

10-day Plant Course Learner Guide

Units of competency:

RIIMPO317F - Conduct roller operations

**RIIMPO318F - Conduct civil construction skid steer loader
operations**

RIIMPO319E - Conduct backhoe/loader operations

RIIMPO320F - Conduct civil construction excavator operations

**RIIMPO321F - Conduct civil construction wheeled front end
loader operations**

Table of Contents

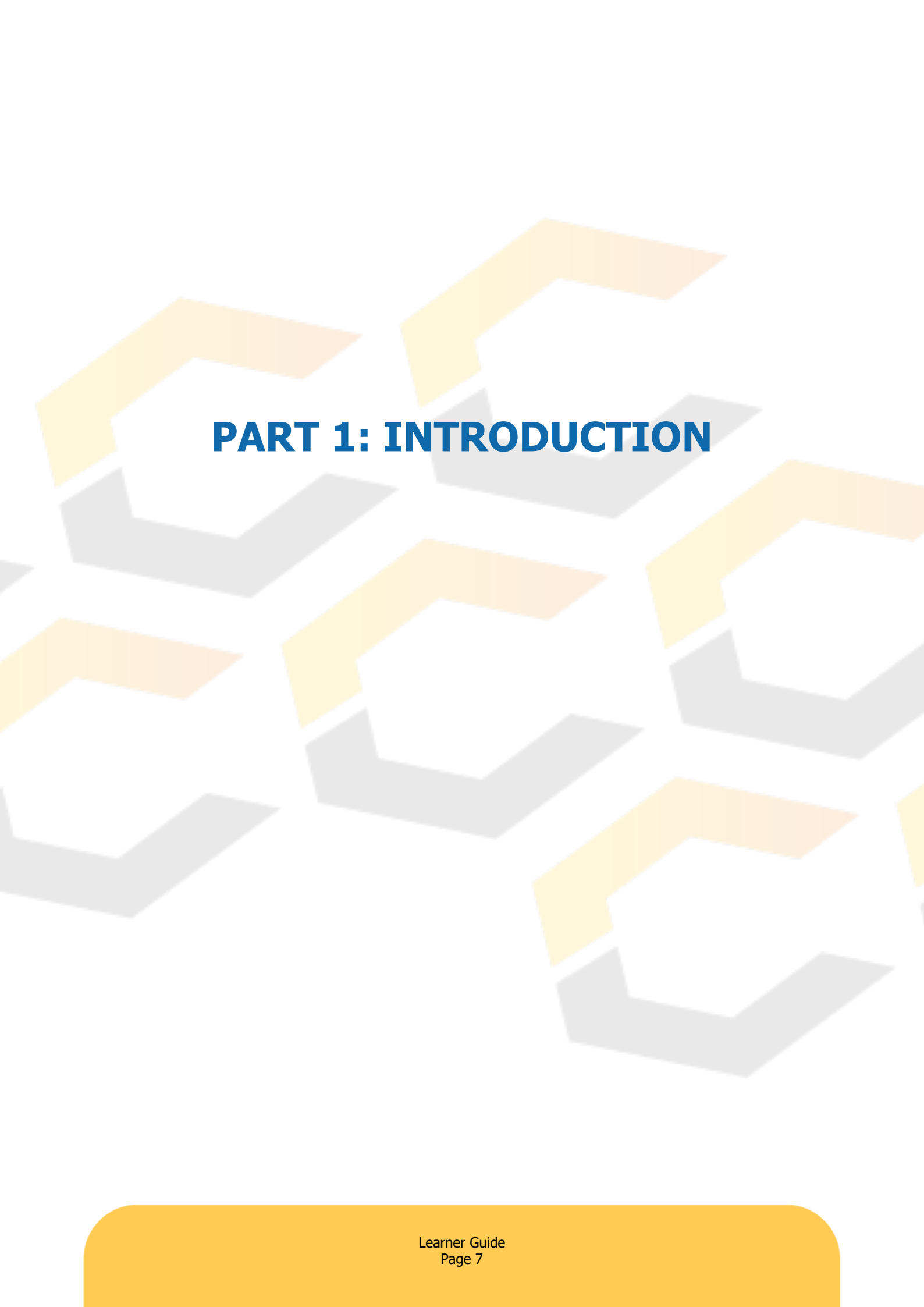
PART 1: INTRODUCTION	7
1.1 Introduction	8
PART 2: GENERAL INFORMATION	10
2.1 Work Safely	11
2.1.1 Health & Safety Rules	11
2.1.2 Operations Documentation	11
2.1.3 How to Keep Everyone Safe	12
2.2 Work Instructions	13
2.2.1 Reading and Checking Your Work Instructions	13
2.2.2 Work Method Statements	14
2.2.3 Project Quality Requirements	14
2.2.3.1 Site Material Characteristics	14
2.2.3.2 Plans, Drawings and Sketches	15
2.2.4 Civil Construction Sequences	16
2.2.5 Emergency Procedures	17
2.2.5.1 Emergency Shutdown of Equipment	17
2.2.5.2 Evacuation	17
2.2.5.3 First Aid	17
2.2.5.4 Fire Fighting Equipment	18
2.3 Hazard Identification and Control	19
2.3.1 Identifying Hazards	19
2.3.2 Working Near Power Lines	21
2.3.2.1 Tiger Tails	23
2.3.2.2 Contact with Power Lines	23
2.3.4 Controlling Hazards	25
2.3.4.1 Personal Protective Equipment (PPE)	27
2.3.4.2 Traffic Control Barricades and Signage	28
2.3.4.3 Safe Operating Speeds	28
2.3.4.4 Safe Travel Speeds	29
2.3.5 Environmental Protection Requirements	29
2.4 Choose and Check Plant and Equipment	30
2.4.1 Conduct Routine Checks	30
2.4.2 Recording and Reporting Faults	31
2.5 Communicate When Operating Plants and Moving and Lifting Loads	31
2.6 Earthworks Calculations	33
PART 3: EXCAVATOR	35
3.1 Excavator	36
3.1.1 What is an Excavator?	36
3.1.2 Excavator Components	37
3.1.3 Excavator Operations	38
3.1.4 Excavator Characteristics and Limitations	39
3.1.5 Choosing Excavator Attachments	40
3.1.6 Fitting and Removing Attachments	41
3.1.7 Pre-Start Checks	42
3.1.8 Operational Checks	43
3.2 Operate the Piece of Equipment	44
3.2.1 Assessing Materials to be Excavated	45
3.2.2 Soil Technology	46
3.2.3 Safe Operating Techniques	47
3.2.4 Using Attachments	48
3.2.5 Excavating or Loading Material	49
3.2.6 Dumping Material into Trucks	50
3.2.7 Levelling	50

3.2.8 Stockpiling	50
3.2.9 Backfilling	51
3.2.10 Battering and Benching	51
3.2.11 Site Clean-Up	51
3.2.12 Other Excavator Tasks	52
3.3 Adjust Techniques to Meet Changing Conditions	53
3.4 Lift, Carry and Place Loads Using Slings and Lifting Gear	53
3.4.1 Determine the Weight of the Load	54
3.4.1.1 Check the Excavator Load Chart.....	55
3.4.2 Choose Lifting Gear	56
3.4.2.1 Types of Lifting Gear	56
3.4.3 Inspect and Connect Lifting Gear	57
3.4.4 Positioning the Excavator	58
3.4.5 Lifting Techniques	58
3.5 Monitor and Check for Hazards.....	59
3.5.1 Reporting Hazards.....	59
3.6 Park and Shut Down the Excavator	60
3.6.1 Parking the Excavator.....	60
3.6.2 Shutting Down the Excavator	61
3.7 Post-Operational Checks.....	62
3.8 Relocate the Excavator	63
3.8.1 Moving an Excavator from Site to Site.....	63
3.9 Clean the Excavator and Do Routine Maintenance	64
PART 4: BACKHOE/LOADER	65
4.1 Backhoe/loader.....	66
4.1.1 What is a Backhoe/Loader?	66
4.1.2 Backhoe/Loader Components	67
4.1.3 Backhoe/Loader Tasks	68
4.1.4 Backhoe/Loader Characteristics and Limitations.....	68
4.1.5 Select and Fit Attachments.....	69
4.1.5.1 Remove and Fit Backhoe/Loader Attachments.....	70
Fitting Attachments.....	70
Removing Attachments	70
4.1.6 Pre-Start Checks.....	71
4.1.7 Operational Checks.....	72
4.1.7.1 Backhoe/Loader Inspection Checklist	73
4.1.7.2 Test Backhoe/Loader Attachments	76
4.2 Operate the Backhoe/Loader.....	77
4.2.1 Assess Materials to be Shifted	78
4.2.2 Safe Operating Techniques	79
4.2.2.1 Safe Travel Speeds	80
4.2.3 Drive to the Work Area	80
4.2.4 Backhoe/Loader Techniques.....	81
4.2.4.1 General Driving.....	82
4.2.4.2 Reversing	82
4.2.4.3 Manoeuvring.....	82
4.2.4.4 Braking	83
4.2.4.5 Attachment Operation	83
4.2.4.6 Bucket Loading	83
4.2.4.7 Load Carrying	84
4.2.4.8 Load Discharge.....	84
4.3 Backhoe/Loader Operations	84
4.3.1 Mixing Materials	85
4.3.2 Stripping and Spreading Materials.....	85
4.3.3 Cutting and Boxing	85
4.3.4 Trench Excavation	86
4.3.5 Backfilling	87

4.3.6 Levelling	87
4.3.7 Loading Vehicles and Machinery	88
4.4 Adjust Techniques to Meet Changing Conditions	88
4.5 Lift, Carry and Place Loads Using Slings and Lifting Gear	89
4.5.1 Determine the Weight of the Load	89
4.5.2 Select Lifting Gear	91
4.5.2.1 Types of Lifting Gear	91
4.5.3 Inspect and Connect Lifting Gear	91
4.5.4 Position the Backhoe/Loader	92
4.5.5 Lifting Techniques	93
4.6 Monitoring Systems and Alarms	94
4.7 Checking Completed Work	95
4.8 Park and Shutdown the Backhoe/Loader	95
4.8.1 Parking the Backhoe/Loader	96
4.8.2 Shutting Down the Backhoe/Loader	96
4.9 Post-Operational Checks	97
4.10 Prepare the Backhoe/Loader for Transportation	97
4.10.1 Move Backhoe/Loader between Worksites	97
4.11 Carry Out Maintenance Tasks	98
4.11.1 Servicing and Minor Replacements	98
4.11.2 Clean and Store Backhoe/Loader Attachments	99
PART 5: SKID STEER LOADER	100
5.1 Skid steer loader	101
5.1.1 What is a Skid Steer Loader?	101
5.1.2 Skid Steer Loader Components	101
5.1.3 Skid Steer Loader Operations	102
5.1.4 Skid Steer Loader Characteristics and Limitations	102
5.1.5 Select Attachments	103
5.1.6 Fit and Remove Attachments	104
5.1.7 Pre-Start Check	105
5.1.8 Operational Checks	106
5.2 Operate the Skid Steer Loader	107
5.2.1 Assess Materials to be Shifted	108
5.2.2 Safe Operating Techniques	109
5.2.2.1 Safe Operating Speeds	110
5.2.3 Excavating, Loading and Transporting Material	111
5.2.4 Discharging Material from the Bucket	111
5.2.5 Levelling	112
5.2.6 Stripping and Spreading Topsoil	112
5.2.7 Backfilling Excavations	112
5.2.8 Site Clean-Up	112
5.2.9 Selecting and Using Attachments	113
5.2.10 Mixing Materials	114
5.3 Monitoring Systems and Alarms	114
5.4 Adjust Techniques to Meet Changing Conditions	115
5.5 Lift, Carry and Place Loads Using Slings and Lifting Gear	116
5.5.1 Determine the Weight of the Load in Coordination with Other Personnel	116
5.5.3 Inspect and Connect Lifting Gear	117
5.5.4 Positioning the Skid Steer Loader	118
5.5.5 Lifting Techniques	118
5.5.6 Checking Completed Work	119
5.6 Park and Shut Down the Loader	120
5.6.1 Parking the Skid Steer Loader	120
5.6.2 Shutting Down the Skid Steer Loader	121

5.6.3 Post-Operational Checks	121
5.7 Prepare the Skid Steer Loader for Relocation.....	121
5.7.1 Relocate the Skid Steer.....	122
5.8 Clean and Carry Out Routine Maintenance	123
PART 6: WHEELED FRONT END LOADER.....	124
6.1 Wheeled front end loader	125
6.1.1 What is a Wheeled Front End Loader?.....	125
6.1.2 Wheeled Front End Loader Components.....	126
6.1.3 Wheeled Front End Loader Operations	127
6.1.4 Choosing Front End Loader Attachments	127
6.1.5 Fit and Remove Attachments.....	128
6.1.6 Pre-Start Check	129
6.1.7 Operational Checks.....	130
6.1.8 Assess Materials to be Shifted	131
6.1.9 Safe Operating Techniques	132
6.1.9.1 Driving to the Work Area	133
6.1.10 Using Attachments	133
6.2 Excavating, Loading and Transporting Materials.....	134
6.2.1 Dumping Material into Trucks.....	135
6.2.2 Mixing Materials	135
6.2.3 Stripping and Spreading Topsoil	135
6.2.4 Levelling	136
6.2.5 Cutting and Boxing	136
6.2.6 Backfilling	136
6.2.7 Site Clean-Up	136
6.3 Monitoring Systems and Alarms	137
6.4 Lift, Carry and Place Loads using Slings and Lifting Gear.....	138
6.4.1 Determine the Weight of the Load in Coordination with Other Personnel	138
6.4.2 Choosing Lifting Gear.....	139
6.4.2.1 Types of Lifting Gear	139
6.4.3 Inspecting and Connecting Lifting Gear	139
6.4.4 Positioning the Front End Loader	140
6.4.5 Lifting Techniques	140
6.4.6 Checking Completed Work	141
6.5 Park and Shut Down the Front End Loader.....	141
6.5.1 Parking the Front End Loader.....	142
6.5.2 Shutting Down the Front End Loader	142
6.6 Post-Operational Checks.....	143
6.7 Prepare the Front End Loader for Relocation.....	143
6.7.1 Relocate the Loader.....	144
6.8 Clean the Loader and Carry Out Routine Maintenance.....	144
PART 7: ROLLER.....	145
7.1 Roller	146
7.1.1 What is a Roller?	146
7.1.2 Types and Applications of Rollers.....	147
7.1.3 Roller Components	150
7.1.4 Roller Operations.....	151
7.1.4.1 Roller Operations Documentation	152
7.2 Choose and Check Plant and Equipment.....	152
7.2.1 Select a Roller Attachment	153
7.2.2 Fit and Remove Attachments.....	154
7.2.3 Pre-Start Check	155
7.2.4 Operational Checks.....	156
7.3 Operate the Roller.....	157

7.3.1 Site Conditions	158
7.3.2 Assess Materials to be Compacted	158
7.3.2.1 Soil Technology and Compaction.....	159
7.3.2.2 Identify, Remove or Manage Contaminants.....	159
7.3.3 Safe Operating Techniques	160
7.3.4 Drive to the Work Area	161
7.3.5 Roller Techniques	161
7.3.6 Operate Attachments.....	162
7.3.7 Compacting.....	162
7.3.8 Levelling Procedures.....	163
7.3.9 Road Works	163
7.3.10 Sealing and Finishing the Surface	163
7.4 Monitoring Systems and Alarms	164
7.5 Adjust Techniques to Meet Changing Conditions	165
7.6 Monitor and Check for Hazards.....	165
7.7 Checking Completed Work.....	166
7.8 Park and Shut Down the Roller	166
7.8.1 Parking the Roller	166
7.8.2 Shutting Down the Roller	167
7.8.3 Post-Operational Checks	167
7.9 Prepare the Roller for Relocation.....	168
7.9.1 Relocate the Roller	169
7.10 Clean the Roller and Carry Out Routine Maintenance	169
PART 8: MAINTENANCE, HOUSEKEEPING AND PROCESSING RECORDS.....	170
8.1 Maintenance and refuelling	171
8.1.1 Carry Out Maintenance Tasks.....	171
8.1.2 Vehicle Refuelling Procedures.....	172
8.2 Clean Up After Work.....	173
8.2.1 Clearing the Work Area.....	173
8.2.2 Cleaning and Storing Attachments	174
8.3 Process Written Records.....	174



PART 1: INTRODUCTION

1.1 Introduction

In this course you will learn how to use a number of pieces of heavy machinery used in the civil construction industry.

The course includes the units of competency **RIIMPO317F Conduct roller operations, RIIMPO318F Conduct civil construction skid steer loader operations, RIIMPO319E Conduct backhoe/loader operations, RIIMPO320F Conduct civil construction excavator operations and RIIMPO321F Conduct civil construction wheeled front end loader operations**

You will learn about completing the following general tasks as well as the specific tasks listed under the unit titles:

- ◆ Planning and preparing for work.
- ◆ Conducting routine and pre-operational checks.

Unit: RIIMPO320F Conduct civil construction excavator operations

In this course you will learn how to use an excavator in civil construction including:

- ◆ Operating excavators.
- ◆ Relocating the excavator.
- ◆ Maintenance and other housekeeping tasks.

RIIMPO319E Conduct backhoe/loader operations

You will learn about:

- ◆ Operating the backhoe/loader:
 - ◇ Lifting, carrying and placing materials.
 - ◇ Selecting, fitting and removing attachments for the backhoe/loader.
- ◆ Relocating the backhoe/loader from site to site.
- ◆ Carrying out machine operator maintenance.
- ◆ Cleaning up.

Unit: RIIMPO317F Conduct Roller Operations.

You will learn about roller operations including:

- ◆ Using attachments.
- ◆ Operating the roller.
- ◆ Maintaining the roller.
- ◆ The different types of rollers and which roller is best equipped for different activities.



Unit: RIIMPO318F Conduct civil construction skid steer loader operations



You will learn about civil construction skid steer loader operations including:

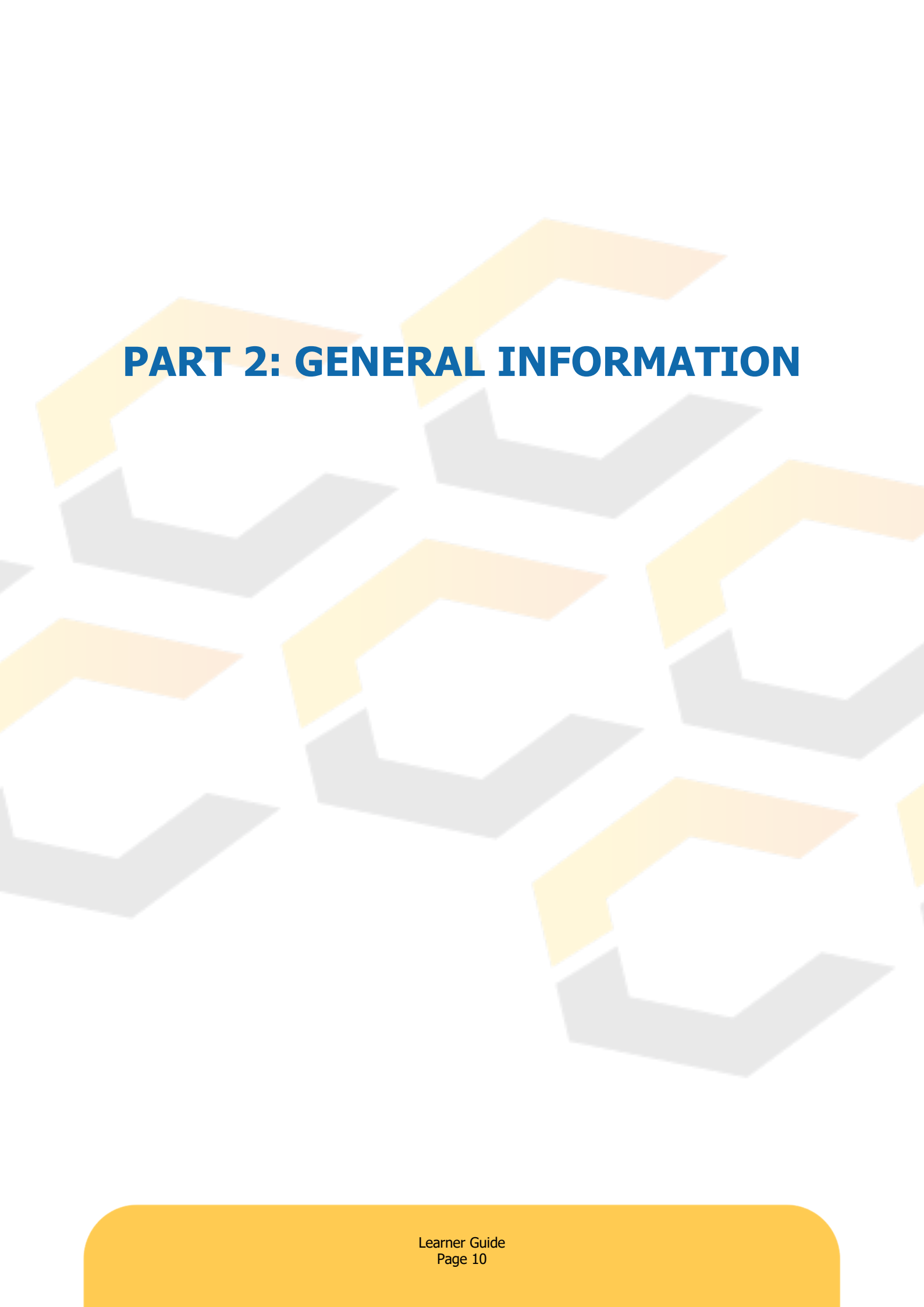
- ◆ Operating skid steer loaders.
- ◆ Relocating the skid steer.
- ◆ Maintenance and other housekeeping tasks.

RIIMPO321F Conduct civil construction wheeled front end loader operations

You will learn about civil construction wheeled front end loader operations including:



- ◆ Operating wheeled front end loaders.
- ◆ Relocating the front end loader.
- ◆ Maintenance and other housekeeping tasks.



PART 2: GENERAL INFORMATION

2.1 Work 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.



2.1.1 Health & Safety Rules

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

Acts	These are laws that you have to follow.
Regulations	These explain what the law means.
Codes of Practice or compliance code	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.

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.

2.1.2 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 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.

In hazardous working areas where permission is required to work, the operator must ensure to obtain required permits, obtain and review SWMS and perform risk assessments before the work is commenced.

2.1.3 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 fire fighting equipment, first aid and evacuation.
- ◆ Handling hazardous materials.
- ◆ Safe operating procedures.
- ◆ Personal protective clothing and equipment.
- ◆ Safe use of tools and equipment.



2.2 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 of the details about where you will be working. For example:

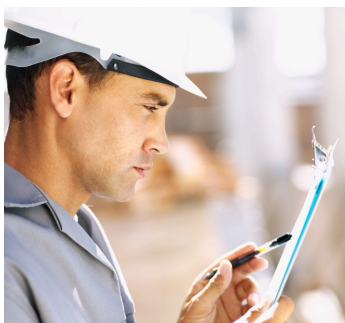
- ◆ **The Site** – Is there clear access for all equipment? Are there obstacles in the way? What are the ground conditions like? Is the site ready for work to begin? Are there structures, workers, traffic or areas you need to avoid?
- ◆ **The Weather** – Is there wind, rain or other bad weather? Is it too dark?
- ◆ **Facilities and Services** – Are there power lines or other overhead 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 power lines or other people?

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

- ◆ **The Task** – What kind of material is being moved or compacted? How much is there to move or work with? How much does it weight? How long do you have to complete the work? Where will the work be done? Where will the load be discharged? Does the job need a special type of attachment or bucket?
- ◆ **Plant** – What type of plant will be used? How big is it? How much room does it need?
- ◆ **Attachments** – What equipment will you need to shift the load safely? Is the equipment available?
- ◆ **Communications** – How are you going to communicate with other workers?
- ◆ **Procedures and Rules** – Do you need any special permits or licences for the work? Are there site rules that affect the way you will do the work, e.g. traffic control requirements?



2.2.1 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. This is especially important in civil construction projects that need to be completed in a particular sequence.

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.

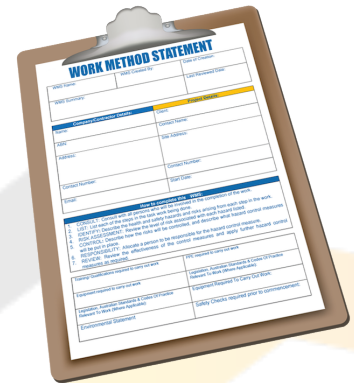
If you don't know where to get your instructions or you can't understand the language or civil construction terminology being used in them, you can ask your boss or supervisor. They will tell you where to find your work instructions and explain what they mean.

2.2.2 Work Method Statements

Many worksites require a work method statement before any work can start. A work method statement 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. They will also 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.



2.2.3 Project Quality Requirements

Every civil construction project will have quality requirements. These outline when tasks need to be completed and the required standard of the work.



Your work instructions and plans or drawings will guide you, and help you to make sure you are achieving the quality standard for the project.

They can include:

- ◆ Project dimensions.
- ◆ Project tolerances.
- ◆ Standards of work.
- ◆ Material standards.

2.2.3.1 Site Material Characteristics

Make sure you are familiar with the site product or materials before you start to move them around. Have a look at the composition of the materials to see what kind of equipment you will need to move them, and what techniques to use.

Some materials are more cohesive or sticky while others may be much less stable to work with, or create hazards like dust or damage to equipment if they are not handled just the right way, i.e. **clay is more cohesive (stickier than sand or soil)**.



Part of the civil construction project may involve compacting materials as part of preparing a site or creating roads. You will need to confirm the level of compaction that is needed in your work instructions or project plans.

You should take into account the following when handling low viscous materials such as mud and wet sand:

- ◆ There should be room for run off
- ◆ Safety hazards, e.g. slips and fall, spilling out on to a road or into a water supply.

2.2.3.2 Plans, Drawings and Sketches



When looking for information or instructions for a civil construction project, you will come across plans, drawings and sketches. Examples of these are:

- ◆ Project plans.
 - ◆ Site plans.
 - ◆ Work plans.
 - ◆ Project drawings.
- ◆ Sketches made to explain work that is happening on site.

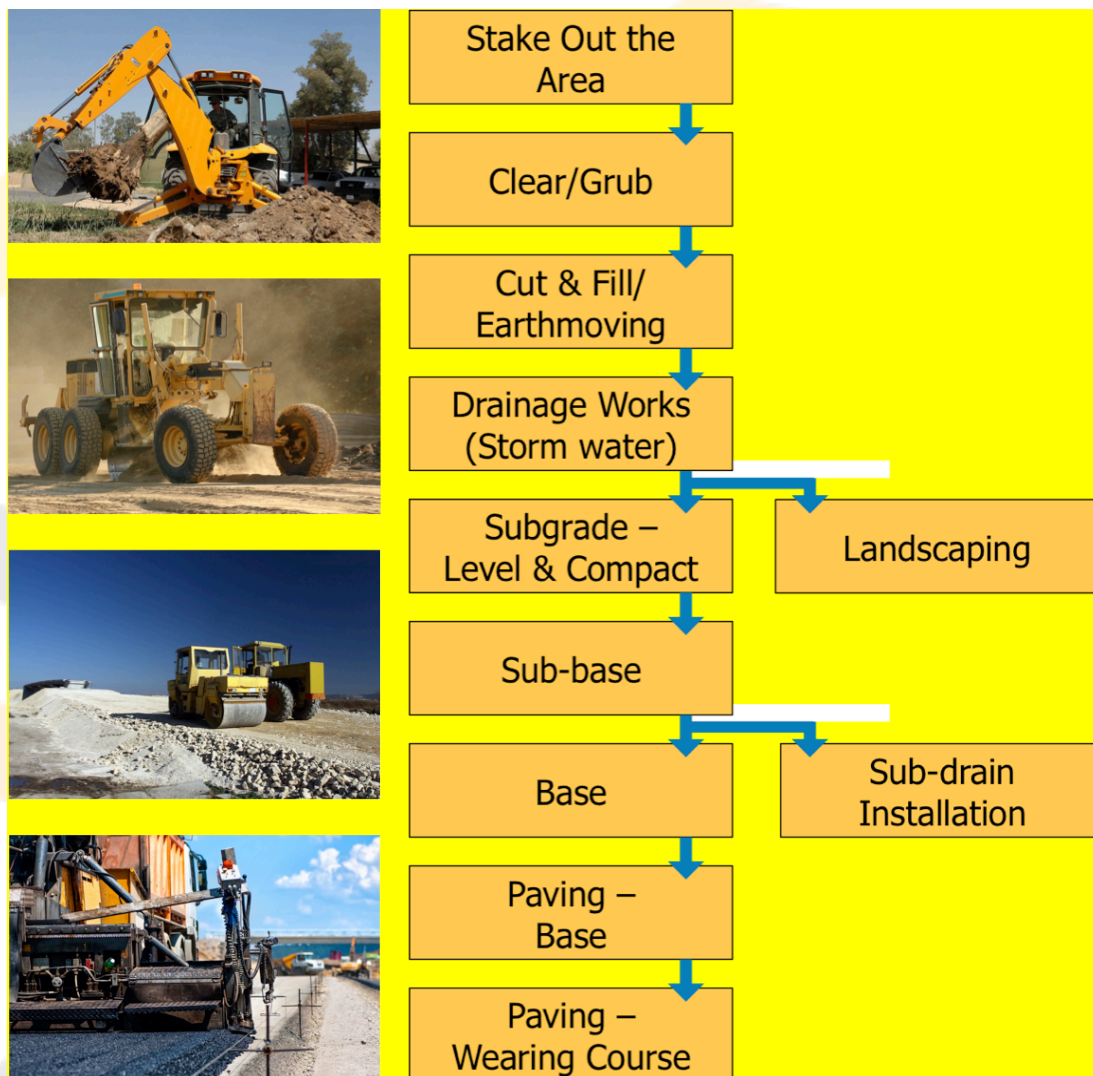
Plans and drawings are useful because they can help you to get an overview of the site and the project as a whole. It can also be the best way to explain exactly what needs to be done.

You need to be familiar with the scale and symbols used in the plans and drawings so you can understand them properly. If you're not sure ask your supervisor or site personnel for help.

2.2.4 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:



After the area is cleared and before the base is prepared for road construction, the following needs to be done:

- **Earthmoving**
- **Drainage**
- **Subgrade level**
- **Compaction**
- **Any landscaping**

2.2.5 Emergency Procedures



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

- ◆ Emergency shutdown.
- ◆ Evacuation.
- ◆ Fuel Spills
- ◆ First aid.
- ◆ Firefighting.

2.2.5.1 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.



2.2.5.2 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.



2.2.5.3 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.

2.2.5.4 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.

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**.

2.3 Hazard Identification and Control

Before you start work, you need to check for any hazards or dangers in the work area. If you find a hazard or danger you need to do something to control it. This will help to make the workplace safer.

The best way to control hazards is to use a simple problem-solving approach:

1. Identify the problem (What is the hazard?).
2. Identify the cause of the problem (What is causing the hazard?).
3. Work out the different options that you have to solve the problem (What can be done to eliminate or minimise the hazard as much as possible?).
4. Choose the best option to solve the problem and apply it (What is the best option to eliminate or minimise the hazard?).
5. Check to see if the problem has been solved (Has the hazard been eliminated or reduced to a safe level?). If not, you will need to use additional, or better options for fixing the problem (controlling the hazard).



2.3.1 Identifying Hazards



Part of your job is to look around to see if you can find any hazards before you start any work.

A **hazard** is the thing or situation that causes injury, harm or damage.

When you start checking for hazards, make sure you look everywhere. A good way to do this is to check:

- ◆ Up high above your head.
- ◆ All around you at eye level.
- ◆ Down low on the ground (and also think about what is under the ground).



Some hazards you should check for in the work area are:

- ◆ Overhead and underground services.
- ◆ Uneven, soft, slippery or unstable terrain.
- ◆ Trees.
- ◆ Fires.
- ◆ Bridges.



- ◆ Excavations.
- ◆ Buildings.
- ◆ Traffic.
- ◆ Embankments.
- ◆ Cuttings.
- ◆ Hazardous materials.
- ◆ Structures such as site offices and scaffolds.
- ◆ The weather and environment.



- ◆ Other workers or site visitors.
- ◆ Pedestrians and other public traffic.
- ◆ On-site vehicles, plant, equipment and machinery.
- ◆ Poorly maintained or faulty equipment.



- ◆ Hazards from components of the excavator (e.g. hoses under pressure, hydraulic tanks, cooling systems or braking systems).
- ◆ Road surface and edge solidity.
- ◆ Handling characteristics of the excavator.

- ◆ Effects of the load as you move or scoop it.
- ◆ Chemical hazards such as fuel, chemicals, contaminants, gases or dusts.
- ◆ **Operating a plant near the edge of unconsolidated fill may cause the edge fill to collapse.**

2.3.2 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. You should check with the local electrical authority for information and advice to find out the voltage of power lines in your work area.

VIC

In Victoria the Framework for Undertaking Work Near Overhead and Underground Assets states that equipment must not be closer than the following distances to electric/power lines:

Electric/Power Line Type	Distance
Distribution lines up to and including 66kV (power poles)	6.4m (or 3.0m with a qualified spotter)
Transmission lines greater than 66kV (towers)	10m (or 8m with a qualified spotter)

Note: 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.

QLD

The Queensland Electrical Safety Regulation breaks down the distances in detail. Exclusion zones are broken down not only by size of electric/power line but also by the competency level of the operator. This means that the requirements should be clarified with the electrical authority before work commences even if the distance appears to be outside the zones.

The following minimum distances are provided as guidance:

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

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.

ACT

In the ACT mobile plant operators and persons erecting or working from scaffolding must maintain a safe minimum distance to power lines as outlined in the table below:

Electric/Power Line Type	Distance
Less than 33kV	4.0m
33kV or more (transmission lines)	5.0m

TAS

In Tasmania equipment must not be closer than the following distances to electric/power lines:

Electric/Power Line Type	Distance
Up to and including 133kV (poles)	6.4m (or 3m with a safety observer)
Greater than 133kV (towers)	10m (or 8m with a safety observer)

SA

In South Australia mobile plant operators and persons erecting or working from scaffolding must maintain a safe minimum distance to power lines as outlined in the table below:

Electric/Power Line Type	Distance
Up to 132kV (including 132kV poles)	6.4m (or 3.0m with a spotter)
132kV or more (including 132kV towers)	10.0m (or 8.0m with a spotter)

WA

In Western Australia this falls under Regulation 3.64 from the OSH Regulations and states the following as the minimum distances:

Electric/Power Line Type	Distance
Up to 1kV (insulated)	0.5m
Up to 1kV (uninsulated)	1.0m

Above 1kV and up to 33kV	3.0m
Above 33kV	6.0m

NT

In the Northern Territory equipment must not be closer than the following distances to electric/power lines:

Electric/Power Line Type	Distance
Up to and including 132kV (distribution lines)	6.4m (or 3m with a spotter)
Greater than 132kV (transmission lines)	10m (or 8m with a spotter)

2.3.2.1 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.



2.3.2.2 Contact with Power Lines



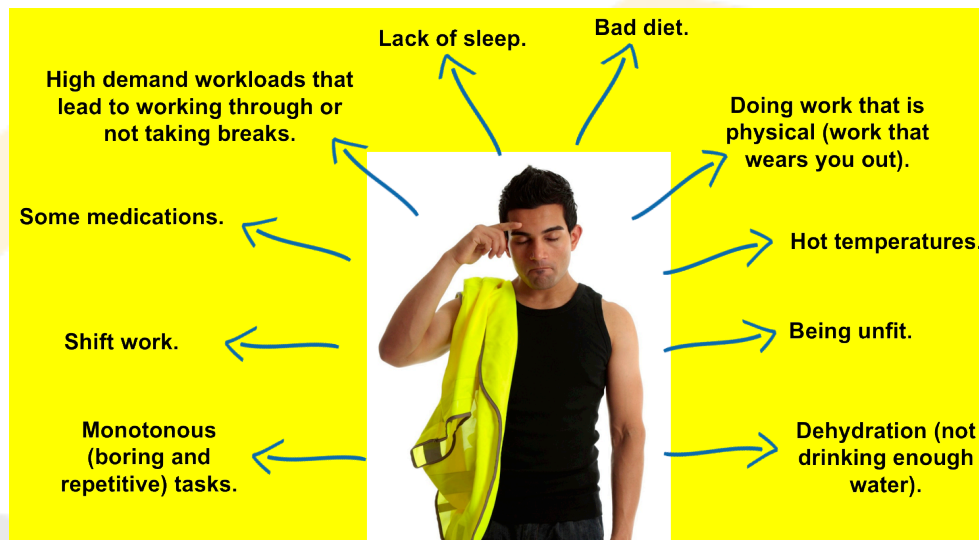
If the equipment (e.g. excavator, backhoe, loader) makes contact with live power lines you should:

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.

2.3.3 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. ◆ Micro sleeps (nodding off for a short period of time).
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.

2.3.4 Controlling Hazards

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.

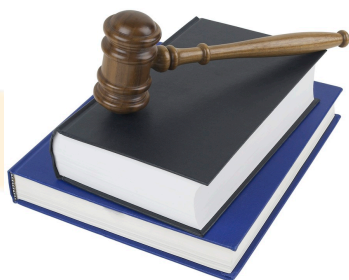


After you have found hazards or dangers you need to work out how bad they are:

1. What is the chance that the hazard will hurt someone or cause damage?
2. If it does happen, how bad will the injury or damage be?



Thinking about these things will help you to choose how to control the hazards. Hazard controls need to follow:



- ◆ Legislation (laws).
- ◆ Australian Standards.
- ◆ Codes of Practice.
- ◆ Manufacturers' specifications.
- ◆ Industry standards.

The best way to control hazards is to use the Hierarchy of Hazard Control. The hierarchy of hazard control is a range of options that can eliminate, or reduce the risk of hazards.

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.



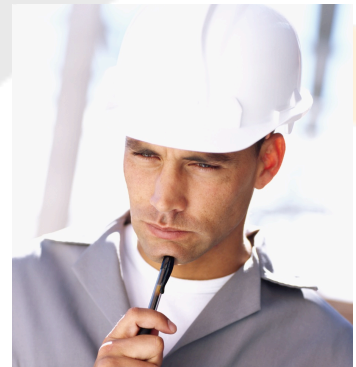
This table shows you the six different types of controls in order from best to worst:

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. This includes using signage and barricades.
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.

It is important to think about all of the options available when deciding on the best hazard controls. You may need to use more than one control measure to bring the risk level down to an acceptable level.

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. Check the situation after you have applied a control measure to see if more controls, or different controls are needed to make the job safe. If more controls are needed, make sure they are applied before you start or continue the work.

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.



2.3.4.1 Personal Protective Equipment (PPE)

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.

It includes:



people know where you are.

- ◆ **Head protection** – hard hats and helmets (to be worn whenever the person could be struck on the head).
- ◆ **Foot protection** – non-slip work boots.
- ◆ **Hand protection** – gloves.
- ◆ **Eye protection** – goggles, visors or glasses.
- ◆ **Ear protection** – plugs or muffs (to be worn when the noise could contribute to the loss of hearing (85 DBA).
- ◆ **Breathing protection** – masks or respirators.
- ◆ **Hi-visibility clothing** – clothing that makes you stand out and lets other people know where you are.
- ◆ **Weather protection** – clothing that protects you from the sun or from the cold.

Make sure any PPE you are wearing is in good condition, fits well and is right for the job.

If you find any PPE that is not in good condition, tag it and remove it from service. Tell your supervisor about the problem and they will organise to repair or replace the PPE.



2.3.4.2 Traffic Control Barricades and Signage

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

On worksites it is often necessary to control the movement of traffic around and through the site. To do this there are two different types of traffic 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.

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 and fences.



Where a dangerous obstruction is caused by earthworks being performed on a public road, erect barricades and signages.

Where signs and barricades are considered inadequate to control a potential hazard, the flow of road traffic must be controlled by using traffic management services.

An unregistered vehicle permit must be obtained before an unregistered rubber tyred plant is driven along a public road.

2.3.4.3 Safe Operating Speeds

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

Operating the equipment at too fast a speed can cause instability.
Never leave an unattended plant engine running.



2.3.4.4 Safe Travel Speeds



Going too fast will reduce the stability and control of the piece of equipment, 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.

2.3.5 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.



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

- ◆ Waste management.
- ◆ Water quality protection.
- ◆ Flora and Fauna (Plants and Animals)
- ◆ Noise control.
- ◆ Refuelling areas and procedures
- ◆ Dust management.
- ◆ Vibration control.

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

2.4 Choose and Check Plant and Equipment



Once you have confirmed your job requirements you need to choose the right equipment and attachments to get the job done.

When choosing equipment and attachments you need to think about:

- ◆ The task requirements, specifications and goals.
- ◆ The appropriateness of the equipment for the completion of the task.
- ◆ The characteristics, correct use, operating capacity and limitations of each item.
- ◆ The potential risks to yourself and others in the intended use of the

equipment.

Information about technical capabilities and limits can be found in the operator manuals supplied by the manufacturer of each item. Information about the warning systems and alarms fitted on the plant can also be found in the operator's manual.



It is not safe to operate plant, equipment or attachments outside site procedures and the manufacturer's specifications. This may cause the machinery to break and could also cause an accident or injury.

2.4.1 Conduct Routine Checks

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

Also make sure you are wearing the correct PPE before you start checking the machine.



Routine checks are made up of:

Pre-Start Checks

Visual checks that are made before you start the equipment.

Operational Checks

Checks of all functions once the machine has been started.

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.

These routine checks are discussed in detail with each plant.

2.4.2 Recording and Reporting Faults

Once all routine checks are finished, you will need to report any problems, faults, defects and damage that you found during the inspection so that they can be repaired and the machine and equipment are safe for you or the next operator to use.

Record the details of the problem in a fault report or the relevant logbook. Most sites have a fault report form that will need to be 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.



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.

Make sure the piece of equipment is tagged out (isolated from use) until the repairs have been made. This will help to stop anybody from using it before it has been repaired.

Note: If equipment or an attachment is faulty:

- 1: Don't Use it**
- 2: Tag out**
- 3: Report to the supervisor (Get repaired)**
- 4: Record in the logbook**



2.5 Communicate When Operating Plants and Moving and Lifting Loads

Communicating when operating plants and 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.

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.



If you are unsure of the hand signals that are used on your site, speak with your supervisor or other team members.

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

HAND SIGNALS	
Hoisting Raise  Whistle, Bell & Buzzer Signals 2 Short ..	Hoisting Lower  Whistle, Bell & Buzzer Signals 1 Long _
Luffing Boom Up  Whistle, Bell & Buzzer Signals 3 Short ...	Luffing Boom Down  Whistle, Bell & Buzzer Signals 4 Short
Slewing Right  Whistle, Bell & Buzzer Signals 1 Long, 2 Short _ ..	Slewing Left  Whistle, Bell & Buzzer Signals 1 Long, 1 Short _ .
Jib/Trolley Out; Telescoping Boom Extend  Whistle, Bell & Buzzer Signals 1 Long, 3 Short _ ...	Jib/Trolley In; Telescoping Boom Retract  Whistle, Bell & Buzzer Signals 1 Long, 4 Short _
Stop  Whistle, Bell & Buzzer Signals 1 Short .	
Creep Speed: Appropriate hand signal for motion with hand opening and closing	

2.6 Earthworks Calculations

As an operator of heavy machinery, 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:

$$\text{Area} = \text{Length (L)} \times \text{Width (W)}$$

For example:

40 square metres (40m²) may be marked out as:

- ◆ 10 x 4 metres.
- ◆ 5 x 8 metres.
- ◆ 20 x 2 metres.

$$\begin{aligned}\text{Area} &= \text{L} \times \text{W} \\ &= 10\text{m} \times 4\text{m} \\ &= 40\text{m}^2\end{aligned}$$

$$\begin{aligned}\text{Area} &= \text{L} \times \text{W} \\ &= 5\text{m} \times 8\text{m} \\ &= 40\text{m}^2\end{aligned}$$

$$\begin{aligned}\text{Area} &= \text{L} \times \text{W} \\ &= 20\text{m} \times 2\text{m} \\ &= 40\text{m}^2\end{aligned}$$

$$\text{Area} = \text{Length} \times \text{Width}$$

For example:

A section 20m long and 4m wide would have the following area.

$$\begin{aligned}\text{Area} &= 20\text{m} \times 4\text{m} \\ \text{Area} &= 80\text{m}^2\end{aligned}$$

Volume can be calculated using the following formula, i.e. multiplying length x width x depth or height. Depth if it is a hole or height if it is a pile.

$$\text{Volume} = L \times W \times H$$

For example:

An area with a length of 10 metres, a width of 4 metres and that is 2 metres deep will be 80 cubic metres (80m³) of material.

$$\text{Volume} = L \times W \times H$$

$$\text{Volume} = 10\text{m} \times 4\text{m} \times 2\text{m}$$

$$\text{Volume} = 80\text{m}^3$$

$$\text{Volume} = \text{Length} \times \text{Width} \times \text{Depth}$$

For example:

A trench 20m long, 4m wide and 0.5m deep would be calculated in the following manner.

$$\text{Volume} = 20\text{m} \times 4\text{m} \times 0.5\text{m}$$

$$\text{Volume} = 40\text{m}^3$$

It is important that you are familiar with basic earthworks calculations and are able to access and use calculation data on the worksite.

PART 3: EXCAVATOR



3.1 Excavator

3.1.1 What is an Excavator?

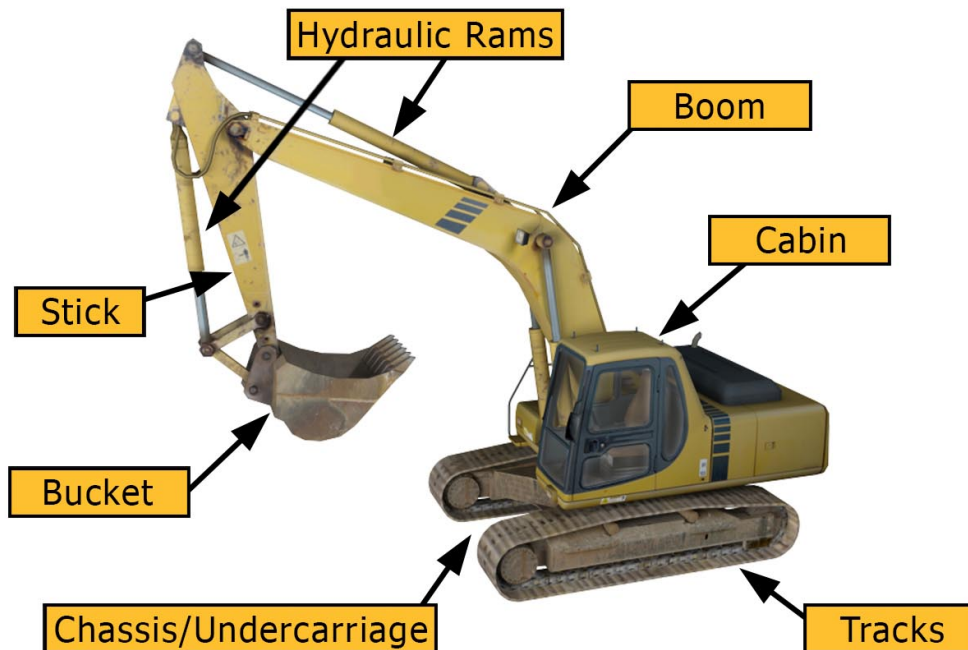
An excavator is a self-propelled vehicle, either tracked (crawler) or wheeled, with an upper structure that can move a minimum of 360 degrees.

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.



3.1.2 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.

3.1.3 Excavator Operations



- ◆ Trench excavation.



- ◆ Landscaping (ripping, removal of trees, stripping or spreading topsoil and materials).



The tasks performed by an excavator may include:

- ◆ Loading.
- ◆ Lifting and carrying materials.
- ◆ Bulk excavation.
- ◆ Backfilling.
- ◆ Stockpiling.
- ◆ Battering and benching.
- ◆ Compacting materials. (with suitable attachments, vibrating compaction plates or wheels)
- ◆ Demolition.
- ◆ Rock breaking.
- ◆ Cutting and boxing.
- ◆ Pipe laying.
- ◆ Cut and fill.
- ◆ Mixing materials.
- ◆ Site clean-up.

3.1.4 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. The heat from hot asphalt increases the tyre pressure of a rubber tyred plant.



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.
 - ◆ Manoeuvring capability, such as turning radius and stopping distances.
 - ◆ Attachment use.
 - ◆ Use of slings and guide ropes.
- ◆ Materials and handling requirements.

You could also check the **information provided by the employer** and check the **load chart and the specifications and options of the machinery (data plate)**.

3.1.5 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, mud bucket, rock bucket, trench bucket.
Lifting Devices	Slings, lifting gear. (SWL and approved lifting lug)
Rock Breakers (Hydraulic Hammers)	For breaking rocks or concrete.
Vibrating Compaction Plate or Wheel	Used for compacting soil and other materials.
Other Approved Attachments	May include GPS for machine guidance, magnets, log grapples Hydraulic jaws, and blades.

Use a **plant's guidance systems**:

- ◆ When you have a large work area
- ◆ When working on narrow pass ways.

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. Otherwise you may need to check the workplace equipment procedures for your site.



3.1.6 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.



all connectors are correctly joined.

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

Note: All pins and clips to be fitted or Hydraulic quick hitch locked. Check all pins and keeper plates are in place and any loose bolts are tightened to prevent the attachment from falling off.

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.



3.1.7 Pre-Start Checks

Pre-start checks are done before the engine is started. Walk around the piece of equipment and look for anything that is out of the ordinary.

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. If the plant has low pressure in its tyres, have the tyre pressure adjusted to recommended pressures. Check the condition and tension of tracks. Check that the track pin is centred 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 tightened.
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.

3.1.8 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 on the excavator:

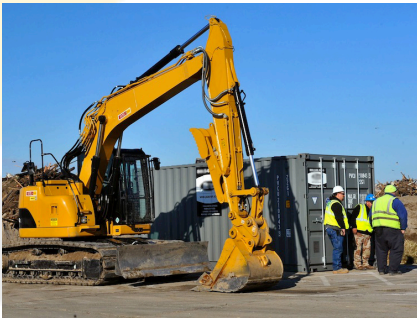
Part or Function	What to Check
All Controls	Test all arm and bucket movements.
Gauges and Instruments	Check that all instruments are displaying properly and are not signalling any alarms or warnings.
Safety Devices	Test all lights, alarms and other warning devices.
Attachments	Check that the attachment 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.

3.2 Operate the Piece of Equipment

During civil construction 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 the site.
- ◆ Team leaders.
- ◆ Site safety personnel.



3.2.1 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 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.

Note: You cannot achieve adequate compaction using only the excavator tracks or the bucket

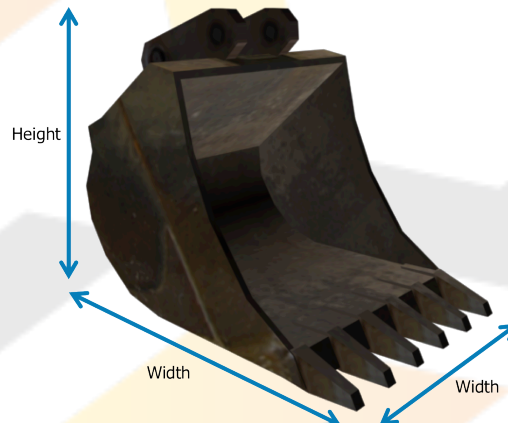
You will also need to assess the weight of the materials you are working with.

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

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



Check the weight of the materials against the manufacturer's specifications to make sure you don't overload the equipment. **Keep in mind that uneven, rough, boggy or sloping ground can all reduce the amount of material that the equipment can safely carry.**

3.2.2 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.
 - ◆ Note: You cannot compact material properly using, for instance, just the wheels or bucket of a skid steer loader. You need to use compaction wheels or plates.

3.2.3 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, cutting and boxing, landscaping.



3.2.4 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.



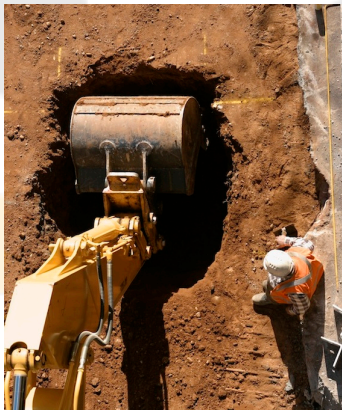
3.2.5 Excavating or Loading Material

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. Talk to the site supervisor who will contact 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 sand bags.
- ◆ Broken tiles.
- ◆ Moisture.
- ◆ Any other unusual material.

Check relevant statutory authority maps and plans.

If cutting a trench across a footpath or when excavating an area across a footpath:

- ◆ Gather information and permits from relevant authorities who may run services under the footpath.
- ◆ Excavate slowly towards any underground services.
- ◆ Ensure you have all the relevant plans, drawings and sketches.
- ◆ Set barricades and signs to isolate the area.



If you accidentally damaged an underground electrical cable, the supervisor must be immediately contacted to render the power supply safe. The supervisor should contact the electrical supply authority.

3.2.6 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.

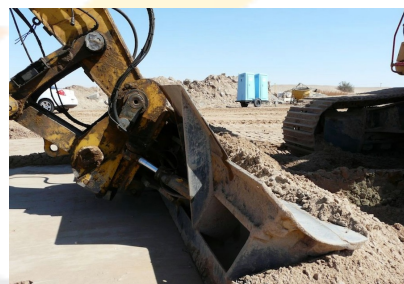
3.2.7 Levelling

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.



3.2.8 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 on to the excavator and/or cause the excavator to overturn and trap the operator.

3.2.9 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.

Note: You cannot achieve adequate compaction using only the excavator tracks or the bucket. Complete the filling of the trench compacting the aggregate in layers no greater than 150 mm, use a vibrating plate compactor or similar.



3.2.10 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.

Note: Worksafe may need to be notified

3.2.11 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.



3.2.12 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).
- ◆ **Compaction** – Compaction can only be achieved using the appropriate equipment (Vibrating Plate or Wheels), using only the excavator bucket and/or tracks will not compact adequately
- ◆ **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.

3.3 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 Ground/Soil Conditions – Ground conditions can vary on a site depending on soil types, rock, sand, soil or clay, the size and weight of the excavator can cause issues on soft ground, especially after heavy rain.



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, such as landscaping or preparing road base, you will be working with different materials, attachments and personnel.

3.4 Lift, Carry and Place Loads Using Slings and Lifting Gear

In civil construction projects you may need to use the equipment to lift and carry loads using slings and lifting gear, for example lowering pipes into trenches, or moving equipment or construction materials around the site.

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

You not allowed to attach slings to the teeth of the bucket. You may break off the teeth and/or the sling could slip off the teeth and cause the load to fall, which may injure or kill someone or damage the load. It is against regulations to sling loads using a plant without the appropriately approved lifting connection fitted.



3.4.1 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 or loader 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 sheets.
- ◆ 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.

Once you know the weight of the load you need to make sure the excavator or loader you are using has the capacity to lift it safely. You can check the capacity 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 or loader.

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



3.4.1.1 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, 1m ³ 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

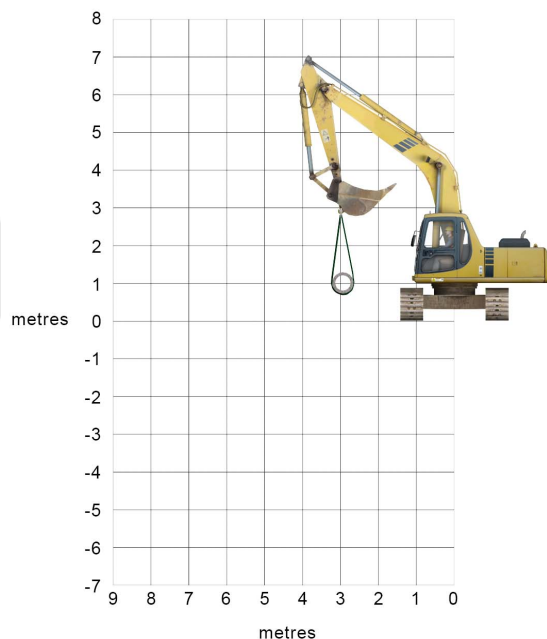
The ratings are based on 75% of tipping load, stationary on firm level ground as per AS 1418.5.

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

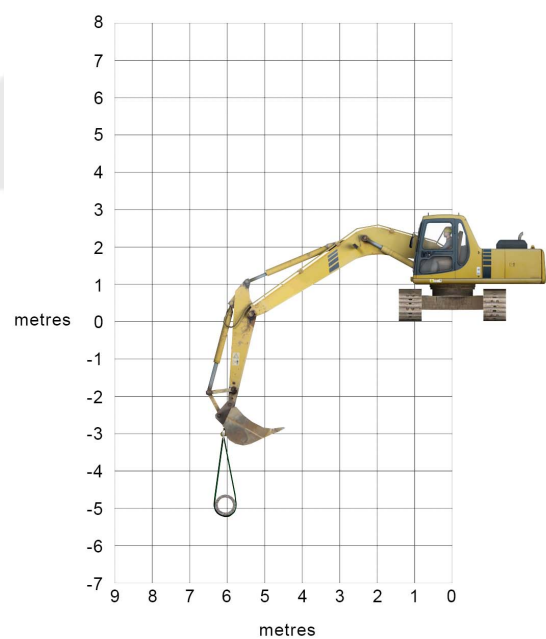
For "pick and carry loads" on firm level ground the load shall not be greater than 66.7% of tipping load as per AS 1418.5 or 88.9% of the Safe Working Load (SWL).

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.

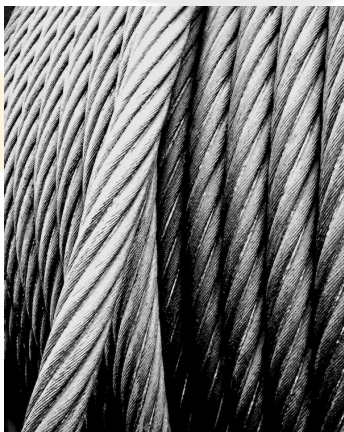
3.4.2 Choose Lifting Gear

When using an excavator or loader 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.



3.4.2.1 Types of Lifting Gear



Lifting gear that may be used includes:

- ◆ Wire rope slings – also known as Flexible Steel Wire Rope (FSWR).
- ◆ Chain slings. (No Tag!! NO Use)
- ◆ Synthetic slings. (Tears or damage)
- ◆ Eye bolts, shackles and hooks – used to attach lifting gear to the load and excavator. **(10% Wear Maximum)**

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. (Note: Must be tagged or cannot be used)

Defects that would condemn a lifting chain and hook from safe use include:

- ◆ Cracks in links
- ◆ Over 10% wear
- ◆ Over 10% elongation
- ◆ Over 5% wear or stretch in throat of hook
- ◆ Over 10% wear in bite hook
- ◆ Twisted or damaged links
- ◆ No SWL tag
- ◆ Rusted
- ◆ Chain or hook affected by heat
- ◆ Spot welded links

3.4.3 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 or loader 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.



3.4.4 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.
- ◆ Any other 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, especially if you need to travel with it.

- ◆ The excavator is in line with the load so it will not swing when it is lifted.

Minimum 16mm Tag line to be used

3.4.5 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.
If the load you are going to lift is likely to swing, attach tag lines to the load.
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.

3.5 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.

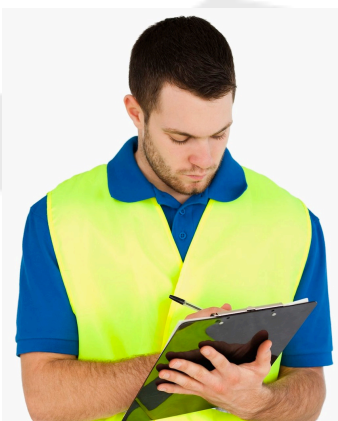
Live Stockpiles – Movement of materials in a live stockpile is likely. There is always the potential for the walls of a stockpile to collapse if it is incorrectly excavated.

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



Operator fatigue

3.5.1 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.

Your worksite may have standard paperwork that needs to be filled out, for example:

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

3.6 Park and Shut Down the Excavator

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.



3.6.1 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.

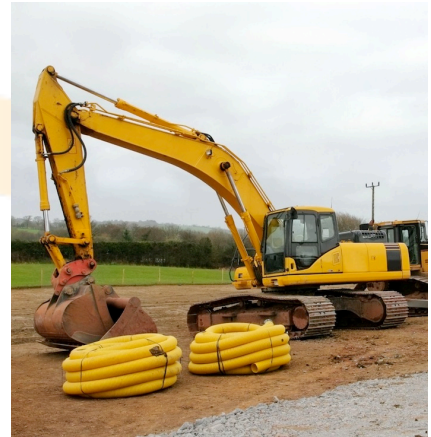
- ◆ Move all attachments into the shutdown position and release any pressure from the lines. Attachments should be lowered with the cutting-edge flat on the ground and pressure removed from hydraulic lines.

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

3.6.2 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.

3.7 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.

You will need to report any problems, faults, defects and damage that you found during the inspection so that they can be repaired and the machine and equipment are safe for you or the next operator to use.

3.8 Relocate the Excavator



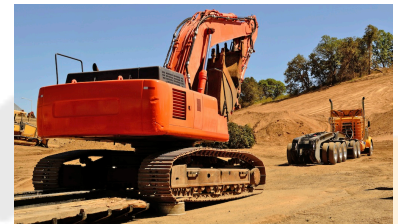
The excavator will need to be prepared before it can be moved from site to site.

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). Remove never happens
- ◆ 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.



Note: You must ensure the excavator is securely tied down as per the appropriate regulations
The safest way to load a plant with rubber tyres onto a truck via a steep ramp is to do it slowly with the rear of the machine facing up the ramp and bucket low.

3.8.1 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 or compliance code.
- ◆ 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 ramps.

Once on board the excavator must be securely locked down to prevent any movement.

3.9 Clean the Excavator and Do Routine Maintenance

It may not be practical to clean the excavator after every use but you should clean it 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.



PART 4: BACKHOE/LOADER



4.1 Backhoe/loader

4.1.1 What is a Backhoe/Loader?

A backhoe/loader is a wheeled, self-propelled machine with a front-mounted bucket and rear-mounted backhoe/loader attachment.



The backhoe/loader loads and pushes materials. The backhoe/loader attachment digs into the ground to excavate materials.

When the bucket lifts or swings, it moves the materials toward the machine and then into the discharge area.

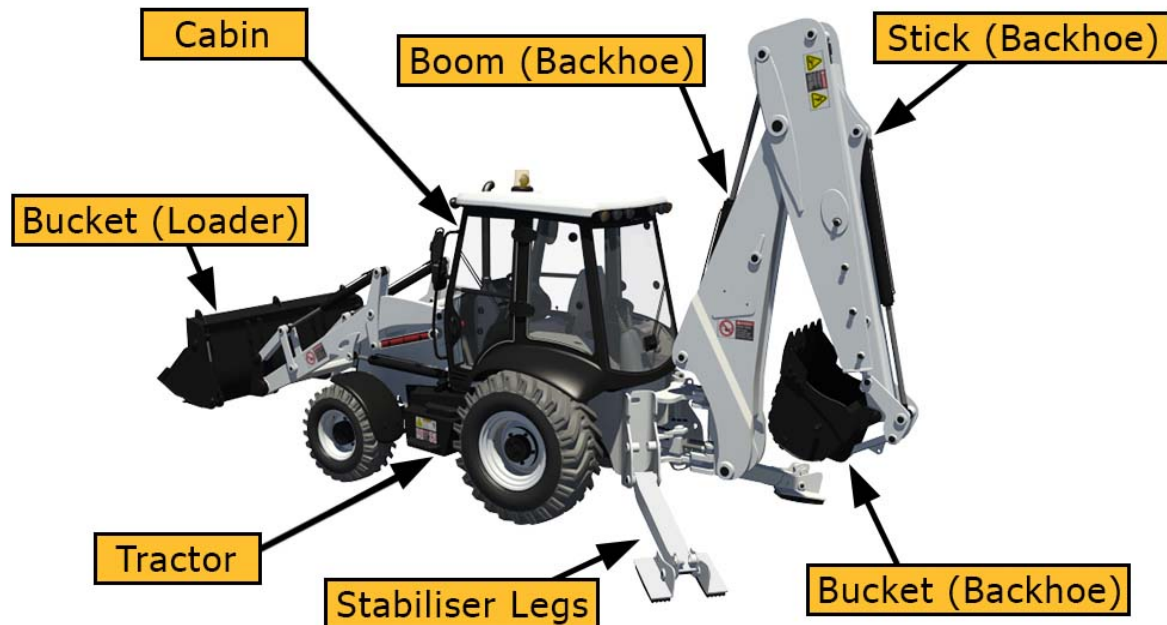
The machine should be stationary while the backhoe/loader attachment is being used.

The backhoe/loader attachment adds weight and length to the machine and this needs to be accounted for when moving it.

The attachment also adds crush, pin or pivot points. It is necessary to be aware of these points when operating the machine.

4.1.2 Backhoe/Loader Components

The following diagram and table outline the basic components of a backhoe/loader.



Component	Description
Bucket (Backhoe)	Hand section of the backhoe. The bucket does the digging and moving of material.
Stick (Backhoe)	Forearm section of the backhoe.
Boom (Backhoe)	Upper arm section of the backhoe. It is angled upwards so that digging is made easier with obstacles in the way.
Stabiliser Legs	Keeps the backhoe/loader stable while digging.
Cabin	Where the operator sits. The operator can face towards the loader or towards the backhoe. Each has separate controls to operate the attachments.
Tractor	Contains the engine of the machine.
Bucket (Loader)	Bucket at the front of the machine that loads, excavates, levels or pushes materials.

4.1.3 Backhoe/Loader Tasks

Backhoe/loaders are very functional machines capable of performing in a variety of tasks. These include:

Task	Description
Backfilling	Filling in holes.
Trench Excavation	Removing materials from designated areas in the trench formation.
Landscaping	Mixing of materials, stripping or spreading of topsoil or other materials such as gravels, also scrub clearing, ripping and cutting surfaces, compacting of surfaces.
Loading Plant	Loading materials onto other plant items, such as dump trucks, wagons, hoppers, chutes and any other cartage vehicle.
Lifting Materials	Transporting materials from one area to another.
Rock Breaking	Breaking rock and other demolition tasks.
Cutting and Boxing	◆ Cutting or removing 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. ◆ Prior to both cutting and boxing, the area is usually ripped to loosen the materials. This makes the task easier to perform.
Battering and Benching	◆ Batters are the slopes adjacent to constructed works (cuttings or embankments). ◆ Benches are steps that are dug into the materials to allow safe working on slopes. ◆ Both battering and benching take practice to achieve the required tolerances and shapes. It is necessary to know the limitations of the machine. Check site procedures and talk to experienced operators before attempting to cut or trim batters.

4.1.4 Backhoe/Loader Characteristics and Limitations

The differences between types and models of backhoe/loaders varies greatly. The one you choose will depend on the work to be carried out and the terrain to be worked in.

You should assess the ground conditions to decide whether or not the backhoe/loader you choose is suitable for the conditions.

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



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

4.1.5 Select and Fit Attachments

There are a range of attachments and equipment that can be fitted to the backhoe/loader, including:

Attachments	Examples of Use
Scarifier	Used for breaking up the surface of the site.
Ripper/Tynes	Used for ripping the surface and loosening materials where needed.
Auger	Used for moving materials up or down.
Rock/Concrete Breaker (Hydraulic Hammer)	Used to break rocks and concrete. Will often look like a large jackhammer.
Buckets	Tilt bucket, four-in-one bucket, standard bucket. The most common attachments for backhoe/loaders. Could be front or rear mounted depending on the needs of the worksite.
Mower/Slasher	Used for mowing or slashing of vegetation.
Forklift	For using the backhoe/loader as a forklift.
Free Grab/Rock Grab	Used for picking up large items such as rocks. Usually attached to the rear support frame.
Broom	Used to sweep the surface clean. Particularly important for removing debris from public roads.
Lifting Devices	Slings, lifting gear, platforms.
Vibrating Compaction Plate and Wheel	Used for compacting areas.
GPS	Used for machine guidance. Useful for keeping the backhoe/loader on a set path.
Extending Devices	Used to extend the reach of the attachments.
Other Approved Attachments	This includes magnet attachments, log grapples and blade graders.

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

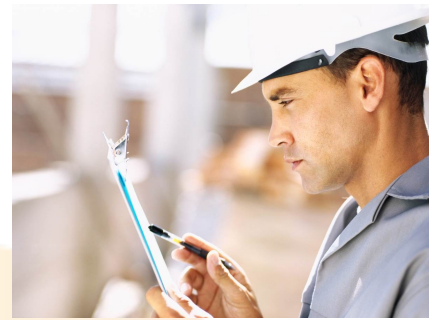
- What the attachment is designed for.
- If it is an approved attachment that can be used with the backhoe/loader you are operating.
- The manufacturer's requirements for the attachment.
- That you know how to use the attachment properly.

You will find this information in the operator's manual for the backhoe/loader and the operator's manual for the attachment. Otherwise you may need to check the workplace equipment procedures for your site.

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

Once again, the operator's manual for the specific backhoe/loader you are operating will have exact instructions on the connection process which must be followed at all times.

Once the attachment is fitted to the backhoe/loader you need to inspect the coupling points and any hydraulic hoses to make sure they are secure.



4.1.5.1 Remove and Fit Backhoe/Loader Attachments

Attachments need to be treated in accordance with the manufacturer's specifications and guidelines.



Each attachment has a different job to perform therefore must be fitted in a different location or manner.

You must familiarise yourself with the requirements for each individual attachment by reading the operator's manual or equipment guides.

Most attachments are fitted and removed using locking pins, coupling

attachments or screws, nuts and bolts.

Fitting Attachments

Generally, to fit an attachment:

1. Collect any documentation needed such as manufacturer's instructions, operator's manuals.
2. Collect any equipment that may be needed, including hand tools.
3. Park the backhoe/loader in the appropriate location.
4. Connect the attachment; making sure all bolts, nuts and locking pins are correctly applied.
5. Refer to the operator's manual or speak to your supervisor if you have any concerns with attachments.



Removing Attachments



When removing attachments it is necessary for you to remember safety first:

- ◆ Ensure the attachment is safe to remove.
- ◆ Check that all points of the attachment have been undone before removing the attachment.
- ◆ Heavy attachments should be removed with good manual handling techniques. Use team lifts as much as possible.

4.1.6 Pre-Start Checks

Pre-start checks are done before the engine is started. Walk around the backhoe/loader and look for anything that is out of the ordinary.

Part or Component	What to Check for
Structure	Check the general condition of the backhoe/loader. Check for oil or other fluid leaks. Check for any signs of visual weaknesses, damage, stressed welds or paint separation.
Tyres	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.
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.
Power Arms	Make sure you check the power arms 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 backhoe/loader dangerous to operate you need to inform your supervisor or an authorised person. Then isolate the backhoe/loader and don't use it until it is repaired.
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.

Part or Component	What to Check for
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.
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 or bar are 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 backhoe/loader 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.

4.1.7 Operational Checks

Operational checks are carried out once the engine is started.



Climb up to the backhoe/loader cabin 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 backhoe/loader. Never jump from the backhoe/loader.

Adjust the seat until comfortable and make sure you have maximum visibility.

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.

Always make sure your seat/safety belt is on and attachments are raised before moving off.

Controls and functions that need to be checked on the backhoe/loader:

Part or Function	What to Check for
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 and other warning devices.
Attachments	Check that the attachment is secured and connected to the backhoe/loader 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.

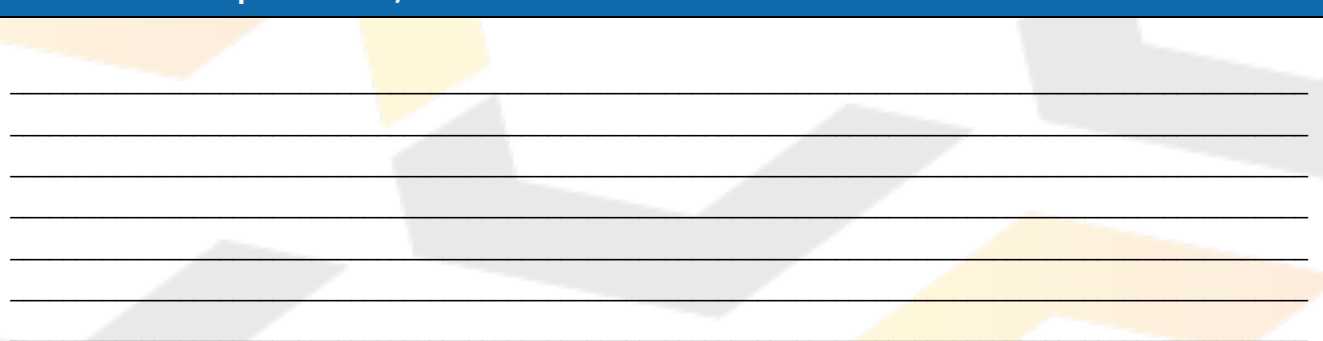
Once you have finished your operational checks it is a good idea to check for external signs of oil or fluid leaks. It is common for the start-up process to cause a leak through hoses breaking.

4.1.7.1 Backhoe/Loader Inspection Checklist

Backhoe/Loader Inspection Checklist				
Company Name		Date		
Operator Name		Site		
Machine Number		Operator Name		
Check Type (please circle)		Pre-Start Post-Operational		
Component	What to Check for	✓	Comments	
External Check				
Tyres and wheels.	Inflation, pressure, damage, covers.			
Loader bucket, linkage and retainers.	Wear, damage, cracks, leaks.			
Backhoe/loader bucket, linkage and retainers.	Excessive wear, damage, cracks, leaks.			
Backhoe/loader stick, boom, cylinders.	Damage, wear, cracks, grease, loose parts.			
Underneath machine.	Leaks, loose parts, damage.			
Frame, steps, handholds.	Condition, damage, cleanliness.			
Hydraulic cylinders, tubes, hoses, fittings.	Damage and leaks.			
Outriggers & stabilisers.	Clean, secure, packing present.			
Covers and guards	Damage, wear, secured.			
Windows, wipers and mirrors.	Cleanliness, damage, fluid levels.			
Decals and signage.	Readability, wear.			
Load capacity plate.	Damage, wear, visible.			
Overall machine.	Loose/missing parts, damage, wear, missing guards and safety devices.		Out of Service Tag Attached? Yes / No	
Engine Check				
Fluids.	Engine oil, hydraulic oil, transmission oil, coolant, engine pre-cleaner, brake fluid.			
Batteries.	Cleanliness, loose nuts/bolts.			
Air filter.	Damage, dirt buildup, indicators.			
Radiator.	Damage, leaks, dirt buildup, blockages.			
Hoses.	Leaks, wear, damage.			
Belts.	Tightness, wear or cracks.			
Overall engine.	Damage, dirt buildup, leaks.		Out of Service Tag Attached? Yes / No	
Internal/Cabin Check				
Levers, controls and gauges.	Damage, cleanliness, labels, working.			
ROPS.	Damage, cracks, wear.			
Floor plates.	Clear and free of oil/grease.			

Seat and seat belts.	Adjustment, damage, wear.		Out of Service Tag Attached? Yes / No
Fire extinguisher.	Damage and charge.		
Logbook, running sheet, vehicle history, service sheets.	Present and correct		
Overall cabin interior.	Clean, damage, missing parts.		

Out of Service Tag Attached? Yes / No

Action Taken to Repair Backhoe/Loader:

Name:

Date of Repair:

Return to Service Authority by Supervisor

Comments:

Supervisor
Name:

Signature: _____

Date:

4.1.7.2 Test Backhoe/Loader Attachments

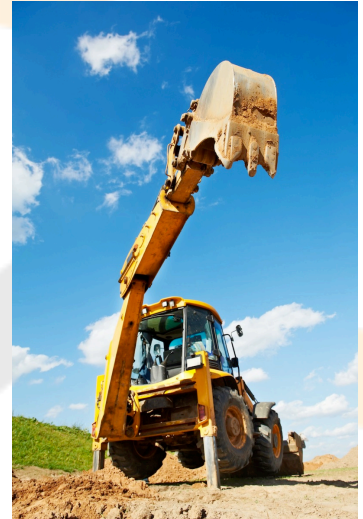
Once the attachment is fitted, it is necessary to test it to ensure the correct fit, that it is secure, and that the attachment will function as required. This is to ensure the attachment will not break or become unsafe during use or operation.

The testing procedure for each attachment will be outlined in the operator's manual for the machine or in your site procedures.

To test the attachment for correct fit and use, turn the machine on and operate the attachment controls. Ensure that the attachment moves as it should, and has full range of motion (appropriate to the specific attachment).

Things to consider when testing an attachment for fit and operation include:

- ◆ Site procedures.
- ◆ Backhoe/loader procedures.
- ◆ Safe operating procedures.
- ◆ Attachment operations manual.
- ◆ Backhoe/loader operator's manual.
- ◆ Site plans, i.e. don't do your test in the middle of a process or other activity.



The steps for checking attachments should include:

- 1** Visual inspection.
- 2** Physical inspection.
- 3** Check the hydraulic hoses for any bulges or unexpected lumps.
- 4** Check the controls to manoeuvre the attachment.
- 5** Check warning lights and alarms.
- 6** Check that the attachments are authorised.

Once all routine checks are finished, you will need to report any problems, faults, defects and damage that you found during the inspection so that they can be repaired and the machine and equipment are safe for you or the next operator to use.

4.2 Operate the Backhoe/Loader



During civil construction backhoe/loader operations you will need to:

1. Assess the materials you are working with.
2. Use the equipment safely within the technical specifications and limits.
3. Use the equipment for tasks that it is specifically designed for.
4. 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.



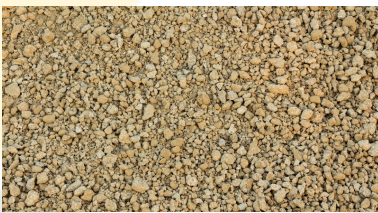
Workers you may need to coordinate with include:

- ◆ Other mobile and processing plant operators.
 - ◆ Maintenance workers.
 - ◆ Water truck/cart operators.
 - ◆ Service vehicle operators.
 - ◆ Crane and float operators.
 - ◆ Contractors and site visitors.
 - ◆ Inspectors, both internal and external, including WHS, environmental and quality assurance officers.
- ◆ Supervisors.

4.2.1 Assess Materials to be Shifted

You will need to assess the materials you are working with to figure out the best way to handle them. 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:



- ◆ Topsoil.
- ◆ Clays.
- ◆ Silts.
- ◆ Gravel.
- ◆ Mud.
- ◆ Stone.
- ◆ Rock, which might be:
 - ◆ Metamorphic.
 - ◆ Igneous.
 - ◆ Sedimentary.
 - ◆ Blended materials.

- ◆ Organic materials.
- ◆ Bituminous mixes.

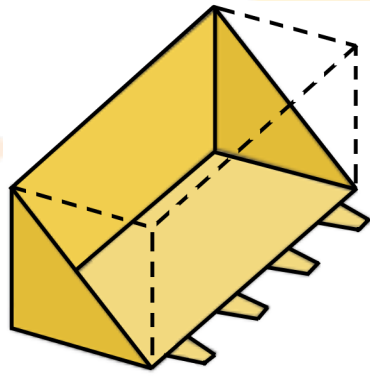
You will also need to assess the weight of the materials you are working with.

Material	Weight per m ³	Material	Weight per m ³	Material	Weight per m ³
Bronze	8.5t	Gypsum	2.3t	Sand, beach, wet	2.3t
Clay	1.9t	Iron Ore	5.4t	Sand, river, wet	1.5t
Coal	846kg	Lead	11.4t	Shale	2.6t
Concrete	2.4t	Lime (stone)	2.6t	Terracotta	1.8t
Earth	1.9t	Sand, beach, dry	2.0t	Zinc	7.0t
Granite	2.6t				

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:

$$\frac{\text{Bucket Length} \times \text{Height} \times \text{Width}}{2}$$



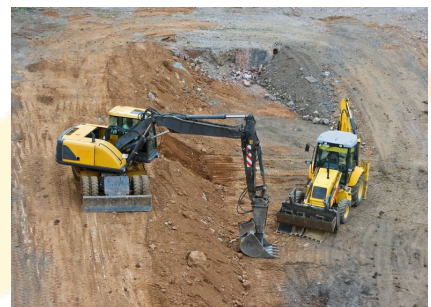
Check the weight of the materials against the manufacturer's specifications to make sure you don't overload the backhoe/loader.

Keep in mind that uneven, rough, boggy or sloping ground can all reduce the amount or material that the backhoe/loader can safely carry.

4.2.2 Safe Operating Techniques

To make sure your work is done in a safe way it is important to follow some basic safe operating techniques, such as:

- ◆ Ensuring that you have read the operator's manuals prior to using a new machine.
- ◆ Identifying the terrain you will be moving through and noting any potential problems or hazard areas.
- ◆ Altering your operating techniques based on the prevailing conditions.
- ◆ Monitoring speed.
- ◆ Keeping within backhoe/loader tolerances and capacity.
- ◆ Following site procedures for safe operations of backhoe/loaders. This includes restricting passengers from riding in the backhoe/loader unless provided with an approved seat and seat belt.
- ◆ Recognising defects or problems.



- ◆ Using the appropriate operating techniques for the materials being moved. For example, clay is more cohesive and harder to excavate than topsoil. It would therefore need the operator to change their techniques used.
- ◆ Following movement plans and haul circuits established during site meetings.
- ◆ Abiding by communication protocols established for the site. This includes following all directions and using approved communication techniques for the site.
- ◆ Always following site procedures for incidents and emergency situation. This includes reporting all incidents that occur.



It is important to note that when running an internal combustion engine in an enclosed space the exhaust fumes can kill. Ensure that the space is adequately ventilated and that you are using an approved exhaust control unit, such as a catalytic converter (scrubber).

Appropriate safe operating limits and techniques should be outlined in site operations manuals and operator's manuals.

Speaking with team members or other backhoe/loader operators will allow you to exchange tips and techniques for the site or conditions you are operating in.

4.2.2.1 Safe Travel Speeds

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

4.2.3 Drive to the Work Area

Before shifting any material the backhoe/loader must be driven to the work area.

You should make sure that the route and direction of travel is clear and that you travel at a safe speed. Also ensure that grounded attachments are raised to the correct height or stowed.

Always check over both shoulders to ensure the direction of travel is clear before reversing, and use a higher gear or speed. A reverse warning device should indicate to others that you are intending to reverse.



Wherever possible, side hill travel should be avoided, as there is a greater chance of turning the machine over.



If you must drive the backhoe/loader down a sloping surface you **should drive directly down the slope**, not across or diagonally down. This will ensure the machine is as stable as possible.

On approach to downhill or uphill travel you should reduce the speed of the backhoe/loader and select an appropriate gear for the grade.

During downhill travel always select a low gear to help control the descent. Often this is the same gear that would be used to climb the hill.

If you need to cross a ditch you should slow your speed and approach the ditch

at an angle.

DO NOT coast (put into a neutral gear and roll) the backhoe/loader downhill.

4.2.4 Backhoe/Loader Techniques

When operating a backhoe/loader it is important for you to feel confident in your machine and to know its capabilities.

This is best achieved by reading the operator's manual.

Also spend the time to work out engine rev performance, what speeds are appropriate for which tasks, at what height the bucket performs best and other factors for the backhoe/loader you are operating.

This will help you to operate safely in all terrains and to adjust your operating techniques effectively.



Operating techniques include:

- ◆ General driving.
- ◆ Reversing.
- ◆ Manoeuvring.
- ◆ Braking.
- ◆ Attachment operation.
- ◆ Bucket loading.
- ◆ Load carrying.
- ◆ Load discharge.

4.2.4.1 General Driving

General driving techniques include:

- ◆ Be alert to hazards and dangers at all times.
- ◆ Be careful not to drive over or too close to trench areas or be in a position that the machine may be exposed to an open or unprotected edge of a trench, bench or batter.
- ◆ Watch the terrain for hazards such as tree stumps.
- ◆ Keep clear of holes and soft areas.
- ◆ Travel downhill in gear and do not travel across steep slopes.
- ◆ If you are tired, sick, medicated or have drugs or alcohol in your system – don't drive.
- ◆ Do not carry passengers.
- ◆ Have the bucket close to the ground.
- ◆ Cross rail lines at an angle.



4.2.4.2 Reversing



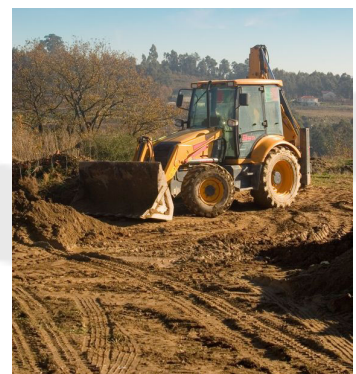
Reversing techniques include:

- ◆ Make sure the way is clear before starting to reverse.
- ◆ Look behind you and keep looking in the direction you are travelling.
- ◆ Turn the seat to face the direction of travel or work (if possible). This will help you to avoid neck injuries as well as make the task safer and more efficient.

4.2.4.3 Manoeuvring

Manoeuvring techniques include:

- ◆ Room and space for movement are often limited but techniques can improve with practise.
- ◆ Look out for other plant, structures, stockpiles and roadways.
- ◆ Be familiar with the worksite and your work area.
- ◆ Know the limitations of machine.
- ◆ Talk to other operators about tips for improving operation and manoeuvring.



4.2.4.4 Braking

Braking techniques include:



- ◆ Have machine sympathy.
- ◆ Don't brake too suddenly unless in case of accident.
- ◆ Allow enough distance to stop, particularly with a loaded bucket.
- ◆ Don't put the machine off balance when braking.
- ◆ Watch out for braking while turning, especially if locking brakes are fitted.
- ◆ Read the operator's manual – know your machine's capabilities.

4.2.4.5 Attachment Operation

Every piece of equipment has design limits and operational recommendations. This applies both to the attachment and the backhoe/loader as a vehicle.

Operating within the specifications, recommendations and design limits ensures you do not damage either the backhoe/loader or the attachments.

How each attachment is used will be outlined in the operator's manual and shown to you during your equipment induction and familiarisation process.

It is important that you follow and respect the usage recommendations and the design limits for attachments, as this will guide you in using attachments safely and efficiently to achieve the desired results.

If you are unsure of how you should fit, use or remove an attachment, read the operator's manual or speak with an authorised mechanic or fitter or other members of your team.



4.2.4.6 Bucket Loading



Bucket loading techniques include:

- ◆ Apply the correct technique for the type of bucket you are using.
- ◆ Talk to more experienced operators and ask for mentoring if you feel you need help.
- ◆ Don't overload the bucket.
- ◆ Efficiency and effectiveness in loading comes with practice.

4.2.4.7 Load Carrying

Load carrying techniques include:

- ◆ Carry the load low to the ground wherever possible.
- ◆ Travel at a safe speed.
- ◆ Keep the machine balanced.
- ◆ Try to avoid spillages.



4.2.4.8 Load Discharge

Load discharging techniques include:



applicable.

- ◆ Discharge the load on level ground or surface to avoid rollover.
- ◆ Have machine sympathy.
- ◆ Raise the bucket to the correct height for discharge before starting to roll the bucket.
- ◆ Roll the bucket to ensure clean discharge of materials.
- ◆ Ensure correct braking (or use of hand/load brake) to stop movement if

4.3 Backhoe/Loader Operations

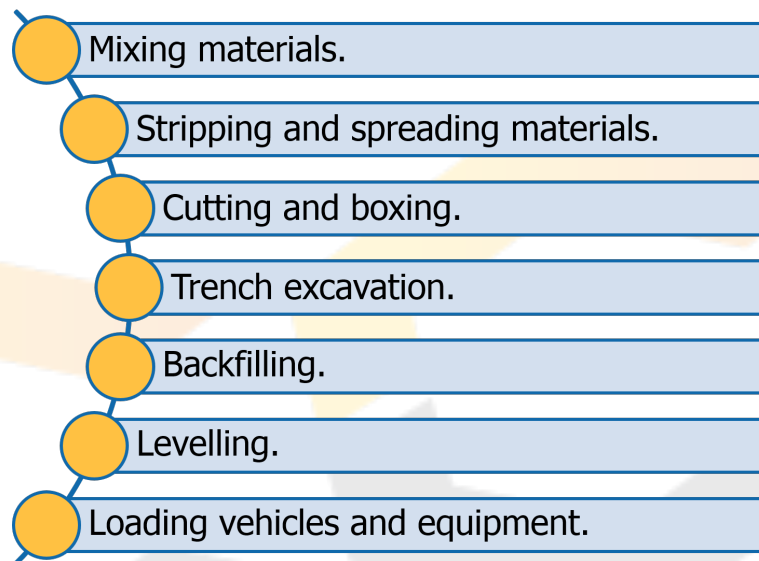
Identifying and applying techniques that will help you achieve optimum output is a matter of knowing your backhoe/loader, the attachments you are using and the terrain you are operating in.

One of the best methods for developing operational techniques is to ask a more experienced operator to mentor you.

Due to the high centre of gravity of a backhoe/loader unit, you must be able to adapt to different terrain conditions. It is necessary to raise or lower the boom on the backhoe/loader and use the bucket to balance the machine.



Backhoe/loader operations include:



4.3.1 Mixing Materials



Backhoe/loaders can be used to mix materials as they have a large bucket and are able to move large amounts of materials quickly.

A tiller attachment is useful for this kind of work. You can use one to break up the ground and mix topsoil or clay with other materials to prepare the ground for future work.

Rippers and scarifiers can also be used to break up the ground before mixing materials.

4.3.2 Stripping and Spreading Materials

Backhoe/loaders can be used to strip back the top layer of earth to excavate or level an area. This is achieved by the blade of the bucket as it is used to cut and lift a small amount of the topsoil.

This topsoil can be transported to another area and spread out. Spreading topsoil can be done a number of ways. You can discharge the soil from the bucket bit by bit as you move along, or scrape a small pile of topsoil over an area using the blade of the bucket or a 4-in-1 bucket.



4.3.3 Cutting and Boxing



Cutting involves the 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.

4.3.4 Trench Excavation

Backhoe/loaders are often used for digging trenches and holes, i.e. excavations. If you are excavating or digging it is important to remember some points including:



- ◆ Check for underground services (power, telephone, gas, water, sewer, drainage and fibre optic cable lines) before starting to excavate. Talk to the site supervisor who will contact the supply authorities for council maps of the site.
- ◆ Cut a trench to required specifications and deposit full buckets of material away from the trench.
- ◆ If cutting a trench across a footpath:
 - ◇ Obtain information and permits from relevant authorities who may run services under the footpath.
 - ◇ Excavate slowly towards any underground services.
 - ◇ Provide appropriate barricades and signs.
- ◆ Remove any large rocks from a trench where required.
- ◆ If trench excavations are deeper than 1.5m, or the material is likely to collapse, the backhoe/loader operator is required to bench and batter the sides then lower trench shields before the excavation is entered.
- ◆ Do not undercut a trench, bank or stockpile, as it could collapse and cause the backhoe/loader to overturn and trap the operator underneath.
- ◆ When operating on soft or uneven ground the load that you can safely raise or carry will be reduced.
- ◆ Loads should be placed a safe distance from the trench – not closer than 1m with material coming to rest no closer than 0.5m from the excavation.
- ◆ Use barricades, guard rails or fencing and warning signs to prevent workers falling into a trench or vehicles/machines getting too close. Nobody should be standing within operating radius of the backhoe/loader.
- ◆ Monitor indication signs that you are getting close to a previous excavation or an underground service when excavating. 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.

4.3.5 Backfilling

The backhoe/loader can be used to backfill trenches or small excavations after work has been completed. When backfilling it is important that you ensure the right materials are deposited into the excavation, and 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.

When backfilling trenches remember to:

- ◆ Keep a 90 degree angle unless your site plans say otherwise.
- ◆ Keep clear of edges and drop-offs.
- ◆ Avoid soft edges and deep holes.

Trenches over 1.5m must be shored to prevent collapse. This is required if people will be working in the trench area or alongside.

4.3.6 Levelling

Levelling with the backhoe/loader is performed by having the bucket placed flat on the ground and the machine move backwards, dragging the bucket.

It is important to remember the following points:

- ◆ Work to the designated grades in the required manner. This will include the type of levelling, the grade and slope, and the fall (for water to shed off).
- ◆ Levelling information and procedures will be discussed during your task briefings.
- ◆ 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 must be checked against site reference points such as pegs, benchmark points or other defined levels.



4.3.7 Loading Vehicles and Machinery

Backhoe/loaders can load materials into site vehicles and machinery, such as dump trucks, wagons, hoppers and chutes.



When loading materials and loads into vehicles it is important that you know where the driver is and coordinate your approach with them. You don't want to accidentally run into them.

Approach the side of the vehicle or machinery slowly once it has stopped in position.

Avoid contact with the vehicle or machinery by leaving enough room to raise the bucket.

Once the bucket is high enough you can move in closer and roll it forward to deposit the load into the vehicle or machinery.

4.4 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 loader 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 such as landscaping or preparing road base you will be working with different materials, attachments and personnel.



4.5 Lift, Carry and Place Loads Using Slings and Lifting Gear

In civil construction projects you may need to use the backhoe/loader to lift and carry loads using slings and lifting gear. For example, lowering pipes into trenches. The backhoe/loader end of the machine should be used for this kind of work. Using the front bucket for lifting should only be done if using a bucket attachment that is specifically designed for lifting (has an approved and rated lifting lug).

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



4.5.1 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 backhoe/loader 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 sheets.
- ◆ Check the weighbridge certificate.
- ◆ Calculate the weight of the load or material.



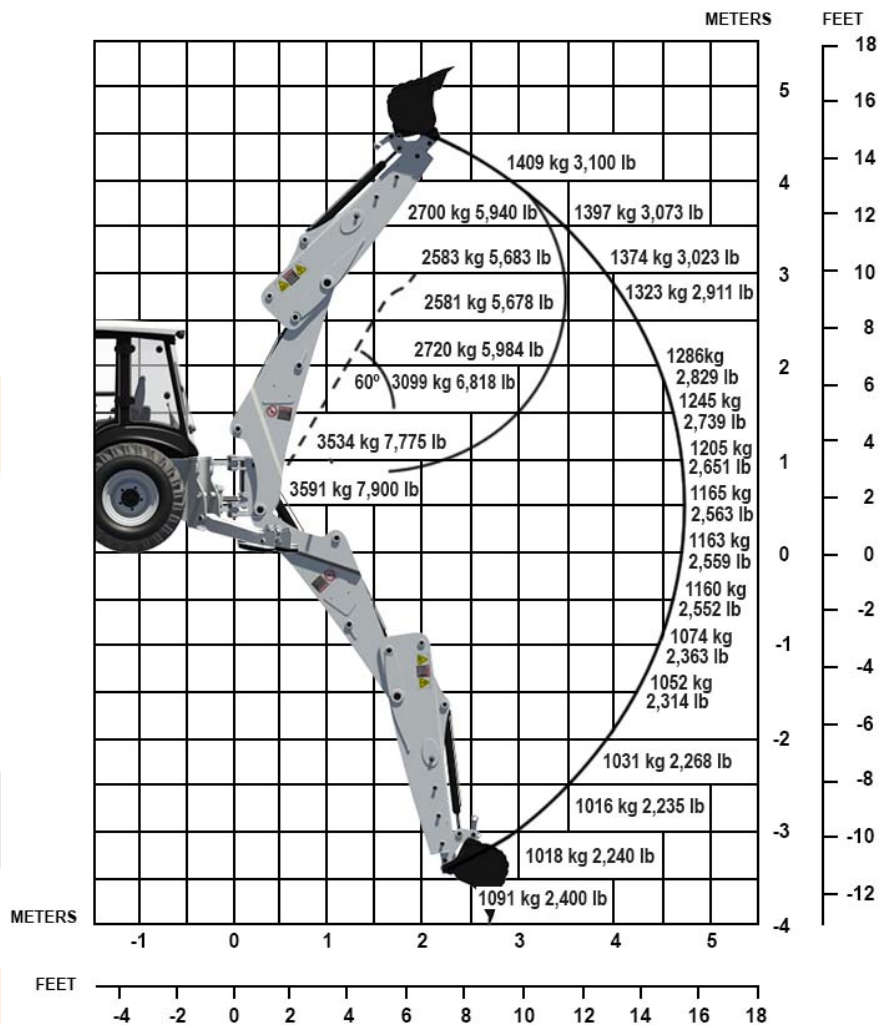
If you cannot be sure of the weight and cannot calculate it, do not lift the load.

Once you know the weight of the load you need to make sure the backhoe/loader you are using has the capacity to lift it safely. You can check the capacity of the machine 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 backhoe/loader.

Always check the backhoe/loader load chart to make sure that any load that is lifted is within the capacity of the machine.

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



4.5.2 Select Lifting Gear



When using the backhoe/loader 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.

4.5.2.1 Types of Lifting Gear

Lifting gear that may be used with the backhoe/loader 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 backhoe/loader.



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.

4.5.3 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 backhoe/loader 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.

4.5.4 Position the Backhoe/Loader

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

- ◆ The machine is on firm level ground.
- ◆ The load, backhoe/loader and lifting gear can all be safely accessed.
- ◆ Any other 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, especially if you need to travel with it.
- ◆ The backhoe/loader is in line with the load so it will not swing when it is lifted. This could include being at a 90 degree angle to the excavation area.
- ◆ You have a clear line of sight to the excavations and areas you will be lifting loads into.
- ◆ You have enough swing room to operate the backhoe/loader safely.
- ◆ You are using extended or engaged stabilisers for additional support.



4.5.5 Lifting Techniques

Follow these guidelines whenever using the backhoe/loader to shift a load using slings and lifting gear:



- ◆ 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 the shortest distance possible to maintain effective and efficient control of the machine and the load.
- ◆ Constantly monitor the load during any moving activities.
- ◆ Keep the load as low as safe and practical if travelling with the load.
- ◆ The swing zone of the backhoe/loader attachment should be clear.
- ◆ 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 backhoe/loader, 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 Monitoring Systems and Alarms

Each machine has its own set of alarms, monitoring systems and gauges to help you safely and efficiently operate it, and warn you if something is wrong. Each make and model of the same type of machine can be different so it is important that you are familiar with all of the systems for the equipment you are using. Check the operator's manual for a full list of devices, alarms and warnings.



Here are some examples of the gauges and warning systems for a backhoe/loader:



- ◆ Engine oil pressure.
- ◆ Engine temperature.
- ◆ Hydraulic oil pressure.
- ◆ Hydraulic oil temperature.
- ◆ Electrics.
- ◆ Fuel.

Generally, alarms and warnings fit into 3 categories:

Warning Type	Category	Examples	What You Should do
Category 1	These types of warnings let you know that the machine needs some attention, but it is still safe to operate.	◆ Low fuel. ◆ Low system voltage.	Keep operating as long as it is safe to, and report the problem once you stop work.
Category 2	These warnings indicate that there is a problem caused by the way you are operating that may lead to problems with the equipment.	◆ Equipment is overheating. ◆ Equipment is overloaded.	Change the way you are operating and if the problem is not fixed, stop operating and report the issue.
Category 3	This is the most serious warning level. Continuing to operate while this warning is sounding will cause damage to the machine.	◆ The park brake is on. ◆ Low engine oil pressure.	Stop operating and shut down the equipment immediately. Report the problem straight away.

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.

If you hear an alarm while you are operating the plant.

- ◆ **Stop operating and consult the operator's manual or the dealer to identify the problem.**
- ◆ **If the problem cannot be fixed, stop operating, tag out and report the issue to your employer.**

Various hazards including operator fatigue are discussed in the previous sections of this Learner Guide.

4.7 Checking Completed Work



The key to completing tasks efficiently is good time management and knowing how to use your equipment properly.

Once you have completed your work you will need to check it against:

- ◆ Your work instructions and project plans and drawings.
- ◆ Project quality requirements and timelines.

Speak to your supervisor when the work is completed to see if there are any other tasks that need to be done to complete the job.

4.8 Park and Shutdown the Backhoe/Loader

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



4.8.1 Parking the Backhoe/Loader

Backhoe/loaders need to be parked in a safe way that will allow easy access to the vehicle.



Safe parking practices include:

- ◆ Stop the backhoe/loader on a flat level surface in the designated area and keep the access points clear.
- ◆ Park the backhoe/loader away from overhangs, excavations, access ways and tidal or flood areas.
- ◆ If the backhoe/loader must be parked on a sloping surface it should be facing across the slope.
- ◆ Keep the backhoe/loader away from refueling 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 shut down position and release any pressure from the lines.

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

4.8.2 Shutting Down the Backhoe/Loader

Shut down procedures include:

- ◆ Cooling of the engine before shutting it down. This depends on the backhoe/loader 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 backhoe/loader using any applicable lock out or isolation devices and removing the keys. This will prevent any movement of the backhoe/loader.
- ◆ Ensuring 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.

4.9 Post-Operational Checks

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

General maintenance activities are done to keep all plant and equipment working safely for longer.

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



4.10 Prepare the Backhoe/Loader for Transportation

Before a backhoe/loader can be moved from one site to another, it will need to be prepared for transport. On most sites it is necessary to:

Clean the Machine Thoroughly	Cross-contamination is an issue for sites. Most will not allow a dirty machine onto site because of cross contamination of weed seeds, dirt particles, bacteria, fuels, or oils.
Empty the Fuel Tank	Fuel should be emptied from the machine as a safety issue if required or if specified in site procedures.
Secure any Moving Parts	Security pins, locking pins and plates applied where appropriate. These pins are designed to keep movable parts from moving.
Lock and Lower the Bucket for Relocation	Sometimes the bucket may need to be removed altogether if the backhoe/loader is a large model.
Remove Attachments	These may need to be removed from the backhoe/loader and stowed appropriately for transporting with the machine.

4.10.1 Move Backhoe/Loader between Worksites



Moving larger plant and equipment between worksites is normally done on a float (trailer) because the machines are too slow, or not allowed to drive on the road.

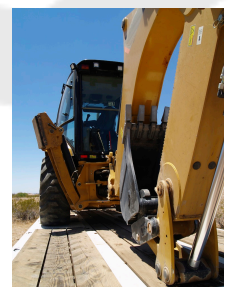
Make sure that an approved traffic management plan is in place. This may include:

- ◆ Stopping other traffic to allow the equipment to move freely.
- ◆ Using escort vehicles where needed.
- ◆ Sometimes a haul vehicle crossing will be established to allow materials movement across public roadways. Always follow designated traffic control and maintain communication with other workers involved.

When transportation is required, you will need to drive the machine onto the float. The safest way to do this is to use a spotter to make sure you are moving onto the float as straight as possible and that you stop in the right position to secure the equipment onto the trailer.

Once the equipment is in place on the back of the float, locking pins will need to be engaged and it will be tied down and secured onto the float.

A spotter would also be used when unloading the vehicle once it gets to the next place.



4.11 Carry Out Maintenance Tasks



Maintenance activities could include:

- ◆ Cleaning the backhoe/loader.
- ◆ Authorised servicing and minor replacements or repairs.
- ◆ Refuelling.
- ◆ Recording and reporting of faults through workplace procedures.

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 backhoe/loader stays at its operating capacity for as long as possible.

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



4.11.1 Servicing and Minor Replacements



Replacements that the operator can make will vary with the backhoe/loader and worksite but could include filters, fluids, wiper blades, attachments, accessories and ancillary items.

If you need to remove the radiator cap on a machine that has not completely cooled off, slightly loosen the cap to release the pressure and then slowly remove the cap. Make sure you use gloves and safety goggles and a rag or cloth when removing the cap.

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

4.11.2 Clean and Store Backhoe/Loader Attachments

Attachments need to be kept in good working order. This requires correct maintenance such as cleaning the attachments, and storing them in designated storage locations.



with care.

Things to consider if your attachments require manual cleaning:

- ◆ Some materials that you work with can become extremely hot and sticky, and could possibly burn through your clothing and skin. Use appropriate cleaning instruments and wear personal protective equipment (PPE) as required.
- ◆ Backhoe/loader attachments such as ripping tynes can be sharp. Clean

Most attachments will have designated storage locations as outlined in the site requirements.

This is to ensure the attachment can be found quickly and easily the next time it is needed, and so that it is kept free from damage.

Storage requirements could include:

- ◆ Must be stored in a padded hard case box – particularly with laser levels.
- ◆ Must be stored in particular environmental conditions such as a certain temperature.



Reading, knowing and understanding the particular requirements for each attachment is the only way of ensuring items are correctly cleaned and stored.

Refer to the manufacturer's guidelines, operator's manual and worksite procedures for each item.

PART 5: SKID STEER LOADER



5.1 Skid steer loader

5.1.1 What is a Skid Steer Loader?

A skid steer loader is a self-propelled wheeled or tracked machine that turns by skidding or reversing the wheels or tracks on one side of the machine.

It has a front-mounted bucket-supporting structure and linkage and is used to excavate, lift, transport and discharge material.



5.1.2 Skid Steer Loader Components

There are many models of skid steer loaders, but they share the same main components. The following diagram illustrates the basic components:



Component	Description
Hydraulic Arms	Attached to the rear of the machine to provide counter balance to loads. Hydraulic arms operate the bucket.
Bucket	A scoop at the front of the loader, with hydraulic arms that can lift and lower the bucket for excavating, pushing, lifting and tipping.
Cabin	Protected with a safety cage, the driver and controls are in the cabin.
Chassis	Provides the base for the loader, drive train and engine.

5.1.3 Skid Steer Loader Operations

The tasks performed by a skid steer loader may include:



- ◆ Rock breaking.
- ◆ Excavations.
- ◆ Backfilling.
- ◆ Compacting.
- ◆ Cutting batters and benches.
- ◆ Lifting and carrying materials.
- ◆ Loading vehicles.
- ◆ Mixing materials.
- ◆ Site clean up.
- ◆ Stripping/spreading topsoil and materials.

- ◆ Other activities that use specific attachments.

5.1.4 Skid Steer Loader Characteristics and Limitations



The two main differences between types of skid steer loaders are the size of the loader 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 or not you should be using a skid steer with tracks instead of tyres. Tracks can provide more stability and traction on soft or boggy ground.

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

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



5.1.5 Select Attachments

There are a range of attachments and equipment that can be fitted to a skid steer including:



- ◆ Bucket – for scooping and sometimes levelling uneven terrain.
- ◆ Multipurpose 4:1 bucket – can be used to scoop, carry, pick up and for levelling.
- ◆ Pallet forks.
- ◆ Dozer blade – can be used for levelling surfaces as well as clearing rubble/waste.
- ◆ Pavement milling devices – for removal of concrete or other surfaces in preparation for resurfacing.
- ◆ Hammer.
- ◆ Backhoe arm and bucket.
- ◆ Auger – for drilling holes.
- ◆ Power broom.
- ◆ Concrete cutter or saw.
- ◆ Chain digger – used for digging trenches.
- ◆ Asphalt cutter or saw.
- ◆ Rotary hoe – for tilling ground.



- ◆ Profiler – to ensure surfaces match specific profiles.
- ◆ Tiller/mixer.

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 loader 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 skid steer and the operator's manual for the attachment. Otherwise, you may need to check the workplace equipment procedures for your site.



5.1.6 Fit and Remove 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 loader. 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 skid steer loader 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.



procedures.

Generally, **to remove an attachment:**

1. Collect any required tools or equipment.
2. Ensure the loader 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

A manufacturer's approved and specially designed lifting lug attachment with SWL marked on the machine must be provided on a skid steer loader to attach slings so that the skid steer loader may be used as a crane.

5.1.7 Pre-Start Check

Pre-start checks are done before the engine is started. Walk around the loader and look for anything that is out of the ordinary.

Part or Component	What to Check
Structure	Check the general condition of the loader. 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.
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.
Power Arms	Make sure you check the power arms 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 loader dangerous to operate you need to inform your supervisor or an authorised person. Then isolate the loader and don't use it until it is repaired.
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.
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 or bar are 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 skid steer 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.

5.1.8 Operational Checks

Operational checks are made once the engine is started.



Climb into the skid steer 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 loader.

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

Start up the loader 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 on the skid steer:

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 signalling any alarms or warnings.
Safety Devices	Test all lights and other warning devices.
Attachments	Check that the attachment is secured and connected to the loader 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.

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.

Once all routine checks are finished, you will need to report any problems, faults, defects and damage that you found during the inspection so that they can be repaired and the machine and equipment are safe for you or the next operator to use.

5.2 Operate the Skid Steer Loader



During civil construction skid steer 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.



- ◆ Site safety personnel.

Workers you may need to coordinate with include:

- ◆ Supervisors and management.
- ◆ Other plant and vehicle operators.
- ◆ Traffic controllers or other workers on the site.
- ◆ Team leaders.

5.2.1 Assess Materials to be Shifted

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:



- ◆ Topsoil.
- ◆ Clays.
- ◆ Silts.
- ◆ Gravel.
- ◆ Mud.
- ◆ Stone.
- ◆ Rock, which might be:
 - ◆ Metamorphic.
 - ◆ Igneous.
 - ◆ Sedimentary.
 - ◆ Blended materials.
 - ◆ Organic materials.
 - ◆ Bituminous mixes.

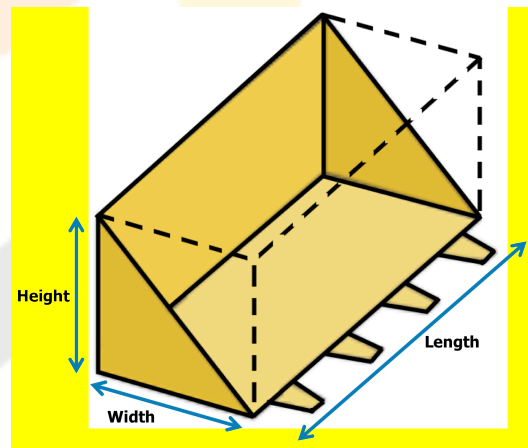
You will also need to assess the weight of the materials you are working with.

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:

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



Check the weight of the materials against the manufacturer's specifications to make sure you don't overload the skid steer. Keep in mind that uneven, rough, boggy or sloping ground can all reduce the amount of material that the skid steer can safely carry.

5.2.2 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 skid steer loader is suitable for the ground conditions and that the bucket is suitable to the task.

Skid steer loaders are relatively easy to tip over because of their short wheel-base. Always keep to safe driving speeds for the conditions and terrain.

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

Always travel with the bucket as low as the ground conditions will allow.

Keep in constant communication with other personnel throughout your loader 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 skid steer you are using.

This will include information about:

- ◆ Safe operating speeds and techniques.
- ◆ Safe travel speeds.
- ◆ Monitoring systems and alarms.



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



- ◆ Excavating, loading and transporting materials.
- ◆ Bucket discharge.
- ◆ Levelling.
- ◆ Striping and spreading.
- ◆ Backfilling.
- ◆ Site clean-up.
- ◆ Mixing materials.

- ◆ Levelling materials.

5.2.2.1 Safe Operating Speeds

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

Operating the loader too fast can cause instability.



5.2.3 Excavating, Loading and Transporting Material

Excavation is an important step in a lot of projects because it prepares the site for future work.



Excavating and loading with a skid steer is done by driving the bucket into the materials and scooping them up. This can include cutting into the ground or loading materials from a stockpile.

Don't overload the bucket – make sure you work out the capacity of the bucket and assess the material to be loaded.

Some points to remember when traveling with a load:

- ◆ Constantly monitor the load as you drive.
- ◆ Always travel with the bucket as low as possible and tilted back for greater stability and vision and less spillage.

When loading trucks it is important that you know where the driver is and coordinate your approach with them. You don't want to accidentally run into them.

- ◆ Approach the side of the truck slowly once it has stopped in position.
- ◆ Avoid contact with the truck by leaving enough room to raise the bucket.
- ◆ Once the bucket is high enough you can move in closer and roll it forward to deposit the load into the truck.



5.2.4 Discharging Material from the Bucket



After you have excavated the required materials and transported them to the designated location, you will be required to discharge (or dump) the materials.

When discharging a load:

- ◆ Raise the bucket to the correct height for discharge before starting to roll bucket. Then roll the bucket to ensure clean discharge of materials.
 - ◆ Place loads to ensure stability and avoid causing hazards.
 - ◆ Constantly keep sight of the load that you are discharging.
- ◆ Keep a safe operating grade when placing a load.

5.2.5 Levelling

Often the skid steer will be used to level out uneven ground. This task may be completed using the blade of the bucket or other attachments, such as a spreader bar.

When levelling, you need to 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.



5.2.6 Stripping and Spreading Topsoil

Skid steer loaders can be used to strip back the top layer of earth to excavate or level an area. The blade of the bucket is used to cut and lift a small amount of the topsoil.

This topsoil can be transported to another area and spread out. Spreading topsoil can be done a number of ways. You can discharge the soil from the bucket bit by bit as you move along, or scrape a small pile of topsoil over an area using the blade of the bucket or a 4-in-1 bucket.



5.2.7 Backfilling Excavations



The skid steer can be used to backfill trenches or small excavations after work has been completed. When backfilling it is important that the right materials are deposited into the excavation, and 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.

5.2.8 Site Clean-Up

Skid steer loaders are useful for cleaning up work sites after major works have been completed, or preparing smaller 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.



5.2.9 Selecting and Using Attachments

- Bucket.
- Multipurpose 4:1 bucket.
- Pallet forks.
- Dozer blade.
- Pavement milling devices.
- Backhoe arm and bucket
- Stump Grinder
- Approved lifting jib
- Forks
- Rotary hoe.
- Profiler.
- Tiller/mixer.
- Auger.
- Power broom.
- Hammer.
- Mower Attachment
- Rake
- Smudge bar

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. Check the manufacturer's specifications or instructions for information.

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.

5.2.10 Mixing Materials

You may need to mix materials using the loader. A tiller is a useful attachment for this kind of work. You can use one to break up the ground and mix topsoil or clay with other materials to prepare the ground for future work.



5.3 Monitoring Systems and Alarms

Each machine has its own set of alarms, monitoring systems and gauges to help you safely and efficiently operate it, and warn you if something is wrong.

Each make and model of the same type of machine can be different so it is important that you are familiar with all of the systems for the equipment you are using. Check the operator's manual for a full list of devices, alarms and warnings.



Here are some examples of the gauges and warning systems that may be found on a skid steer:



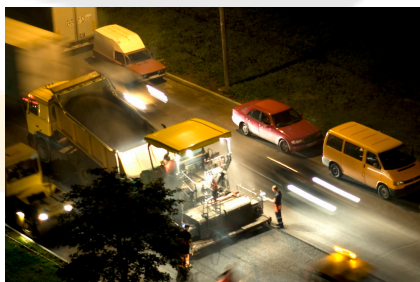
◆ Fuel.

- ◆ Engine oil pressure
- ◆ Engine temperature.
- ◆ Hydraulic oil pressure.
- ◆ Hydraulic oil temperature.
- ◆ Electrics.

Generally, alarms and warnings fit into 3 categories:

Warning Type	Description	Examples	What You Should Do
Category 1	These types of warnings let you know that the machine needs some attention, but it is still safe to operate.	◆ Low fuel. ◆ Low system voltage.	Keep operating as long as it is safe to, and report the problem once you stop work.
Category 2	These warnings indicate that there is a problem caused by the way you are operating that may lead to problems with the equipment.	◆ Equipment is overheating. ◆ Equipment is overloaded.	Change the way you are operating and if the problem is not fixed, stop operating and report the issue.
Category 3	This is the most serious warning level. Continuing to operate while this warning is sounding will cause damage to the machine.	◆ The park brake is on. ◆ Low engine oil pressure.	Stop operating and shut down the equipment immediately. Report the problem straight away.

5.4 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 loader 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 such as landscaping or preparing road base you will be working with different materials, attachments and personnel.

5.5 Lift, Carry and Place Loads Using Slings and Lifting Gear

In civil construction projects you may need to use the skid steer to lift and carry loads using slings and lifting gear for example, lowering pipes into trenches or moving equipment or construction materials around the site.

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



5.5.1 Determine the Weight of the Load in Coordination with Other Personnel

You need to coordinate with authorised personnel to work out the weight of the load to make sure your loader 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 sheets.
- 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.

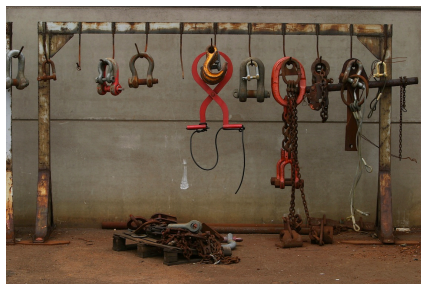


Once you know the weight of the load you need to make sure the loader you are using has the capacity to lift it safely. You can check the capacity of the loader in the operator's manual or manufacturer's specifications.

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 loader.

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

5.5.2 Select Lifting Gear



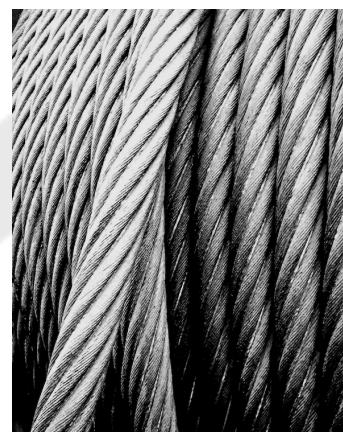
When using the loader for lifting, make sure it is fitted with the correct lifting attachment or that the machine has the appropriate lifting lugs. Always use an approved lifting lug or lift connection that is clearly marked with the Safe Working Load (SWL).

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.

Lifting gear that may be used with the skid steer 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 skid steer.

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.



5.5.3 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 loader 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.

5.5.4 Positioning the Skid Steer Loader

Before lifting a load with slings you need to get the skid steer into the right position to access the load. This is important because a swinging load can cause the skid steer to tip over. Make sure:

- ◆ The loader is on firm level ground.
- ◆ The load, skid steer and lifting gear can all be safely accessed.
- ◆ Any other 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, especially if you need to travel with it.
- ◆ The loader is in line with the load so it will not swing when it is lifted.



5.5.5 Lifting Techniques

Follow these guidelines whenever using the loader to lift a load using slings and lifting gear:

Guidelines 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.
If the weight of the load causes the machine to tilt or if the hydraulics begin to strain stop the lift immediately and lower the load back down.
Loads 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.
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 loader, 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.
Check the hydraulic hoses and rams before and after lifting to make sure no damage has been done to the equipment.

5.5.6 Checking Completed Work



The key to completing tasks efficiently is good time management and knowing how to use your equipment properly.

Once you have completed your work you will need to check it against:

- ◆ Your work instructions and project plans and drawings.
- ◆ Project quality requirements and timelines.

Speak to your supervisor when the work is completed to see if there are any other tasks that need to be done to complete the job.

5.6 Park and Shut Down the Loader

Once all tasks are complete and the work for the day is done, it is important that you park and shut down the loader

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.



5.6.1 Parking the Skid Steer Loader

The skid steer needs to be parked in a safe way that will allow easy access to the vehicle.



across the slope.



barricades should be erected to warn people.

Safe parking practices:

- ◆ Stop the skid steer on a flat level surface in the designated area and keep the access points clear.
- ◆ Park the skid steer away from overhangs, excavations, access ways and tidal or flood areas.
- ◆ If the skid steer must be parked on a sloping surface it should be facing
- ◆ Keep the skid steer 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 skid steer has to be parked on a public access way, lights, signs and

5.6.2 Shutting Down the Skid Steer Loader

Shutdown procedures include:



- ◆ Cooling of the engine before shutting it down. This depends on the loader 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 skid steer, using any applicable lock out or isolation devices and removing the keys. This will prevent any unauthorised movement of the loader.
- ◆ 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.

5.6.3 Post-Operational Checks

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

General maintenance activities are done to keep all plant and equipment working safely for longer.

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



5.7 Prepare the Skid Steer Loader for Relocation



The skid steer will need to be prepared before it can be moved from site to site.

Some issues in moving the loader to another worksite may include:

- ◆ Cross-contamination between sites.
- ◆ Hazards from loose or detached parts.
- ◆ Movement of the loader in transit.

Before relocating the skid steer you may need to do some or all of the following things:

Clean the skid steer loader thoroughly.

Clean any attachments going with the loader.

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.

5.7.1 Relocate the Skid Steer

Skid steer loaders 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 skid steer onto the transport and use a spotter to help guide the loader up the ramps.

Once on board the loader must be securely locked down to prevent any movement.



5.8 Clean and Carry Out Routine Maintenance

It may not be practical to clean the skid steer loader after every use but you should clean it 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 loader, 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.



PART 6: WHEELED FRONT END LOADER



6.1 Wheeled front end loader

6.1.1 What is a Wheeled Front End Loader?

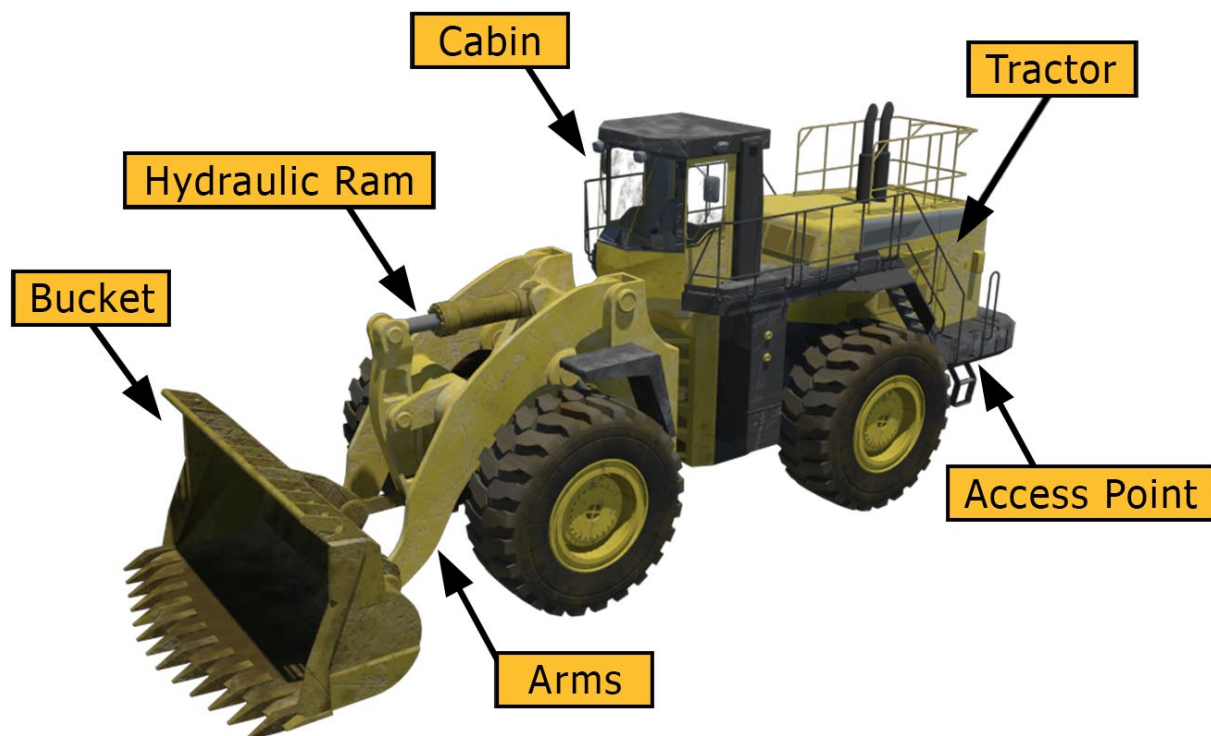
A wheeled front end loader is a self-propelled machine that has a front mounted bucket connected to the end of two booms (arms). The bucket has a very large capacity, and may be removable or permanently mounted.

The machine is self-propelled, meaning that it has a powerful engine and does not require pushing, pulling or towing.



6.1.2 Wheeled Front End Loader Components

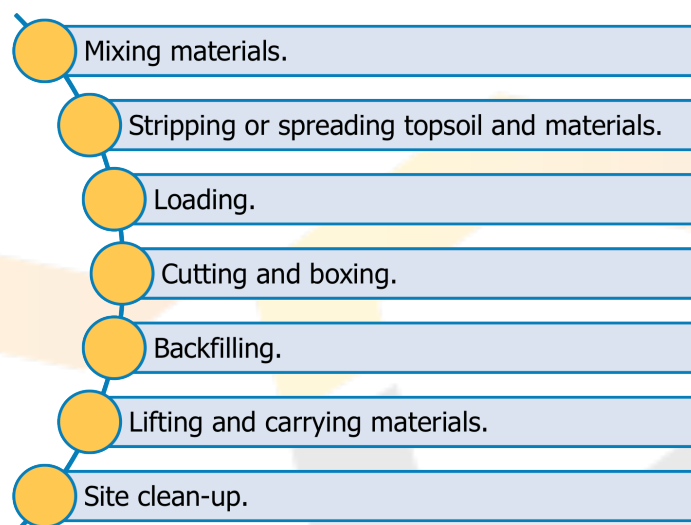
The following diagram outlines the basic components of a wheeled front end loader:



Component	Description
Cabin	Where the operator sits. Contains the controls for the operation of the wheeled loader.
Tractor	Contains the engine of the machine.
Access Point	The point where the operator can safely access the loader cab.
Arms	Raises and lowers the bucket.
Bucket	Used to move materials. The most common attachment.
Hydraulic Ram	Moves the arms and bucket/attachment.

6.1.3 Wheeled Front End Loader Operations

Most actions occur through the front end loader's forward movement. The loader is capable of:



A front end loader may also be used for levelling out surfaces.

6.1.4 Choosing Front End Loader Attachments

The most commonly used front end loader attachment is a multi-purpose 4:1 bucket, which can be used to scoop, carry, pick up and level materials.

Other approved attachments may include:

Attachment Type	Examples and Uses
Rippers or Scarifiers	For ripping the surface and loosening materials where needed.
Augers	Used for drilling holes and moving materials.
Lifting Devices	Slings, lifting gear, platforms.
GPS	For machine guidance and levelling.
Tillers	For mixing materials.



When choosing 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 loader 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 loader and the operator's manual for the attachment. Otherwise you may need to check the workplace equipment procedures for your site.

6.1.5 Fit and Remove 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 loader. 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:



all connectors are correctly joined.

1. Collect any required tools or equipment.
2. Make sure the front end loader 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

Generally, to **remove** an attachment:

1. Collect any required tools or equipment.
2. Ensure the front end loader 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.



6.1.6 Pre-Start Check

Pre-start checks are done before the engine is started. Walk around the loader and look for anything that is out of the ordinary.

Part or Component	What to Check
Structure	Check the general condition of the front end loader, including any loose nuts or bolts. Check for oil or other fluid leaks. Check for any signs of visual weaknesses, damage, stressed welds or paint separation. Make sure a Roll Over Protective Structure (ROPS) and a Falling Object Protective Structure (FOPS) are fitted to the loader.
Tyres	Check the condition and air pressure of the tyres to make sure they are within the manufacturer's specifications. If the loader has water-filled tyres check the pressure with the valve at the top of the wheel.
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.
Safety Pins	Check safety pins are in place where needed and loose bolts are tightened. Also check keeper plates and pins are in place.
Power Arms	Make sure you check the power arms 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 loader dangerous to operate tell your supervisor or an authorised person. Then isolate the loader and don't use it until it is repaired.
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, Hoses and Piston Rods	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.
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 are in good condition. Check that the cabin is clean. Check that the floor plates are free from grease and oil.
Service History and Logbook	Check the machine hour meter, manufacturer's recommendation and logbook to find out if the loader 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.

6.1.7 Operational Checks

Operational checks are made once the engine is started.



Make sure all holding brakes are on and the loader is in neutral gear (where appropriate) before the loader is started.

Start up the loader following the manufacturer's instructions. Where the machine has two pedals for independent rear brakes (designed for manoeuvrability), the pedals must be connected together.

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

Controls and functions that need to be checked on the loader:

Part or Function	What to Check
All Controls	Test all arm and bucket movements.
Switches and Gear Buttons	Check the master switch, isolation switches and start switch or key. Test gear change buttons or quick shift arrangements.
Gauges and Instruments	Check that all instruments are displaying properly and are not signalling any alarms or warnings.
Safety Devices	Test all lights and other warning devices.
Attachments	Check that it works properly.
Travel, Turning and Brakes	Test all movements and brakes, including the emergency stopping device.
Ancillary Equipment	Test all communications devices and any other systems or functions fitted, e.g. air-conditioning, radio, two-way radios, lights.

Once you have finished your operational checks it is a good idea to check for external signs of oil or fluid leaks.

6.1.8 Assess Materials to be Shifted

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	Characteristics
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 loader, 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 used will depend on the 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 loader 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

6.1.9 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 loader is suitable for the ground conditions and that the bucket is suitable to the task.
- ◆ Always keep to safe driving speeds for the conditions and terrain so that the loader doesn't tip over.
- ◆ Keep clear of holes or soft ground areas. Be careful when driving along the high side of a trench as it could cave in.
- ◆ Always travel with the bucket as low as the ground conditions will allow.
- ◆ Keep in constant communication with other personnel throughout your loader 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 front end loader you are using. This will include information about:

- ◆ Safe operating speeds and techniques.
- ◆ Safe travel speeds.
- ◆ Monitoring systems and alarms.

Front end loader operators will usually use the following techniques to complete civil construction tasks:



- ◆ Site clean-up.

- ◆ Mixing materials.
- ◆ Stripping or spreading topsoil and materials.
- ◆ Levelling.
- ◆ Cutting or boxing.
- ◆ Backfilling.

6.1.9.1 Driving to the Work Area

Check that the route and direction of travel is clear – check over both shoulders before reversing. If a reverse warning device is not fitted, sound the horn twice before moving off.

Raise attachments smoothly and keep the bucket at a safe travelling height (as low as possible) while moving to the work area.

Travel directly up or down a sloping surface, not across or diagonally down. This will ensure the loader is as stable as possible. Avoid side hill travel where possible.



On approach to downhill or uphill travel, reduce speed and choose an appropriate gear for the grade. During downhill travel always use a low gear to help control the descent. Often this is the same gear that would be used to climb the hill.

Take care when changing gears during uphill travel, especially when in a heavy loader. If you miss a gear you could lose control of the loader. If the loader does not have enough power to climb, reverse back down and choose the correct

gear to climb the hill.

Do not ever coast (put into a neutral gear and roll) the loader down a hill.

6.1.10 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. Check the manufacturer's specifications or instructions for information.

To use attachments safely and effectively you should:

- ◆ 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.



6.2 Excavating, Loading and Transporting Materials

Excavating and loading with a front end loader is done by driving the bucket into the materials and scooping them up. This can include cutting into the ground or loading materials from a stockpile.

Make sure you work safely and follow the work plan including:



while you work.

- ◆ Checking for underground services (power, telephone, gas, water, sewer, drainage and fibre optic cable lines) before starting to excavate. Talk to the site supervisor who will contact 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 your loader

When excavating you should 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 sand bags.
- ◆ Broken tiles.
- ◆ Moisture.
- ◆ Any other unusual material.



Don't undercut a bank or stockpile as it could collapse and the loader could overturn.

Don't overload the bucket – make sure you work out the capacity of the bucket and assess the material to be loaded.

Some points to remember when travelling with a load:

- ◆ Constantly monitor the load as you drive.
- ◆ Always travel with the bucket as low as possible and tilted back for greater stability and vision and less spillage.



6.2.1 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.
- ◆ Place a layer of soil in the truck to take the impact of large rocks.
- ◆ Never 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.

6.2.2 Mixing Materials



You may need to mix materials using the loader. A tiller is a useful attachment for this kind of work.

You can use one to break up the ground and mix topsoil or clay with other materials to prepare the ground for future work.

Rippers and scarifiers can also be used to break up the ground before mixing materials.

6.2.3 Stripping and Spreading Topsoil

Front end loaders can be used to strip back the top layer of earth to excavate or level an area. The blade of the bucket is used to cut and lift a small amount of the topsoil.

This topsoil can be transported to another area and spread out. Spreading topsoil can be done a number of ways. You can discharge the soil from the bucket bit by bit as you move along, or scrape a small pile of topsoil over an area using the blade of the bucket or a 4-in-1 bucket.



6.2.4 Levelling

Often the loader will be used to level out uneven ground. This can be done using the blade of the bucket.



When levelling, you need to 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.

6.2.5 Cutting and Boxing

Cutting 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.



6.2.6 Backfilling

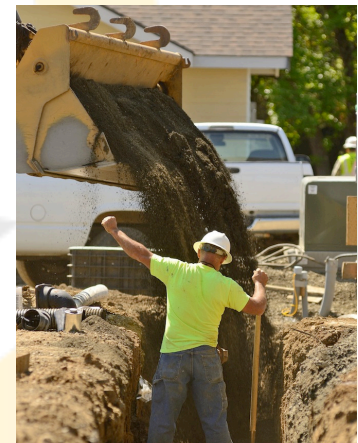
The front end loader can be used to backfill trenches or excavations after work has been completed.

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.

Always approach a trench square-on (form a 'T' with the trench) and take care when working near the high side of the trench or on soft or sloping ground.

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.



6.2.7 Site Clean-Up

Front end loaders 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.

6.3 Monitoring Systems and Alarms

Each machine has its own set of alarms, monitoring systems and gauges to help you safely and efficiently operate it, and warn you if something is wrong. Each make and model of the same type of machine can be different so it is important that you are familiar with all of the systems for the equipment you are using. Check the operator's manual for a full list of devices, alarms and warnings.

Here are some examples of the gauges and warning systems that may be found on a front end loader:



- ◆ Engine oil pressure
- ◆ Engine temperature.
- ◆ Hydraulic oil pressure.
- ◆ Hydraulic oil temperature.
- ◆ Electrics.

- ◆ Fuel.

Generally alarms and warnings fit into 3 categories:

Warning Type	Description	Examples	What You Should Do
Category 1	These types of warnings let you know that the machine needs some attention, but it is still safe to operate.	◆ Low fuel. ◆ Low system voltage.	Keep operating as long as it is safe to, and report the problem once you stop work.
Category 2	These warnings indicate that there is a problem caused by the way you are operating that may lead to problems with the equipment.	◆ Equipment is overheating. ◆ Equipment is overloaded.	Change the way you are operating and if the problem is not fixed, stop operating and report the issue.
Category 3	This is the most serious warning level. Continuing to operate while this warning is sounding will cause damage to the machine.	◆ The park brake is on. ◆ Low engine oil pressure.	Stop operating and shut down the equipment immediately. Report the problem straight away.

6.4 Lift, Carry and Place Loads using Slings and Lifting Gear



In civil construction projects you may need to use the front end loader to lift and carry loads using slings and lifting gear for example, lowering pipes into trenches or moving equipment or construction materials around the site.

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

6.4.1 Determine the Weight of the Load in Coordination with Other Personnel

You need to coordinate with authorised personnel to work out the weight of the load to make sure your loader 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 sheets.
- ◆ 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.



Once you know the weight of the load you need to make sure the loader you are using has the capacity to lift it safely. You can check the capacity of the loader 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 loader.

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

6.4.2 Choosing Lifting Gear



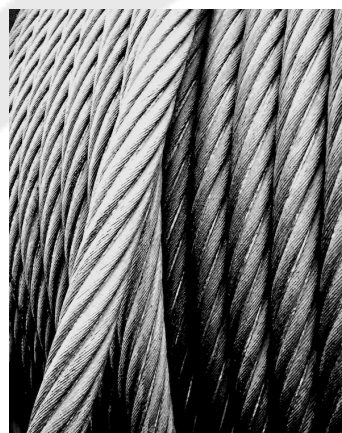
When using the loader for lifting, make sure it is fitted with the correct lifting attachment or that the machine has the appropriate lifting lugs. Always use an approved lifting lug or lift connection that is clearly marked with the Safe Working Load (SWL).

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.

6.4.2.1 Types of Lifting Gear

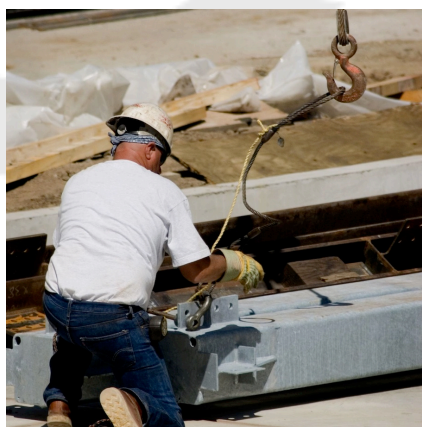
Lifting gear that may be used with the loader includes:

- ◆ 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 loader.



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.

6.4.3 Inspecting and Connecting 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 loader 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.

6.4.4 Positioning the Front End Loader

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

Before lifting a load:

- ◆ The loader is on firm level ground.
- ◆ The load, loader and lifting gear can all be safely accessed.
- ◆ Any other 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, especially if you need to travel with it.
- ◆ The loader is in line with the load so it will not swing when it is lifted.

6.4.5 Lifting Techniques

Follow these guidelines whenever using the front end loader 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.	☐
If the weight of the load causes the machine to tilt or if the hydraulics begin to strain stop the lift immediately and lower the load back down.	☐
Loads 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.	☐
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 loader, 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.	☐
Check the hydraulic hoses and rams before and after lifting to make sure no damage has been done to the equipment.	☐

6.4.6 Checking Completed Work



The key to completing tasks efficiently is good time management and knowing how to use your equipment properly.

Once you have completed your work you will need to check it against:

- ◆ Your work instructions and project plans and drawings.
- ◆ Project quality requirements and timelines.

Speak to your supervisor when the work is completed to see if there are any other tasks that need to be done to complete the job.

6.5 Park and Shut Down the Front End Loader

Once all tasks are complete and the work for the day is done, it is important that you park and shut down the loader.

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.



6.5.1 Parking the Front End Loader

The loader needs to be parked in a safe way that will allow easy access to the vehicle.

Safe parking practices:



- ◆ Stop the loader on a flat level surface in the designated area and keep the access points clear.
- ◆ Park the loader away from overhangs, excavations, access ways and tidal or flood areas.
- ◆ If the loader must be parked on a sloping surface it should be facing across the slope.
- ◆ Keep the loader 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 loader has to be parked on a public access way, lights, signs and barricades should be erected to warn people.

6.5.2 Shutting Down the Front End Loader

Shutdown procedures include:

- ◆ Cooling of the engine before shutting it down. This depends on the loader 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 loader, using any applicable lock out or isolation devices and removing the keys. This will prevent any unauthorised movement of the loader.
- ◆ 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.

6.6 Post-Operational Checks



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

General maintenance activities are done to keep all plant and equipment working safely for longer.

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

6.7 Prepare the Front End Loader for Relocation

The loader will need to be prepared before it can be moved from site to site.

Some issues in moving the loader to another worksite may include:

- Cross-contamination between sites.
- Hazards from loose or detached parts.
- Movement of the loader in transit.

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

- ◆ Clean the loader thoroughly.
- ◆ Clean any attachments going with the loader.
- ◆ 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.



6.7.1 Relocate the Loader



Front end loaders 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 loader onto the transport and use a spotter to help guide the loader up the ramps.

Once on board the loader must be securely locked down to prevent any movement.

6.8 Clean the Loader and Carry Out Routine Maintenance

It may not be practical to clean the loader after every use but you should clean it 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 loader, 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.



PART 7: ROLLER



7.1 Roller

7.1.1 What is a Roller?

A roller is a self-propelled or towed machine used for the primary purpose of compacting a variety of types of construction materials. It may be rubber tyred, smooth drum, padded drum or grid (open) face type.

A roller achieves compaction by one or more of the following methods:

- ◆ Static weight.
- ◆ Kneading.
- ◆ Vibration.
- ◆ Impact.

A grid roller is used to break down oversized construction materials.

Padded drums may include sheepsfoot, padfoot, tamping foot or wedge foot.



7.1.2 Types and Applications of Rollers

The types of rollers you may use while working on a civil construction site are:

Self-Propelled Rollers	
	
Self-Propelled Pneumatic Tyred Roller Also known as rubber tyred roller. A roller type that is used to finish fresh sealed asphalt to produce a trafficked finish, and to bed down the asphalt or sealed surface. Spreads the compaction across the tyres and compacts the surface by pressing down on the surface with the weight of the roller and the rolling of the tyres.	Self-Propelled Smooth Drum Vibratory Roller Commonly identified as a basic roller. These rollers compact the surface by the roller's weight and the rolling and vibration of the roller drum.
	
Self-Propelled Padded Drum Vibratory Roller Rollers that are used for compaction and pulverising materials. They have a square or rectangular block attached to the drum of the roller in a pattern that enhances the ability of the roller to compact and pulverise the ground.	Self-Propelled Double Drum Vibratory Roller The drum vibrates at different speeds and frequencies to achieve greater compaction. At a half setting the vibrating is fast and achieves shallow compaction. At full setting the vibration is slower and achieves a much deeper compaction. A vibratory roller has an advantage over static rollers in that it can achieve greater compaction for the same weight machine.
	
Self-Propelled Smooth Drum Roller (Including 3 Pointers)	

Sometimes called static rollers. Used in a similar way as smooth drum rollers utilising the weight of the roller to compact materials. These rollers compact the surface by the roller's weight and the rolling of the roller drums or wheels.

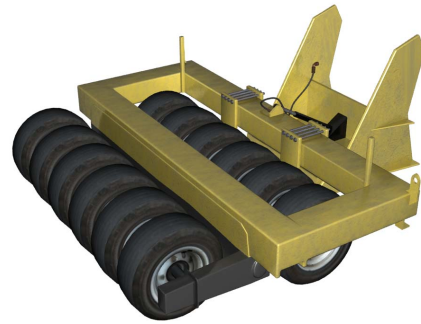


Towed Rollers



Towed Grid Roller

Used for breaking up rocky material while compacting the materials. These rollers are usually towed behind a tractor.



Towed Pneumatic Multi-Tyred Roller

A series of pneumatic or rubber tyres that kneads and smooths the surface

These rollers compact the surface by kneading the material with the weight of the roller and rolling of the tyres.



Towed Padded Drum Vibratory Roller

Commonly towed behind another item of machinery such as a grader or tractor. Used for multi-tasking and for keeping onsite costs down.

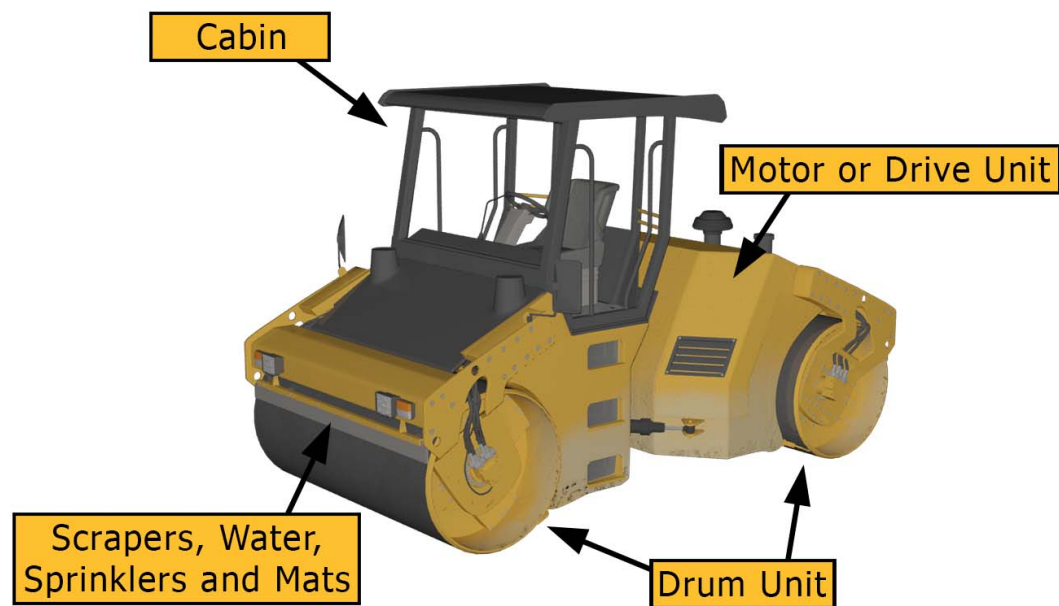


Towed Smooth Drum Vibratory Roller

This tow behind attachment is used to compact materials using vibration.

7.1.3 Roller Components

The following diagram and table explains the basic components of a roller.



Component	Description
Cabin	Part where operator sits and operates the machine. Controls include: joy stick or control levers, transmission controls, brakes, and emergency stop controls.
Motor or Drive Unit	Engine of the machine.
Drum Unit	Can be single drum, double drum or rubber tyre.
Scrapers, Water Sprinklers and Mats	Used to prevent hot asphalt from sticking to roller drums. May not be present on all rollers.

7.1.4 Roller Operations

On a civil construction worksite, the primary task of the roller and roller operator is compaction of materials to the required amount. **A roll overprotective structure and safety belts (ROPS)** must be provided on the roller to protect the operator, if there is a likelihood of the roller being overturned.

When you are operating a roller, you will be expected to:

1. **Compact the materials to the required density.** Also known as percentage of compaction.
2. **Comply with the roller pattern.** This pattern is generally half a drum overlap from the last pass, but may be different in specific circumstances. The required pattern will be told to you during a toolbox meeting or other site meeting. If you are unsure of the required pattern, ask your team leader.
3. **Seal and finish the surface.** This means you will be ensuring the final road surface is fit for purpose and safe to use. Generally, a multi-tyred roller is used for this task.



You may be working with:

Earthworks	Base level materials or soil type materials.
Pavement	Depending on the location within Australia this could refer to the entire road area or may mean a concrete type surface.
Bitumen	The black, oil by-product that is mixed with an aggregate to create a road surface that is flexible, yet waterproof.
Asphalt	The name given to bitumen and aggregate mixture that is used to cover base levels to build a road.

Your roller pattern may vary and the type of roller you are operating will vary depending on the task you are doing and the material you are working with.

Limitations of a roller:

- ◆ Speed limitations
- ◆ Steep slopes

7.1.4.1 Roller Operations Documentation

Examples of details that will be included in your operations documentation:

Operations Details	Use
The Pattern and Density of Compaction Requirements	To ensure the task meets specifications.
Sealing or Finishing Compaction Percentages	Is required for quality assurance and to meet task specifications.
The Type of Materials Being Compacted	This makes it easier to predict the amount of time needed to complete the task.
Earthworks Calculations	Best described as knowing the capacity of the machine, how much material it can compact in each pass, how many passes can be done in an hour or the length of the pass circuit.

Being able to access, interpret and apply the requirements of the documents is part of the job for any plant operator.

7.2 Choose and Check Plant and Equipment

Once you have confirmed your job requirements you need to choose the right equipment and attachments to get the job done. Rollers can be used to prepare areas for other work or to finish surfaces.



The type of roller you use will depend on:

- ◆ The type of material being compacted or worked.
- ◆ The size of the area you are working on.
- ◆ The finish (what the materials or area need to look like) required by the plan.

Information about technical capabilities and limits can be found in the operator manuals for each item.

It is not safe to operate plant, equipment or attachments beyond the manufacturer's specifications. This may cause the machinery to break and could also cause an accident.

7.2.1 Select a Roller Attachment

Attachments can be used to keep the roller cool, clean and able to function correctly. This is because the materials that a roller may be compacting could be very hot and sticky.

Once set, both asphalt and bitumen can be very difficult to remove from the drum, so it is best to avoid the materials sticking to the drum in the first place.



Some attachments used with a roller include:

Attachment	Description
Blade	This may be used to assist with levelling of the materials. It should be placed before the drum to level before rolling.
Scraper Bar	This is used to keep the drum free of debris or materials. They are commonly used on steel drummed rollers.
Spray Bar	This is a bar that sprays water onto the drum or wheels of the roller to keep the drum or the rubber wheels cool. It is particularly important when rolling asphalt and bitumen.
Wheel or Drum Broom	These are used to sweep materials from the drum or wheels. They are commonly used on rubber wheeled or multi-tyred rollers.
Drag Broom	This attachment is a broom that is pulled behind the roller. It is not a common attachment because most sweeping is done after the surface has had a chance to settle.
Padded Drum Attachment and Blade	In bitumen surfaces the padding is used to bed down the materials without shattering. They are often used to traffic the finished surface and ensure it is ready for vehicle movements.

If any attachments are used, ensure they meet the manufacturer's specifications and are approved for use with your roller. Any approved attachments should be listed in your operator's manual.

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 roller 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 roller and the operator's manual for the attachment. Otherwise you may need to check the workplace equipment procedures for your site.



7.2.2 Fit and Remove 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 roller. 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. Ensure these attachments are free from any faults before using them.

Fitting Attachments



- ◆ Make sure the bolts, nuts or connecting pins are correctly applied.
- ◆ Hydraulic hoses must be connected correctly.
- ◆ Water hoses must be connected to the appropriate reservoir. Water jets must face in the right direction.
- ◆ Scraper bars must be positioned to remove the debris without obstructing operations and the bar blade must be facing the drum or wheels.

Incorrectly fitted attachments can damage the roller or the worksite and could void any insurances or warranties on the vehicle

Removing Attachments

- ◆ Ensure the attachment is safe to remove.
- ◆ Check for the temperature of the attachment and only remove it when the temperature is correct.
- ◆ Check that all hoses and points of the attachment have been undone before removing the attachment.
- ◆ Heavy attachments should be removed with good manual handling techniques. Use team lifts as much as possible.



7.2.3 Pre-Start Check

Pre-start checks are done before the engine is started. Walk around the roller and look for anything that is out of the ordinary.

Part or Component	What to Check For
Structure	Check the general condition of the roller. Look for any obvious signs of wear and tear. Check for oil or other fluid leaks.
Drums and Wheels	Check the drum condition and surface. Check the condition and air pressure of the tyres to make sure they are within the manufacturer's specifications.
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.
Attachments and Ancillary Equipment	Check the condition and security of any attachments.
Decals and Signage	Check that all decals and signage are present on the machine.
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 are 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 roller 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.

7.2.4 Operational Checks

Operational checks are made once the engine is started.



Climb to the operator's seat 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 roller.

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

Start up the roller 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 on the roller:

Part or Function	What to Check For
Gauges and Instruments	Check that all instruments are displaying properly and are not signalling any alarms or warnings.
Safety Devices	Test all lights and other warning devices.
Attachments	Check that the attachment is secured and connected to the roller properly. Check the condition of the attachment. Check that it works properly.
Drum	The vibratory or compaction system will need to be checked to make sure it is operating 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.

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.

7.3 Operate the Roller



During civil construction roller operations you will need to:

1. Assess the materials you are working with.
2. Use the equipment safely within the technical specifications and limits.
3. Use the equipment for tasks that it is specifically designed for.
4. 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 the site.
 - ◆ Team leaders.
- ◆ Site safety personnel.

7.3.1 Site Conditions

Site conditions, terrain and grades will affect the operation of the machine.



This in turn requires the operator to be able to change operational styles and techniques based on the prevailing conditions.

If the ground is rough or stony you should slow down accordingly to a safe speed.

While compacting a large sloped area it is best to perform rolling up and down the slope as opposed to across or diagonally across.

If you need to cross a ditch while in the roller you should approach and cross it slowly, and **at an angle**.

7.3.2 Assess Materials to be Compacted

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

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

- ◆ Topsoil.
- ◆ Clays.
- ◆ Silts.
- ◆ Gravel.
- ◆ Mud.
- ◆ Stone.
- ◆ Rock, which might be:
 - ◇ Metamorphic.
 - ◇ Igneous.
 - ◇ Sedimentary.
 - ◇ Blended materials.
 - ◇ Organic materials.
 - ◇ Bituminous mixes.



7.3.2.1 Soil Technology and Compaction

In civil construction, compaction is where materials are compressed (squashed) into a given space to achieve a set amount of stability in the soil.



During the compaction process, the amount of air spaces, voids and moisture trapped within the materials is squeezed out and more materials are pushed into the space.

Different types of soils compact in different ways. Some, like sand, will need to be mixed with other materials before any compaction activities could start.

Other materials, such as clay, will need to be at the correct moisture content

(not too wet or too dry).

You will need to assess the type of materials to be compacted, the work area or circuit, and the grade of the site. This will help you determine if the machine you are operating is going to be able to achieve the level of compaction required.

Knowing the required compaction amount or percentage is essential to the process. You will be able to find the percentage of compaction that you need to reach in site plans, quality assurance plans, specifications or by speaking with your supervisor or site quality assurance officer.

If your machine is not able to achieve the level of compaction required, speak with your supervisor to develop a work pattern or plan which will achieve the percentage of compaction required.

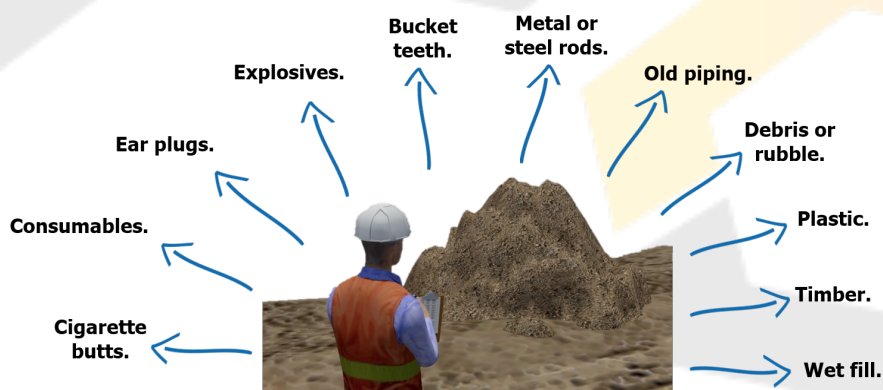


Every civil construction project has very detailed and explicit specifications which outline acceptable ranges for all aspects of the project, including compaction percentages, acceptable materials and acceptable moisture contents.

7.3.2.2 Identify, Remove or Manage Contaminants

During roller operations you may come across contaminants in the materials you are rolling or compacting. It is important that contaminants are removed or managed to make sure the final surface meets quality requirements.

Contaminants found in materials on a civil construction site could include:



Safely remove all contaminants from the area. If it is not safe to remove the contaminants you need to isolate the area and report the situation to your supervisor who will organise for the safe removal of the contaminants.

7.3.3 Safe Operating Techniques

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

General safe operating techniques include:

- ◆ Continuously monitoring and checking for hazards, and warning other workers if there is danger.
- ◆ Making sure the roller is suitable for the ground conditions and to the task.
- ◆ Keeping to safe driving speeds for the conditions and terrain.
- ◆ Keeping the roller within tolerances and capacity.
- ◆ Keeping clear of holes or soft ground areas.
- ◆ Being careful when driving along the high side of a trench as it could cave in.
- ◆ Recognising defects or problems.
- ◆ Using the appropriate rolling or compacting techniques for the type of materials being compressed.
- ◆ Sticking with the rolling pattern established during site meetings.
- ◆ Keeping in constant communication with other personnel throughout your roller operations.



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 roller you are using. This will include information about:

- ◆ Safe operating speeds and techniques.
- ◆ Safe travel speeds.
- ◆ Monitoring systems and alarms.

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

- ◆ Levelling.
- ◆ Compacting.

7.3.4 Drive to the Work Area

Before compacting any surface the roller must be driven to the work area.



You should make sure that the route and direction of travel is clear and that you travel at a safe speed. Always check over both shoulders to ensure the direction of travel is clear before reversing.

Wherever possible, side hill travel should be avoided as there is a greater chance of turning the machine over.

If you must drive the roller down a sloping surface you should drive directly down the slope, not across or diagonally down. This will ensure the roller is as

stable as possible.

On approach to downhill travel you should reduce the speed of the roller and select an appropriate gear for the grade.

During downhill travel always select a low gear to help control the descent. Often this is the same gear that would be used to climb the hill.

Be cautious when changing gears during uphill travel, especially when in a heavy roller. Missing a gear could result in you losing control of the roller.

If the roller does not have enough power to climb the incline, reverse back down the hill and select the correct gear to climb the hill.

DO NOT ever coast (put into a neutral gear and roll) the roller downhill.



7.3.5 Roller Techniques



Roller operators need to be able to identify and use techniques that help achieve the best possible results on the worksite.

Each site has specific design specifications that need to be met and roller operators are crucial to the finished project.

Some of the techniques which an operator could use to achieve the best possible result can include:

- ◆ Keeping to the roller pattern as accurately as possible.



- ◆ Travel at optimum speeds.

- ◆ Monitor the ground for potential hard or uneven surfaces.

- ◆ Accurately identifying if attachments are required to achieve the finished result.

- ◆ Selection of the appropriate gears for the slopes of the ground – low gear for steep slopes.

- ◆ Ensure smooth compaction through steady, even speed.

Some techniques that may be used include:

- ◆ **Roller Patterns** – following a designated pattern or path.
- ◆ **Roller Repetitions** – Rolling the same area a designated number of times. Generally between 3 and 6.
- ◆ **Team Rolling** – Having two rollers working together to continually roll a section. This can be helpful but edges may need special consideration to achieve the appropriate degree of compaction.



Techniques for operation cannot be learnt from a book. They are something that can only be done on the site. For further assistance, speak with other experienced operators or your trainer to demonstrate specific techniques.

7.3.6 Operate Attachments



Every piece of equipment has design limits and operational recommendations. Operating within these specifications, recommendations and design limits ensures you do not damage either the roller or the attachment.

7.3.7 Compacting

During the compacting process there are a number of important points to remember. You must:

- ◆ Work at a safe and acceptable speed.
- ◆ Use an appropriate path of travel and ensure direction of travel is clear.
- ◆ When using a blade, position it at the correct depth, level and angle.
- ◆ Use the correct roller patterns. Generally 3-6 passes will be made on each segment of the work area, offsetting each pass by half a roller width.
- ◆ Engage and disengage the compacting device when required for the materials being compacted.



The correct use of the drum controls will assist in achieving the required compaction outcomes. The quicker the vibration the lighter the compaction. The slower the vibration the heavier the compaction.



Rollers must work within the designated roller pattern for the site to ensure that compaction degrees are achieved as efficiently as possible.

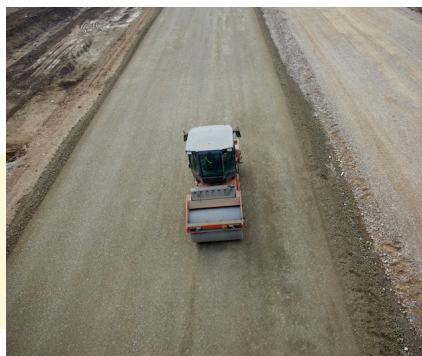
Sometimes to achieve the compaction levels within the designated timeframes, multiple rollers will be used to compact the same area, each staggered slightly to achieve the required roller pattern.

If too much water is used on the soil being compacted, rolling will bring excess water to the surface and prevent the soil from being compacted properly.

7.3.8 Levelling Procedures

Levelling with your roller is the removal of lumps and bumps from the work area. Roller levelling helps to achieve appropriate gradients for the specifications.

When levelling, work to the designated grades in the required manner. This could include the type of levelling, the grade and slope, and the fall (for water to shed 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 must be checked against site reference points such as pegs, benchmark points or other defined levels.

Levelling information and procedures will be discussed during your task

briefings.

7.3.9 Road Works

When using a vibratory roller, the first run against the kerb on uncompacted soil you should drive slowly without the vibrator.

Do not leave the vibrator on while the roller is not traveling, or it will potentially sink into the ground (**the roller would vibrate itself into the soil**).

Rolling operations on a road should begin on the **kerbside** and work in overlapping runs across towards the crown. All runs should overlap the previous run.

If cracks begin to appear after rolling with the vibrator on, perform another run with the vibrator off to remove the cracks. Always turn the vibrator off before stopping the roller.



7.3.10 Sealing and Finishing the Surface



Sealing and finishing is the last stage of road construction or maintenance and the roller is the last machine to move along the surface and complete the job. Once asphalt and aggregate has been deposited on the road the roller (usually a rubber tyre roller) forces the aggregate into the liquid asphalt without crushing it in the process.

Several passes are usually required to finish the surface properly and the roller should be driven slowly to get the best result. Rolling should stop once the asphalt has hardened to avoid damaging the bond between the aggregate and

the asphalt.

7.4 Monitoring Systems and Alarms

Each machine has its own set of alarms, monitoring systems and gauges to help you safely and efficiently operate it, and warn you if something is wrong. Each make and model of the same type of machine can be different so it is important that you are familiar with all of the systems for the equipment you are using. Check the operator's manual for a full list of devices, alarms and warnings.

Here are some examples of the gauges and warning systems that may be found on a roller:

- ◆ Engine oil pressure.
- ◆ Engine temperature.
- ◆ Hydraulic oil pressure.
- ◆ Hydraulic oil temperature.
- ◆ Electrics.
- ◆ Fuel.



Generally alarms and warnings fit into 3 categories:

Warning Type	Category Description	Examples	What You Should Do
Category 1	These types of warnings let you know that the machine needs some attention, but it is still safe to operate.	◆ Low fuel. ◆ Low system voltage.	Keep operating as long as it is safe to, and report the problem once you stop work.
Category 2	These warnings indicate that there is a problem caused by the way you are operating that may lead to problems with the equipment.	◆ Equipment is overheating. ◆ Equipment is overloaded.	Change the way you are operating and if the problem is not fixed, stop operating and report the issue.
Category 3	This is the most serious warning level. Continuing to operate while this warning is sounding will cause damage to the machine.	◆ The park brake is on. ◆ Low engine oil pressure.	Stop operating and shut down the equipment immediately. Report the problem straight away.

7.5 Adjust Techniques to Meet Changing Conditions

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



run.

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 roller 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 level or compact as much and you will need to adjust the quantities you are dealing with in each

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 compact more or move onto other stages of the civil construction project preparing the road base you will be working with different materials, attachments and personnel.



7.6 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:



Other Machines – At all times you need to know when other machines are working near the roller. Know and stick to your agreed speeds, travel paths or roads. Good communication between operators is essential to avoid collisions.

Personnel – Good communication is the key to working with other personnel. Be aware of people in the work area. Make sure they are not in danger and are a safe distance from the roller. 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.

7.7 Checking Completed Work

The key to completing tasks efficiently is good time management and knowing how to use your equipment properly.

Once you have completed your work you will need to check it against:

- ◆ Your work instructions and project plans and drawings.
- ◆ Project quality requirements and timelines.

Speak to your supervisor when the work is completed to see if there are any other tasks that need to be done to complete the job.



7.8 Park and Shut Down the Roller

Once all tasks are complete and the work for the day is done, it is important that you park and shut down the roller.

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.



7.8.1 Parking the Roller

The roller needs to be parked in a safe way that will allow easy access to the vehicle.

Safe parking practices include:



- ◆ Stop the roller on a flat level surface in the designated area and keep the access points clear. If the roller has to be parked on a sloping surface, the roller should face across the slope (note: only if no level area can be found).
- ◆ Park the roller away from overhangs, excavations, access ways and tidal or flood areas.
- ◆ Keep the roller away from refuelling sites and areas when parking to prepare for maintenance. This keeps the rest of the machines on the site able to access the fuel.
- ◆ Apply locks and brakes.
- ◆ Move attachments into the shutdown position. Make the attachments safe in the way needed for the worksite.



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

7.8.2 Shutting Down the Roller

Shutdown procedures include:

- ◆ Cooling the engine before shutting it down. Dependent upon the vehicle but commonly the same amount of time as the engine warm up time.
- ◆ Monitor controlled lowering of temperatures and pressures.
- ◆ Walk around the machine looking for any signs of damage or faults that may have occurred during the task.
- ◆ Secure the vehicle and use any applicable lock out or isolation devices and remove the keys. This will prevent any unauthorised use or movement of the roller.
- ◆ Ensure equipment is correctly stowed in accordance with site and manufacturers requirements.



Any problems found during the shutdown procedures need to be documented in the way required by the worksite.

7.8.3 Post-Operational Checks

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

General maintenance activities are done to keep all plant and equipment working safely for longer.

As part of your job as a roller 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 of the Machine	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 drum or tyres.
- ◆ Hydraulics (rams, hoses and connections).
- ◆ Structure and attachments for damage or wear.

7.9 Prepare the Roller for Relocation

The roller will need to be prepared before it can be moved from site to site.

Some issues in moving the roller to another worksite may include:

- ◆ Cross-contamination between sites.
- ◆ Hazards from loose or detached parts.
- ◆ Movement of the roller in transit.

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

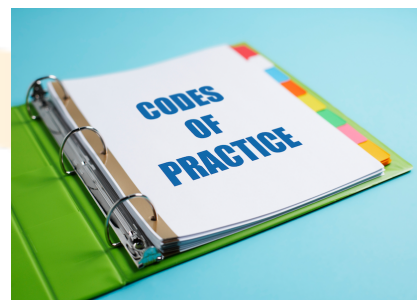


- ◆ Clean the roller thoroughly.
- ◆ Clean any attachments going with the roller.
- ◆ Empty the fuel tank (if practical).
- ◆ Secure all moving parts.
- ◆ Remove and store any attachments going to the new site.
- ◆ Make sure all connectors are secure and locked.

7.9.1 Relocate the Roller

Moving a roller between worksites is normally done on a float (trailer), as most rollers are too slow and heavy to move on the road. Any transport must comply with:

- ◆ Codes of practice.
- ◆ Traffic management requirements.
- ◆ Site regulations.
- ◆ Traffic codes and road rules.



Be careful when loading the roller onto the transport and use a spotter to help guide the roller up and down the ramps.



Once on board the roller must be securely locked down to prevent any movement.

If a roller is being moved across a public road ensure that all traffic rules are obeyed, traffic is stopped to allow the roller to move without other traffic, making sure that an approved traffic management plan and escort vehicles are in place.

Expect significant damage to road surfaces if a pad foot roller of any kind is moved across a sealed surface.

7.10 Clean the Roller and Carry Out Routine Maintenance



It may not be practical to clean the roller after every use but you should clean it 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 roller, 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.



PART 8: MAINTENANCE, HOUSEKEEPING AND PROCESSING RECORDS

8.1 Maintenance and refuelling

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

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 piece of equipment stays at its operating capacity for as long possible. **Check the service manual** provided by the manufacturer to establish the service and the frequency of the service to be carried out on the machine you operate.

Maintenance activities could include:

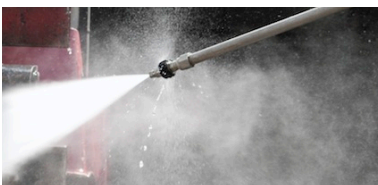


- ◆ Air filters – should be checked daily in dusty conditions. Clean or replace them as necessary.
- ◆ Greasing or lubricating attachments.
- ◆ Checking drum parts and replacing them as needed.
- ◆ Checking bucket teeth and replacing them as needed.
- ◆ Battery checks – clean the battery, check electrolyte levels. When changing the battery of a plant, the **earth/negative battery clamp** should be removed first.
- ◆ Fuel and other fluids – check and maintain levels.



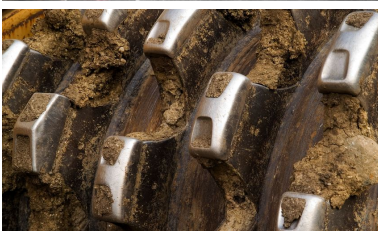
- ◆ Refuelling.
- ◆ Recording and reporting of faults through workplace procedures.

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



All tools, equipment and attachments must be kept in good working order. This means cleaning, checking, maintaining and storing them correctly, by following worksite procedures and manufacturers' guidelines.

Clean all items by removing dirt, mud, moisture or other contaminants.



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, equipment and attachments need to be maintained in line with manufacturers' recommendations or your worksite procedures.



8.1.2 Vehicle Refuelling Procedures

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

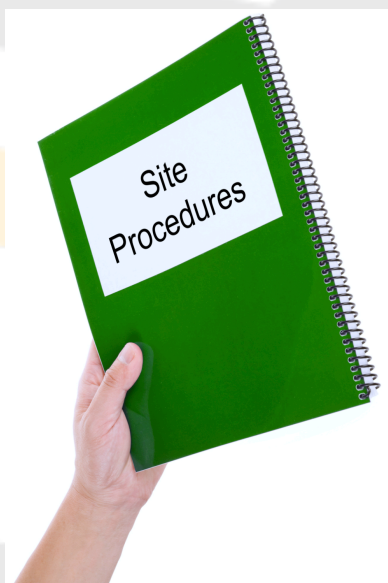
Some sites may have refuelling areas for plant and machinery set up to make sure any spills or incidents can be contained without causing damage to the environment. Spill response procedures need to be clear and spill kits available to manage any incident. (Bunding may be required)

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.

8.2 Clean Up After Work

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



8.2.1 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. Stockpile them for later use, where possible.
- ◆ 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.

8.2.2 Cleaning and Storing Attachments

Once the attachment has been removed it should be cleaned, checked or 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.



8.3 Process Written 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 piece of equipment may include:

- ◆ Inspection checklists.
- ◆ Fault reports.
- ◆ Fuel, oil, hydraulic and other fluid usage.
- ◆ Computer readings of various equipment functions.
- ◆ Diary entries.
- ◆ Service manuals or logbooks.
- ◆ Repair request forms.
- ◆ Part requisition forms.
- ◆ Hazard reports – including Take-5 forms.



- ◆ Incident reports – accident forms, incident reports, environmental incident reports, WHS investigation reports, quality assurance (QA) reports.

Some other records, reports and paperwork that may be needed include:



- ◆ Computer readings – from process monitoring, test results, activity reports, and materials readings.
- ◆ Logs – supply logs, work activity logs, training logs, stockpile logs, usage or driver logs.
- ◆ Shift documents – end of shift, end of process, quality information.

You will usually need to include details like the make and model number of the piece of equipment, together with 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.

Once all maintenance tasks or minor repairs are completed and the paperwork is signed off you can return the piece of equipment to service. This means it is safe and ready to use.

Notify your supervisor or other authorised personnel that the equipment is ready to be used again.

It is important that you keep detailed records of all your activities, especially any problems you had during your shift. You may need to explain what you say, or what you did, at a later time.

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.

