



**County of Henrico**  
**Office of Emergency Management**  
**And Workplace Safety**

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**Safety Manual**  
**Chapter 5 Excavation and Trenching**

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| <b>Area of Application:</b> | County of Henrico General Government & Schools  |
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| <b>Rev. No.</b>             | <b>Date</b> <b>Description</b>  |
| 001                         | 04/05/17    Updated definitions and procedures.   |
| 002                         |   |

**Purpose:**

This chapter establishes the excavation and trenching procedures that are required at every active County of Henrico construction site. The procedures outlined in this chapter will help to ensure the requirements of the Virginia Occupational Safety & Health (VOSH) Standards 29 CFR 1926.650, 651, 652 are met.

**Scope:**

This chapter applies to all County of Henrico employees and hired contractors.

**Program Administration:**

Through guidance from the Office of Emergency Management and Workplace Safety (EMWS), each affected department will establish a written program that outlines the hazards inherent to excavation and trenching, and how affected County of Henrico employees and contractors will meet VOSH Standards 29 CFR 1926.650, 651, and 652.

**Definitions:**

**Acceptable Engineering Practices** – proven methods that are applied by a registered professional engineer (PE).

**Benching (Benching System)** – protecting workers from cave-ins by removing the sides of an excavation to form one or a series of horizontal steps, usually with vertical or near-vertical surfaces between levels.

**Cave-In** - a mass of soil and/or rock from an excavation wall, or from under a trench shield or support system that suddenly falls in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

**Competent Person** – an individual who can identify existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization and qualifications to take prompt corrective action to eliminate them.

**Cross Braces** - the horizontal pieces of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either upright or walls.

**Excavation** - means any man-made cut, cavity, trench, or depression in the earth's surface formed by soil and/or rock removal.

**Faces or Sides** - the vertical or inclined earth wall or surface formed by an excavation.

**Failure** - the breakage, displacement, or permanent deformation of a component or connection so that a support system's structural integrity and its supportive capabilities are compromised or fail.



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**Hazardous Atmosphere** – surrounding air that by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, that may cause death, illness, or injury.

**Kickout** - the unforeseen release or failure of a cross brace.

**Protective System** - the manner of protecting workers from cave-ins. Appropriate methods include support systems, sloping and benching soil, shield systems (i.e., trench boxes) and other apparatus that provide the necessary protection.

**Registered Professional Engineer** - a degreed person who is registered as a professional engineer (PE) in the state where he/she is employed.

**Shield or Trench Box** - a unified support system designed to prevent cave-ins once it is set up or lowered into an excavation.

- Shields can be permanent structures (a trench box) or can be designed to be portable and moved from one end of the trench to the other as work progresses.
- Additionally, shields can be either pre-manufactured or job-built so they are in compliance with 1926.652 (c)(3) or (e)(4)
- Shields used in trenches are usually referred to as “trench boxes” or “trench shields.”

**Shoring** - a hydraulic, mechanical or timber system that supports the walls of an excavation to prevent cave-ins.

**Sloping** – cutting back trench sides or walls at an angle that is inclined away from the excavation. The angle of incline required to prevent cave-in varies with such factors as the soil type, environmental conditions, and application of surcharge loads.

**Surcharge Load** - any load imposed upon the soil surface close enough to the excavation to cause lateral pressure to act on the system in addition to the basic earth pressure. Groundwater will also cause an additional pressure, but it is not a surcharge load.

**Trench** - a narrow subsurface excavation.

- In general, the depth is greater than the width, but no more than 15 feet (4.6 m).
- Even if forms or other structures are installed or constructed in a trench reduce the width to less than 15 feet (4.6m), the excavation is still considered a trench.

**General Requirements:** The following procedures are required for all excavation work sites within the County:

**Note:** Trench boxes shall be the primary means of protecting workers at an excavation site. If that is not possible, the competent person or supervisor shall refer to 29 CFR 1926, VOSH Standards for the Construction Industry; Appendix B and C to 1926 Subpart P- Shoring and Benching illustrations for guidance.

- A. Any surface encumbrances that create hazards shall be removed or supported, as necessary, to safeguard workers.
- B. Prior to digging, the location of all utility installations, such as sewer, telephone, fuel, electric, water, or any other underground installations that may be encountered shall be marked.
- C. Miss Utility and/or properly owners shall be contacted per VA Code § 56-265.16:1.E and advised of the proposed work. If possible, the utilities or property owner will establish the location of any underground installations prior to digging.

**Note:** When a utility or property owner does not, or cannot, mark locations of underground installations within 24 hours, the work may proceed only if the competent person does so with



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caution. If possible, detection equipment or other acceptable means to locate utility installations should be used.

- D. The assumed location of utility installations will be determined by a safe and acceptable method.
- E. While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard workers.

**Note:** All removed soil and/or digging equipment shall set at least 2 feet from the edge of the excavation.

- F. If the soil and/or trenching equipment has the possibility of rolling or falling into the excavation, retaining devices shall be used. If this is not possible, spoils must be loaded into a dump truck.
- G. Prior to digging, trench boxes will be visually inspected for stress cracks or wear along cross-brace welds.
- H. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth. For longer trenches, a safe means of exit must be located within 25 feet of all workers.
- I. All workers will wear hard hats, steel-toed shoes, reflective vests, and other necessary personal protective equipment while working in excavations near traffic and its hazards.
- J. Continual inspection of the excavation will be made by the competent person before workers enter the excavation, during the trench work, and as the excavation is filled.

**Note:** If the competent person observes conditions that could result in a cave-in, a hazardous atmosphere, the failure of personal protective equipment, or other hazard, workers will exit the area until corrective action ensures their safety.

- K. No excavation as defined in this chapter will be left unattended and unprotected.
- L. When an excavation site must be left unattended at lunch or overnight, the perimeter shall be marked with a safety fence, and/or barricades and caution tape.
- M. For deeper excavations or special situations where a vertical wall excavation with shoring box is not possible, the competent person shall refer to 29 CFR 1926, Virginia OSH Standards for the Construction Industry; Appendix B and C to 1926 Subpart P- Shoring and Benching illustrations for further assistance.

**Soil Classification:**

All County of Henrico soil is classified as Type C soil. Type C soil is the least stable soil. Type C soils are granular and particles do not adhere to each other. Type C Soils include gravel, and sand.

**Atmospheric Testing:**

- A. Atmospheric testing shall be performed inside excavations greater than five feet in depth where there is a possibility of a hazardous or toxic atmosphere (i.e., maintenance on sewage lines, working near known natural gas lines, or near landfills).
- B. Testing shall be done prior to entry and shall be continuous while workers occupy the excavation.
- C. Before a worker enters an excavation, if the surrounding air may be hazardous, a calibrated direct-reading instrument, shall be used to analyze the atmosphere for following conditions in this order:
  - 1. An oxygen concentration between 19.5% - 23.0%
  - 2. An Lower Explosive Limit (LEL) of no more than 10%
  - 3. No more than a 10 ppm concentration of H<sub>2</sub>S (Hydrogen Sulfide)



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- D. If atmospheric conditions inside an excavation fail to meet any criteria listed in C.1 – C.3, the excavation will be ventilated with continuous forced air.
- Note:** No worker will enter an excavation until the oxygen, LEL and any hazardous gas detections are within or below safe levels.
  - Note:** To prevent an unsafe concentration of carbon monoxide during the use of gasoline-powered equipment (i.e., pipe saw) adequate ventilation and continuous air monitoring shall be done.
  - Note:** Self-contained Breathing Apparatus will not be worn while working within any permit required excavation for any reason, including atmospheric testing.
- E. Atmospheres within a permit-required confined space will be tested hourly and the readings shall be noted on the Confined Space Permit.
- F. If entrants exit the confined space for more than 15 minutes, the excavation will be re-tested prior to re-entry.
- G. If a hazardous atmosphere is detected:
- Each entrant shall leave the excavation immediately;
  - The space shall be evaluated to determine how the hazardous atmosphere developed;
  - Corrective action to protect workers from the hazardous atmosphere before any subsequent entry takes place shall be in place.

**Protection from Water Accumulation:**

- A. For excavations that may produce a water accumulation, the competent person shall monitor the floor of the trench at regular intervals.
- B. Workers will not enter an excavation where water has accumulated (i.e., from a ruptured water main pipe or rainwater run-off) unless another worker qualified to run a pump safely is on site.
- Note:** Pumping will be monitored by a worker qualified to operate the equipment throughout the excavation activity.
- C. Workers who enter deep pits shall wear harnesses and lanyards for quick and safe egress.
- D. Excavations across streams, drainage ditches, or in areas where water accumulates naturally, shall be avoided.
- Note:** If trenching must be done where the water table is near ground-level, diversion ditches, dikes, or other suitable alterations shall be made to prevent excess water from entering the excavation and to provide adequate drainage of adjacent areas.

**Stability of Adjacent Structures:**

- A. Excavations close to buildings, walls, or other structures should be avoided.
- B. If no alternative exists, support systems such as shoring, bracing, or underpinning shall be set in place to ensure the stability of such structures, and for the protection of workers.
- Note:** Excavations around buildings, walls, or other structures require the authorization and presence of a PE. If this is not feasible, the PE's approval (as construction documents) will be accessible and adhered to throughout the excavation work.
- C. Excavations required below the level of the base or footing of any foundation or retaining wall that are likely to cause unsafe conditions shall not be permitted except when:



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1. A support system such as underpinning, is provided to ensure the safety of workers and the stability of the structure,
  2. The excavation is in stable rock,
  3. A PE determines any structure is an adequate distance from the excavation and will be unaffected by the activity,
  4. A PE determines the excavation will not pose a hazard to workers.
- D. The PE who approves any or all exceptions will submit his/her authorization in writing. This documentation will be accessible at the site throughout the duration of the excavation activity.
- E. Sidewalks, pavement, or other ground-level structures will not be undermined unless an adequate and approved support system protects workers from structural collapses.

**Installation and Removal of Support:**

This section applies to excavations that require protection beyond a trench box:

- A. Components of support systems shall be connected so that workers are protected from cave-ins, structural collapses, or being struck by any piece of the support system.
- B. Individual support system components shall not be subject to loads that exceed the manufacturer's specifications.
- C. Before removing individual support system components, precautions such as installing other structural pieces to carry the current load shall be put in place.
- D. Removal shall begin at, and progress from, the floor of the excavation to ground level.
- E. Support structure components shall be released slowly so the chance of failure to the remaining structure, or a cave-in, is avoided.
- F. Backfilling shall progress as the support system is removed from the excavation.

**Trench Boxes (Shield Systems):**

- A. Loads shall not exceed what the trench box is designed to support.
- B. A copy of the "Manufacturer's Tabulated Data" will be accessible at an excavation site where the trench box is being used.
- C. Employees shall never enter a trench box as it is being installed, removed, or adjusted vertically.
- D. Trench boxes may be permitted to rest no more than 2 feet above the excavation floor provided there is no space between the outside of the trench box and the excavation wall.

**Disclaimer:**

Although every effort has been made to ensure this Chapter addresses all applicable regulations, it is the responsibility of each department to maintain compliance.