Trenching and Excavation



What is meant by a trench and an excavation?

Generally speaking, an excavation is a hole in the ground as the result of removing material. A trench is an excavation in which the depth exceeds (is bigger than) the width.

What are the hazards associated with trenching and excavation?

Working in trenches and excavations is hazardous to both the workers who work inside them, and to workers on the surface. The hazards include:

- Cave-ins or collapses that can trap workers.
- Equipment or excavated soil falling on workers (e.g., equipment operated or soil/debris stored too close to the excavation).
- Falling into the trench or excavation.
- Flooding or water accumulation.
- Exposure to a hazardous atmosphere (e.g., gas, vapour, dust, or lack of oxygen).
- Contact with buried service lines such as electrical, natural gas, water, sewage, telecommunications, etc.
- Contact with overhead electrical lines.
- Slips, trips and falls as workers climb on and off equipment, or from inappropriate access and egress methods.
- Being struck by moving machinery, or by falling or flying objects.
- Hazards related to materials handling (e.g., lifting, struck by, crushed between, etc.).

What is meant by soil types?

Definitions of soil types vary by jurisdiction in Canada. In addition, some jurisdictions have not defined soil types, but do require preventative measures when an excavation reaches a certain depth or proportion.

When a soil type is defined, the purpose is to try to identify or predict the potential for the soil to move and cause a collapse while the work is being done. Soil types typically use a scale of 1 to 4 where 1 is hard and dense to 4 which is loose, soft, wet or muddy soil, or a scale of A to C where A is hard and solid, and C is soft, sandy, filled or loose.

The soil type is determined by the characteristics of the soil’s consistency, ease of removal, appearance, ability to excavate with hand tools vs. machine,

water seepage, whether the soil has been excavated before, etc.

What you should do before you begin an excavation?

The employer or supervisor is responsible for the work, and must take the necessary steps to identify all the hazards and risks before beginning any work. These steps include to:

- Identify the soil type(s) related to the excavation or trench you are going to dig. Soil properties often vary widely within a single trench (e.g., the soil type changes from top to bottom and along the length of a trench).
- Look for the legislative requirements that apply in your jurisdiction and the type of protective measures to be taken.
- Locate all buried services. Contact the owners of any underground utilities/services that may be in that location and ask them to identify and mark the location.
- Identify and locate overhead power lines.
- Make sure these services are de-energized as necessary.
- Know all of the contact numbers of these services if there is an emergency.
- Check areas adjacent to the site for potential hazards and sources that can impact the stability of soil. Be aware that nearby vehicles and equipment can cause the soil to vibrate and then collapse.
- Determine if nearby buildings or structures and their foundations may put pressure on the soil and affect the walls of the trench.
- Test for hazardous gas, vapours, and dust before entering.
- Test for oxygen levels in the space before entering, and during the work as required.
- Plan appropriate organization of the work site, and good housekeeping practices including moving debris and excavated soil far enough away from the excavation site.
- Remove water from the excavation.
- Protect workers from falling into the excavation.
- Identify appropriate personal protective equipment including high visibility apparel for vehicular traffic and make sure every worker wears them as required.
- Have a worker above ground when a worker is working in the trench to warn those in the trench of danger and to provide emergency help.
- Prepare work permits for work in confined spaces, as appropriate.
- Have a means of exit provided from the inside of the trench, usually no more than 8m (25 ft) away than any worker in the trench.
- Plan for adverse weather conditions (e.g. hot or cold environments, storms, etc.).
- Prepare an emergency plan and rescue procedures.
- Keep first aid boxes at the site.
- Educate and train workers about all existing and potential hazards and risks and appropriate safety measures.

What factors determine what is the appropriate protective system to use?

In general, trenches that are 1.2 metres (4 feet) deep or greater require a protective system unless the excavation is made entirely in stable rock. The factors to consider include:

- Soil type
- Depth of cut
- Water content of soil
- Changes due to weather or climate
- Surcharge loads (e.g., spoil, other materials to be used in the trench) and
- Other operations in the area

What are the different types of protective systems used to protect against cave-ins?

There are two basic methods of protecting workers against cave-ins:

- Sloping
- Temporary protective structures (e.g., shoring, trench boxes, pre-fabricated systems, hydraulic systems, engineering systems, etc.)

Sloping

Sloping involves cutting back the trench wall at an angle that is inclined away from the work area of the excavation. The angle of slope required depends on the soil conditions. Benching is a similar method to sloping.

Temporary protective structure

Saskatchewan Labour defines a temporary protective structure as “a structure or device in an excavation, trench, tunnel or excavated shaft that is designed to provide protection from cave-ins, collapse, sliding or rolling materials, and includes shoring, trench boxes, trench shields and similar structures.”

- **Shoring** is a system that supports the sides or walls. Shoring requires installing aluminum, steel, or wood panels that are supported by screws or hydraulic jacks. Some systems can be installed without the workers entering the trench. This option provides additional safety for those workers. Wherever possible, install the shoring equipment as the excavation proceeds. If there is any delay between digging and shoring, no one should enter the unprotected trench.
- **Trench Boxes** are commonly used in open areas that are away from utilities, roadways, and foundations. Trench boxes can be used to protect workers in cases of cave-ins, but not to shore up or support trench walls. They can support trench walls if the space between the box and the trench wall is backfilled with soil and compacted properly. Otherwise, a cave-in or collapse may cause the trench box to tilt or turn over. Workers should not be present in the box when it has to be moved.
- **Other:** In some cases, the trench or excavation walls are made of rock but are not entirely stable. Support the walls by using rock bolts, wire mesh, or a method that provides equivalent support.

What should you NOT do during an excavation?

- Do not enter an unprotected trench deeper than 1.2 metres (4 feet).
- Do not start digging before locating and de-energizing the buried services.
- Do not enter a trench before testing the air for hazardous gasses and vapours, or the lack of oxygen.
- Do not place the sections of pipes, piles of spoil, unused tools, and timber, and other materials within 1 metre from the trench’s edge.

- Do not rely on natural freezing to act as a method of soil stabilization.
- Do not work under suspended or raised loads and materials.
- Never stand behind a backing vehicle.

What can be included in a trenching and excavation inspection checklist?

The following are some points to consider. Each circumstance will be different, so be sure to adapt the questions to suit your situation.

Underground/Utility Services

- Know the contact numbers?
- Located, identified and informed respective parties?
- Grounded, isolated, de-energized, or protected from unplanned release?

Housekeeping

- Excavated material, pipes etc. are placed 1 metre away from the edge of the excavation or trench wall?
- Are pumps available to remove water?
- Is the base and foot of the ladder secure, and free of garbage or water?
- Are materials placed on the site obstructing the worker’s or vehicle’s ability to move freely?
- Are established traffic controls used, where required, including adequate signage, personnel, and lighting?
- Has the excavation been marked to make the workers and others aware of the excavation (e.g., fence, flags, or other safeguards)?
- Are sanitary facilities available at the site, as appropriate?

General

- Are proper barriers or guardrails in place to protect anyone or equipment falling into the excavation or trench?
- Has the air in the excavation been tested for low oxygen, and hazardous gasses and vapours?
- Is a safe means of entry/exit provided such as a sufficiently long and secured ladder placed at appropriate distances (within 25 feet of all workers)?
- Are cracks visible in the ground around the trench or excavation that may indicate soil movement?
- Are there any signs of water seeping into the trench or excavation?
- Are workers wearing appropriate PPE (e.g., hard hats, respirators, , safety boots, hearing protection)?
- Are high visibility vests or clothing provided and worn by all exposed to vehicular traffic?
- Are first aid boxes available at the site?
- Are operators qualified to operate the heavy machinery/equipment?
- Does a competent person regularly inspect the excavation (at the start of each shift before work begins or after any event likely to have affected the strength or stability of the excavation)?
- Is there a competent person stationed at the surface of the trench to warn workers in the trench of danger and to provide emergency help?

Sloping

- Has the soil type been considered when determining the angle of the slope?
- Are they being sloped or benched back to a safe angle?

Temporary protective equipment, such as:

Timber Shoring

- Is the shoring equipment the right equipment as required for the depth of the trench/excavation and type of soil?
- Is the equipment damaged (e.g., cracked, crushed, split, or bowed)?
- Are there loose or missing cleats?
- Are the struts off level?

Trench Boxes

- Are the boxes damaged or have defects?
- Are the plates deformed, bent, have holes, or show other damage?
- Are the welds cracked, bent, or distorted?
- Are there missing or missing struts?
- Are trench boxes shifting or settling to one side?

Hydraulic Shoring

- Are there any visible leaks in hoses or cylinders?
- Are there bent bases?
- Is any equipment cracked, split, broken or cracked?

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