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Learner Guide

RIIMPO320
Conduct Civil Construction Excavator Operations

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1. Introduction

These materials are based on the National Unit of Competency **RIIMPO320F – Conduct Civil Construction Excavator Operations**

You will learn about:

- Plan and prepare for work
- Conducting routine checks
- Operating excavators
- Relocating excavators
- Maintenance and routine tasks

Operating an excavator involves the skilled and safe execution of tasks using a powerful, versatile piece of heavy construction equipment. Excavators are essential to the civil construction, mining, demolition, and infrastructure sectors, primarily used for digging (excavating) trenches, foundations, and holes, but also for various other tasks including material handling, demolition, and forestry work.
The machine is defined by its cab, boom, stick, bucket (or attachment), and undercarriage (tracks or wheels), allowing for 360-degree rotation of the upper structure (superstructure) while the undercarriage remains stationary. This rotational capability, combined with complex hydraulic controls, is what grants the excavator its high degree of flexibility and power.

1.1 What is an Excavator

An excavator is a self-propelled vehicle, either tracked (crawler) or wheeled, with an upper structure that can move a minimum of 360 degrees.

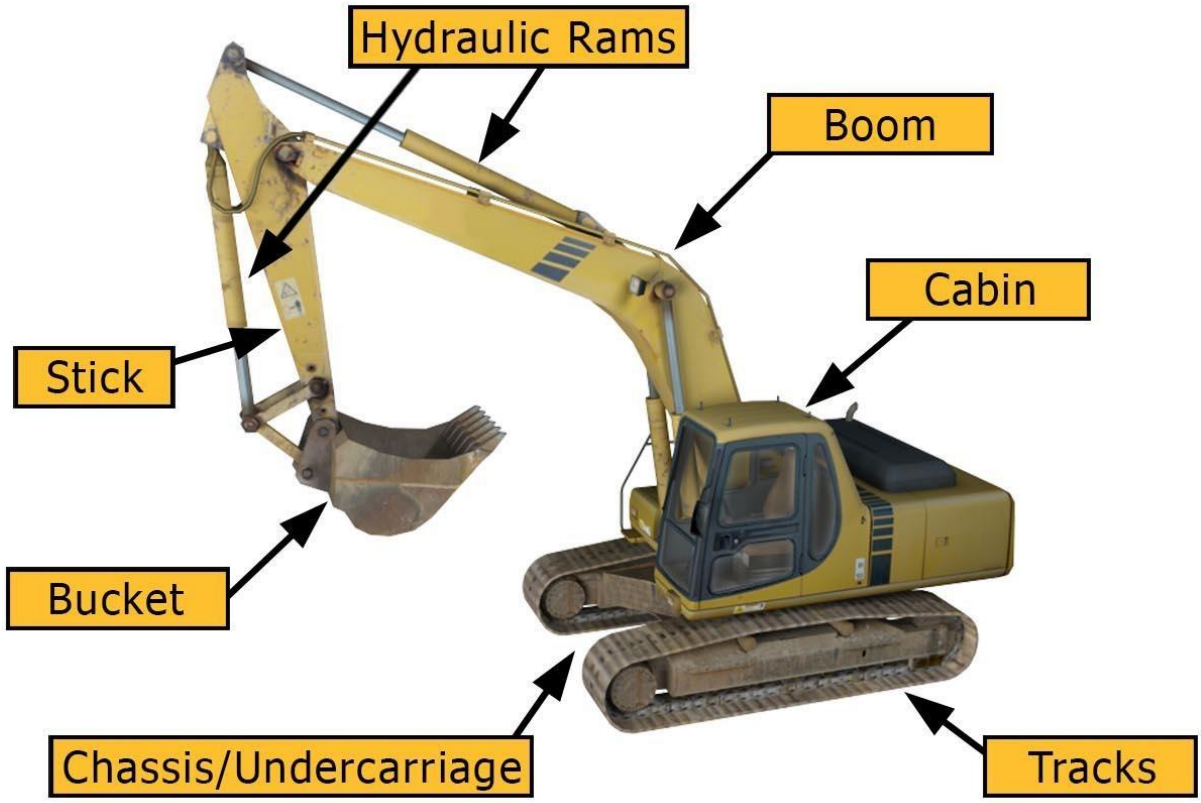
The machine can excavate, then swing and discharge materials. This action is done through movement of a bucket fitted to the boom and arm or telescoping boom. There is no movement of the chassis or undercarriage of the machine.

The tasks performed by an excavator may include:

- Loading.
- Lifting and carrying materials.
- Bulk excavation.
- Backfilling.
- Trench excavation.
- Stockpiling.
- Battering and benching.
- Compacting materials.
- Demolition.
- Rock breaking.
- Landscaping - ripping, removal of trees, stripping or spreading topsoil.
- Cutting and boxing.
- Pipe laying.
- Cut and fill.
- Mixing materials.
- Site clean-up.

1.2 Excavator components

The following diagram and table outline the basic components of an excavator:



Component	Description
Hydraulic Rams	Control the boom/arms of the hydraulic excavator.
Boom	The 'arm' of the excavator may be used to excavate or control any other relevant attachment. The boom is generally controlled through the use of hydraulic rams.
Cabin	The position that the operator controls the excavator from.
Tracks	Tracks, made up of individual shoes, spread the weight of the excavator over a larger area than with tyres. This makes it easier for the excavator to move across soft ground without getting bogged.
Chassis/Undercarriage	The lower section of the excavator stays stationary while excavation work is being completed. The upper section of the excavator is able to slew (rotate) independently from the undercarriage.
Bucket	The tool used to perform excavation or other relevant tasks.
Stick	Provides the digging force to the bucket. Come in different lengths.

1.2 Are there different types of Excavators?

Yes, there are several different types of excavators, primarily distinguished by their undercarriage (mobility) and their size/application.
Here is a detailed explanation of the main types and their operational differences:

1. Based on Undercarriage (Mobility)
This is the most common way to categorize excavators, as it dictates where the machine can work.

Type	Description	Primary Application	Key Operational Difference
Tracked Excavator	The machine moves on continuous tracks (like a tank).	Mining, forestry, heavy construction, digging trenches, and working on soft, uneven, or steep terrain.	Superior stability, flotation, and traction. Slower to move between distant sites and cannot drive on public roads.
Wheeled Excavator (Rubber Duck)	The machine moves on heavy-duty rubber tyres.	Civil construction, roadworks, and utility work, particularly in urban areas or on established surfaces.	High mobility and speed on paved surfaces. Less stable on rough terrain and often requires stabilizers (outriggers) for heavy lifting.

2. Based on Size and Application
Excavators are also grouped by size, which determines their power and reach.

Type	Typical Weight Range	Primary Application	Key Operational Difference
Mini/Compact Excavator	Under 6 tonnes (e.g., 1–5 tonnes).	Landscaping, residential construction, trenching in confined spaces, and indoor demolition.	Exceptional manoeuvrability and small footprint. Some models have zero or minimal tail swing to work against walls.
Standard/Medium Excavator	7 to 45 tonnes.	General road building, large foundation work, bulk excavation, and utility installation.	Versatility and balance of power, reach, and transportability. The workhorse of the industry.
Large/Mass Excavator	Over 50 tonnes (often over 100 tonnes).	Large-scale mining (moving overburden), quarrying, and major infrastructure projects (dams, large ports).	Maximum power, capacity, and reach. Requires significant time and effort to dismantle and transport between sites.

3. Specialized Types
Other specialized types address unique project needs:

- **Long-Reach Excavator:** Features an extended boom and stick assembly (often over 15–30 meters) for reaching high structures or deep into water, commonly used for dredging or demolition of tall buildings.
- **Dragline Excavator:** A massive machine used primarily in surface mining for overburden removal. It uses cables to drag a bucket towards itself, rather than relying solely on hydraulic force.

2. Working Safely

You must follow all safety rules and instructions when performing any work. If you are not sure about what you should do, ask your boss or supervisor. They will tell you what you need to do and how to do it in a safe way.

2.1 Health and Safety Rules

Every workplace has to follow laws and rules to keep everyone safe. There are 4 main types:

Type	Explanation	
Acts	These are laws that you have to follow.	
Regulations	These explain what the law means.	
Codes of Practice	These are instructions on how to follow the law, based on industry standards.	
Australian Standards	These tell you what the minimum requirement is for a job, product or hazard.	
Policies & Procedures	**Site specific SWMS**	**Site specific Risk Assessments**

Some states use OHS laws, and other states use WHS laws. They both talk about the same thing but use different words or names for people. If you have any questions about safety rules you should talk to your boss or supervisor.

2.2 Operations Documentation

Before starting your work, you need to make sure you have access to all operations documentation for the job. This will help you to do your work in the safest way and make sure all work is compliant.

Operations documentation includes:

Site Details
The information and safety requirements of the workplace environment (where you will be working).

Hazard Details
Any hazards in the work area or related to the work. This could also include instructions on how to handle dangerous or hazardous materials.

Task Details
Instructions of what the work is or what you will be doing (this can include diagrams or plans). Also instructions on how to safely do the job.

Faulty Equipment Procedures
Isolation procedures to follow or forms to fill out.

Signage
Site signage tells you what equipment you need to have, or areas that are not safe to be in.

Emergency Procedures
Instructions on what to do in emergency situations, for example if there is a fire, accident or emergency where evacuation or first aid is needed.

Equipment and Work Instructions
Details of how to operate plant and equipment and the sequence of work to be done.

2.3 How to Keep Everyone Safe

WHS law says that all companies and workers need to keep themselves and other people safe while they work. This is called a duty of care.

To keep yourself and other workers safe you need to:
Follow your instructions.

- Follow all workplace rules.
- Make sure all equipment is safe to use.
- Carry out your work safely.
- Report any problems.

If you think something is dangerous, tell your boss or supervisor as soon as possible.

Your worksite will also have instructions for working safely including:

- Emergency procedures, including using firefighting equipment, first aid and evacuation.
- Handling hazardous materials.
- Safe operating procedures.
- Personal protective clothing and equipment.
- Safe use of tools and equipment.

2.4 Health and Safety Rules – Work Instructions

You need to be clear about what work you will be doing. Make sure you have everything about the job written down before you start. This includes what you will be doing, how you will be doing it and what equipment you will be using.

Make sure you have all the details about where you will be working. For example:

- **The Site** – Is there clear access for all equipment? Are there buildings, structures, facilities or traffic in the way?
- **The Weather** – Is there wind, rain or other bad weather? Is it too dark?
- **Facilities and Services** – Are there power lines or underground services to think about?
- **Traffic** – Are there people, vehicles or other equipment in the area that you need to think about? Do you need to get them moved out of the area? Do you need to set up barriers or signs?
- **Hazards** – Are there dangerous materials to work around or think about? Will you be working close to traffic or machinery?

You also need to make sure you have all the details about the kind of work you will be doing:

- **The Task** – What type of works need to be cut? How many? How long will it take?
- **Equipment and Materials** – What type of equipment will be used? How big is it? How much room does it need? Are there any special materials or chemicals that will be used?
- **Communications** – How are you going to communicate with other workers?
- **Procedures and Rules** – Do you need any special permits or licences? Are there site rules that affect the way you will do the work?

2.5 Reading and Checking Your Work Instructions

All work needs to follow worksite, environment and company safety procedures.

Procedures help to make sure that all work is done in a safe way, without damaging equipment or putting people in unsafe situations. They also help to make sure that work is done in the correct order and doesn't interrupt or get in the way of other work that is happening on the site.

Your work instructions will tell you the safest way to do the job, and the equipment that you will need to use. It is a good idea to check your work instructions with your boss or supervisor to make sure you know exactly what you need to do.

In some situations, you may be required to put together a clear set of instructions from various sources. To do this you may need to understand and obtain relevant information from site drawings, blueprints or plans.

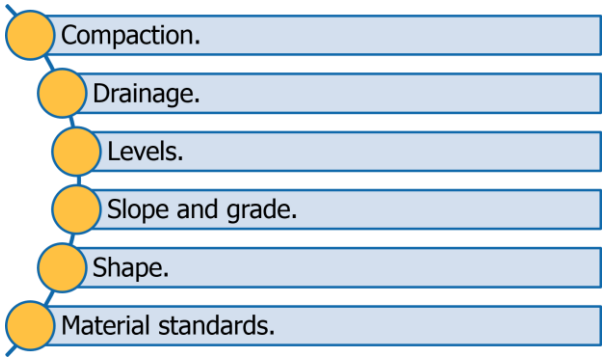
If you don't know where to get your instructions or you can't understand them, you can ask your boss or supervisor. They will tell you where to find your work instructions and explain what they mean.

2.6 Job Specifications

Job specifications will tell you the types, quantities, grades and classifications of materials you will be working with.

Every task or activity relating to operating an excavator will also have quality requirements. These outline when tasks need to be completed and the required standard of the work.

They relate to:



These requirements will guide you to make sure you are achieving the quality standard for the project. To apply the requirements, you need to follow instructions and procedural documents exactly. You will need to get the information out of these documents and use it to do your job It is essential that these quality requirements are known, understood and adhered to in all activities and tasks.

Specifications may be given to you as drawings and plans. Plans are usually "scale drawings" that represent a large area on a small sheet of paper and show proportion at the same time.

Project plans and maps give you an overview of the site, for example:

- The location of your work area in relation to the whole work site.
- The position of stockpiles, work zones, roads and access areas.
- The location of environmentally sensitive or 'no go' areas.
- Contours, or the lay of the land, e.g. slopes, banks, depressions.

Depending on the project, drawings may be very detailed, or they could be simple sketches.

You should learn about the conventions and symbols used in the plans and drawings so you can understand what the information means.

2.7 Organising Work Activities

After receiving and clarifying all your work instructions and requirements, you will need to organise and plan for your work activities. This is a major component of excavator operations activities because each step must be completed before the next step can start.

Organising your work activities involves scheduling your daily and weekly tasks to complete all assigned tasks in the best, most efficient manner that still meets the requirements of the worksite. It will allow you to plan for the time ahead to ensure that project timelines do not get out of hand.

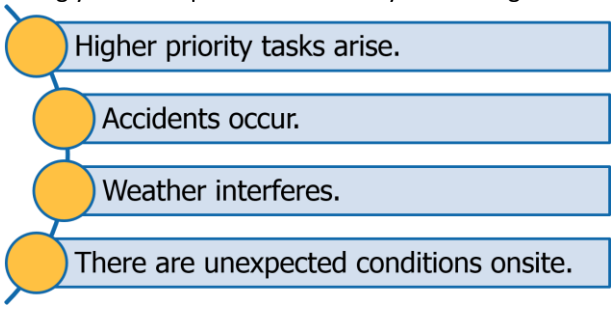
While you will be performing your own work activities you will also be involved with the activities of plant and machinery operators. This means you are required to sequence work activities and work with others onsite concerning timing issues.

Some people prefer a handwritten checklist or work method statement, others a computerised diary entry. What works for you is the most important thing.

A Work Method Statement (WMS) is a list of steps that outlines how a job will be done. It also includes any hazards that occur at each step, and what you need to do about them. These statements can also be known as Safe Work Method Statement (SWMS), Job Safety Analysis (JSA) or Safe Operating Procedure (SOP).

Work method statements are a great tool for organising your work activities and making sure you have completed everything. This is because they outline the details of all tools, equipment and coordination with other workers relating to your job. Make sure all of these are available and ready before you start.

Flexibility is important when organising your work priorities to allow you to reorganise if:

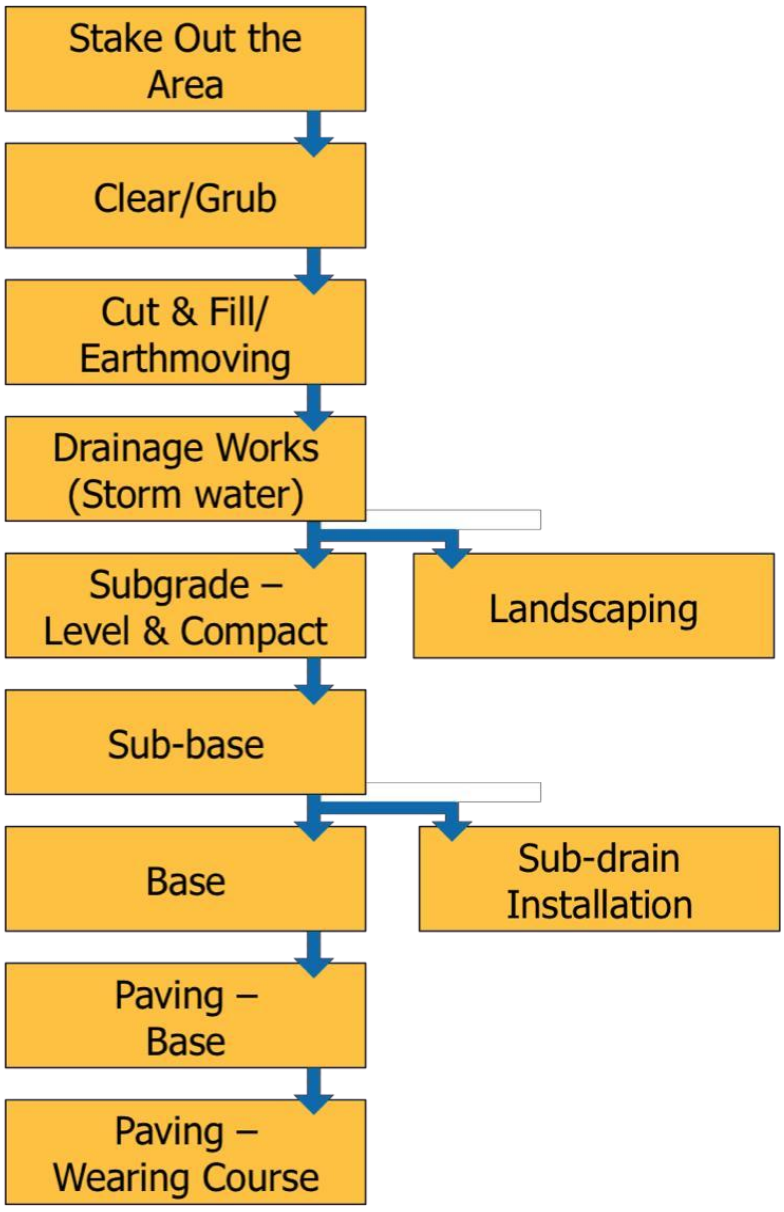


You need to take responsibility for your own activities to make sure that your assigned activities will be completed to the required standard, in the documented manner and within appropriate timeframes.

2.8 Civil construction sequences

Civil construction projects are made up of a range of smaller tasks or activities. It is important that these are done in the right order for the project to go smoothly.

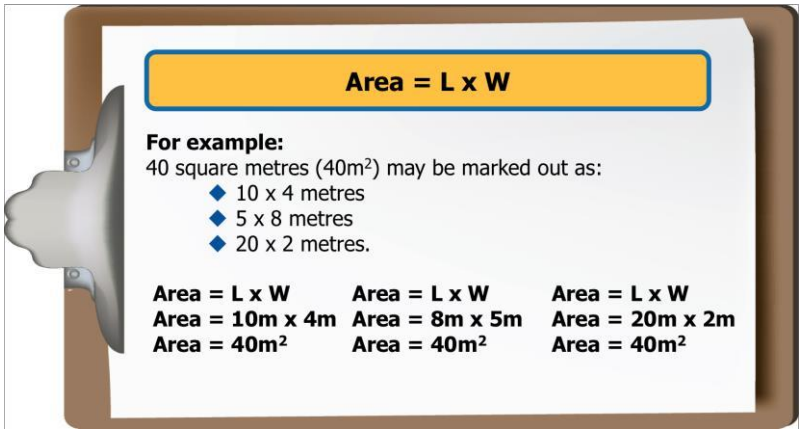
Here is a basic civil construction sequence from clearing the area through to preparing for road construction:



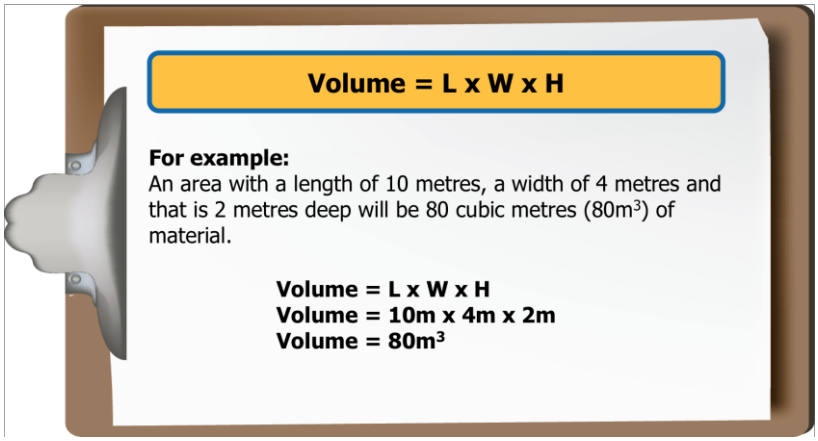
2.9 Earthworks calculations

As an excavator operator, the two main calculations you will need to be able to apply are for **Area** and **Volume**.

Area can be calculated using the following formula:



Volume can be calculated using the following formula:



2.10 Worksite Communications

It is important to coordinate your activities with other workers when you are planning for and carrying out the work to make sure everyone knows:

- The work being completed.
- How, when and where you will be operating.
- What they need to do.

All workers on site must understand their own role and the roles of others before starting work. It helps to make sure work is done safely and efficiently.

Workers you may need to coordinate with on site include:

- Supervisors and management.
- Plant and vehicle operators.
- Traffic controllers or other workers on the site.
- Team leaders.
- Site safety personnel.
- Processing plant operators.
- Maintenance workers.
- Crane and float operators.
- Contractors.
- Inspectors, both internal & external, including WHS, environmental and quality assurance officers.
- Site visitors.

You need to resolve any coordination requirements with all appropriate personnel before starting your work. This can be done by organising communications equipment, filling out documents and deciding on any special hand or whistle signals that will be used with other personnel.

Some communication methods may involve:

- Site meetings.
- Toolbox meetings.
- Team briefings.
- Notice boards.
- Policies, procedures and manuals.
- Work Methods Statements (WMS).
- Communications equipment, including:
  - Two-way radio.
  - Mobile phones.
  - Computers.
  - Landline phones.
  - Whistles, horns or bells.
  - Hand signals.
  - Flag signalling.
  - Verbal instructions.

If you are at all unsure about any aspects of communication on your worksite, re-read your work instructions or plans and speak with your supervisor.

2.11 Emergencies

Emergency procedures will vary depending upon the worksite. These procedures could include:

Emergency shutdown.
Evacuation.
First aid.
Firefighting.

Emergency Shutdown of Equipment

If there is a fire, emergency or accident you might need to use the emergency stop on the equipment you are using. This will turn the equipment off immediately. You can also use the emergency stop if the equipment stops working properly or you lose control of the equipment.

Evacuation

Things to remember are:

1. Keep calm.
2. Move away from the danger to a designated evacuation point, sometimes called an emergency assembly area.
3. Do not let other people into the area.
4. Call emergency services in accordance with workplace procedures and policies.

First Aid

First Aid is the quick care given to an injured or ill person. Every site will have a First Aid Officer. If somebody needs first aid you must tell your supervisor or First Aid Officer. Do not try to give first aid if you have not been trained.

Fire-Fighting Equipment

Fire-fighting equipment on site could be anything from small fire extinguishers through to large water cannons. Different fire-fighting equipment should be used for different types of fire. Always check the equipment for information on what type of fire it can be used on.

Steps for using a fire extinguisher:

1. Evacuate the area.
2. Isolate the area.
3. Call emergency services or other designated on-site procedure.
4. If it is safe to do so, use an extinguisher to attempt to control the fire using the **PASS** system.

P	**Pull the pin.**
A	**Aim at the base of the fire.**
S	**Squeeze the trigger.**
S	**Sweep the base of the fire.**

Contact your site emergency management team as soon as possible and call the fire brigade on **000**.

3. Identify and Manage Risks and Hazards

Before you start work, you need to check for any hazards or risks in the area.

A **Hazard** is a thing or situation with the potential to cause harm or damage.

A **Risk** is the chance of a hazard causing harm or damage.

If you find a hazard or risk, you need to do something to control it. By lowering or removing risks we can make hazards less dangerous. This will help to make the workplace safer.

3.1 Identify Hazards

Below are some hazards you should be aware of when using an excavator:

1. **Underground or Overhead Utilities:** Hitting buried services like gas lines, electrical cables, water mains, or fibre optics during digging, leading to explosions, electrocution, or major outages.

2. **Rollover:** Occurs when operating on Uneven, soft, slippery or unstable terrain or when swinging heavy loads uphill or across the machine's rated lifting capacity.

3. **Trench/Excavation Collapse:** The ground surrounding a trench or excavation may fail due to the weight and vibration of the excavator, causing the machine to fall in or entrench personnel.

4. **Slewing/Swing Impact:** The rotational movement of the cab and counterweight creates a large **crush zone**. This is a high risk for striking ground personnel, other vehicles, or fixed objects (like walls or power poles).

5. **Contact with Overhead Hazards:** Striking **overhead power lines, gantries, bridges, or tree limbs** with the boom or stick, leading to electrocution or structural damage.

6. **Load Dropping/Failure:** Exceeding the machine's **Safe Working Load (SWL)**, poor rigging, or attachment failure (like a quick hitch releasing unexpectedly) causing the load to drop.

7. **Blind Spots:** Large size and cab structure create significant **blind spots**, particularly to the rear and sides, increasing the risk of collision with workers or equipment.

8. **Ground Instability (Sinkage):** Operating on soft or saturated ground can cause the tracks to sink or the machine to become bogged, creating an unstable work platform and increasing rollover risk.

9. **Attachment Hazards:** Hazards specific to the attachment being used, such as **flying debris** from a hammer, or the potential for a **grab to drop material**.

10. **Hazards from components of the excavator:** High-pressure hoses, hydraulic fluid leaks can penetrate the skin, causing severe internal tissue damage and systemic health issues. Cooling systems or braking systems.
    ◆
11. **General Hazards:** Other workers or site visitors, Pedestrians and other public traffic, On-site vehicles, plant, equipment and machinery.

3.2 Working near power lines

Working near power lines can be very dangerous if you are not careful.

It is very important that you know the safe operating distances for different types of power lines and the steps you must take if your job needs you to work closer than the safe distances.

Generally, if you need to work closer than the safe work distance you must:

Contact the local electrical authority for permission to work closer (this is called an exemption).

Have the power lines shut off. If this is not possible then have the power lines insulated.

Use a spotter (depending on local laws and rules).

Distances are different depending on the voltage of the power lines and the state/territory you are working in. You should check with the local electrical authority for information and advice to find out the voltage of power lines in your work area.

NSW

In New South Wales, for anyone who is not accredited, equipment operation may not be any closer than the following distances to electric/power lines:

Electric/Power Line Type	**Distance**
Up to and including 132kV	3.0m
Above 132kV up to and including 330kV	6.0m
Above 330kV	8.0m

To work closer than these distances requires authority from the relevant electrical authority and adherence to cl.64(2)(e) of the regulations.

Tiger Tails

Tiger tails are used as a visual aid to identify the location of overhead power lines.

It is important to note that tiger tails **DO NOT** insulate the power lines so exclusion zones and safe operating distances must still be maintained, even when tiger tails are present.

Contact with Power Lines

If the excavator makes contact with live power lines you should:

1. Stay calm, remain in your seat, and warn others to keep away.
2. Try to break contact by lowering the bucket and get someone to switch off the power if possible.
3. If it is unsafe to stay in the machine, jump well clear and don't make contact with the ground and the machine at the same time.
4. Remain a safe distance from the machine and warn others to keep clear.
5. Have someone notify the supervisor, who should contact the appropriate electrical authority.

3.2 Assess Risks

Once you have identified the hazards on site or related to the work you will be doing you may be required to assess their risk level.

Risk levels are worked out by looking at 2 factors:

Consequence	How bad will it be if the hazard causes harm?
Likelihood	What is the chance of the hazard causing harm?

You can use a table like the one shown here to work out the risk level:

	Consequence				
Likelihood	**1. Insignificant**	**2. Minor** First Aid Required	**3. Moderate** Medical Attention and Time Off Work	**4. Major** Long Term Illness or Serious Injury	**5. Catastrophic** Kill or Cause Permanent Disability or Illness
1. Rare	Low	Low	Moderate	Moderate	Moderate
2. Unlikely	Low	Low	Moderate	Moderate	High
3. Possible	Low	Moderate	High	High	Extreme
4. Likely	Moderate	Moderate	High	High	Extreme
5. Almost Certain	Moderate	High	High	Extreme	Extreme

For example, a hazard that has a **Major** consequence and is **Almost Certain** to occur has a risk level of **Extreme**.

	Consequence				
Likelihood	**1. Insignificant**	**2. Minor** First Aid Required	**3. Moderate** Medical Attention and Time Off Work	**4. Major** Long Term Illness or Serious Injury	**5. Catastrophic** Kill or Cause Permanent Disability or Illness
1. Rare	Low	Low	Moderate	Moderate	Moderate
2. Unlikely	Low	Low	Moderate	Moderate	High
3. Possible	Low	Moderate	High	High	Extreme
4. Likely	Moderate	Moderate	High	High	Extreme
5. Almost Certain	Moderate	High	High	**Extreme**	Extreme

The risk level will help you to work out what kind of action needs to be taken, and how soon you need to act. The table below is an example of a site risk policy:

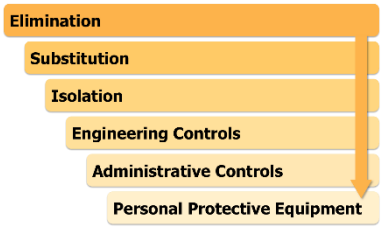
Risk Level	Action
Extreme	**This is an unacceptable risk level** The task, process or activity **must not proceed**.
High	**This is an unacceptable risk level** The proposed activity can only proceed, provided that: **1.** The risk level has been reduced to as low as reasonably practicable using the hierarchy of risk controls. **2.** The risk controls must include those identified in legislation, Australian Standards, Codes of Practice etc. **3.** The risk assessment has been reviewed and approved by the Supervisor. **4.** A Safe Working Procedure or Work Method Statement has been prepared. The supervisor must review and document the effectiveness of the implemented risk controls.
Moderate	**This is an unacceptable risk level** The proposed activity can only proceed, provided that: **1.** The risk level has been reduced to as low as reasonably practicable using the hierarchy of risk controls. **2.** The risk assessment has been reviewed and approved by the Supervisor. **3.** A Safe Working Procedure or Work Method Statement has been prepared.
Low	The proposed task or process needs to be managed by documented routine procedures, which must include application of the hierarchy of controls.

The action you take will depend on:

- The organisation's policies.
- The worksite's procedures.
- Relevant laws and regulations.

3.3 Control Hazards

The best way to control hazards is to use the Hierarchy of Hazard Control. The Hierarchy of Hazard Control is the name given to a range of control methods used to eliminate or control hazards and risks in the workplace.



You start at the top of the list and see if you can take away (eliminate) the hazard or danger.

If you can't take it away you move down the list to see if you can swap it for something safer (substitution).
Keep working through the list until you find something that controls that hazard or danger.

This table shows you the 6 different types of controls in order from best to worst:

Hierarchy Level	Action
1. Elimination	Completely remove the hazard. This is the best kind of hazard control.
2. Substitution	Swap a dangerous work method or situation for one that is less dangerous.
3. Isolation	Isolate or restrict access to the hazard.
4. Engineering Controls	Use equipment to lower the risk level.
5. Administrative Controls	Site rules and policies attempt to control a hazard.
6. Personal Protective Equipment	The least effective control. Use PPE while you carry out your work.

Hazard control measures need to be put in place before you start your work, or as soon as you see a hazard while you are doing your work. Hazard controls can sometimes be listed in your work instructions or you can ask your boss or supervisor for help.

Talk to the other workers in the area to make sure they are aware of the control measures you have put in place.

Once a hazard control is in place you will need to check to make sure it is working well to control the hazard or danger.

Talk to your supervisor or safety officer if you are not sure if it is safe enough to carry out your work. If you think the hazard is still too dangerous you should not try to do the work.

3.4 Personal Protective Equipment

Personal Protective Equipment (PPE) is clothing and equipment designed to lower the chance of you being hurt on the job. It is required to enter most work sites.

Personal Protective Equipment (PPE) necessary for operating an excavator is generally standard for a construction, mining, or civil infrastructure environment. The primary focus is on visibility, impact protection, and hearing protection.
The specific PPE required is always mandated by the site's Safety Management Plan, but typically includes:

Item	Purpose	Detail/Requirement
1. High-Visibility Clothing	**Visibility:** Ensures the operator is easily seen by ground crew, spotters, and other plant when mounting, dismounting, or walking on site.	Long sleeves and long pants (or high-vis vest/jacket worn over standard clothing), meeting relevant Australian standards (e.g., AS/NZS 4602.1).
2. Safety Footwear	**Foot Protection:** Protects against crushing injuries, slips, and punctures.	Steel-toe safety boots/shoes, often with puncture-resistant soles.
3. Hard Hat	**Head Protection:** Protects against falling debris or striking the head during pre-start checks, maintenance, or when the operator is outside the cab.	Must be worn when outside the enclosed cabin.
4. Safety Glasses	**Eye Protection:** Protects the eyes from dust, debris, and flying particles.	Should be worn at all times, especially when performing pre-start checks, refuelling, or interacting with materials outside the cab.
5. Hearing Protection	**Hearing Protection:** Mitigates the risk of long-term hearing loss from the machine's engine and hydraulic pump noise.	Earplugs or earmuffs, mandatory when outside the cabin, and often recommended inside the cab if noise levels are high or windows are open.
6. Work Gloves	**Hand Protection:** Required during pre-start checks, refuelling, and minor maintenance to protect hands from cuts, abrasion, grease, and hot components.	Durable work gloves suitable for mechanical handling.

3.5 Site Signage Requirements

In some cases you may need to isolate the work area. Set up barricades and dangerous signage to warn others that you are working in the area and that it is for them to come too close.

Signage requirements will differ depending upon the location of the site. Highway signage requirements are different from rural roads or footpaths.

Sites that could require signage may include:

Site Type	Signage Requirement
Urban Environments	All require signage but the number of signs will vary with the level of congestion or use. Low traffic or rural areas can have fewer signs than a major road.
Off-Road and Un-Trafficked Areas	Require isolation signage and restricted access signs.
High-Use Areas	Parking sites, pedestrian areas and buildings – signage could vary depending on the location.
Open Trenches	Any areas of open trenches should be signed and isolated from the public.

To control the movement of traffic around and through the site there are 2 different types of management plans:

Traffic Management Plan

Deals with traffic moving through the site, i.e. traffic on public roads and members of the public.

Vehicle Management Plan

Deals with on-site vehicle movements, haul circuits and dump runs, and material routes.

A Traffic Management Plan provides the details to safely manage traffic during the conduct of works on roads and normally includes:

- A traffic guidance scheme (diagrams).
- Worksite hazard assessment (such as a Work Method Statement).
- Details of the location, nature and duration of the works.

In the traffic or vehicle management plan, signs and the distances between signs will be listed. Reading the plans will show you where particular signs need to be placed.

Signs and barriers may include:

- Danger or warning signs like speed limits, ‘workmen ahead’ or ‘reduce speed’.
- Flashing lights.
- Barricades, fences and cones.
- Guide signs.
- Arrow boards.
- Bollards.
- Portable traffic lights and signals.
- Hazard markers.

General awareness of the ‘rules of the road’ on site will help ensure a safe working environment for everyone.

Included in the traffic and vehicle management plans are requirements for isolating the site to keep the general public out and keeping construction traffic away from pedestrians and other vehicles.

Plans for site isolation will detail the usage of barricades, fences, traffic controllers and police officers. They can also show how specific areas of the site will be isolated to keep the construction crews safe (generally done using concrete barriers).

Some worksites will also have specific areas for heavy vehicles to keep other site traffic away from particular zones.

If you have any concerns about the site traffic management plans and identifying or implementing the signage requirements, speak with your supervisor or the site traffic control officer.

3.6 Environmental Protection Requirements

Environmental protection requirements are part of every worksite. Make sure you check with your supervisor about what environmental issues need to be managed during your work. The requirements are used on worksites to ensure the minimum possible effects on the immediate work environment such as plants, animals and resources. They also cover more immediate physical issues such as noise, dust and vibration.

All environmental details should be listed in an ‘Environmental Management Plan’ for the site. It can include details for:

- Waste management.
- Water quality protection.
- Noise control.
- Vibration control.
- Dust management

The environmental management plan will outline the steps and processes needed to prevent or minimise damage to the environment through the use of machinery and equipment.

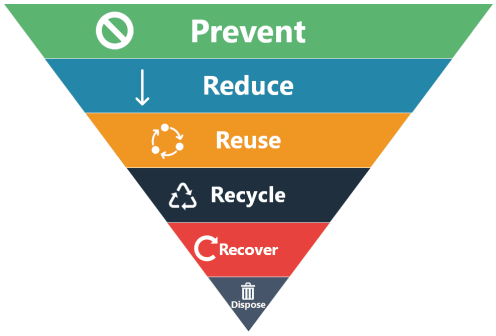
3.7 Waste Management

It is very important that water, air and land are protected from pollution sources. Steps must be taken to either protect the environment or restore it after work is done.

Waste and clean-up management procedures on site may include taking steps to use environmentally friendly materials (including recycled materials) and implementing methods of sorting waste into categories for recycling and correct disposal.

The plan will outline:

- Disposal of site waste materials and rubbish.
- Recycling waste materials.
- Re-use of waste materials.



On many sites you may also be required to re-use soils from excavations or re-vegetation works. This will reduce the amount of soil being wasted and the amount of new materials that may need to be ordered in.

3.8 Reporting Hazards and Environmental Issues

Any hazard or environmental issue that you identify will need to be reported. If you have taken any action, you will also need to report those details.

This could include written or verbal reports. Your worksite may have standard paperwork that needs to be filled out, for example:

- Hazard report forms.
- Work method statements.
- Other documents.

Your report may need to be given to a safety officer, your supervisor or a member of the management team.

3.9 Excavator characteristics and limitations

The two main differences between types of excavators are the size of the machine and whether it has wheels or tracks. The one you choose will depend on the work and the terrain to be worked in.

You should assess the ground conditions to decide whether you need an excavator with tracks or tyres. Tracks can provide more stability and traction on inclines, soft or boggy ground.

Check the operator's manual and manufacturer's specifications for information about:

- Load limits.
- Balance requirements with and without a loaded bucket.
- The limits on slopes that can be negotiated both loaded and unloaded.
- Manoeuvering capability, such as turning radius and stopping distances.
- Attachment use.
- Use of slings and guide ropes.
- Materials and handling requirements.

3.10 Choosing excavator attachments

There are a range of attachments and equipment that can be fitted to your excavator including:

Attachment	Description
Ripper/Tynes	For ripping the surface and loosening materials where needed.
Augers	Used for drilling holes.
Buckets	Excavating bucket, tilt bucket, rock bucket, trench bucket.
Lifting Devices	Slings, lifting gear.
Rock Breakers (Hydraulic Hammers)	For breaking rocks or concrete.
Vibrating Compaction Plate and Wheel	Used for compacting soil and other materials.
Other Approved Attachments	May include GPS for machine guidance, magnets, log grapples and blades.

When selecting an attachment, you have to work out if it is suitable for the tasks you need to complete by confirming:

- What the attachment is designed for.
- If it is an approved attachment that can be used with the excavator, you are operating.
- The manufacturer's requirements for the attachment.
- That you know how to use the attachment properly.

You will find this information in the operator's manual for the excavator and the operator's manual for the attachment.

3.11 Fitting and removing attachments

Once you have decided that the attachment is right, you need to attach it securely using approved attachment points and methods.

Each attachment will have its own requirements for how and where it is fitted on the excavator. You can find this information in the operator's manual or manufacturer's instructions.

Make sure you take appropriate safety precautions (such as releasing hydraulic pressures where needed) before fitting or removing attachments.

Generally, to fit an attachment:

1. Collect any required tools or equipment.
2. Make sure the excavator is safely parked and correctly located for attaching the equipment.
3. Follow manual handling procedures – attachments can be heavy and awkward to manipulate.
4. Connect the attachment using the manufacturer's guides and ensuring all connectors are correctly joined.

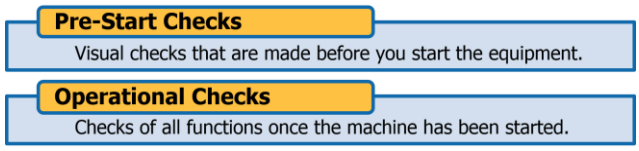
Generally, to remove an attachment:

1. Collect any required tools or equipment.
2. Ensure the excavator is safely parked and removal of the attachment will not cause a hazard.
3. Ensure any pressure couplings have the pressure released before detaching.
4. Disconnect connectors in correct order and using recommended safety procedures.

3.12 Check Plant, Tools and Equipment

Before you use any piece of equipment, you need to conduct routine checks to make sure it is safe to use. Check the equipment logbook before you start your inspection to see if there are any faults that still need to be fixed before you can use it.

Also make sure you are wearing the correct PPE before you start checking any machines or equipment.



Generally, routine checks are performed at the start of each day or shift. You can use an inspection checklist to keep a record of the checks you have made.

Plant and equipment items will need to be checked both before and after the item has been started. This involves:

Communication equipment should also be checked regularly to ensure it is in good working order.

Pre-Start Checks

Pre-start checks are done before the engine is started. Walk around the excavator and look for anything that is out of the ordinary. You should monitor all these during the day

Part or Component	What to Check
Structure	Check the general condition of the excavator. Check for oil or other fluid leaks. Check for any signs of visual weaknesses, damage, stressed welds or paint separation.
Tyres or Tracks	Check for mud, which may be thrown from the tyres and cause damage. Check the condition and air pressure of the tyres to make sure they are within the manufacturer's specifications. Check the condition and tension of tracks. Check that the track pin is centered over the track roller, and that track sag is within acceptable limits. The track tension should be adjusted if it is too loose. To check the tension of tracks, place a straight edge on the track from the roller to the drive wheel/cog and measure the distance from the edge down to the track. As a general rule, the allowable track sag is 2.5-3.8cm but you need to check the manufacturer's specifications for the excavator you are operating to be sure.
Bucket	Check the bucket for worn or broken components e.g. teeth, blade, bolts. Inspect the hydraulics and connections for wear and tear. Check the condition of the pivot pins.
Boom Arm	Make sure you check the arm for damage or defects but be careful not to put yourself in a position where you could be crushed if there is a malfunction. If you find excessive wear in the power arms and connections that make the excavator dangerous to operate, you need to inform your supervisor or an authorised person. Then isolate the excavator and don't use it until it is repaired.
Safety Pins	Check all pins and keeper plates are in place and any loose bolts are
Fluids and Lubrication	Check that the oils (engine, transmission, hydraulic) and fuel are at the right levels. Check that the water or other approved coolant is at the right level. Transmission fluid needs to be checked in accordance with the manufacturer's specifications. Check that parts are lubricated to ensure smooth operation.
Engine	Check condition and security of battery. Check electrolyte levels. Check for any obvious signs of damage or wear.
Hydraulic Rams and hoses	Hydraulic rams and pressure hoses are checked for splits, leaks, fractures, bulges and bent piston rods.
Decals and Signage	Check that all decals and signage are present on the machine. This includes the load chart, which must be clearly readable for the excavator to be used.
Windows	Check that the windows are clean, and you have good visibility from the operator's chair.
Cabin	Check that the seat and safety belt is in good condition. Check that the cabin is clean.
Service History and Logbook	Check the machine hour meter, manufacturer's recommendation and logbook to find out if the excavator needs to be serviced. You can also check the instruments or computer for this information on later models. For exact details on the components for the machine you are operating, check the operator's manual as different brands may have different requirements.

Operational Checks

Operational checks are made once the engine is started.

Climb into the excavator using 3 points of contact at all times (2 hands and 1 foot or 2 feet and 1 hand). This is the safest way to climb in and out of the excavator.

Adjust the seat until comfortable and make sure you have maximum visibility. Secure your safety belt.

Start up the excavator by following the manufacturer's instructions.

You will need to let the engine idle for the required amount of time. Depending upon the individual machine this idle time could range from 3 to 10 minutes.

Controls and functions that need to be checked and monitored on the excavator:

Part or Function	What to Check
All Controls	Test all arm and bucket movements.
Gauges and Instruments	Check that all instruments are displaying properly and are not signaling any alarms or warnings.
Safety Devices	Test all lights, alarms and other warning devices.
Attachments	Check that the attachment is secured and connected to the excavator properly. Check the condition of the attachment. Check that it works properly.
Travel, Turning and Brakes	Test all movements and brakes, including the emergency stopping device.
Ancillary Equipment	Test out all communications devices and any other systems or functions fitted, e.g. positioning instrumentation (GPS, auto levelling controls).

Once you have finished your operational checks it is a good idea to check for external signs of oil or fluid leaks. It is common for the start-up process to cause a leak through hoses breaking.

3.13 Check all faults

If faults are found with the plant, tools or equipment, it is necessary to report them to your worksite or maintenance supervisor.

This is so the fault can be recorded, and the item tagged or locked out until repaired.

Equipment that is faulty should be moved to an isolation area and tagged with an appropriate tag that meets the needs of the workplace. This is to ensure the fault does not cause an accident or injury to other workers. Damaged or defective items must not be used.

Record the details of the problem in a fault report or the equipment logbook.

Here are 10 common categories of faults that could be found on an excavator:

1. **Hydraulic Leaks:**
    - **Fault:** Visible drips, weeping, or continuous streams of hydraulic fluid from hoses, fittings, boom cylinders, or under the main pump housing.
    - **Consequence:** Loss of hydraulic function, environmental contamination, and fire risk.
2. **Abnormal Noise/Vibration:**
    - **Fault:** Excessive squealing, grinding, or loud knocking from the engine, swing mechanism, or final drives (tracks).
    - **Consequence:** Indicates worn bearings, failing gears, or an impending engine/pump seizure.
3. **Undercarriage Wear:**
    - **Fault:** Excessively worn or broken track pads, rollers, idlers, or drive sprockets. Tracks may be too loose or too tight.
    - **Consequence:** Loss of traction, poor stability, and risk of the track coming off (derailing).
4. **Boom/Stick/Bucket Pin Wear:**
    - **Fault:** Excessive play where the pins connect the bucket to the stick, the stick to the boom, or the boom to the chassis.
    - **Consequence:** Reduced digging accuracy, machine instability, and risk of the attachment completely failing/disconnecting.
5. **Cylinder Drift/Creep:**
    - **Fault:** The boom, stick, or bucket slowly drifts downward after the controls have been locked.
    - **Consequence:** Indicates failed internal seals within the hydraulic cylinders, compromising holding ability and precision.
6. **Engine Cooling Issues:**
    - **Fault:** Overheating, low coolant level, or a broken cooling fan belt.
    - **Consequence:** Engine shutdown, major engine damage, or head gasket failure.
7. **Electrical/Warning System Faults:**
    - **Fault:** Active Check Engine, Hydraulic Temp, or Low Oil Pressure warning lights or alarms
    - **Consequence:** Indicates a critical safety parameter has been exceeded; requires immediate diagnosis and shutdown.
8. **Slew (Swing) Brake Failure:**
    - **Fault:** The upper structure continues to drift or creep after the swing control is centred, or it swings freely without resistance.
    - **Consequence:** Loss of load control, making precise placement impossible, and serious risk of striking objects or personnel.
9. **Track Motor/Drive Failure:**
    - **Fault:** One track moves significantly slower or with less power than the other, or the final drive housing feels excessively hot.
    - **Consequence:** Difficulty tracking straight, poor manoeuvrability, and potential for complete loss of track function.
10. **Attachment Coupler Faults:**
    - **Fault:** The quick hitch mechanism does not fully lock, or the safety pin/lock is seized or broken.
    - **Consequence:** Risk of detaching during operation.

3 Operating an Excavator

During civil construction excavator operations you will need to:

- Assess the materials you are working with.
- Use the equipment safely within the technical specifications and limits.
- Use the equipment for tasks that it is specifically designed for.
- Continuously monitor and check for hazards.

It is important to coordinate your activities with other workers when you are planning and carrying out the work to make sure everyone knows:

The work being completed.
How, when and where you will be operating.
What they need to do.

All workers on site must understand their own role and the roles of others before starting work. It helps to make sure work is done safely and efficiently.

Workers you may need to coordinate with include:

Supervisors and management.
Other plant and vehicle operators.
Traffic controllers or other workers on site.
Team leaders.
Site safety personnel.

3.1 Assessing materials to be excavated

You will need to assess the materials you are working with to figure out the best way to handle it. For example, clay is more cohesive and harder to excavate than topsoil.

There may be different types of materials being handled at the worksite. They may include:

Material	Description
Clays and Mud	Clay and mud can tend to be dense and sticky and may not discharge cleanly if wet or damp. Sometimes, particularly with damp materials, the dump process may be longer than normal. Mud can purge from the excavator, rather than discharge smoothly.
Topsoil and Organic Materials	Generally, these types of materials are loose and will dump cleanly. As topsoil can be reused in re-vegetation activities, it will normally be dumped in a quarantine area to keep it free from contaminants. It may be necessary to clean down the machine before starting work in other areas or prior to hauling topsoil or organic matter to prevent contamination.
Stones, Rocks and Gravel	The operating techniques needed will depend on the type of type of rock, and the size of gravel and stones. For example: • Metamorphic rocks are heavy and hard. • Igneous rock is volcanic and can be hard but may also be very light. Igneous rock can be very abrasive and may cause damage to the excavator or wear down ripping points quickly. • Sedimentary rocks and shale could peel out when cut and removed.
Silts and Sands	Depending on the amount of moisture, silts and sands can move cleanly and easily or can be difficult because of the fine and sometimes crumbly nature of the materials.
Construction Site Materials	Construction site materials can be blended materials, bituminous mixes and waste materials. How these materials handle will depend on the properties of the materials and the environmental conditions such as the moisture levels. Knowing the material and how it reacts during operational activities is essential in order to complete required tasks efficiently and achieve optimum output.

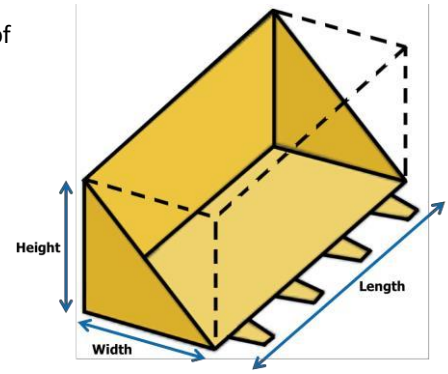
You will also need to assess the weight of the materials you are working with.

Material	Weight / Cubic Metre	Material	Weight / Cubic Metre
Bronze	8.5 t	**Lead**	11.4 t
Clay	1.9 t	**Lime (stone)**	2.6 t
Coal	864 kg	**Sand, beach, dry**	2.0 t
Concrete	2.4 t	**Sand, beach, wet**	2.3 t
Earth	1.9 t	**Sand, river, wet**	1.5 t
Granite	2.6 t	**Shale**	2.6 t
Gypsum	2.3 t	**Terracotta**	1.8 t
Iron Ore	5.4 t	**Zinc**	7.0 t

Think about the size of the bucket you are using and work out the weight of the load.

To work out the volume that the bucket can hold multiply the height (H), width (W) and length (L), then divide it by 2:

$$\frac{L \times W \times H}{2}$$



Checking the weight of the materials against the manufacturer's specifications, delivery dockets, weighbridge dockets or in some cases marked on the load, to make sure you don't overload the excavator. Keep in mind that uneven, rough, boggy or sloping ground can all reduce the amount or material that the excavator can safely carry.

3.2 Soil technology

Characteristics of the materials being moved or loaded will affect your work.

You need to understand the basics of soils, clays and other materials so you are able to:

- Know how to best respond to them and handle them.
- Achieve the best outcomes in your work.
- Calculate load amounts.
- Understand conditions for moving the materials.

3.3 Safe operating techniques

To make sure your work is done in a safe way it is important to follow some basic safe operating techniques.

Make sure the excavator is suitable for the ground conditions and that the bucket is suitable to the task.

Keep clear of holes or soft ground areas. Be careful when driving along the high side of a trench as it could cave in.

Keep in constant communication with other personnel throughout your excavator operations. Continuously monitor and check for hazards and warn other workers if there is danger.

Report your progress on a regular basis to your supervisor and modify your work to meet any new project or quality requirements or changing conditions.

The operator's manual will outline the limitations of the excavator you are using. This will include information about:

Safe operating speeds and techniques
Safe travel speeds.

Excavator operators will usually use the following techniques to complete civil construction tasks:

Excavating or loading materials.
Dumping materials.
Levelling materials.
Stockpiling materials.
Backfilling.
Battering and benching.
Site clean-up.
Other excavator tasks, e.g. mixing materials, cut and fill, pipe laying.

Safe Operating Speeds

While operating the excavator make sure movements are smooth, not jerky, and that you operate the excavator at a safe speed.

Operating the excavator too fast can cause instability.

Safe Travel Speeds

Going too fast will reduce the stability and control of the excavator, as well as putting yourself and other workers in the area in danger.

Your speed may be affected by a range of factors including:
The age of the machine.
The work environment.
Ground conditions.
Attachments fitted.
Visibility.
Site rules, policies and procedures.
The amount of traffic, other vehicles or obstructions in the area.

3.4 Using attachments

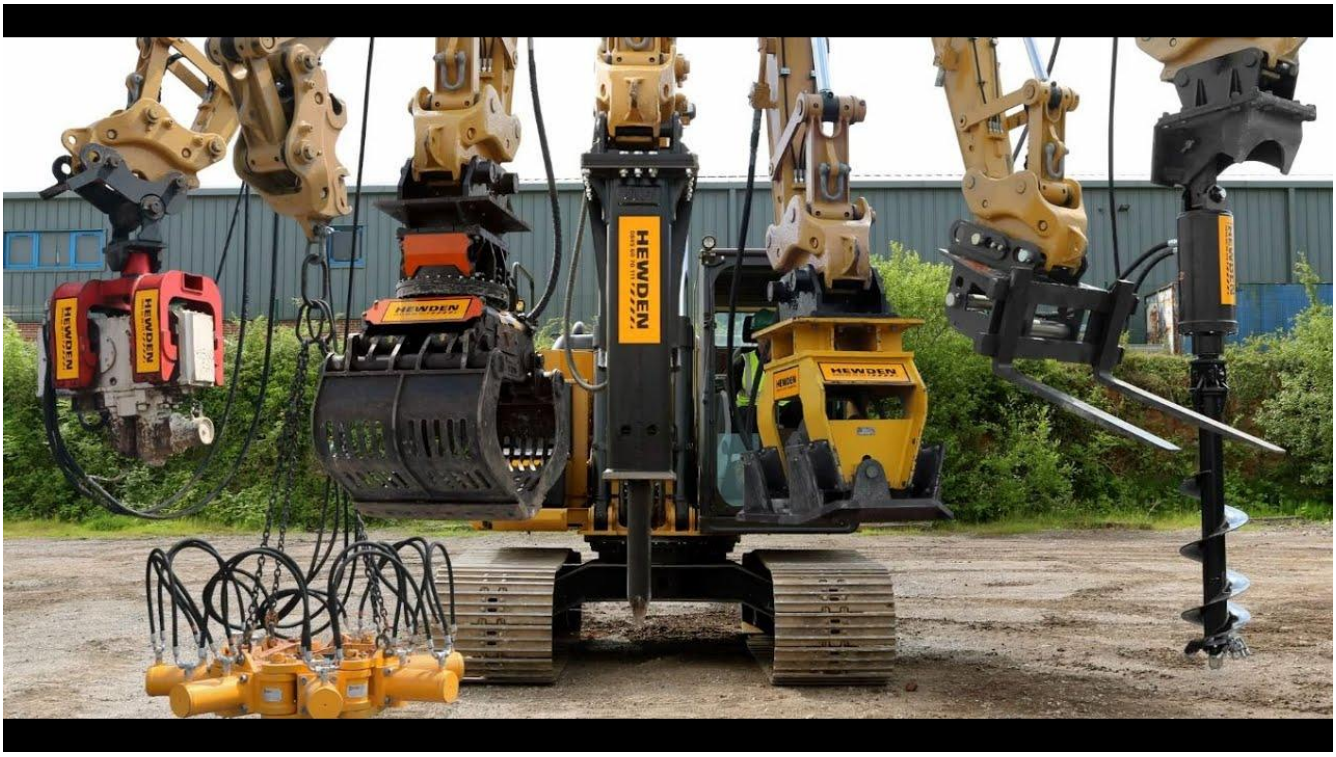
You need to know and understand the operational limits of the equipment you are using to make sure you don't damage it or put yourself in danger.

Each attachment has been designed to do a specific type of work, for a specific type or range of materials. Do not ever use an attachment for any job other than the one it is designed for.

Make sure you have enough room to operate the attachment safely without putting other workers in danger.

Keep all operations within the limits and capabilities of the equipment. You could damage the attachment if you push it too hard.

After you have finished using the attachment, check your work to make sure it matches the plan.



3.5 Excavating or loading material

When using the excavator for civil construction work make sure you work safely and follow the work plan, including:

Checking for underground services (power, telephone, gas, water, sewer, drainage and fibre optic cable lines) before starting to excavate.
Talking to the site supervisor, dial before you dig and engineers have contact with the supply authorities for council maps of the site.

Checking state or territory standards for safe operating distances from power lines.

Using barricades, guard rails or fencing and warning signs to prevent workers falling into a trench or vehicles and machines getting too close. No workers should be standing within operating radius of the excavator while you work.

If you are excavating a trench, deposit full buckets of material away from the trench. Loads should be placed at least 1m away with material coming to rest no closer than 0.5m from the excavation.

While you are excavating you need to check for signs that you are getting close to a previous excavation or an underground service. If you notice any of the following signs, stop operating immediately and hand dig to investigate:

Crushed blue metal or plastic tape.
Clean sand or sandbags.
Broken tiles.
Moisture.
Any other unusual material.

If cutting a trench across a footpath:

Gather information and permits from relevant authorities who may run services under the footpath.
Excavate slowly towards any underground services
Set barricades and signs to isolate the area.

3.6 Dumping material into trucks

When dumping material into a truck:

- Approach the truck slowly or wait until it is correctly positioned.
- Make sure you know where the driver is at all times.
- Make sure the turntable is level when slewing to prevent the machine from overturning.
- Place a layer of soil in the truck to take the impact of large rocks.
- Never slew a load over the cabin of the truck as the bucket could hit the cabin or load could drop onto the cabin.
- Be careful of large boulders tipping out of the bucket onto the truck.
- Make sure anyone in the area is at a safe distance from loading operations and that they stay within your view.

3.7 Levelling

Levelling materials can be done using the bucket or using a dozer blade fitted to the excavator.
When levelling, work to the designated grade, slope and fall (for water to run off). In many cases GPS and laser control systems are now used to provide a more accurate finish to the work. This eliminates the need to have a person standing close by, ready to take levels although this may still need to occur with some works.

Levelling equipment needs to be calibrated regularly and checked against site reference points such as pegs, benchmark points or other defined levels.

3.8 Stockpiling

Excavators are used to either create stockpiles by placing materials into the pile or to empty a stockpile by removing materials.

Do not undercut a bank or stockpile, as it could collapse and cause the excavator to overturn and trap the operator underneath.

3.9 Backfilling

The excavator can be used to backfill trenches or small excavations after work has been completed.
When backfilling make sure that you do two things:

- Check that the right materials are deposited into the excavation.
- Check that the right level of compaction is achieved.

Loose materials in a trench or excavation can settle over time and sink down. Make sure there is enough material packed into the trench to keep the ground even after the work is completed.

3.10 Battering and Benching

Batters are the slopes to the side of constructed works – these could be cuttings or embankments.

Benches are steps that are dug into the materials to provide flat areas for safe working on slopes, or raising the equipment up to assist with excavating and loading materials.

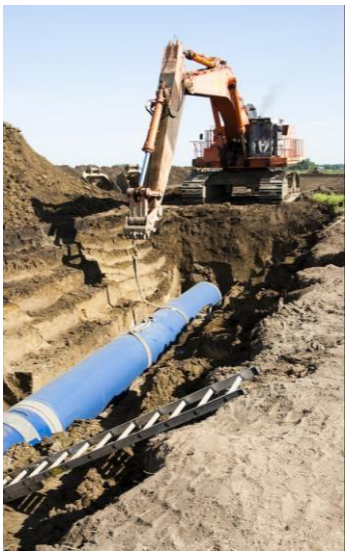
Excavations deeper than 1.5m that workers need to enter or that are likely to collapse due to the material will require you to bench or batter the sides. Then trench shields can be lowered into position before workers enter the excavation.

3.11 Site clean up

Excavators are useful for cleaning up worksites after major works have been completed or preparing sites for other work.

Site clean-up includes removing unwanted materials from the area. You may need to stockpile them for later use, or deposit them in an area where they can be removed from the site.

3.12 Other excavator tasks



Excavators can also be used for:

Mixing Materials – excavators can be used to do this as they have a large bucket and are able to move large amounts of materials quickly.

Cutting and Boxing – this involves cutting or removal of material above a required level i.e. cutting down to create a floor or design level. Boxing is the technique of removing materials below a level and may involve trenching, or removing sections of pavement in a "box" type shape to a desired level.

Pipe Laying – this is completed after trenching. A pipe laying attachment could be used if necessary.

Cut and Fill – this involves removing (cutting out) materials and replacing them (filling in the hole).

Landscaping – These tasks include removal of trees and other obstacles and ripping of the ground. It may also include stripping or spreading of topsoil or other materials and compacting materials.

3.13 Adjust Techniques to Meet Changing Conditions

While you are working and moving materials, the site will change.

Lighting Changes – Twilight is the time when your eyes might become more tired and difficult to focus. It could be more difficult to see the terrain and to judge distances. Set up temporary lighting where possible and go slowly.

Weather Conditions – Rain, sleet, snow, wind and humidity can all affect both your excavator and the materials you are working with. Additional moisture from any source will change the composition of the materials, possibly making them heavier and slippery. This means you will not be able to lift or haul as much and you will need to adjust the quantities you are dealing with in each load.

Changing Work Conditions – As more materials are moved around or removed from a site the work conditions may change. Materials that you are working with can change throughout a project. As you excavate deeper or move onto other stages of the civil construction project you will be working with different materials, attachments and personnel.

4. Lift, carry and place loads using slings and lifting hear

In civil construction projects you may need to use the excavator to lift and carry loads using slings and lifting gear for example lowering pipes into trenches.

It is important that this work is conducted in coordination with authorised personnel such as a licensed dogger or rigger.

4.1 Determine the Weight of the Load

You need to coordinate with authorised personnel to work out the weight of the load to make sure your excavator can safely lift it without damaging the equipment, attachment or making it unstable.

The weight of the load can be found in a number of ways:

- Check for weight markings on the load.
- Check delivery dockets or information sheet
- Check the weighbridge certificate.
- Calculate the weight of the load or material

.

If you cannot be sure of the weight and cannot calculate it, do not lift the load.

To ensure a safe, secure lift ensure you have the correct lifting gear, you have set up exclusion zones, the ground is level and you have open lines of communication

Once you know the weight of the load you need to make sure the excavator you are using has the capacity to lift it safely. You can check the capacity of the excavator in the operator's manual or manufacturer's specifications.

If you are using an attachment to lift the load you need to check that it is also rated to be able to lift the load. Keep in mind that using an attachment may also reduce the overall capacity of the excavator.

Pass on any information about machine and equipment capacity to the person slinging the load.

Check the Excavator Load Chart

Always check the excavator load chart to make sure that any load that is lifted is within the capacity of the excavator.

EXCAVATOR LOAD CHART										
22 Tonne Excavator fitted with a 3.05m long arm, 1m³ bucket and 600mm shoes										
Radius	**Max Reach**		**7.6m**		**6.1m**		**4.6m**		**3.0m**	
Hook Height	**Front**	**Side**	**Front**	**Side**	**Front**	**Side**	**Front**	**Side**	**Front**	**Side**
6.1m	*3100	*3100	*3450	*3250						
4.6m	*3150	2650	*3950	3250	*4100	*4100				
3.0m	*3300	2400	*4450	3050	*5050	4500	*6450	*6450	*10750	*10750
1.5m	3550	2300	4550	2950	*6050	4200	*8300	*6450	*5450	*5450
0m	3600	2300	4450	2850	6200	4000	*9650	6050	*6900	*6900
-1.5m	3900	2500	4350	2750	6100	3850	*9650	5900	*10200	*10200
-3.0m	4654	2950			6100	3900	9650	6000	*14900	12300
-4.6m	6650	4250					9200	6100	*13800	12700

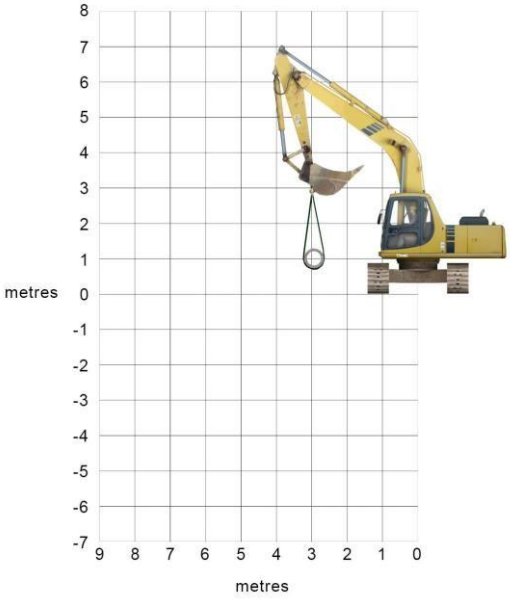
The ratings are based on 75% of tipping load, stationary on firm level ground as per AS 1418.5.

* The ratings do not exceed 87% of hydraulic lifting capacity or 75% of tipping load.

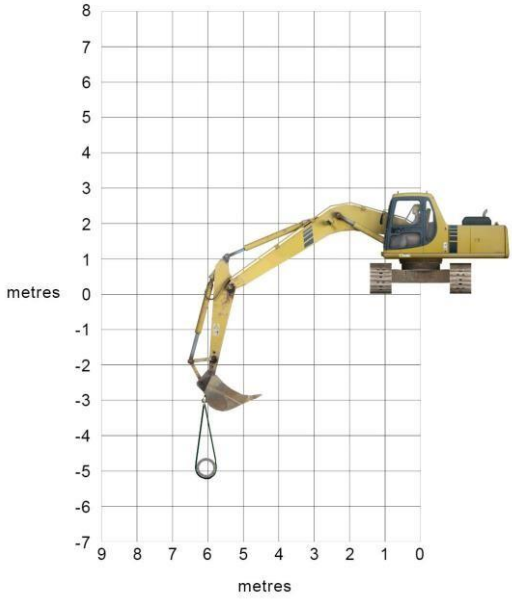
For "pick and carry loads" on firm level ground the load shall not be greater than 66.7% of tipping load as per AS 1418.5 or 88.9% of the Safe Working Load (SWL).

Where ground is sloping, rough or not firm, the load must be dramatically reduced.

For example:

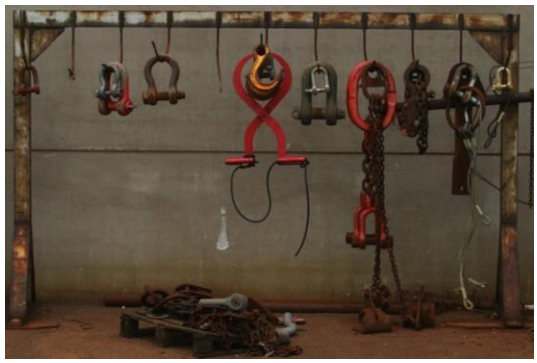


At a radius of 3.0 metres and a hook height of 3.0 metres the Safe Working Load would be 10,750kg when hoisted over the side.



At a radius of 6.1 metres and a hook height of (minus) -3.0 metres the Safe Working Load would be 3,900kg when hoisted over the side.

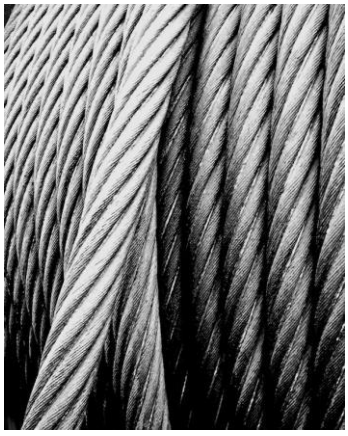
4.2 Choose Lifting Gear



When using the excavator for lifting, make sure it is fitted with the correct lifting attachment or that the machine has the appropriate lifting lugs. Always use an approved lifting lug or lift connection that is clearly marked with the Safe Working Load (SWL).

Lifting gear needs to be selected based on the type, size, weight and shape of the load to be lifted. Only a licensed dogger or rigger is authorised to select and inspect lifting gear, determine the weight of loads and select and apply slinging techniques.

Types of Lifting Gear



Lifting gear that may be used with the excavator includes:

Wire rope slings – also known as Flexible Steel Wire Rope (FSWR).
Chain slings.
Synthetic slings.
Eye bolts, shackles and hooks – used to attach lifting gear to the load and excavator.

Each piece of lifting gear is rated to a specific capacity known as a Working Load Limit (WLL). This WLL can change depending on how the lifting gear is connected and arranged. This is why a licensed dogger or rigger needs to decide what lifting gear is being used and how it will be used.

4.3 Inspect and Connect Lifting Gear

Slings and other lifting gear must be inspected before and after use for any signs of damage or wear. All faults must be reported in accordance with site procedures and the equipment must be isolated (removed from service).

Once the correct attachment and lifting gear has been chosen and inspected by a licensed dogger or rigger, you need to make sure it is connected to the excavator properly. Slings should only be attached to manufacturer approved lifting lugs using a shackle that is rated to lift the load.

Remember: Only a licensed dogger or rigger can select, inspect and apply slinging techniques and determine the weight of loads. You may only participate in these activities under the direct guidance of a qualified dogger or rigger.

4.4 Positioning the Excavator

Before lifting a load with slings you need to get the excavator into the right position. Make sure:

- The excavator is on firm level ground.
- The load, excavator and lifting gear can all be safely accessed.
- Personnel, plant and equipment not directly involved are a safe distance away.
- You have enough overhead clearance to lift the load.
- You have enough room to move once you have lifted the load.
- The excavator is in line with the load so it will not swing when it is lifted.

4.5 Lifting Techniques

Follow these guidelines whenever using the excavator to shift a load using slings and lifting gear:

Operating Techniques for Lifting Loads	
Follow directions from the dogger to position the lifting point over the centre of gravity of the load to keep the load from swinging.	☐
When you are given the signal perform a test lift then lower the load again so that any changes to the slings and load can be made.	☐
Keep all movements smooth and slow.	☐
Stop the lift immediately if the weight of the load causes the machine to tilt or if the hydraulics begin to strain.	☐
Check the hydraulic hoses and rams before and after lifting to make sure no damage has been done to the equipment.	☐
Materials should be moved shortest distance possible to maintain effective and efficient control of the machine and the load.	☐
Constantly monitor the load during the move.	☐
Keep the load as low as safe and practical if travelling with the load.	☐
Monitor your speed of travel and stay within safe speed limits.	☐
Maintain a safe distance from exposed edges.	☐
Follow all hand signals or other designated signals.	☐
If the slings shift on the load being lifted stop the excavator, warn workers in the area, carefully lower the load and have the slings re-positioned and secured.	☐
Make sure that if lowering objects such as pipes into trenches that the trench is shored and workers are standing a safe distance away.	☐
Land the load at the designated location. Ensure that it is secure and stable.	☐
Make sure lifting equipment is properly detached before moving off.	☐

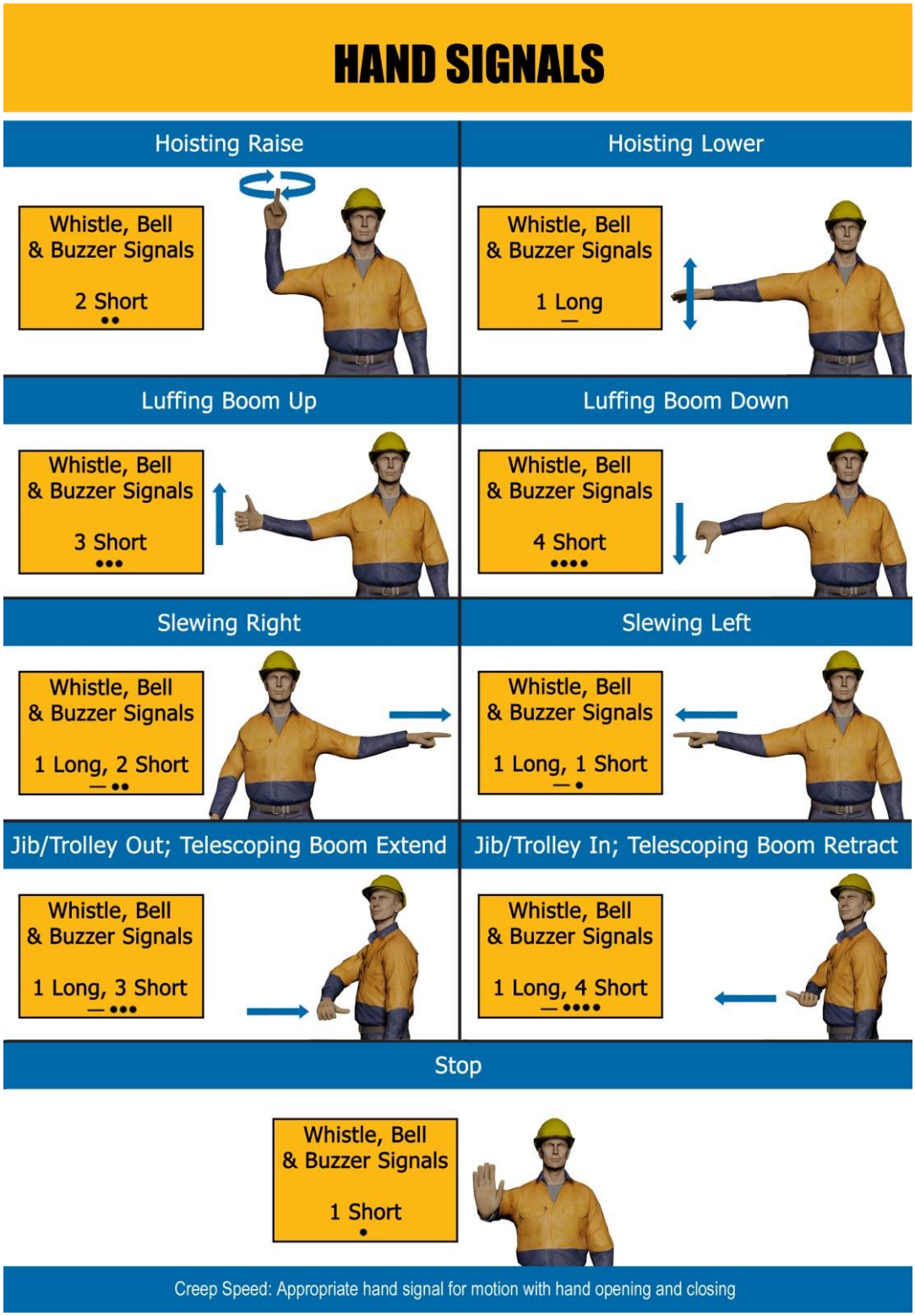
4.6 Communicating When Moving and Lifting Loads

Communicating when transporting and lifting loads may involve communication equipment such as two-way radios. Whistles, bells or other devices may also be used as audible signals to assist with movement of loads. Communications can include; where the load is going, what the load is and what risks or hazards could be encountered.

There are also specific hand signals that apply to the lifting and movement of loads. Hand and audible signals are designed to make the lifting and placement of objects safer and more effective.

Make sure you confirm all signals with the dogger who is directing you before you start to shift the load. Make sure you follow all directions given to you by the person who is directing the lift.

Shown here are the hand and audible signals used in Australia:



4.7 Monitor and Check for Hazards

While you work it is important to always be on the lookout for new hazards, and to check that hazard controls are still in place and working effectively. This will help to ensure the safety of yourself, other personnel, plant and equipment.

Check the following things while you work:

Overhead Power Lines, Structures and Clearances – Know how far you are from overhead power lines at all times. Use a spotter to guide you if you cannot clearly see. Be aware that the distance to the overhead services may be reduced as ground conditions change or stockpiles are created. You also need to be aware of overhead clearances when dumping materials into trucks or other haulage units.

Other Machines – At all times you need to know when other machines are working near the excavator. Good communication between operators is essential to avoid collisions.

Live Stockpiles – Movement of materials in a live stockpile is likely. There is always the potential for the walls of a stockpile to collapse if it is incorrectly excavated.

Personnel – Good communication is the key to working with other personnel. Be aware of people in work area. Make sure they are not in danger and are a safe distance from the excavator. If you are authorised, tell them to leave if they shouldn't be there, or call on someone who is authorised.

Operator Fatigue – Fatigue is one of the leading causes of accidents for operators of all types of vehicles and equipment.

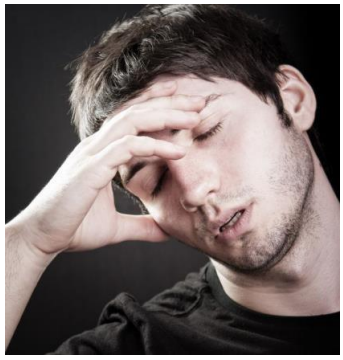
FATIGUE CAN BE CAUSED BY:

Warning signs that you are suffering fatigue include:

Physical	➢ Slow reaction time. ➢ Tiredness, yawning or sore eyes. ➢ Headaches, stomach or other problems.
Mental	◆ ➢ Trouble concentrating and thinking clearly. ➢ Shorter than normal attention span. ➢ Boredom, irritability or lack of motivation.
Work	◆ ➢ Poor or careless performance. ➢ Overlooking minor but potentially important details. ➢ Lower levels of communication and cooperation with others.

It is very important that fatigue is managed properly. Here are some ways you can manage fatigue:

- Get enough sleep.
- Drink plenty of water.
- Take regular breaks.
- Keep a healthy diet.
- Keep a reasonable level of fitness.



Talk to your boss or supervisor about breaking up boring or monotonous tasks or rotating the work you are doing with other workers if possible.

4.8 Reporting Hazards

Any hazard or environmental issue that you identify during your work will need to be reported. If you have taken any action you will also need to report those details. This could include written or verbal reports.

- Hazard report forms.
- Work method statements.
- Other reports or documents.

5. Park, shut down & prepare for relocation

Every piece of machinery has slightly different park and shutdown procedures. For the exact procedure for the machine
you are operating, check the operator's manual.

5.1 Parking the Excavator

Your excavator needs to be parked in a safe way that will allow easy access to the vehicle. Safe parking practices include:

- Stop the excavator on a flat level surface in the designated area and keep the access points clear.
- Park the excavator away from overhangs, excavations, access ways and tidal or flood areas.
- If the excavator must be parked on a sloping surface it should be facing across the slope.
- Keep the excavator away from refuelling sites and areas when parking or you can block the rest of the machines on the site from accessing fuel.
- Apply all locks and brakes.
- Move all attachments into the shutdown position and release any pressure from the lines.

If the excavator has to be parked on a public access way, lights, signs and barricades should be erected to warn people.

5.2 Shutting Down the Excavator

Shutdown procedures include:

Cooling of the engine before shutting it down. This depends on the excavator but is usually the same amount of time as the engine warm up time.

Monitoring the controlled lowering of temperatures and pressures.

Walking around the machine looking for any signs of damage or faults that may have occurred during the task.

Securing the excavator using any applicable lock out or isolation devices and removing the keys. This will prevent any unauthorised movement of the excavator.

Making sure equipment is correctly stowed in accordance with site and manufacturer's requirements.
Any problems found during the shutdown procedures need to be documented in the way required by the worksite.

5.3 Post-Operational Checks

Post-operational checks need to be done to make sure the excavator is ready for the next operator.

As part of your job as an excavator operator, you need to inspect your machine to find and report any faults or damage that may have occurred during your work activities.

Your inspection should include:

Visual Inspection
Physically looking for anything odd, wrong, broken or damaged.

Visual Inspection of the Environment
Is any fluid leaking?

Signals
Alarms, lights, electronic indicators showing that something may be wrong.

Gauges
Showing temperatures and the levels of fuel, oil and other fluids.

Post-operational checks should include all of the things you look for when conducting pre-start checks.

For example:

Fluid levels.
Condition of tracks or tyres.
Visibility (windows and mirrors).
Hydraulics (rams, hoses and connections).
Structure and attachments for damage or wear.

5.4 Reporting Faults

Once a fault has been found, it needs to be reported and fixed.

Most sites have a fault report form – out of service tag - that will need to filled in with the details. The form will generally need the machinery or equipment make and model numbers, the site identification numbers, the type of fault and the person reporting the fault.

You also need to make sure the excavator is tagged out (isolated from use) until the repairs have been made.

Some sites will have a verbal system of reporting where you speak with a supervisor who then documents the fault, while others may require the operator to organise repairs of the fault directly.

5.5 Relocate the Excavator

The excavator will need to be prepared before it can be moved from site to site. Some issues in moving the excavator to another worksite may include:

Cross-contamination between sites.

Hazards from loose or detached parts.

Movement of the excavator in transit.

Before relocating the excavator, you may need to do some or all of the following things:

Clean the excavator thoroughly.
Clean any attachments going with the excavator.
Empty the fuel tank (if practical).
Secure all moving parts.
Remove and store any attachments going to the new site.
Make sure all connectors are secure and locked.
If possible, lower the bucket to rest position and lock it into place or remove the bucket if needed.

5.6 Moving an Excavator from Site to Site

Excavators can be moved on special trailers or on the back of a truck.
Any transport must comply with:

Codes of practice.

Traffic management requirements.

Site regulations.

Traffic codes and road rules.

Be careful when loading the excavator onto the transport and use a spotter to help guide the excavator up the correct ramps. Parking on firm level ground is advised for loading and unloading. Once on board the excavator must be securely locked down to prevent any movement.

6. Clean and carry out routine maintenance

It may not be practical to clean the excavator after every use but you should clean it as thoroughly as often as possible. Mud and other contaminants left for long periods will eventually damage the machine.

Cleaning is also a good way to do an even closer inspection of the excavator, and may highlight issues you didn't see during the walk-around inspections.

Cleaning will need to be done in a designated area to avoid any negative impact on the environment or contamination of the site.

6.1 Carry Out Maintenance Tasks

Before carrying out any routine maintenance and minor repairs make sure you have all of the tools and equipment you will need to finish the job.

When conducting maintenance activities, it is important to keep people in the area safe by using barricades or fences if necessary and locking out machines.

Tasks should be completed within designated areas and others should be informed of what you are doing.

You should conduct servicing, maintenance and housekeeping tasks to ensure the excavator stays at its operating capacity for as long possible.

Maintenance activities could include:

- Air filters – should be checked daily in dusty conditions.
- Clean or replace them as necessary.
- Greasing or lubricating attachments.
- Checking bucket teeth and replacing them as needed.
- Battery checks – clean the battery, check electrolyte levels.
- Fuel and other fluids – check and maintain levels.
- Refuelling.
- Recording and reporting of faults through workplace procedures.

You will also need to coordinate with mechanics, maintenance supervisors or other site workers to ensure the vehicle is serviced at regular programmed intervals.

6.2 Vehicle Refuelling Procedures

All refuelling of equipment needs to be done in line with safety procedures and workplace instructions.

Some sites may have refuelling areas for plant and machinery set up to make sure any spills or incidents can be contained without causing damage to the environment. Spill response procedures need to be clear and spill kits available to manage any incident.

Other sites use a service truck or fuel tanker that travels to each machine to refuel. On these sites it is very important that all procedures are followed to avoid any incidents (such as fires in a coal mine environment) or damage to the environment. For example, there may be site rules against refuelling plant and equipment near a waterway or sensitive area.

Refuelling can be a dangerous activity, so it is important that you know and understand the correct procedures and techniques. If you are not sure what to do, speak with your supervisor.

These are some general guidelines for refuelling plant and equipment.

Always check the procedure for your worksite before any refuelling is done.

Park the machine in an appropriate location or within a bunded area. This contains any environmentally sensitive fluids or spills from entering and causing damage to the environment.

Shut down the machine and apply all brakes and isolations.

Leave the cabin, or if company procedures do not allow this make sure you do not restart the machine until you have permission from the refuelling operator.

If you are responsible for refuelling the machine, make sure you have the right PPE on before you start. This may include safety glasses, face shields, gloves or other approved gear.

Activate the fuel pump correctly and make sure all safety procedures are followed.

Shut down the fuel pump once the machine has been refuelled.

Roll up or safely tidy all fuel lines or hoses.

7. Conduct housekeeping activities

Once all your tasks are finished, you will need to clean up the site and conduct housekeeping activities associated with Excavator Operations. This includes removing any tools, equipment and excess materials that have been used.

7.1 Processing Maintenance Records

Most sites have workplace forms, logbooks or checklists for writing down details of all machine maintenance work.

They are used to record the history of the machinery and equipment so that all operations and any problems can be monitored.

They are also a way of making sure that all repairs and maintenance are done correctly and on time.

Written maintenance records for your excavator may include:

- Inspection checklists.
- Fault reports.
- Fuel, oil, hydraulic and other fluid usage.
- Computer readings of various excavator functions.
- Diary entries.
- Service manuals or logbooks.
- Repair request forms.
- Part requisition forms.

You will usually need to include details like the excavator make and model number, site identification numbers, the type of maintenance carried out, the repairs or replacements that were done and the person who did the work.

Follow your site record keeping and reporting procedures. If in doubt about completing and processing written maintenance records, talk to your supervisor or an experienced worker.

7.2 Clean Up After Work

Once all your excavator tasks are finished, you will need to clean up the site. This includes removing any tools and equipment that have been used.

7.3 Clearing the Work Area

In clearing your work area you will be carrying out housekeeping activities. Housekeeping procedures on your site may include:

- **Eliminating or controlling any potential hazards.** Your duty of care means you shouldn't leave a possible source of danger or accident for others.
- **Using the correct PPE.** Make sure you use appropriate PPE when dealing with waste or possible hazardous materials as you clear up. For example, chemicals used for cleaning can be dangerous unless used correctly.
- **Removing any hazard controls that are no longer needed,** e.g. temporary fences, barricades and signage.

- **Recycling or disposing of materials to carry out site clean-up tasks,** e.g. construction materials, stockpiled materials, stones, rocks, gravel and bituminous mixes, paper and site rubbish. Put any waste materials in the bins provided, and recycle where possible, in line with the site plans for environmental management or waste disposal.
- **Packing up, maintaining and storing plant, equipment and tools.**

Good housekeeping will help you to see any problems or hazards on the worksite. This will help you to make sure the working environment is safe.
It is your responsibility to clean up after your work activities and not leave it to someone else to do.

It is your responsibility to clean up after your work activities and not leave it to someone else to do.

7.4 Cleaning and Storing Attachments

Once the attachment has been removed it should be cleaned, inspected for wear or damage and maintained and stored according to the manufacturer's instructions and site requirements. This will help to make sure that they are kept in good working order.

While you are cleaning attachments, check each item for damage, wear and tear or defects. If anything is wrong report it, repair it, or have it fixed by a qualified person.

Most equipment will have specified storage areas and requirements so make sure you know where and what these are before you detach heavy attachments. This will allow you to offload the attachment where it is meant to be and minimise heavy lifting or handling.

Be careful when you are cleaning and maintaining attachments. They may be sharp or hot so make sure you are wearing PPE whenever handling them.

7.5 Process Written Records

Site record keeping procedures keep the site and running smoothly. Part of your role will include completing and processing records for your excavator and the tasks that you have completed.

As well as the maintenance records you have filled in, some other records, reports and paperwork that may be needed include:

Logs – supply logs, work activity logs, training logs, usage or driver logs. Shift

documents – end of shift, end of process.

Fault reports.

Hazard reports.

Incident reports – accident forms, incident reports or environmental incident reports.

It is important that you keep detailed records of all your activities, especially any problems you had during your shift.

Make sure you keep notes about what happened and what you did to fix it. This includes faulty or broken equipment, operational issues (mistakes or not following procedures correctly for some reason) and any other unusual things.

7.6 Checking and Maintaining Equipment

All tools and equipment must be kept in good working order. This means cleaning, checking, maintaining and storing them correctly, and following worksite procedures and manufacturers' guidelines.
Clean all items by removing dirt, mud, moisture or other contaminants.
When cleaning equipment, remember that it could be covered in site materials that can get very hot and sticky. These could burn through your clothing and skin so always use appropriate cleaning instruments and wear the right PPE.
Some parts might also be sharp so make sure you handle them carefully.

While you are cleaning, check each item for damage or wear and tear. If anything is wrong report it, repair it, or have it fixed by a qualified person.
Tools and equipment needs to be maintained in line with manufacturers' recommendations or your worksite procedures.

8. General overview

This general overview outlines the systematic knowledge required for safely and compliantly.
The Unit of Competency **RIIMPO320F Conduct Civil Construction Excavator Operations** is the nationally recognized training standard in Australia that outlines the necessary skills and knowledge for operating an excavator safely and competently within the resources and infrastructure industries.
This unit focuses on ensuring that an operator can execute the full cycle of excavator duties, from initial planning and safety checks through to operation, shutdown, and documentation, adhering strictly to workplace procedures and regulatory requirements.

Detailed Overview of RIIMPO320F
The unit is structured around four main Elements of Competency, defining the scope of a certified operator's responsibilities:

1. Plan and Prepare for Excavator Operations
This element ensures the operator understands the job *before* starting the machine.

- **Documentation:** Accessing, interpreting, and applying relevant documentation, including work requirements, safe operating procedures (SOPs), and the machine's load charts.
- **Safety and Hazards:** Identifying site-specific hazards (especially underground and overhead services), environmental issues, and implementing control measures. This includes referencing **Dial Before You Dig** information.
- **Coordination:** Coordinating and communicating with ground crew, spotters, surveyors, and other plant operators to ensure a safe and efficient workflow.
- **PPE:** Selecting and wearing the required Personal Protective Equipment (PPE) for the site and task.

2. Operate Excavator in Line with Established Requirements
This covers the technical and safety aspects of running the machine during the shift.

- **Pre-Start and Start-Up:** Conducting thorough **pre-operational and start-up checks** (e.g., fluid levels, hydraulic leaks, undercarriage wear, safety systems).
- **Fault Management:** Identifying and reporting faults or defects immediately, and rectifying those within the scope of operator responsibility.
- **Operational Techniques:** Driving, manoeuvring, and operating the excavator using techniques suited to the equipment's limitations and the site conditions (e.g., proper tracking, safe swing radius, and stable setup).
- **Monitoring:** Continuously monitoring machine performance using gauges, indicators, and alarms, and responding appropriately to warnings (e.g., overheating, low oil pressure).

3. Load, Carry and Place Materials
This is the core execution element, focusing on the quality and precision of the earthmoving work.

- **Digging and Excavating:** Utilizing the boom, stick, and bucket controls to accurately excavate materials to the required depth, angle, and batter slope, while maintaining stability.
- **Material Handling:** Loading haul trucks efficiently without exceeding their capacity, lifting materials safely within the machine’s load limits, and placing or spreading materials accurately.
- **Attachment Use:** Safely attaching, removing, and operating various attachments (e.g., hammers, grabs, augers) as required for the task.
- **Shutdown:** Performing safe park-up, shutdown, and securing procedures (e.g., lowering the boom and attachment, engaging the park brake, and isolating the machine).

4. Conduct Housekeeping Activities
This element addresses post-operational responsibilities.

- **Site Clearance:** Clearing the immediate work area of hazards and leaving the machine and environment in a safe state.
- **Hazard Reporting:** Managing and reporting any unresolved hazards to maintain a safe working environment for the next shift.
- **Documentation:** Completing and filing all necessary workplace documentation, including logbooks, maintenance reports, and shift records.

Successful completion of this unit demonstrates the operator’s competency to manage the risks and requirements of excavator operations in the Australian civil construction and mining sectors.

9. Australian Standards

There is **no single, mandatory Australian Standard (AS)** dedicated specifically to the operation of excavators.
Instead, the requirements for conducting excavator operations safely and competently in Australia are defined by a combination of a **Nationally Recognised Unit of Competency** and compliance with overarching **Work Health and Safety (WHS) legislation**.

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1. National Competency Standard
The fundamental requirements for excavator operators are established within the national vocational education and training (VET) system:

- **Unit of Competency: RIIMPO320F Conduct Civil Construction Excavator Operations** (or the current version of this unit).
- **Purpose:** This unit defines the skills and knowledge required to **plan, prepare, operate, and shut down** an excavator for various tasks in the resources and infrastructure sectors.

Successful completion of this unit and obtaining the corresponding **Statement of Attainment** proves the operator's competence to perform the job according to industry best practices and required procedures.

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2. Regulatory and Compliance Framework
All excavator operations must adhere to legally binding requirements that supersede any voluntary standard:

- **WHS/OHS Acts and Regulations:** These state and territory laws are mandatory and require all parties (the employer, the site manager, and the operator) to manage the risks associated with operating machinery, including specific duties related to:
    - **Plant Safety:** Ensuring the excavator is maintained and inspected according to manufacturer specifications.
    - **Risk Management:** Identifying and controlling hazards like underground services (e.g., using **Dial Before You Dig** procedures), trench collapse, and rollover.
- **Manufacturer Specifications:** The operator must strictly follow the **manufacturer's operation and maintenance manuals**, especially regarding safe operating slopes, load charts, and approved attachments.
- **Site-Specific Rules:** Every workplace, particularly mines and large construction sites, enforces its own **Safe Work Procedures (SWPs)** and **Traffic Management Plans** that the operator must comply with.