State of Hawaii
Dept. of Labor & Industrial Relations
HIOSH
Hawaii Occupational Safety & Health

HAZARD HIGHLIGHT

July 2023 Vol.26

Digging Up Trouble?

Here's how you can protect your Crew

Trenches and excavations are an integral part of construction work, but they can also pose a serious hazard to employees. Trench collapses and cave-ins continue to occur frequently, causing serious injuries and fatalities each year. It is essential for employers to take proactive measures to protect their workers from these hazards by implementing proper safety procedures and providing necessary equipment.

This article seeks to highlight the importance of protecting employees from trench and excavation hazards by discussing common risks associated with these activities, legal requirements that must be met, as well as practical steps that employers can take to ensure the safety of their workforce.

Difference between an excavation and a Trench

Excavation is any man-made cut, cavity, trench, or depression in the Earth's surface formed by earth removal.

Trench is 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, but the width of a trench (measured at the bottom) is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Note: Any trenches 20 feet deep or greater require that the protective system be designed by a Registered Professional Engineer (RPE) or be based on tabulated data prepared and/or approved by RPE in accordance with 1926.652(b) and (c).

Hazards of trenching and excavation operations

The greatest risk from excavations is Cave-ins. **Cave-in** means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Other hazards working inside or near an excavation include:

- Water accumulation hazard
  - Drowning
  - Sides become unstable
  - Electrocution hazard if electrical equipment are present
  - Inspect trenches following a rainstorm or other water intrusion
- Inhalation hazards
  - Carbon monoxide
  - Other work done in excavation that may affect atmosphere (e.g., painting, welding)
- Lack of oxygen
- Underground utilities (e.g., water, electrical, natural gas)
- Equipment hazards
  - Cause carbon monoxide
  - Equipment that can fall or roll inside the excavation
  - Can cause cave-in due to moving earth equipment or vibrations caused by equipment
- Spoils close to edge and causing extra weight on trench walls leading to cave-ins
- Falls hazard
- Delay in evacuation hazard
- Ergonomics

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Competent Person

HIOSH standards require that employers have a Competent Person inspect trenches daily and as conditions change before worker entry to ensure elimination of excavation hazards. HIOSH defines **Competent Person** as:

> *One who is capable of identifying existing or predicting development of hazards in the surroundings or working conditions which are unhealthy, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate the hazards.*

Under the HIOSH standards, tasks performed by the Competent Person include:

- Classifying soil,
- Inspecting protective systems,
- Designing structural ramps,
- Monitoring water removal equipment, and
- Conducting site inspections.

Soil Classification Categories

Some of the compliance methods permitted under the Excavation standards require the Competent Person to classify soil and rock deposits as:

- **Stable rock** means a *solid mineral matter that can be excavated with vertical sides and remain intact while exposed.*

- **Type A soil** means *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** means the following:

  (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** means the following:

  (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.

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Protective Systems

HIOSH generally requires that employers protect workers from cave-ins by:

Benching means a method of protecting workers from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels. *Benching cannot be done in Type C soil*.

Sloping involves cutting back the trench wall at an angle inclined away from the excavation.

Shoring requires installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins.

Shielding protects workers by using trench boxes or other types of supports to prevent soil cave-ins. Designing a protective system can be complex because you must consider many factors: soil classification, depth of cut, water content of soil, changes caused by weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench) and other operations in the vicinity.

In many cases the type of protective system needed is well known and simple to use. Other times employers will undertake the more complex process of designing a protective system. Designing a protective system requires consideration of many factors, including: soil classification, depth of cut, water content of soil, weather and climate, and other operations in the vicinity.

Employers are free to choose the most practical design that will provide the necessary protections. Any system used must meet the required performance criteria.

Finally, all safety devices and safeguards in use must be kept in good condition and operable. If found not in good condition or inoperable, then it must be identified as unsafe by tagging or removed from its place of operation to prevent further use.

Access and Egress

HIOSH generally requires that employers protect workers from cave-ins by providing ladders, steps, ramps, or other safe means of egress for workers working in trench excavations 4 feet or deeper. The means of egress must be located so as not to require workers to travel more than 25 feet laterally within the trench.

Any structural ramps used solely for worker access or egress must be designed by a competent person. Structural ramps used for access or egress of equipment must be designed by a competent person qualified in structural design. Also, structural members used for ramps or runways must be uniform in thickness and joined in a manner to prevent tripping or displacement.

What do employers need to do to maintain materials and equipment used for protective systems?

Employers are responsible for maintaining materials and equipment used for protective systems. Defective and damaged materials and equipment can cause protective systems to fail and lead to other excavation hazards.

Employers must ensure that:

- Materials and equipment are free from damage or defects that might impair their proper function;

- Manufactured materials and equipment are used and maintained consistent with the manufacturer's recommendations and are used so as to prevent worker exposure to hazards;

- A competent person examines any damaged materials or equipment to evaluate its suitability for continued use; and

- If a competent person cannot assure that damaged material or equipment can support the intended loads or is otherwise suitable for use, the materials and equipment are removed from service until evaluated and approved by a registered professional engineer

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When must employers conduct trench and excavation site inspections?

Employers must ensure that the Competent Person inspects all excavations, adjacent areas, and protective systems daily for possible cave-ins, indications of failures in protective systems and equipment, hazardous atmospheres, and other hazardous conditions.

Inspections must be done at least prior to the start of work and as needed throughout the shift. Inspections are also required after natural events, such as rainstorms, or other hazard-increasing occurrences, such as blasting work.

If inspections reveals any unsafe conditions, the employer must clear workers from the hazardous area until the necessary safety precautions have been taken.

Finally, under §12-110-3(c) of the Hawaii Administrative Rules (HAR) written records of the daily inspections must be kept on the project site for the duration of the project. At minimum, the record must contain:

1. Date and start time of the inspection,
2. The name of the employee conducting the inspection,
3. The scope (project areas) of the inspection, including the names of all contractors and subcontractors covered by the scope of the inspection,
4. Brief description of all potential and actual hazards noted during the inspection,
5. Name and title of the person responsible for correcting the identified hazards noted during the inspection,
6. Information regarding how the hazard was eliminated, corrected, or abated including the recommendations made for preventing the recurrence of the hazards.

Worker Rights

The Hawaii Occupational Safety and Health Law entitles employees to a safe workplace. You have the right to speak up about hazards (e.g. trench and excavation hazards) without fear of retaliation.

If you believe working conditions are unsafe, contact the Hawaii Occupational Safety and Health (HIOSH) office at (808) 586-9092 or email DLIR.HIOSH.complaints@hawaii.gov

This is one in a series of informational fact sheets highlighting HIOSH programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of HIOSH standards, refer to Title 12, Subpart 8 of the Hawaii Administrative Rules.

Stay Informed of Workers Rights: OSHA.GOV/WORKERS

For more information, please contact HIOSH at:
dlir.hiosh.ct@hawaii.gov or 808-586-9100

CONSULTATION & TRAINING
(808) 586-9100
http://labor.hawaii.gov/hiosh

Auxiliary aids and services are available upon request to individuals with disabilities.
TDD/TTY Dial 711 then ask for (808) 586-9116.