INTEGRAL SKILLS

RIGGING - INTERMEDIATE

CPCCLRG3002 Licence to perform rigging intermediate level

LEARNER GUIDE

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MODIFICATION HISTORY

Version	Date	Nature of Amendment
1	12 Feb 20	Creation
2	19 May 22	Up dated Unit of Competency
3	9 Aug 22	Update page 45 –table section 3.2.1.3

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1.1 Introduction

This training course is based on the National High Risk Licence Unit of Competence **CPCCLRG3002 Licence to Perform Rigging Intermediate Level**.

You will learn about:

- Planning out your work.
- Selecting and inspecting equipment.
- Setting up for the rigging task.
- Erecting and dismantling structures and plant.

1.1.1 What Types of Work Can You Do with a Rigging Intermediate Level Licence?

A person with an intermediate rigging high risk work licence is allowed to complete the following range of tasks:

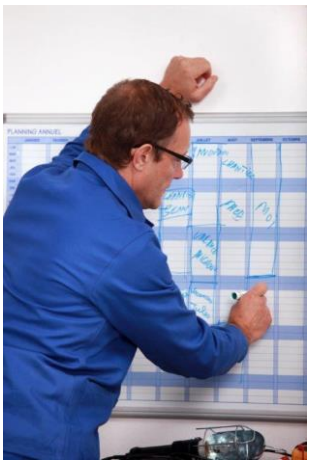
- Anything that a basic rigger can do.
- Erection of cranes, conveyors, dredges and excavators.
- Erection of tilt-up panels.
- Erection of jib hoists and self-climbing hoists.
- Demolition work.
- Dual and multiple lifts.

1.1.2 High Risk Work Licence Requirements

Once you pass your assessment you will have 60 days to apply for your licence.

You must renew your licence within 12 months of its expiry otherwise:

- Your licence can't be renewed.
- You need to repeat the course and re-apply for your licence.
- You need to enrol in the course again and be supervised by somebody who has a current licence for the same class.



You can still do high risk work without a licence as long as:

- You are enrolled in a high risk course for the class, and
- You are being supervised by somebody who has a licence for the same class.

Any licensed worker must take reasonable steps to make sure the way they work does not impact on the safety of themselves or any other worker. This is their legal duty of care. Failing to work safely can result in the health and safety regulator:

- Suspending or cancelling your licence.
- Refusing to renew your licence.
- Ordering that you are reassessed to ensure you are competent.

Your employer might ask you for evidence that you have a high risk licence before you start any high risk work. You can show them:

- Your licence.
- Proof from the training company that you have passed your assessment.
- Proof that you are currently completing a course for high risk work.

1.2 Plan Job

It is important that you are aware of the requirements relating to your work. Before you begin your tasks ensure that you access the relevant documentation and plan your work.

Requirements relating to your work may include:

- WHS requirements.
- Duty of care.
- Safe Work Method Statements.

1.2.1 Work Health and Safety Requirements

Work Health & Safety (WHS) is defined as laws and guidelines to help keep your workplace safe.

These can be broken down into four main types:

Law	Description
Acts	Laws to protect the health, safety and welfare of people at work.
Regulations	Gives more details or information on particular parts of the Act.
Codes of Practice	Are practical instructions on how to meet the terms of the Law.
Australian Standards	Give you the minimum levels of performance or quality for a hazard, work process or product.

It is important that you are familiar with the WHS laws that exist in your state or territory.

The following WHS legislative requirements will affect the way that you work:

- Duty of Care.
- Australian Standards.
- Industry WHS Standards and Guidelines.
- Health & Safety representatives, committees and supervisors.
- Job Safety Analysis (JSA) and Safe Work Method Statements (SWMS).
- Licences.
- National safety standards.
- WHS and Welfare Acts and regulations.
- Safety Codes of Practice.

1.2.2 Duty of Care

All personnel have a legal responsibility under duty of care to do everything reasonably practicable to protect others from harm by complying with safe work practices.

This includes activities that require licences, tickets or certificates of competency or any other relevant state and territory WHS requirements.

1.2.3 Safe Work Method Statements

A Safe Work Method Statement (SWMS) details how specific hazards and risks, related to the task being completed, will be managed and is developed by the employer.

SWMS fulfill a number of objectives:

- They outline a safe method of work for a specific job.
- They provide an induction document that workers must read and understand before starting the job.
- They assist in meeting legal responsibilities for the risk management process, hazard identification, risk assessment and risk control.
- They assist in effectively coordinating the work, the materials required, the time required and the people involved to achieve a safe and efficient outcome.
- They are a quality assurance tool.

Safe Work Method Statements may also be referred to as Safe Work Procedures (SWP) or Job Safety Analysis (JSA).

An example of a Safe Work Method Statement can be found in Appendix A.

1.2.4 Assess the Task

Before you start any work or planning, look to see what the task actually is.

- Will you be directing one or more cranes?
- Will you be assembling or disassembling plant or equipment?
- Will you be erecting tilt-up panels?
- Will you be demolishing structures?
- What equipment will you need and is it available?
- What is the weather doing and is it safe to carry out the work?

All of these factors will introduce different hazards and requirements to the work.

There may be other factors that you need to consider once you have assessed the task including:

- Workplace-specific issues.
- Safe and adequate communications.
- Access and egress to and from the work area.
- Location of the task.
- Permits required for the task.
- Equipment required for the task and its availability.
- Capability or capacity of cranes and associated rigging equipment.

1.2.5 Gather Site Information

Planning the job before you start is an important step in any high risk work.

A site-specific Job Safety Analysis (JSA) or Safe Work Method Statement (SWMS) or other site-specific documentation should be reviewed to make sure the work is carried out according to workplace procedures.

If there are any task plans or schedules available, you should also make sure you are familiar with them. Structural plans will also need to be referred to throughout the job planning.

1.2.6 Forces and Loads

A 'load' is any type of force exerted on an object. It is important to understand the relevant forces and loads that are associated with the rigging work you will be doing.

Forces and loads apply to structures, equipment and plant such as:

- Static lines.
- Safety nets.
- Hoists.
- Mast climbers.
- Guy ropes.
- Cantilevered crane loading platforms.
- Cranes.
- Tilt-up panels.

Forces and loads can be divided up into the following types:

Load Type	Explanation
Dead Load	The weight of a crane, hoist or scaffold before it is carrying a load.
Static Load	Any load that does not change in size, weight or position over time (does not move or change).
Dynamic Load	These include loads that are moving or changing. This includes: ◆ Live load: The load being lifted by a crane or hoist. ◆ Wind load: The total force exerted by the wind on a structure or part of a structure. See AS 2550 for more information on wind loads.

1.3 Risk Management

HAZARDS CREATE RISK. CHECK FOR HAZARDS.

A **RISK** is the chance of a hazard hurting you or somebody else or causing some damage.

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

If you can remove or at least control a **HAZARD** you can reduce the **RISK** involved.

1.3.1 Consultation and Communicating with Others

Make sure you talk to the right people. They will be able to give you the best information to safely carry out your work. This can include:

- Safety officers who can tell you about:
  - Workplace-specific hazards.
  - Workplace-specific hazard controls.
  - Workplace policies.
- Engineers who know about:
  - Plans and drawings.
  - Load bearings (of ground and suspended surfaces).
- Supervisors who can provide you with guidance for:
  - Job specifics.
  - Local, job and site knowledge.
  - Work area arrangements.
  - Other contractors.
- Colleagues.
- Managers who are authorised to take responsibility for the workplace or operations.

It is important to communicate with workplace personnel and safety officers before starting on a worksite to ensure that any workplace policies and site-specific procedures are adhered to.

1.3.2 Risk/Hazard Identification

When identifying hazards always remember to check:

- **Above head height** – remember the load may be moving above your head.
- **At eye level** – look around to see if there is anything in the way of where you want to move the load.
- **On the ground (and below)** – Have a look at the ground conditions and think about where the load is being moved to. Will it support the weight of the load?

Common workplace hazards include:

- Ground conditions:
  - Underground services.
  - Non-weight bearing surfaces.
  - Recent excavations.
  - Soil conditions (e.g. recently filled trenches)
- Overhead hazards:
  - Power lines.
  - Overhead service lines.
  - Bridges.
- Poor lighting.
- Surrounding structures:
  - Buildings.
  - Obstructions.
  - Facilities.
  - Trees.
- Traffic:
  - Pedestrians.
  - Personnel.
  - Vehicles.
  - Other plant.
- Weather:
  - Wind.
  - Lightning.
  - Rain.
- Other worksite-specific hazards:
  - Dangerous materials.

1.3.2.1 Working Near Power Lines

Working near power lines can be 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 state or territory you are working in and 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.

Queensland

The Queensland Electrical Safety Regulation breaks down the distances in detail. Exclusion zones are broken down not only by size of 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:

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

New South Wales

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

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.

Australian Capital Territory

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:

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

Victoria

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

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)

Tasmania

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

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)

South Australia

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:

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)

Western Australia

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

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

Northern Territory

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

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)

Tiger Tails

Tiger tails are used to clearly show the location of overhead power lines. Tiger tails **DO NOT** insulate the power lines so exclusion zones and safe operating distances must still be used, even when tiger tails are in use.

1.3.3 Risk Assessment

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

Risk levels are worked out by looking at 2 factors:

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

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

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

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

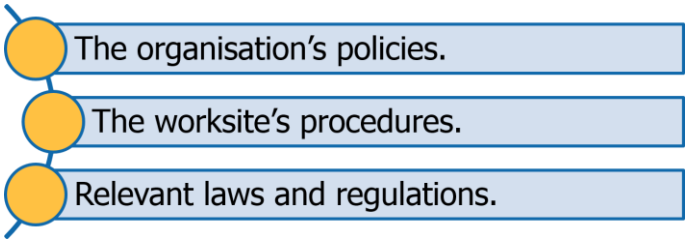
	Consequence				
Likelihood	**1. Insignificant**	**2. Minor** First Aid Required	**3. Moderate** Medical Attention and Time Off Work	**4. Major** Long Term Illness or Serious Injury	**5. Catastrophic** Kill or Cause Permanent Disability or Illness
1. Rare	Low	Low	Moderate	Moderate	Moderate
2. Unlikely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

The risk level will help you to work out what kind of action needs to be taken, and how soon you need to act.

The table below is an example of a site risk policy:

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

The action you take will depend on:



1.3.4 Hazard Controls

Once hazards and risks have been identified and assessed you need to work out what the best way to manage them will be.

The Hierarchy of Hazard Control is the name given to a range of control strategies used to eliminate or control hazards and risks in the workplace. Hazard controls should be applied before you start work, or as soon as a hazard is identified during the work.

The Hierarchy has 6 levels.

Always start at the top of the list and work your way down.

Hierarchy Level	Explanation
1. Elimination	Completely remove the hazard. This is the best kind of hazard control.
2. Substitution	Swap a dangerous work method or situation for one that is less dangerous.
3. Isolation	Isolate or restrict access to the hazard.
4. Engineering Controls	Use equipment to lower the risk level.
5. Administrative Controls	Site rules and policies attempt to control a hazard. Includes Safe Work Practices.
6. Personal Protective Equipment	The least effective control. Use PPE while you work. This should be selected at the planning stage of your work, and checked before starting the job.

You may need to use a number of control strategies in conjunction to reduce the risk level to an acceptable level.

1.3.4.1 Personal Protective Equipment Used During Rigging Work

Riggers often have to wear helmets, gloves, eye protection, face masks and respirators, and steel-capped boots to protect themselves from injury.

It is the responsibility of your employer to provide the necessary protective equipment. It is the responsibility of riggers to wear and use the equipment properly.

Sign	Explanation	Sign	Explanation
	Safety helmets with chin straps must be worn wherever there is a risk of objects falling from above and on any worksite where the hard hat sign is displayed.		Hearing protection must be worn where there are high volumes of noise such as trucks and equipment.
	Riggers should wear close fitting pigskin gloves to protect hands from: ◆ Heat and abrasion. ◆ Molten metal. ◆ Sharp edges.		Riggers should be careful to choose footwear that is comfortable, gives maximum grip and provides protection from pinching, jamming and crushing.
	Wear eye protection if you are likely to be exposed to: ◆ Physical damage. ◆ Chemical damage. ◆ Radiation damage.		To prevent permanent damage caused by ultra violet rays always wear a hat, long sleeves, long trousers and use sun block cream when working outside.
	Riggers should wear respiratory protective devices if exposed to: ◆ Toxic gases and vapours. ◆ Irritating dusts, such as silica.		It is important to wear the appropriate high visibility clothing to make sure other operators know where you are.

1.4 Identify Equipment Requirements

Once you have worked out exactly what the job requirements are you can begin to decide on the equipment you will use to do the work.

Riggers may use, or work with, any of the following equipment to carry out their job:

Plant & Associated Equipment:

- Scaffolds.
- Elevating work platforms (EWPs).
- Stages.
- Personnel boxes/workboxes.
- Cantilevered crane loading platforms.
- Hoists and mast climbing equipment.
- Safety screens and shutters.

Cranes including:

- Non-slewing cranes.
- Mobile slewing cranes.
- Vehicle loading cranes.
- Tower cranes.
- Self-erecting tower cranes.
- Portal boom cranes.
- Derrick cranes.
- Bridge and gantry cranes.

Tools & Lifting Equipment:

- Fibre ropes.
- Turnbuckles.
- Jacks.
- Flexible steel wire rope (FSWR).
- Wire and synthetic slings.
- Lever-action winches.
- Chains.
- Sheaves.
- Skates.
- Rigging screws.
- Spreader bars.
- Girder trolleys.
- Anchors.
- Lifting beams.
- Wedges.
- Levels.
- Shackles.
- Rollers.
- Eyebolts.
- Chain blocks.
- Bolts.
- Beam clamps.
- Tirfors.
- Braces.
- Load equalising gear.
- Plate clamps.
- Spanners.
- Rope grips.
- Levers.
- Podgers.
- Chain motors.
- Lifting clutches (swift lifts).

1.4.1 Safety Equipment

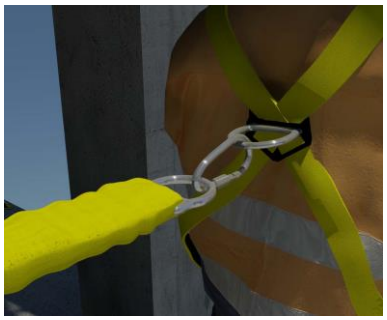
Depending on the requirements of the job, you may need to use safety equipment to reduce the risk to an acceptable level.

Safety equipment includes:

- Safety harnesses.
- Lanyards.
- Energy absorbers.
- Inertia reels.
- Static safety lines.
- Safety nets.

All safety equipment should be selected at the planning stage.

1.4.1.1 Safety Harnesses



In most cases when working at heights a full body harness should be worn.

Harnesses must be correctly fitted in accordance with the manufacturer's instructions to ensure effectiveness.

Workers should connect the fall-arrest line to the attachment point on their harness (dorsal attachment point in the middle of the back, or the chest connection) that will provide the best protection for the situation in which it is being used.

Safety harnesses must meet the requirements of AS/NZS 1891 Industrial fall-arrest systems and devices.

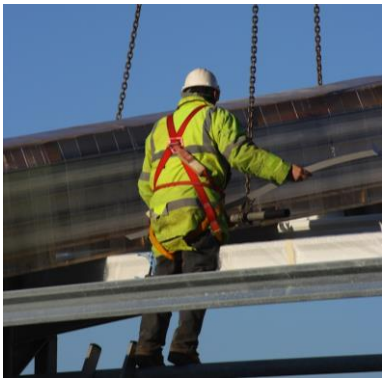
1.4.1.2 Lanyards & Energy Absorbers

There should be a minimum of slack in the fall-arrest lanyard between you and the anchor point, which should be as high as the equipment permits.

The length of the lanyard should restrict the fall distance to a maximum of 2 metres before the fall-arrest system takes effect.

Avoid work above the anchor point, as this will increase the free fall distance in the event of a fall, resulting in higher forces on the body and greater likelihood of the lanyard snagging on obstructions.

To reduce injuries caused by a fall, energy absorbers should be used as part of the lanyard.



1.4.1.3 Inertia Reels

Inertia reels provide a worker with a relatively free range of movement or extra reach compared to a lanyard, with the added safety feature of being able to lock in the event of a fall, arresting the descent of the worker.

Inertia reels should not be used in the following situations:

- While working on a sloped surface (e.g. a steeply pitched roof) or any other surface where a fall may not be a quick vertical one.
- Locked as a constant support for a worker during normal work.
- In conjunction with a lanyard.

Inertia reels must comply with AS 1891.3 Fall arrest devices.

1.4.1.4 Static Safety Lines

Static lines are horizontal or substantially horizontal lines to which a lanyard may be attached and which is designed to arrest a free fall.

These provide a suitable anchor point for a fall-arrest system, while still allowing a limited range of movement along the path of the line.

1.4.1.5 Safety Nets

Industrial safety nets are sometimes used as an effective means of fall protection for those working at heights where it is not practicable to provide scaffolds or temporary guard railings.

When combined with overlay nets of finer mesh size, they can also be used to contain falling debris.

Safety nets may be installed where there is a risk of tools, equipment and materials falling from a height on other workers, plant, machinery, structures or pedestrians.

1.5 Identify Communication Methods

As a rigger you need to be able to communicate with those around you while you work, and you need to be able to understand task and equipment instructions. These can include:

- Manufacturer's guidelines (instructions, specifications, checklists).
- Industry operating procedures.
- Workplace procedures (work instructions, operating procedures, checklists).

Workplace communications may take the form of:

- Verbal and non-verbal language.
- Written instructions.
- Signage.
- Hand signals.
- Whistle or buzzer signals.
- Listening.
- Questioning to confirm understanding, and appropriate worksite protocol.
- Toolbox meetings.

Talk to the appropriate personnel (e.g. supervisors, colleagues or managers) to discuss the best methods for communication while you are still at the planning stage of the job.

For example, you may consider using the following methods to conduct a tilt-up panel erection on a building site:

- Hand signals.
- Whistle or buzzer signals.
- Fixed channel two-way radio.
- Verbal instructions.
- Written instructions.

DO NOT use a mobile phone to talk to the crane operator while conducting rigging work.

2.1 Select and Inspect Rigging Equipment

Your selection of rigging and associated equipment will depend on a number of factors. Make sure the equipment you are using is suitable for the type of job and the shape, size, weight and requirements of any loads.

The selection of equipment also includes any cranes, hoists, plant or scaffold required to carry out the job.

2.1.1 Selection of Rigging Equipment

Once you have clearly identified the work that needs to be completed you will need to select appropriate rigging equipment.

It is important that you consider how you will:

- Complete the tasks (tools, plant, equipment and materials required).
- Position materials and equipment safely.
- Access the task.
- Ensure the safety of all personnel during and after the work has been completed.
- Ensure the security of all equipment during and after the work has been completed.

2.1.1.1 Equalising Gear

Equalising gear is used to keep a load balanced and steady during a lift, and also helps to distribute the load evenly across the lifting gear and cranes or hoists.

Spreader, Lifting and Equalising Beams

Spreader, lifting and equalising beams are devices, which spread the load evenly for a given lift.

Spreader beams literally "spread" a two-legged top sling. A spreader beam has better stability than a lifting beam and a higher potential capacity for a given size of steel section used. Spreader beams require more headroom than lifting beams due to the two-legged sling arrangement at the top.

Lifting beams have a centre-lifting lug at the top to accommodate a crane hook and a bottom lug at each end for connecting slings. Headroom for the lift is reduced, as no top slings are required.

Equalising beams are used for dual crane lifts, or handling tilt-up panels. These beams allow you to position the load appropriately to its centre of gravity in relation to the capacity of the crane or cranes lifting the load. This helps to keep the load stable and helps to ensure that no crane is overloaded during a dual crane lift.

Equalising Sheaves

Equalising sheaves allow a load to find its point of balance while still maintaining stability and without putting strain on the lifting gear and the crane(s).

These sheaves are commonly used for handling tilt-up panels.

2.1.1.2 Associated Equipment

There is a wide range of equipment that is designed for specific tasks and that are often used in rigging operations. These can include:

Chain Blocks

Chain blocks are a geared portable appliance used for hoisting a load suspended on a chain.

Lever Blocks/Lever-Action Winches

Lever blocks are a geared portable appliance incorporating a load chain, which is operated by a lever handle.

Chain Motor

A chain motor is a mechanical device used for lifting heavy loads, objects and equipment. It has a large electric motor with a gearbox and chain drive.

When it has been attached to an overhead hang point the heavy gauge chain and hook can be used to raise and lower loads.

Rollers

Rollers can be used where the loads are bulky or heavy, and there is no room to lift the load into position by crane.

Types of rollers include:

- Steel scaffold tube for light loads.
- Solid steel bar for heavy loads.
- Timber rollers or logs for 'bush jobs'.

Jacks

A jack is a geared mechanical device which is placed under a load to raise or lower it.

Skates

Skates are a method of moving heavy loads with a set of small rollers fixed into a solid frame which are set in bearings and run very freely. They are built to hold a specific rated capacity which should not be exceeded.

Wedges

Steel wedges are used to pack under steel columns on the concrete base to ensure the column is plumb.

Girder Trolleys

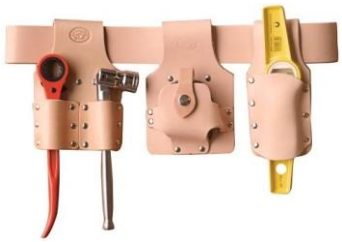
Girder trolleys are attached to the lower flange of a steel girder to provide a means of moving loads along the length of the girder.

Hand Tools

Hand tools are used throughout different rigging tasks. These can include spanners, podgers, levers, levels, tirfors, bolts and braces.

Hand tools should be inspected for:

- Faulty ratchets (where applicable).
- Obvious signs of damage or wear.



Rigging Screws / Turnbuckles

An enclosed device with an anchorage point and a threaded rod in each end.

Used to tension an FSWR or to provide fine adjustment to a sling assembly.

Hooks, Shackles, Eyebolts & Slings

Hooks, shackles and eyebolts are used to connect the crane or hoist with the lifting gear and the load.

Always make sure that all hooks, shackles and eyebolts are rated for the work and are not damaged or worn beyond acceptable levels.

Slings may be FSWR, chain or synthetic. All slings should have rating labels or tags.

Make sure that all slings are in safe working order before you use them.

Lifting Clutches (Swift Lifts)

Lifting clutches are used to lift concrete slabs and beams.

The lifting clutch is connected to an anchor embedded in the concrete of tilt-up panels.

Slings can then be attached to the lifting clutch with hooks.

2.1.2 Select and Inspect Associated Plant and Equipment

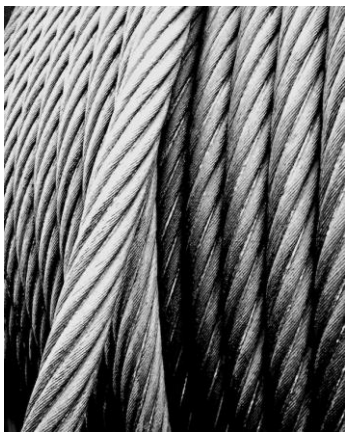
Depending on the type of rigging task, there are a number of associated types of plant and equipment that you may use.

These include:

- Sheaves and drums (used with cranes and hoist assemblies).
- Purchases and tackles (different pulley systems that are configured to gain mechanical advantage).
- Access equipment (elevating work platforms, work baskets and mast climbers).
- Load shifting equipment (cranes and hoists).

2.1.2.1 Flexible Steel Wire Rope

Fatigue in crane ropes can be caused through both vibration and friction.



Crane pendant ropes are susceptible to fatigue caused by vibration in the rope.

Hoist and luffing ropes can suffer from external wear caused by the friction of moving over sheaves and around drums.

It is important to check the rope diameter of FSWR that is fitted on a crane to make sure it is still safe to use.

Generally, if the rope has reduced to 85% of its original diameter you will need to discard it, even if there is no evidence of broken wires.

Always make sure that the correct FSWR is used to replace defective ones.

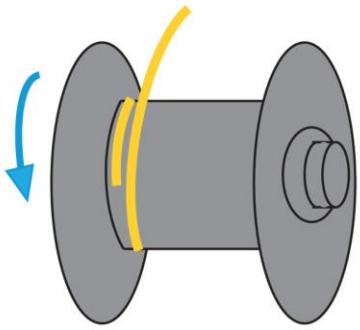
The correct size, length, lay and construction of rope must always be used and may be different from crane to crane.

Check the manufacturer's manual, specifications or load chart for the requirements of the specific crane.

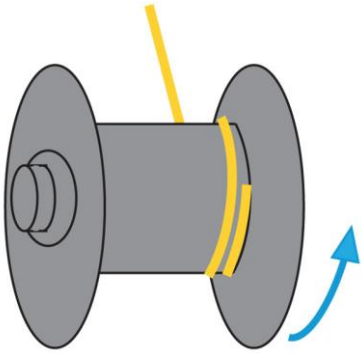
2.1.2.2 Winding Flexible Steel Wire Rope onto a Drum

Replacing the FSWR on a drum needs to be carried out properly for the rope to sit neatly in position and to avoid damage to the rope.

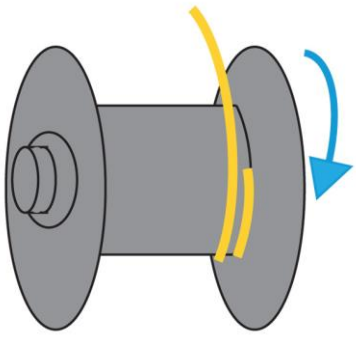
If the FSWR is not tightly laid on a multi-layered hoist drum, jamming, crushing and fatigue can occur as the rope jams in-between the lower levels.



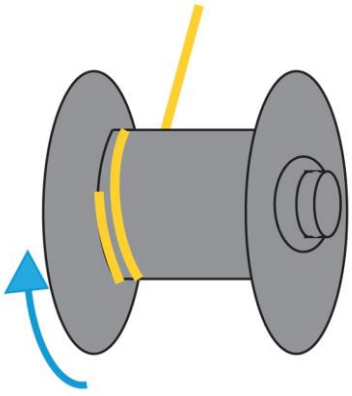
RH lay rope overwound



RH lay rope underwound



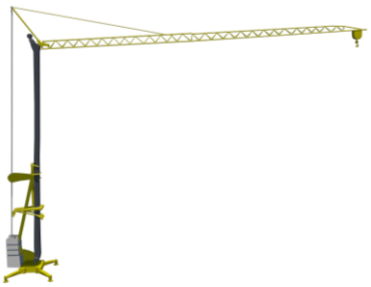
LH lay rope overwound



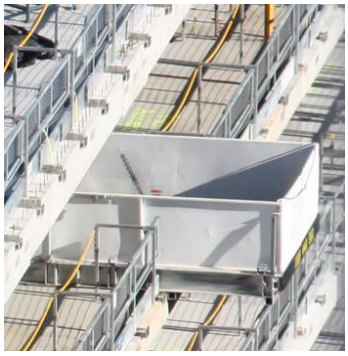
LH lay rope underwound

2.1.2.3 Cranes and Plant

Cranes that you may work with could include:

 **Tower Cranes** A boom or jib is mounted on a tower structure.	 **Self-Erecting Tower Cranes** A tower crane where the tower structure and boom/jib elements are not disassembled into component structures and can be transported between sites as a complete unit. The erection and dismantling processes are an inherent part of the crane's function.	 **Portal Boom Cranes** The boom/jib is mounted on a portal frame, which is supported on runways along which the crane may travel.
 **Mobile Cranes (Slewing)** A crane capable of travelling over a supported surface without the need for fixed runways. Relies only on gravity for stability.	 **Non-Slewing Mobile Cranes** A mobile crane incorporating a boom/jib that does not slew.	 **Vehicle Loading Cranes** A vehicle-mounted crane. Principal purpose of loading and unloading the vehicle.
 **Bridge Cranes** Consists of a bridge beam or beams that are mounted to end carriages at each end. Capable of travelling along elevated runways and has one or more hoisting mechanisms arranged to traverse across the bridge.	 **Gantry Cranes** Consists of a bridge beam supported at each end by legs mounted on carriage ends. Gantry cranes are capable of travelling on supporting surfaces or deck levels, whether fixed or not and has a crab with one or more hoisting units arranged to travel across the bridge.	 **Derrick Cranes** Has a slewing strut-boom with the boom pivoted at the base of a mast which is either guyed (guy-derrick) or held by backstays (stiff-leg derrick) and which is capable of luffing under load.

During rigging operations you may also work with:



Cantilevered Crane Loading Platforms
Cantilevered Crane Loading Platforms (CCLPs) are used to place loads with a crane into work areas high up off the ground.

Perimeter Safety Screens & Shutters
Perimeter safety screens and shutters are designed to prevent personnel and any debris, tools or materials falling from a height.

Materials Hoists

Materials hoists run up and down the outside of a tower using a wire rope hoisting system for raising and lowering the platform.

2.1.3 Types of Access Equipment

Access equipment is used to safely access a work area for any work at heights. These types of equipment often required additional use of safety systems such as work positioning or fall-arrest systems.

Generally, access equipment is made up of a work platform and a means of gaining safe access to the work area.

A work platform should be fixed to a structure for stability and installed with edge protection. It should be fitted so that it can be accessed and exited safely.

The surface should be non-slip, large and strong enough to safely support all the tools, materials and people placed upon it. It should not be fixed at a steep angle.

Work platforms include:

- Scaffolding (e.g. mobile, tower, suspended).
- Elevating work platforms (e.g. boom type, scissor lift or hydraulic lift).
- Mast climbers.
- Workboxes (crane or forklift lifted).

2.1.3.1 Scaffolds

Modular Scaffolds

Tube and Coupler Scaffolds

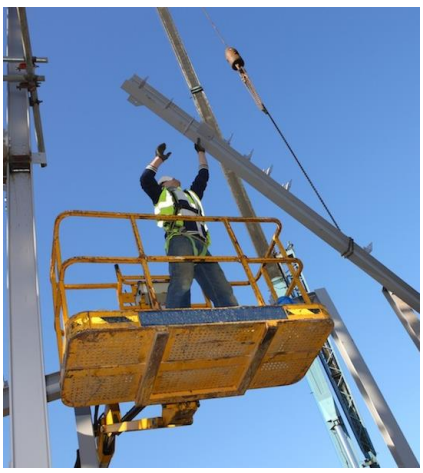
Hung Scaffolds

The erection of a scaffold from which a person or object could fall more than 4m must be carried out or directly supervised by a person holding the appropriate level scaffolding high risk work licence.

One of the most common forms of scaffolding used during the erection of low rise portal frame buildings and modern structural design multi-storey construction is mobile prefabricated tower frame scaffolds.

2.1.3.2 Elevating Work Platforms

Elevating work platforms (EWPs) are available in a variety of types and sizes such as boom type, scissor lifts and vertical mast.



When using an EWP it is important that:

- Operators wear a safety harness attached by a lanyard (with energy absorber) of appropriate length to a suitable anchorage point on the platform.
- The operator is adequately trained to use the EWP. A licence is required for the operation of boom type EWPs where the boom length is 11 metres or more.
- The use of the EWP should comply with the Australian Standard AS 2550.10 Cranes – Safe Use – Elevating work platform.
- The EWP has been checked to make sure it is in safe working order.

2.1.3.3 Mast Climbers

Mast climbers are made up of work platforms that are raised and lowered along 1 or more masts using a hoist mechanism.

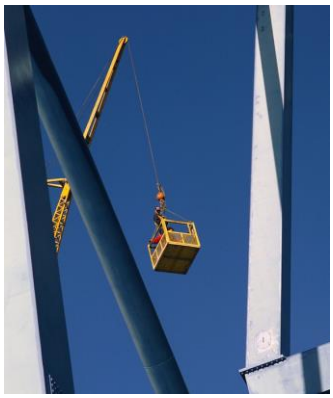
They may need to be tied to a building under circumstances prescribed by the manufacturer to make sure they remain stable during use.

Mast climbers are generally not suitable for use if the profile of a structure changes at different elevations (e.g. if the upper floors of a building 'step' back or balconies extend from the building).

The erection and dismantling of mast climbing work platforms must be carried out, or be directly supervised, by a person holding an appropriate high risk work rigging or scaffolding licence.

Further information on mast climbing work platforms is provided in AS 2550.16 Cranes – Safe Use – Mast climbing work platforms.

2.1.3.4 Crane Lifted Personnel Boxes/Workboxes



Personnel boxes or workboxes are used to lift workers with a crane.

Crane-lifted workboxes are often suitable for very high work or isolated parts of the project where it is difficult or impractical to provide scaffolds or EWPs.

The workbox must be specifically designed for the purpose of lifting people. Its design must be registered with a state or territory regulatory authority and meet all of the necessary requirements of the workplace, crane manufacturer and AS 2550 and AS1418.17.

The workbox and workers must be securely attached to an approved anchor point (capable of withstanding the force of the box falling). Workers should be attached via a lanyard and full body harness, unless the workbox is enclosed.

The workbox must be stamped or be provided with a stamped metal data plate, securely and permanently attached to it in a prominent position, and providing the following information:

- The maximum hoisted load (kilograms).
- The rated capacity (kilograms).
- The tare mass (kilograms).
- Minimum allowable (rated) crane capacity (kilograms).

2.1.4 Inspection of Associated Plant and Equipment

ALL rigging and associated equipment must be inspected before use.

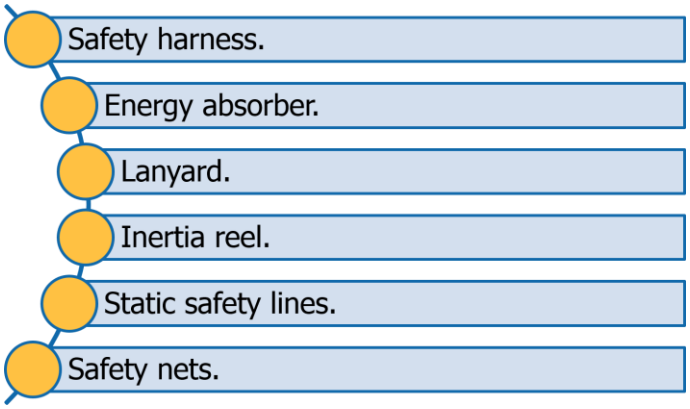
Rigging equipment, such as scaffolds and plant, needs to be inspected by a competent and licenced person before they are used.

Plant and equipment, such as elevating work platforms, mast climbers or cranes, needs to be checked daily before use to make sure all items are working properly. These checks need to be completed by a person licenced to operate that equipment. All other rigging equipment (where applicable) needs to be inspected before any work is carried out.

2.2 Inspect Safety Equipment

All safety equipment needs to be inspected for serviceability before you start the rigging work.

Safety equipment includes:



All harnesses and appropriate attachments need to be inspected in accordance with AS 1891.

2.2.1 Inspect Fall-Arrest Harness

A fall-arrest harness must be inspected before use. Common defects that will condemn a safety harness from use are:

- Fraying.
- Splitting.
- No current inspection tag.
- Any obvious signs of damage to any part of the harness.

Shown here are some examples of things you need to check the harness for:

Component	Condition/Fault to be Checked
Webbing	◆ Cuts or tears. ◆ Abrasion damage. ◆ Excessive stretching. ◆ Damage due to contact with heat, corrosives or solvents. ◆ Deterioration due to rotting, mildew, or ultraviolet exposure.
Snap Hooks	◆ Distortion of hook or latch. ◆ Cracks or forging folds. ◆ Wear at swivels and latch pivot pin. ◆ Open rollers. ◆ Free movement of the latch over its full travel. ◆ Broken, weak or misplaced latch springs (compare if possible with a new snap hook). ◆ Free from dirt or other obstructions, e.g. rust.
D-rings	◆ Excessive 'vertical' movement of the straight portion of the D-ring at its attachment point of the belt, so that the corners between the straight and curved sections of the D become completely exposed. NOTE: Excessive vertical movements of the D-ring in its mounting can allow the nose of larger snap hooks to become lodged behind the straight portion of the D, in which position the snap hook can often accidently 'roll out' of the D under load. ◆ Cracks, especially at the intersection of the straight and curved portions. ◆ Distortion or other physical damage of the D-ring. ◆ Excessive loss of cross-section due to wear.
Buckles and Adjusters	◆ Distortion or other physical damage. ◆ Cracks and forging laps where applicable. ◆ Bent tongues. ◆ Open rollers.
Stitching	◆ Broken, cut or worn threads. ◆ Damage or weakening of threads due to contact with heat, corrosives, solvents or mildew.

An example of a Safety Harness Inspection Checklist can be found in Appendix B.

2.2.2 Inspect Inertia Reel

Shown here are some examples of things you need to check an inertia reel for:

Component	Condition/Fault to be Checked
Rope (Fully extend rewind drum anchorages)	◆ Cuts. ◆ Abrasions or fraying. ◆ Stretching. ◆ Damage due to contact with heat, corrosives, or solvents. ◆ Excessive dirt or grease impregnation. ◆ With rewind anchorages give a firm pull with the rope fully extended to check that the rope end is securely anchored to the drum.
Anchorage Body	***a) Mountain ring:*** ◆ Physical damage or wear, especially at any pivot points. ◆ Cracks, especially in corners. ◆ Mounting security. ***b) Anchorages body proper:*** ◆ Physical damage such as significant dents, distortion, or corrosion. ◆ As far as possible, but without dismantling, check for the entry of foreign bodies such as small stones. ◆ Loose or missing screws, nuts or similar objects (external check only). ◆ Position of the clutch compression indicator button (fitted only to rewind drums with steel rope).
Locking Mechanisms and Rope Guides	◆ Check externally visible rope guides for excessive wear or ridging. ◆ Check that the rope-locking mechanism locks and holds securely when the rope is given a sharp tug. ◆ Ensure that the rope runs freely through the anchorage with no tendency to stick or bind, and that on rewind drum anchorages the rope rewinds completely without loss of tension.
Hardware	◆ Examine the condition and locking action of any associated snap hooks or links.

2.3 Report all Defects and Isolate Faulty Equipment

If you identify any equipment that is defective, damaged or faulty you must not use it. The equipment needs to be isolated from use to stop anybody from accidentally using it and the defect needs to be reported to an authorised person.

Make sure you complete any isolation procedures as required.

This may include tagging or locking out equipment and completing fault reports or other documentation.

Faulty lifting equipment may need to be labelled and rejected, destroyed or returned to the manufacturer for repair (depending on the type and severity of the fault).

2.4 Select and Check Communication Equipment

It is important that the two-way system provides clear signals without any interference on the channel.

Make sure all equipment is working properly and that you can communicate with the crane or hoist operator clearly **BEFORE** you start the job.

Do not use any communication equipment that is not consistently working properly. Check that there is no interference on the channel.

The two types of two-way radio are conventional and fixed channel.

2.4.1 Conventional Radio

Great care must be taken when allocating frequencies/channels to make sure that there are no other operators using the same frequency in the area.

Interference on your frequency can be a safety hazard. Stop work until the radio is checked or a new frequency selected and allocated.

2.4.2 Fixed Channel Radio

Fixed channel radio is a computer-controlled two-way system that locks other radio users out of your selected frequency.

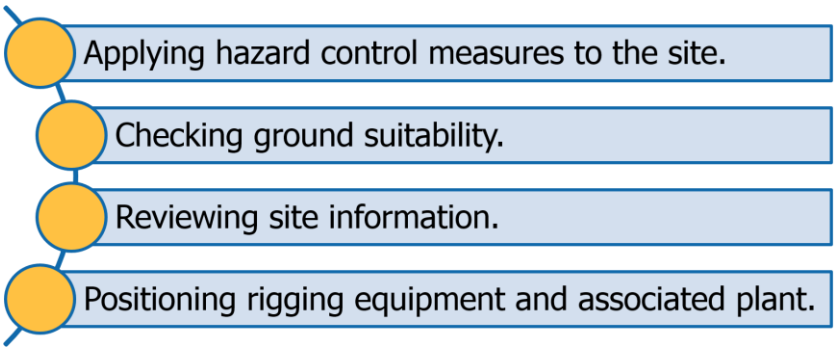
With fixed channel radio it is possible to have several separate groups on one site communicating by radio without interfering with each other.

Fixed channel radio is recommended for large sites.

3.1 Set Up for the Task

You need to make sure everything is set up correctly so that you can carry out the rigging work safely and efficiently. Planning and preparation are essential to conducting the work safely and on schedule.

This includes:



3.1.1 Apply Hazard Control Measures

Part of preparing the site includes setting up any hazard controls.

This might include:

- Setting up barricades to keep traffic and pedestrians outside of the work area.
- Setting up extra lighting or safety shutters/screens.
- Having power lines insulated or disconnected.

Some hazards are caused by the work being done so you may need to move obstructions such as equipment, materials or debris, or install trench covers if working near excavations.

Always wear the required PPE for the job. Make sure that any control measures are consistent with workplace and safety standards.

If you are unsure what the required PPE is, check with your WHS officer or supervisor.

3.1.2 Check Ground Suitability

Before setting up any equipment or plant you need to make sure the ground will support the weight of the equipment and load.

All rigging tasks need to be carried out on a firm surface that is going to be able to support any structures or the completion of the task. The plant could become unstable during operation if the ground is rough, uneven or soft.

Backfilled trenches may not have compacted completely and are dangerous to set up the equipment on.

All equipment must be set up following the 1:1 ratio. This is where plant and equipment is set up at least 1m away from an excavation (or recently filled trench) for every 1m of depth.

For example, you would set up equipment at least 2m away from a 2m deep excavation.

This is a guide only – a competent person must check the stability of the ground before any equipment is set up.

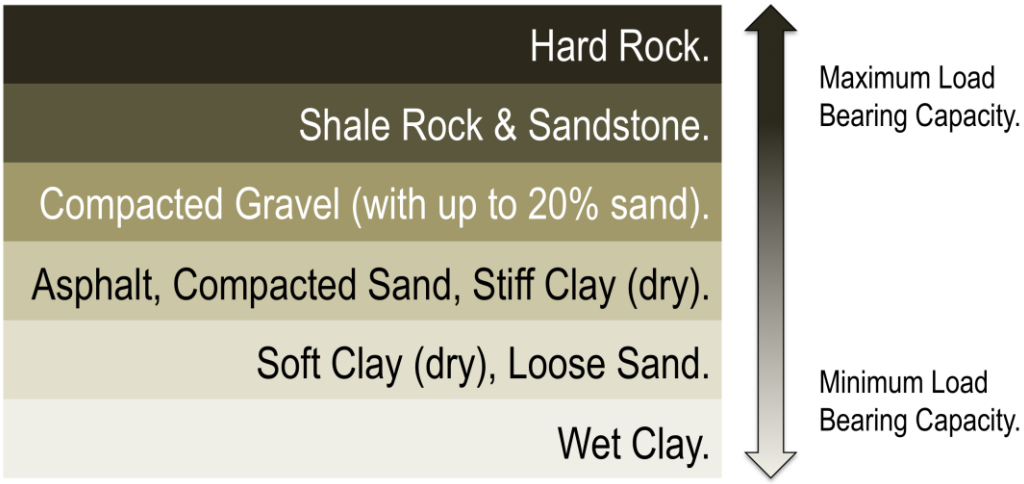
Check to make sure there are no underground services running through the area where you plan to set up the plant.

The pressure of the equipment could cause damage to the underground services/pipes/cables.

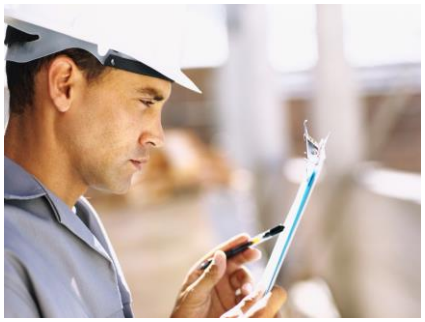
You may need to use packing or mats under the outriggers to make the equipment stable on soft ground.

You will need to establish the ground stability by referring to a soil report from an engineer.

Different ground and soil types have different load bearing pressures depending on how firm or dense they are. The diagram here is a general guide for different ground types:



3.1.3 Review Site Information



Talk to other associated personnel such as doggers, other riggers and crane operators to review the site information and make sure you have properly selected and set up the equipment needed to carry out the job safely.

All work must be in keeping with safety standards and workplace rules to ensure the safety of all workers.

All structures and associated plant that are being erected as part of the rigging work need to be carried out according to procedures and site information.

Procedures and site information includes:

- Safe Work Method Statements (SWMS).
- Local conditions including access and egress.
- Site-specific Job Safety Analyses (JSA).
- Task plans.
- Work schedules.
- Structural plans.

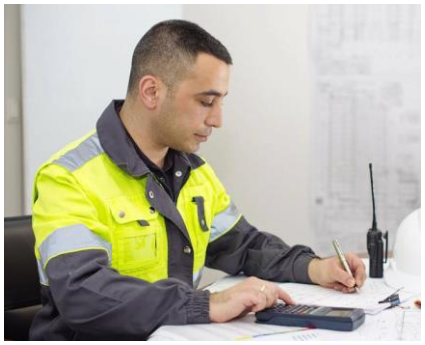
3.1.4 Determine Forces and Loads

You also need to determine all forces and loads associated with the erecting, operation and dismantling of structures and associated plant to make sure rigging equipment is set up correctly.

This includes working out the weights of plant and equipment, and the additional weight of loads as they are moved around the site.

You will also need to consider wind loads if you are working on a particularly windy day.

Check the manufacturer's specifications for all plant and equipment to locate their wind rating. It is extremely dangerous to operate some equipment in high winds, especially when shifting loads.



Once these forces and loads have been determined you are able to make sure that:

- Any cranes or hoists are configured correctly.
- Lifting equipment and/or load locations (e.g. ground, scaffolds or suspended floors) are capable of handling the load.
- All associated plant and equipment is capable and appropriate for completing the task.

3.1.5 Fit Safety Equipment

All safety equipment needs to be fitted before starting the rigging work.

You need to make sure it is appropriate for the task and that it fits you correctly.

Never begin a rigging task without the appropriate safety equipment.

Safety systems (such as static lines, work positioning systems and fall-arrest systems) and some plant and equipment (such as elevating work platforms and crane-lifted personnel boxes/workboxes) require the use of a full body fall-arrest harness and installed anchor points.

Safety equipment also includes Personal Protective Equipment (PPE).

Always make sure you are wearing the correct PPE for the task and worksite.

Generally at a minimum this would include:

- Hard hat/safety helmet.
- Safety gloves.
- Steel-capped work boots.
- High-visibility clothing.

Check for signage on site or talk to a manager or supervisor if you are unsure of the PPE requirements for the site.

Any equipment and plant that you will be using throughout the rigging work needs to be correctly and safely positioned.

It also includes coordinating resources so that you have everything that you need in or close to the work area.

This will allow you to erect, install or disassemble plant and equipment without having to continuously leave the work area, or disrupt operations that may be taking place elsewhere on the worksite.

3.2 Erect Structures and Associated Plant

All structures and associated plant that are being erected as part of the rigging work need to be carried out according to procedures and site information. All work must be in keeping with safety standards and workplace rules to ensure the safety of all workers.

3.2.1 Lifting and Installing Concrete Panels

Setting up a rigging system for erecting precast concrete elements requires careful and thorough pre-planning.

For general precast elements, such as beams or flat slabs, care should be taken to determine if it is necessary to equalise loads between lifting points on any element.

Pre-cast concrete is commonly used in a wide range of modern building and construction projects.

Pre-cast concrete includes pre-tensioned beams, pre-cast concrete floor and facade panels.

All pre-cast panels should be handled in accordance with the manufacturer's instructions.

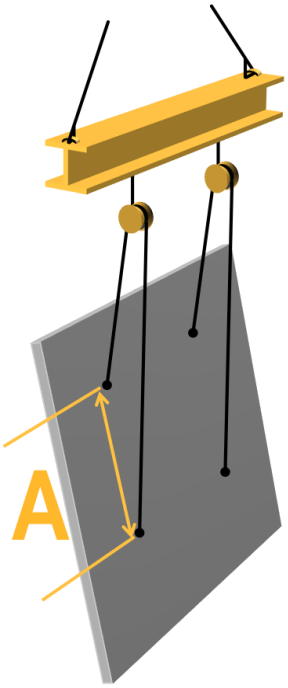
Pre-cast concrete can come in the following types:

- Pre-stressed concrete beams.
- Transfer beams.
- Pre-cast concrete facade panels.

3.2.1.1 Calculations for Tilt-Up Panels

Concrete tilt-up panels are used in the construction of buildings such as warehouses, factories and commercial and residential buildings. They are positioned and fixed with temporary bracing until the structure is able to support itself.

Three tilt-up panels are to be raised and positioned using the rigging configurations shown below:



Panel 1

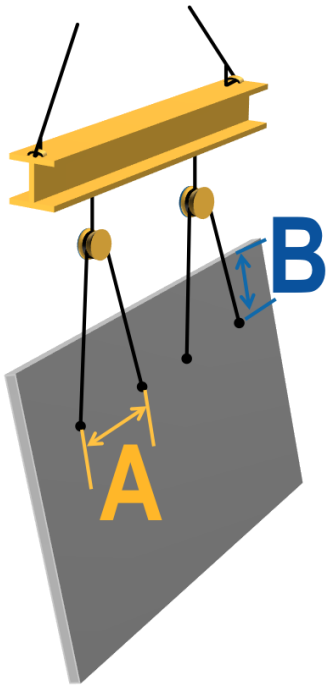
Example 1:

Configuration of Panel 1:

- Dimension A is 1.5 m

To work out the minimum length of the sling follow the formula:
Sling length = 2A

2 x 1.5 m = 3m is the minimum length.



Panel 2

Example 2:

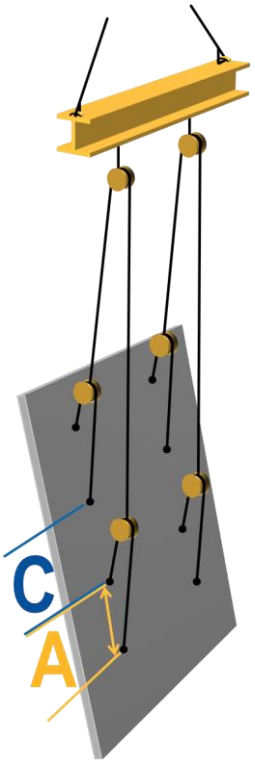
Configuration of Panel 2:

- Dimension A is 1.0 m
- Dimension B is 1.5 m

To work out the minimum length of the required slings follow the formula:

Sling length = 3 x B + A

3 x 1.5 + 1 = 5.5m is the minimum length.



Panel 3

Example 3:

Configuration of Panel 3:

- Dimension A is 2.4 m
- Dimension C is 1.5 m

To work out the following two minimum lengths of the required slings follow the formulae:

For the 4 Slings:

Sling length = 3A

3 x 2.4 = 7.2m

For the 2 slings:

Sling length = 4.5 x A or 4.5 x C (whichever is greater)

4.5 x 2.4 = 10.8m.

3.2.1.2 Planning to Install Tilt-up Panels

When planning to install tilt-up panels you will need to complete a risk assessment, identify worksite hazards and implement relevant hazard controls.

Before attempting to install or remove concrete panels you will need to make sure you have the appropriate equipment, for example:

- Crane(s) – capable of handling the weight of the panel and fitted with a load indicator.
- Bracing – to help position and support the panel.
- Work platforms/access equipment – to gain access to lifting points once the panel is in place.
- Supports (lifting clutches) – to safely connect the lifting gear to the panel.
- Lifting gear/equipment – appropriate for the load e.g. slings, shackles, swift lifts.
- Communication equipment – to coordinate and direct the movement of the load.
- Personal Protective Equipment (PPE) – relevant to the task and site requirements.
- Risk controls – including barriers and exclusion zones.
- Access equipment – to safely access the task.

3.2.1.3 Specific Requirements for Tilt-Up Panel Erection

The following minimum standards apply for all equipment relating to the erection of tilt-up panels:

Item	Minimum Requirement for Safe Use
Lifting Clutches	Proof tested every 12 months.
Lifting & Bracing Insert	Minimum safety factor of 2.25 (or 2 and a quarter).
Panel Braces	Minimum safety factor of 2. Retaining devices should be fitted to the locking pins of adjustable panel braces. The information concerning the rated capacity of an adjustable brace at zero and maximum extension should be available at the worksite.
Bracing Anchors	The maximum load on an expansion anchor for brace fixing is 65% of the first slip load. ALL chemical anchors used to fix braces should be individually proof-tested to the rated capacity.
Shims	The height of shims under the panel edge should not be more than 40mm unless specifically designed. The minimum width of shims under the panel edge should be 100 mm or the panel thickness (whichever is lesser).

You will need to thoroughly examine the shop drawings for the panel before rigging it. This will show you the correct rigging configuration for the particular panel you are lifting.

Incorrect slinging of the tilt-up panel could result in overstressing of the panel or the possibility of breakage.

3.2.1.4 Lifting and Fixing Panels

Make sure all personnel in the work area are not put in any danger. Never overreach the safe working radius of the crane, be careful of load swing particularly in windy conditions and monitor for sudden failure in the panel or rigging gear.

When lifting a panel from its casting bed the suction effect will increase the load on the crane. To allow for this, increase the dead load of the panel by 40% (multiply by 1.4).

If possible, braces should be fixed to tilt-up panels before they are lifted. There should be at least two braces of equal capacity at right angles to each panel face (unless specifically designed otherwise).

When a panel is in its final position it should have maximum tolerance of 5mm in its alignment. Braces should not be removed from a panel before it is connected to the supporting structure.

3.2.2 Erecting a Non-Guyed Light Tower

At an intermediate rigging level you are able to erect a non-guyed tower, such as a light tower.

This is a tower that is designed to be stable and supported without the use of additional bracing or ties.

This process requires you to erect and stabilise the base of the light tower, then raise, position and connect the remainder of the tower.

This may be completed using a crane or winch, and depending on the size of the tower you may also need to use access equipment such as an Elevating Work Platform (EWP) to fasten it in position.

You will need to coordinate with other personnel, especially if working from the basket of an EWP, and if directing a crane.

Make sure you have selected appropriate communication equipment, or have discussed and decided on appropriate communication techniques (verbal, hand or whistle signals) before you start.

You will need to select lifting gear appropriate to the task and check that it is in safe working order before using it.

Always follow the manufacturer's instructions for setting up and levelling the light tower and use the correct tools and bolts to secure it in place.

The removal of the light tower should follow the same procedure as the installation, in reverse.

3.2.3 Tower Cranes

A Tower Crane is a jib or boom/job crane mounted on a tower structure. They can be demountable or permanent and can have a horizontal (hammerhead) or luffing jib.

Tower cranes are an effective option for building and construction. They provide excellent reach and capacity and are able to adapt to the size of a building as it is erected.

Internal type tower cranes are supported inside a building or structure by using a series of extendable beams (according to the design requirements).

When erecting or dismantling a tower crane it is important to identify all hazards, implement all hazard controls, check all equipment including safety equipment (e.g. safety harness and lanyard) and plan out the work sequence.

You will need to find out the total weight of each component of the tower crane before you start to erect it.

This information can be found in the manufacturer's specifications or the owner's/operator's manual. You should also check for any labels, signage or markings on each component.

All sections of the boom and jib need to be lifted properly by connecting the lifting gear (slings) to the appropriate place, for example:

- The top chords.
- Lifting lugs incorporated on the boom chords.
- Or in accordance with the manufacturer's specifications.

You will also need to determine the maximum number of tower sections that the crane can stand on before it must be tied to the building or structure.

This information can be obtained from an authorised engineer or the crane manufacturer.

The counterweights for the tower crane must always be installed **EXACTLY** as the manufacturer has instructed to maintain crane stability.

The counterweight ropes may be tensioned using turnbuckles.

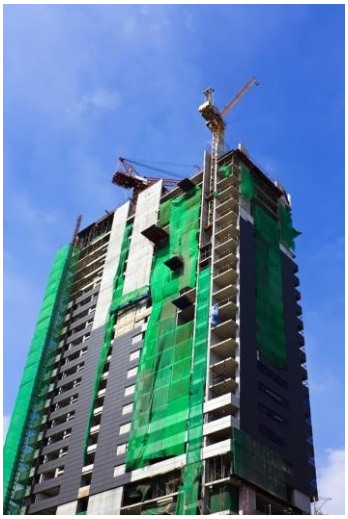
You must make sure that these are locked out using a locking plate to prevent them from coming loose due to vibration in the rope.

There are two main types of tower assemblies which may be used depending on the situation:

- Internal climbing.
- External climbing.

Regardless of the type of tower crane it is always important to make sure that the crane and sections are clear of any obstructions before climbing. This will help you to ensure the correct balance is achieved and the tower sections can climb without jamming.

3.2.3.1 Internal Climbing Tower Cranes



Internal climbing tower cranes are able to climb or 'jump' to gain height, as a building gets taller. They are often positioned within a shaft inside the structure of the building.

It is important that the tower guides are released from the sides of the shaft to the minimal measurement required before the climbing process starts.

You must make sure these guides are placed at the set measurement apart in accordance with engineer's specifications.

You will need to be aware of the next guide position before climbing.

The boom will need to be luffed out very slowly to the required radius to help the crane achieve equilibrium (centre of balance).

Travelling type counterweights may be locked or unlocked while the boom is luffed to a minimum radius and high boom angle.

Clear communication is required between the personnel at the top (machine deck) and bottom (pontoon) of the tower. These personnel need to coordinate to make sure the hydraulic rams are retracted and extended in the correct sequence to keep the crane stable while it is climbing.

If the hydraulic control is engaged and no movement occurs you will need to check for jamming of the tower on the lift shaft, incorrect balance or malfunction of hydraulic controls or equipment.

Once the crane is in the new, elevated position, the centre pontoon beam is retracted.

3.2.3.2 External Climbing Tower Cranes

External type tower cranes are tied to the outside of a structure or building. The distances between ties are determined by an engineer or manufacturer's specifications.

Since these cranes are external to the building they are more susceptible to, and must be rated for wind.

Check the engineer's or manufacturer's specifications for the wind rating of any crane you are erecting.

External climbing tower cranes implement the use of a monorail to guide new tower sections in underneath the raised crane assembly while the climbing frame is fully extended.

This monorail is attached to the upper end of the tower. As new sections of tower are installed under the crane it is important that the bolts connecting the crane to the tower are never undone.

The new tower crane section needs to be lifted up and positioned/suspended from the extendable monorail. The crane boom needs to be positioned at a minimum radius or luffed up (or trolley adjusted) to balance the crane while it is lifted.

Once the new tower section is in position it must be bolted in place and tensioned as per the manufacturer's specifications. The licensed rigger (intermediate or advanced level) is responsible for communicating with the crane operator from inside the tower during the climbing procedure.

The process for removing tower sections is the reverse of installing them:

1. Luff the boom out to balance the crane.
2. Remove top tower section bolts.
3. Tower section being removed is repositioned correctly on monorail/support rail.
4. The top section of the crane is lowered correctly, as per instructions from the rigger.
5. The remaining bolts are correctly fastened and torqued.
6. The removed section is safely lowered from the crane.

3.2.4 Lattice Boom Cranes

As a licensed rigger, you may be required to add or remove lattice boom sections on cranes.

Always refer to the manufacturer's specifications or the crane operator's manual for details of the maximum cantilevered boom length supported from the boom butt section (mobile cranes), as this will affect your choice of boom section in relation to the capacity of the crane.

The cantilevered boom section is supported by the connection of the bridle to the boom butt section.

While dismantling the boom it is important to remove the bottom pins first.

This will prevent the boom from dropping suddenly. Be careful not to be inside or under the boom while removing pins – a sudden boom collapse could crush you!

When connecting new sections of boom the pins should always be connected from the inside to the outside.

When adding a lattice boom section to a crane:

1. The boom is lowered to a safe working height with section joints adequately supported with packing or dunnage.
2. The hook block is released and the hoist rope wound back onto the drum.
3. The luffing bridle is lowered so that pendants can be released.
4. The luffing bridle is connected properly to the butt section of the mobile crane.
5. The boom is lifted slightly so that retaining pins can be safely removed from pendants and boom pins, and that the bottom boom pins can be driven out from the outside.
6. The boom is once again lowered and the top pins are driven out.
7. The head section is moved by the supporting crane (if applicable).
8. The new section is placed into position and aligned to the remaining boom.
9. The jib pins are driven in from the inside.

Afterwards you will need to make sure that the following tasks are carried out:

- Head section is replaced (if removed as part of the adding/removing process).
- Pendants are reconnected.
- Luffing bridle is released from the cradle.
- Hoisting rope and hook block are reset and reconnected.
- Boom is luffed up.

3.2.5 Coordinating Multiple Crane Lifts

Multiple lifts may include performing a lift with two or more cranes, two or more winches or a combination of a crane and winch lift.

Multiple lifts are hazardous operations and should not be done when one crane or winch could do the job safely.

They are most commonly used in large scale operations such as the construction of power stations, oil rigs or bridges.

Careful planning is required when multiple lifts are to be performed including:

- Consultation of all personnel involved.
- Selection of the correct crane/s and equipment.
- Examination of the work site and ground/surface conditions.
- Calculation of load and gear weight.
- Completion of a successful 'dummy run'.

When more than one crane is used in a multiple lift each must have an additional capacity above its share of the load:

- Two cranes = 20% greater than the share of the load.
- Three cranes = 33% greater than the share of the load.
- Four cranes = 50% greater than the share of the load.

Equalising gear can be used when cranes are positioned close together to lift large loads.

Example 1:

A dual lift (2 crane multiple lift) is being conducted. The load to be lifted is 14 tonnes.

To find out the minimum capacity of both of the crane required for this lift we must use the following formula.

Minimum Crane Capacity = Load Share + 20% for each crane

NOTE: This formula changes depending on the total number of cranes. For three cranes change 20% to 33%. For four cranes change 20% to 50%.

Step	Calculations	Explanation
Step 1	$\frac{14}{2} = 7$	Calculate the Load Share. This is done by dividing the total load by the amount of cranes in the lift.
Step 2	7 + (7 x 20%) = Minimum Crane Capacity	Sub information into the formulae.
Step 3	7 + 1.4 = Minimum Crane Capacity 8.4 = Minimum Crane Capacity	Complete the calculation for each step in the formulae.

Conclusion: 8.4 tonne is the Minimum Crane Capacity.

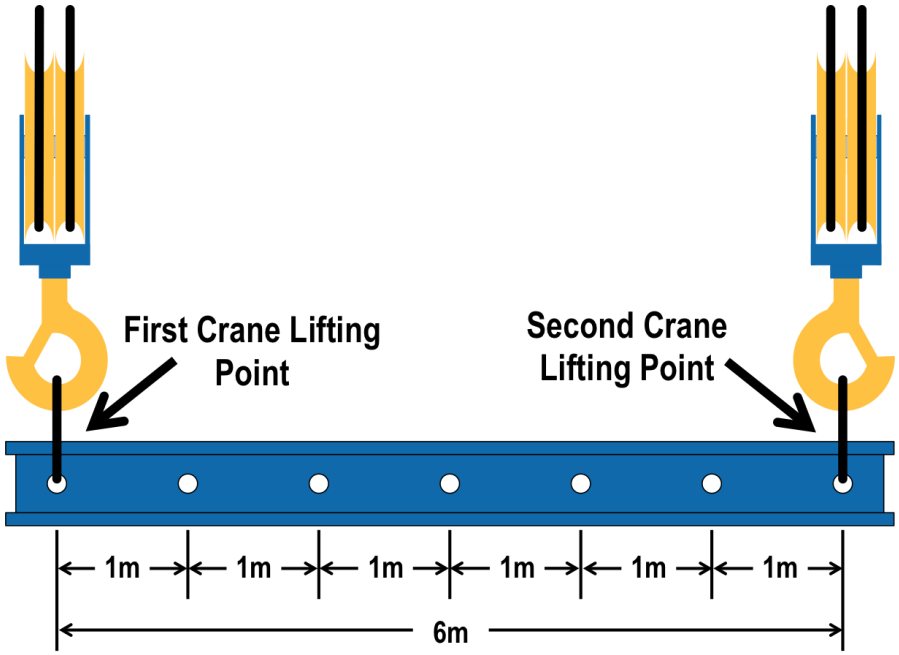
When coordinating a multiple lift make sure that:

- You do not operate in strong winds.
- Keep hoist ropes vertical.
- Only one movement is completed at a time.
- Slow crane movements are used.
- Avoid load swing by luffing up rather than luffing down. Never Luff down, it is dangerous to do so as it increases the load radius, decreases load capacity and could cause damage to the crane and load.
- Slewing motions are avoided.
- Cranes are aligned in pick and carry operations.
- Use doggers and other riggers to observe and report on the progress of the lift in areas that you cannot observe.

3.2.5.1 Calculations for Multiple Crane Lifts using Equalising Gear

Example 1:

A pre-stressed concrete beam is to be lifted and repositioned using two lattice boom mobile cranes and the equalising beam. There are no on-site limitations on the positioning of the cranes.



The configuration is as follows:	
Weight of a pre-stressed concrete beam	39 tonnes
Weight of the equalising beam and lifting gear	1 tonne
Capacity of first crane at maximum working radius	20 tonnes
Length of the equalising beam	6m

To find out how far along the equalising beam from the first crane's lifting point you would attach the pre-stressed concrete beam's lifting slings use the following formula:

$$\text{Distance} = \text{Beam length} - \left(\frac{1^{st}\ \text{Crane Capacity x Beam Length}}{\text{Total Weight + Additional Capacity}} \right)$$

Step	Calculations	Explanation
Step 1	39t + 1t = 40t	Add the weight of the pre-stressed concrete beam and the weight of the equalising beam and lifting gear.
Step 2	Distance = 6m – [(20t x 6) ÷ (40t + (40t x 20%))]	Sub the information from the configuration into the above formula.
Step 3	Distance = 6m – [(20t x 6) ÷ (40t + (40t x 20%))] Distance = 6m – [(20t x 6) ÷ 48t] Distance = 6m – [120t ÷ 48t] Distance = 6m – 2.5 Distance = 3.5m Distance = 4m	Complete each step in the formula: *Total Weight + Additional Capacity* *1st Crane Capacity x Beam Length* *Complete the division* *Get the distance* *Round to the nearest whole number*

Conclusion: 4m is the slinging point distance.

Example 2:

To find out the minimum capacity of the second crane at the required working capacity following the same configuration follow the formula:

$$2^{nd}\ \text{Crane Capacity} = \text{Distance x} \left(\frac{\text{Total Weight + Additional Capacity}}{\text{Beam Length}} \right)$$

Step	Calculations	Explanation
Step 1	39t + 1t = 40t	Add the weight of the pre-stressed concrete beam and the weight of the equalising beam and lifting gear.
Step 2	Capacity = 4m x [(40t + (40t x 20%)) ÷ 6]	Sub the information from the configuration into the above formula.
Step 3	Capacity = 4m x [(40t + (40t x 20%)) ÷ 6] Capacity = 4m x [48t ÷ 6] Capacity = 4m x 8 Capacity = 32t	Complete each step in the formula: *Total Weight + Additional Capacity* *Complete the division* *Distance multiplied by the result*

Conclusion: The second crane must have a minimum capacity of 32 tonnes.

3.3 Demolishing Structures

Demolition rigging work may include the dismantling of walls, columns, towers, structural beams, tilt-up and scenery panel structures.

Before attempting any demolition work it is important that you inspect all equipment for damage and defects before use. This equipment may include:

- Winches and cranes – These should be rated to at least 1.5 times the weight of the members being demolished.
- Chains – Felling chains should have a minimum diameter of 8mm.
- Ropes – FSWR felling rope should have a minimum diameter of 12mm.

Tag, isolate and report any non-serviceable items.

3.3.1 Felling Columns and Members

You need to work out the weight of the member being felled. This is calculated by multiplying the volume of the member by the weight of the material it is made from.

For example:

A concrete member that is 5m tall and 350mm square weighs 1.47 tonne (rounded to 1.5 tonne).

To work this out you calculate:

Member Weight =

Width (m) x Length (m) x Height (m) x Mass of Concrete in a m^3 (t)

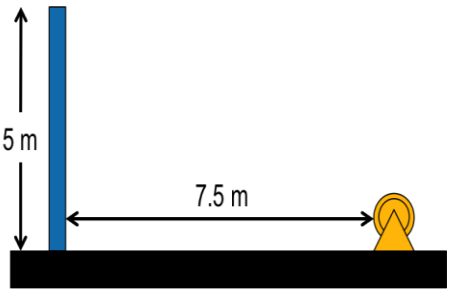
Using the above formulae we are able to work out the weight of the concrete member (as shown in Step 1 – Step 3) and using the weight we are able to work out the minimum capability required of the winch (Step 4).

Step	Calculations	Explanation
Step 1	**Width = 0.35m** **Length = 0.35m** **Height = 5m** **Mass of Concrete = 2.4t per m^3**	Convert the units of the information given into appropriate units required for the calculation.
Step 2	0.35m x 0.35m x 5.0m x 2.4t = 1.47t	Sub information into the formulae
Step 3	1.47t = 1.5t	Round the answer.
Step 4	1.5 x 1.5 = 2.25	Calculate the minimum capability of the winch by multiplying the member weight by the safety number.

Conclusion: The member weighs around 1.5t and requires a winch with a capability of at least 2.25t

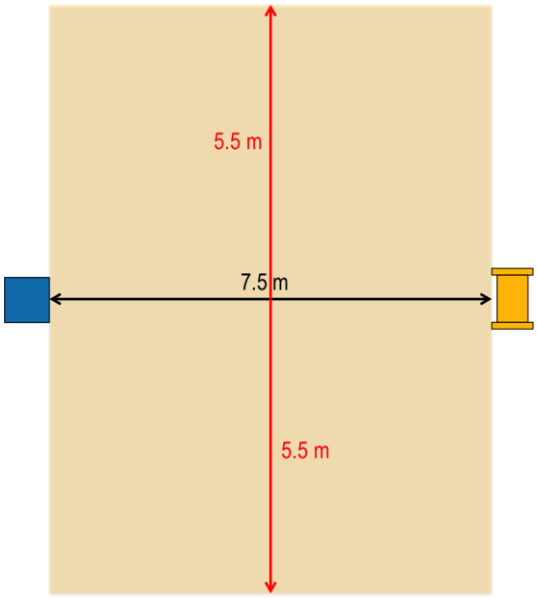
Before you start inspect the ground surface to make sure it is strong enough to take the impact of the collapsing structure.

You also need to make sure that you have enough room to work in, and that you consider the space needed to fell structures, columns and walls. For example you should have a horizontal distance of at least 1.5 times the height of a structure between the pulling mechanism and the structure when using chains or rope to fell it.



This same rule applies where the winch is located on a level above the base of the member to be felled, where the vertical measurement is taken from the winch height to the height of the member.

No one should stand closer to the rope or chain than three quarters (75%) of the distance between the mechanism and the structure during felling.



3.3.1.1 Felling Techniques

UNDER NO CIRCUMSTANCES should snatch loading be used when felling structural members.

It is not safe and can result in dynamic forces being created, possibly in excess of the capacity of the crane.

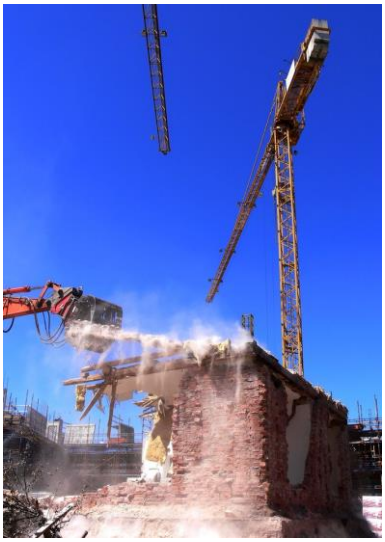
On multi-storey buildings free-standing columns and walls should be demolished before floors.

When felling a concrete reinforced column, leave the reinforcing bars closest to the direction of the fall uncut until the felling is complete.

3.3.2 Cutting and Removing Beams

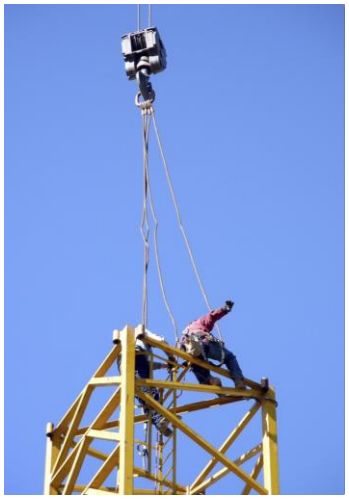
When cutting and removing beams it is important to:

- Make sure all personnel are wearing appropriate Personal Protective Equipment (PPE) and are positioned in a safe place.
- Allow for unusual centres of gravity by using long slings or spreader beams.
- Use the minimum possible radius when using a crane to avoid load swing.
- Use temporary guys to keep beams stable during demolition work.
- Be aware that a suspended pre-stressed beam may collapse suddenly if it is turned upside down or on its side. This is very unsafe and could cause damage to plant and equipment.
- Monitor the surrounding structure for signs of overstressing or unexpected movement. If either of these situations occurs you must immediately stop, remove everybody from the area and report the situation to the demolition supervisor.



3.4 Dismantling Structures and Plant

Once all operations have been completed you may be required to dismantle or remove plant, safety and associated equipment from the work area.



Always follow the manufacturer's instructions when disassembling equipment to ensure the safety of all personnel in the area, to maintain stability during the process and to prevent any damage to the plant and equipment.

Continue to work safely at heights while equipment is dismantled.

Once they are no longer needed, safety systems such as static lines, fall-arrest harnesses and safety nets should be dismantled according to the correct sequence and procedures.

They should then be removed from the work area.

Always work methodically and follow site procedures to avoid any unplanned collapse of plant and equipment.

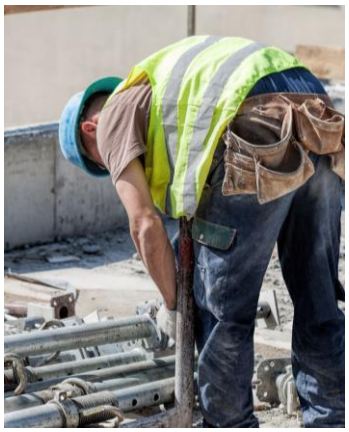
Unplanned collapse can result in serious injuries to personnel and damage to equipment and materials.

3.5 Inspecting the Completed Work

Once the rigging work has been completed you will need to inspect the job to make sure everything has been done properly in accordance with task plans and schedules and structural drawings/plans.

Review the work method statement used and make sure all steps have been completed.

3.5.1 Tidy the Work Area



Once the work has been completed you need to clean up the work area. Remove any leftover materials and debris created by the task.

Litter and other building debris can cause a tripping hazard for personnel. Make sure all rubbish is collected and disposed of correctly.

Dispose of any debris properly without impacting negatively on the environment. Make sure all materials are collected and removed properly.

Divide up recycling and other waste materials for correct removal and processing.

3.6 Incidents and Emergency Response

Emergencies can happen quickly and without warning when work is being done at heights.

If all necessary precautions, hazard control measures and safety equipment have been used then the risk of serious consequences is reduced.

However you should always be prepared to take action in an emergency situation, even if that action is as simple as calling for help.

3.6.1 What is an Incident?

An incident is:

1. An accident resulting in personal injury or damage to property.

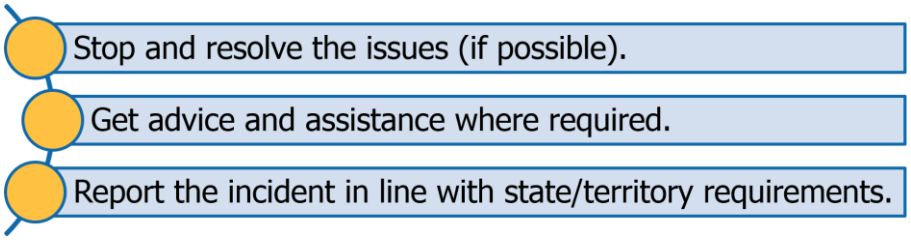
OR

2. A near miss or dangerous occurrence which does not cause injury but may pose an immediate and significant risk to persons or property, and needs to be reported so that action can be taken to prevent recurrence.

All incidents MUST be reported!

3.6.1.1 Responding to an Incident

If an unsafe incident or event occurs during rigging operations you should:



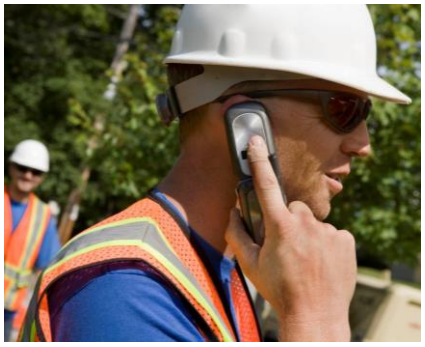
3.6.2 Workplace Emergencies

Site emergencies may include:

- Fire (electrical, chemical, gas, mechanical, paper, wood or natural).
- Gas leak.
- Toxic and/or flammable vapours emission.
- Vehicle/machine accident.
- Chemical spill.
- Injury to personnel.
- Structural collapse.

3.6.2.1 General Emergency Response

In the case of an emergency:



- Remain calm.
- Raise the alarm and explain the nature of the emergency to:
  - Other people at the workplace.
  - Your supervisor.
  - The workplace safety officer.
  - Emergency services.
- Tell any personnel or workers about where unsafe areas are.
- Evacuate if necessary (refer to site emergency plans).

3.6.2.2 General First Aid

First Aid kits must be supplied by your employer/PCBU.

The location of these kits should be clearly marked with signage.

In the case of an emergency where somebody requires first aid, notify your supervisor or first aid officer and they will take action.

3.6.3 Report All Hazards, Incidents and Injuries

Depending on the nature and severity of the situation you may need to report to:

- Your supervisor.
- Emergency services (e.g. police, ambulance, fire brigade and emergency rescue).
- WHS regulatory authority (e.g. WorkSafe, WorkCover).

Ask your WHS representative or supervisor at the site office for the relevant forms and procedures for reporting hazards, incidents and injuries.

3.7 Conclude Rigging Operations

Once all rigging work is completed and signed off you need to make sure all equipment is made ready for the next task.

This includes:

- Inspecting and storing all rigging and associated equipment.
- Removing and storing hazard control measures/treatments that are no longer required on site.

3.7.1 Inspect and Store All Rigging Equipment after Use

Inspect all tools and equipment that you have used during the rigging work.

This includes:

- Tools.
- Safety devices/systems.
- Plant and equipment.

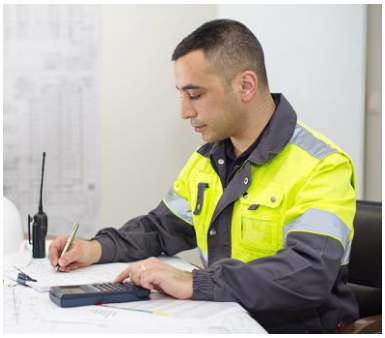
Isolate any defective equipment. Record the fault and report it to an authorised person in accordance with procedures.

All serviceable equipment should be stored according to procedures and manufacturers' specifications.

3.7.2 Remove Hazard Control Measures

Remove all hazard controls that are no longer required and complete any documentation related to the job (work permit sign-off and incident reports).

Advise the appropriate personnel of the completion of the job and carry out any remaining requirements as per site procedures.



Appendix A – Safe Work Method Statement

SWMS Name:	SWMS Created By:	Date of Creation:
SWMS Summary:		Last Reviewed Date:

Company/Contractor Details:	**Project Details:**
Name:	Client:
ABN:	Contact Name:
Address:	Site Address:
Contact Number:	Contact Number:
Email:	Start Date:

How to complete this SWMS:
1. CONSULT: Consult with all persons who will be involved in the completion of the work.
2. LIST: List each of the steps in the task work being done.
3. IDENTIFY: Describe the health and safety hazards and risks arising from each step in the work.
4. RISK ASSESSMENT: Review the level of risk associated with each hazard listed.
5. CONTROL: Describe how the risks will be controlled, and describe what hazard control measures will be put in place.
6. RESPONSIBILITY: Allocate a person to be responsible for the hazard control measure.
7. REVIEW: Review the effectiveness of the control measures and apply further hazard control measures as required.

Training/Qualifications Required To Carry Out Work: Are All Workers Adequately Trained And Qualified? Yes / No	PPE Required To Carry Out Work:
Legislation, Australian Standards & Codes Of Practice Relevant To Work (Where Applicable):	Equipment Required To Carry Out Work:
Environmental Statement:	Safety Checks Required Prior To Commencement Of Work:
Coordination With Other Trades:	Permits Required For Commencement Of Work: Have These Permits Been Acquired? Yes / No

Risk Analysis Matrix

Use this table to determine the level of risk associated with an identified hazard.

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

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

Safe Work Method Statement

Work Step	Associated/Identified Hazards	Risk Level	Hazard Controls	Revised Risk Level	Person Responsible
Work your way through each step in the work process, giving a brief description of what is required at each stage.	What hazards can be identified for this step?	What is the risk level?	What hazards controls will be put into place to deal with the identified hazards for this step?	Has the risk been reduced?	Who is responsible for carrying out the work and maintaining the hazard controls?

Work Step	Associated/Identified Hazards	Risk Level	Hazard Controls	Revised Risk Level	Person Responsible
Work your way through each step in the work process, giving a brief description of what is required at each stage.	What hazards can be identified for this step?	What is the risk level?	What hazards controls will be put into place to deal with the identified hazards for this step?	Has the risk been reduced?	Who is responsible for carrying out the work and maintaining the hazard controls?

Personnel Signoff

All personnel required to carry out this task need to be listed below.

By signing this SWMS, each person declares that they have carefully read the SWMS and that they understand their responsibilities and requirements to complete the work.

Name (please print)	Position / Qualification	Signature	Date

Senior Management Signoff

Does this SWMS meet the necessary safety requirements? Yes / No

Does this SWMS require review? Yes / No Review Date:

Additional Comments:			
Name:	Position:	Signature:	Date:

Appendix B – Harness Inspection Checklist

Safety Harness Daily Inspection Checklist			
Company Name:			Date:
Person Performing Inspection:			Site:
Harness ID Number:			
Check Type (please circle)	Pre-Start		Post-Operational
Component	**What to Check for**	✓	**Comments**
Webbing	Cuts or tears. Abrasion damage. Excessive stretching. Damage due to contact with heat, corrosives or solvents. Deterioration due to rotting, mildew, or ultraviolet exposure.		
Snap Hooks	Distortion of hook or latch. Cracks or forging folds. Wear at swivels and latch pivot pin. Open rollers. Free movement of the latch over its full travel. Broken, weak or misplaced latch springs. Free from dirt or other obstructions, e.g. rust.		
D-Rings	Excessive 'vertical' movement of the straight portion of the D-ring at its attachment point of the belt, so that the corners between the straight and curved sections of the D become completely exposed. Cracks, especially at the intersection of the straight and curved portions. Distortion or other physical damage of the D-ring. Excessive loss of cross-section due to wear.		
Buckles & Adjusters	Distortion or other physical damage. Cracks and forging laps where applicable. Bent tongues. Open rollers.		
Stitching	Broken, cut or worn threads. Damage or weakening of threads due to contact with heat, corrosives, solvents or mildew.		**Out of Service Tag Attached? Yes / No**
Fault Report:			
Harness isolated from service? Yes / No			