ARCOSA
SHORING PRODUCTS

Excavation & Shoring Overview:
Duties and Roles of the ~~Qualified~~ Competent Person

Presented by:

James McRay,
Trench Safety Training Specialist

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Weight of Soil

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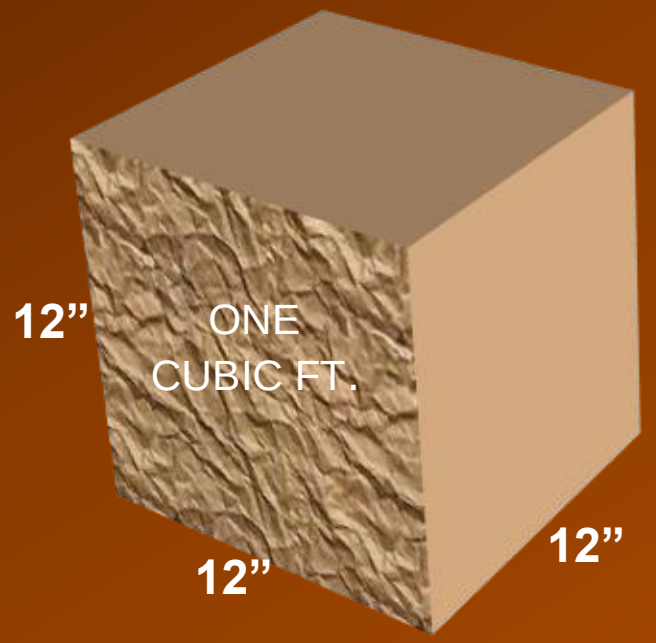
One Cubic Foot
(12” x 12” x 12”)
weighs between
90 to 140 Lbs.



Weight will depend on soil density and moisture content

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Weight of Soil

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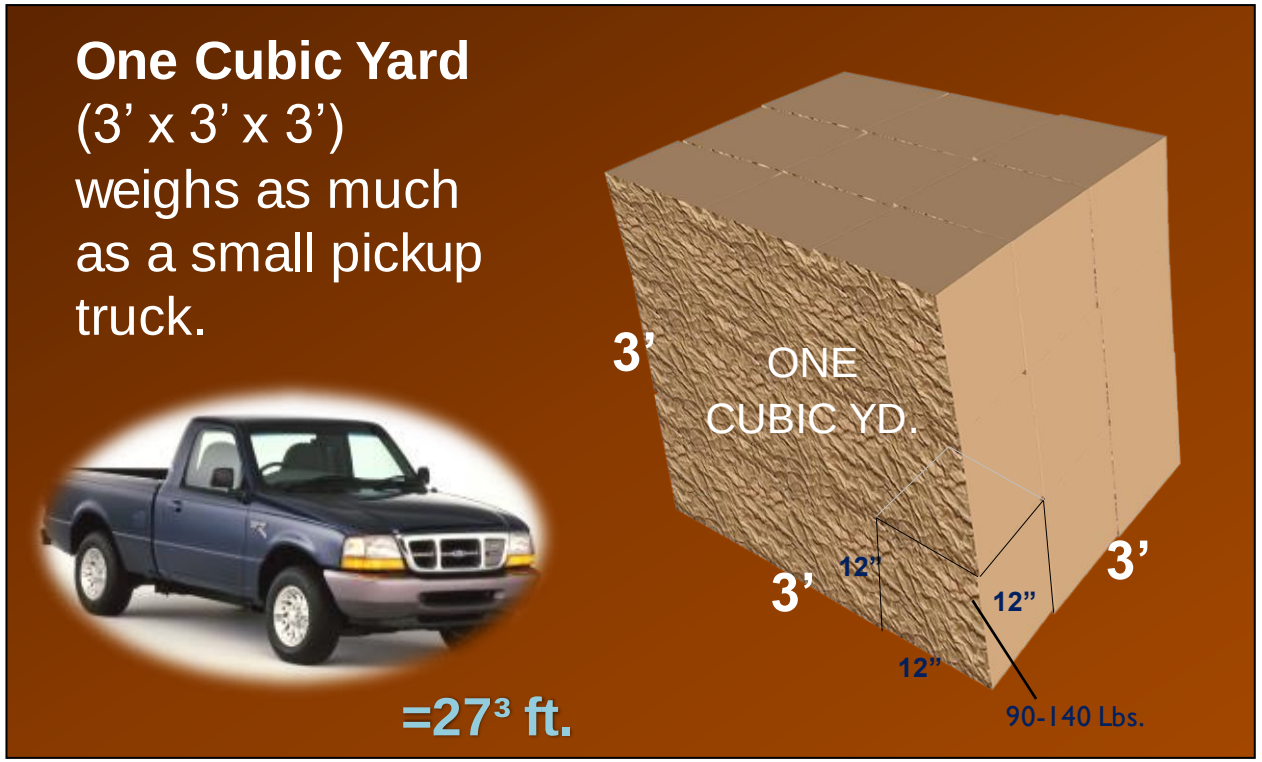

Weight will depend on soil density and moisture content

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Recent Headlines

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- *Plumber rescued from collapsed trench at mall after five hours*
- *Workers rescued from trench collapse at North Texas middle school*
- *Construction worker killed in San Francisco trench collapse*
- *One dead after trench collapse in Knox Co*
- *Hartford worker injured by falling trench box, fire official says*

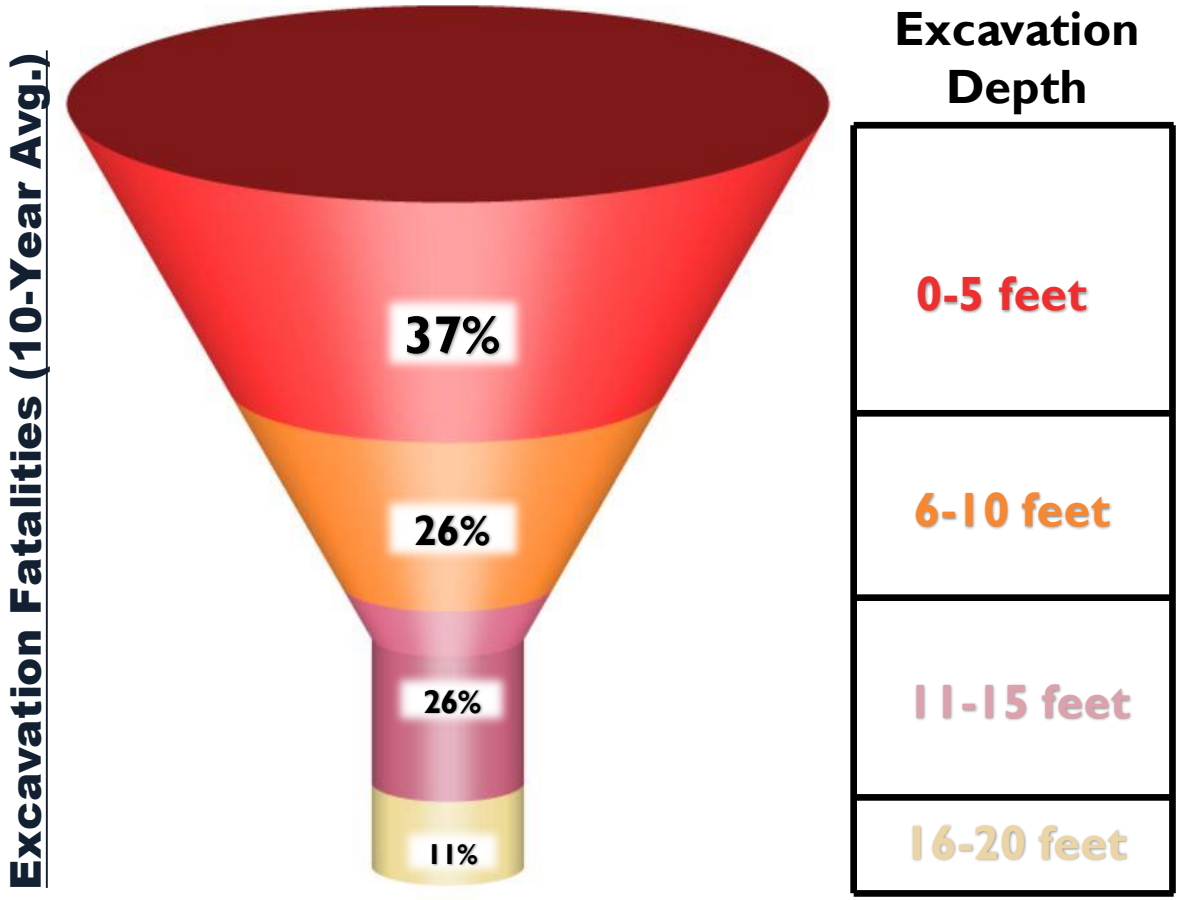
Recent Headlines

ARCOSA SHORING PRODUCTS

- Plumber rescued from collapsed trench at mall after five hours
  - **7 to 8 feet deep**
- Workers rescued from trench collapse at North Texas middle school
  - **4 feet deep**
- Construction worker killed in San Francisco trench collapse
  - **8 to 10 feet deep**
- One dead after trench collapse in Knox Co
  - **10 feet deep**
- Hartford worker injured by falling trench box, fire official says
  - **Huh?**

Trench Related Incidents

Incidents and depth may be opposite of what you assumed…



MIOSHA PART 9

Excavation, Trenching and Shoring

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- To ensure standards are met and each excavation is free of hazards – Part 9 requires that the employer designate a representative to design, construct and maintain the work area so it is free of all hazards.
- This representative is defined as the ~~QUALIFIED~~ COMPETENT PERSON

Role of the Competent Person

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- Responsible for overall safety of excavation*
- Knowledgeable in process of soil classification
- Responsible for selection and use of proper protective systems
- Represents employer in MIOSHA visits
- Has authority to implement protective measures

Competent Person (cont'd)

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- Identified in writing by employer
- Key piece of any good safety program
- Required on every site with excavation*
- Has tools and publications necessary to conduct job
- Can be any trade or position with company

Definition: “EXCAVATION”

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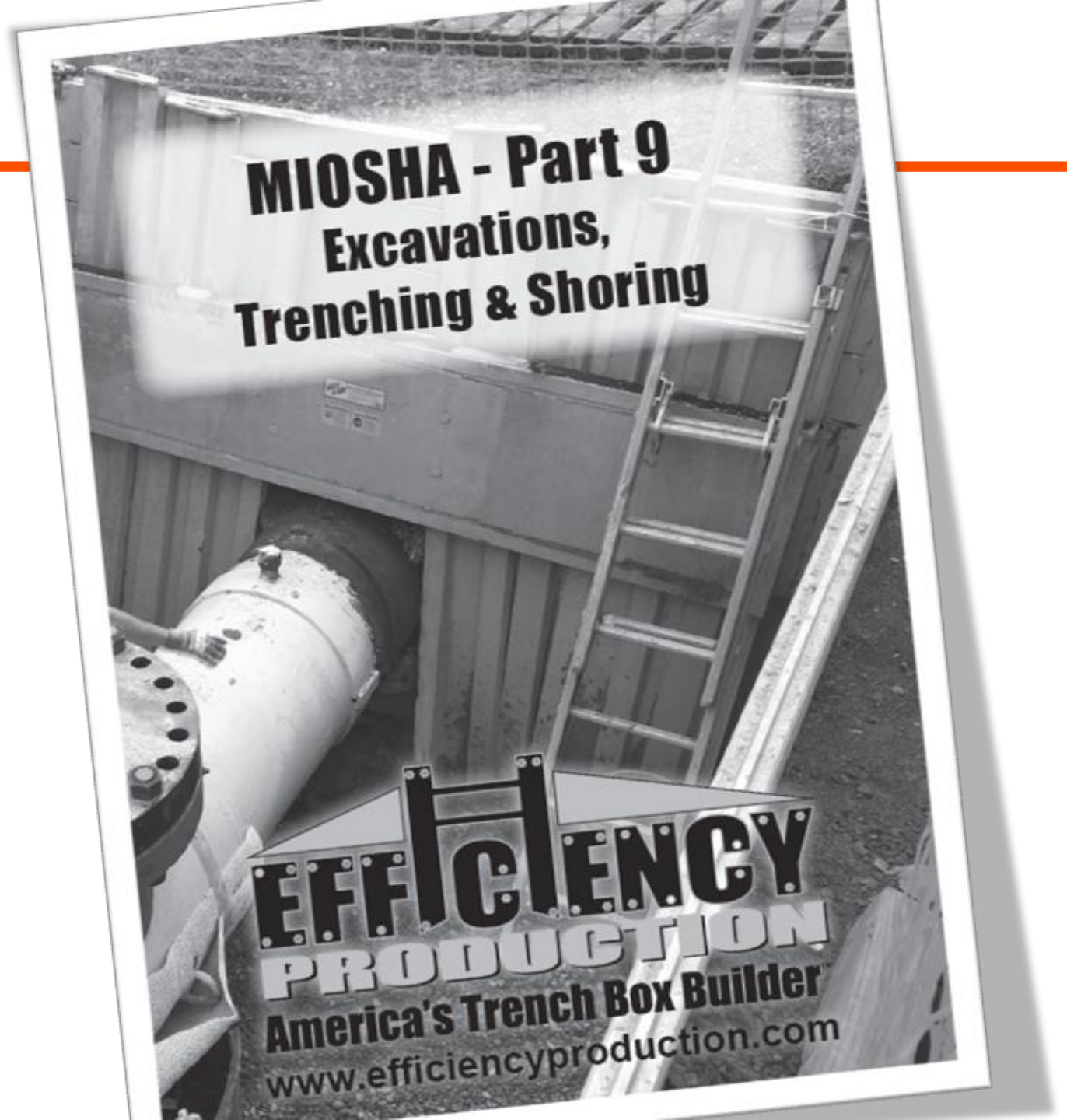
Any man-made cut, cavity, trench, or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal.” MIOSHA Part 925(6)


MIOSHA - Part 9
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Trenching & Shoring
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Definition: Excavation vs. Trench

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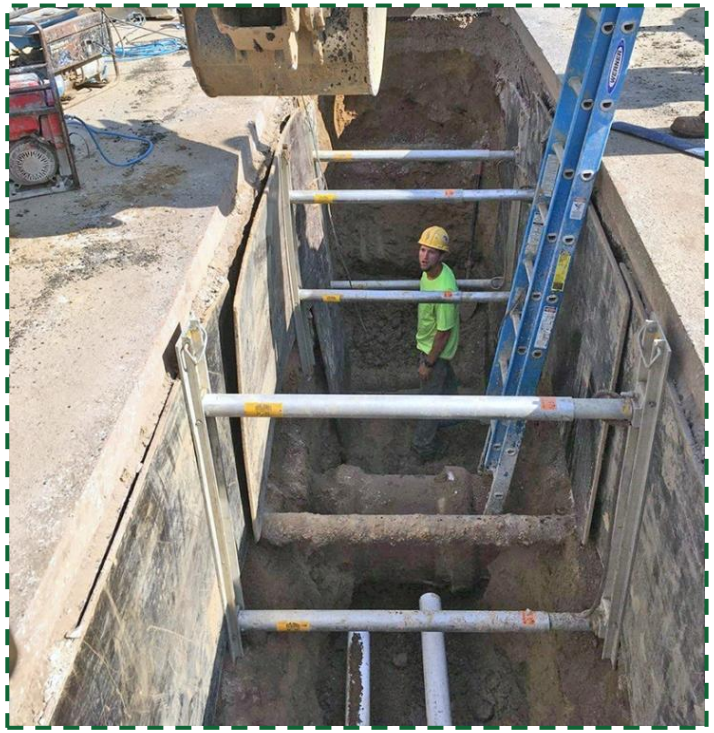
EXCAVATION

Any manmade cavity in ground

TRENCH

Excavation deeper than wide



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INSPECTIONS – Rule 932 (Unchanged)

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- (4a) An ongoing inspection of an excavation or trench shall be made by a Competent person.
- (4b) After every rainstorm or other hazard-producing occurrence, an inspection shall be made for evidence of possible slides or cave-ins.
- (4c) Where these conditions are found, all work shall cease until additional precautions, such as additional shoring or reducing the slope, have been accomplished.

Spoil Pile Rule – Rule 933 (Unchanged)

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(2) An excavation that an employee is required to enter shall have excavated and other material stored and retained not less than **2 feet** from the excavation edge.

Underground Utilities – Rule 931 (Unchanged)

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(1) An employer shall not excavate in a street, highway, public place, a private easement of a public utility, or near the location of a public utility facility owned, maintained, or installed on a customer's premises, without having first ascertained the location of all underground facilities of a public utility in the proposed area of excavation.

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Underground Utilities

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Support lines

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Underground Utilities

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Utility lines

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Access and Egress – Rule 933 (Unchanged)

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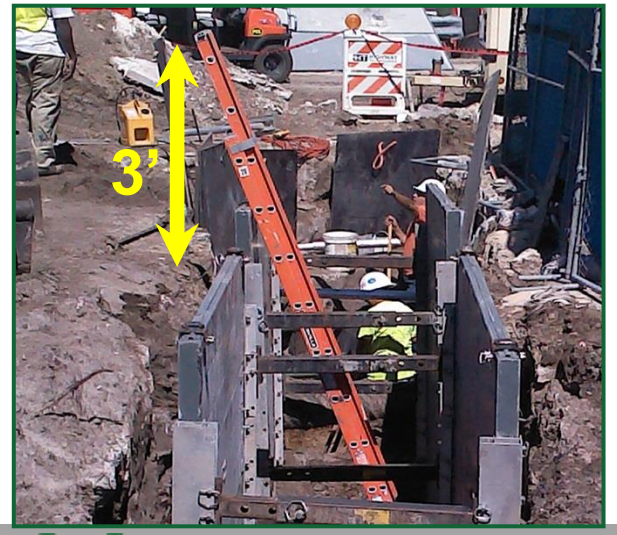
(4) An excavation **4 feet** or deeper and occupied by an employee shall be provided with either a **ladder** extending not less than **36 inches** above the top as a means of access or with a **ramp** meeting the requirements of sub-rule (5) of this rule. Lateral travel along the wall of the trench to a ladder or other means of egress shall not exceed **25 feet**. (UNCHANGED)



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Access and Egress – Rule 933

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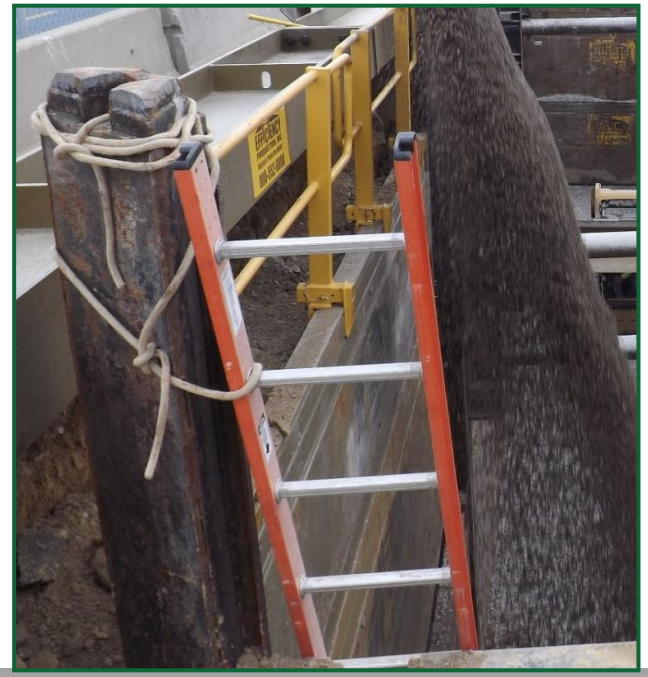
- Ladders shall be SECURE to prevent movement
- Ladders must meet the standards of MIOSHA Part 11 – Rule 1124 (Portable Ladders)



Access and Egress - Rule 933

(5) An earth ramp may be used in place of a ladder if it meets ALL of the following requirements

A. The ramp material shall be stable
B. The sides of the excavation above the ramp shall be maintained to the angle of repose or shored along means of egress
C. The degree of the ramp shall not exceed 45 degrees
D. Vertical height between the floor of the trench and the toe of the ramp shall not exceed 30 inches (UNCHANGED)

Access and Egress - Rule 933 - NEW

ARCOSA SHORING PRODUCTS

- (6a) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person.
- (6b)Structural ramps used for access or egress of equipment shall be designed by a competent person
- (10) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

CONFINED SPACE

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An Enclosed Space with:

- Limited means of entry and exit
- Large enough for a person to enter
- Not designed for continuous employee occupancy
- Potential for hazards

Hazardous Atmospheres; Testing & Controls - Rule 934 (UNCHANGED)

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To prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, all of the following requirements apply:

- Where an oxygen deficiency (an atmosphere that contains less than 19.5% oxygen) or a hazardous atmosphere exists, such as in excavations in areas where hazardous substances are stored nearby, the atmosphere in the excavation shall be tested before employees enter excavations that are more than 4 feet (1.22 m) deep.

Hazardous Atmospheres; Testing & Controls - Rule 934 (UNCHANGED)

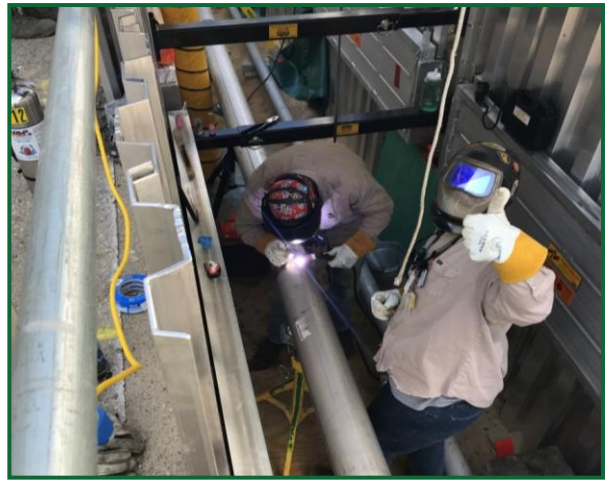
(b) Precautions shall be taken to prevent employee exposure to atmospheres that contain less than 19.5% oxygen and any other hazardous atmosphere. These precautions include providing proper respiratory protection or ventilation in accordance with the requirements of this part.

Hazardous Atmospheres; Testing & Controls - Rule 934 (UNCHANGED)

ARCOSA SHORING PRODUCTS

(c) Precautions shall be taken, such as providing ventilation, to prevent employee exposure to an atmosphere that contains a concentration of a flammable gas in excess of 20% of the lower flammable limit of the gas (LFL/LEL)

Note: Most gas detectors come with 10% of LEL as default setting. Exercise caution if modifying this setting or altering detector limits.



Hazardous Atmospheres; Testing & Controls - Rule 934 (UNCHANGED)

(d) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

Exposure to Water Accumulation - Rule 932

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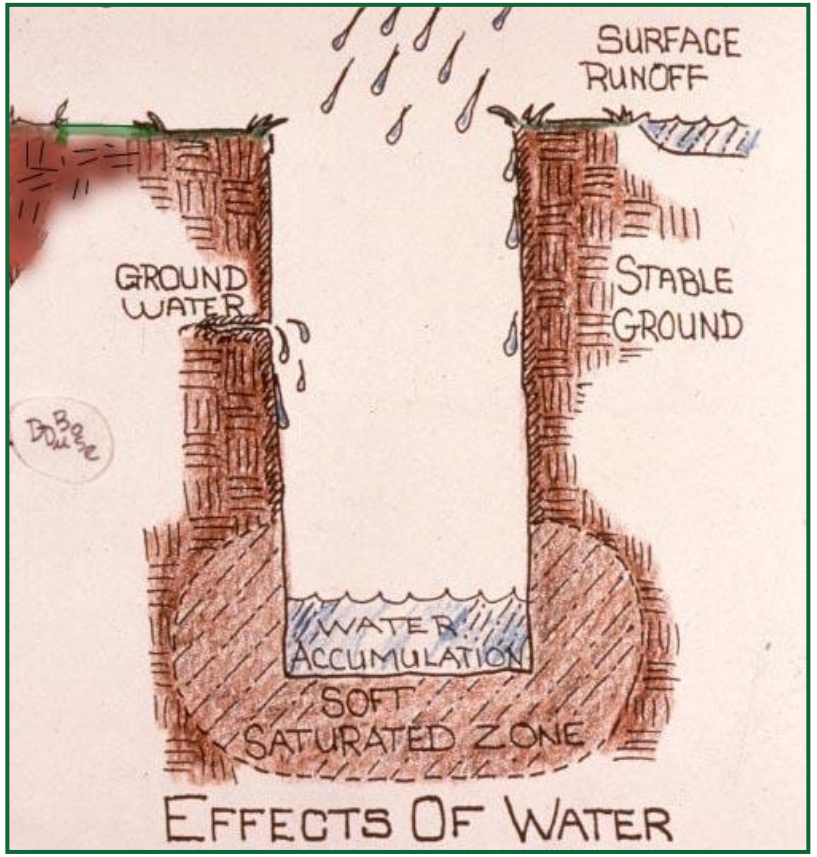
Rule 932 (UNCHANGED)

(2a) An employee shall not work in an excavation in which there is accumulated water or in which water is accumulating unless precautions have been taken to protect employees against the hazards posed by water accumulation.



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Exposure to Water Accumulation - Rule 932

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(2b) Precautions necessary to protect employees adequately vary with each situation, but may include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or the use of a safety harness and lifeline.

Support

Pump

Lifeline

Walkways, Sidewalks, & Roadways - Rule 951

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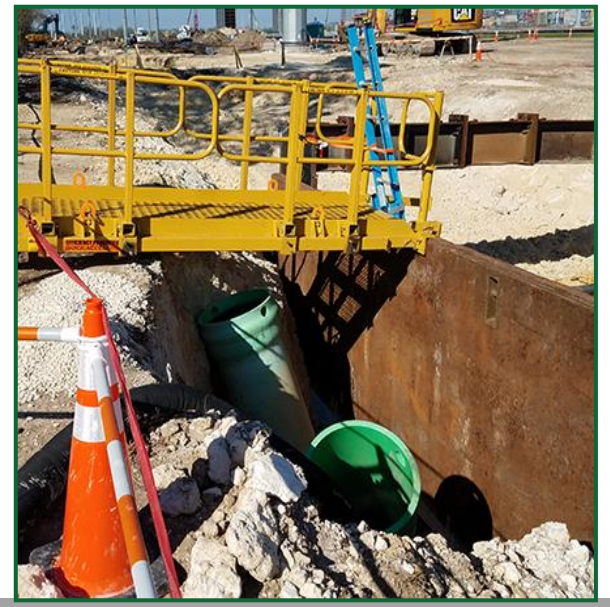
Walkways over trenches **6 feet** deep must have guardrails as fall protection.



Walkways, Sidewalks, & Roadways - Rule 951

~~A sidewalk shall not be undermined unless it is shored to support a live load of not less than 125 pounds per square foot.~~

(1) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures. (NEW)

SOIL CLASSIFICATION

Soil Classification

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- To properly construct a safe work area the Competent Person must know what materials make up the excavation.
- Classification of soil is one of the skills that separates the Competent Person from other safety personnel

OSHA Soil Types

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- STABLE ROCK
- **TYPE A** (BEST)
- **TYPE B** (GOOD)
- **TYPE C** (EVERYTHING ELSE)

OSHA Soil Types

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- RULE 926: SOIL MEANS ANY OF THE FOLLOWING:

MIOSHA Soil Types – Rule 926

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i. SOFT CLAY
ii. MEDIUM CLAY
iii. FIRM SOIL
iv. STIFF CLAY
v. Fill
vi. Granular Soil
vii. Organic soil
viii. Running Soil




PROTECTIVE SYSTEMS

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Protective Systems

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Every employee working in a trench or excavation over **5 feet** deep must be protected from a cave-in by a protective system:

- **Sloping** (Angle of Repose)
- **Shoring** to support walls
- **Shielding** to protect occupants inside when walls cave-in

Protective Systems

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- 4’-9” Rule?
- 5’-6” Rule?

Protective Systems

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Protective Systems

New to MIOSHA 2024 – Rule 942 (8)

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- Competent Person can design protective system for depths up to 20 Ft.
- Depths greater than 20 Ft. require design by a Registered Professional Engineer, or
- Manufactured Protective System with Tabulated Data stamped by an RPE

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Angle of Repose, Sloping – Rule 925

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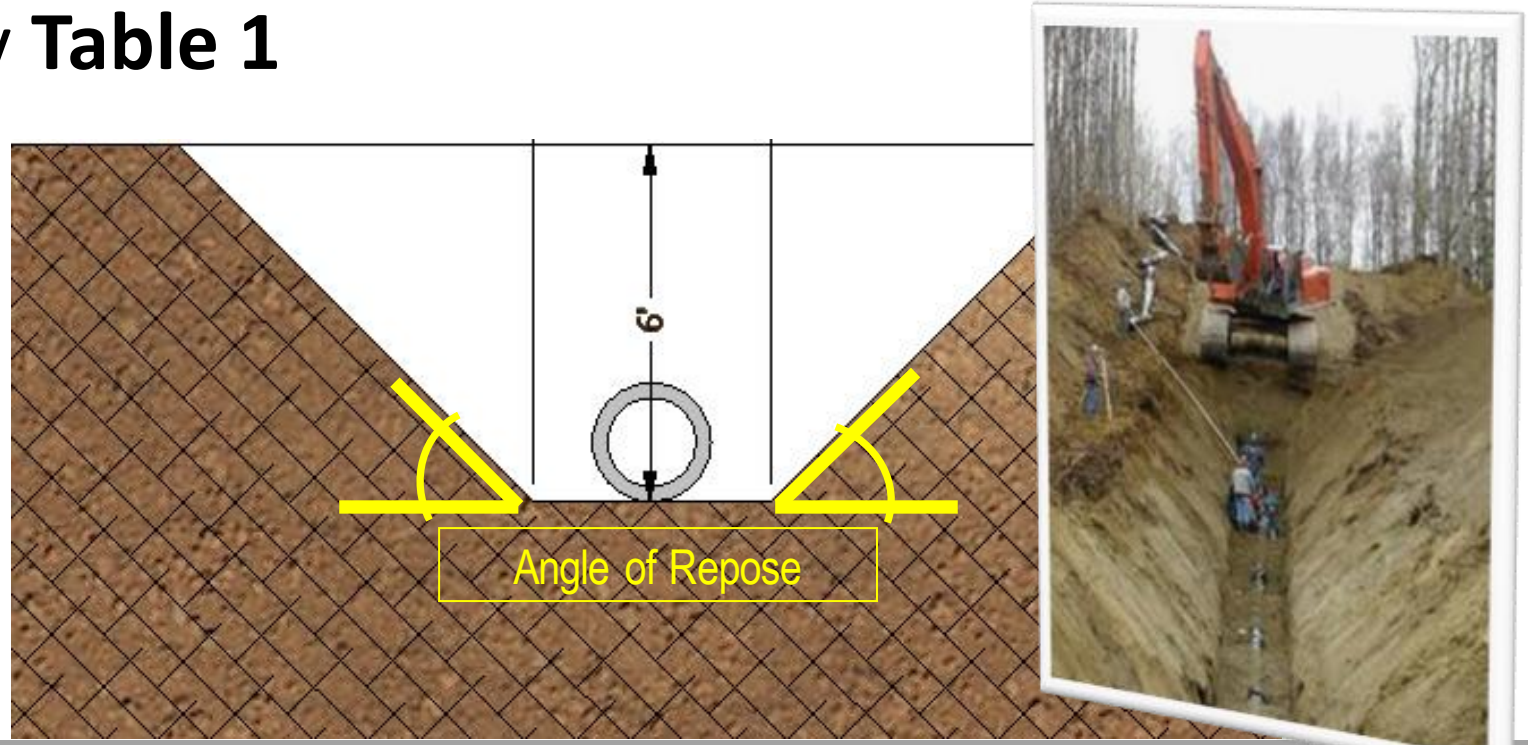
Angle of Repose means the maximum permissible slope as determined by **Table 1**



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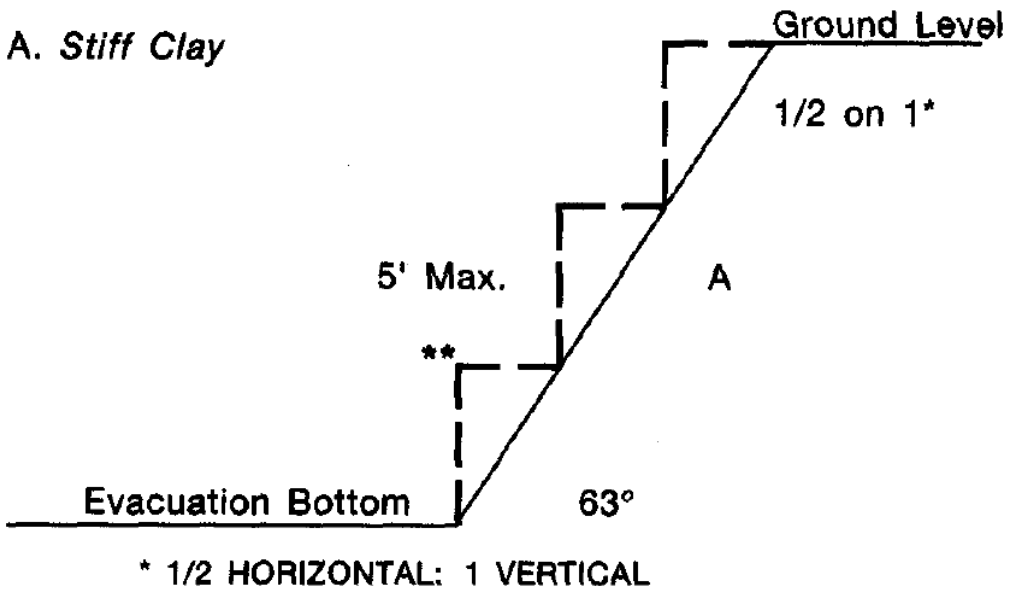
Angle of Repose, Benching – Rule 925

Angle of Repose means the maximum permissible slope as determined by **Table 1**



Unconfined Compression Strength for determining Slope

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Unconfined Compressive Strength (TSF)

Soft Clay	Medium Clay	Firm Soil	Stiff Clay
Less than 1.0 TSF	Minimum of 1.0 TSF	Minimum of 1.5 TSF	Minimum of 2.5 TSF

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MIOSHA TABLE 1

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Example 1: Soil testing indicates a cohesive (or clay-type soil) with unconfined compressive strength of 1.0 TSF

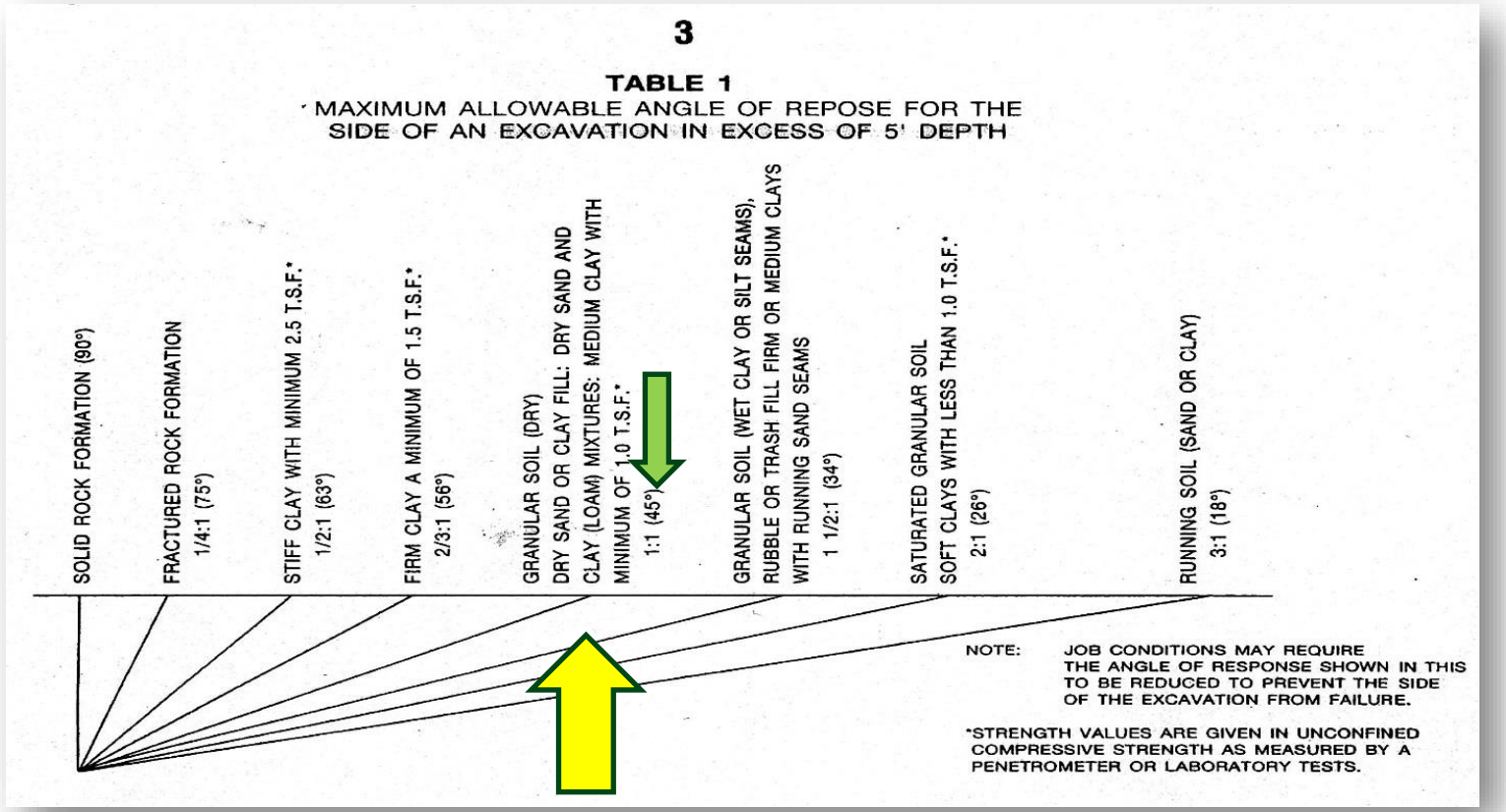

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TABLE 1

MAXIMUM ALLOWABLE ANGLE OF REPOSE FOR THE SIDE OF AN EXCAVATION IN EXCESS OF 5' DEPTH

- SOLID ROCK FORMATION (90°)
- FRACTURED ROCK FORMATION 1/4:1 (75°)
- STIFF CLAY WITH MINIMUM 2.5 T.S.F.* 1/2:1 (63°)
- FIRM CLAY A MINIMUM OF 1.5 T.S.F.* 2/3:1 (56°)
- GRANULAR SOIL (DRY) DRY SAND OR CLAY FILL: DRY SAND AND CLAY (LOAM) MIXTURES: MEDIUM CLAY WITH MINIMUM OF 1.0 T.S.F.* 1:1 (45°)
- GRANULAR SOIL (WET CLAY OR SILT SEAMS), RUBBLE OR TRASH FILL FIRM OR MEDIUM CLAYS WITH RUNNING SAND SEAMS 1 1/2:1 (34°)
- SATURATED GRANULAR SOIL SOFT CLAYS WITH LESS THAN 1.0 T.S.F.* 2:1 (26°)
- RUNNING SOIL (SAND OR CLAY) 3:1 (18°)

NOTE: JOB CONDITIONS MAY REQUIRE THE ANGLE OF RESPONSE SHOWN IN THIS TO BE REDUCED TO PREVENT THE SIDE OF THE EXCAVATION FROM FAILURE.

*STRENGTH VALUES ARE GIVEN IN UNCONFINED COMPRESSIVE STRENGTH AS MEASURED BY A PENETROMETER OR LABORATORY TESTS.

Proper angle of repose is 1:1 (45°)

MIOSHA TABLE 1

ARCOSA SHORING PRODUCTS

Example 2: Soil testing indicates a cohesive (or clay-type soil) with unconfined compressive strength of 2.25 TSF

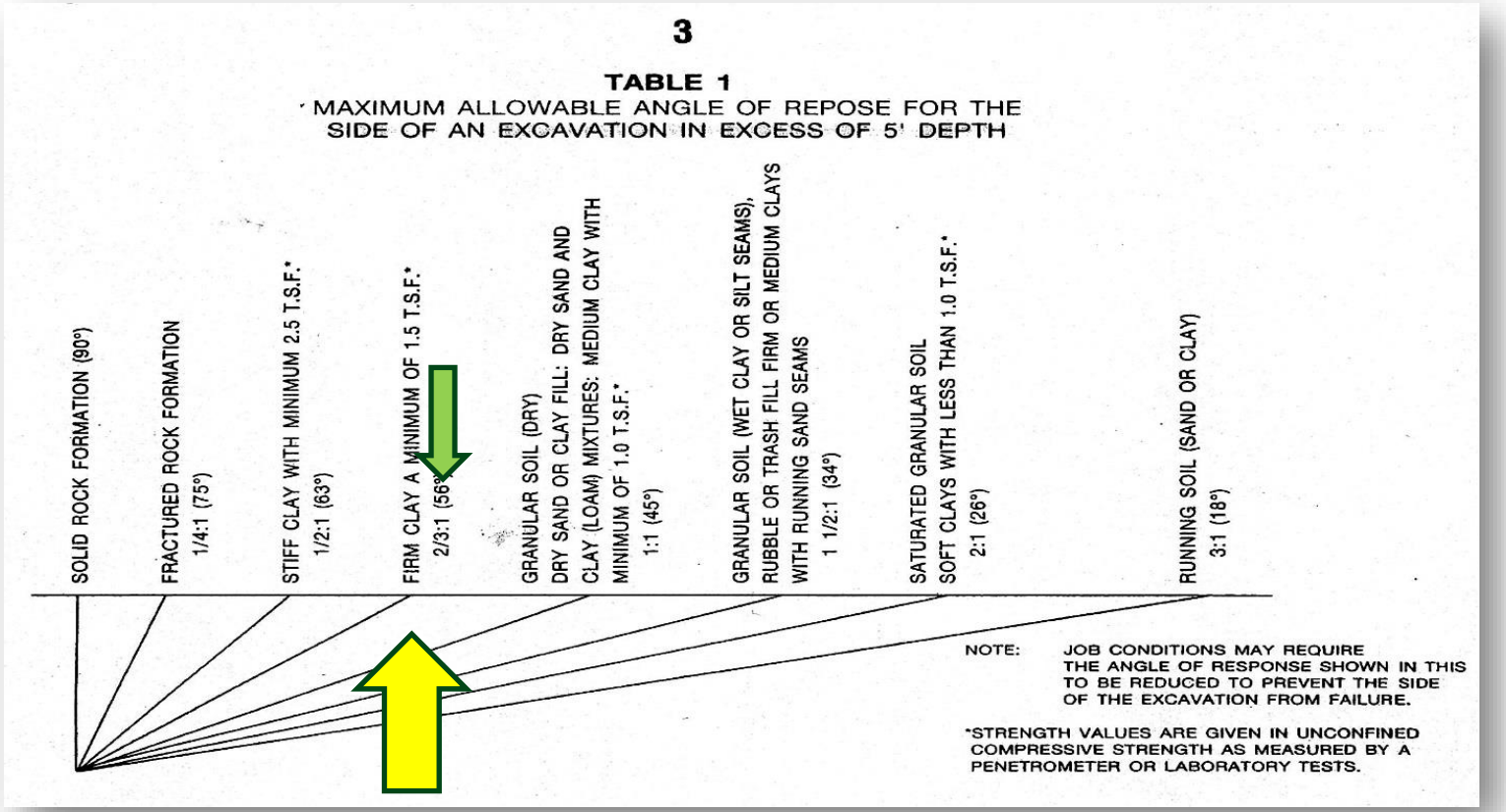

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TABLE 1

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STIFF CLAY WITH MINIMUM 2.5 T.S.F.*	1/2:1 (63°)
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GRANULAR SOIL (DRY) DRY SAND OR CLAY FILL: DRY SAND AND CLAY (LOAM) MIXTURES: MEDIUM CLAY WITH MINIMUM OF 1.0 T.S.F.*	1:1 (45°)
GRANULAR SOIL (WET CLAY OR SILT SEAMS), RUBBLE OR TRASH FILL FIRM OR MEDIUM CLAYS WITH RUNNING SAND SEAMS	1 1/2:1 (34°)
SATURATED GRANULAR SOIL SOFT CLAYS WITH LESS THAN 1.0 T.S.F.*	2:1 (26°)
RUNNING SOIL (SAND OR CLAY)	3:1 (18°)

NOTE: JOB CONDITIONS MAY REQUIRE THE ANGLE OF RESPONSE SHOWN IN THIS TO BE REDUCED TO PREVENT THE SIDE OF THE EXCAVATION FROM FAILURE.

*STRENGTH VALUES ARE GIVEN IN UNCONFINED COMPRESSIVE STRENGTH AS MEASURED BY A PENETROMETER OR LABORATORY TESTS.

Proper angle of repose is 2/3:1 (56°)

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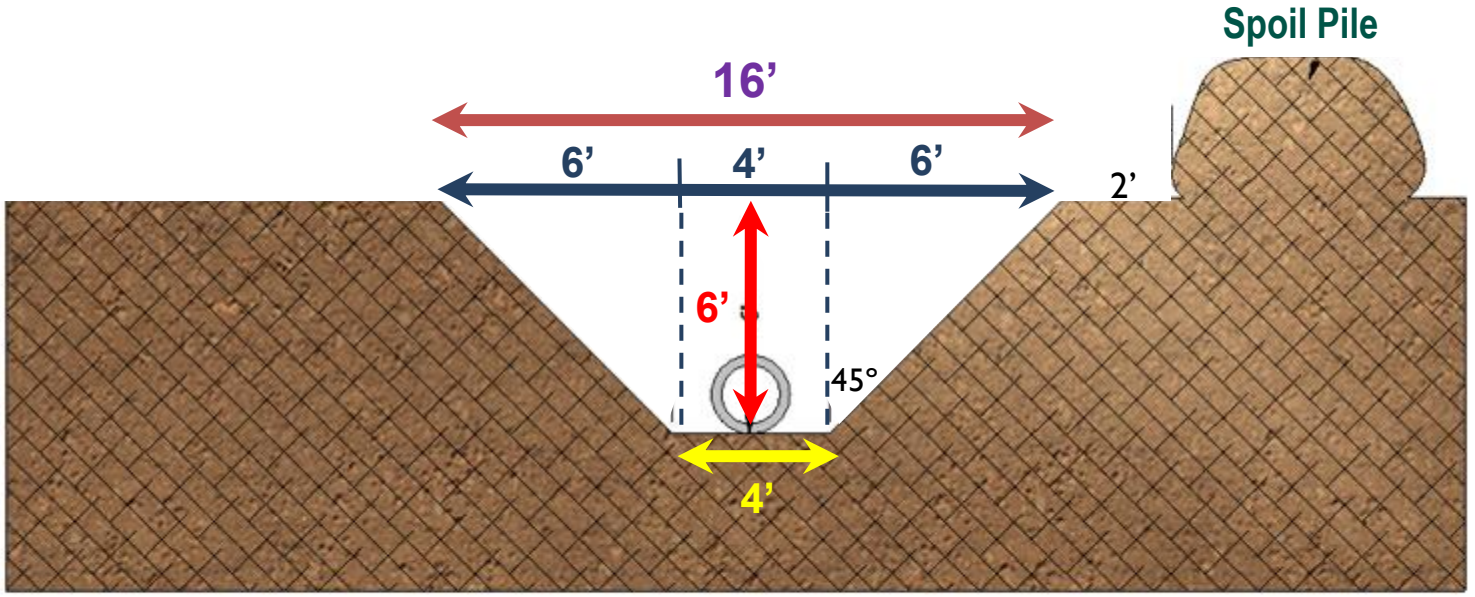
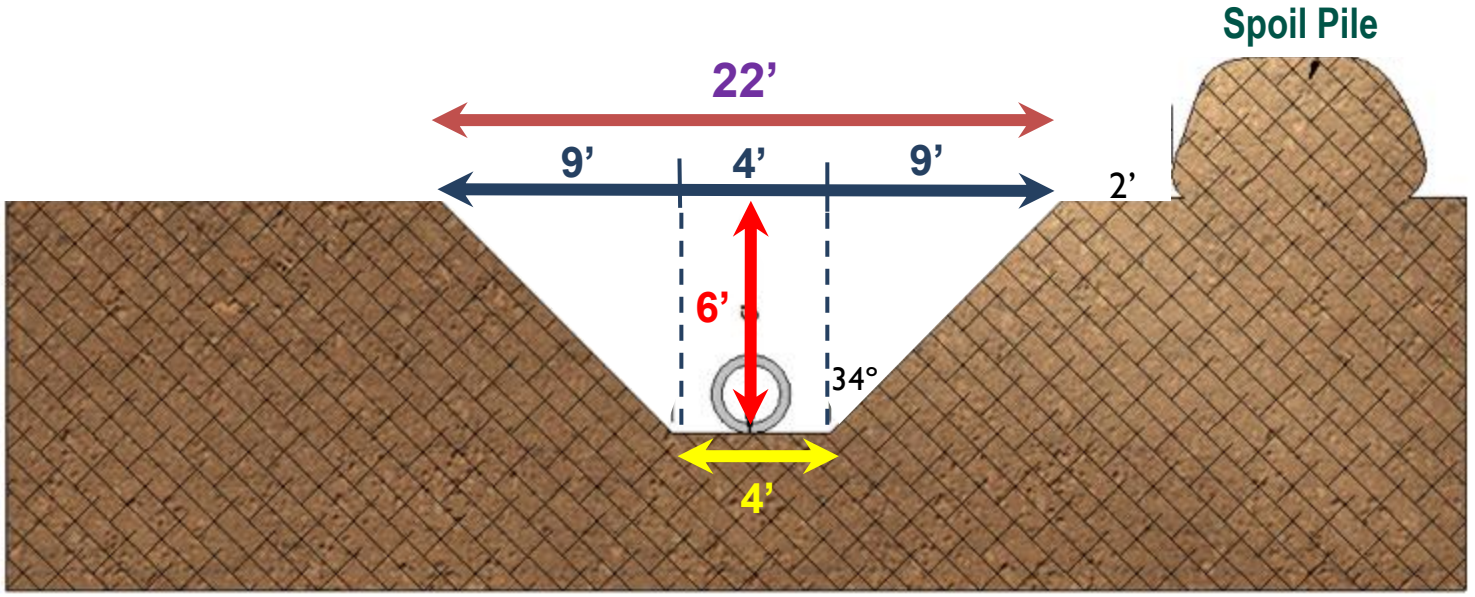
Sloping a Trench



SECTION OF TRENCH 6' DEEP

Example of 6’ deep excavation in Medium Clay, Angle of Repose 1:1 (45^0)

Sloping a Trench



SECTION OF TRENCH 6' DEEP

Example of 6’ deep excavation in Rubble Fill, Angle of Repose 1-1/2:1 (34^0)

TRENCH SHIELDS

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Manufacturer's Tabulated Data

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- All manufactured shielding and shoring equipment shall be supplied with Tabulated Data indicating the proper use and limitations of the equipment
- This data shall be used for the design of the protected area and should be available on site if requested by MIOSHA
- Manufactured systems shall be used within the limits of this Tabulated Data

Serialized Tab Data – Steel Trench Shield

Manufacturer

Model # of Shield

Option & Lifting Information

Limitations

Certified by Engineer

Serial # of Shield

Weight

Soil Types

Max. Depths

Soil Descriptions

Placement Diagram

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	SERIAL NUMBER SAMPLE		PAGE 1 OF 2 STEEL TRENCH SHIELD
MODEL: HT6-1020	N/A	MAX SPREADER LENGTH	20 FEET
KNIFE-EDGE N/A	FOAM FILLER N/A	COLLAR TYPE	7" O.D. x 3/4" WALL w/2" PIN HOLES
DATE OF MANUFACTURE N/A	LIFT-LUG RATING 8,100 LBS	WEIGHT AS MANUFACTURED	13,850 LBS

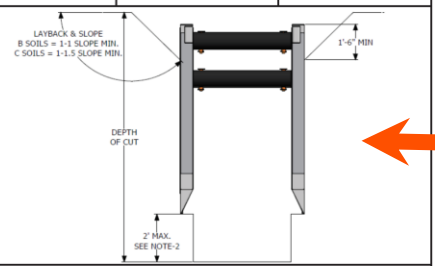
REPRODUCED FROM OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION RULES AND REGULATIONS, 29 CFR, NO 209, PART 1926, SUBPART P

SHIELD SIZE		PSF RATING	EXAMPLES OF MAXIMUM ALLOWABLE DEPTH OF CUT (FEET) IN SOIL TYPE TO BE EXCAVATED		
HEIGHT (FEET)	LENGTH (FEET)	MAXIMUM LATERAL EARTH PRESSURE CAPACITY AT TRENCH BOTTOM IN POUNDS PER SQUARE FOOT	TYPE B-45 (II) MEDIUM COHESIVE TO GRANULAR SOIL 45 PSF PER FT OF DEPTH	TYPE C-60 (III) SOFT COHESIVE TO SATURATED SOIL. 60 PSF PER FT OF DEPTH	TYPE C-80 (IV) SOFT SUBMERGED AND FLOWING SOIL. 80 PSF PER FT OF DEPTH
10	20	1440	32	24	18
			DESCRIPTION	DESCRIPTION	DESCRIPTION
			CLAY, WITH UNCONFINED COMPRESSIVE STRENGTH GREATER THAN 0.5 TSF BUT LESS THAN 1.5 TSF COHESIONLESS GRAVEL, SILT, SILT LOAM OR SANDY LOAM	SOFT COHESIVE SOIL UNCONFINED COMPRESSIVE STRENGTH GREATER THAN 0.3 TSF, BUT LESS THAN 0.5 TSF CLAY, SAND AND LOAMY SAND; SATURATED SOIL THAT IS STABLE, DRY SAND, OR DEWATERED SOILS	SOFT COHESIVE SOIL UNCONFINED COMPRESSIVE STRENGTH LESS THAN 0.3 TSF. FRACTURED ROCK THAT IS NOT STABLE, OR SUBMERGED SAND AND LOAMY SAND THAT IS FLOWING. (SEE NOTE 5)

LIMITATIONS IN USE OF TABLE

1. TRENCH SHIELD TO BE ASSEMBLED AND INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. (SEE PAGE-2)
2. EXCAVATION 2 FEET BELOW BOTTOM OF SHIELD IS PERMITTED WHEN NO LOSS OF SOIL FROM BEHIND OR BELOW THE BOTTOM OF SHIELD IS ENCOUNTERED. SEE PARAGRAPH 1926.652 (e)(2)(i). THE COMPETENT PERSON SHALL MAKE THE DETERMINATION FOR COMPLIANCE. SUDDEN SHIFTING OF THE SHIELD VERTICALLY SHALL BE AVOIDED.
3. DEPTH RATING IS BASED ON TEMPORARY LOADING, CONSULT MANUFACTURER IF SHIELD IS SUBJECT TO LONG TERM LOADING
4. ADDITIONAL SHIELDS MAY BE STACKED WITH NO PENALTY IN DEPTH OF CUT AS LONG AS THE RATING OF THE EACH SHIELD IS NOT EXCEEDED AT THE DEPTH IT IS USED. MANUFACTURER APPROVED STACKING METHOD MUST BE USED.
5. C-80 DOES NOT REPRESENT THE WORST POSSIBLE SOIL CONDITION. OBTAIN SITE-SPECIFIC ENGINEERING FOR EXTREMELY NON-STABLE CONDITIONS SUCH AS MARINE CLAY, PEAT, SOFT SUBMERGED AND FLOWING CLAYS, ETC.
6. ANY MODIFICATIONS OR ALTERATIONS NOT ALLOWED UNLESS APPROVED IN WRITING BY EFFICIENCY PRODUCTION.
7. CONTRACTOR'S COMPETENT/QUALIFIED PERSON SHALL BE RESPONSIBLE FOR MONITORING SOIL CONDITIONS AND SHALL BE RESPONSIBLE FOR COMPLIANCE WITH ALL FEDERAL, STATE AND LOCAL LAWS, RULES, AND REGULATIONS.
8. SPREADER PINS SHALL BE 8620 COLD DRAWN 80-90 KSI MIN. YIELD AND NO MORE THAN 1/4" SMALLER THAN COLLAR AND SPREADER PIN HOLES AS MANUFACTURED BY EFFICIENCY PRODUCTION.
9. LIFT LUG RATING IS (THE SAFE WORKING LOAD) FOR EACH INDIVIDUAL LIFT LUG.
10. WEIGHT LISTED IS FOR SHIELD ONLY. USE ASSEMBLED WEIGHT INCLUDING SPREADERS FOR RIGGING PURPOSES

CONTINUED ON REVERSE SIDE



MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING U.S. PATENT NUMBERS: 4,090,365-4,114,383-4,259,028 ONE OR MORE OF THE FOLLOWING CANADIAN PATENT NUMBERS: 1,062,683-1,062,684

CERTIFIED BY: EFFICIENCY PRODUCTION.

A DIVISION OF ARCOSA SHORING PRODUCTS

STATE OF MICHIGAN
ALEXANDRE NEDELTCHEV
ENGINEER
No. 6201052055
LICENSED PROFESSIONAL ENGINEER

9 4 2020

WARNING: Any use of this product not specifically described on this certificate could cause cave-in, collapse, or structural failure, and may result in injury, or death

Page One

Serialized Tab Data – Steel Trench Shield

Limitations Continued

Assembly Instructions

Use in Stable Soil

Use in Unstable Soil

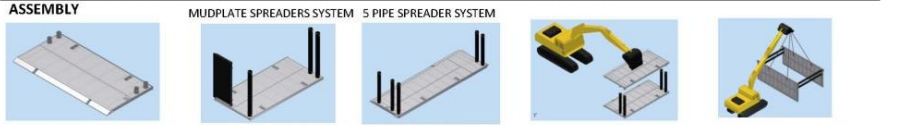
Special Uses

EFFICIENCY PRODUCTION MASON, MI 48854 PH (800) 552-8800 PAGE 2 OF 2

- NOT TYPE A IF FISSURED, SUBJECT TO VIBRATION, PREVISOUSLY DISTURBED OR PART OF A SLOPED LAYERED SYSTEM WHERE LAYERS DIP INTO EXCAVATION ON A SLOPE OF FOUR HORIZONTAL TO ONE VERTICAL (4H:1V) OR GREATER.
- PREVIOUSLY DISTURBED SOILS MAY BE TYPE B UNLESS THEY WOULD BE CLASSIFIED AS TYPE C. SOIL THAT MEETS THE REQUIREMENTS OF TYPE A, BUT IT IS SUBJECT TO VIBRATION OR FISSURED MAY BE TYPE B. DRY ROCK THAT IS NOT STABLE OR SOIL THAT IS PART OF A SLOPED, LAYERED SYSTEM WHERE LAYERS DIP INTO THE EXCAVATION ON A SLOPE LESS STEEP THAN FOUR HORIZONTAL TO ONE VERTICAL (4H: 1V) ARE TYPE B BUT ONLY IF MATERIAL WOULD OTHERWISE BE CLASSIFIED AS TYPE B.
- SOIL IN A SLOPED LAYERED SYSTEM WHERE LAYERS DIP INTO THE EXCAVATION ON A SLOPE OF FOUR HORIZONTAL TO ONE VERTICAL (4H:1V) OR STEEPER MAY BE TYPE C. SUBMERGED SOIL IS MATERIAL WITH WATER FREELY SEEPING AND ENTERING THE TRENCH, BUT ONLY PART OF THE DEPTH OF THE RETAINED SOIL IS SUBMERGED. CONDITIONS MORE SEVERE WOULD REQUIRE DEWATERING OR SEALING FOUR SIDES OF THE EXCAVATION AND PUMPING THE TRENCH, SUCH SEVERE CONDITIONS WOULD REQUIRE THE SERVICES OF A SOILS ENGINEER TO ESTABLISH THE DESIGN PRESSURE. CONSULT THE MANUFACTURER FOR PRESSURES EXCEEDING TABULATED VALUES.
- ANY SOIL THAT WILL STAND UNSUPPORTED LONG ENOUGH TO INSTALL TRENCH SHIELD MAY BE CLASSIFIED AS C-60
- ANY USE OF A TRENCH SHIELD WITHOUT EFFICIENCY SPREADERS AND PINS OR EQUAL WILL VOID THE TABULATED DATA AND WARRANTY.
- SHIELD WAS DESIGNED TO BE USED WITHOUT PLATES EXTENDING BELOW, ABOVE, OR NEXT TO IT. ANY USE OF SUCH PLATES OR PANELS MAY VOID THE TABULATED DATA AND MAY REQUIRE SITE SPECIFIC ENGINEERING.
- TRENCH SHIELDS ARE DESIGNED TO BE PUSHED TO GRADE IF NECESSARY. AS NOTED BELOW, ANY UNNECESSARY ABUSE BY THE EXCAVATOR AND OR OPERATOR (SUCH AS POUNDING WITH THE BUCKET) WILL VOID THE TABULATED DATA AS WELL AS THE WARRANTY.
- CONDITION OF SHIELD, SPREADER PIPES, AND SPREADER PINS MUST BE CHECKED/ INSPECTED FOR SERVICEABLITY BY THE COMPETENT PERSON PRIOR TO EACH USE. PSF RATING IS NOT VALID IF THERE IS ANY VISIBLE DAMAGE TO, OR REPAIRS MADE TO THE SHIELD THAT HAS NOT BEEN DOCUMENTED AND CERTIFIED BY A REGISTERED PROFESSIONAL ENGINEER.
- A MINIMUM OF 2 SPREADERS, 1 ARCH, OR 1 SPREADER AND 1 MUDPLATE MUST BE INSTALLED ON EACH END OF TRENCH SHIELD PRIOR TO USE.
- DEPTH AND PSF RATING ARE FOR LATERAL EARTH PRESSURES ONLY AND DO NOT TAKE ANY SURCHARGES INTO ACCOUNT.

ASSEMBLY

MUDPLATE SPREADERS SYSTEM 5 PIPE SPREADER SYSTEM



LAY SIDE PANEL FLAT ON GROUND WITH COLLAR SOCKETS UP

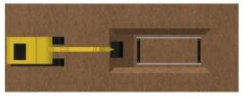
PLACE SPREADER PIPE AND/OR PLATE ON TO COLLARS OR INTO BRACKETS AND PIN IN PLACE. SECURE PINS WITH KEEPERS

LOWER SECOND SIDEWALL ONTO SPREADERS AND PIN

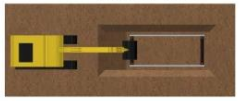
STAND TRENCH SHIELD IN UPRIGHT POSITION AND PREPARE FOR INSTALLATION

USING A TRENCH SHIELD IN STABLE SOIL

EXCAVATE TO GRADE JUST SLIGHTLY WIDER THAN THE TRENCH SHIELD. DIG WALLS VERTICAL TO MINIMUM OF 18" BELOW THE TOP OF THE SHIELD. SLOPE SOILS ABOVE SHIELD ACCORDING TO MANUFACTURERS TABULATED DATA. INSTALL SHIELD IN TRENCH.

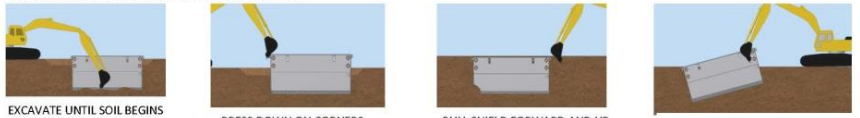


EXCAVATE IN FRONT OF THE TRENCH SHIELD



PULL SHIELD FORWARD BY FRONT TOP SPREADER PIPE OR WITH PULLING EYES. (PULLING EYES SHALL BE USED WITH SPREADERS WIDER THAN 72" OR WHEN SOIL PRESSURE IS SEVERE ENOUGH TO CAUSE SPREADER TO DEFLECT).

USING A TRENCH SHIELD IN UNSTABLE SOIL



EXCAVATE UNTIL SOIL BEGINS TO CRUMBLE BEYOND DESIRED TRENCH WIDTH. PLACE SHIELD IN LINE OF EXCAVATION

PRESS DOWN ON CORNERS TO PUSH SHIELD DOWN TO GRADE

PULL SHIELD FORWARD AND UP ON APPROPRIATE ANGLE

EXCAVATE SOIL WITHIN THE SHIELD AND REPEAT PREVIOUS PROCESS

USING TRENCH SHIELDS FOR PATCHWORK, REPAIRS OR TIE-INS

*CENTER SHIELD OVER WORK AREA
*LAY SOIL AT ENDS BACK ACCORDING TO MANUFACTURER'S TABULATED DATA OR USE MANUFACTURER'S DESIGNED PLATES TO PROTECT FROM CAVE-INS

MANHOLE BOX W/CORNER END PLATES

CORNER END PLATES HELP PREVENT LOOSE MATERIAL FROM RUNNING INTO THE END OF THE SHIELD. SOIL AT ENDS SHOULD BE SLOPED ACCORDING TO MANUFACTURER'S TABULATED DATA

USING 4-SIDED SHIELDS

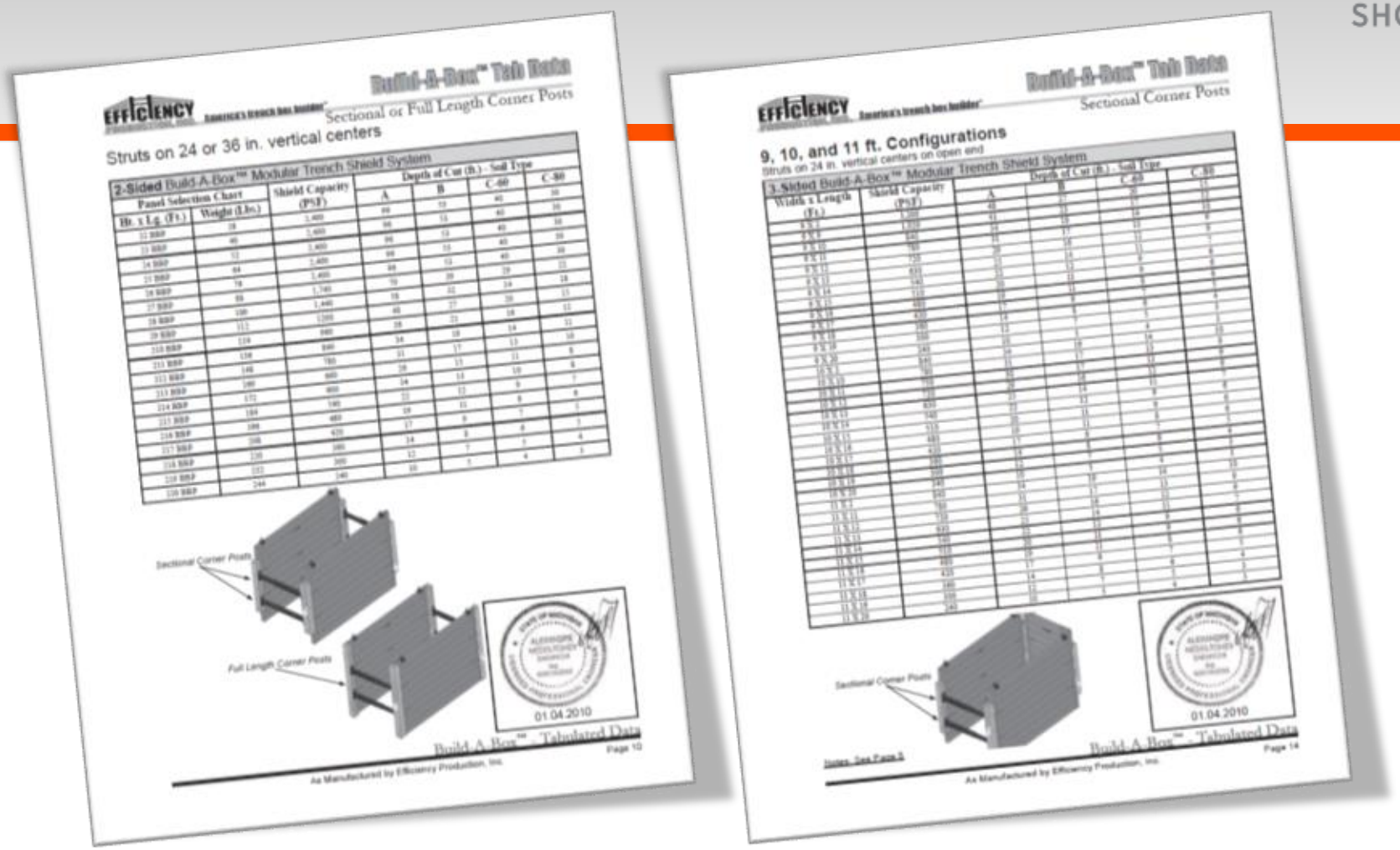
WHEN USING SHIELDS AS PROTECTION DURING MANHOLE ASSEMBLY WORK, INSURE THAT PROPER END PANELS ARE USED, OR LAY SOIL AT THE ENDS BACK ACCORDING TO MANUFACTURER'S TABULATED DATA

*THIS MATERIAL IS INTENDED TO PROVIDE BASIC ASSEMBLY AND INSTALLATION INFORMATION ONLY.
*ALWAYS USE TRENCH SHIELD IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY LAWS AND REGULATIONS.
*FAILURE TO DO SO COULD CAUSE SEVERE INJURY OR DEATH.

Page Two

Non-Serialized Tab Data

ARCOSA SHORING PRODUCTS



Modular Systems will have charts showing depth ratings based on configuration of equipment

CERDA INDUSTRIES

GME TRENCH PROTECTION SPECIALISTS

EFFICIENCY PRODUCTION America's Trench Box Builder

PRO-TEC EQUIPMENT

Movement of Shield – Rule 945

(3) An employee shall not be allowed in shields when shields are being installed, removed, or moved **vertically**. (New)

HYDRAULIC SHORES

ARCOSA
SHORING PRODUCTS

CERDA INDUSTRIES

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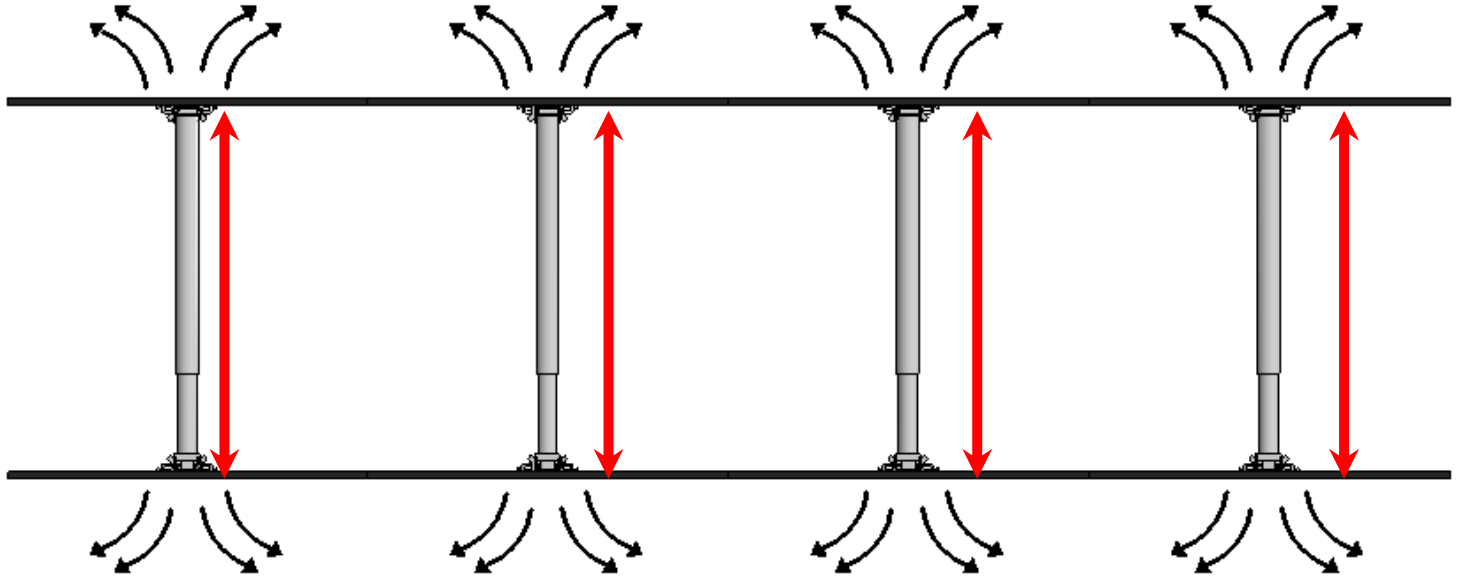
PRO-TEC® EQUIPMENT

Hydraulic Shores

ARCOSA SHORING PRODUCTS

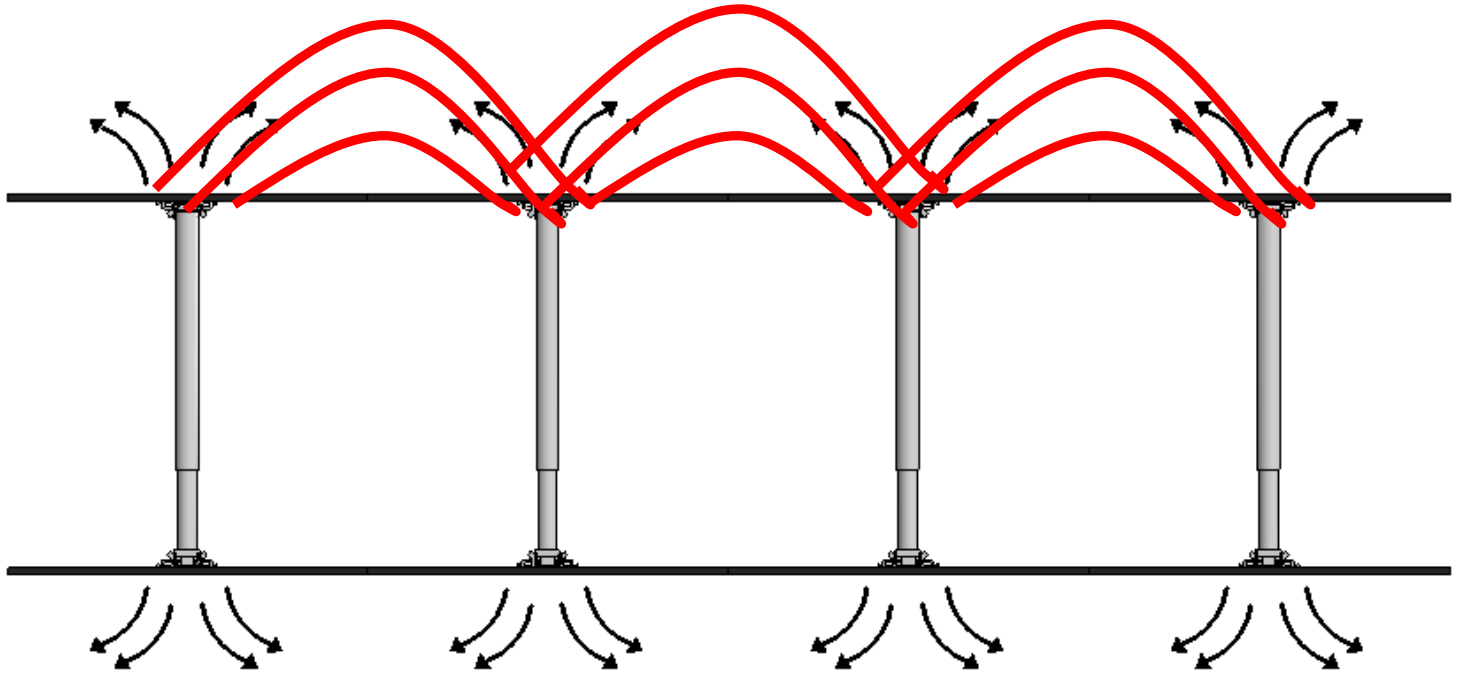
As hydraulic cylinders are pressurized against trench wall – pressure arcs radiate from center of cylinder in all directions



Hydraulic Shores

ARCOSA SHORING PRODUCTS

If adjacent shores are located close enough for arcs to intersect – pressure arches are formed. These arches shore the banks



Hydraulic Shoring Tab Data

ARCOSA SHORING PRODUCTS

Depth of Trench (ft.) SEE NOTE 5	Max. Horizontal Shoring Spacing (ft.) SEE NOTE 6	Maximum Vertical Cylinder Spacing (ft.) SEE NOTE 1	Max. Width of Trench (ft.) *12 ft.* - SEE NOTE 1, 2 *15 ft.* - SEE NOTE 2, 7	Sheeting SEE NOTE 2 and:
TYPE "A" SOIL				
Up To 10'	8'	4'	12' or 15'	3
11' To 15'	8'	4'	12' or 15'	3
16' To 20'	8'	4'	12' or 15'	3
21' To 25'	8'	4'	12' or 15'	3
TYPE "B" SOIL				
Up To 10'	8'	4'	12' or 15'	3
11' To 15'	7'	4'	12' or 15'	3
16' To 20'	6'	4'	12' or 15'	3
21' To 25'	5'	4'	12' or 15'	3
TYPE "C-60" SOIL				
Up To 10'	6'	4'	12' or 15'	3
11' To 15'	5'	4'	12' or 15'	4
16' To 20'	4'	4'	12' or 15'	4
21' To 25'	3'	4'	12' or 15'	4

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PRO-TEC® EQUIPMENT

TIMBER SHORING

ARCOSA
SHORING PRODUCTS

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PRO-TEC® EQUIPMENT

SHEETING FRAMES

Sheeting frames utilize a ***reverse-cantilever principal*** where steel sheeting is braced in an upper waler/frame combination

STEEL SHEETING

ARCOSA
SHORING PRODUCTS

CERDA INDUSTRIES

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EFFICIENCY PRODUCTION America's Trench Box Builder

PRO-TEC® EQUIPMENT

SLIDE RAIL SYSTEM

Slide Rail Systems utilize steel panels that slide in vertical posts

QUESTIONS