Weber State University

Excavation and Trenching Program

The Trenching and Excavation Standard is 29 CFR 1926 Subpart P

WEBER STATE UNIVERSITY
Environmental Health & Safety

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Objective

The objective of the excavation and trenching program is to assure the safety of staff who work in or around excavations as part of their job duties. It is also designed to protect faculty, staff, students, and visitors of the university who work or travel in the vicinity of excavations. This standard complies with the requirements of the Occupational Safety and Health Administration (OSHA) regulations, 29 CFR 1926 (Construction), Subpart P.

Scope

This standard applies to excavation work performed by Weber State University staff. Contractors must comply with all local, state, and federal safety requirements, and must assure that all employees performing work on Weber State property have been suitably trained and are provided appropriate personal protective equipment.

Definitions

Benching – A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or more horizontal steps, usually with vertical or near-vertical surfaces.

Cave-in – The movement of soil or rock into an excavation, or the loss of soil from under a trench shield or support system, in amounts large enough to trap, bury, or injure and/or immobilize a person.

Competent Person – One who is capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross Braces – The horizontal members of a shoring system installed from side to side of the excavation. The cross braces bear against either uprights or wales.

Excavation – Any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

Faces or Sides – The vertical or inclined earth surfaces formed as a result of excavation work.

Failure – The movement or damage of a structural member or connection that makes it unable to support loads.

Hazardous Atmosphere – An atmosphere that is explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, that may cause death, illness, or injury.

Kickout – The accidental movement or failure of a cross brace.

Protective System –A method of protecting workers from cave-ins, from material that could fall or roll from an excavation face into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems and other systems that provide the necessary protection.

Shield – A structure used in an excavation to withstand cave-ins and which will protect employees working within the shield system. Shields can be permanent structures or portable units moved along as work progresses. Shields used in trenches are usually referred to as “trench boxes” or “trench shields.”

Shoring – A structure that is built or put in place to support the sides of any excavation to prevent cave-ins.

Sloping – Sloping the sides of the excavation away from the excavation to protect employees from cave-ins. The required slope will vary with soil type, weather, and surface or near surface loads that may affect the soil in the area of the trench.

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.

Trench – A narrow excavation (in relation to its length) made below the surface of the ground and is 15 feet or less in width at the bottom of the trench excavation.

Type A Soil – Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if: (i) The soil is fissured; or (ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or (iii) The soil has been previously disturbed; or (iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or (v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B Soil – (i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or (ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam. (iii) Previously disturbed soils except those which would otherwise be classified as Type C soil. (iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or (v) Dry rock that is not stable; or (vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C Soil – (i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or (ii)Granular soils including gravel, sand, and loamy sand; or (iii) Submerged soil or soil from which water is freely seeping; or (iv) Submerged rock that is not stable; or (v) Material in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or steeper.

Uprights – The vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called “sheeting”.

Wales – Horizontal members of a shoring system placed in the direction of the excavation face whose sides bear against the vertical members of the shoring system or earth (the uprights or sheeting).

Responsibilities

Department: Departments are expected to maintain safe and healthy living, learning, and working environments for faculty, staff, students, and visitors to campus.

- Each department performing excavation work must appoint a "competent person(s)" to ensure compliance with this program.
- Departments must ensure that all persons designated as "competent persons" have attended an OSHA compliant "competent person" training.
- Departments must ensure that all persons entering excavations greater than four feet deep have attended awareness level training. Contact EHS for this training.
- Provide sufficient equipment to ensure safe operations.

Competent Person Responsibilities: Competent persons designated by the department will perform the following tasks once they have received the appropriate training.

- Be familiar with soil analysis and determine the class of soil for each excavation.
- Determine the appropriate protective system needed to prevent potential cave-in. Be familiar with protective systems and how to use them.
- Determine the appropriate methods to eliminate or control for all hazards, including protection from potential cave-in.
- Conduct site inspections in accordance with the requirements outlined in this program and maintain necessary documentation.
- Ensure employee training for all employees entering excavations greater than four feet deep.
- Ensure appropriate personal protective equipment is provided and worn.

Employees: Employees who work in or around excavation must:

- Follow the requirements of this program.
- Attend required training.
- Wear assigned personal protective equipment.

EHS: EHS will provide technical support, competent person and awareness level training, and oversight for this program. Involvement by EHS does not relieve the departments, supervisors, or competent persons of their individual responsibilities. EHS responsibilities for this program include:

- Develop, Implement, and administer the program.
- Training on the aspects of the program requirements and maintaining records.
- Serve as a technical resource.
- Provide guidance on the selection of protective systems.
- Evaluate the overall effectiveness of the program on a periodic basis and making appropriate changes as needed to assure the safety of personnel.

General Guidelines

Utilities and Pre-Work Inspection:

Prior to excavation the site shall be thoroughly inspected by the competent person to determine if special safety measures must be taken.

- All equipment, materials, supplies, permanent installations (for example, buildings or roadways), trees, brush, boulders and other objects at the surface that could present a hazard to employees working the excavation shall be removed or supported as necessary to protect employees.
- The location of sewers, telephone, fuel, electric, water lines, or any other underground installations that may be encountered during excavation work shall be determined and marked prior to opening an excavation.
- If it isn't possible to establish the exact location of these installations, the work may proceed with caution if detection equipment or other safe and acceptable means are used to locate the utility.
- Excavation shall be done in a manner that does not endanger the underground installations or the employees engaged in the work. Utilities left in place shall be protected by barricades, shoring, suspension or other means as necessary to protect employees.

Protection of the Public:

Barricades, walkways, lighting, and warnings shall be provided for the protection of the public before the start of an excavation operation. Guardrails, fences, or barricades will be provided adjacent to walkways, driveways and other pedestrian or vehicle thoroughfares.

Protection of Workers in Excavations:

- Supervisors must assure that workers are protected from hazards that may arise during excavation work.
- Stairs, ladders, or ramps will be provided when workers enter excavations over four feet deep. The maximum distance of lateral travel required to reach the means of egress shall not exceed 25 feet.
- A competent person, qualified in structural design, will design structural ramps used for egress or access of equipment. Ramps with two or more structural members will have structural members that are uniform thickness and connected together to prevent displacement and will not present a tripping hazard.
- Those workers exposed to vehicular traffic will wear warning vests or other suitable garments made of high visibility material that meet ANSI 107 guidelines.
- No one will work underneath loads handled by lifting or digging equipment. Workers will stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials.
- A warning system will be used when mobile equipment is operated next to the edge of an excavation if the operator does not have a clear, direct view of the edge of the excavation.
- Materials and equipment should be kept at least two feet from the edge of the excavation with the proper protective system in place.

Hazardous Atmospheres:

- The competent person will test the atmosphere in excavations over four feet deep before worker entry and continuously during work if a hazardous atmosphere exists or could reasonably be expected to exist (i.e. near stored hazardous substances, underground tanks, or gas pipelines).
- Workers will not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with the following:
    - Oxygen concentration below 19.5% or above 23.5%.
    - Combustible gas concentration greater than 10% of the lower flammable limit (LEL).
    - Concentrations of hazardous substances that exceed the permissible exposure limit (PEL).
    - Airborne contaminants that exceed the threshold limit value (TLV).
- The above hazards are typically monitored with a 4-gas air monitoring meter. Additional information regarding confined space entry and air monitoring can be found in the WSU Confined Space Program.
- Suitable precautions will be taken as necessary to include but not limited to:
    - Engineering controls such as ventilation.
    - Respiratory Protection. See WSU Respiratory Protection Program for details.

Personal Protective Equipment:

- All employees working in trenches or excavations shall wear approved hard-hats and steel toed shoes or boots.
- Employees exposed to flying fragments, dust, or other materials produced by drilling, sawing, sanding, grinding and similar operations shall wear approved safety glasses.
- Employees exposed to hazards produced by, or performing, welding, cutting, or brazing operations shall wear, as determined by the competent person, approved safety glasses or a welding face shield or helmet.
- Employees entering deep and confined footing excavations shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.
- Fall protection may also be necessary for personnel working on top of the excavation or trench, if a fall hazard of six feet or more is present.
- Employees shall wear, as determined by the competent person, approved gloves or other suitable hand protection.
- Employees using, or working in the immediate vicinity of, hammer drills, masonry saws, jackhammers or similar high noise producing equipment shall wear suitable hearing protection.
- Emergency rescue equipment, such as breathing apparatus, a safety harness and line, and a basket stretcher shall be readily available where hazardous atmospheric conditions exist or may develop during work in an excavation. This equipment shall be attended when in use. Only personnel that have received approved training and have appropriate equipment shall attempt retrieval that would require entry into a hazardous atmosphere. If entry into a known hazardous atmosphere must be performed, then the competent person shall be given advance notice so that the hazards can be evaluated and rescue personnel placed on standby if necessary.

Hazards Associated with Water Accumulation:

- Employees shall not work in excavations that contain or are accumulating water unless precautions have been taken to protect employees against the hazards posed by water accumulation and the competent person has given prior approval. The precautions taken could include:
  - Special Support or Shield Systems
  - Water Removal Equipment
  - Safety Harnesses and Lifelines
- 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 person trained tin the use of the equipment.
- The competent person shall inform workers of the precautions or procedures that are to be followed if water accumulates or is accumulating in an excavation.

Protection of Workers from Falling Objects:

- Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of:
  - Scaling to remove loose material.
  - Installation of protective barricades, such as wire mesh or timber, at appropriate intervals on the face of the slope to stop and contain falling material.
  - Benching sufficient to contain falling material.
  - Removal of loose material a sufficient distance from the excavation that the material cannot roll or slide into the excavation.
- Excavation personnel shall not be permitted to work above one another where the danger of falling rock or earth exists.
- Employees shall be protected from excavated materials, equipment or other materials that could pose a hazard by falling or rolling into excavations.
- Protection shall be provided by keeping such materials or equipment at least 2 feet from the edge of excavations, by the use of restraining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.
- Materials and equipment may, as determined by the competent person, need to be stored further than 2 feet from the edge of the excavation if a hazardous loading condition is created on the face of the excavation.
- Materials piled, grouped or stacked near the edge of an excavation must be stable and self-supporting.

Inspection by Competent Person:

- The competent person for excavations shall conduct daily inspections of excavations, adjacent areas, and protective systems for evidence of a situation that could result in possible cave-ins, failure of protective systems, hazardous atmospheres, or other hazardous conditions.
- An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other

hazard increasing occurrence. These inspections are only required when the trench will be or is occupied by employees.

- Where the competent person finds evidence of a situation that could result in a possible cave-in, failure of protective systems, hazardous atmosphere, or other hazardous conditions, exposed employees shall be removed from the hazardous area until precautions have been taken to assure their safety.
- The competent person shall maintain a written log of all inspections conducted. This log shall include the date, work site location, results of the inspection, and a summary of any action taken to correct existing hazards.

Protective Systems

Protection of Employees:

Employees in an excavation shall be protected from cave-ins by using either an adequate sloping and benching system or an adequate support or protective system. The only exceptions are:

- Excavations made entirely in stable rock; or
- Excavations less than 4 feet in depth where examination of the ground by the competent person provides no indication of a potential cave-in.

Protective systems shall be capable of resisting all loads that could reasonably be expected to be applied to the system.

Protective systems in excavations greater than 20 feet in depth shall be designed by a Registered Professional Engineer.

Sloping and Benching Systems Design:

The slope and configuration of sloping and benching systems shall be selected and constructed by the competent person by either:

- Sloping the excavation at an angle no steeper than one and one-half horizontal to one vertical in accordance with type C soil.
- Finding the appropriate sloping and benching angles based on soil type by the use of a registered professional engineer who can determine the angle used.

Support Systems, Shield Systems, and Other Protective Systems:

Use protective systems only as manufacture guidelines or compliance standards allow.

Materials and Equipment

Materials and equipment used for protective systems shall be free from damage or defects that might affect their proper function.

Manufactured materials and equipment used for protective systems shall be used and maintained in accordance with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

When materials or equipment used for protective systems are damaged, the competent person shall ensure that these systems are examined by a competent person to 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 shall be

removed from service. These materials or equipment shall be evaluated and approved by a registered professional engineer before being returned to service.

Support Installation and Removal:

Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other potential hazards.

Support systems shall 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.

Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to support.

Before temporary removal of individual support members begins, additional precautions shall be taken as directed by the competent person to ensure the safety of employees. These precautions could include, for example, the installation other structural members to carry the loads imposed on the support system.

Removal of support systems shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly. If there is any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation the work shall be halted until it can be examined by the competent person.

Backfilling shall progress together with the removal of support systems from excavations.

Additional Requirements for Support Systems for Trench Excavations:

Excavation of material to a level no greater than 2 feet below the bottom of the members of a support system is allowed, but only if the system is designed to resist the forces calculated for the full depth of the trench. There shall be no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

Installation of a support system shall be closely coordinated with the excavation of trenches.

Employees shall not be permitted to work above other employees on the faces of sloped or benched systems except when employees at the lower levels are protected from the hazard of falling, rolling, or sliding material or equipment.

Shield Systems:

Shield systems shall not be subjected to loads that are greater than those they were designed to withstand.

Shields shall be installed in a manner that will restrict lateral or other hazardous movement of the shield that could occur during cave-in or unexpected soil movement.

Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

Excavation of material to a level no greater than 2 feet below the bottom of the shield system is allowed, but only if the system is designed to resist the forces calculated for the full depth of the

trench. There shall be no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield system.

The shield shall extend at least 18 inches above the top of the trench excavation.

Excavation Emergencies

There is a high potential for death and/or injury to co-workers attempting a trench rescue. Staff should not place themselves in a position of danger to save another. Ogden City Fire Department is the designated response agency and it is extremely important to activate the emergency response system by calling 911. WSU staff are not trained, nor expected, to perform trench rescue. However, there are several actions that can be taken to support the rescue team(s) and further protect on site personnel.

- If the victim is not visible, try to identify the area where the victim most likely is located as closely as possible.
- Hand digging, if it is safe to approach the site, can begin immediately.
    - Mechanical excavating equipment should not be used to dig the person out due to the potential for additional injury, crushing, or dismemberment.
- Have someone meet the fire department upon their arrival and brief them on the situation.
- Assemble materials and equipment that may be beneficial during rescue operations, such as shovels, plywood/lumber, ladders, buckets, etc.
- Clear the area so that rescue personnel have access to the site.

Employee Training

Awareness Level Training: Each employee required to enter an excavation greater than four feet deep must complete the Trenching and Excavation Safety training prior to entry. Contact EHS to complete this course.

Competent Person Training: Designated departmental competent persons who will be performing inspections and providing oversight must attend an OSHA compliant Competent Person training. Topics include:

- Hazards related to excavation work.
- Work practices and selection of protective systems.
- Methods of evaluating the site and conducting inspections.
- Requirements of this program and any related programs.
- Emergency Procedures.

Training should be completed:

- Before an employee is first assigned duties
- Whenever there is a change in program that presents a hazard about which an employee has not previously been trained
- Whenever WSU has reason to believe that there are inadequacies in an employee's knowledge or performance of those procedures.

Each department shall maintain training records to show the required training has been completed. Training records shall contain employee names, trainer names, and training dates.