Carry out manual excavation

RIICCM205E

Unit overview

- In this unit you will learn how to:
  - Prepare for work;
  - Dig small excavations by hand;
  - Complete and isolate the excavation; and
  - Clean up after manual excavation.

Compliance documentation

- There are five broad compliance requirements you need to know that apply to your work:
  - Government legislation or Acts and Regulations, as well as Codes of Practice;
  - Australian Standards;
  - Company policies and procedures;
  - Site management plans; and
  - Engineer's specifications and project specific plans.

Understanding work instructions

- The manual excavation task you have to carry out can be given to you in a number of ways:
  - A verbal direction given by a supervisor to carry out the work.
    - Being told what to do.
  - A company work order.
    - Written instructions.
  - A written instruction given to you by a supervisor, engineer or inspector.
  - A subcontract to perform the work.
    - Written specifications.

Understanding work instructions

- You should always consult your worksite supervisor to confirm the instructions or determine the scope of the work.
  - This may include:
  - Types of tasks to be performed;
  - Order in which they will proceed, to complete the entire job as efficiently as possible;
  - Locations of services and possible problems arising from them; and
  - Materials which have to be stockpiled, transferred, removed or placed to be loaded onto trucks.

Identifying the safety requirements

- A worksite safety plan will have been developed for the site to ensure the safety of all workers prior to the commencement of work.
  - The plan will cover matters relating to:
  - Site access;
  - Site emergency procedures;
  - Personal protective equipment (PPE);
  - Safe work procedures; and
  - Site rules.

Identifying the safety requirements

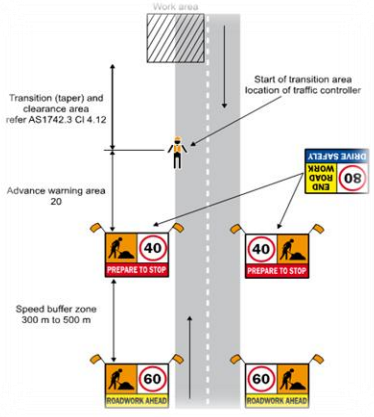
- Identify and become familiar with:
  - Worksite safety plans
  - Worksite access – a planned area
  - Worksite emergencies – what to do
  - PPE – must wear
  - Hazards and risks – be aware of what they are
  - Utilities – underground and overhead
  - Records – accessible
  - Locating services onsite – Dial Before you Dig
  - Underground services – potential to damage
  - Spotters – use in areas around services

Safety signage

- Safety signage and barricades must be erected before work commences according to site procedures and the traffic management plan.
  - These may include:
  - Mandatory signs (blue and white)
  - Prohibitory signs (red, black and white)
  - Warning signs (black and yellow)
  - Danger signs (red, black and white)
  - Emergency information signs (green and white)
  - Fire related signs (red and white)
  - Hazchem signs
  - Hazard/barrier demarcation tape.

Implementing traffic management signage

- Work carried out on or near roadways will require some form of traffic control to protect you, your workmates and the general public.
  - A traffic management plan will enable drivers and other road users to be:
  - Warned;
  - Instructed; and
  - Guided safely around or past the work area.



- For illustration purposes only: This plan may not comply in your State or Territory

Selecting and checking plant, tools and equipment

- The design and job requirements must be taken into account when selecting plant, tools and equipment, to ensure that they meet the requirements of the job.
- You will be responsible for selecting, checking and cleaning the equipment and tools you will be using both before and after the day's work.

- Post hole digging tool

Environmental requirements

- Each State or Territory has their own Environmental Protection legislation which requires all personnel on the worksite to take all reasonable and practicable measures to prevent or minimise any environmental damage resulting from their work.
  - It is important that all possible sources of risk for the worksite are identified and procedures followed to:
    - Minimise the environmental impact;
    - Comply with the Act; and
    - Avoid prosecution for the workers and the company.

Personnel have a duty to notify of any activity that could cause environmental harm involving:			
Land contamination	Sediment control	Waste	Vibration
Oil, fuel and chemical handling, storing or transport	Acid sulphate soils	Vegetation	Lighting
Water	Air	Noise	

Summary

- Manual excavation requires the work to be well planned and safely carried out according to site procedures and State or Territory legislative requirements.

- The correct selection and usage of plant, tools, materials and equipment will ensure work is carried out safely and to the specified quality and tolerances.

- Workers must at all times during operations be aware of their responsibilities for worker safety and to protect the environment.

Learning check 1

1.	Name two things you should check for when carrying out a pre-operational check on your tools and equipment.
2.	Name two types of PPE a manual excavator may be required to wear to carry out their duties according to site procedures.
3.	Manual excavators must ensure they obey signage and traffic control measures that have been placed in and around the site. a) True b) False
4.	Manual excavators should be alert to which of the following environmental problems at the worksite? a) Dust b) Noise c) Acid sulphate soil d) All of the above

Confirming the location and specifications of the excavation

- Marking out the area where the excavation is to be carried out serves two purposes:
  - You excavate only the required area; and
  - You will be able to identify and mark out any underground services within the relevant area.

- The Safe Work Method Statement (SWMS) or work instructions from your supervisor will identify the exact dimensions you are required to manually excavate.

- Walk through the area with your SWMS and Dial Before You Dig (DBYD) plans and do a visual search to orientate yourself and the plans.

Identifying service markers

- Service markers can indicate a number of services and utilities including electrical, water and sewerage pipes, gas and telecommunications cables.
- Look for obvious signs such as pits or chambers, kerb markers, marker posts, valves and hydrants.
- You will also need to look for less obvious signs such as sunken trenching, tracks or greener grass that could indicate a trench dug after a road has been constructed.

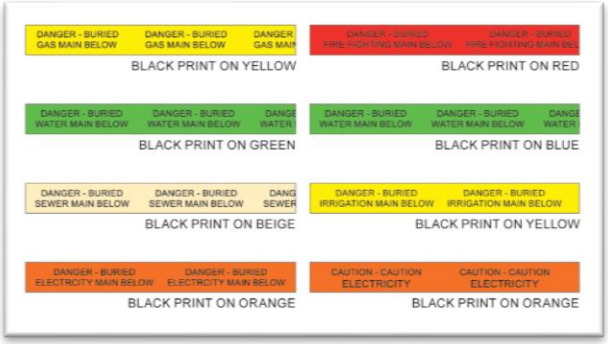
- Gas main marker

- Manhole in road

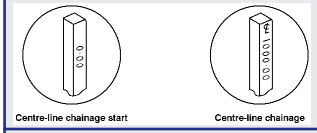
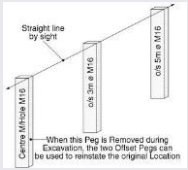
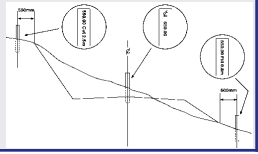
- Water main marker

Caution, hazard and danger tapes

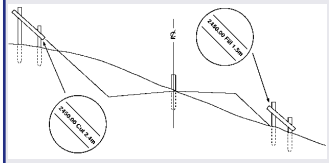
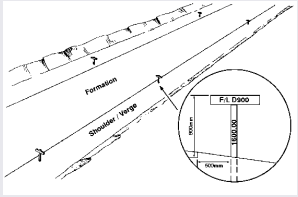
- Caution, hazard and danger tapes can be of various colours and have different printed messages on the tape.
- Tapes can be used to advise of buried services below, to advise of a hazard or to exclude persons from certain areas.
- If you locate any of these in the area that you are required to manually excavate, refer to the SWMS or plans to ascertain what is required.



Survey pegs and boards

Centre Line Pegs  	▪ indicate the centre line of the road or drainage work ▪ usually white in colour ▪ marked on the side facing the start with the chainage from the start (in metres).
Offset Pegs  	▪ installed to preserve and identify the original location point ▪ the distance by which it is offset from the original peg will be written on it.
Batter Pegs 	▪ indicate the limits of the cut or fill on the job ▪ are normally positioned at every cross section 500 mm outside the line of cut or fill ▪ are marked with the chainage and depth of cut or fill.

Survey pegs and boards

Batter Boards and Profiles 	▪ indicate the slope to which cuts and fills are to be finished ▪ usually marked with chainage and depth of cut or fill ▪ may also be marked with the batter slope.
Formation Profiles 	▪ can be used to ensure the finished carriageway will be at the correct level ▪ are set up 500 mm from the edge of the carriageway at every cross section ▪ marked with the chainage and the vertical distance between their tops and the finished road level.

Confirming the location of underground services

- A critical part of planning safe work is the validation of records at the worksite.

The Dial Before You Dig service (www.1100.com.au) provides free and easy access to the records of a large number of services, including telecommunications, electricity and gas.

- Before commencing work you must check and confirm with your worksite supervisor that the location and alignment of all underground or overhead services at the worksite have been correctly identified and marked.

Using hand tools correctly

- As a manual excavator you must:
  - Ensure the tools are continuously maintained and kept in a safe operating condition;
  - Be trained in the safe operation of the tools according to State or Territory legislative requirements and the manufacturer's and site requirements;
  - Be aware of your body position and movements while lifting, pushing, pulling and carrying loads; and
  - Size up the load to make sure it is not too heavy or too large for you to grip and lift.

Type of manual excavation

- The SWMS will indicate what type of manual excavation is required which could be:
  - Post holes
  - Small trenches
  - Small pits
  - Small cut to fill areas.

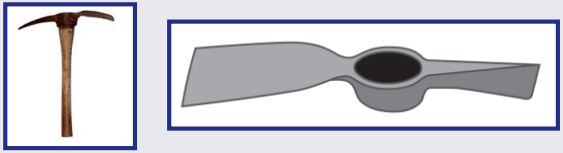
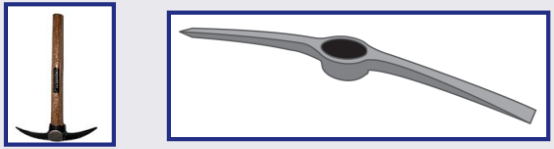
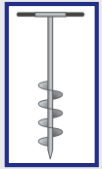
Soil and weather conditions

- The ground conditions that you encounter when performing manual excavations will vary according to the soil type.
- The tools that you select for the job will also depend on the weather conditions you are faced with.
- In wet weather the soil you are digging and shifting will be heavier requiring you to reduce the load on your shovel.
- Dry conditions may require that you dampen the soil slightly to avoid issues with dust.

Soil types

Rock or Gravel	Particle size will vary from general (2 mm minimum) to stone and up to boulders (250 mm and up).
Sand	Individual grains can be seen and felt readily.
Silt	Grains are very small, not individually recognisable to the naked eye.
Clay	Grains are extremely small, usually containing colloids which give clay its characteristic stickiness, plasticity and slipperiness when wet.
Sandy Loam	Sandy loam is a mixture of sand with minor amounts of silt and clay.
Silt Loam	Silt loam is a mixture of fine grades of sand, a small amount of clay and a large amount of silt.
Organic Matter	Organic matter is partly decomposed vegetable or other previously living matter. It appears as peats, organic silts or organic clays.

Common hand tools

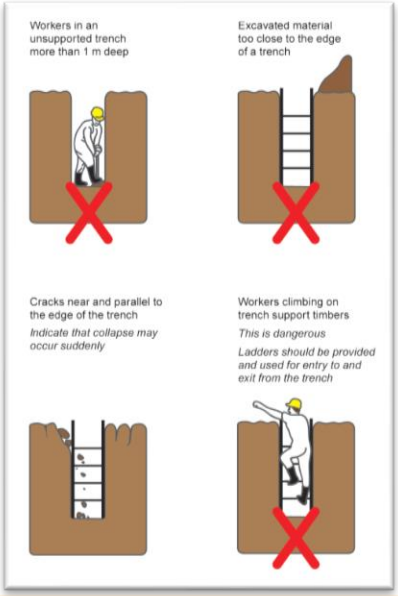
Mattock Used for the excavation of foundations and trenches or the lessening of excess material.	
Pick Used for loosening of firm material in excavations and trenches.	
Hand Operated Auger Is often used to excavate holes up to 1 m deep for pier and beam footings.	

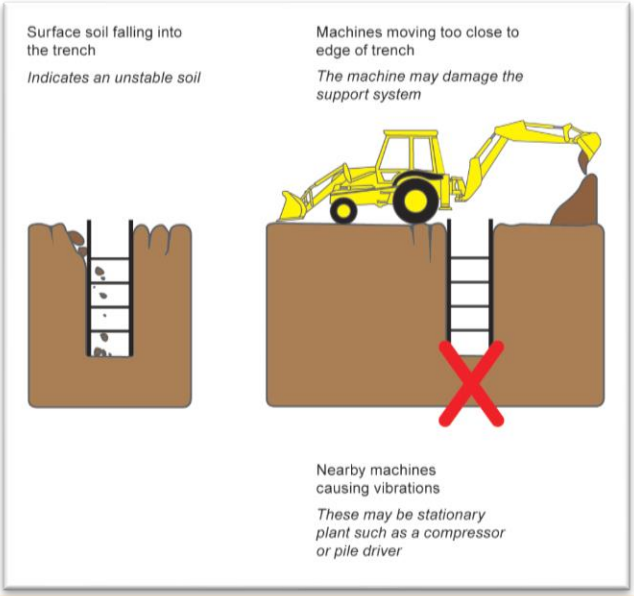
Common hand tools

Crowbar or Spud Bar Used to loosen material when digging holes for posts, excavations, removal or breaking of rocks and rolling of logs or posts.	
Post Hole Digging Tools Designed to be driven into loosened dirt and have a scissor like action for retaining dirt whilst removing the tool from the hole.	
Spades and Shovels Used to move dirt in open areas. The blade of shovels can be square mouth or rounded and are designed for different purposes.	  

Preventing trench collapse

- Examples of hazardous situations that occur in simple trenching:





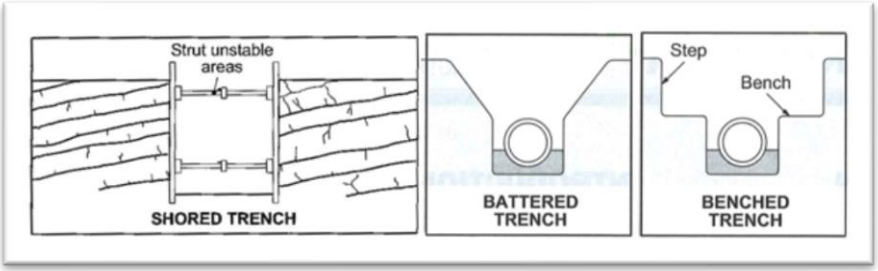
Preventing trench collapse

- Trenches collapse for a number of reasons:
  - The depth of the trench
    - Deep trenches are more susceptible to collapse than shallow trenches.
  - Ground condition
    - Wet, loose or fractured ground is more susceptible to collapse than dry consolidated ground.
  - Vibrations
    - Vibrations from machinery such as dozers, compactors, or shock waves if explosives are being used to fracture hard rock, can cause weak areas of the trench to collapse.
  - Loading
    - Excessive loads close to the trench can cause the wall to collapse. Heavy machinery and spoils should not encroach closer than 1.5 m to the trench wall.

Installing trench support

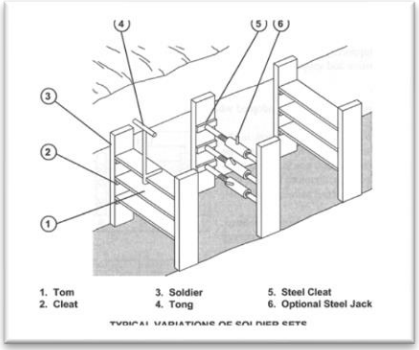
- OH&S legislation requires that for excavations greater than 1.5 m in depth (where personnel are required to work), ground support systems must provide adequate support against the collapse of the sides of the excavation.

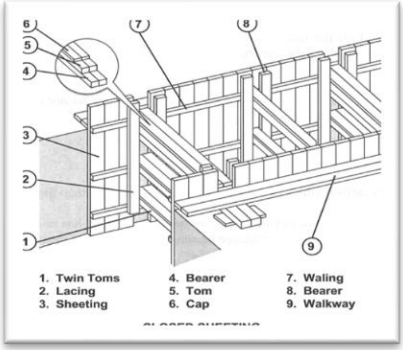
Shoring: requires the placement of sheeting or timber along the walls of the trench to prevent collapse.	Battering: is the widening of the trench above the embedment zone using a sloping batter (usually 45°) to widen and stabilise the trench.	Benching: is the use of horizontal excavated steps to stabilise the excavation.

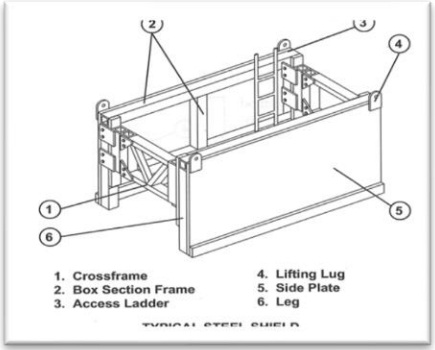


Installing trench support

- Principally there are three different methods of ground support in use:
  - Soldier sets;
  - Closed sheeting; and
  - Shields.







Placing barricades around the excavation

- Open trenches are a safety hazard for the unwary.
  - Steps must be taken to prevent vehicles, workers or the public falling into an open trench such as:
  - Planning and placement of access ways;
  - Warning signs;
  - Barricades; and
  - Sentries.

Placing barricades around the excavation

- Warning Barricades
  - These barricades call your attention to a hazard but offer no physical protection.
  - They are usually barrier tape, mesh, stands or posts.

- Protective Barricades
  - These barricades call your attention to a hazard and provide physical protection.

- In all cases, signage must be erected on either side of the barrier stating the nature of the enclosed hazard.

Summary

- Correctly identifying the location of the worksite and locating any underground services is vital to carrying out manual excavation work.
  - Once any services are identified the job of carrying out manual excavation can commence.
  - Using the correct tools and equipment means that you can carry out your manual excavation tasks as effectively as possible to meet the job specifications.
  - As a manual excavator you must be aware of your own safety and only lift loads that you can easily handle, making sure you are aware of correct handling techniques to avoid repetitive strain and back injuries.
  - Taking basic precautionary measures to prevent trench collapse will promote safety when manually excavating trenches.
  - Using barricades appropriately will ensure the safety of you, your colleagues and the public.

Learning check 2

1.	What are three key manual handling techniques you need to follow when excavating manually?
2.	Name three physical soil types you might encounter during manual excavation.
3.	Deep trenches are more likely to collapse than shallow trenches. a) True b) False
4.	What services may not show up on specifications and site plans:? a) Services on private property. b) Local government assets. c) Government services such as roads, local government intersection lighting and traffic light wiring. d) All of the above.
5.	There are two different styles of barricades, what are they?

Cleaning loose material out of the excavation

- To complete the job:
  - Make sure the excavation has square or plumb sides and a flat or level bottom according to the construction plans and specifications;
  - Clean out the loose excavated material from the excavation;
  - Trim excavations for footings, pipe laying or sub-grades for paving to the required levels; and
  - Fill holes with approved fill materials and compact as specified.

Checking the excavation

- Once you have completed your task it should be confirmed that the excavation complies with the dimensions listed in the construction plans and specifications, SWMS or your work instructions.
- Get your original work plans and check against the stringlines on the marked out parameters, checking the dimensions and levels.
  - Before asking your supervisor to check the excavation, make sure the sides of the excavation are straight and the floor cleared of all loose materials.
- If your dimensions are out or you are unsure about whether you have met the specifications, ask your supervisor to check the site with you.

Summary

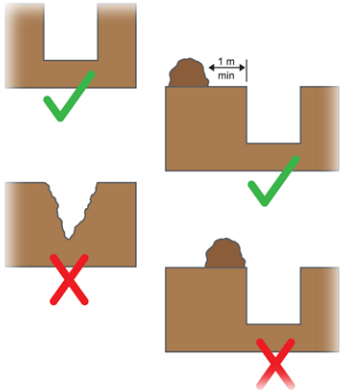
- Clearing loose materials (spoil) from the excavation as you work makes your job quicker and easier.
  - Working close into the area that you are digging minimises strain on your back, knees and body in general.
  - Always lift slightly less than the amount that will fit on your shovel.
  - You will be able to lift more material more easily for a longer period of time before getting tired or causing repetitive strain injury.
- When used correctly your work specifications will guide your work.
  - When you have finished your excavation double check against your work specifications to make sure you have carried out your task correctly.
  - The work specifications will also remind you of any services that need to be restored when you clean up.

Learning check 3

1.	Clearing the loose soil from the excavation is part of the manual excavator's role. a) True b) False
2.	Work specifications for a manual excavation site are just a guide, if the dimensions are out a little it won't matter. a) True b) False

Cleaning up

- It is important that all loose material is cleared from the excavation site.
- Make sure that all excavated soil is at least 1 m back from the edge of the excavation.
- This will prevent the trench collapsing from:
  - Excess weight on the trench edge;
  - Loose material falling; and
  - Rain washing soil back in.



Cleaning up

- Remove all waste products from site and store unused and reusable materials.
  - The final operation at the worksite is restoration of:
    - Road surfaces
    - Utilities
    - Contaminated areas
    - Drainage and watercourses
    - Sodding or grassing
    - Private property
  - Clean up also involves removal of:
    - Machinery and amenities sheds
    - Temporary sediment controls
    - Traffic control
    - Barricading

Cleaning up

- Tools and equipment must be thoroughly checked and cleaned before packing and storing.
- Remove all dirt from tools.
- Use a bench grinder, sharpening stone or sharpening file to sharpen tools.
- Lightly sand and oil wooden handles.

Regular care and maintenance will enhance the life of the equipment and maintain its accuracy.

Learning activity

- It's the end of the job, the end of the project, let's get on with the next one.

- Understandable, but discuss as a group why it is important to clear up a worksite and clean up plant and equipment.

- Come up with five good reasons.

Summary

- The clean up is an important part of finishing operations as it ensures:
  - The site is environmentally safe and acceptable for use by others; and
  - Tools and equipment are made ready for the next operation.

- Worksite restoration ensures that:
  - All unnecessary materials, signage, environmental controls are removed;
  - The worksite is returned for use; and
  - The worksite meets all environmental requirements and standards.

- Tools and equipment must be thoroughly checked and cleaned before storing in readiness for the next job.
- Damaged or worn equipment must be reported and the necessary servicing or repairs carried out to ensure safe equipment is available for the next operation.

Learning check 4

1.	Utilities uncovered on the worksite should be restored on completion of the job. a) True b) False
2.	Name two types of safety measures or environmental control that must be removed from the worksite at the completion of operations.
3.	Before leaving the site all equipment and tools should be checked for any losses, damage and defects. a) True b) False
4.	Any soil, dirt or dust left on the roadway can be removed by hosing it down the drainage system to make the road safer. a) True b) False
5.	The work area should be cleaned up according to: a) The user manual for excavating tools b) Australian Standard 1407 c) The project environmental management plan d) Australian Standard 1684?