HEALTH, SAFETY & ENVIRONMENTAL MANUAL	11.10 Trenches and Excavations				
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Trenches and Excavations

PURPOSE

To ensure all workers understand the hazards, risks, protection measures and related legislation when working in or around trenches and excavations.

PROCEDURE

What's the difference between a trench and an excavation? An excavation is a hole left in the ground as the result of removing material. A trench is an excavation in which the depth exceeds the width.

An unstable trench or excavation can collapse, killing or injuring workers by suffocation or crushing when a worker is buried by falling soil.

Trench stability is affected by a number of factors such as:

- soil type
- weather
- moisture
- vibration
- surcharge (excessive weight near the trench)
- time
- existing foundations, and
- previous excavation

There are 3 basic methods of protecting workers against cave-ins:

- sloping
- shoring
- trench boxes

Note: Unless the walls are solid rock, never enter a trench deeper than 1.2 metres (4 feet) if it is not properly sloped, shored or protected by a trench box.

Soil types

Soil type in a trench can be made by visual and physical examination. If there is more than one soil type present the trench must follow the classification with the highest number.

- **Type 1** Soil – is hard, very dense and only able to be penetrated manually with a small sharp object. It has low moisture content and has no signs of water seepage. It can only be excavated by mechanical equipment. Stiff grey clay is a good example

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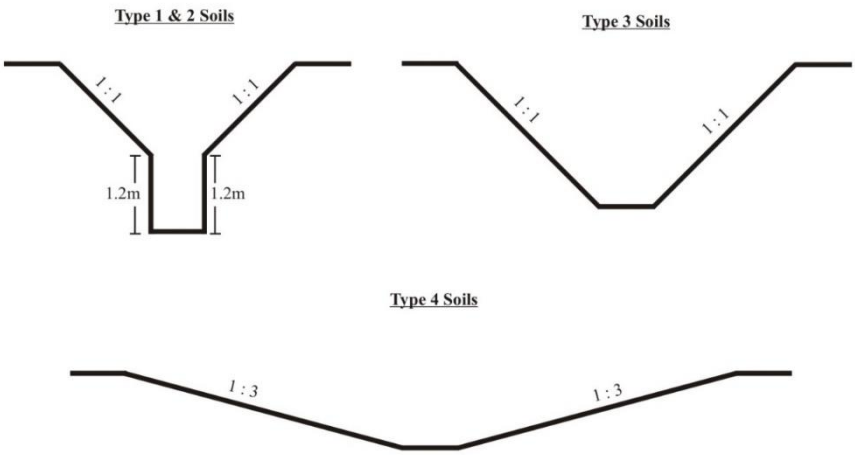
- **Type 2** Soil – is very stiff, dense and is difficult to penetrate manually with a small sharp object. It has low to medium moisture content and has a damp appearance after it is excavated. Soft brown clay is a good example.
- **Type 3** Soil
  (a) previously excavated soil; or
  (b) soil that is stiff to firm or compact to loose in consistency and has one or more of the following characteristics:
    (i) It exhibits signs of surface cracking.
    (ii) It exhibits signs of water seepage.
    (iii) If it is dry, it may run easily into a well-defined conical pile.
    (iv) It has a low degree of internal strength.
  Sand and gravel are a good example.
- **Type 4** Soil – is soft to very soft and very loose in consistency. It is sensitive to disturbance by equipment travel, excavation, etc. It runs easily or flows and/or is wet and muddy. This type will also exert fluid pressure on structures. Wet silty sand is a good example.

Trench Design for Different Soil Types

Trenches that are not protected by an engineered shoring system or a trench box liner must be dug to the soil type standards in the *Regulations for Construction Projects, Section 234*.

- No trench can have a vertical wall greater than 1.2m unless it is in stable rock.
- In type 1 and 2 soils excavated walls above 1.2m must have a slope gradient of 1:1 or less.
- In type 3 soils excavated walls must be graded at a 1:1 slope or less from the floor of the trench.
- Type 4 soils must be graded with a slope of 1:3 or less from the bottom of the trench.



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Digging and Excavating

- Operators who are digging in the vicinity of the utility must complete the "***Pre-Dig and Post-Dig Hazard Assessments***" as part of their daily equipment inspection. The pre-dig assessment will be reviewed by the supervisor before digging starts.
- Mechanical excavation must not be used closer than 0.3 metre (1 foot) in any direction to the utility line.
- Excavation within 0.3 metre (1 foot) in any direction of the utility line must be carried out by hand digging.
- Operators use a signaller if needed. Ask your supervisor for help. Stop if you cannot see the utility line or safely dig near it.
- Use proper support procedures for the utility line.
- If the utility is in clay or heavy soils, use caution. As soil is removed, undermining, or shifting of the utility line may occur.
- See section 11.5 for more details regarding underground utilities.

Hydro Vac Trucks

- If using a hydro vac truck onsite for any excavation, valid locates for that area must be available. Hydro Vac trucks cannot be used without valid locates.
- Once a utility has been exposed, but may be buried again, mark/flag/stake the utility so its location is clearly visible.

The utility owner (i.e. Union Gas, Hydro) have ultimate authority over all work procedures.

Trench Boxes

Trench boxes are not usually intended to shore up or support trench walls. They are meant to protect workers in case of a cave-in.

- Trenches must be backfilled immediately following the use of a trench box.
- When using a trench box, the engineered drawings and specifications must be kept at the site and the trench box must be properly identified.
- As long as workers are in the trench, they shall remain in the trench box.

Inspections

- Inspect trench boxes for structural damage, cracks in welds and other damage.
- Check ground surface for tension cracks which may develop parallel to the trench at a distance one-half to three-quarters of the trench depth.

- Check the trench box often to make sure it is not shifting or settling more on one side than the other.

Other Trench Regulations

All operators digging trenches or excavations, supervisors and labourers must be aware of and understand Sections 222- 242 of the Regulations for Construction Projects.

- No person shall work in a trench unless another worker is above ground in close proximity to the trench.
- No excavation shall be performed that will affect the stability of a building or structure until precautions have been taken to prevent damage or falling.
- For hydro poles, the base of the pole needs to be out of the 1:1 zone + 1m buffer, otherwise requires pole support or shoring.
- Precautions must be taken during an excavation to prevent rocks or loose materials from striking a worker.
- All excavated trench material (spoils) must be kept a minimum of 1 metre from the edge to the toe of the spoil pile. This includes equipment and materials.

Manhole installation

While manhole installation by itself is not necessarily a critical task, it may involve components which J-AAR considers critical – Working from Heights and Trenching and Excavation.

There are two tasks that must be considered for this section:

1. Removing rigging equipment (hooks) from manhole sections
2. Positioning and aligning sections on top of each other

General procedures

- Workers must never use rigging equipment or the top of the sections as a work platform
- Using a spreader beam as a working platform is against J-AAR procedures.
- Ladders must never be used as a work platform. Performing work from any type of ladder is not advisable in most cases as ladders are primarily intended for access and egress.
- The steps of a manhole are considered a ladder.
- A ladder is considered a work platform when:
  - Push/pull forces are required when on the ladder;
  - The task requires the worker's mid chest/belt buckle to extend outside the siderails of the ladder;
  - The location of the elevated work may require the worker to take one foot off the ladder.

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Procedures

Back Filling

- Back filling during the install is considered the best practice by J-AAR.
- When possible, backfill so the top of the section is between 0.9 m and 1.1 m from the ground as the work is being completed. This eliminates any fall hazards from the outside of the manhole and allows workers the ability to easily walk around to **remove rigging equipment** and/or **position the section.**
- This also eliminates the need to carry out any work on the inside of the manhole as it can be easily handled from the ground above.

Ladders for Access

- When backfilling is not possible, using extension ladders on the outside of the sections or the manhole steps on the inside to **remove or access rigging** is an option.
- This is considered access/egress to the rigging and is acceptable if not used as a work platform.
- Ladders can be used for access/egress and for the removal of rigging as long as the ladder is positioned in such a way so that the worker does not move their chest/belt buckle outside the siderails of the ladder.
- However, using the steps inside the section may not provide a safe work platform for workers who need to **position the sections**, depending on the work required.
- Alternatively, the use of taglines may be required.

Taglines

- When working from the steps is not an option to position sections, using taglines attached to each section may be a viable alternative.
- Workers can position each section using a tagline from a safe distance.
- A section must never be flown over a worker.

If the work dictates that there are no other options available, stop work and speak with the supervisor. Another plan may be required.

Internal Combustion Engines

If an internal combustion engine is being operated in an excavation, building or other enclosed structure, it must have an adequate supply of air for combustion and adequate natural or mechanical ventilation to ensure the exhaust gases and fumes will not accumulate.

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Testing, done by a competent worker in accordance with a written testing strategy, can be completed to ensure that airborne concentrations of carbon monoxide do not exceed the applicable limits as determined by Ontario Regulation 833.

Ladders and Access/Egress

If a support system, like a trench box, is used for an excavation, a ladder for access to or egress from the excavation shall be placed within the area protected by the support system.

Choose the right ladder for the job. Remember the following:

- CSA approved Grade 1, Grade 1A or Grade 1AA ladders must be used at construction projects.
- Ladders will be inspected each day before the shift starts by the topman in each crew or by someone designated by the supervisor.
- Defective or broken ladders must be tagged out and removed from the site. Returned to the shop.
- Aluminum ladders may not be used where there is a risk of electrocution from overhead wires or other electrical hazard areas. Typically, this would be on road reconstructions. In this case, fibreglass ladders must be used.

Use the ladder in accordance with the safety regulations and procedures:

- Ladder must be set up at a safe angle. Not less than 1/4 and not more than 1/3 of the length from a point directly below the top of the ladder.
- It must be located so that an adequate landing surface that is clear of obstructions is available at the top and bottom of the ladder.
- All ladders must be placed on a stable base.
- It must be secured at the top and bottom to prevent movement.
- It must extend above the top by at least 900 mm (3 feet).
- When climbing up or down, always face the ladder and maintain 3-point contact.
- Don’t carry tools, equipment, or material in your hands while climbing. Use a hoist line for lifting and lowering.
- When a stepladder is being used, its legs shall be fully spread open, and its spreaders shall be locked.
- No worker shall stand or step on the top cap, top step or pail shelf of a stepladder.

Cement and Concrete Hazards

J-AAR workers must occasionally use cement or concrete for a variety of tasks, but primarily to bench manholes, set forms, repair structures, curb or sidewalk.

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Cement
Portland cement can hurt you if it contacts your skin, contacts your eyes or is inhaled. Cement usually contains a metal called hexavalent chromium. This metal causes allergic dermatitis (inflammation of the skin). The dust reacts with sweat or damp clothing to form a corrosive solution. Inhaling cement dust irritates your nose and throat. It can also cause choking and trouble breathing. Whether cement is wet or dry, you also need to worry about silica.

Concrete
Wet concrete can burn your skin or cause skin ulcers if it falls inside your boots or gloves or soaks through your clothes. Concrete finishers who kneel on fresh concrete have had their knees severely burned. The burns caused by concrete may be slow. You may not feel anything until several hours later. That's why it's important to wash concrete off your skin right away.

Protect yourself:

- Wear a N, R, or P95 mask when pouring or mixing dry cement
- Wear eye protection for mixing, pouring, and other work with dry cement
- Work upwind from cement dust
- Remove rings and watches because cement dust can collect underneath and burn your skin
- Wear alkali-resistant gloves
- Wear coveralls with long sleeves and full-length pants
- Pull sleeves over gloves
- When working with wet mortar or concrete, tuck pants inside boots and duct-tape the top
- Use waterproof boots high enough to keep concrete from flowing over the top.
- Don't wash your hands with water from buckets used for cleaning tools
- If your skin comes in contact with cement, wash with cold running water as soon as possible. Flush out any open sores or cuts. Get medical attention if your skin still feels like it's burning.

Required Documentation

J-AAR has a strict locates policy. If you do not have valid locates on site, no excavation is to take place.

J-AAR supervisors must complete the **Trench Inspection** (most recent version can be found on HCSS) at least daily or as conditions change. Changing conditions include:

- Change of soil type
- Change of crew
- Encountering a structure

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- Water found in excavation
- Sudden change in vibration or surcharge

When trench boxes or other support systems are used engineered stamped drawing must be readily available.

Training Requirements

Supervisors, labourers and operators will attend a Trenching Safety or Ground Disturbance course.

All workers will review this section of the J-AAR HSE Manual with a focus on special procedures and legislation.

Legislation

Construction Regulations, 213/91, Sections 222-242, 78-84.