

Trenching

A. Definitions.

1. *Excavation*: Any man-made cut, cavity, trench, or depression in an earth surface that is formed by earth removal.
2. *Trench*: A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth of a trench is greater than its width, and the width (measured at the bottom) is not greater than 15 ft (4.6 m). If a form or other structure installed or constructed in an excavation reduces the distance between the form and the side of the excavation to 15 ft (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.
3. *Competent person*: An individual who is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate or control these hazards and conditions.

B. Trenching and excavation operations will comply with the following standards.

1. *Surface encumbrances*. All surface encumbrances that are located so as to create a hazard to employees will be removed or supported, as necessary, to safeguard employees.
2. *Underground installations*.
 - a. The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, will be determined prior to opening an excavation.
 - b. Utility companies or owners will be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law) or cannot establish the exact location of these installations, the City may proceed, provided it does so with caution and provided detection equipment or other acceptable means to locate utility installations are used.
 - c. When excavation operations approach the estimated location of underground installations, the exact location of the installations will be determined by safe and acceptable means.

d. While the excavation is open, underground installations will be protected, supported, or removed as necessary to safeguard employees.

3. Access and egress.

a. *Structural ramps.*

1) Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design and will be constructed in accordance with the design.

2) Ramps and runways constructed of two or more structural members will have the structural members connected together to prevent displacement.

3) Structural members used for ramps and runways will be of uniform thickness.

4) Cleats or other appropriate means used to connect runway structural members will be attached to the bottom of the runway or will be attached in a manner to prevent tripping.

5) Structural ramps used in lieu of steps will be provided with cleats or other surface treatments on the top surface to prevent slipping.

b. *Means of egress from trench excavations.* A stairway, ladder, ramp, or other safe means of egress will be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees.

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

d. *Exposure to falling loads.* No employee will be permitted underneath loads handled by lifting or digging equipment. Employees will be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

e. *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system will be utilized, such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

4. Hazardous atmospheres.

a. *Testing and controls.* The following minimum requirements will apply:

- 1) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or reasonably could be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation will be tested before employees enter excavations greater than 4 feet in depth.
- 2) Adequate precautions will be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation.
- 3) Adequate precaution will be taken, such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.
- 4) When controls intended to reduce the level of atmospheric contaminants to acceptable levels are used that are, testing will be conducted as often as necessary to ensure that the atmosphere remains safe.

b. *Emergency rescue equipment.*

- 1) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, readily will be available where hazardous atmospheric conditions exist or reasonably may be expected to develop during work in an excavation. This equipment will be attended when in use.
- 2) Employees entering bell-bottom pier holes or other similar deep and confined footing excavations will wear a harness with a lifeline securely attached to it. The lifeline will be separate from any line used to handle materials and will be individually attended at all times while the employee wearing the lifeline is in the excavation.

5. Protection from hazards associated with water accumulation.

- a. Employees will not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate 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 could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

- 1) Excavations will be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.
- 2) Slopes specified in paragraph (b)(1)(i) of this section, will be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart:
 - b. *Option 2 - Determination of slopes and configurations using 29 CFR, Safety and Health Regulations for Construction, Subpart P, Excavations.* Maximum allowable slopes, and allowable configurations for sloping and benching systems, will be determined in accordance with the conditions and requirements set forth in *Appendix A (Soil Classification)* and *Appendix B (Sloping and Benching)* of 29 CFR, *Safety and Health Regulations for Construction, Subpart P, Excavations.*
 - c. *Option 3 - Designs using other tabulated data.*
 - 1) Designs of sloping or benching systems will be selected from and in accordance with tabulated data, such as tables and charts.
 - 2) The tabulated data will be in written form and will include all of the following:
 - a) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;
 - b) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;
 - c) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
 - 3) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available to the Secretary upon request.
 - 4) *Option 4 - Design by a registered professional engineer.*
 - a) Sloping and benching systems not utilizing Option 1, Option 2, or Option 3 above will be approved by a registered professional engineer.

b) Designs will be in written form and will include at least the following:

- The magnitude of the slopes that were determined to be safe for the particular project;
- The configurations that were determined to be safe for the particular project;
- The identity of the registered professional engineer approving the design.

c) At least one copy of the design will be maintained at the jobsite while the slope is being constructed.

11. Design of support systems, shield systems, and other protective systems. Designs of support systems, shield systems, and other protective systems will be selected and constructed will be in accordance with the requirements of one of the following options:

a. *Option 1 - Designs using 29 CFR, Safety and Health Regulations for Construction, Subpart P, Excavations.* Designs for timber shoring in trenches will be determined in accordance with the conditions and requirements set forth in *Appendix A (Soil Classification)*, *Appendix C (Timber Shoring for Trenches)*, and *Appendix D (Aluminum Hydraulic Shoring for Trenches)* of *29 CFR, Safety and Health Regulations for Construction, Subpart P, Excavations*. If manufacturer's tabulated data cannot be utilized, designs will be in accordance with *Appendix D*.

b. *Option 2 - Designs Using Manufacturer's Tabulated Data.*

- 1) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data will be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.
- 2) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer will only be allowed after the manufacturer issues specific written approval.
- 3) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations will be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy will be made available to the Secretary upon request.

c. *Option 3 - Designs using other tabulated data.*

- 1) Designs of support systems, shield systems, or other protective systems will be selected from and be in accordance with tabulated data, such as tables and charts.

- 2) The tabulated data will be in written form and include all of the following:
 - a) Identification of the parameters that affect the selection of a protective system drawn from such data;
 - b) Identification of the limits of use of the data;
 - c) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
 - 3) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available to the Secretary upon request.
- d. *Option 4 - Design by a registered professional engineer.*
- 1) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, will be approved by a registered professional engineer.
 - 2) Designs will be in written form and will include the following:
 - a) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and
 - b) The identity of the registered professional engineer approving the design.
 - c) At least one copy of the design will be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design will be made available upon request.
12. Materials and equipment.
- a. Materials and equipment used for protective systems will be free from damage or defects that might impair their proper function.
 - b. Manufactured materials and equipment used for protective systems will be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.
 - b. When material or equipment that is used for protective systems is damaged, a competent person will examine the material or equipment and evaluate its suitability for

continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment will be removed from service, and will be evaluated and approved by a registered professional engineer before being returned to service.

13. Installation and removal of support.

a. *General.*

- 1) Members of support systems will be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.
- 2) Support systems will be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.
- 3) Individual members of support systems will not be subjected to loads exceeding those which those members were designed to withstand.
- 4) Before temporary removal of individual members begins, additional precautions will be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.
- 5) Removal will begin at, and progress from, the bottom of the excavation. Members will be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.
- 6) Backfilling will progress together with the removal of support systems from excavations.

b. *Additional requirements for support systems for trench excavations.*

- 1) Excavation of material to a level no greater than two (2) feet below the bottom of the members of a support system will be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.
- 2) Installation of a support system will be closely coordinated with the excavation of trenches.

14. Sloping and benching systems. Employees will not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.
15. Shield systems.
 - a. Shield systems will not be subjected to loads exceeding those which the system was designed to withstand.
 - b. Shields will be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
 - c. Employees will be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
 - d. Employees will not be allowed in shields when shields are being installed, removed, or moved vertically.
 - e. Additional requirement for shield systems used in trench excavations. Excavations of earth material to a level not greater than two (2) feet below the bottom of a shield will be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Work Zone Traffic Control

Of equal importance to the safety of the public traveling through the temporary traffic control zone is the safety of the worker performing the many varied tasks within the work site. Work areas present temporary and constantly changing conditions that are unexpected by the traveler. These work area conditions almost always present situations that are more confusing for the driver, creating an even higher degree of vulnerability for the personnel on or near the roadway.

Below are key elements of traffic control management that should be considered in any procedure for assuring worker safety. These various traffic control techniques must be applied by qualified persons with sound judgment and common sense.

- A. **Training.** All workers should be trained in how to work next to traffic in a way that minimizes their vulnerability. In addition, workers with specific traffic control responsibilities should be trained in traffic control techniques, device usage, and placement.
- B. **Worker Clothing.** Workers exposed to traffic should be attired in bright, highly visible clothing similar to that of flaggers.