SECTION 27.0 | TRENCHING AND SHORING

The purpose of this program is to ensure the safety of employees during work in trenches and excavations. If an employee performs work on a site other than Hindsight Electric, LLC's site, the facility owner's plan should be used if it exists and is as strict (or stricter) than this plan. In cases where the other facility's plan does not exist or is less strict than this plan, Hindsight Electric, LLC employees will operate under this plan. It is the policy at Hindsight Electric, LLC to permit only trained and authorized personnel to create or work in excavations.

27.1 | Definitions

1. **Accepted engineering practice** - the standard of practice that is required by a registered professional engineer.
2. **Aluminum Hydraulic Shoring** - a manufactured system that consists of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails (wales).
3. **Bell-bottom pier hole** - a type of footing excavation in which the bottom cross-section is larger than the shaft above, forming a bell shape.
4. **Benching (Benching system)** - a method to prevent cave-ins by excavating to form one or more horizontal steps on the sides of an excavation (usually with vertical or near-vertical surfaces between levels).
5. **Cave-in** - the unanticipated movement of soil or rock into an excavation, or the movement of soil from under a trench shield or support system in quantities large enough to bury, trap, or injure and immobilize a person.
6. **Cross brace** - a horizontal member of a shoring system that is installed from side to side in an excavation. Cross braces contact either uprights or wales.
7. **Excavation** – a man-made cavity, trench, cut, or depression in the earth surface that is formed by removing earth.
8. **Faces (sides)** - the vertical or inclined earth surfaces that are formed as a result of excavation work.
9. **Failure** - the damage or movement of a structural component that compromises its ability to support loads.
10. **Hazardous atmosphere** - an atmosphere that is poisonous, explosive, flammable, irritating, toxic, oxygen deficient, corrosive, oxidizing, or otherwise harmful, which may cause illness, injury, or death.
11. **Health Safety Officer** – the employee responsible to develop and implement this program, conduct unannounced work site inspections, and ensure that company departments comply with program requirements.
12. **Kickout** - the accidental failure or movement of a cross brace.
13. **Protective system** - a way to protect employees from cave-ins, material falling or rolling into an excavation, or the collapse of adjacent structures. This includes sloping and benching systems, support systems, shield systems, and other systems that protect the employee.
14. **Ramp** - an inclined walking or working surface used to access one point from another. A ramp may be fashioned from earth, or from structural materials such as wood or steel.
15. **Sheeting** - the components of a shoring system that keep the earth in position and are supported by other components of the shoring system.
16. **Shield (Shield system)** - a structure that protects employees by withstanding cave-ins. These may be permanent or portable units that move along as work progresses. Shields that are used in trenches are usually termed "trench shields'' or "trench boxes".
17. **Shoring (Shoring system)** - a structure that supports the sides of an excavation to prevent cave-ins. It is built or put in place.
18. **Sloping (Sloping system)** –protects employees from cave-ins by sloping the sides of the excavation away from the excavation. The soil type, weather, and surface or nearby surface loads (may affect the soil in the area of the trench – e.g., adjacent buildings, vehicles near the edge of the trench etc.) will affect the required slope.
19. **Stable rock** – rock (natural solid mineral material) that can have vertical sides in the excavation (they will remain intact while exposed).

20. **Structural ramp** - a ramp that is constructed of wood or steel, and usually is used for vehicle access. Ramps that are constructed out of soil or rock are not considered structural ramps.
21. **Support system** - a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.
22. **Tabulated data** - tables and charts used to design and construct a protective system that are approved by a registered professional engineer.
23. **Trench (Trench excavation)** – an excavation below the earth's surface that is narrow (in relation to its length).
24. **Trench box or Trench shield** - See "Shield".
25. **Type A Soil** is cohesive with an unconfined compressive strength of 1.5 tons per square foot (tsf). Type A soils include clay, silty clay, sandy clay, clay loam, caliche, hardpan, and sometimes-silty clay loam and sandy clay loam. No soil should be classified as Type A if it is fissured; subject to vibration from traffic, pile driving, or similar effects; previously disturbed; or part of a sloped, layered system where the slope is four horizontal to one vertical or greater.
26. **Type B Soil** is cohesive soil with unconfined compressive strength greater than .5 tsf but less than 1.5 tsf. Type B soils include granular cohesionless soils live angular gravel, silt, silt loam, sandy loam, and sometimes silty clay loam and sandy clay loam; previously disturbed soils that are not Type C; fissured soils and soils subject to vibration that would otherwise be classified as Type A; dry rock that is not stable; and material that is part of a sloped, layered system where the layers dip on a slope less steep than four horizontal to one vertical.
27. **Type C Soil** is cohesive soil with an unconfined compressive strength of .5 tsf or less. Type C soils include granular soils such as gravel, sand, and loamy sand; submerged soil; soil from which water is freely seeping; submerged rock that is not stable; or material in a sloped, layered system where the layers dip into the excavation at a slope of four horizontal to one vertical or steeper.
28. **Uprights** - the vertical components of a trench shoring system that are placed on the earth. They are usually positioned so that uprights do not touch one another. If uprights are in touching or interconnected with each other, or are closely spaced, they are often called "sheeting."
29. **Wales** - horizontal components of a shoring system that are placed parallel to the excavation face, and whose sides touch the vertical components (uprights or sheeting) of the shoring system or earth.

27.2 | Duties of the Safety Manager

Management in each region will determine whether this program is required for regulatory compliance. If it is required, management will decide which employees are required to be trained. Management will choose a training facility or use a qualified in-house trainer to conduct the training. All personnel involved in working in trenches or excavations must be trained.

<u>Protective Systems or Equipment</u>

1. Monitor water removal operations and equipment.
2. Remove workers if the circumstances warrant it.
3. Atmospheric testing.
4. Inspect excavations that are likely to receive runoff from heavy rains to determine whether diversion ditches, dikes, or other suitable protection are required.
5. Determine if there is a potential for cave-in to assess whether shoring or other protective system is required.
6. Examine damaged material or equipment used for protective systems to determine whether it is suitable for continued use.
7. Classify soil and rock deposits (visually and testing) to determine appropriate protection; if conditions change, re-classify.
8. Determine the appropriate excavation slope to prevent cave-ins due to surplus loads from equipment or stored material, adjacent structures, operating equipment, or traffic, and ensure that the slope is achieved.

Inspecting Trench and Protective Systems
Prior to entry, inspect for evidence of failure of protective systems, a possible cave-in, hazardous atmospheres, or other hazardous conditions, and authorize the immediate removal of employees from the hazardous area.

Unsafe Access/Egress
Design structural ramps to be used solely by employees to enter or exit the excavation. Any structural ramps that are used for equipment must be designed by someone with structural design qualifications.

Utilities and Pre-work Site Inspection
1. Determine the location of underground utilities before excavating and contact utility companies where applicable.
2. If utility companies or owners are unable to respond within 24 hours to a request to locate underground utility installations or are unable to establish the exact location of these installations, your company is allowed to proceed but must do so cautiously and must use detection equipment or another acceptable means to locate utility installations.
3. Excavations shall be conducted such that they do not endanger underground installations or employees involved in the work. If utilities are left in place, they must be protected by shoring, barricades, suspension, or other means to protect employees.

Protection of the Public
1. Prior to beginning excavation operations, barricades, walkways, lighting and posting must be in place for the protection of the public.
2. Excavations that are adjacent to walkways, driveways and other pedestrian or vehicle thoroughfares must have guardrails, fences, or barricades installed. During the period between sunset and sunrise, warning lights or other lighting must be maintained as required for the safety of the public and employees.
3. Hazardous excavations (including wells, holes, pits, shafts) must be effectively barricaded, or covered and posted to prevent unauthorized access. These types of temporary excavations must be backfilled as soon as possible.

Protection Against Falls
Where employees and the general public are permitted to cross over excavations, walkways or crossings must have standard guardrails or railings installed. If workers in the excavation pass under these walkways or bridges, the walkway or bridge must have a standard guardrail and toe board installed.

27.3 | Protection of Workers in Excavations

Access and Means of Egress
Where employees must enter trench excavations over 4 feet deep, a ladder, ramp or stairs must be provided. An employee must not have to travel more than 25 feet laterally; or along the length of the trench before reaching a means of egress. In other words, egress shall not exceed 25ft of lateral travel.

Structural Ramps
1. A competent person must design any structural ramps used solely by employees as a means of entering or exiting the excavation. All structural ramps that are used for equipment entering or exiting the excavation must be designed by a person with structural design qualifications and must be constructed according to the design.
2. All ramps and runways that have two or more structural components must have the structural components connected together to prevent displacement or movement.
3. The structural components of ramps and runways must be of uniform thickness.
4. Runway structural component connections (cleats or other appropriate means) must be attached to the bottom of the runway or attached such that they do not pose a tripping hazard.
5. All structural ramps that are used instead of steps must have cleats or other top surface treatment to prevent slipping.

Ladders

1. If using portable ladders, the ladder side rails must extend at least 3 feet above the upper surface of the excavation.
2. If performing work near exposed energized equipment or systems, ladders must have nonconductive side rails.
3. Where ladders serve two-way traffic, or where ladders serve as the primary means of exiting and 25 or more employees are working in the excavation, you must provide two or more ladders, or a double-cleated ladder.
4. Prior to use, inspect ladders for signs of damage or defects. Any damaged or defective ladders must be removed from service and marked with "Do Not Use" until they are repaired.
5. Only use ladders on stable and level surfaces unless the ladder is secured. If placing a ladder in a location where it can be displaced by workplace activities or traffic, you must secure it using barricades to keep these activities away from the ladder.
6. Ladders that are not self-supporting must be positioned so the foot of the ladder is one foot away from the support for every four feet of height.
7. Never allow employees on ladders to carry any object or load that could cause them to lose their balance and fall.

Exposure to Vehicular Traffic

When employees are exposed to vehicular traffic they must be provided with and must wear vests or other suitable clothing that is marked with or made of reflective or highly visible material. Flagmen must wear warning vests that are red or orange and must be made from reflective material if worn during night work. Engineering controls such as barriers are preferable over PPE.

Employee Exposure to Falling Loads

Employees are never allowed under loads being handled by lifting or digging equipment, or where loads may fall. When a vehicle is being loaded or unloaded, employees must stand away to avoid being struck by any spillage or falling materials. If a vehicle provides adequate protection for the operator, they may remain in the cab of a vehicle being loaded or unloaded.

Warning System for Mobile Equipment

When mobile equipment is operated near the edge of an excavation, if the operator does not have a clear and direct view of the edge of the excavation, a warning system must be used. The warning system will include barricades, hand, or mechanical signals, or stop logs. If possible, the grading should be sloped away from the excavation.

Hazardous Atmospheres

1. In excavations over 4 feet deep, or if a hazardous atmosphere exists or could reasonably be expected to exist, you must test the atmosphere for air contaminants (oxygen, flammable gasses, etc.). Hazardous atmospheres may be expected in excavations: near or containing gas pipelines; in landfills; or in areas where hazardous substances are stored nearby.
2. Precautions must be taken to prevent exposing employees to atmospheres with less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include proper respiratory protection or forced ventilation of the workspace.
3. Where necessary, forced ventilation must be provided to ensure the atmosphere is safe.
4. If controls are used to reduce the level of atmospheric contaminants to acceptable levels, you must perform continuous air monitoring. The atmospheric monitoring must be equipped with an audible and visual alarm.
5. You must use a properly calibrated direct reading gas monitor to test the atmosphere. When testing potentially toxic atmospheres, you may use direct reading gas detector tubes or other acceptable means.

Protection from Hazards Associated with Water Accumulation

1. Do not work in excavations with accumulated water, or that are accumulating water, unless employees have been protected and precautions taken against the hazards posed by water accumulation. Precautions must include inspection by a competent person prior to beginning work, special shield or support systems to protect from cave-ins, water pumps to control the level of water or safety harnesses and lifelines.
2. If using water removal equipment to control or prevent water from accumulating, the equipment and operation must be monitored by a competent person who is trained in using the equipment.
3. Diversion ditches, dikes, or other suitable means must be used to prevent surface water from entering the excavation if the work interrupts the natural drainage of surface water (such as streams). You must take precautions to provide adequate drainage of the area next to the excavation.
4. The competent person must inform employees of the precautions or procedures that must be followed if water accumulates or is accumulating in an excavation.

Stability of Adjacent Structures

1. A competent person must determine if the stability of adjoining buildings, walls, sidewalks, or other structures is affected by the excavation work.
2. Where excavation operations could affect the stability of adjoining buildings, walls, or other structures, you must use support systems (e.g., shoring, bracing, or underpinning) to ensure structures are stable and employees are protected.
3. Do not allow excavation below the level of the footing or base of a foundation or retaining wall that could reasonably pose a hazard to employees.

Protection of Employees from Falling Objects and Loose Rocks or Soil

1. Employees must be adequately protected from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. This will include:
    - Removing loose material
    - Installing protective barricades, such as wire mesh or timber, on the face of the slope (at reasonable intervals) to stop and contain falling material.
    - Sufficient benching to contain falling material.
2. Excavation workers are not permitted to work above one another where there is a danger of falling rock or earth.
3. Employees must be protected from equipment, excavated materials, or other materials that are a hazard by falling or rolling into excavations.
4. You must keep such materials or equipment at least 2 feet from the edge of excavations or use restraining devices to prevent materials or equipment from falling or rolling into excavations or use a combination of both if necessary.
5. If determined by the competent person, materials and equipment may need to be stored more than 2 feet from the edge of the excavation if it poses a hazardous loading condition on the face of the excavation.
6. All materials that are piled, grouped, or stacked near the edge of an excavation must be self-supporting and stable.
7. To determine timber shoring or aluminum hydraulic shoring, you must refer to the appendixes A & C of 29 CFR 1926 (Excavations).
8. All devices must be in good repair, and well maintained in order to be used. If a device is damaged it must be inspected.
9. Employees must be protected from falling, rolling, or sliding materials or equipment. Never subject shields to excessive forces. Install shields to protect employees from lateral loads. Restrict employees from being in the shield when it is being installed or removed. Shields must be designed to resist the calculated trench forces.
10. Soil is classified into different types (using the following categories). This determines the type of cave-in protection required. A competent and trained person must determine the soil type using these classifications.

- **Grain size** is usually classified into four types: gravel, sand, silt, clay (gravel is the least stable, and clay is the most stable).
- **Saturation** is how much water the soil is currently holding. Soil that is completely saturated is much less stable than soil that is slightly damp. However, completely dry soil (no water content) is unstable.
- **Cohesiveness** determines how well the soil sticks together. The more the soil sticks together, the more stable the trench walls will be. The field test for cohesiveness usually involves rolling soil in your hand into the shape of a worm and noting how and when it separates.
- **Unconfined compressive strength** defines the weight per square foot the soil can withstand. This determines how easily the soil will shear and cave in.

11. Soil classifications must be determined by testing. Then, a protective system is designed according to the soil classifications.
    - **Type A** is the most stable type of soil. It is heavy, dense and consists mostly of clay.
    - **Type B** has a medium level of stability. It is made of soils such as silt, sandy loam, and medium clay.
    - **Type C** is the least stable soil. It usually consists of gravel, loamy sand, and soft clay.

<u>**Daily Inspection**</u>

1. Daily, the competent person must inspect excavations, adjacent areas, and protective systems for evidence of a circumstance that could result in a cave-in, failure of the protective system, hazardous atmosphere, or other hazardous conditions. The competent person conducts an inspection prior to work starting, and throughout the shift as necessary. They will also inspect after every rainstorm or other occurrence that increases the hazard. This is only required if the trench will be, or is, occupied by employees.
2. If the competent person finds evidence of a circumstance that could result in a cave-in, failure of protective system, hazardous atmosphere, or other hazardous conditions, all exposed employees must be immediately removed from the area until precautions have been taken to ensure their safety.
3. All inspections will have a written log. This log will include the date, location of the work site, inspection results, and a summary of any action taken to correct existing hazards.

26.4 | Personal Protective Equipment

PPE must be of proper fit, adequate for the task at hand and readily available. Defective or damaged PPE must be discarded / replaced or repaired in order to ensure maximum effectiveness. The following safe work practices shall be followed regarding trenching / shoring and PPE:

1. Employees working in trenches or excavations must wear approved hard-hats and steel toed boots or shoes.
2. Employees, who are exposed to flying particles, dust, or other materials resulting from sanding, grinding, drilling, sawing, and other similar operations must wear approved safety glasses with side shields.
3. Employees who perform, or are exposed to hazards produced by, cutting, welding, or brazing operations must wear approved glasses or a welding face shield or helmet.
4. Employees who enter deep and confined footing excavations (e.g., bell-bottom pier holes) must wear a harness with a secure lifeline. The lifeline must be distinct from any line used to handle materials and must be monitored separately all the time that the employee wearing the lifeline is in the excavation.
5. Employees must wear suitable hand protection (e.g., approved gloves).
6. Employees who use or work near, masonry saws, hammer drills, jackhammers or similar noisy equipment must wear suitable hearing protection.
7. When working near the edge of an excavation 6 feet or more deep, employees must be protected from falling. Fall protection may be provided by barricades, guardrail systems, or fences.
8. Where hazardous atmospheric conditions exist or may develop during work in an excavation, you must have emergency rescue equipment (e.g., a safety harness and line, breathing apparatus, and a basket stretcher) readily available. When it is being used, this equipment must be attended to. Only trained, qualified employees who have appropriate equipment should attempt retrieval that requires entry into a hazardous atmosphere.