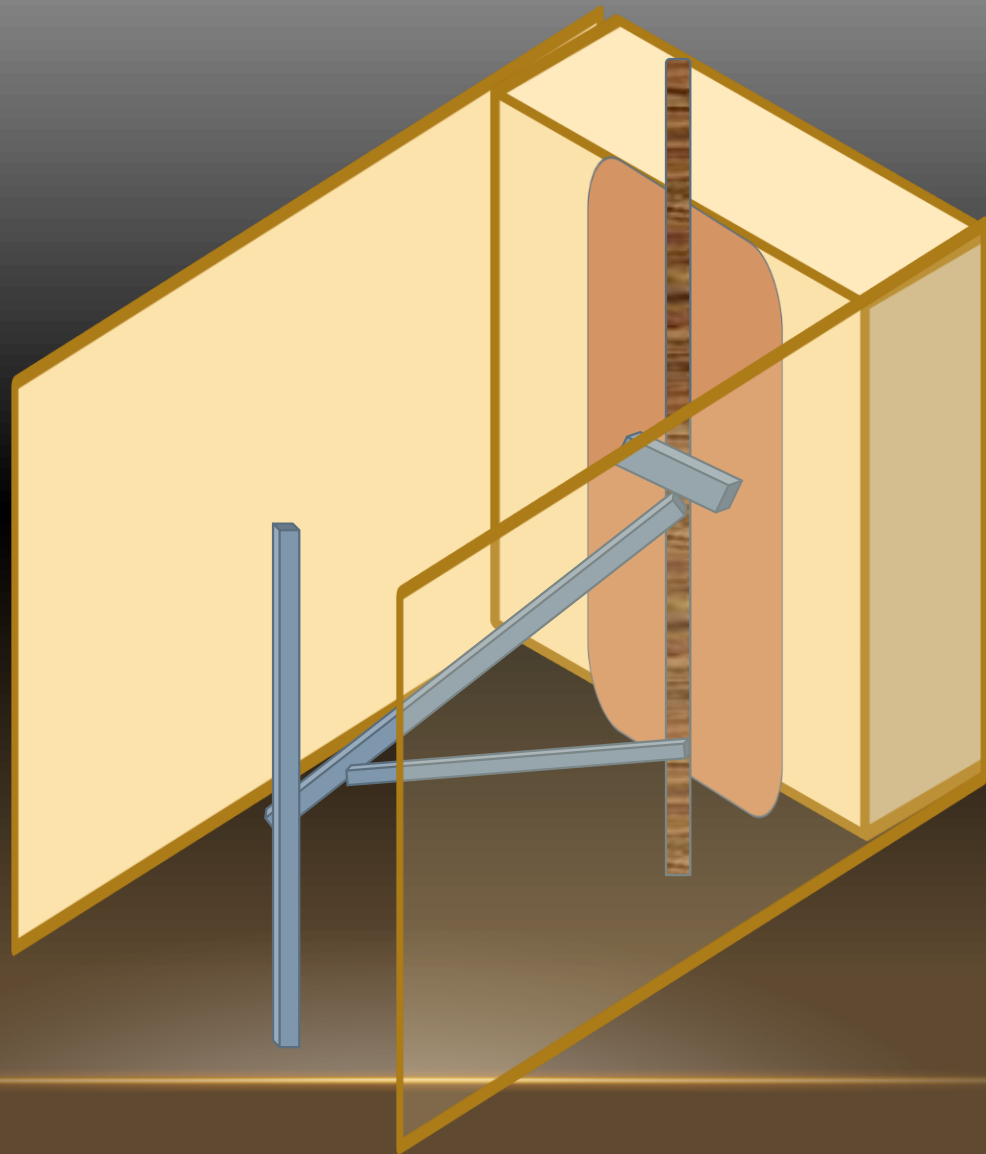
- Refer to OSHA CFR 1926 Subpart P Appendix D Table D 1-4 for Type C soil, pages 8 through 10 to determine dimension of hydraulic cylinder, and vertical and horizontal spacing requirement.

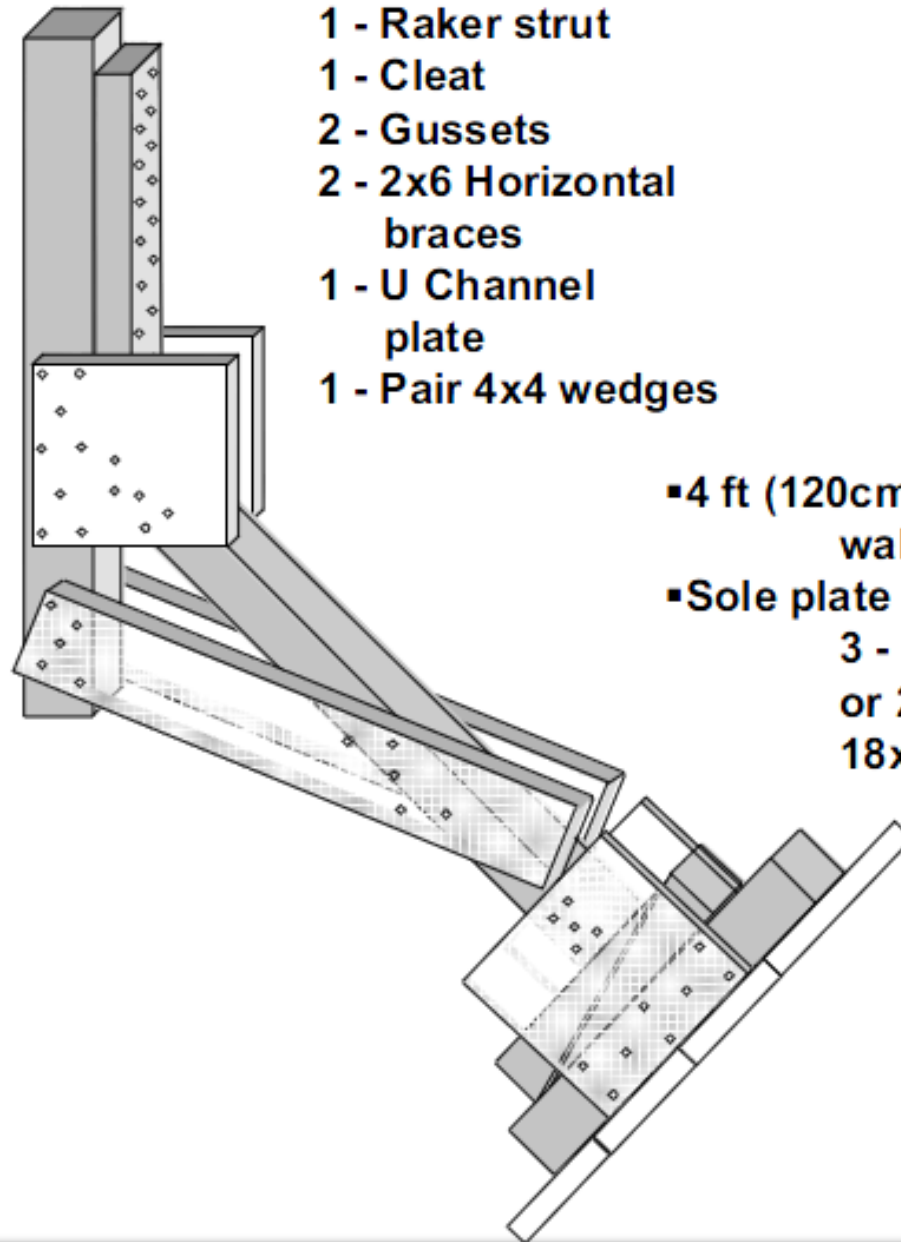
PROCEDURES FOR INSTALLING SHORING

- Timber, screw jacks, hydraulic shoring devices and pneumatic shoring devices can be used side by side provided that the individual device is rated for the conditions.

- For end wall shoring, panels can be secured in place with a flying shore. Horizontal bracing is not sufficient.







- 1 - Wall plate
- 1 - Raker strut
- 1 - Cleat
- 2 - Gussets
- 2 - 2x6 Horizontal
braces
- 1 - U Channel
plate
- 1 - Pair 4x4 wedges

- 4 ft (120cm) minimum
wall plate
- Sole plate is
3 - 2x6x18 (45cm)
or 2 - $\frac{3}{4}$ Plywood
18x18 (45x45cm)

“SAME SIDE SET” INSTALLATION

- This technique is used when there is sufficient room for rescuers to stand on both sides of the trench
- The first set of panels placed in a trench should always have three shores to hold them in place.
- Ropes attached to the bottom of the panels are used to lower the panels into the trench.
- Panels are lowered from each side with the strong backs facing each other and then positioned as vertical as possible using the ropes
- Ropes can then be wrapped around the top of the strongbacks or picketed to the ground.

“OPPOSITE SIDE SET”

- Used when there limited space for the rescuers to stand, usually on the spoil pile side.
- Two 4”x4” runners are placed in the trench with the bottoms secured against the bottom of the opposite side the panels will be inserted from and the tops on the same side as the panel will be inserted from.
- The panel is placed on the runners with the strong back facing down.
- Rescuers will then push the runners to awaiting rescuers on the opposite side and those rescuers will position the panel vertically using the attached rope.
- The near side panels will bet set using the “same side set” method.

INSTALLATION PROCEDURES (PNEUMATICS SHORING)

- “First piece In Last Piece Out”.
- The first installed shore should be no lower than 18 inches below the lip.
- Last installed shore should be no higher than 24 inches from the bottom of the trench.
- Hydraulic shores can be lowered by ropes from the top without rescuers usually having to enter the trench.
- *Shoot the middle shore first, then the bottom shore, then the top shore before continuing down into the trench.*
- *If a rescuer must enter the trench to assist with placing the bottom pneumatic shore then the top shore should be set after the middle one.*

SHORING A NON-INTERSECTING TRENCH

- **Timbers**- Set top shore, middle shore and bottom shore. Remove in reverse order.
- **Pneumatic**- Set the middle strut, bottom strut, and top strut, as a rule, all necessary shores can be installed from ground level.
- **Hydraulic**- Set and expand struts between the uprights, as a rule, all necessary shores can be installed from ground level.
- **Screw jacks** - Follow timber guidelines.
- Backfill all voids behind the panels once they are set and shored.
- Using basic carpentry skills toe-nail all screw jacks and pneumatic shores to the strong backs.

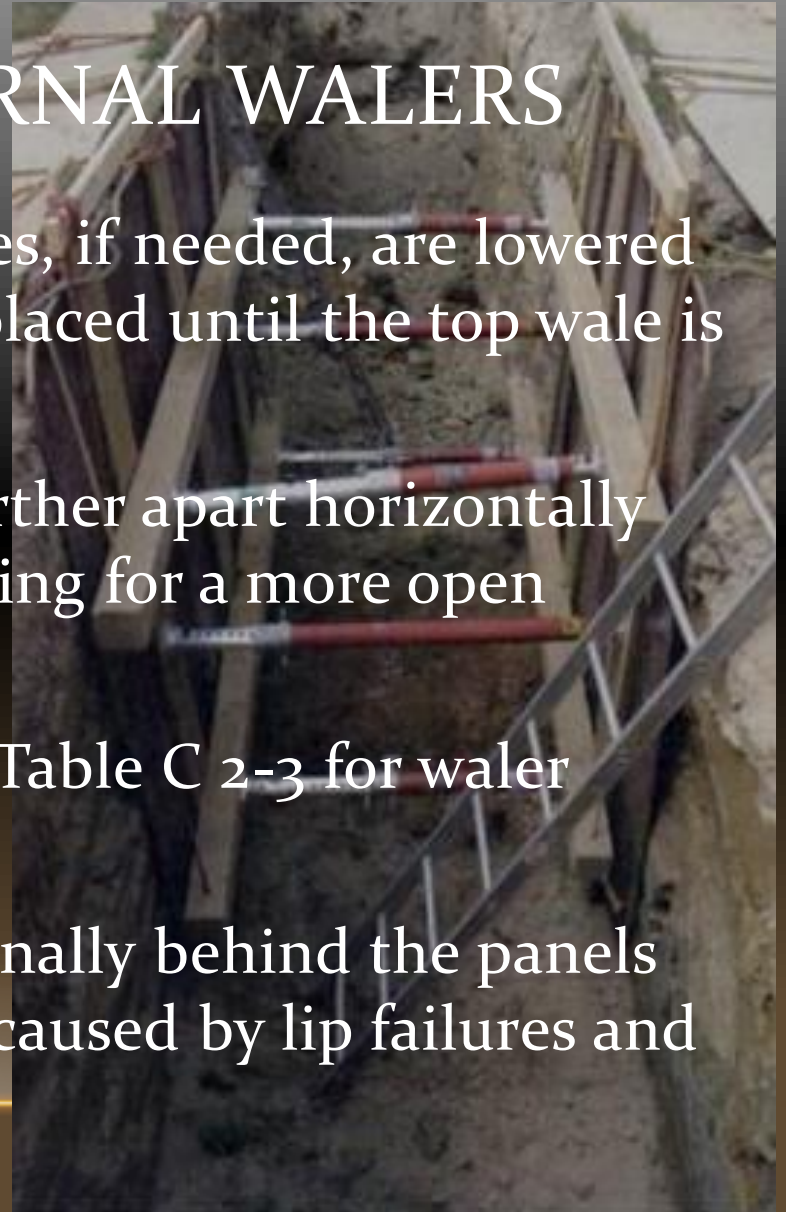
INTERNAL AND EXTERNAL WALERS

- For Non-intersecting trench.
- Wales (waler) are horizontal members that span multiple trench panels to create a safe work area.
- Provide a larger less congested area to work from.
- Timber wales are of larger dimension than shoring devices. (8x8, 10x10...)
- Are lowered into the trench at appropriate heights and secured with shoring devices.



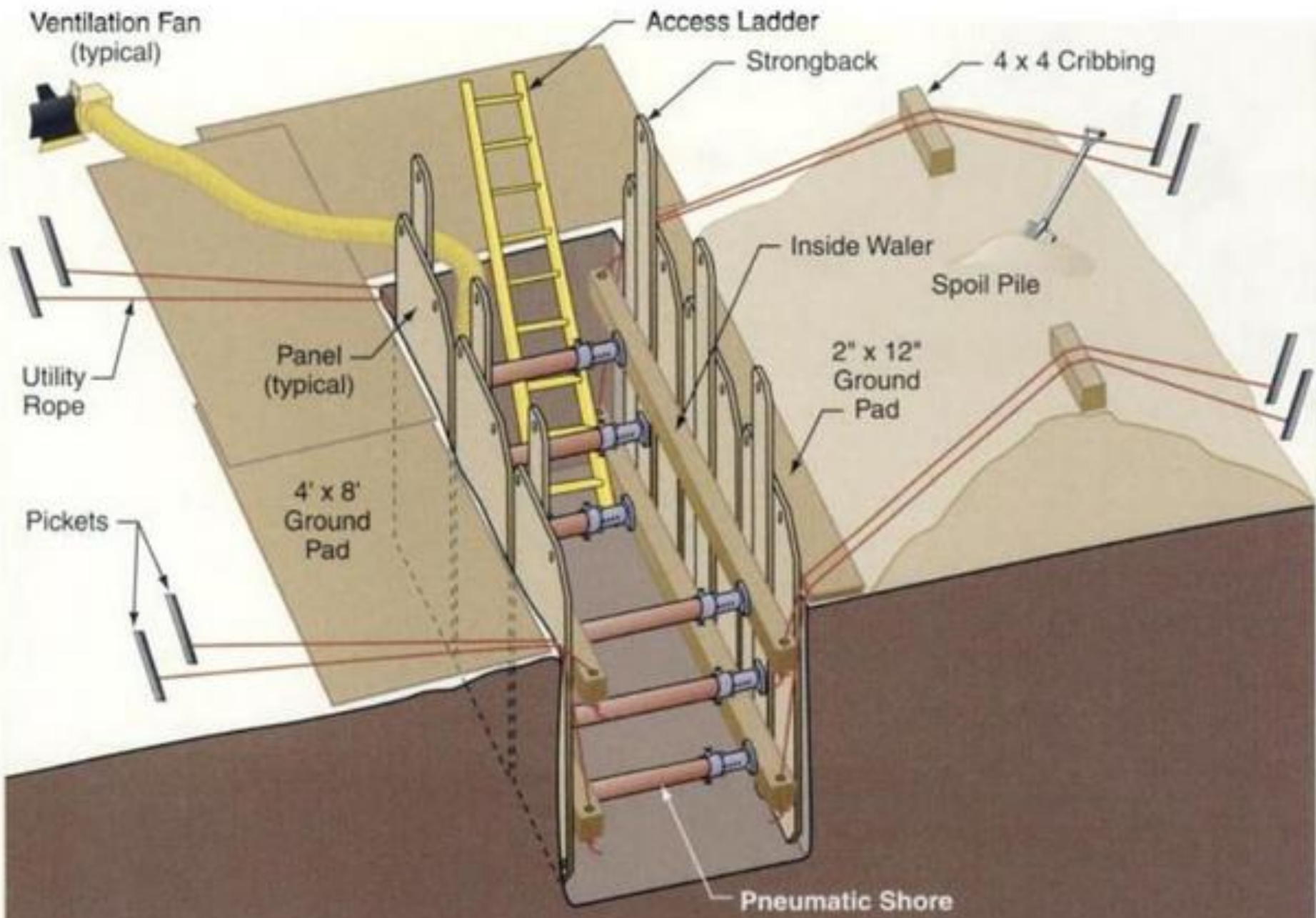
INTERNAL AND EXTERNAL WALERS

- Lower wales, and middle wales, if needed, are lowered into the trench first but not placed until the top wale is secured.
- Shoring devices can be set further apart horizontally when attached to wales allowing for a more open workspace.
- OSHA CFR 1926 Appendix C Table C 2-3 for waler installation specifications.
- Walers can also be used externally behind the panels to assist in filling large voids caused by lip failures and slough-ins.



INTERNAL AND EXTERNAL WALERS

- Outside walers are placed against the trench wall **before** insertion of the panels.
- Backfilling will be needed to allow the forces of the shores to be distributed effectively when the shores are installed.
- Backfill only **after** the installation of the wales and panels, but before the shores are installed.





SHORING A DEEP WALL TRENCH

- Measure the depth and width of the trench.
- Prepare panels and wales.
- Prepare the shores.
- Set the bottom wales on the trench floor.
- Lower the bottom set of panels (2) in an upright position and secured.
- Place a top panel horizontally across the two deep panels.
- Shore the top panels using appropriate shoring devices.
- The lower upright panels can be waled or each panel can be shored depending on availability of equipment

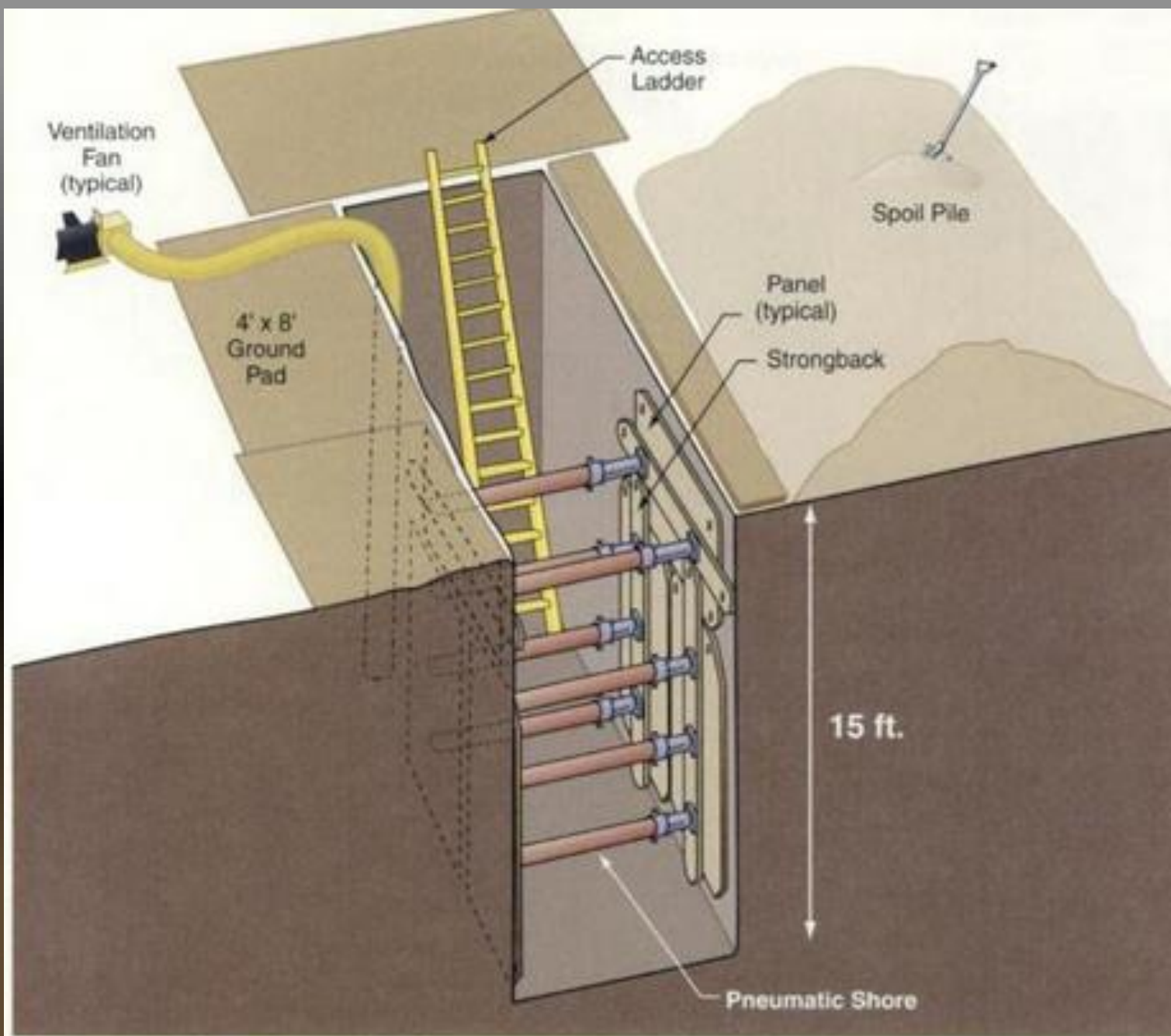


Figure 15-15 The deep trench.

“T”-TRENCH

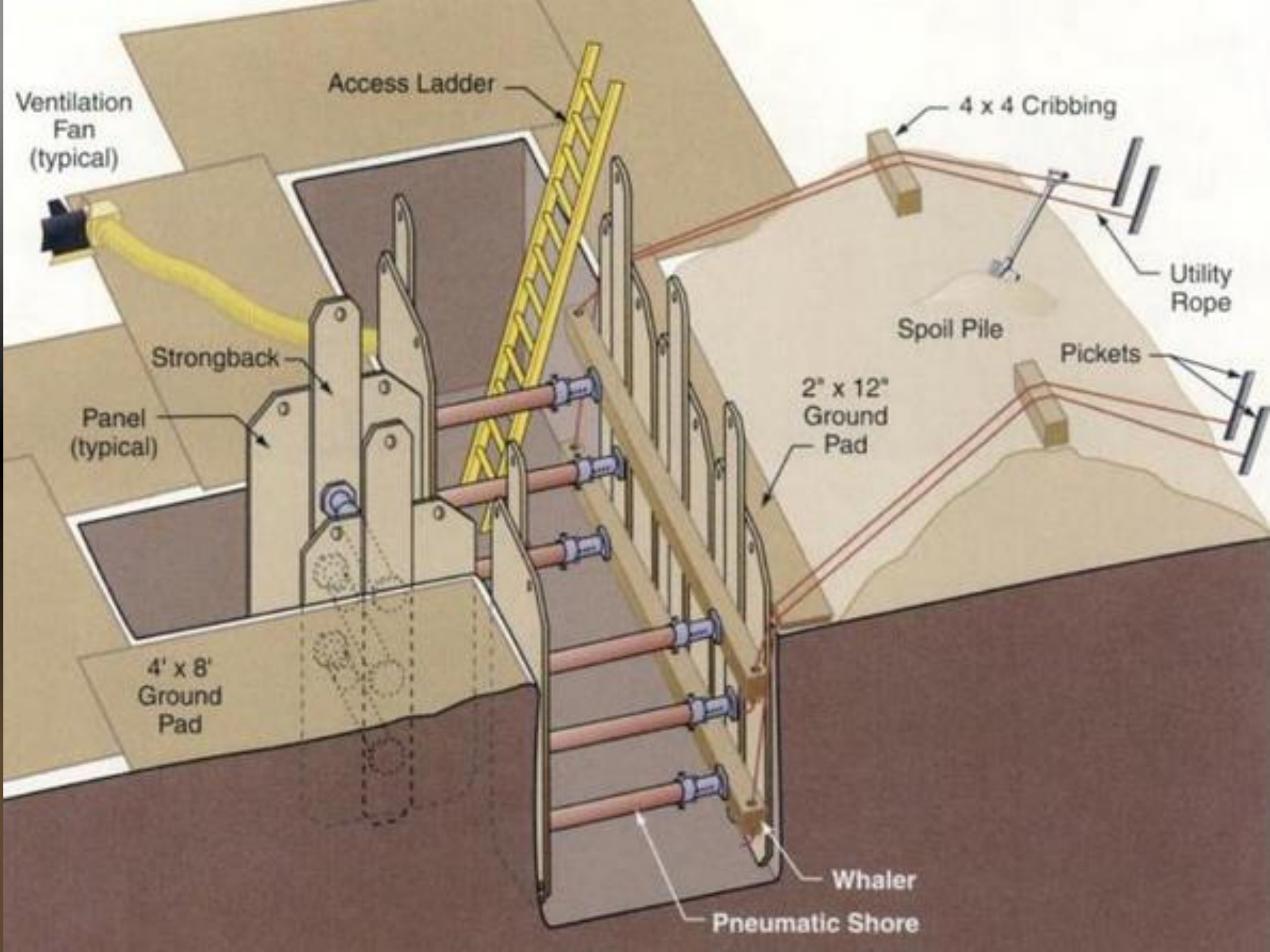
- 7 Panels and 2 Walers will be needed and materials used for a nonintersecting trench.
- Is very unstable because there are two unsupported interior exposed corners.
- The 2 Walers will be needed to capture the three panels that will be needed to support the upper portion of the “T”.
- Prohibit activity on the corners of the trench

“T”-TRENCH

- Set pickets for tiebacks for panels and wales, if needed.
- Set two panels on the wall of the “T” leg and secure the shores in the appropriate order according to the type used.
- This should be done 4 feet away from the intersecting leg.
- Lower the appropriate number of wales to the bottom of the upper wall of the “T”.

“T”-TRENCH

- Set two panels on the opposite “T” leg corners and three panels on the upper wall of the “T”.
- Secure the shores to the Walers in the appropriate order according to the type used.
- Tighten the “T” leg shores if needed.





- 1 Install the middle shore on the first set of panels. Take care not to over-pressurize the shores until a counter force is available on opposite side of trench wall.



- 2 Position the bottom wale in the bottom of the trench.



4 Install the middle shore on the outside set of panels.



- 5** Install the bottom shore between the wale and the strongback on the outside set of panels.



- 6** Position the top wale, then install the top shores between the wale and the strongback on the outside set of panels.



7

The completed T-trench with center panels spanned by wales.

“L” TRENCH

- 6 panels
- 4 – 12' 6"x6"x 12' walers will be needed, in addition to the same materials used for a non-intersecting trench.
- Is very unstable because of the unsupported interior corner that is exposed.
- Limit the activity on the corners of the trench
- Set pickets for tie backs for panels and wales (if needed).
- Set the opposing “L” wall panels.

“L” TRENCH

- Lower the appropriate number of wales to the bottom of the trench for both sides.
- Secure the appropriate number of thrust blocks on the inside “L” panels, this can be done prior to placing the panels in the trench.
- Secure all Walers into position in the appropriate order according to devices used

- Secure all outside wall corner blocks and attach appropriate shoring device(s) between the outside wall corner and inside wall corner at the appropriate levels within the trench.
- When using pneumatic shores, use one 23 degree angle swivel or two 15 degree angle swivels.

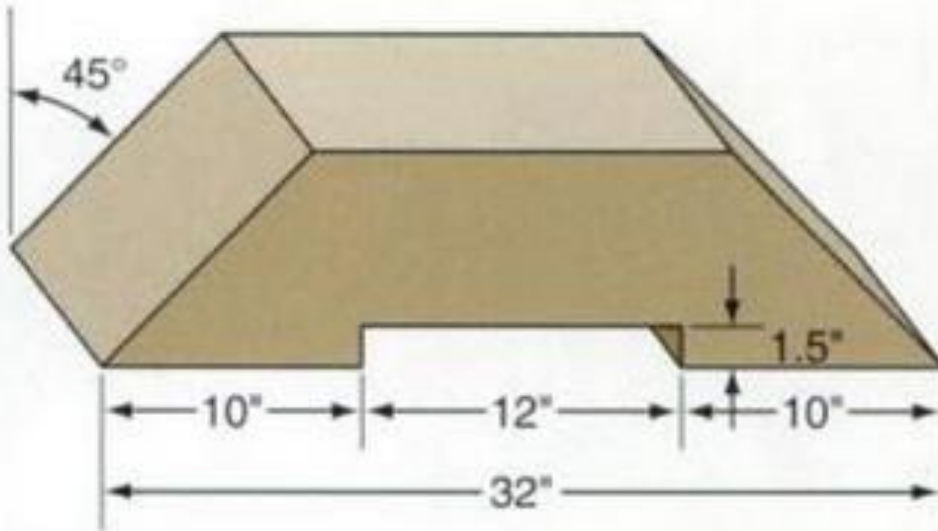


1 Wales are placed in the bottom of trench.



2 The first set of panels is installed on the inside L corners with middle shore shot.

THRUST BLOCKS

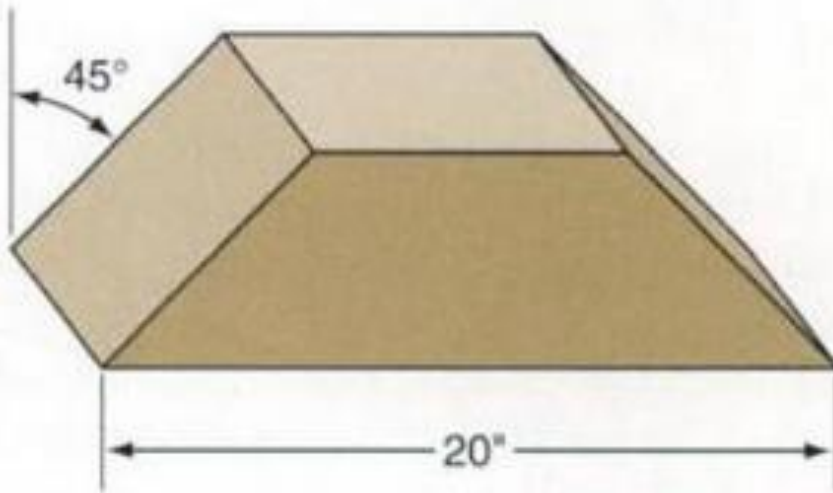


- 3 The **thrust** block is used on the opposite side panel from the wale and provides both a flat and angled surface as a base to shot shores.



- 4 **Thrust** block being toe nailed to the strongback.

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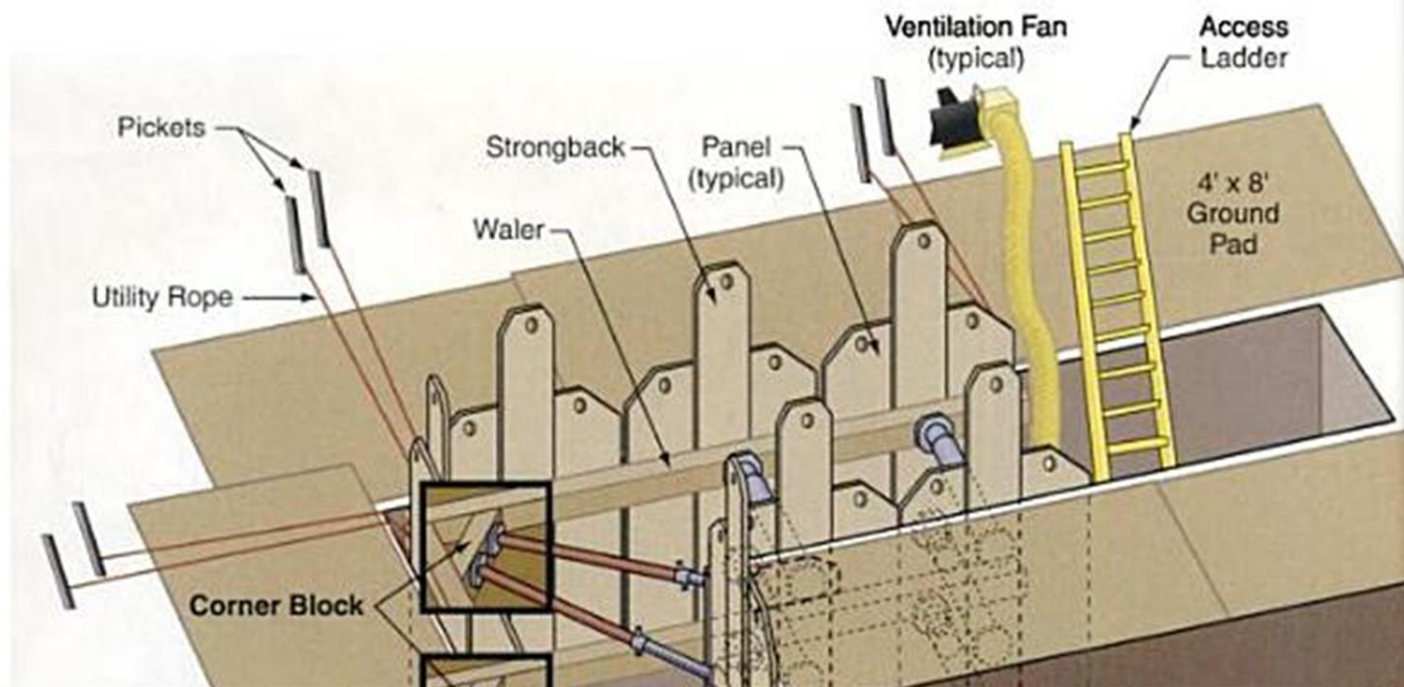


- 8 Corner **blocks** are used in the outside corners where the wales meet. They provide a platform for the base of the installed shore.



- 9 Corner **blocks** in place.

THRUST BLOCKS





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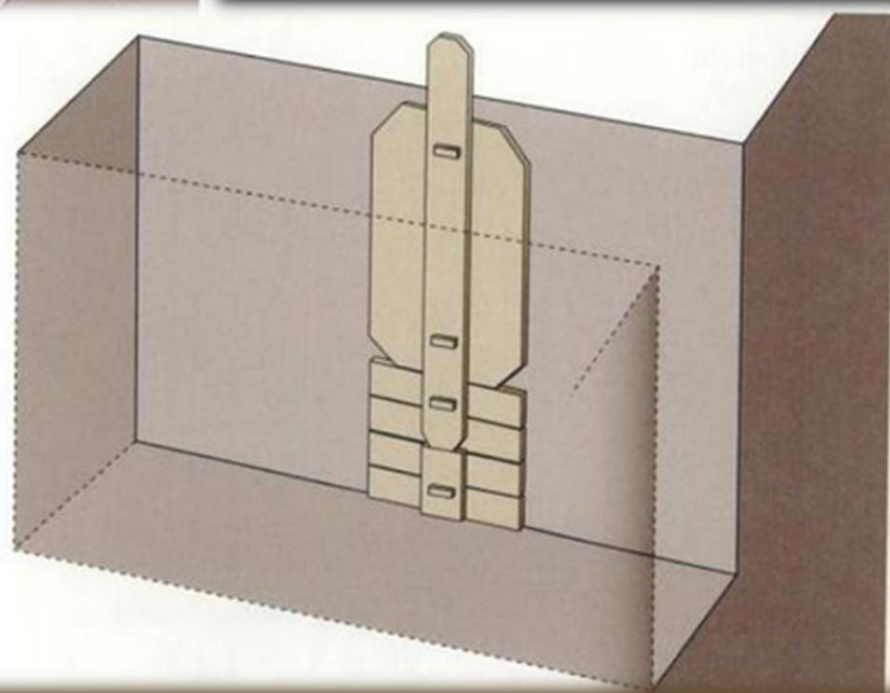
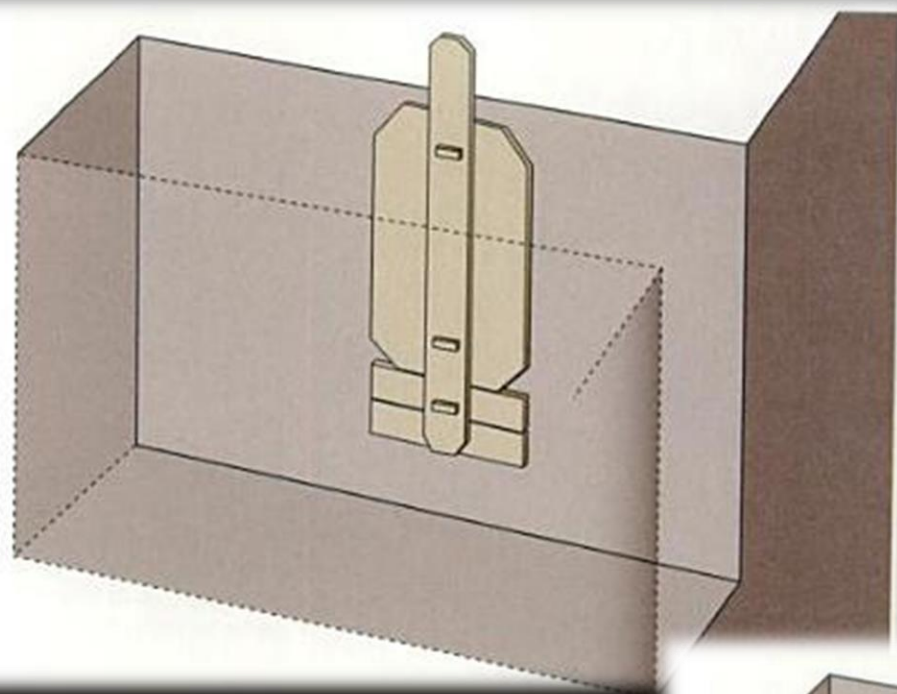
The completed L-trench.



Other L -Trench
Shoring Methods

SUPPLEMENTAL SHORING

- Is Required When A Void Is Created Extending 2 Feet Below The Bottom Of The Protective System.
- When Constructing A Standard Panel To Panel Shoring Operation Supplemental Shoring Consist Of 2 To 4 2 "X 12 "X 12 Foot Long Strongbacks Placed Horizontally Behind The Bottom Of The Vertical Strong Back Of Each Panel And To The Same Configuration On The Opposite Wall.
- This System Would Continue Until The Victim Is Reached And Retrieved.
- When Constructing A Waler Type Protective System
 - Sheets Of Plywood (1 1/8")
 - Shoreform (Minimum 1")
 - Additional 2"x12" Strongbacks Can Be Lowered Between The Strongbacks Attached To The Panel As Need And Shimmed In Placed Until They Need To Be Lowered Again.



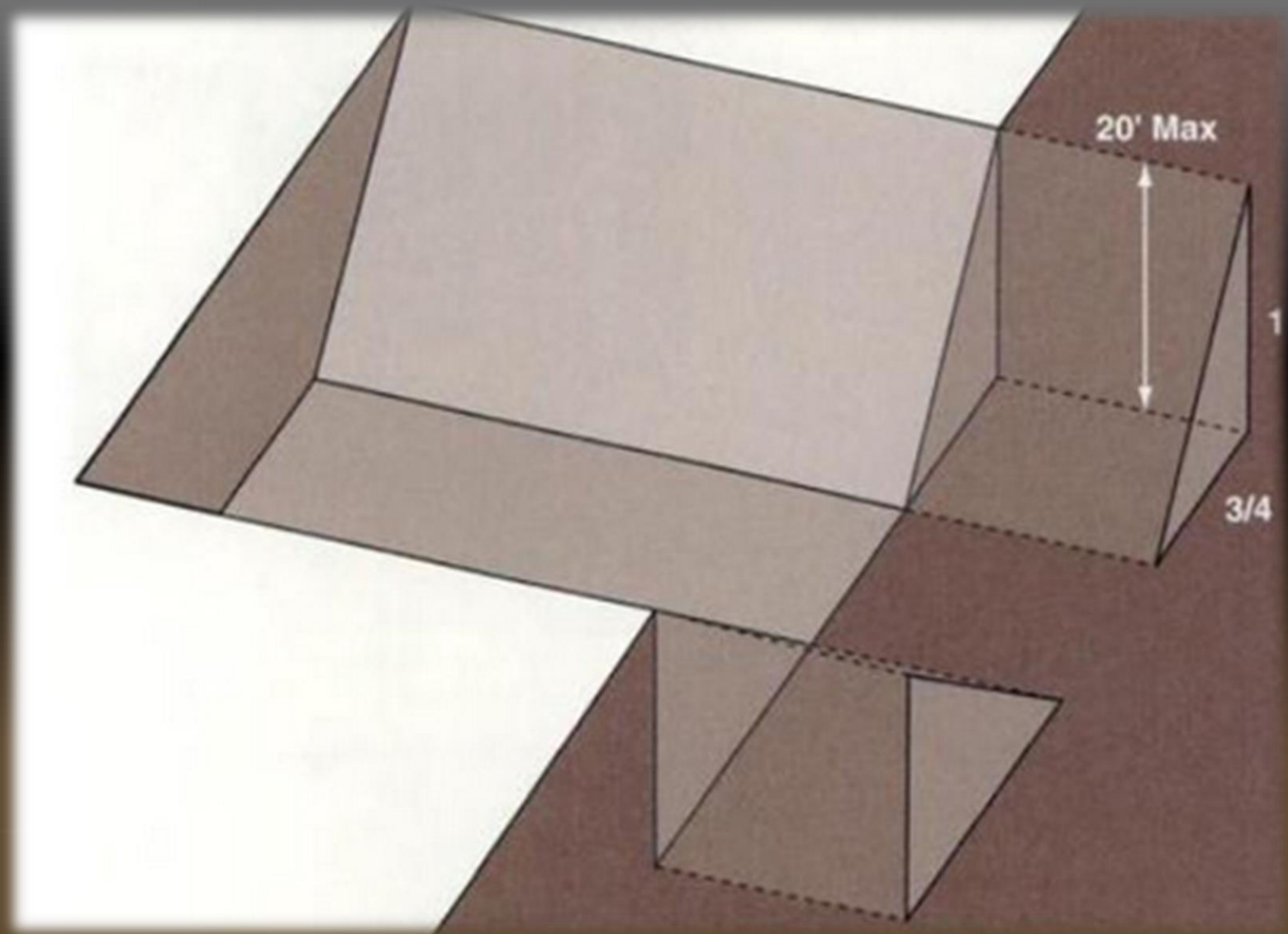
SLOPING OR BENCHING

- Method To Decrease The Angle Of A Wall To The Point That It Cannot Collapse.
- Reduces The Gravitational Forces And Total Amount Of Unconfined Compressive Forces That May Be Present.
- May Be Useful For A “Body Recovery” Operation When A Large Safe Opening Is Needed.

SLOPING OR BENCHING

- Requires A Tabulated Data Sheet.
- Is Time Consuming.
- Requires A Lot Of Space.
- See Osha Cfr 1926.Appendix B Page 2 For Allowable Slope Data Chart.
- The Maximum Slope, Designated For Type C Soil, Is 1 1/2 Foot Of Run (Horizontal) For Every 1 Foot Of Rise

SLOPING



BENCHING

