EFFICIENCY®
PRODUCTION, INC.
America's Trench Box Builder™

Trench Safety & Qualified Person

Presented by:

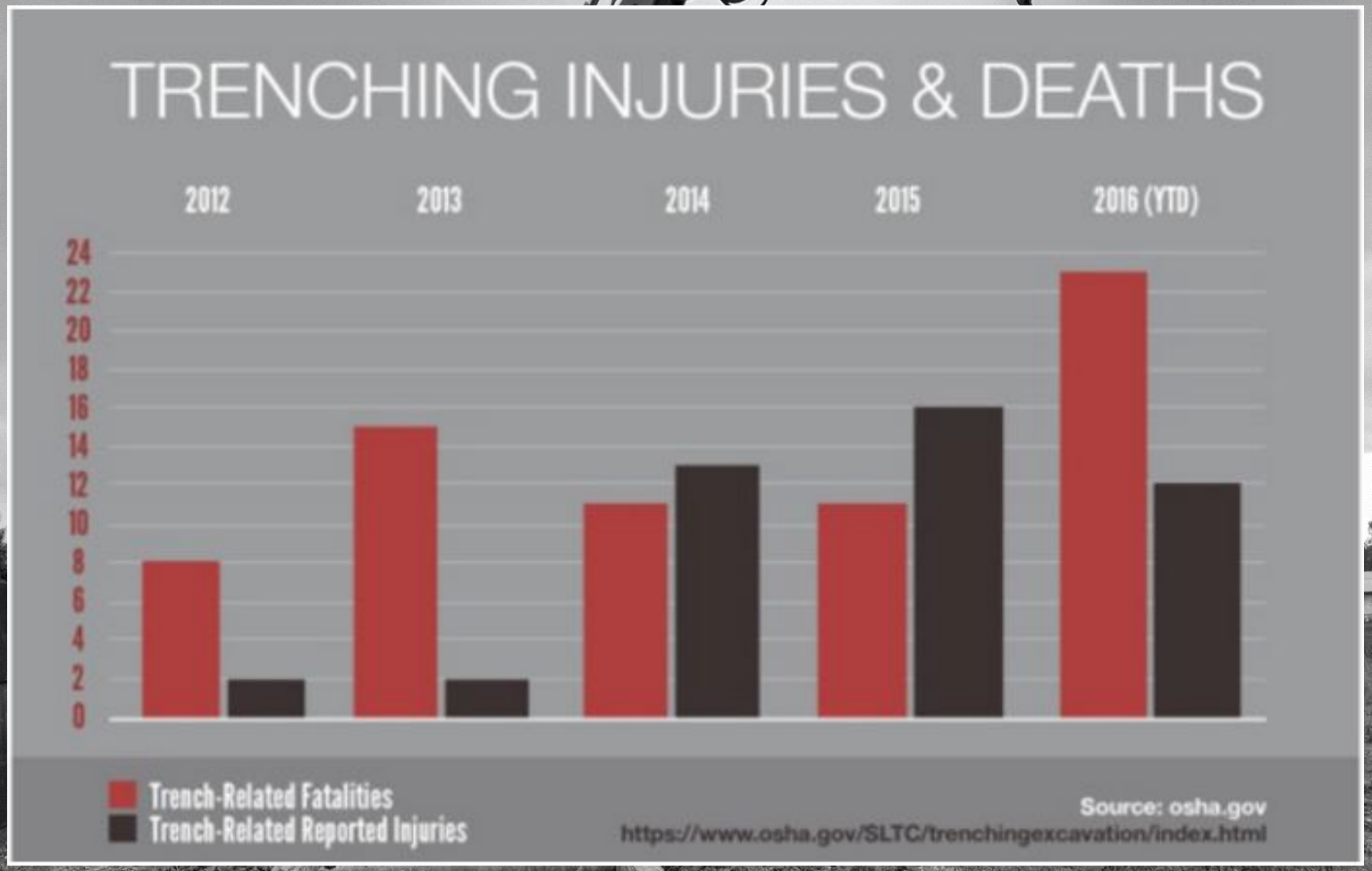
Mike Ross – National Training Director

SPECIAL OPERATIONS
SHORING DIVISION
PLANNING
CONSULTING
TRAINING
INSTALLATION

Excavation Hazards

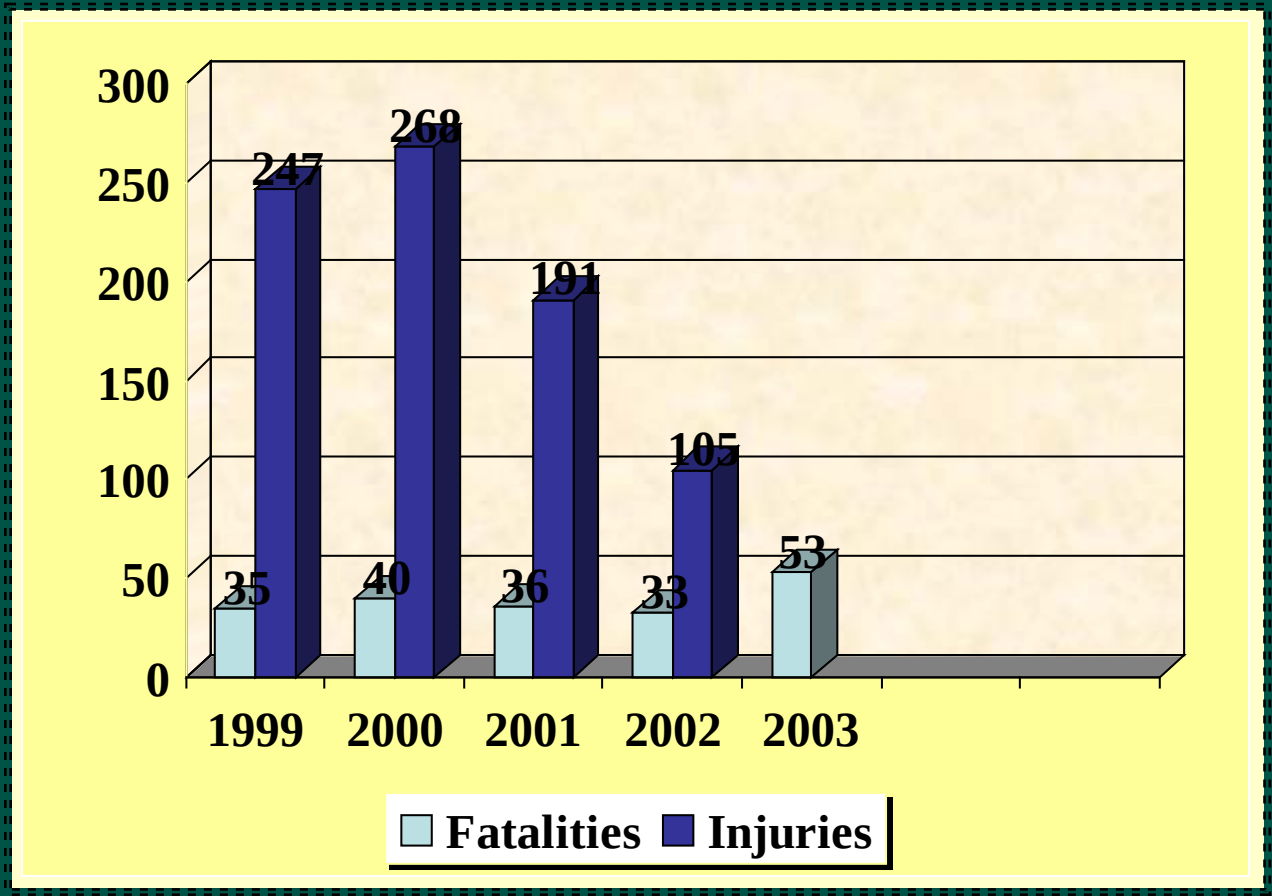
Excavation has always been dangerous work.

Workers in the underground industry have a 112% better chance of being killed than general construction trades



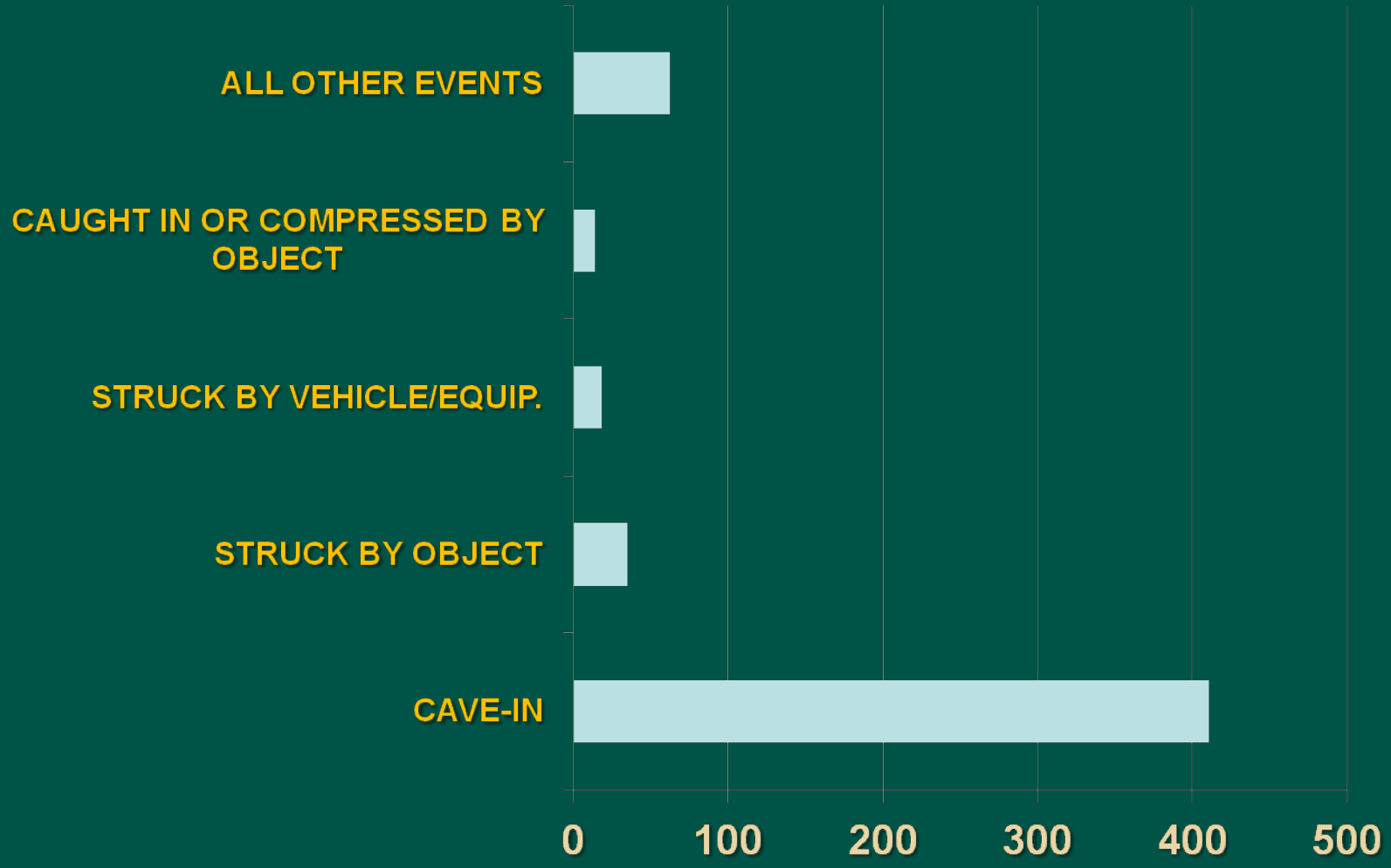
2016 Statistics show another spike with fatalities double the previous two years….

Excavation Fatalities & Injuries

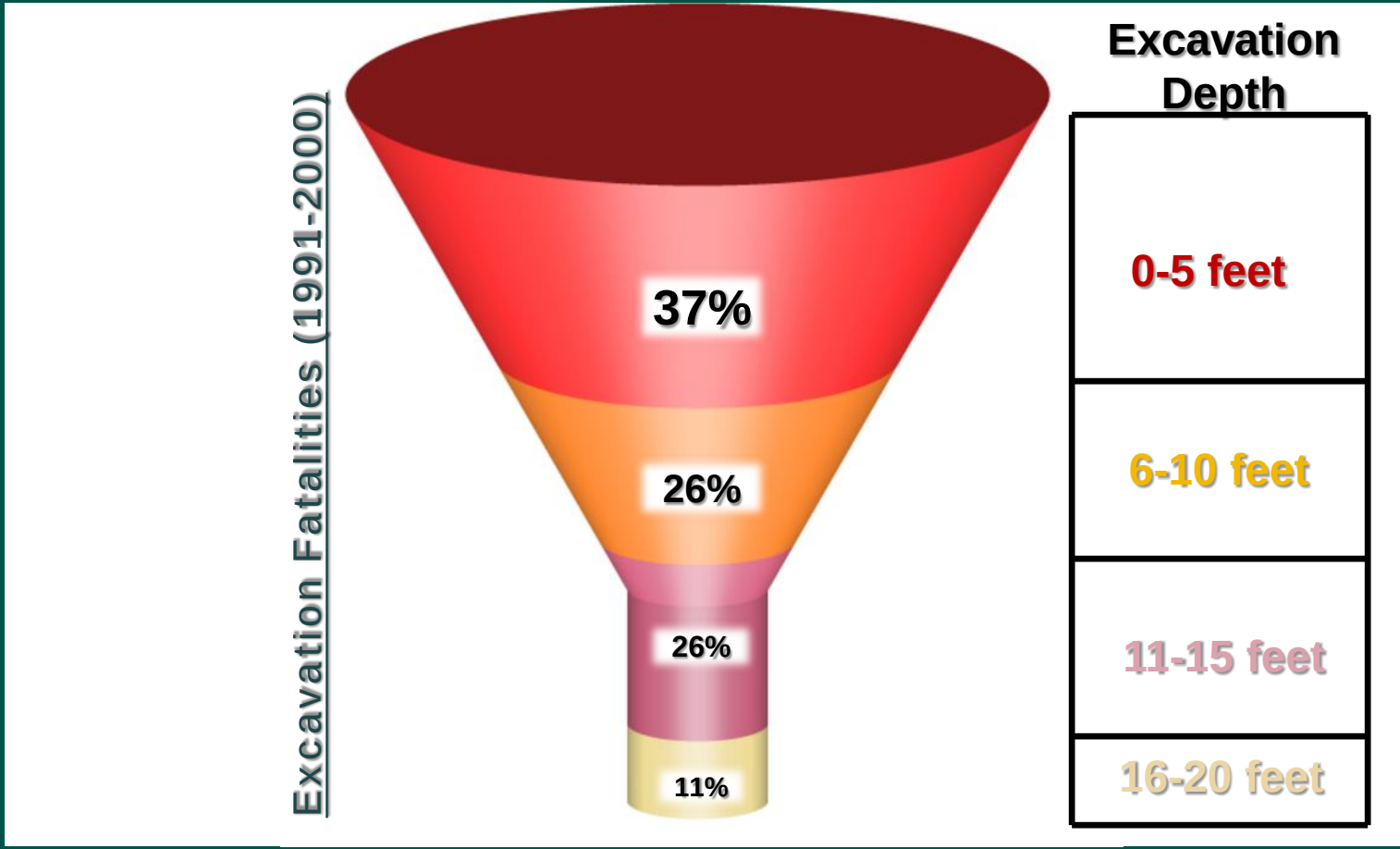


Statistics show that excavation work has a fairly low occurrence rate but the ratio of fatality per occurrence at 33% is alarmingly high and remains steady.

TRENCH FATALITIES BY EVENT 1992-2001 (CDC)



Hazard and depth may be opposite of what you assumed...



Which excavation seems more dangerous?

SAFETY & OSHA Subpart P

Depth & Size are not the only factors…

Source: FACE Program


Safety
Standards

FEDERAL SAFETY STANDARD

29 CFR 1926 – Subpart P Excavation & Trenching

STATE SAFETY STANDARD

MIOSHA Part 9 Excavation, Trenching and Shoring

Michigan is one of several states to have their own OSHA Administration (MIOSHA)

Part 9 is unique to Michigan

All other states utilize OSHA Subpart P or a nearly identical state standard

MIOSHA-STD-1306 (09/05)
14 Pages

DEPARTMENT OF LABOR & ECONOMIC GROWTH

DIRECTOR'S OFFICE

CONSTRUCTION SAFETY STANDARDS

Filed with the Secretary of State on August 17, 1979 (as amended November 23, 1982) (as amended January 11, 1988) (as amended July 8, 1993) **(as amended September 3, 1996)**

This rule takes effect 15 days after filing with the Secretary of State

(By authority conferred on the director of the department of consumer and industry services by sections 19 and 21 of Act No. 154 of the Public Acts of 1974, as amended, and Executive Reorganization Order No. 1996-2, being §§408.1019, 408.1021, and 445.2001 of the Michigan Compiled Laws)

R 408.40951 of the Michigan Administrative Code is effective as of the date of this amendment.

Visit our website at: www.michigan.gov/mioshastandards

PART 9. EXCAVATION, TRENCHING, AND SHORING

TABLE OF CONTENTS

R 408.40901 Scope.

Rule 901. This part pertains to the digging of excavations and trenches which an employee is required to enter and the supporting systems used on construction operations.

R 408.40925 Definitions A to Q.

Rule 925. (1) "**Angle of repose**" means the maximum permissible slope as determined by table 1.

(2) "**Braces**" or "**struts**" means the horizontal cross members of a shoring system that bear against the uprights or stringers.

(3) "**Excavation**" means any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal. For the purpose of this part, a trench is an excavation.

(4) "**Hazardous atmosphere**" means an atmosphere which, by reason of being any of the following, may cause death, illness, or injury:

(a) Explosive.
(b) Flammable.
(c) Poisonous.
(d) Corrosive.
(e) Irritating.
(f) Oxygen deficient.
(g) Toxic.
(h) Otherwise harmful.

(5) "**Kickouts**" means the accidental release or failure of a stringer or brace.

(6) "**Qualified person**" means a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

R 408.40926 Definitions; S.

Rule 926. (1) "**Sheet piling**" means a continuous row of timber or steel piles driven in close contact to provide a tight wall to resist lateral pressure of water, adjacent earth, or other materials.

(2) "**Sides,**" sometimes called faces or walls, means the vertical or inclined earth surfaces formed as a result of excavation work.

(3) "**Slope**" means the acute angle formed by the side of a trench or excavation and the horizontal plane.

(4) "**Soil**" means any of the following:

(a) "**Clay**" — a very fine textured soil that derives its resistance to displacement from cohesion and may be:

OSHA 1926 Subpart P & MIOSHA Part 9 are unique standards organized as "Performance Based" Standards

Standards identify common hazards associated with underground construction and provide minimum safety limits. The employer ensures that each excavation is free of identified or predictable hazards.

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 PERSON

Qualified Person

A person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

Rule 925 (6)

Role of the Qualified Person

- **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**

Qualified Person (cont'd)

- **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**

Duties Specific to Qualified Person

- An excavation as a work area does not exist until work begins.
- It is the duty of the Qualified Person to DESIGN, CONSTRUCT and MAINTAIN a safe work area.
- The work area is assumed to be as safe as this room – free of all known or predictable hazards

DEFINITIONS

Definitions

- **Excavation:**
  - **Any man-made cavity or depression in the earth's surface, including it's sides, walls, or faces, formed by earth removal. (Rule 925)**

Definitions

- **Trench:**
  - **An excavation having a depth greater than its width measured at the bottom (Rule 927)**

Definitions

- **Cave-in**

  Separation of a mass of soil from the bank of a trench or excavation

This hazard *IS ALWAYS* present in any excavation


Potential
Hazards

Specific Excavation Considerations

- **Inspections**
- **Surface Obstructions**
- **Underground Utility Lines**
- **Overhead Power Lines**
- **Access & Egress**
- **Exposure to Vehicular Traffic**
- **Exposure to Falling Loads**
- **Hazardous Atmospheres**
- **Water Accumulation**
- **Stability of Adjacent Structures**
- **Walkways, sidewalks, roadways**

INSPECTIONS

Rule 932

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

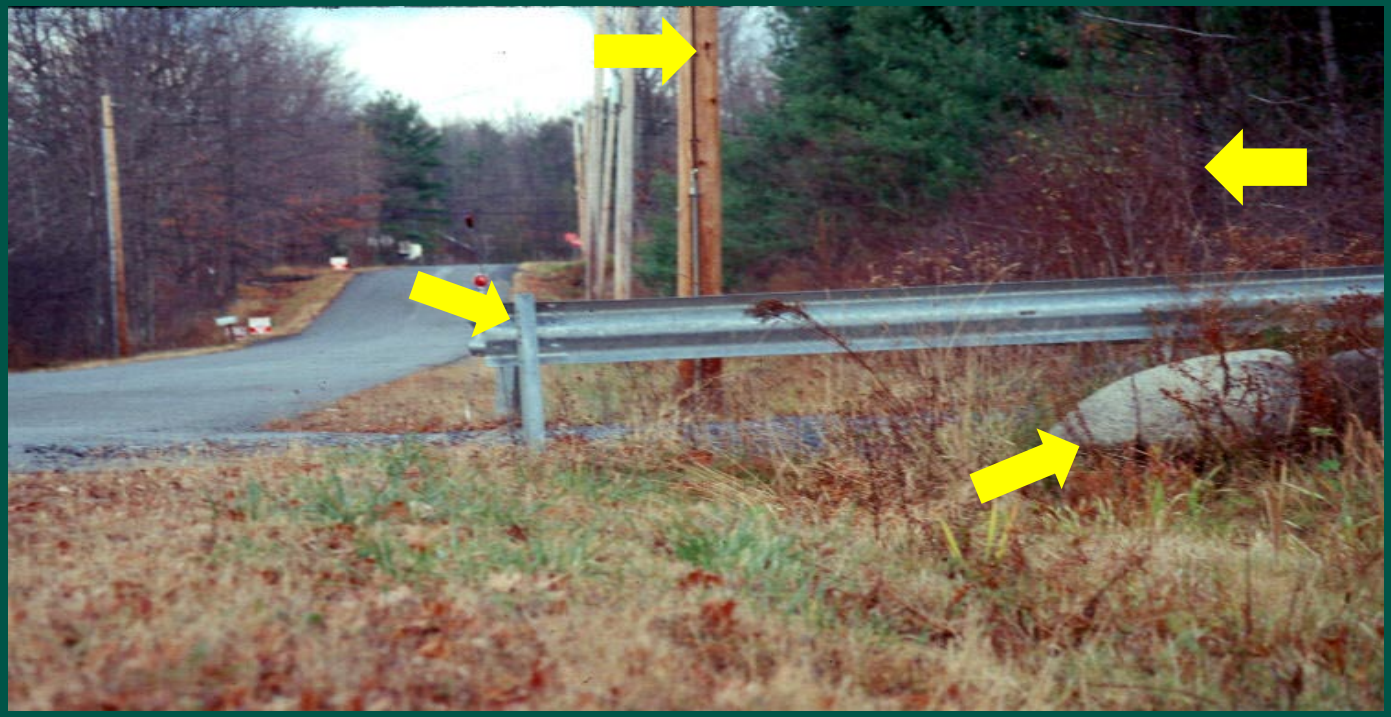
INSPECTIONS

Rule 932

- The Qualified Person designs, constructs and MAINTAINS the safe work area. Maintenance is accomplished through *ongoing* inspections to ensure conditions comply with design.

Surface Obstructions

A tree, boulder, rock fragments or other obstructions whose movement could cause injury to an employee shall be removed or supported



Underground Utilities

Rule 931

(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

CALL MISS DIG

811
MISS DIG System, Inc.
www.missdig.org 1-800-482-7171

MICHIGAN'S UTILITY COLOR CODE

RED	Electric
YELLOW	Gas, Oil, Steam or Petroleum
ORANGE	Communications
BLUE	Potable Water
PURPLE	Reclaimed Water Irrigation
GREEN	Sewer & Drain Lines
WHITE	Proposed Excavation
PINK	Temporary Surveying

Underground Utilities

MISS DIG FACT SHEET

MIOSHA
Michigan Occupational Safety and Health Administration

MIOSHA Fact Sheet

Construction Safety & Health Division

MISS DIG – New Public Act 174

The MISS DIG System:

New legislation in 2013 created the Miss Dig Underground Facility Damage Prevention and Safety Act 174 that went into effect on April 1, 2014. The act requires that a person or public agency must provide a dig notice to MISS DIG on intent to excavate, tunnel, discharge explosives or demolish at least **three business days**, but not more than 14 calendar days, before commencing the activity. Upon notification, MISS DIG will notify participating members to stake their underground utility lines and/or provide overhead electric line assistance to ensure adequate clearances are maintained. The staking is only an approximation and does not indicate the exact location (to the inch) or the depth of the utility. Participating utilities include underground telephone and telegraph, gas, electric, water, sewer, and storm lines and drains.

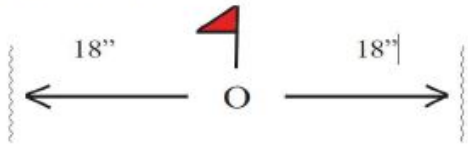
A positive response system is housed at the MISS DIG notification system that will allow facility owner/operators or their authorized locating contractor to provide status of dig notices sent to them by MISS DIG. Once the facility owner/operator or the locating contractor determines the status of the dig notice (such as clear or marked) they can then post that response to the system.

The new Act 174 contains requirements when excavating with power equipment in proximity to utility marks and provides guidance for both exercising "reasonable care" and identifying "when working" in close proximity to underground utilities applies.

Hand exposing must be performed prior to the use of power equipment in the Caution Zone. "Caution Zone" means the area within 48 inches of either side of the marking.

Caution Zone

Hand exposing or soft excavation. "Approximate location" is defined as a strip of land at least 36 inches wide, but not wider than the width of the marked utility, plus 18 inches on either side of the utility marks. Excavator can request additional assistance if the location of marked utility within the approximate location cannot be determined when hand digging.



Hand Exposing

MIOSHA Rules:

It is the employer's responsibility to identify all underground utilities before beginning an excavation in accordance with Part 9, Excavation, Trenching and Shoring Systems, Rule 931(1). Upon notice from the contractor, MISS DIG will notify the utility companies they have on their member list that an excavation site needs to be staked. **Do not assume that all the utilities have been staked!** The only way to know for sure is to access the MISS DIG positive response system.

Part 9, Rule 931(2) requires: Upon receiving the information from the public utility, an employer shall exercise reasonable care when working in close proximity to the underground facilities of any public utility. If the facilities are to be exposed, or are likely to be exposed, ***only hand digging*** shall be employed in such circumstances and such support, as may be reasonably necessary for protection of the facilities, shall be provided in and near the construction area.

So what does this mean for a contractor engaged in construction activities that require excavating? Do I need to comply with both Act 174 and Part 9?

If an employer is excavating and is following the requirements established by Public Act 174, MIOSHA would considered them to be in compliance with the requirements of Part 9 rules 408.40931(1) and 408.40931(2) for addressing the location and working around underground utilities.

MIOSHA also encourages contractors to contact their local Damage Prevention Association (DPA). The website link below gives a listing of all the DPAs' in Michigan. DPA Groups - Miss Dig System, Inc. - Michigan. These associations are a source for knowledge and the sharing of information to help contractors perform their job safely.

For additional assistance, please contact the Construction Safety and Health Division at 517-284-7680 or the Consultation Education and Training Division at 517- 284-7720. Construction Safety Standards can be viewed on the MIOSHA website at www.michigan.gov/mioshastandards.

MIOSHA
CONSTRUCTION SAFETY AND HEALTH DIVISION
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OVERNIGHT MAIL ADDRESS: 525 WEST ALLEGAN STREET, LANSING, MI 48933
www.michigan.gov/mioshа • 517-284-7680
(Revised 08/24/2015)
CSH Fact Sheet - #013

OVERHEAD POWER LINES

Maintain 10-foot clearance from power lines up to 50,000 volts

TABLE A—MINIMUM CLEARANCE DISTANCES

Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
up to 50	10
over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1,000	45
over 1,000	(as established by the utility owner or operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution).

Note: The value that follows "to" is up to and includes that value. For example, over 50 to 200 means up to and including 200kV.

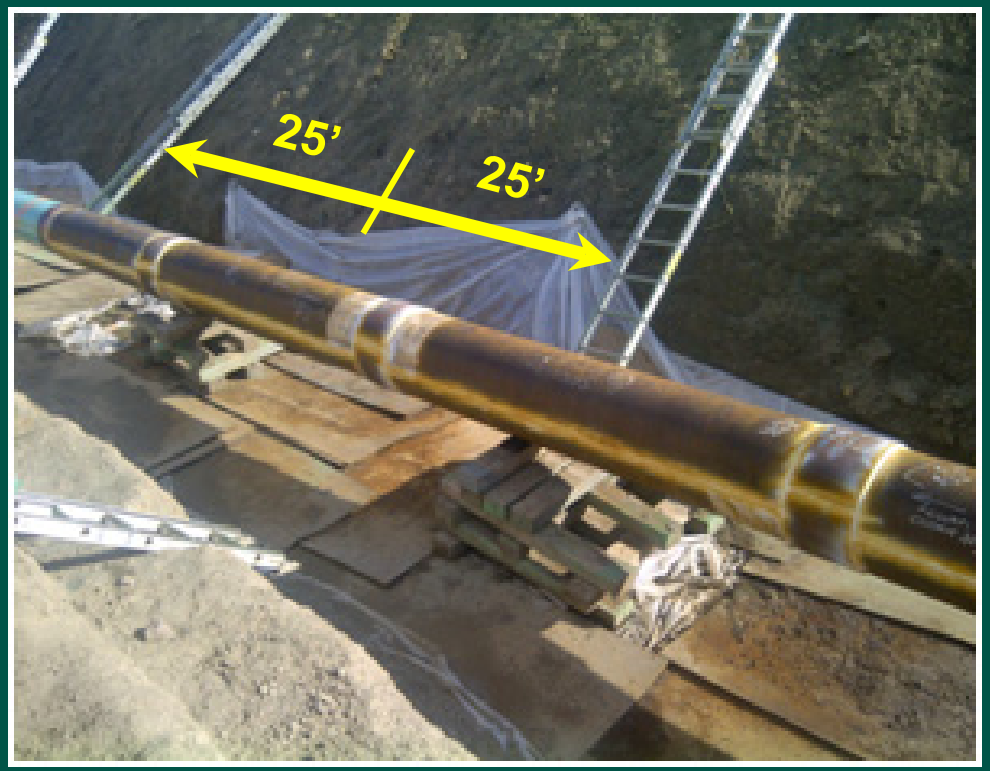
TABLE A – Minimum Clearance Distances

MIOSHA Part 10

Access and Egress

Rule 933

(4) An excavation 48 or more inches in depth and occupied by an employee shall be provided with either a ladder extending not less than 3 feet above the top as a means of access or with a ramp meeting the requirements of subrule (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



Access and Egress

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

Exposure to Vehicular Traffic

Employees exposed to vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

Exposure to Falling Loads

Part 10 – Rule 1023a

(1) Hoisting routes that minimize the exposure of employees to hoisted loads shall be used. An employee shall not be permitted under a suspended load

Hazardous Atmospheres; Testing & Controls Rule 934

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

(a) 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

(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

(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

(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

(2) 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. The 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

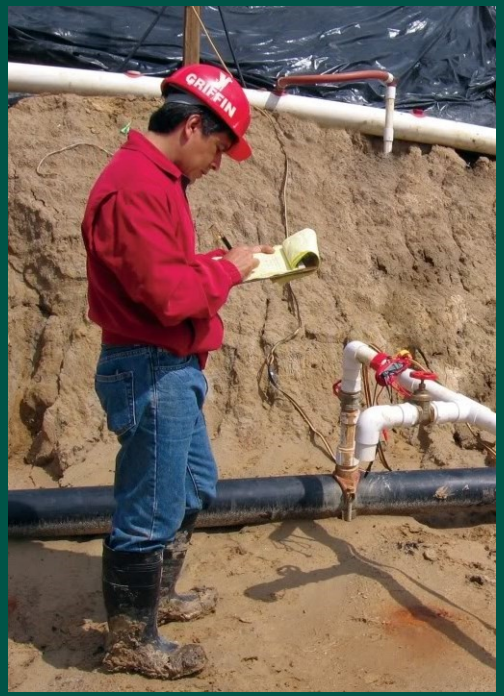
Pump

Lifeline

Exposure to Water Accumulation

Rule 932

(3) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operation shall be monitored by a qualified person or a monitoring system to ensure that the equipment is properly operated.



STABILITY OF ADJACENT STRUCTURES

Rule 953

(1) A structure that is adjacent to an excavation or trench below the level of the base or footing of any foundation or retaining wall shall be protected against settlement, lateral movement, undermining, or washout.

(2) Before the excavation begins, the design of the protection used shall be set forth by a qualified person who is knowledgeable in the subject area.

(3) The shoring, bracing and underpinning shall be inspected daily or more often, as conditions warrant, by a qualified employee.

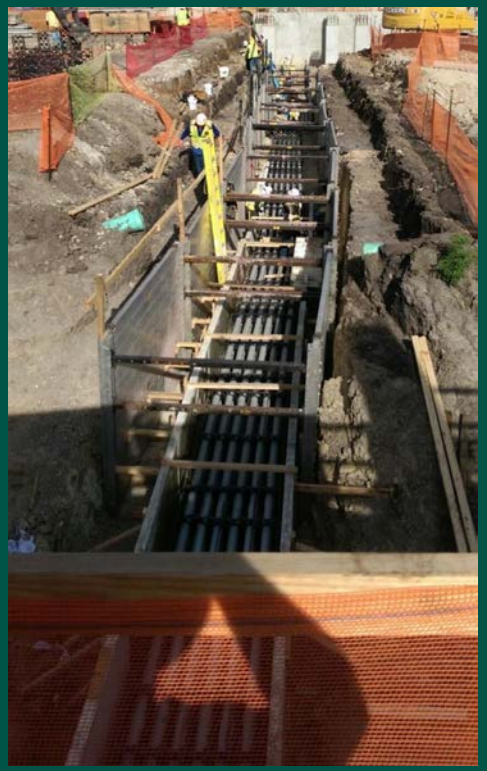
Walkways, sidewalks, roadways
Rule 951

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

Walkways, Sidewalks, Roadways

Rule 951

(2) If an employee or equipment is required or permitted to cross a trench or ditch, a walkway, runway, ramp, or bridge shall be provided and shall have a designed capacity of not less than 3 times the imposed load. A guardrail prescribed by the provisions of Part 21. Guarding of Walking and Working Areas and Part 45. Fall Protection, R408.42101 and R 408.44501, shall be provided.



Fall Protection – Excavations
CS PART 45

1926.501(b)(7) "Excavations."

1926.501(b)(7)(i) Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, or barricades when the excavations are not readily seen because of plant growth or other visual barrier;

1926.501(b)(7)(ii) Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers.

An active excavation shall be protected if obscured. When the excavation becomes a pit or shaft for other operations – it shall be provided with fall protection per CS Part 45.


SOIL
CLASSIFICATION

SOIL CLASSIFICATION

- To properly construct a safe work area the Qualified Person must know what materials make up the excavation.
- Classification of soil is one of the skills that separates the Qualified Person from other safety personnel
- MIOSHA Part 9 provides soil definitions and values but does not provide descriptions of tests to establish these values
- For examples of testing methods and procedures – The Qualified Person can refer to OSHA Subpart P, Appendix A

SOIL CLASSIFICATION

Michigan does not use the A,B,C Soils Classification used in Subpart P and in other states.

MIOSHA classifies soils using a modified and condensed version of standard geotechnical engineering system.

MIOSHA SOIL TYPES

RULE 926: SOIL MEANS ANY OF THE FOLLOWING:

CLAY

A very fine textured soil that derives it's resistance to displacement from cohesion and may be:

(i) SOFT CLAY – A clay-type soil that has an unconfined strength of less than 1.0 TSF

(ii) MEDIUM CLAY – Sometimes called plastic – a clay-type soil that has a minimum unconfined strength of 1.0 TSF

(iii) FIRM SOIL – A clay-type soil that is resistant to forces causing rupture or displacement. A firm clay has a minimum unconfined strength of 1.5 TSF

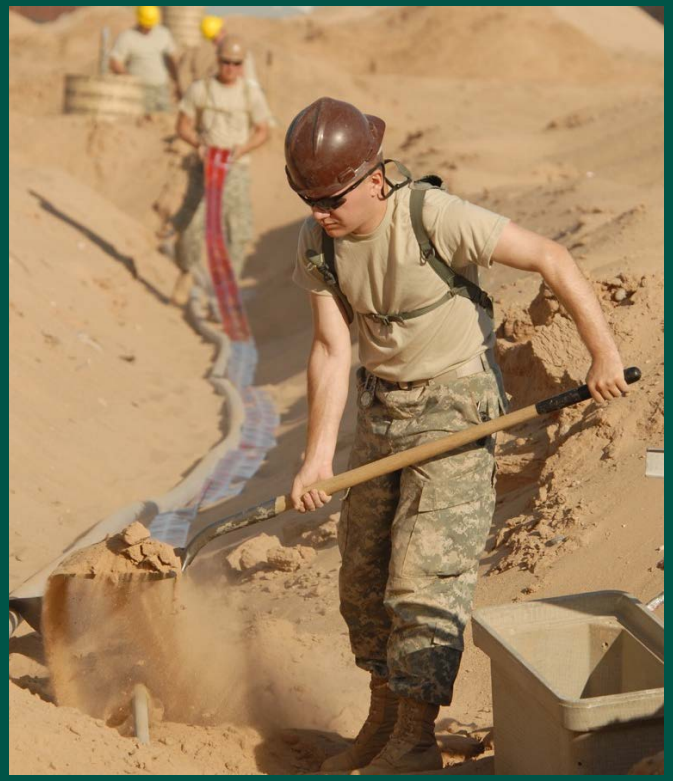
(iv) STIFF CLAY – A clay-type soil that is very resistant to forces causing rupture or displacement. A stiff clay has a minimum unconfined strength of 2.5 TSF

FILL

A manmade soil condition that may be constructed of any type of soil or combination thereof.

GRANULAR SOIL

A coarse grained soil that does not possess cohesion but derives it's strength from internal friction

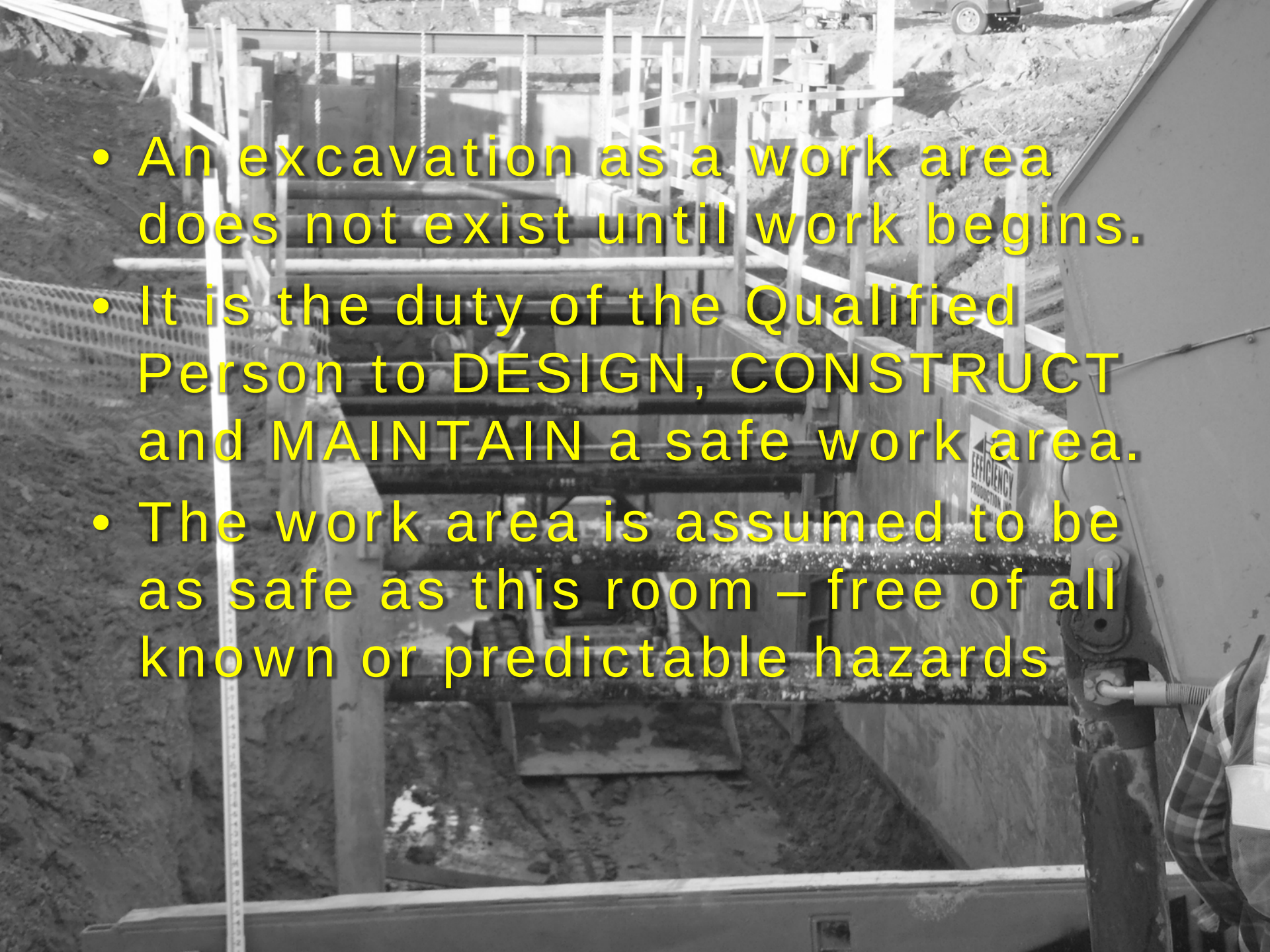


ORGANIC SOIL

A soil that contains significant amounts of peat, muck or marl.

RUNNING SOIL

Any type of soil that has insufficient strength to stand unsupported. Running soil tends to run or slough into the excavation as excavation is being dug.



- An excavation as a work area does not exist until work begins.
- It is the duty of the Qualified Person to DESIGN, CONSTRUCT and MAINTAIN a safe work area.
- The work area is assumed to be as safe as this room – free of all known or predictable hazards

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

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

Protective Systems

Angle of Repose

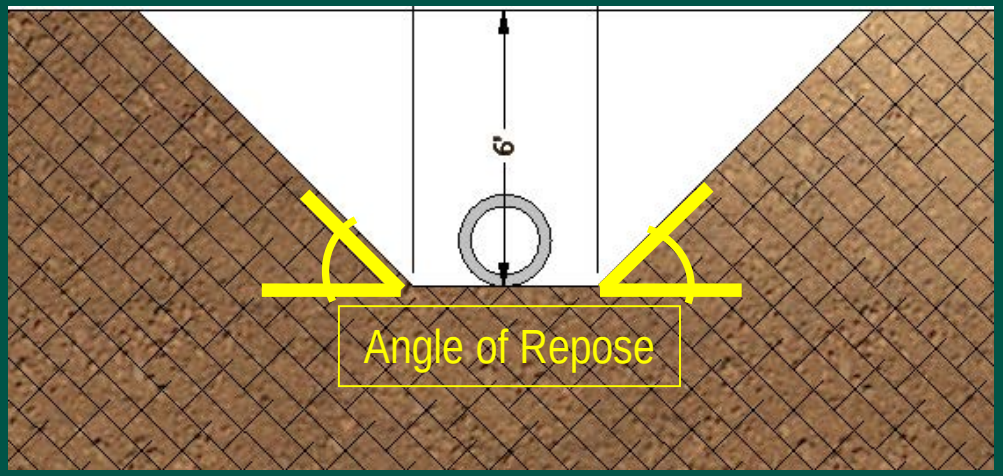
Trench Shields

Shoring

Angle of Repose
(Sloping)

Rule 925 (1)

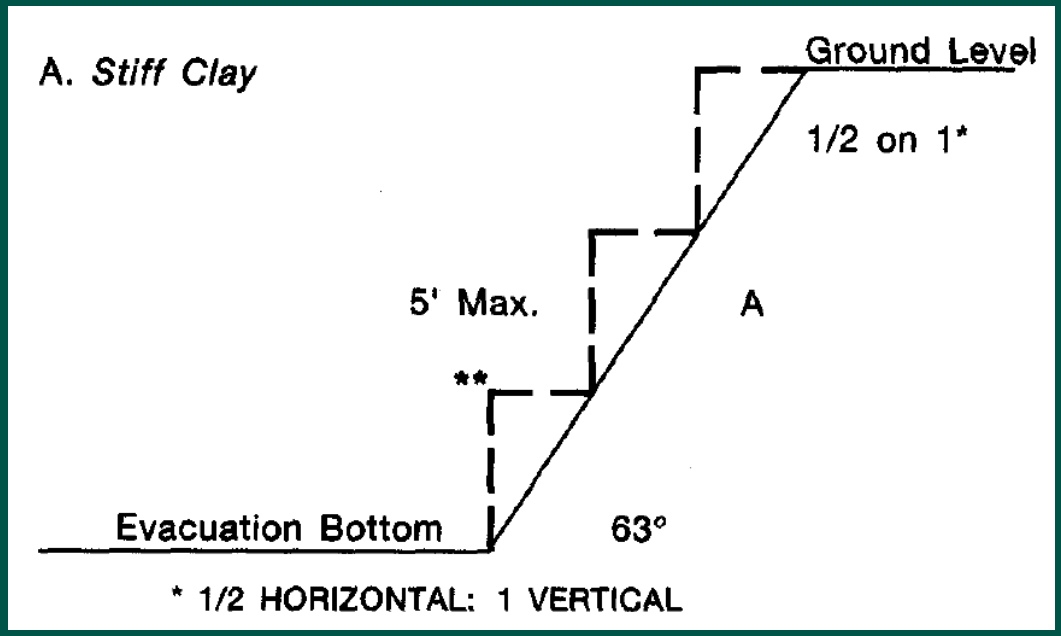
"Angle of Repose" means the maximum permissible slope as determined by Table 1.



Angle of Repose (Benching)

Rule 925 (1)

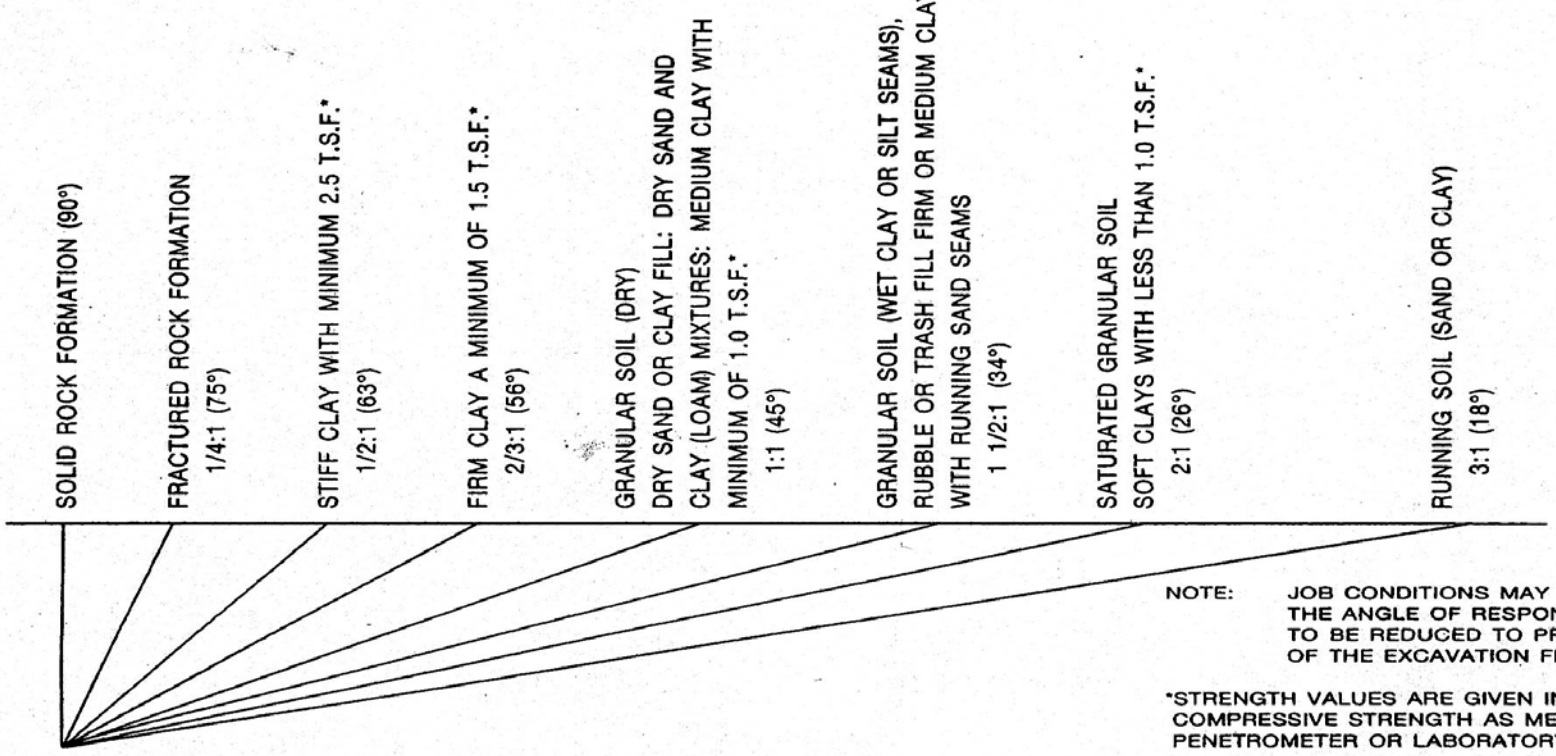
"Angle of Repose" means the maximum permissible slope as determined by Table 1.



MIOSHA TABLE 1

TABLE 1

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



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.

MIOSHA TABLE 1

Qualified Person classifies soil, finds best match on Table 1 and designs work area appropriately

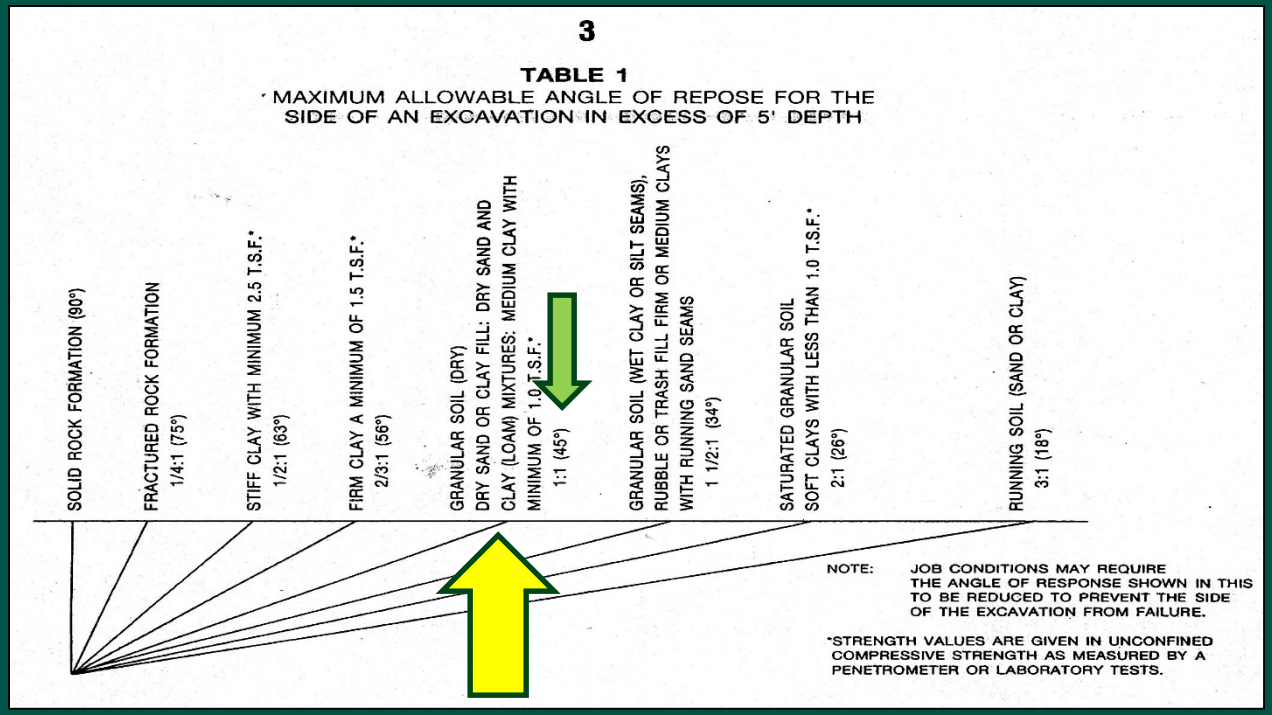


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TABLE 1

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°)

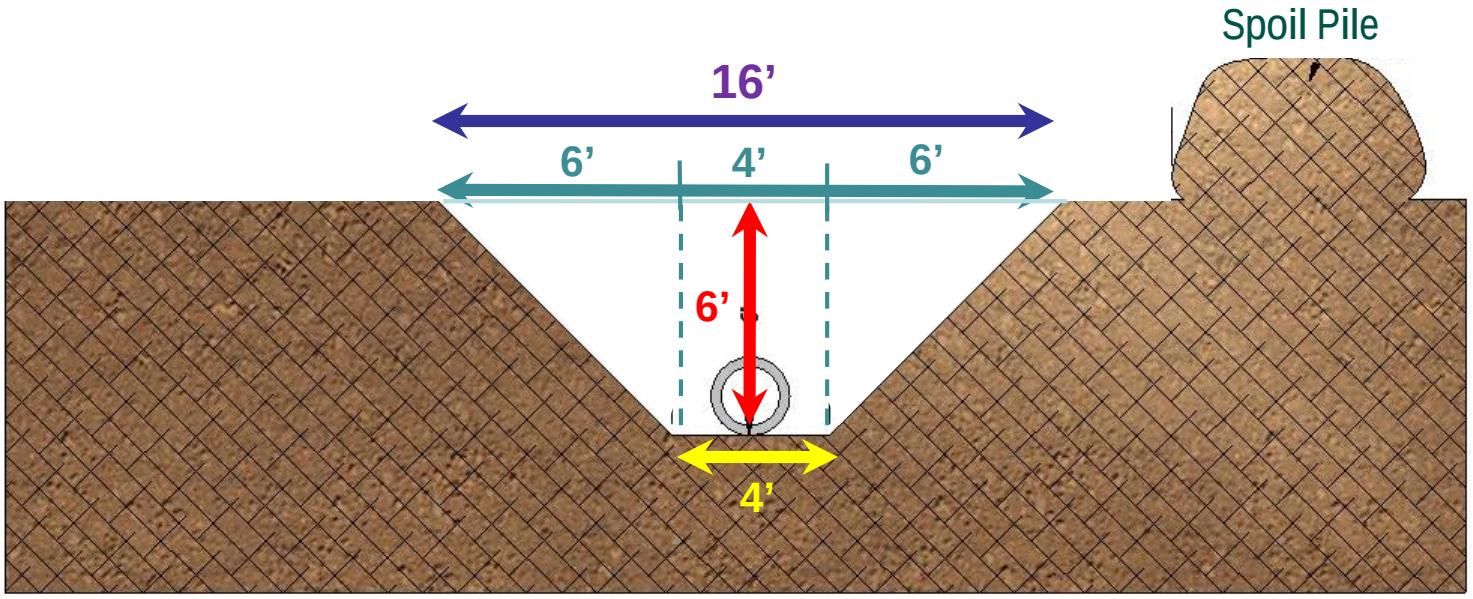
NOTE: JOB CONDITIONS MAY REQUIRE THE ANGLE OF RESPONSE SHOWN IN THIS TO BE REDUCED TO PREVENT THE SIDE OF THE EXCAVATION FROM FAILURE.

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

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

Proper angle of repose is 1:1 (45°)

Angle of Repose (Sloping)

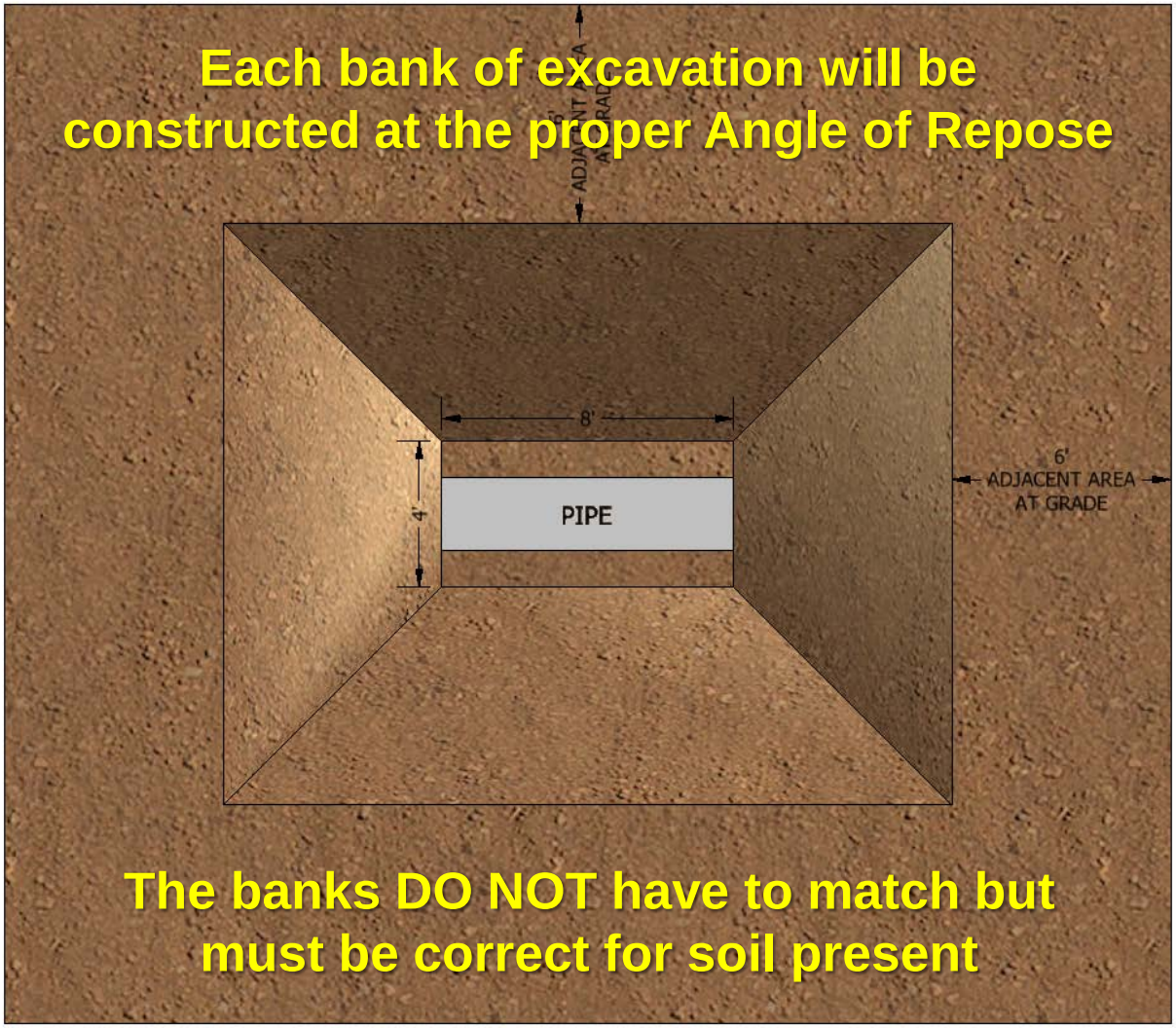


SECTION OF TRENCH 6′ DEEP
1:1 SLOPE

Example of 6’ deep excavation in Medium Clay Angle of Repose 45º

The 45º Angle of Repose is created by laying the bank back 1:1

Angle of Repose (Sloping)



Trench Shields

Trench Shield
General Description

- **A trench shield is a movable box strong enough to protect the employee inside, but light enough to handle easily in the trench**

- **Ideally, the width of a trench is wider than the width of the trench shield to reduce possible friction during movement. Thus, the trench shield cannot effectively prevent soil cave-ins outside the box**

Trenching Boxes and Shields

Rule 945

(1) Portable trench boxes or sliding trench shields may be used for the protection of personnel in place of a shoring system or sloping. Where such trench boxes or shields are used, they shall be designed, constructed, and maintained in a manner that provides protection equal to or greater than the sheeting or shoring required for the trench.

Manufacturer's Tabulated Data

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.

Manufacturer's Tabulated Data

Serialized Trench Shield

Manufacturer

Model # of Shield

Option & Lifting Information

Limitations

Certified by Engineer

Serial # of Shield

Soil Types

Max. Depths

Soil Descriptions

Placement Diagram

EFFICIENCY PRODUCTION INC. America's Trench Box Builder
685 HULL ROAD, MASON, MI 48854 PHONE (517) 676-8800

SERIAL NUMBER 149985

PAGE 1 OF 2
STEEL TRENCH SHIELD

MODEL: HT6-824	4-PIPE "I"	MAX SPREADER LENGTH	20 FEET
KNIFE-EDGE YES	FOAM FILLER YES	COLLAR TYPE	7" O.D. x 3/4" WALL with 2" PIN HOLES
DATE OF MANUFACTURE Sep-1[illegible]	LIFT-LUG RATING 8,100 LBS	WEIGHT AS MANUFACTURED	12,185 LBS

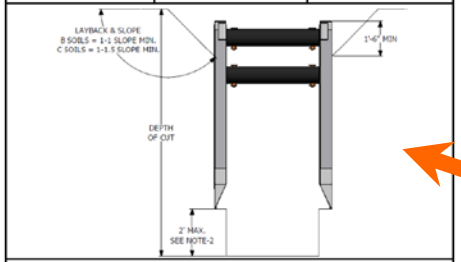
REFERENCE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION RULES AND REGULATIONS, 29 CFR, NO 209, PART 1926, SUBPART P

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
8	24	1140	25	19	14
			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, INC.
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, INC.
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 INC.

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

9/16/2014

⚠ 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

Manufacturer's Tabulated Data
Serialized Trench Shield

Limitations Continued

Assembly Instructions

Use in Unstable Soils

Use in Stable Soils

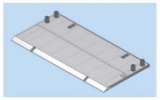
Special Uses

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

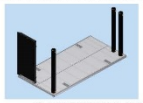
- NOT TYPE A IF FISSURED, SUBJECT TO VIBRATION, PREVIOUSLY DISTURBED OR PART OF A SLOPED LAYERED SYSTEM WHERE LAYERS DIP INTO EXCAVATION ON A SLOPE OF FOUR HORIZONTAL TO ONE VERTICAL (4H:1V) OR GREATER.
- PREVIOUSLY DISTURBED SOILS MAY BE TYPE B UNLESS THEY WOULD BE CLASSIFIED AS TYPE C. SOIL THAT MEETS 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 SERVICEABILITY 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.

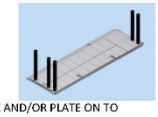
ASSEMBLY

MUDPLATE SPREADERS SYSTEM 5 PIPE SPREADER SYSTEM

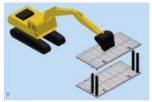


LAY SIDE PANEL FLAT ON GROUND WITH COLLAR SOCKETS UP





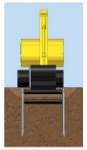
PLACE SPREADER PIPE AND/OR PLATE ON TO COLLARS OR INTO BRACKETS AND PIN IN PLACE. SECURE PINS WITH KEEPERS



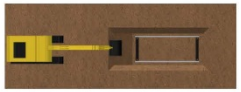
LOWER SECOND SIDEWALL ONTO SPREADERS AND PIN

STAND TRENCH SHIELD IN UPRIGHT POSITION AND PREPARE FOR INSTALLATION

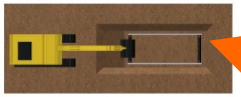
USING A TRENCH SHIELD IN STABLE SOIL



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.

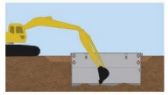


EXCAVATE IN FRONT OF THE TRENCH SHIELD

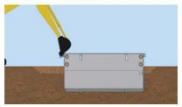


PULL SHIELD FORWARD BY FRONT TOP SPREADER PIPE OR WITH PULLING EYES. (PULLING EYES SHALL BE USED WITH SPREADERS WIDER THAN 72" OR WHEN SOIL PRESSURE IS SEVERE ENOUGH TO CAUSE SPREADER TO DEFLECT).

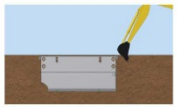
USING A TRENCH SHIELD IN UNSTABLE SOIL



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



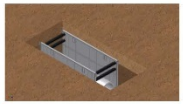
PRESS DOWN ON CORNERS TO PUSH SHIELD DOWN TO GRADE



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

Tabulated Data
Modular System

EFFICIENCY PRODUCTION, INC. America's trench box builder™

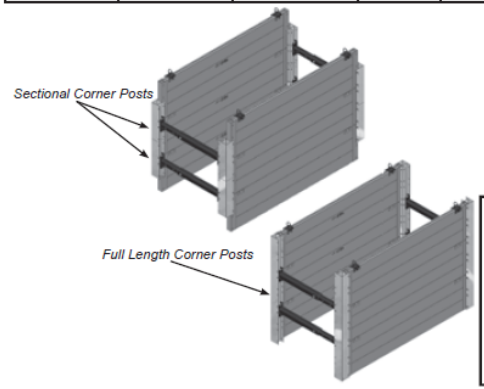
Build-A-Box™ Tab Data

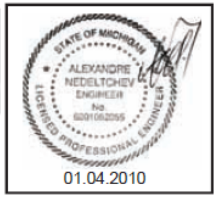
Sectional or Full Length Corner Posts

Struts on 24 or 36 in. vertical centers

2-Sided Build-A-Box™ Modular Trench Shield System

Panel Selection Chart		Shield Capacity	Depth of Cut (ft.) - Soil Type			
Ht. x Lg. (Ft.)	Weight (Lbs.)	(PSF)	A	B	C-60	C-80
22 BBP	28	2,400	96	53	40	30
23 BBP	40	2,400	96	53	40	30
24 BBP	52	2,400	96	53	40	30
25 BBP	64	2,400	96	53	40	30
26 BBP	76	2,400	96	53	40	30
27 BBP	88	1,740	70	39	29	22
28 BBP	100	1,440	58	32	24	18
29 BBP	112	1200	48	27	20	15
210 BBP	124	960	38	21	16	12
211 BBP	136	840	34	19	14	11
212 BBP	148	780	31	17	13	10
213 BBP	160	660	26	15	11	8
214 BBP	172	600	24	13	10	8
215 BBP	184	540	22	12	9	7
216 BBP	196	480	19	11	8	6
217 BBP	208	420	17	9	7	5
218 BBP	220	360	14	8	6	5
219 BBP	232	300	12	7	5	4
220 BBP	244	240	10	5	4	3





EFFICIENCY PRODUCTION, INC. America's trench box builder™

Build-A-Box™ Tab Data

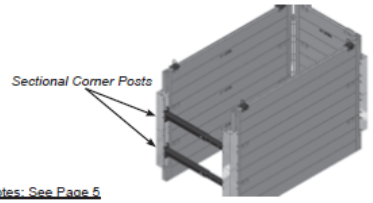
Sectional Corner Posts

9, 10, and 11 ft. Configurations

Struts on 24 in. vertical centers on open end

3-Sided Build-A-Box™ Modular Trench Shield System

Width x Length (Ft.)	Shield Capacity (PSF)	Depth of Cut (ft.) - Soil Type			
		A	B	C-60	C-80
9 X 2	1,200	48	27	20	15
9 X 9	1,020	41	23	17	12
9 X 10	840	34	19	14	10
9 X 11	780	31	17	13	9
9 X 12	720	29	16	12	9
9 X 13	630	25	14	11	7
9 X 14	540	22	12	9	6
9 X 15	510	20	11	9	6
9 X 16	480	19	11	8	6
9 X 17	420	17	9	7	5
9 X 18	360	14	8	6	4
9 X 19	300	12	7	5	3
9 X 20	240	10	5	4	3
10 X 2	840	34	19	14	10
10 X 10	780	31	17	13	9
10 X 11	750	30	17	13	9
10 X 12	720	29	16	12	9
10 X 13	630	25	14	11	7
10 X 14	540	22	12	9	6
10 X 15	510	20	11	9	6
10 X 16	480	19	11	8	6
10 X 17	420	17	9	7	5
10 X 18	360	14	8	6	4
10 X 19	300	12	7	5	3
10 X 20	240	10	5	4	3
11 X 2	840	34	19	14	10
11 X 11	780	31	17	13	9
11 X 12	720	29	16	12	9
11 X 13	630	25	14	11	7
11 X 14	540	22	12	9	6
11 X 15	510	20	11	9	6
11 X 16	480	19	11	8	6
11 X 17	420	17	9	7	5
11 X 18	360	14	8	6	4
11 X 19	300	12	7	5	3
11 X 20	240	10	5	4	3



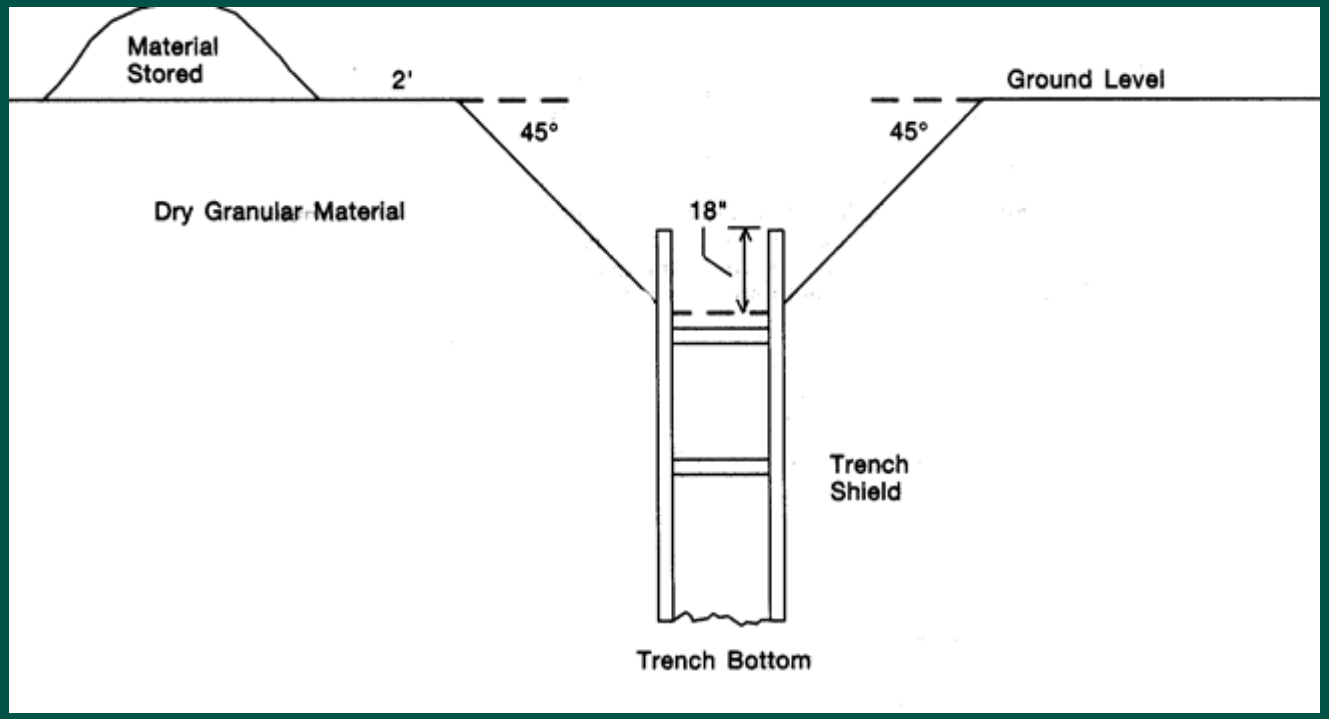
Notes: See Page 5

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

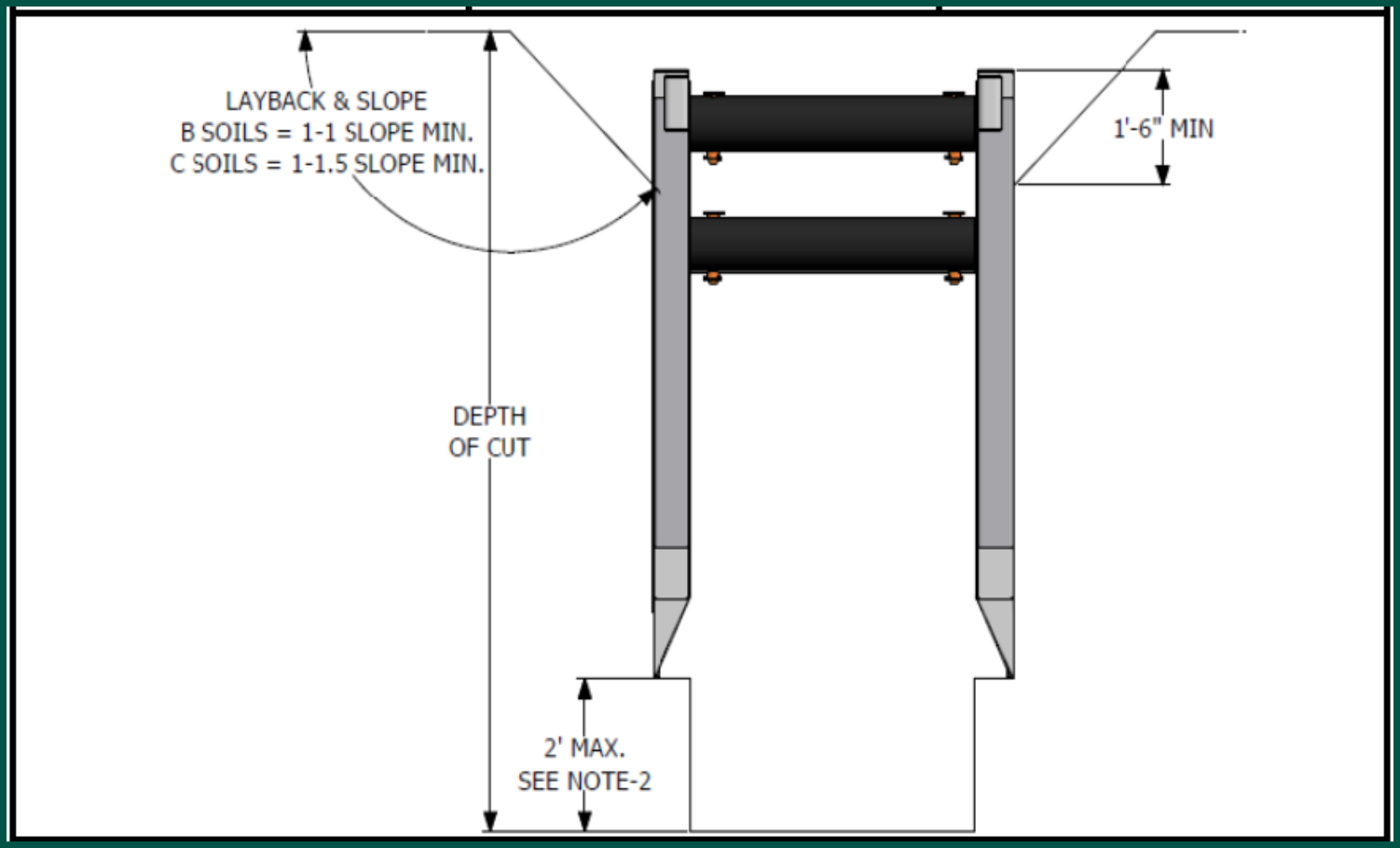
Trench Shield Combined with Sloping

If shielding or support system cannot protect entire depth – sloping top portion is allowed with the following requirements:

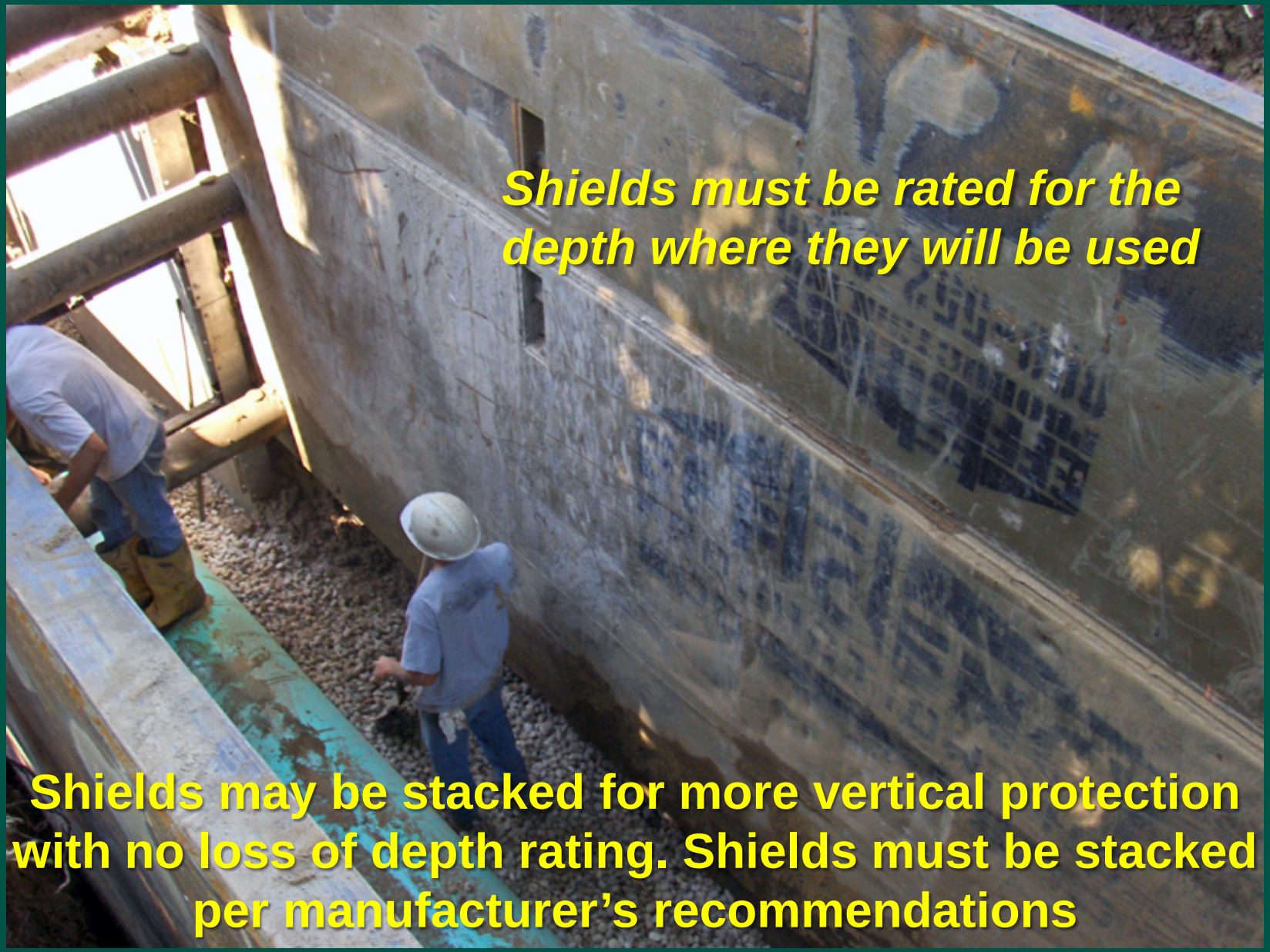
1. **Slope above system shall be correct Angle of Repose.**
2. **Slope shall meet the system 18” below top.**



Placement Diagram
Tabulated Data

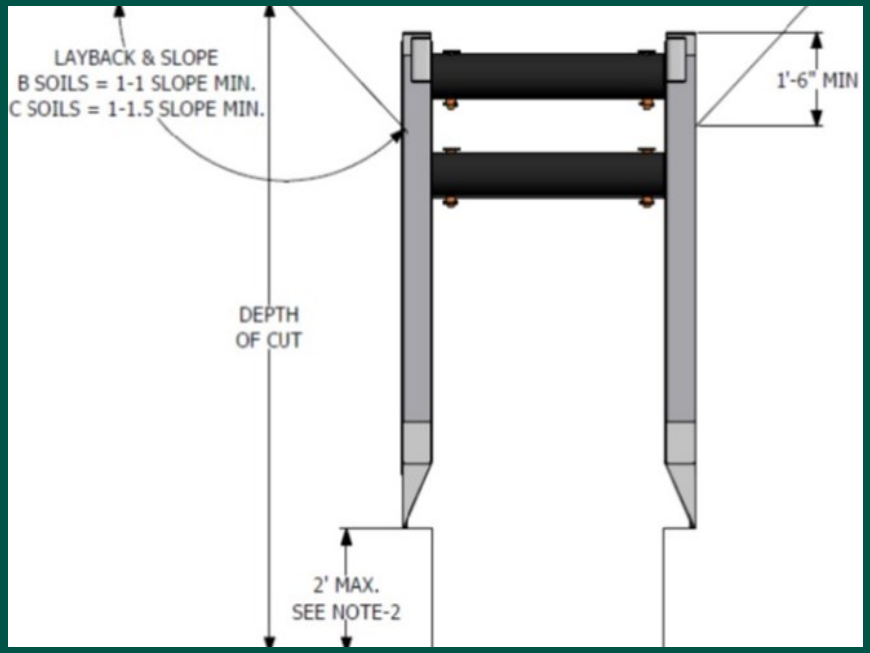


Using Stacked Trench Shields



Trenching Boxes and Shields
Rule 945

(2) The use of benching in conjunction with a portable trench box is permitted when the toe of the trench box is not more than 2 feet above the trench bottom, but only if the trench box is designed to resist the forces calculated for the full depth of the trench and if there are no indications, while the trench is open, of a possible cave-in below the bottom of the trench box.



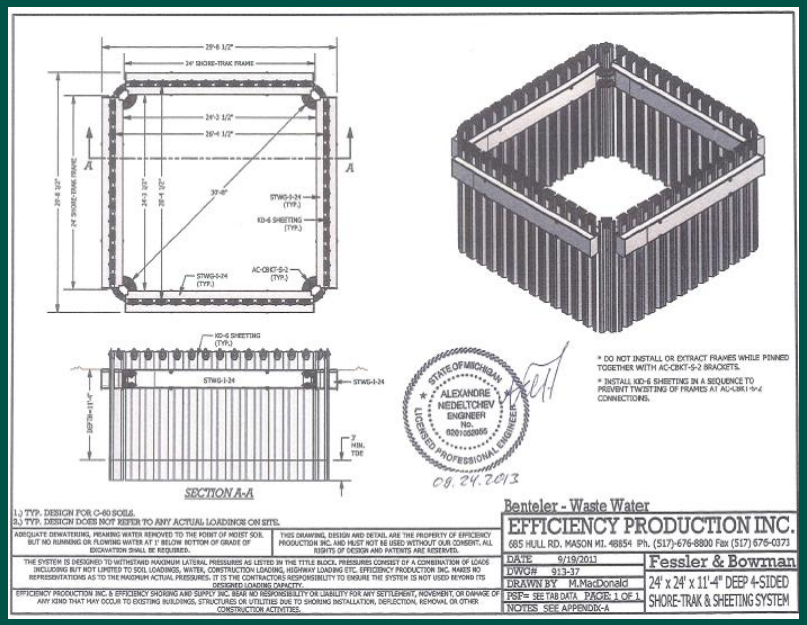
Trenching Boxes and Shields
Rule 945

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

Shoring & Support Systems

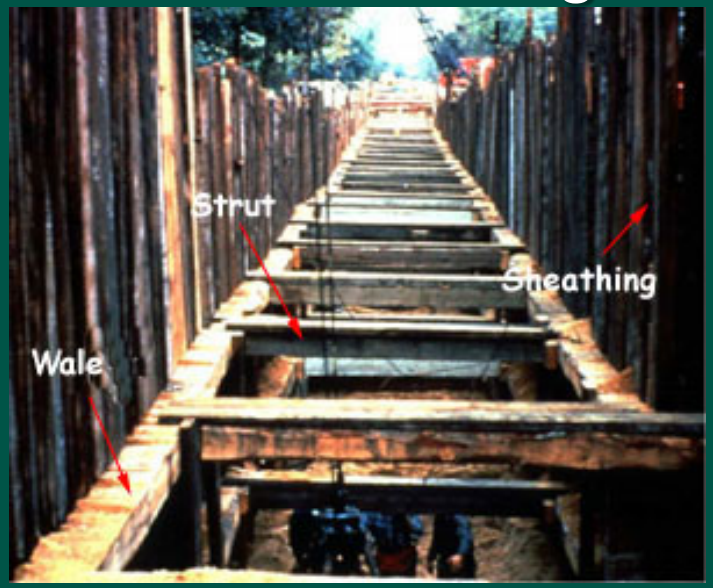
Supporting Systems
Rule 942

(2) A support system shall be designed by a qualified employee. The design of the supporting system shall be maintained at the jobsite. Changes from the design of the support system shall be approved by a qualified employee.

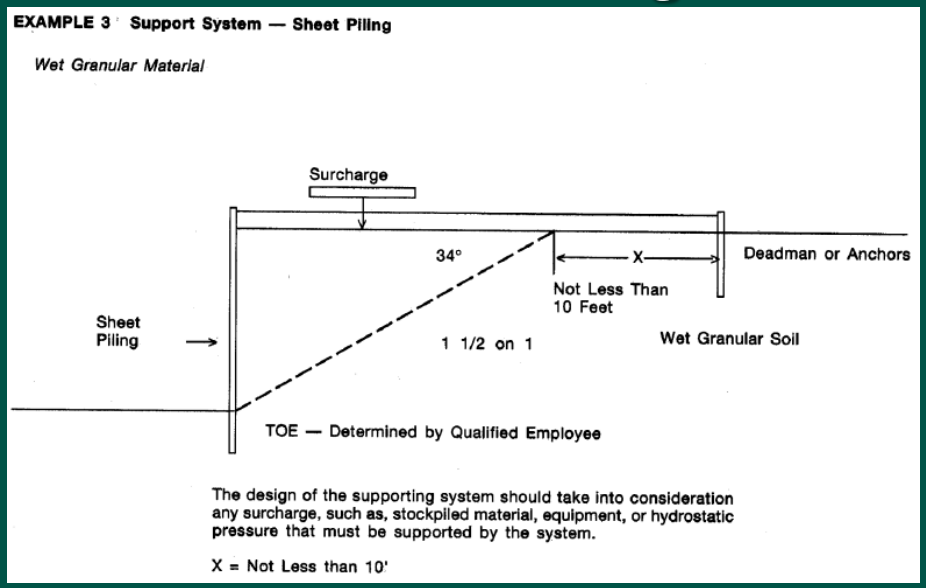


Qualified Person Designed Support Systems

Timber Shoring



Steel Sheeting



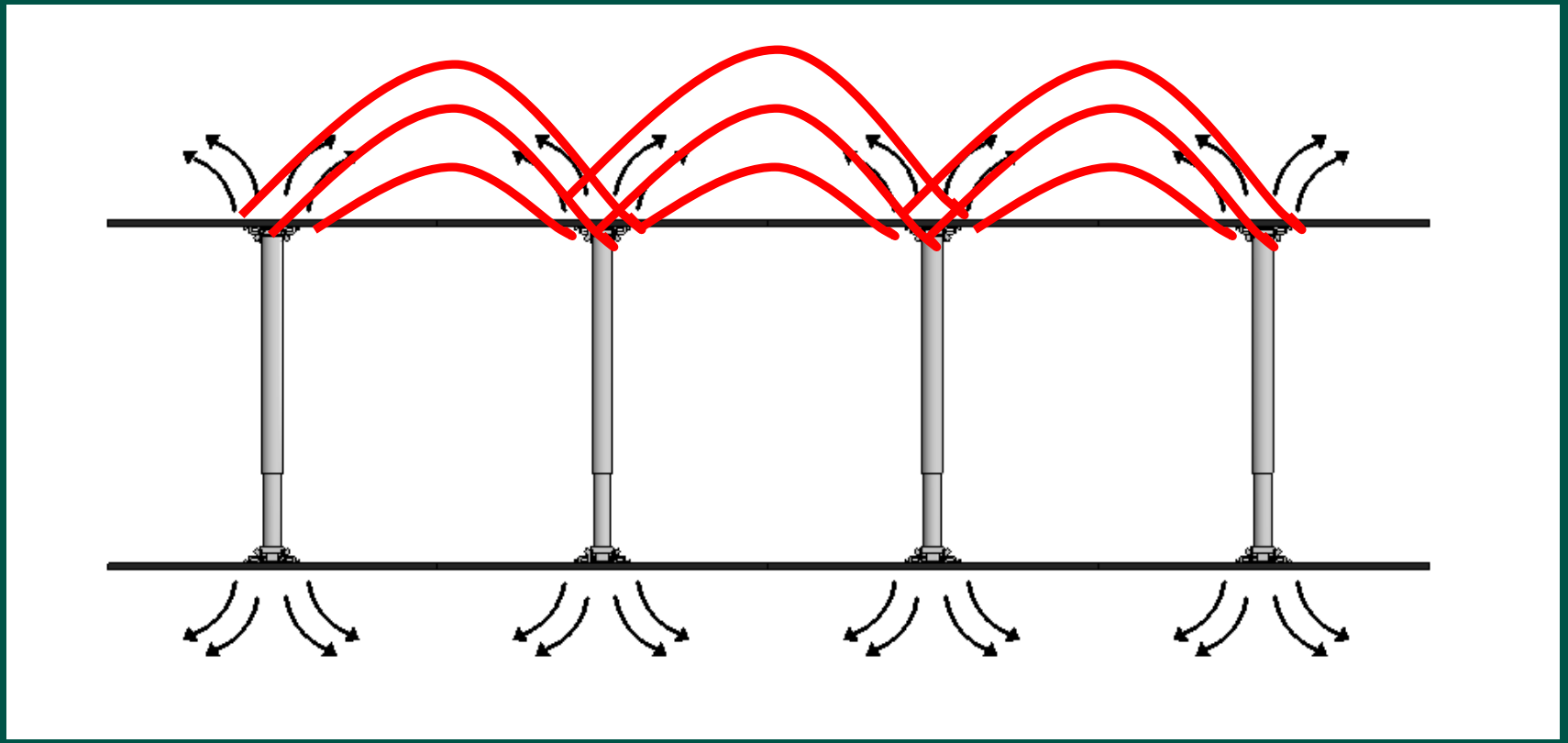
MIOSHA Part 9 allows for support systems designed by Qualified Person – exercise caution and be very sure you can meet all requirements of Rule 942 & Rule 943 before proceeding with this option.

Hydraulic Shores

Hydraulic shoring products are lightweight components that utilize hydraulic pressure to support banks of excavation

Hydraulic Shores

Individual cylinders create pressure arcs that intersect to form pressure arches.



Hydraulic Shores

The pressure arches fan out into the banks – supporting the soil without the presence of sheeting

(If allowed per tabulated data)

Shoring Selection Guide
TABULATED DATA

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

Slide Rail System

Slide rail systems utilize steel panels that slide in vertical posts

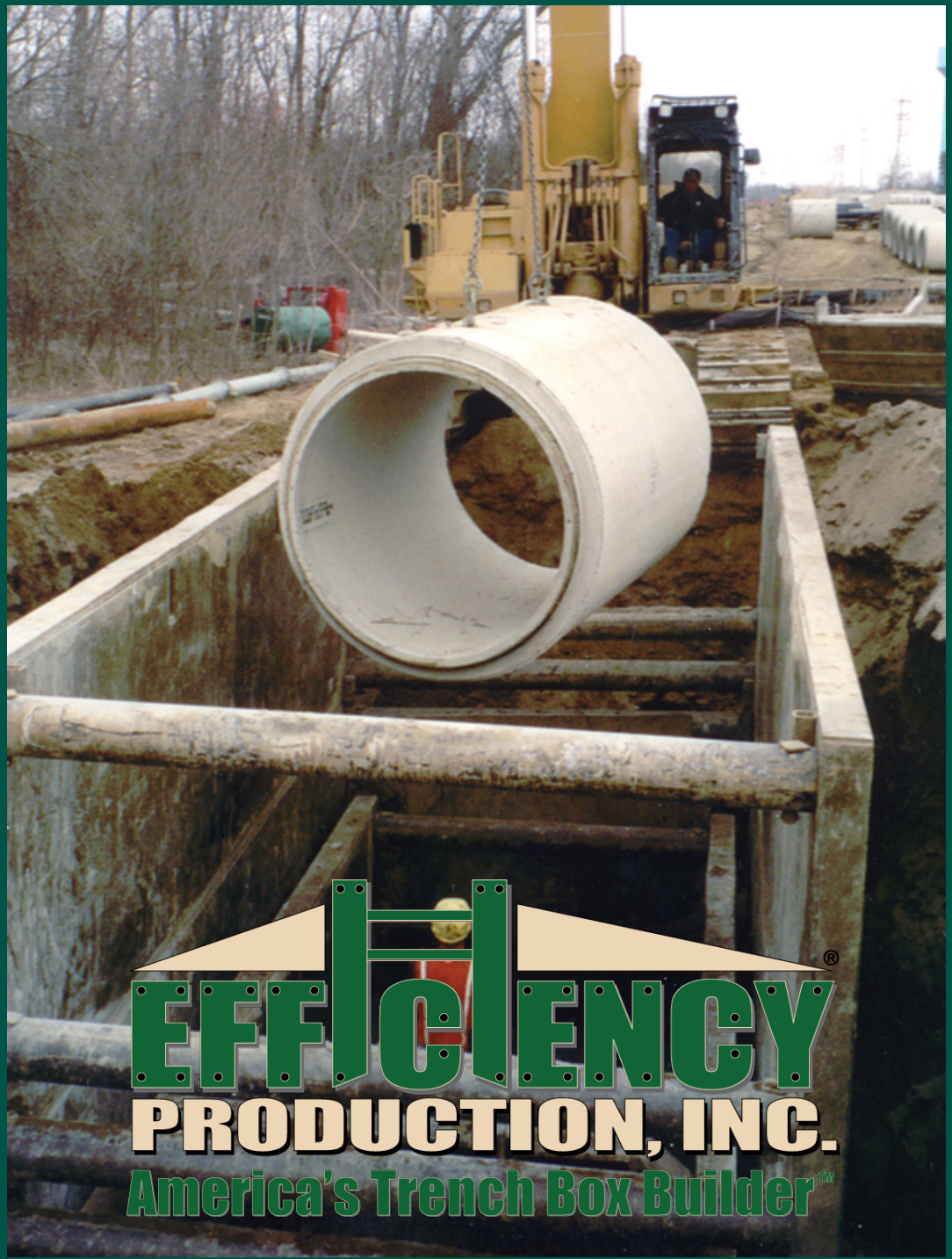
SHEETING FRAMES

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

Safe Working Area

Regardless the conditions – The Qualified Person must DESIGN, CONSTRUCT and MAINTAIN a work area as safe as this room.

WORK



SAFE

QUESTIONS

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