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EXCAVATION SAFETY News

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A Few Important Questions to Ask When…

Selecting Trench Shoring and Shielding Methods

Asking just a few questions will help insure that you get the right shoring or shielding equipment for your jobs. The correct equipment will help promote safety ***and*** productivity. Choosing the wrong equipment can waste money, but more importantly, can result in a serious injury or death.

• *When Selecting Vertical Shores*

> What will you be doing in the trench?

Most often, vertical shores are used when working in relatively good soil conditions, in shallow excavations, and where the walls are parallel. They are easy to install and are relatively inexpensive. They are particularly useful when working around other utilities.

> What is the soil type?

The first step in choosing any excavation protective system is to classify the soil. According to OSHA's Subpart P, there are four types of soils:

1.) Stable Rock — Natural solid materials that stay intact (rare)
2.) Type "A" — Mostly cohesive (clay, rare)
3.) Type "B" — Moderately cohesive (clay, silt)
4.) Type "C" — Least cohesive (loose, granular or wet)

The "Competent Person" must classify the soil, based upon the results of at least one visual and one manual test, using recognized methods of soil testing.

Alternatively, the "Competent Person" may classify all soil as "Type C" and slope, shore, or shield accordingly.

> Is water present?

Workers are ***not*** allowed in trenches and excavations where water has or is accumulating, unless adequate precautions are taken. The precautions vary from job to job, but may include the use of specialized support systems and water-removal equipment.

Water destabilizes the soil. As soil becomes saturated, there is a greater chance of a cave-in. Soil also becomes heavier, which increases pressure on the shoring system.

How deep is the excavation?

Vertical shores must be correctly sized for the excavation depth. The Manufacturer's Tabulated Data for your vertical shores, or OSHA's Subpart P, will provide spacing information.

For example, if using Efficiency Production's Manufacturers Tabulated Data, the drawing in Fig. 1 indicates that the top cylinder needs to be within 1 to 2 feet of the top of the trench, and the bottom cylinder needs to be within 4 feet of the bottom of the trench.

The depth of the trench and type soil will dictate the vertical spacing between the cylinders. The chart in Fig. 2 tells us that when working in "Type B" soil, and 10 feet or less in depth, the maximum vertical spacing between the cylinders is 4 feet.

See "Selecting" on page 2

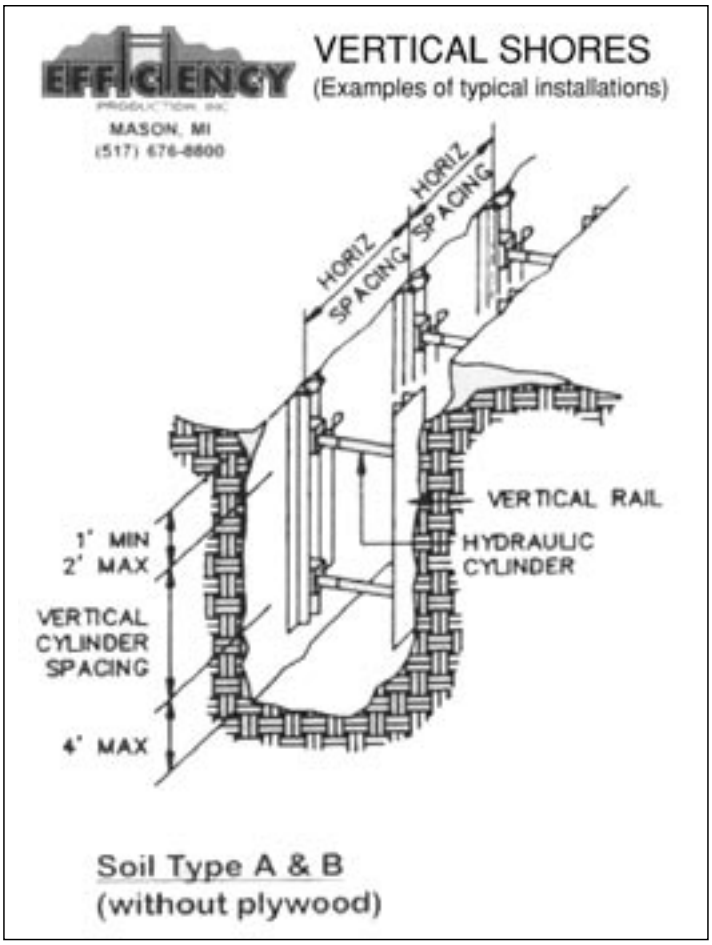
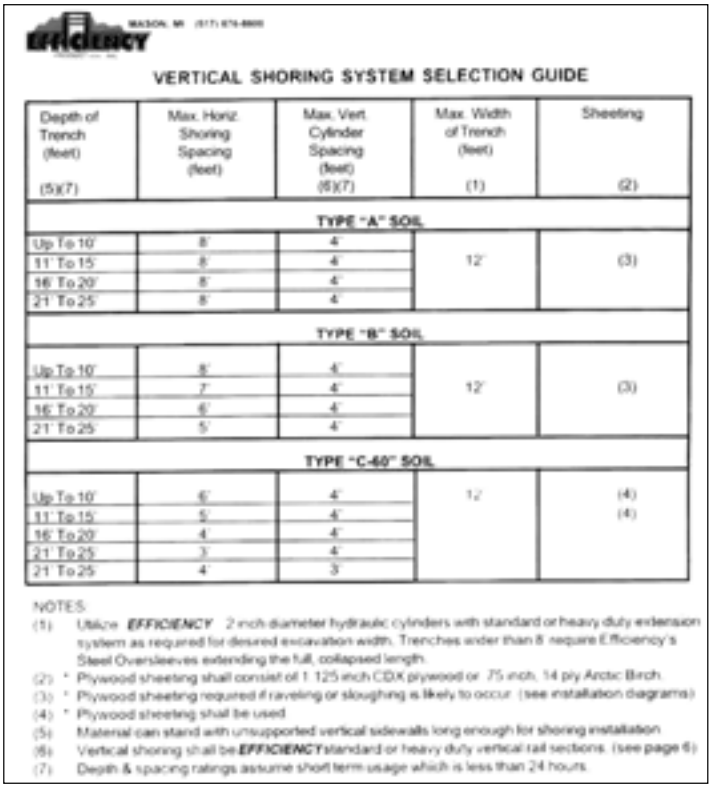


Figure 1

"Selecting" from page 1

> How much trench do you need to shore at one time?
Again, the Manufacturer's Tabulated Data for your vertical shores, or OSHA's Subpart P, will provide the horizontal spacing information.

For example, if using Efficiency Production's data, and working in "Type B" soil, in an excavation that is 10 feet or less in depth, the maximum horizontal spacing between the shores is 8 feet, per Fig. 2.



VERTICAL SHORING SYSTEM SELECTION GUIDE

Depth of Trench (feet) (5)(7)	Max. Horiz. Shoring Spacing (feet)	Max. Vert. Cylinder Spacing (feet) (6)(7)	Max. Width of Trench (feet) (1)	Sheeting (2)
TYPE "A" SOIL				
Up To 10'	8'	4'	12'	(3)
11' To 15'	8'	4'		
16' To 20'	8'	4'		
21' To 25'	8'	4'		
TYPE "B" SOIL				
Up To 10'	8'	4'	12'	(3)
11' To 15'	7'	4'		
16' To 20'	6'	4'		
21' To 25'	5'	4'		
TYPE "C-40" SOIL				
Up To 10'	6'	4'	12'	(4) (4)
11' To 15'	5'	4'		
16' To 20'	4'	4'		
21' To 25'	3'	4'		
21' To 25'	4'	3'		

NOTES:
(1) Utilize EFFICIENCY 2 inch diameter hydraulic cylinders with standard or heavy duty extension system as required for desired excavation width. Trenches wider than 8' require Efficiency's Steel Oversleeves extending the full, collapsed length.
(2) * Plywood sheeting shall consist of 1 1/2 5 inch CDX plywood or .75 inch, 14 ply Arctic Birch.
(3) * Plywood sheeting required if raveling or sloughing is likely to occur. (see installation diagrams)
(4) * Plywood sheeting shall be used.
(5) Material can stand with unsupported vertical sidewalls long enough for shoring installation.
(6) Vertical shoring shall be EFFICIENCY standard or heavy duty vertical rail sections. (see page 6)
(7) Depth & spacing ratings assume short term usage which is less than 24 hours.

Figure 2

> How wide is the trench?
Typical cylinder size ranges are:

- 17" minimum width to 27" maximum width
- 22" minimum width to 36" maximum width
- 28" minimum width to 46" maximum width
- 34" minimum width to 55" maximum width
- 42" minimum width to 69" maximum width
- 52" minimum width to 88" maximum width

Extensions can be used to extend cylinder length.

> Is Finform required?
Finform, or "Finland Form," is a special plywood that is ¾" thick, and consists of 14 plies of Arctic white birch. A 4' x 8' sheet weight 94 pounds, and is used to control sloughing or raveling of trench walls. Sometimes the Manufacturer's Tabulated Data will say Finform is optional, per the determination of the "Competent Person." Other times, use of Finform will be required.

Alternatively, most manufacturers and OSHA will allow the use of 1 1/8" softwood plywood.

• *When Selecting a Trench Shield*

> What will you be doing in the trench?
Always match the system with the working conditions.

If you are laying miles of deep pipe, you are probably working with a large, track-type excavator. Such conditions suggest use of steel trench shields.

If you are making a point-type repair to a utility, in a relatively shallow excavation, you're probably working with a rubber-tired backhoe. An aluminum trench shield would be more appropriate in this case.

If you are involved in a pit-type operation – a tank or sewage pump station – 4-sided protection may be required. That system could be steel or aluminum.

> What is the soil type?
Soil classification, as described on page 1, is going to be required, unless the soil is considered "Type C."

> Is water present?
Dewatering may be required. See page 1.

> How deep is the excavation?
Trench shields have depth ratings, as shown in the Manufacturer's Tabulated Data for specific shields. Once you have determined the type of soil, you can refer to that data to check the depth rating.

As the soil type deteriorates from "A" to "B" to "C," the potential pressure against the trench shield increases. As a result, the trench shield has a more shallow depth rating. For example, a specific trench shield might have the following maximum depth ratings:

- Type "A" soil – 40 feet
- Type "B" soil – 22 feet
- Type "C" soil – 17 feet

If these depth ratings are exceeded, the structural integrity of the shield could be compromised. Someone could be injured or killed. It's also an OSHA violation.

Continued on next page

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> Is it possible to slope part of the excavation?

The common height for trench shields is 8 feet. And trench shields can be stacked to gain additional vertical protection. Alternatively, it might be possible to utilize a combination of sloping and shielding, as shown in Fig. 3.

The required slope is based upon the type of soil.

- For Type "A" Soil – ¾ H to 1 V, or 53°
- For Type "B" Soil – 1 H to 1 V, or 45°
- For Type "C" Soil – 1½ H to 1 V, or 34°

These slopes are good to a depth of 20 feet Depending upon the Manufacturer's Tabulated Data, a Registered Professional Engineer may be required if the excavation is more than 20 feet deep.

Remember that the slope must be at least 18 inches below the top of the shield. See Fig. 3.

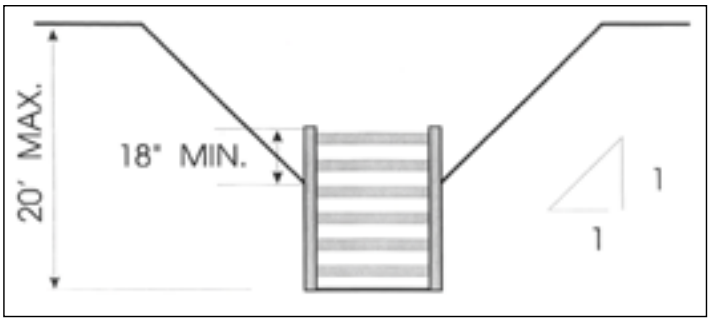

Figure 3

> How long does the trench shield need to be?

Trench shields come in different lengths. Some models are as short at 8 feet or 10 feet. And 16- and 20-foot shields are common. Some may be 24 feet or longer.

If you are laying pipe, a rule of thumb is that the length of the pipe determines the length of the trench shield. For example, if you're laying 13-foot joints of pipe, the trench shield needs to be 16 feet long to work at both ends of the pipe simultaneously.

> How wide does the trench shield need to be?

Again, spreaders come in different lengths – as short as 2 or 3 feet, and as wide as 16 or 18 feet.

The width of the shield, or spreader length, will be determined by the outside diameter of the pipe you are laying. Most contractors want at least 6 inches between the outside of the pipe and the inside wall of the trench shield on each side.

Also consider whether you will be digging inside the trench shield. If yes, you will want to make certain there is sufficient clearance between the outside of the bucket and the inside of the shield. Most contractors want at least 6 inches of clearance on each side of the bucket.

> What type of equipment will be on site to lift the trench shield?

Most rubber-tired backhoes have a limited lifting capacity of approximately 2,000 pounds. As a result, aluminum trench shields are typically used with rubber-tired equipment. Of course, track-type excavators have the ability to safely lift more weight.

Another Rule of Thumb: The excavator needs to be able to lift at least one and half times the weight of the trench shield, at a radius of 15 feet. The operating weight of the excavator offers guidance as to lifting capacity:

Excavator Weight	Lifting Capacity
30,000 to 40,000 lbs.	7,000 lbs.
40,000 to 50,000 lbs.	8,600 lbs.
50,000 to 60,000 lbs.	10,000 lbs.
60,000 to 70,000 lbs.	13,600 lbs.
70,000 to 80,000 lbs.	15,000 lbs.
80,000 to 90,000 lbs.	18,500 lbs.
90,000 to 100,000 lbs.	20,000 lbs.

Consult the operator's manual for your specific backhoe or excavator to determine its lifting capacity. Also, make sure you have the appropriate slings or chains for lifting your shields. Such equipment also needs to be inspected by a qualified person prior to use. ***(Note: Most chains used for securing loads on trucks and trailers are <u>not</u> approved for overhead lifting).***

• When Selecting a Slide Rail Shoring System

Slide rail systems are ideal for pit-type installations, particularly in poor soil conditions. If you are working with a slide rail system, you're probably working closely with a distributor or manufacturer who specializes in these types of systems. Be sure that you have equipment of sufficient size to safely install and remove the system, and dig the hole.

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Inspection Guidelines for Trench Shields and Hydraulic Shores

The Inspection Guidelines below were developed by Frank Balluff of Pro-Tec Equipment, Inc., makers of trench shields and hydraulic shoring systems.

Make photocopies of these lists and provide them to all your job site crews.

Guidelines for Inspecting *Trench Shields*

Watch for:

- A permanent set (deflection) in sidewalls that exceeds several inches.
- Spreader pipe with bends, cracks, or kinks.
- Elongated pin holes in collar or spreader pipes.
- Severe structural damage to top tubes, end tubes, or knife edges.
- Excessive "waffling effect" on inside or outside plate skins (plate appears to be "sucked in" and inner frame members can be easily seen through the skins
- Make sure all spreader pins and keepers are in place and not bent or cracked.
- Inspect lifting eyes and pulling eyes for elongation, cracking or excessive wear.

Minor problems – tears, cracks, or punctures – can usually be repaired according to the manufacturer's instructions for type of welds and welding rod to use.

Major structural damage will require specific written instructions from the manufacturer and possibly factory supplied replacement parts.

Damaged or missing spreader pipe, pins, and keepers should be replaced immediately.

If in doubt about the severity or the need to repair, take a photograph and contact your distributor or manufacturer for assistance.

Guidelines for Inspecting *Hydraulic Shores*

Watch for:

- Signs of any leakage or pressure loss.
- Cracks in rails. Replace if needed
- Make sure that handles are in place, and not damaged,
- Make sure plywood or Finform is securely attached. If it is not attached, make sure it is stable.
- Make sure hydraulic fittings and hoses are free of debris and in good working condition.
- Make sure all pins and keepers are in place and secure.
- Cylinders that are damaged should be repaired or replaced.
- Inspect pump can, fittings and gauges for damage or leaks

This Guy Is Really Asking For It

This worker apparently likes to gamble with his life. Not only is he in a 17-foot deep excavation, it was raining when this photo was taken!

So, what's wrong with this picture? Most obvious is ***the absence of trench shoring or shielding of any kind****. Plus:*

- ***there is no means of access and egress,***
- ***the spoil is set far too close to the edge of the trench.***

Be aware. Be careful. Save lives.