

Construction OS&H

Working at or below ground level



Summary

Common hazards with working at or below ground level
Common excavations
Shafts and headings
Demolition and contaminated sites
Confined spaces

How this module will be taught

Working at ground level can be dangerous and working below ground level is potentially more dangerous, but there is a lot of detailed knowledge to be learned to preserve OS&H for all those involved. So, this module will be taught in the following stages:

- 1 A presentation by the tutor which summarises the main parts of the subject.
- 2 Simulated ‘tool-box briefings’ in which your tutor and some colleagues will take you through the topics in more detail.

What are the common hazards when working at or below ground level?

Although obviously hazardous, working at or below ground level should create no hazards for anyone on a construction project.

Spend 10 minutes thinking about why hazards arise, and list ten possible causes.

Causes of hazards when working at or below ground level

Many of the hazards that do arise have the following causes:

- Inadequate site investigation
- Poor technical design leading to collapse under load or working conditions
- Poor mechanical design of plant & equipment (breaks in use, not powerful enough, components fracture or malfunction)
- Failure to control groundwater
- Poor workplace design
- Poor general supervision
- Signalling systems (manual, mechanical, electronic) malfunction
- Misuse of plant & equipment (not used as designed)
- Collisions with moving plant & equipment
- Poor maintenance (breaks or emits noxious gases)

These cause the following hazards

- Earthworks collapse or cave in
- Exposure to ‘unexpected’ risks in excavations
- Vehicles fall into excavations
- Loads fall from vehicles
- Crushing due to impact of moving or toppling plant and equipment
- Impact from release of pressure
- Falling from plant and equipment
- Falls caused by swinging loads, plant and equipment
- Limbs or bodies caught in machinery
- Poor ergonomics
- Physiological and psychological damage through repetitive work
- Physiological and psychological damage caused by poor environment (wet conditions, noise, heat, poor ventilation, chemicals, noxious gases)

Specific hazards of excavations (1)

Discuss the following with the people sitting near you and be prepared to contribute to a report back to the course.

Outline the precautions that should be taken before anyone is allowed in a trench or excavation.

What conditions can affect the stability of the sides of an excavation?

Why are a considerable number of the accidents in excavation work fatal?

Outline the potential hazards you are likely to meet in a deep excavation.

What precautions do you need to take to avoid danger from underground services?

Specific hazards of excavations (2)

These include:

- Persons becoming trapped and buried in an excavation owing to the collapse of the sides
- Persons being struck and injured by material and other items falling into the excavation
- Persons falling into the excavation
- Unsafe means of access and insufficient means of escape in case of flooding
- Vehicles driven into or too close to the edge of an excavation, particularly while reversing, causing the sides to collapse
- Asphyxiation or poisoning caused by fumes heavier than air entering the excavation, e.g. exhaust fumes from diesel and petrol engines

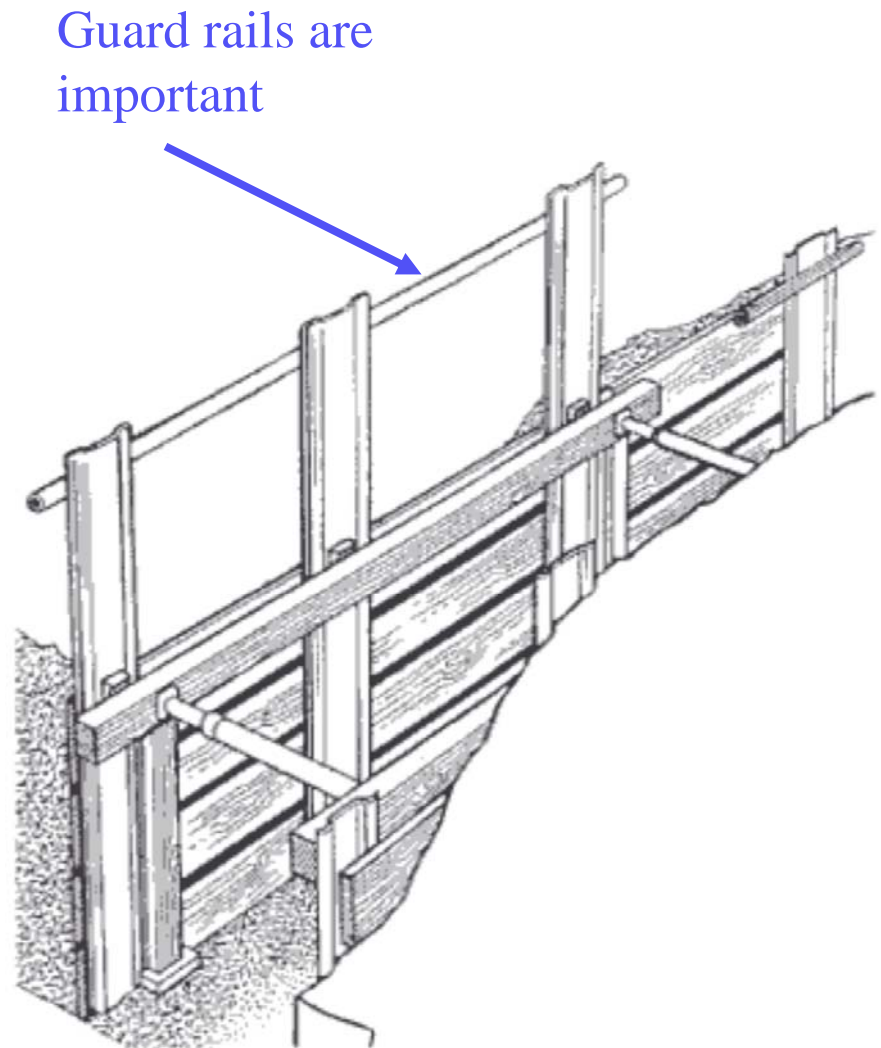
The sides of the excavation or trench should be sloped or battered back to a safe angle of repose, usually 45° , or be supported by timbering or other suitable means to prevent a collapse.

The type of support necessary will depend upon the type of excavation, the nature of the ground and the groundwater conditions.

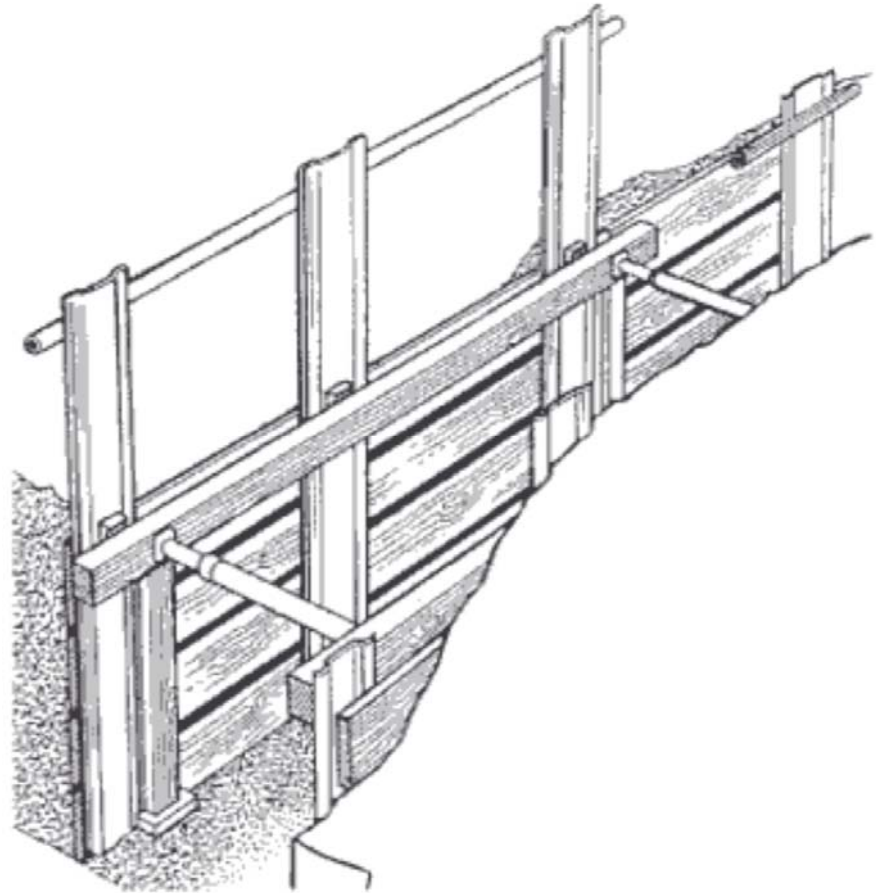


Close boarding or sheeting is required if the ground is unstable or lacks cohesion. Work should not proceed ahead of the trench support.

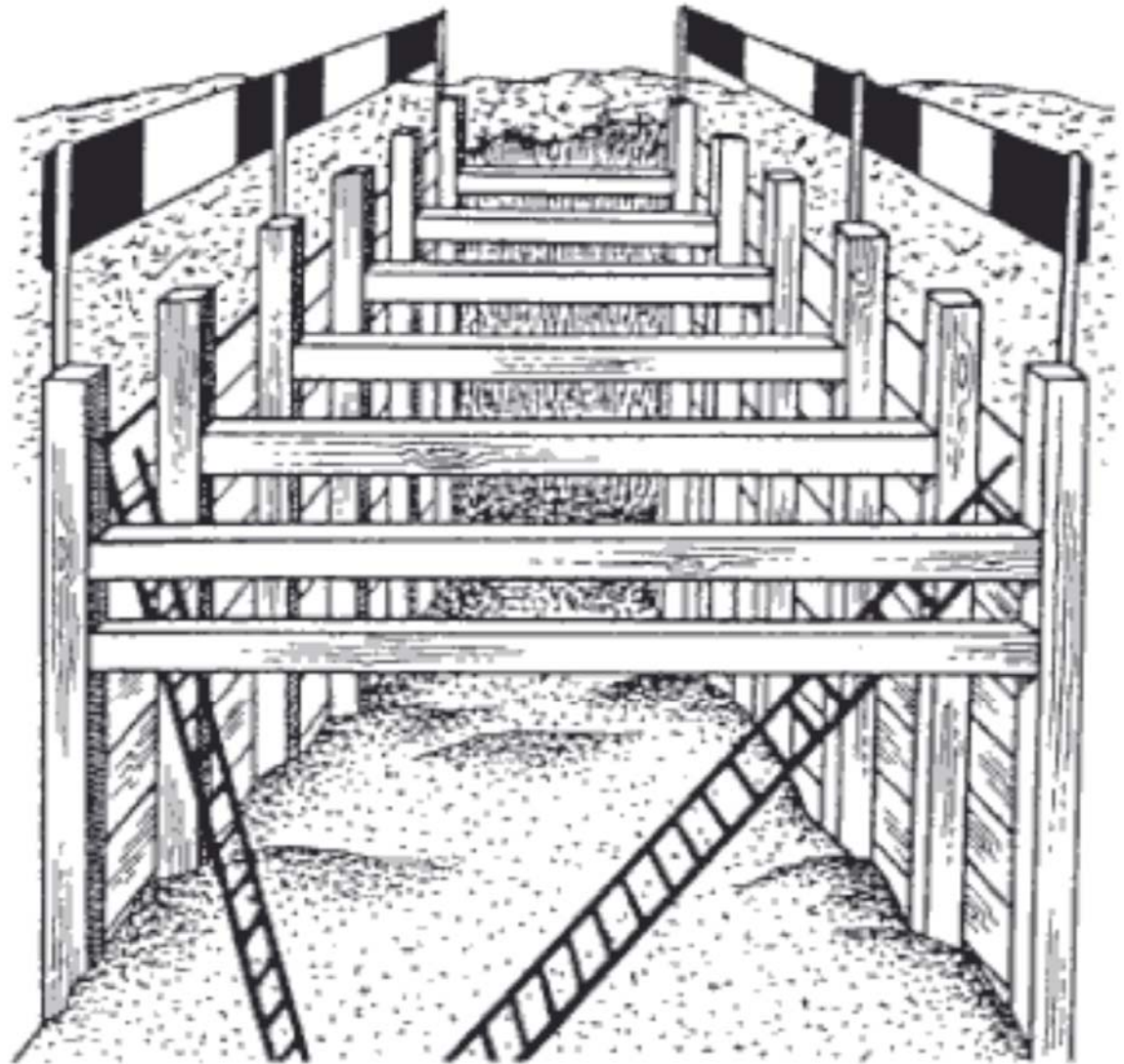
The diagram shows a trench in soft ground being supported by metal 'trench sheets' vertically, which support horizontal timbers. The vertical spacing of the timbers depends upon the assessed strength of the ground.



The struts between the sides of the trench are metal ‘trench struts’, which are adjustable so that they can be firmly braced against the supports. Timber struts, tightened by the use of wedges at the ends, are just as effective.



An example of how
a larger excavation
can be supported
and provided with
safety barriers



Identify the safety defects in this trench excavation



Part of trench unsupported.

Some shoring not braced by screw jacks.

Loose board above workers heads.

Ladder not visible in photo.

Photo and caption courtesy of eLCOSH
www.elcosh.org/images



Points to remember when working in excavations

Never work ahead of the side supports in a trench even when you are erecting shoring.

Appearances can be deceptive. The shallowness of an excavation, or the solid appearance of the ground, are not necessarily an indication of safety.

Deep trenches look dangerous, but most fatal accidents occur in trenches less than 2.5m deep.

Always wear a safety helmet when you work in an excavation.

Buried services (electricity, gas, water, ...)

These can be lethal.
Locate them, mark
them, treat them
very carefully.



Points to remember when searching for buried services

Hand dig with care, as cables may be just below the surface.

Use a spade or shovel and not a fork or pick-axe,
and do not spear the tools into the ground.

If you find a cable embedded in concrete,
do not break it out but seek advice.

If a cable is damaged, even slightly, keep well clear

Do not work bare-chested

Normal work clothing can provide some protection from flash burns

“No load, plant or equipment should be placed or moved near the edge of any excavation where it is likely to cause its collapse and thereby endanger any person” (ILO Code)



“Trench construction, safety: Caterpillar 3128 crawler mounted backhoe straddles trench for underground pipe. Worker in trench is fine grading/cleaning trench with shovel. Workers standing in 8ft deep trench have no support against sidewall collapse. Safety and laws require the trench walls to be supported or sloped back at depths greater than 5ft.”

Source of image &
caption: Robert Carr.



Cranes used in demolition

A cast-steel ball or weight suspended from a crane jib is an extensively used method of demolition.

Cranes as such are not designed for extremes of shock loading likely to arise when a demolition ball is in use and therefore should be used only to drop the ball vertically on a free fall for such operations as breaking up concrete slabs.

They should not be used for swinging the ball. Excavators which are convertible to cranes are designed for drag-line operations which impose a shock load and are more suited to use with a ball.

Modern demolition

... has become a specialised, plant intensive business, especially when recycling is one of the major requirements.



Confined spaces

Every year there are fatal and serious accidents caused by persons entering confined spaces without the necessary tests being carried out or the correct safety and rescue equipment being provided.

In many cases attempted rescue has ended in tragedy, with the death of the poorly equipped rescuer as well as the person to be rescued.

While a closed tank with a restricted access opening may be the obvious example of a confined space, such spaces may also include open manholes, sewers, trenches, bored piles, pipes, ducts, enclosed basements and other places where there is inadequate ventilation.

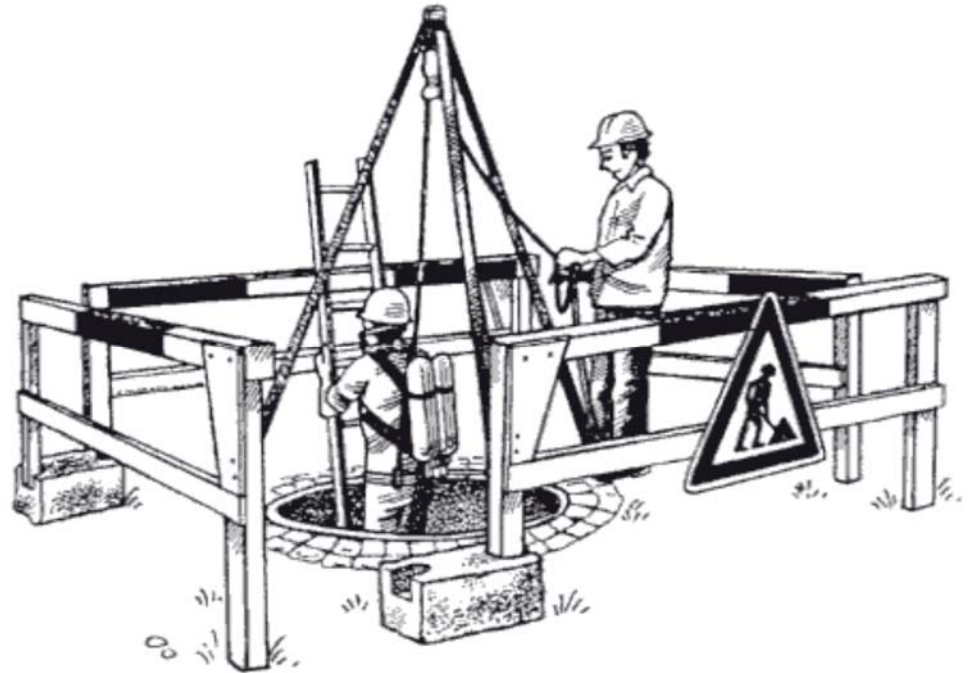
Dangerous atmospheres

Dangerous atmospheres can arise when there is a lack of oxygen or when toxic or flammable gases are present. These may be due to exhaust gases from plant and transport, carbon dioxide forming in chalk soil, decomposition of sludge in a sewer, leaks from gas mains, rusting of metalwork, or the presence of petrol and various kinds of waste from factories and trade premises. Work being done in a confined space can make it dangerous. Examples are some painting work, the use of adhesives to fix floor tiles, and cleaning fluids.

Many ‘accidents’ would have been avoided if supervisors and workers had been properly trained and a permit to enter and a permit to work system had been in operation.

Persons who are actively engaged in work in confined spaces must be fit and properly trained for the job and have the necessary personal protective equipment.

They should remember that an oxygen deficiency can render them unconscious, and that toxic fumes can additionally cause dizziness and a feeling of sickness, while gases can be flammable or explosive.



Essential precautions before entering a confined space (1)

Nobody should enter without instructions from a supervisor and without a written permit to enter or permit to work. Nobody may enter the confined space until the competent person is satisfied that entry is safe.

Equipment for monitoring the atmosphere at frequent intervals must be provided and must be used by a competent person.

There should be forced ventilation to remove and dilute dangerous gases and provide fresh air.

Monitoring must continue while work proceeds, and everyone must leave immediately if told to do so.

Essential precautions before entering a confined space (2)

Everyone should have received proper training and instruction in the precautions to be taken, including the use of emergency breathing apparatus.

Rescue harnesses should be worn by everyone inside the confined space, with lifelines attached to a point outside the space.

No less than two persons should be present when there is work in a confined space. One should be outside the confined space to keep watch and to offer rescue action or assistance. Additional emergency and accident assistance must also be readily available.

Essential precautions before entering a confined space (3)

A proper procedure for rescue in an emergency should be laid down, with specific duties allocated to specific persons.

When working at a manhole in a road or public area, guard stands must be provided and the appropriate traffic signs displayed.

Everyone has to be trained by a competent person in the use of the safety and rescue equipment.



..and sometimes working at ground level
is just plain hard work ..



The USA Department of Labor, Occupational Safety and Health Administration (OSHA) offers some excellent PowerPoint slide shows on Excavations by the OSHA Office of Training and Education

http://www.osha.gov/doc/construction_ecats.html

These can be used to supplement this Theme PowerPoint Presentation