

## Appendix A:

### Additional Program Requirements

#### Spoil Piles

**Temporary spoil** shall be placed no closer than two (2) feet from the surface edge of the excavation, measured from the nearest base of the spoil to the cut. This distance should not be measured from the crown of the spoil deposit. This distance requirement ensures that loose rock or soil from the temporary spoil will not fall on employees in the trench.

Spoil should be placed so that it channels rainwater and other run-off water away from the excavation. Spoil should be placed so that it cannot accidentally run, slide, or fall back into the excavation.

**Permanent spoil** should be placed some distance from the excavation.

#### Surface Crossing of Trenches.

Surface crossing of trenches should not be made unless absolutely necessary. However, if necessary, they are only permitted under the following conditions:

1. Vehicle crossing must be designed by and installed under the supervision of a registered professional engineer.
2. Walkways or bridges must:
  - a. Have a minimum clear width of twenty (20) inches.
  - b. Be fitted with standard rails.
  - c. Extend a minimum of twenty-four (24) inches past the surface edge of the trench.

#### Ingress and Egress

1. Trenches four (4) feet or more in depth shall be provided with a fixed means of egress.
2. Spacing between ladders or other means of egress must be such that a worker will not have to travel more than twenty-five (25) feet laterally to the nearest means of egress,
3. Ladders must be secured and extend a minimum of thirty-six (36) inches above the grade level.
4. Metal ladders should be used with caution, particularly when electrical utilities are present.

#### Exposure to Vehicles

1. Employees exposed to vehicular traffic shall be provided with and required to wear reflective vests or other suitable garments marked with or made of reflectorized or high-visibility materials.
2. Trained flag persons, signs, signals, and barricades shall be used when necessary.

#### Exposure to Falling Loads

1. All employees on an excavation site must wear hard hats.
2. Employees are not allowed to work under raised loads.
3. Employees are not allowed to work under loads being lifted or moved by heavy equipment used for digging or lifting.
4. Employees are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.
5. Equipment operators or truck drivers may remain in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.

**Warning Systems for Mobile Equipment.**

The following steps should be taken to prevent vehicles from accidentally falling in the trench:

1. Barricades must be installed where necessary,
2. Hand or mechanical signals must be used as required,
3. Soil should be graded away from the excavation; this will assist in vehicle control and channeling of run-off water,
4. Trenches left open overnight shall be fenced and barricaded.

**Hazardous Atmospheres and Confined Spaces.**

Employees shall not be permitted to work in hazardous and/or toxic atmospheres. When there is any doubt or question about a hazardous atmosphere, calibrated meters shall be used. Such atmospheres include those with:

1. Less than 19.5% oxygen,
2. A combustible gas concentration greater than 20% of the lower flammable limit, and,
3. Concentration of hazardous substance that exceeds those specified in the Threshold Limit Values for airborne contaminants established by the ACGIH, or Permissible Exposure Limit by OSHA. All operations involving such atmospheres must be conducted in accordance with OSHA requirements for occupational health and environmental controls for personal protective equipment and for lifesaving equipment. Engineering controls (such as ventilation) and respiratory equipment may be required.
4. If there is any possibility that the trench or excavation could contain a hazardous atmosphere, atmospheric testing must be conducted prior to entry. Conditions that might warrant atmospheric testing would be if the excavation was crossed by, was adjacent to, or contained pipelines containing a hazardous material (for example, natural gas lines). Contact EHS for air monitoring if their service is not provided by the contractor.
5. Testing should be conducted before employees enter the trench and should be done regularly to ensure that the trench remains safe. The frequency of testing should be increased if equipment is operating in the trench.
6. Testing frequency should also be increased if welding, cutting, or burning is done in the trench.
7. Employees required to wear respiratory protection must be trained. Fit-tested, and enrolled in a respiratory protection program.
8. Some trenches qualify as confined spaces. When this occurs consult the Confined Space Procedure (Procedure # GS 45) in the safety manual is also required.

**Standing Water and Water Accumulation.**

Methods for controlling standing water and water accumulation must be provided and should consist of the following if employees must work in the excavation:

1. Use of special support or shield systems approved by a registered professional engineer.
2. Water removal equipment, such as well pointing, used and monitored by a competent person.
3. Safety harnesses and lifelines used in conformance with 29 CFR 1926.104.
4. Employees removed from the trench during rainstorms.
5. Trenches carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench.

## Benching, Sloping, Shoring and Shielding Requirements

1. All excavations or trenches four (4) feet or greater in depth shall be appropriately benched, shored, or sloped according to the procedures and requirements set forth in OSHA's Excavation standard, 29 CFR 1926.650, .651, and .652.
2. Excavations or trenches twenty (20) feet deep or greater must have a protective system designed by a registered professional engineer.
3. Excavations under the base of footing of a foundation or wall require a support system designed by a registered professional engineer.
4. Sidewalks and pavement shall not be undermined unless a support system or another method of protection is provided to protect employees from their possible collapse.

### Sloping

Maximum allowable slopes for excavations less than twenty feet (20') in depth based on soil type and angle to the horizontal are as follows:

Soil Type	Height/Depth Ratio	Slope Angle
Type A	0.75 : 1	54 degrees
Type B	1:1	45 degrees
Type C	1.5: 1	34 degrees

A ten (10)-foot-deep trench in Type B soil would have to be sloped to a forty-five (45) degree angle, or sloped ten (10) feet back in both directions. Total distance across a ten (10)-foot-deep trench would be twenty (20) feet, plus the width of the bottom of the trench itself. In Type C soil, the trench would be sloped at a thirty-four (34)-degree angle, or fifteen (15) feet back in both directions for at least thirty (30) feet across, plus the width of the bottom of the trench itself.

### Benching

1. There are two basic types of benching, single and multiple, which can be used in conjunction with sloping.
2. In Type B soil, the vertical height of the benches must not exceed four (4) feet. Benches must be below the maximum allowable slope for that soil type. In other words, a ten (10)-foot deep trench in Type B soil must be benched back ten (10) feet in each direction, with the maximum of a forty-five (45)-degree angle.
3. Benching is not allowed in Type C soil.

### Shoring

1. Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. There are two basic types of shoring, timber and aluminum hydraulic.
2. Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install them. They are also light enough to be installed by one worker; they are gauge-regulated to ensure even distribution of pressure along the trench line; and they can be adapted easily to various trench depths and widths. However, if timber shoring is used, it must meet the requirements of 29 CFR 1926.650, .651, and .652.

3. All shoring shall be installed from the top down and removed from the bottom up. Hydraulic shoring shall be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.
4. The top cylinder of hydraulic shoring shall be no more than eighteen (18) inches below the top of the excavation.
5. The bottom of the cylinder shall be no higher than four (4) feet from the bottom of the excavation. (Two (2) feet of trench wall may be exposed beneath the bottom of the rail or plywood sheeting, if used.)
6. Three (3) vertical shores, evenly spaced, must be used to form a system.
7. Wales are installed no more than two (2) feet from the top, no more than four (4) feet from the bottom and no more than four (4) feet apart, vertically.
8. Here are some typical installations of aluminum hydraulic shoring:
  - a. Vertical aluminum hydraulic shoring (spot bracing)
  - b. Vertical aluminum hydraulic shoring (with plywood)
  - c. Vertical aluminum hydraulic shoring (stacked)
  - d. Aluminum hydraulic shoring water system (typical)

### **Shielding**

1. Trench boxes are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar accidents
2. The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench box and the excavation side must be backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those, which the system was designed to withstand.
3. Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching.
4. The box must extend at least eighteen (18) inches above the surrounding area if there is sloping toward the excavation. This can be accomplished by providing a benched area adjacent to the box.
5. The manufacturer must approve any modifications to the shields.
6. Shields may ride two (2) feet above the bottom of an excavation, provided they are calculated to support the full depth of the excavation and there is no caving under or behind the shield.
7. Workers must enter and leave the shield in a protected manner, such as by a ladder or ramp.
8. Workers may not remain in the shield while it is being moved.