

Part two

Basic rigging

Chapter 11 Steel erection

Introduction

The use of structural steel in the construction of multi-storey buildings was very common until the development of concrete reinforced design. Over recent years, however, structural steel design has started to make a comeback in multi-storey work. Portal frame construction is also widely used for low rise factories and warehouses. Structural steel is used extensively in the construction of power stations, smelters, refineries, bridges, transmission towers, communications towers and other industrial projects.

Certification

Those engaged in (or directly supervising) steel erection must hold a Basic Rigging certificate or equivalent old certificate.

Where steel erection involves multiple crane lifting operations or the use of load equalising gear, the Intermediate Rigging certificate (or equivalent old certificate) is required. The erection of permanently guyed structures (such as some communications towers) requires the Advanced Rigging certificate (or equivalent old certificate).

Trainee riggers who can produce a properly maintained logbook which details at least 25 working days of practical rigging experience in the erection of steel structures greater than 4m in height, are entitled to a major reduction in the amount of practical skills assessment needed to qualify for the Basic Rigging certificate.

Riggers must be familiar with the common erection methods and be able to recognise the typical hazards associated with this type of work. They must be able to read and understand construction drawings and specifications. They must also have the skills necessary to use the tools and equipment needed to erect steel and they must be able to work safely and confidently at heights.

Steel erection

Structural steel is basically a skeleton, designed to support a building. The first section must be fully plumbed and wind braced to ensure stability for the rest of framework.

As erection progresses, the wind bracing must be fitted. In some 'A-Frame' or 'Saw tooth' type buildings, which are long and narrow, the building may have to be guyed for support until each wind brace bay is erected.

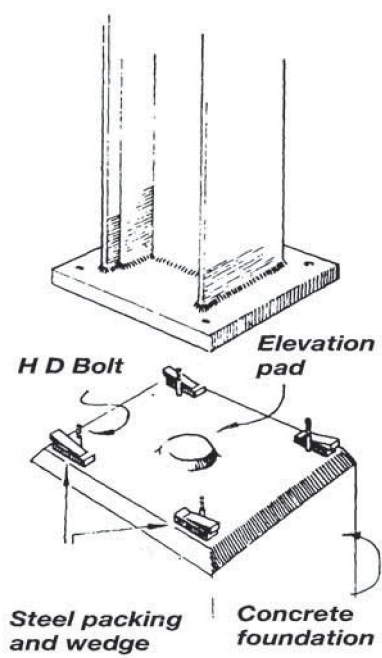
Columns should be guyed to prevent the holding down bolts from pulling out causing the column to collapse. The concrete in the plinth that the column stands on is usually green.

Guys that are left on overnight must be FSWR guys. Fibre ropes shrink when they are wet and stretch when they are dry, and are therefore dangerous to use as guys.

The foreman or a competent person should ensure that every column base is level using a theodolite or a dumpy level before starting to erect the columns. Bush jobs could use a spirit level.

There should be a packer (elevation pad) underneath every column. If the column bases are not level the steel will not be plumb. It can be very difficult to wedge up steel especially if the steel is heavy.

Steel packers approximately the same height as the elevation pad should be placed adjacent to each holding down bolt. Use steel wedges if necessary for plumbing purposes.



The mass (weight) of any steel must be known for lifting into place. When ordering cranes to raise columns, a second crane may be required to 'float' in the base.

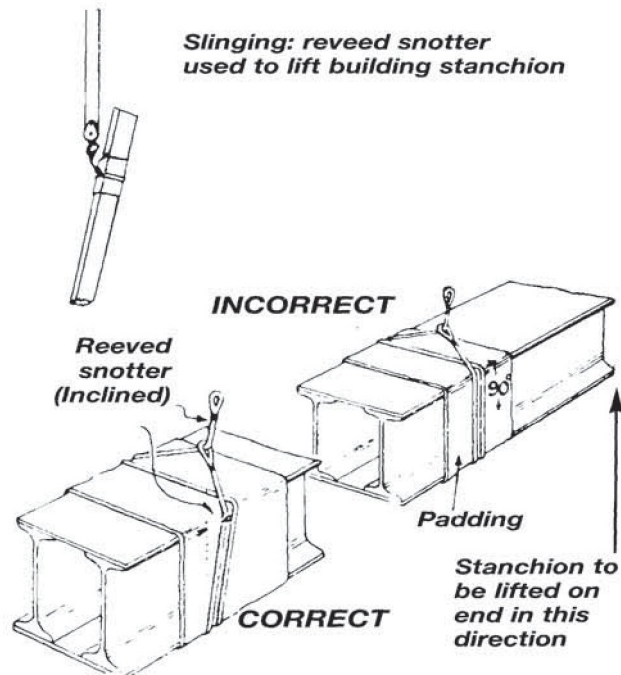
When raising a column with two cranes at the column head each crane should be capable of lifting the total weight of the column. If this is not possible, equalising gear must be used.

To ensure that columns hang vertically they should be slung as near to the top as possible.

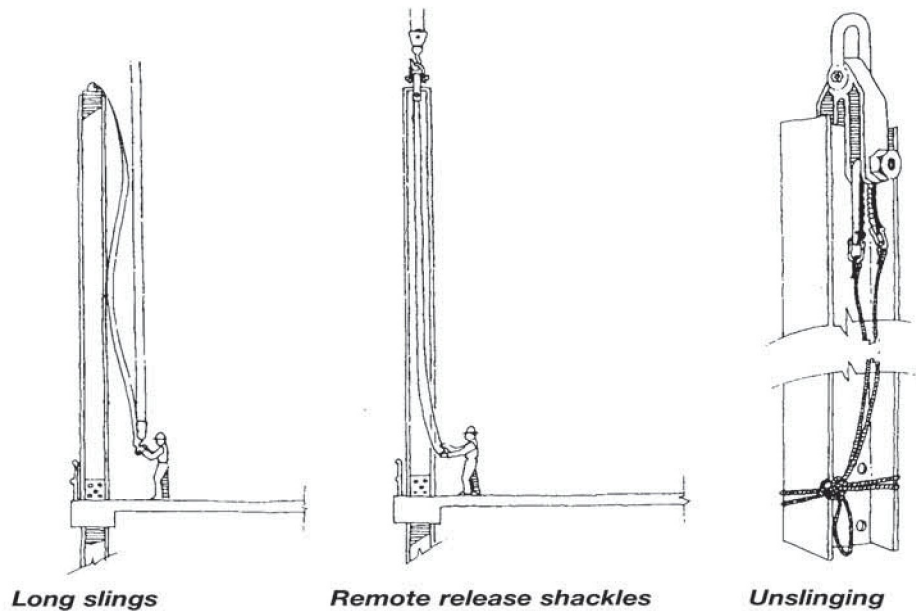
When lifting columns with a reeved sling ensure that the sling is wrapped around twice then nipped (round turn). As the sling is wrapped around, incline the sling toward the nip, stopping the sling from slipping when the column becomes vertical.

The column must be packed to prevent the sling from being damaged by the sharp edges of the column. The packing has to be tied or secured to prevent it from dropping out when the slings

slacken as the column is landed.



Heavy columns which are erected and spliced in the air must have scaffold brackets or bearers fitted before erecting the column.



Beams and girders

The mass (weight) of each beam or girder must be known.

Make sure that the crane is capable of lifting the beam to the required height. That is, check the crane drift before lifting.

Ensure that the correct size slings are used and see that the beam is adequately packed. Ensure that the packing will not drop out when the weight is released from the slings.

Lift the beam level unless it is intended to be canted. Take special care with warren or lattice beams, because the sharp edges of gussets can easily cut through slings.

Attach tag lines to each end of the beam to control it during the lift, even when setting steel on multistorey jobs. Short hand lines at either end will allow the top hands to control the beam more easily.

If a crane has to be boomed out to land a beam the crane must be capable of lifting the beam at that radius. Booming out with a load in the air is dangerous especially if the load is heavy. Lift the beam as close as possible to its final position.

The end of a beam nearest to rigid steel must be fixed first, then if necessary adjust the steel at the other end. The old saying 'get the first podger hole and let your mate worry' is not good practice.

Field bolted beams must be bolted on diagonally opposite sides to prevent the beam from rolling.

Position the beam onto the podger when lowering so that if the crane over runs slightly, the top hands have control. It is dangerous to set the podgers while raising the beam. If the crane operator over runs slightly the sling could be overloaded and broken.

When setting steel beams into the web of other beams make sure that the crane operator 'inches' the load very slowly allowing reaction time for the crane operator to stop.

Do not use shifting spanners for tightening bolts when working aloft. Use proper set or ring spanners (preferably the podger type).

Do not work on wet or wet painted steel. Do not set steel in gale force winds.

Tapered drifts should be held by hand when being driven in to stop them being driven right through.

Hammers should have a restraining lanyard to stop them from being dropped from aloft.

Spliced columns have to be aligned directly above one another when being positioned.

When landing a beam experienced riggers will push a drifting beam across and drop their podgers in.

To lift a beam at the centre by two cranes with a mass greater than the capacity of either crane, use a properly rigged, equalising bridle or equalising beam.

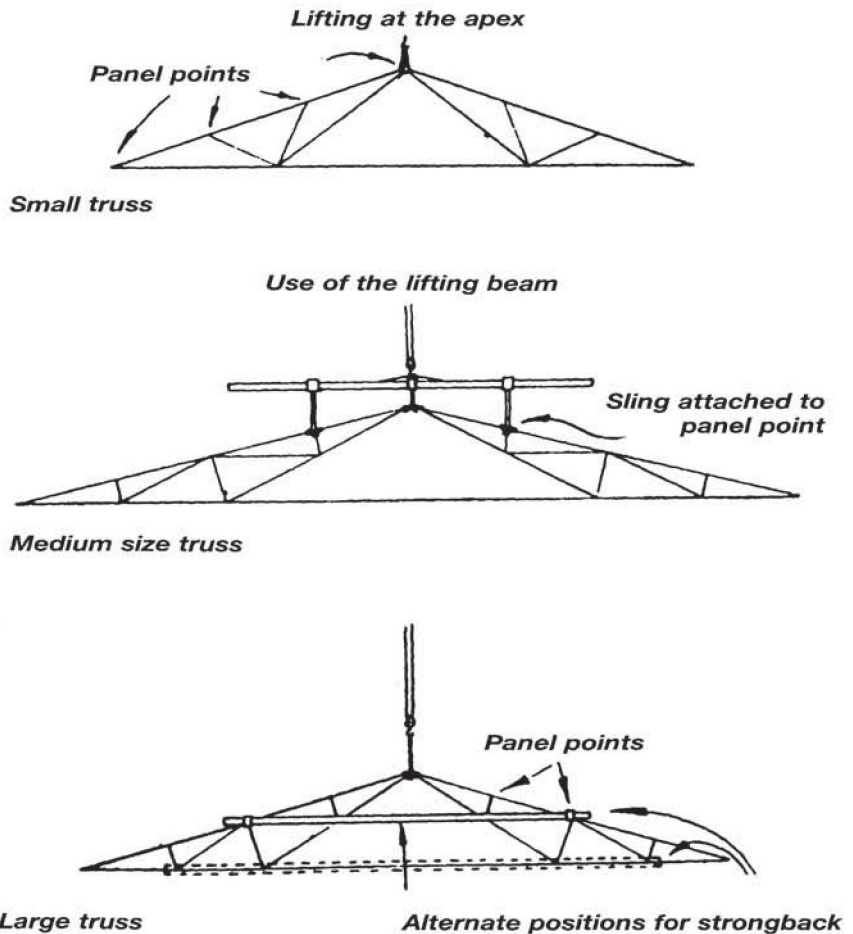
The WLL must be stamped on all lifting gear including equalising beams, shackles, rings and hooks.

Before lifting bowstrings, turnbuckles and rigging screws should be fitted to long beams which may flex excessively. The screws must be fitted with a locking device or preventer lashings.

Roof trusses, lattice girders, purlins and girts

Check the following before attempting to lift roof trusses into position:

- the mass (may have to be calculated)
- the truss points must be properly bolted or riveted.



Roof trusses or lattice girders must not be left standing unsupported in an upright position. They should be secured by lashing or tomming to a building column or another suitable anchorage.

Lifting puts a force on a roof truss that is the opposite to those the truss was designed to take. The bottom chord is only designed to take tension.

When lifting by the top chord, the bottom chord is in compression and can buckle and bend. To stop this strengthen the bottom chord with a strongback or bow strings. Bending in saw tooth trusses which are used mostly for short spans is not as great.

Trusses should always be lifted at the panel points. Make sure that the slings are protected by packing to stop them being cut by the sharp edges of the gusset plates.

Principal high pitched gable trusses should be slung directly at the apex.

Flat pitched gable roof trusses are particularly dangerous to lift. They should be bridled and slung with a central vertical sling. The mass should be evenly distributed to the slings and the crane must have a greater drift.

To maintain control, attach the holding down bolts and fit tag lines to the ends before lifting the truss into its final position.

Fit temporary guys to the apex of the first truss. Four guys should be fitted if the truss exceeds 10m in length. Do not remove the guys until the wind bracing is fitted.

Finish the first bay completely before continuing erection of the rest of the building.

When pulling up the purlins and braces by hand, pull up the purlins first so that the braces can then be fitted underneath. Braces which are fitted first get in the way when trying to pull up the purlins.

Fit the bottom girts first to allow standing room. The girts can be lifted using a gantline or tackle slung off the eaves girder.

Wedge open the angles with wooden wedges to help the top hands enter the braces onto the gusset plates when using double angle knee bracing. The wooden wedges should be lashed to the bracing so that they cannot fall if they drop out.

Do not use both hands to force or podger any steel into place when working aloft.

Bolts, nuts and washers

There is a huge variety of fastenings available for structural connections. The rigger must know which fastenings have been specified by the structural designer for the various members. This involves a careful reading of the drawings and specifications.

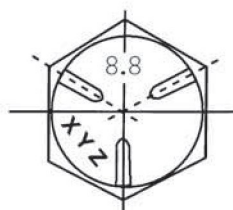
Riggers must also be able to recognise different grade, diameter and length fasteners by visual inspection. If the wrong bolts are used the strength or stability of the steel structure can be seriously affected.

Bolts

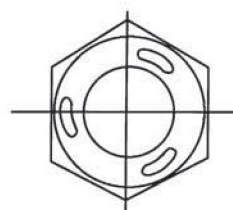
Structural bolts are generally categorised by their nominal diameter, overall length and thread length. The nominal bolt diameter in millimetres is designated with the letter M followed by a number. For instance, an M 16 bolt has a nominal diameter of 16mm.

High strength structural bolts have their heads marked '8.8' (for the steel property class). They also carry three radial lines and the manufacturer's identification or trademark.

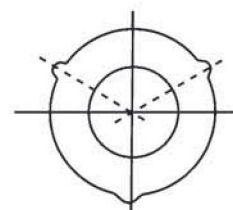
Identification markings



Bolt marking



Nut marking



Washer marking

Nuts

High strength structural nuts can be identified by the three arcs indented or embossed on the non-bearing faces. With some brands of double chamfered nuts, the markings may appear on both faces.

Washers

Washers can be either flat round or square taper. Flat round washers designed to be used with high strength structural bolts and nuts are manufactured with three protruding nibs around their perimeters.

Square taper washers are used less frequently in modern structural design, but are still generally available. They are usually manufactured with taper angles of either 5° (for use with taper flange channels) or 8° (for use with taper flange beams or RSJs).

Further information

Further information on the specifications and allowable tolerances for structural bolts, nuts and washers is given in *AS 1252-High strength steel bolts with associated nuts and washers for structural engineering*.

Torquing bolts and nuts

The fitting of additional bolts and the correct tensioning of all bolts should be carried out once the structural members have been set in place and field-bolted. This is often done by a 'follow-up' crew while the steel-setting crew moves on to the next stage of the erection sequence.

Tools used during the consolidation of the structure include tension wrenches and impact wrenches (commonly referred to as rattle-guns). Impact wrenches can be electrically powered or pneumatic. 'Gunning-up' can be very dangerous unless the necessary precautions are taken and the recommended operating procedures are strictly followed.

Caution: Using an impact wrench for long periods of time can cause hand damage called 'white knuckle'.

When using impact wrenches, observe the following rules:

- the socket and tool should be kept in line
- do not hold the socket
- do not use a worn out socket.

Working aloft

Background

In the past, steel erectors were often expected to work at heights with nothing to protect them from falling except a sense of balance and a lot of luck. Shinning up and sliding down steel columns, walking the top flange of narrow beams, running purlins up roof trusses and riding crane lifted loads were often regarded as standard work practices.

Not surprisingly, this led to high fatality and injury rates among steel erectors.

Since the introduction of modern occupational health and safety laws by the Australian States and Territories, the old methods of working at heights are no longer acceptable.

Minimising the risks

Careful planning can and should reduce the amount of work needed to be carried out at heights. Where space permits and cranes of sufficient capacity are available, entire sections of the structure can be prefabricated on the ground. Using remote release shackles wherever possible can also reduce the need to work at heights.

On large scale industrial projects and bridges, it is often possible to fix scaffolds to structural members or sections of the structure before they are lifted into position. Despite these and other measures, many of the rigger's tasks need to be carried out at heights.

Wherever working aloft is necessary, the work method and means of access should minimise the risk of falling, and the risks to other people in the vicinity.

The area below the work should be barricaded or cordoned off to prevent unauthorised access by other workers or the general public. Where this is not possible, overhead protection decks such as temporary gantries, covered ways, cantilevered catch platforms, perimeter safety screens or debris nets may be necessary.

All hand tools (such as podgers, ring-spanners, drifts and hammers) should be securely stowed on a purpose designed rigger's belt constructed from sturdy leather, canvas webbing or synthetic webbing. Where safety harnesses are used, these generally incorporate loops for the stowing of tools. Bolts, nuts and washers should be kept in a pouch attached to the belt. One handed flogging hammers should be fitted with wrist straps.

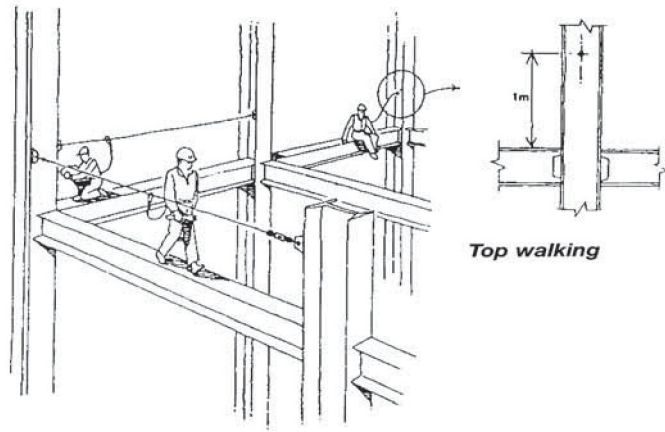
There are many ways of providing steel erectors with a safe working platform and safe means of access which can prevent dangerous falls.

These include the use of:

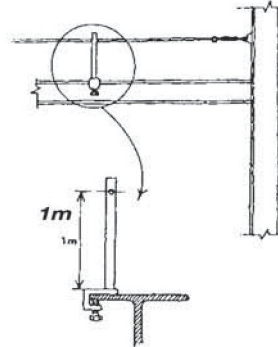
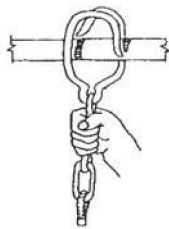
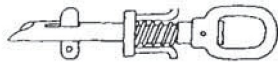
- elevating work platforms (EWPs) such as scissor hoists, travel towers and boom lifts
- scaffolds
- portable ladders
- crane lifted work boxes
- industrial safety nets
- safety line systems.

Safety line systems require a high degree of planning, training and supervision and rely heavily on the steel erector always 'doing the right thing' and not taking short cuts. For these reasons, they should only be used where none of the other methods are practicable.

The static line should be located at least 2.1 m above the beam, as stated on page 142, and lanyards should be connected to the rear D-ring between the shoulder blades.

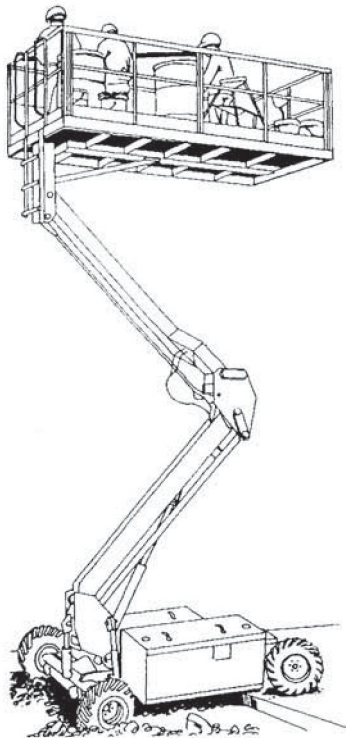


Top walking



Girder grip devices

Elevating work platforms



EWPs should be designed and manufactured to meet the minimum requirements of AS 1418.10 *Elevating work platforms*. The design of all powered boom-type EWP's or any powered EWP designed to lift people more than 2.4m must be registered with a State or Territory regulatory authority.

Providing there is a suitable supporting surface and there is sufficient access, EWPs can provide a very effective working platform for steel erection. There are various types available including self-propelled scissor hoists (some of which have cantilevered rolling platform sections), manually powered cherry pickers, trailer-mounted or truck-mounted travel towers and self-propelled boom lifts.

Your employer must make sure you have been properly trained in the use of the particular type of EWP to be used. Make sure you have read and understood the machine's operating instructions and are aware of its limitations before you use it for the first time. Make sure all the necessary checks have been carried out before each use.

Power operated boom type EWPs with a maximum boom length of 11m or more require a certificate of competency to operate without direct supervision. The boom length is the greater of the vertical distance between the EWP's supporting surface and the underside of the workbasket at its highest possible elevation or the horizontal distance between the boom's centre of rotation and the outer edge of the workbasket at the greatest possible radius.

Note: With the introduction of the nationally uniform certificates, some States and Territories have allowed a phase-in period for this certificate class. If in doubt, check with the local certifying authority.

Observe the following rules when using an EWP:

- make sure the supporting surface has enough load-bearing capacity for the EWP
- do not overload the platform or basket
- do not use the EWP on ramps or inclines which are steeper than the supplier's recommendations
- where fitted, outriggers should be fully extended with pads bearing evenly and the EWP levelled before being elevated
- for self propelled EWPs, make sure the area of operation is free from obstructions and traps such as holes, penetrations, drains or upstands. Where these cannot be removed make sure they are securely barricaded or guarded
- whenever you are elevated, make sure another person who is competent to operate any override controls is always in the immediate area so you can be quickly retrieved in an emergency. Never work in total isolation from another person
- make sure you maintain the recommended clearances from powerlines
- do not climb out of, or into the EWP while it is elevated unless the unit has been specifically designed for this and the supplier's information allows it
- do not try to gain extra height by climbing up the guardrailing, placing planks on the guardrailing or placing ladders, trestles or boxes on the platform
- do not use the EWP as an anchorage for lifting gear unless it has specifically designed attachments for this
- make sure everyone in the basket of a boom type EWP is wearing a safety harness attached to the anchorages provided within the basket. This may save your life in the event of a boom failure. Do not disconnect your lanyard until the basket has been fully lowered.

Further information on the selection and safe use of EWPs is given in AS 2550 *Cranes-Safe use Part 10, Elevating work platforms*.

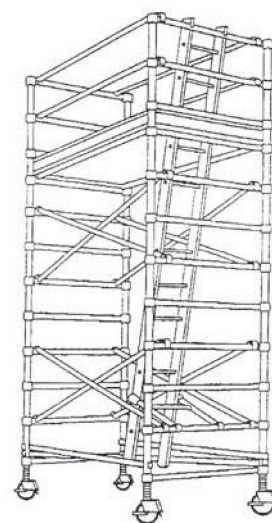
Scaffolds

Scaffolds should be designed and constructed to comply with the minimum requirements of AS 1576 *Scaffolding*.

The design of prefabricated scaffolding systems (including modular, frame and towerframe types) must be registered with a State or Territory regulatory authority.

As a general rule, 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 scaffolding certificate. However, fabricated hung scaffolds and suspended scaffolds may also be erected by persons holding the Advanced Rigging certificate (or equivalent old certificate).

There is a wide variety of scaffold types ranging from simple trestle scaffolds to highly complex tube and coupler arrangements. They are all capable of providing a stable and safe temporary working platform provided the right type of scaffold is selected for the particular work.



Typical tower-frame scaffold

Steel erectors can often make use of scaffolds which have been set up for other work tasks such as wall cladding, bricklaying, concreting, roof work or services installation.

Scaffolds can also be provided specifically for the setting of steel and associated consolidation tasks such as welding, insulation and sheeting. These may include bracket scaffolds attached to large structural members,

perimeter safety screens, formwork shutters or large storage tanks, trestle scaffolds for low level work, cantilevered or spurred scaffolds projecting from the face of the structure, purpose designed hung scaffolds, and suspended scaffolds such as swing stages, work cages and boatswain's chairs. 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.

Observe the following rules when using scaffolds:

- make sure the scaffold has been completed and is ready for use. Carefully read all tags or notices attached to the scaffold. Make sure it has been provided with properly secured means of access such as single ladders or temporary stairways
- on a mobile scaffold, make sure the lower access ladder is clear of the supporting surface
- make sure the operational area for a mobile scaffold is a hard, flat surface free of penetrations or obstructions which could destabilise the scaffold during relocation
- do not place a mobile scaffold closer than 1m to a slab edge, penetration or step down unless a fixed barrier is in place to prevent it crossing that point
- if the supporting surface for a mobile scaffold is sloped, make sure the scaffold is fitted with adjustable castors with brakes and use the adjustment to level the scaffold before use. Where the surface gradient exceeds 50, separate adjustable baseplates or similar must be used to take the load off the castors while the scaffold is in use
- make sure all approaches, access points and platforms have effective lighting without glare or deep shadows
- do not interfere with a scaffold by removing ties, braces, guardrailing, platform planks, toeboards or other members. Any alterations needed to the scaffold must be carried out or directly supervised by a person with the appropriate certificate of competency
- apply the wheel brakes to the castors of a mobile scaffold before use. Do not release the brakes while anyone is on the scaffold
- do not climb up the framework of the scaffold. Use the access provided
- make sure the access ladder of a tower frame scaffold is always on the inside of the scaffold with the access opening in the working platform protected by a hinged trapdoor, sliding hatch or similar
- make sure that, wherever a person or object could fall more than 2m, rigid guardrails, midrails and toeboards are securely fixed to the edges of all platforms and ladder landings
- do not attach shade cloth or other sheeting to a scaffold unless you know it has been designed for the extra deadloading and windloads
- do not use the scaffold as an anchorage for lifting gear unless it has been designed for the additional loading
- do not overload the working platforms. If you are unsure of the scaffold's duty classification, assume it is light duty. The maximum allowable light duty loading is 225kg per platform per bay. This includes the weight of persons and materials
- any materials and equipment deposited on working platforms should be positioned to maintain clear unobstructed access along the full length of the platform at all times
- maintain platforms in a tidy condition by frequently removing surplus material and debris
- where platform decking units are constructed from aluminium gridmesh and the material or tools you are using could fall through the gaps in the gridmesh, cover the platform surface with non-slip sheets of plywood
- do not try to gain extra height by climbing on the guardrailing, placing planks across the guardrails or placing a step ladder or trestle on the working platform

- do not move a mobile scaffold while anyone is on it unless the scaffold has been specifically designed to allow for this
- when relocating a scaffold by crane, make sure it is slung from the base and that the slings are long enough to enclose the scaffold. Additional scaffold tubes may need to be fixed to provide suitable lifting points. For large scaffolds, a purposedesigned lifting frame may be required to prevent the scaffold from distorting during lifting. Make sure all members are secure against dislodgment and all loose materials have been removed from the platforms.

Further advice on the selection, use and inspection of scaffolds is given in AS 4576 *Guidelines for Scaffolding*. Guidance on the erection of fabricated hung scaffolds and suspended scaffolds is given in Chapters 21 and 22 of this Guide.

Portable ladders

Portable ladders should be designed and constructed to meet the minimum requirements set out in AS 1892 *Portable ladders*.

Portable ladders are available in two grades – Industrial and Domestic. Never use a domestic grade ladder for industrial use because it is not required to be as robust and strong as an Industrial Grade ladder.

Ladders can be constructed from steel, aluminium, timber or reinforced fibreglass and are generally classified as being one (or a combination) of the following types:

- **Single ladders**, available in lengths of up to 9m.
- **Extension ladders**, in two or more stages and available in maximum working lengths of up to 15m.
- **Stepladders**, available in lengths of up to 5.5m.
- **Trestle ladders**, used to support scaffold planks and available in lengths of up to 5m.

Trestle ladders are not generally suitable for steel erection but the other types of portable ladders can often be used for unslinging beams and for bolting up structural members.

Ladders can be checked for serviceability by:

- taking each end of the ladder in turn and trying to push the stiles apart and then together. Movement indicates insecure rungs or loose tie rods
- laying the ladder flat, raising one end and attempting to push one stile while pulling the other. If the stiles move relative to each other, the rungs are loose
- tapping timber rungs with a mallet. A dull sound indicates a defective rung.

Damaged or unsound ladders should not be used until they have been repaired and passed re-inspection.

Do not use a ladder with any of the following faults:

- timber stiles warped, splintered, cracked or bruised
- metal stiles twisted, bent, kinked, crushed or with cracked welds or damaged feet
- rungs, steps, treads or top plates which are missing, worn, damaged or loose
- tie rods missing, broken or loose
- ropes, braces or brackets which are missing, broken or worn
- timber members which, apart from narrow identification bands, are covered with opaque paint or other treatment that could disguise faults in the timber.

When using portable ladders, observe the following rules:

- place single and extension ladders at a slope of four to one, and set up step ladders in the fully opened position
- do not handle or use ladders where it is possible for you or the ladder to make contact with power lines. In particular, metal or metal-reinforced ladders must not be used in the vicinity of live electrical equipment
- do not set up a ladder within the arc of a swinging door
- single and extension ladders should be footed by another person or secured top and bottom
- do not use a step ladder near the edge of an open floor or penetration. If the ladder topples, you could fall over the edge
- do not set up ladders on scaffold platforms or EWPs to gain extra height
- always have two hands free to ascend and descend the ladder. Any materials or tools which cannot be safely stowed on your belt should be independently transferred or hoisted to the work location
- always face the ladder when climbing or carrying out work
- your feet should never be higher than 900mm from the top of a single or extension ladder, or the third tread from the top plate of a step ladder
- do not have more than one person on the ladder at any time
- do not work over other people
- make sure there is no danger of crane lifted loads trapping or striking you
- do not overreach. Your belt buckle should be within the ladder's stiles throughout the work
- do not use a ladder for work involving restricted vision or hot work (such as welding or oxy-cutting)
- the use of power tools on a ladder should be limited to tools which are easily operated one handed
- when working from a single or extension ladder, make sure you can brace yourself at all times.

Further advice on the selection and use of ladders is given in AS 1892.4 *Selection, safe use and care of portable ladders*.

Crane lifted work boxes

Crane lifted work boxes 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 work box must be specifically designed for the purpose of lifting people. The work box design must be registered with a State or Territory regulatory authority.

The work box 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 safe working load (kilograms)
- the tare mass (kilograms)
- minimum allowable (rated) crane capacity (kilograms)
- identification reference.

The work box must also be marked permanently and legibly with letters and numerals not less than 25mm high in a colour contrasting with the background, with its safe working load in kilograms.

The work box must be painted in high visibility colours. The lifting slings must be permanently attached to its lifting lugs with moused shackles, or similar. An access door, if fitted, must only open inwards and be provided with a means to secure it shut.

The number of people supported in the work box must not exceed the number specified on the side of the box and, in any event, should not be more than three.

At least one person in the work box must hold a dogging or rigging certificate (or equivalent old certificate).

Any crane used to lift people in a work box must be:

- fitted with a safety hook
- equipped with controls that return to neutral and stop the crane when released
- equipped with power lowering
- equipped with a lockout control to prevent free fall
- fitted with an uplimit switch on the hoist motion
- fitted with a downlimit switch where the work box is to be lowered below the crane's supporting surface.

The following rules must be observed when using crane lifted work boxes:

- use the work box solely for lifting persons and their equipment. Structural members are to be independently lifted into position
- the crane operator must remain at the controls throughout the operation
- all crane movements must be carried out under power
- when the work box is at the maximum intended radius, the crane's SWL must be at least twice the total load of the work box, or 1.5t, whichever is the greater
- there must be an effective means of instant communication between the dogman or rigger in the work box and the crane operator
- where a mobile crane is used, it must not travel while anyone is in the work box
- every person in the work box must wear a safety harness which is attached to the crane hook or hoist rope termination or to purpose designed anchorages within the work box
- where it is necessary to carry oxyacetylene cylinders or any flammable liquids, these should be in the minimum necessary quantities, correctly secured and housed in a compartment separate to the work box. Make sure a suitable fire extinguisher is carried.

Climbing in and out of work boxes at heights can be a dangerous practice. However, where there is no alternative the work box must be securely attached to the structure before anyone enters or exits.

Safety nets

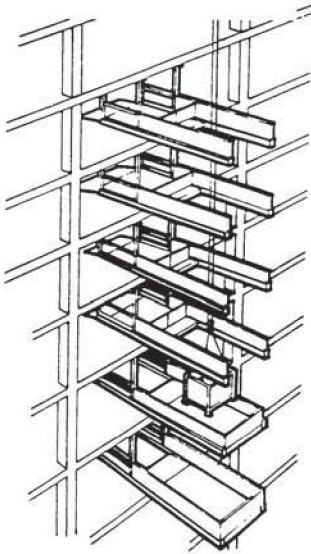
Industrial safety nets are suitable for some types of structures such as bridges and very high portal frames. They can provide an effective means of fall protection while allowing the steel erectors freedom of movement on the structural framework. Guidance on the installation and maintenance of safety nets is given in Chapter 14.

Safety line systems

Safety line systems involve the use of safety harnesses and can include various methods of anchorage including static lines, life lines and fixed anchorage points for inertia reels or lanyards.

The use of these systems as a primary means of fall protection is not generally recommended and should only be considered where none of the other methods mentioned previously are practical. Guidance on the installation and use of safety line systems is given in Chapter 15.

Chapter 12 Cantilevered crane loading platforms



Six rolling CCLPs

Introduction

Cantilevered crane loading platforms (CCLPs) are temporary platforms which are often used during the construction or demolition of multistorey buildings and structures so that materials and equipment can be shifted to or from floor levels.

The platform is generally cantilevered from the face of the building to allow loads to be directly raised or lowered by tower cranes or mobile cranes.

CCLPs can also be used for other purposes such as catch platforms to contain falling debris at the building perimeter and as supporting structures for scaffolds constructed at the building perimeter. They are sometimes setup in a simply-supported mode such as over penetrations or voids, for use as loading platforms, access platforms or protection decks.

CCLPs are available in a variety of designs including fully fabricated and demountable types. They may have either fixed platforms or rolling platforms. Their needles can be anchored to the supporting structure in several ways, such as through bolting, bolting into cast in inserts, or reveal propping. Reveal props may be purpose designed, integral components or they may be general purpose adjustable building props laced together with scaffold tubes and couplers.

Certification

The installation and dismantling of CCLPs must be carried out (or directly supervised) by a person holding either the Basic Rigging certificate or the Intermediate Scaffolding certificate (or equivalent old certificates).

Whenever a CCLP is located or removed by a crane, the slinging and load direction must be controlled by a person with a Dogging or Rigging certificate (or equivalent old certificate).

The propping of CCLPs with adjustable building props and scaffold tubes and couplers or other types of scaffolding equipment must be controlled by a person with an Intermediate Scaffolding certificate.

The platform

The platform needles should be positively secured against lateral displacement.

A minimum of two signs stating both the maximum uniformly distributed load and the maximum concentrated load that the platform can carry must be in clear view on the platform.

The platform decking should be flush with and abutting the floor slab, otherwise suitable ramps should be fitted.

There should not be any gap between the platform and the site handrails.

Platforms located on the side of a building facing a public roadway should not extend beyond the line of the overhead protection provided for the public.

Relocation of crane loading platforms

The floor area where the platform is to be moved to, and the floor area where the platform is to be moved from, should be barricaded to prevent unauthorised persons from entering into the area while the change is made.

Perimeter fencing must be removed while the change is made.

No person should work near the unfenced perimeter edge unless attached to the building by a safety harness.

The area below the platform relocation must be barricaded and spotters provided where necessary.

Clear all loose objects from the platform before the platform is lifted by the crane.

Perimeter fencing (handrails) should be replaced immediately after moving the platform.

All bolts must be placed back in the respective vacant holes when erecting or dismantling.

The lifting position must be clearly marked with signs painted on the platforms.

The lifting lugs should be engineer designed to lift the platform.

Props must be correctly secured at the top and also at the base by bolting, welding, or other suitable securing method to stop any lateral displacement.

The tare weight of the platform must be displayed on the platform.

Some platforms have a rubbish bin inserted under the platform deck. The rubbish bin must be removed and emptied before the platform is shifted.

A waterproof sheet with instructions should be attached to the platform showing all operational and safety instructions of how to use, and lift the platform.

Use

Before the platform can be used:

- all bolts or connectors must be secured and tightened in position
- all props must be plumb and have the rear ties in position
- adjustable props must be adjusted to ensure minimal adjustable jack extension
- rear handrails must be in position
- the side panels and gates must be positively fixed in position.

Gates must be closed at all times except for long loads. All platforms must be kept clean and clear of loose materials.

Platforms should only be used in the manner for which they were designed. Any alterations or different use of the platforms should be to an engineered design.

Rolling platforms

Rolling CCLPs are platforms which can be rolled inside the building and back out again for ease of loading and unloading.

The two braces at the front of the platform, and the two locking pins on the left and right side must be in position and secured at all times for lifting, transporting and use as a loading platform.

The tie bar at the rear of the platform is to be used at all times when lifting or transporting the platform.

The spreader bar under the platform is to be secured and in position at all times.

Move the platform deck forward until it connects with the end of the beam. Secure the left and right side locking pins. Close the gates and place the left and right brace in position. To move the platform backwards, reverse the procedure.

Further information

For further information on the installation of CCLPs, refer to the supplier's design specifications and recommendations for the particular type and model.

The general guidance for the erection of cantilever scaffolds given in *AS 4576 Guidelines for Scaffolding*, can also be applied to CCLPs.

Chapter 13 Erection of hoists and mast climbers

Introduction

Riggers are required to erect, dismantle and carry out maintenance on various types of hoist. These are the external guided cantilevered platform materials (one or two barrow) hoist and the mast climbing work platform. Both types are widely used in the building and construction industry but can also be used effectively in other industries.

Certification

The installation, dismantling and maintenance of cantilevered platform materials hoists and mast climbers must be carried out or directly supervised by a person holding either a Basic Rigging certificate or an Intermediate Scaffolding certificate.

The Basic Scaffolding certificate can only be used where the WLL of the hoist does not exceed 500kg. A Basic Rigging or Advanced Scaffolding certificate is needed where the WLL is over 500kg.

The cantilevered platform (one or two barrow) materials hoist

Cantilevered platform materials hoists run up and down the outside of the tower and are powered by electricity or an internal combustion engine. They are designed for the erection of small multistorey buildings and should be designed and constructed to comply with AS 1418.7 *Builder's hoists and equipment*.

The working height of the platform is 30 metres or less and some have a maximum height of only 16 metres. Check the manufacturer's specifications.

Under no circumstance can these hoists be used to carry passengers. Only certificated personnel carrying out erection, dismantling and maintenance can ride on the platform of a materials only hoist. There must be a notice on the platform clearly displaying the words - **NO PERSONS RIDING**.

Set up

The hoist must not be set up over a trench or excavation. When setting up near a trench the distance between the base of the tower and the edge of the trench must be greater than the depth of the trench.

The hoist must not be set up on bricks. It must be set up on solid timber packing. Where outriggers and screw jacks are fitted they must be tightened to maintain the hoist in a vertical position.

At the base of the tower the handrail must be set back at least 600mm from the working platform to stop people from leaning over and being hit by the platform coming down.

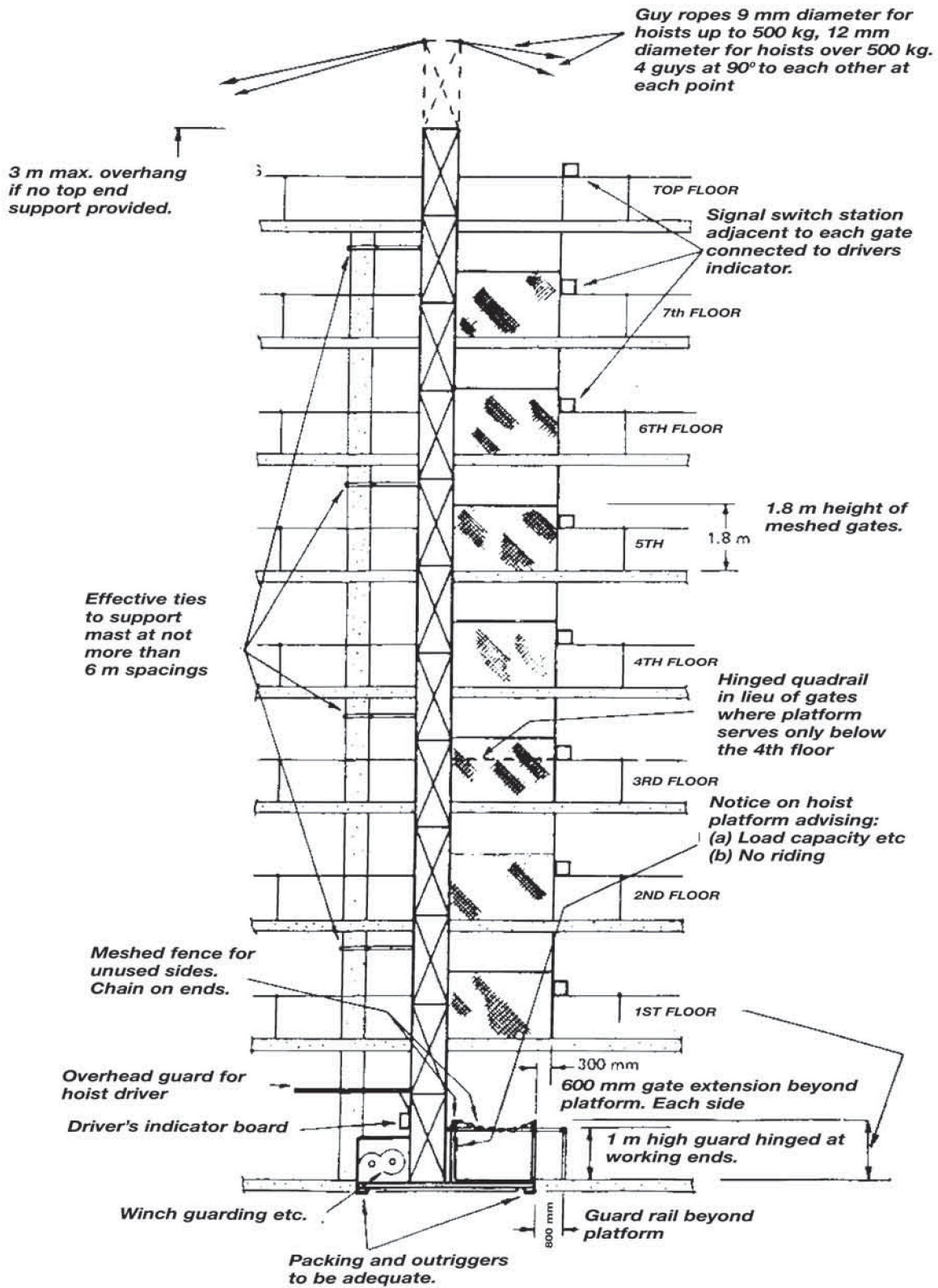
There must be an effective gate in the handrail such as a moveable or sliding rail to allow access to the platform.

On the floors above, a handrail must be placed 600mm from the edge of floors to prevent people falling off. Do not stand inside this barrier unless the platform is at your level.

There must be an overhead guard for the protection of the driver. The hoist must not be set up in front of any access way to a building unless it is blocked off.

The gap between the platform and building floor must be secured and made of solid timber or metal. The gap must be no less than 25mm and no more than 100mm. Do not use loose bridging plates.

Cantilevered platform materials hoist



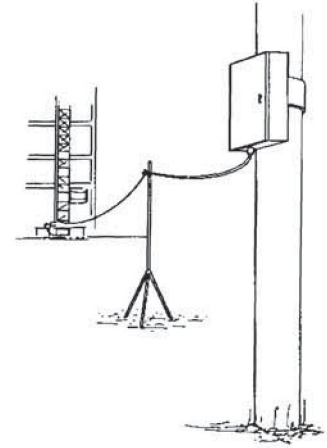
If the hoist goes past any window or opening in the building, the opening must be blocked off to prevent people leaning out and being struck by the platform. Two barrier chains or gates must be in place on either end of the platform.

The tower must be guyed or tied every 6m and have no more than 3m free standing above the top tie, irrespective of the working height of the platform. The guys must extend diagonally from the four corners of the tower and the platform must not foul any guy rope. Guy ropes must be at least 9mm in diameter for hoists to 500kg capacity and at least 12mm for more than 500kg (and 6 x 19 construction).

Ties must be at least the same strength as the guys and rigid enough to stop the tower flexing. Fibre rope guys must not be used because they shrink when wet and stretch when dry.

Electrical

If the electrical power lead from the main box is loose it must be tied up clear of the ground. There have been many serious and fatal accidents because of leads lying in wet ground becoming entangled in, or severed by, equipment. All electrical equipment must be protected against water.



Powerlines must be secured well clear of the ground

The wire hoisting system

All materials only hoists (cantilevered platform and tower) use a wire rope hoisting system for raising and lowering the platform.

There must always be at least two turns of wire rope on the hoist drum. The wire must be fixed mechanically. It must be at least 6 x 19 construction flexible steel wire rope (FSWR) and have no condemnable defects.

The hoist wire must lie neatly on the drum. Do not allow the wire to show loose turns. In the event of a rope failure there is a cam or a gripper to stop the platform from falling.

A top limit switch must be installed to stop the platform approaching closer than 1.5m from the head sheave on the hoist. A floor indicator must be installed where the platform travels more than six floors or 15m or if the driver's view is obstructed.

Working load limit

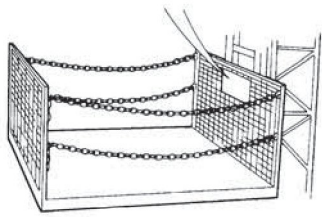
The working load limit (WLL) must be displayed on the platform. The hoist WLL will be either a 'Single barrow 250kg' or a 'Double barrow 500kg'. Do not allow the load to exceed the WLL.

Pre-checks

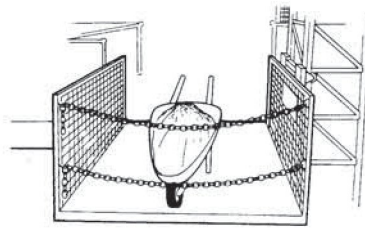
Prior to operating the hoist, carry out the following pre-checks:

- make sure that the hoist ties are in place and the tower has secure foundations. Check that the tower is vertical
- the hoist rope must lie neatly on the drum
- the lead from the power source must be secured well clear of the ground and in good order
- the tower guides must be clean and rust free.

Make sure the SWL and 'No Persons Riding' signs are readable and in place



Wheelbarrow handles should face the building



- the WWL and NO PERSONS RIDING signs must be in place and readable
- the attachment points for the barrier must not be bent or damaged.

Mast climbers

Design and construction

Mast climbing work platforms should be designed and constructed to comply with AS 1418-10 *Elevating work platforms*. The design must be registered with the local regulatory authority.

Mast climbing work platforms are available for use as either freestanding single or multiple tower units tied to the supporting structure as they are erected.

The supplier's information for a particular mast climber should:

- confirm that the design has been registered with the local regulatory authority
- include sufficient instructions to enable the rigger or scaffolder to erect, alter and dismantle the unit safely within its design limitations
- include testing requirements, pre-operational checks and servicing requirements.

Any variation to the supplier's recommendations should be to an engineered design.

Before preparing to set up a site for mast climbers, the distance from electric power lines must be known. If the distance is too close the power must be re-routed, the wires covered or the power cut off.

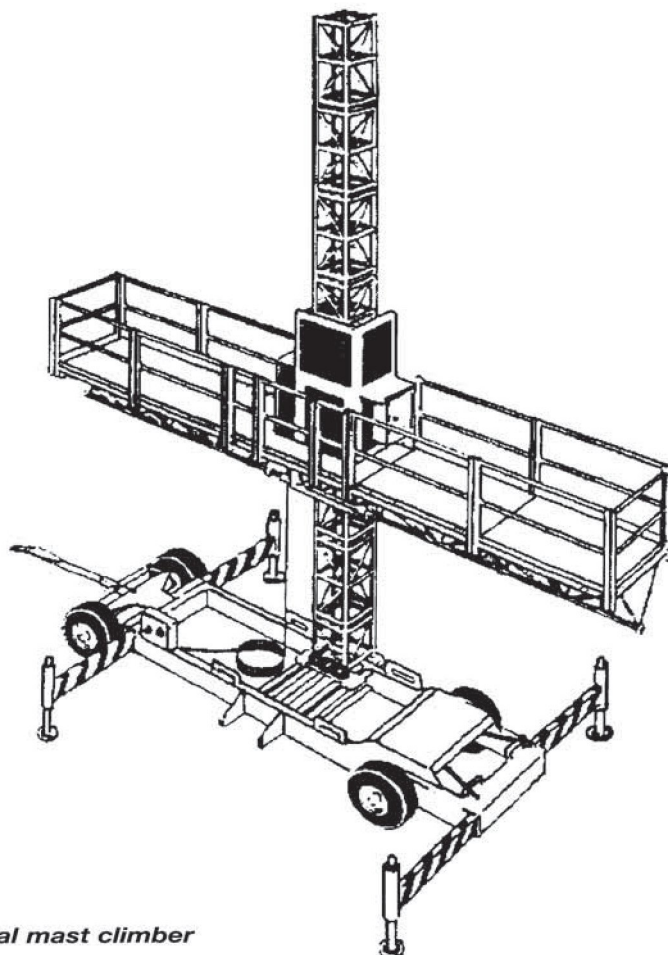
The ground must be checked to ensure that there are no underground services such as large drainage pipes directly under where the base or outriggers are to be situated.

If a mast climber is to be situated on a suspended concrete slab, the capacity of the concrete slab must be checked to ensure that it will take the total weight of the loaded machine. The floor must be supported by propping down the required number of floors, if the concrete is not strong enough. The builder or person in charge must be able to produce an engineer's certificate regarding the strength of the concrete slab.

If the mast climber has to sit on bare ground, the bearing pressure of the ground must be checked to ensure that adequate packing is provided to support the machine.

The area should be level or the base packed so that it is level before the mast is placed and erected.

The site where erection is to take place should be barricaded or roped off to prevent unauthorised persons entering the area.



Typical mast climber

Erection

The manufacturer's manual should be carefully studied before erection starts.

Loose fitting clothes or ties should not be worn as they could be entangled in the moving parts.

Platforms must not be erected or dismantled in high winds.

Base units are fitted with lifting lugs which must be used according to manufacturer's recommendations for the various lifting methods used for cranes, fork lift trucks etc.

The base can be either placed with mast outwards for free standing or with the mast inwards where the mast is tied to the building.

The outriggers must be extended and locked as per manufacturer's recommendations for the actual setup of the machine. Packing must be placed under the screw jack feet to distribute the load required for local ground conditions.

The manufacturer's recommendations should be checked for the free standing height and jack loadings of various models.

A free standing mast should not be used in high winds. The mast must be anchored at the top to ensure stability because high winds can occur suddenly. The building must be checked to ensure that it can withstand the forces of reaction that may occur in high winds.

If the building is not strong enough to support the mast at the top tie position, the anchor (tie) should be lowered to a point where there is enough strength to provide adequate support. The top anchor is usually designed so that it can be removed and turned over the top of the mast if the platform is to be driven to the top.

The platform should be lowered to the lowest position when it is not in use.

Anchoring of masts

Masts which exceed the maximum freestanding height must be tied to the building. When ties are used the base must be placed so that the mast is toward the building.

Tie spacing must be according to the manufacturer's specifications or engineer's design.

The building must be capable of taking the forces imposed by the mast climber at the anchoring points.

The base does not have to be set up on a mobile frame, it may be set up anywhere to suit a particular need.

If the machine is to be set up on needles on the outside of a building, the set up must be done according to an engineered design.

Chapter 14 Industrial safety nets

Introduction

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

Certification

The installation or dismantling of industrial safety nets must be carried out or directly supervised by a person with either a Basic Rigging or a Basic Scaffolding certificate or old equivalent.

Although safety nets can be attached to, or supported from scaffolds, they are often secured directly to the structural framework of buildings, bridges, towers and similar structures.

The advantages associated with safety nets include their ability to provide a comparatively inexpensive means of protecting people from injury due to falling or falling debris without adding considerable loads to the supporting structure.

Their advantage over individual fall arrest systems such as safety harnesses is that they allow unrestricted movement for workers.

The disadvantages are that safety nets can suffer from damage or misuse and are vulnerable to cutting, chafing and damage from sparks. Nets should not be used where they are likely to be exposed to chemicals.

Manufacture

Safety nets should comply with the design, manufacturing and test requirements of BS 3913, *Industrial Safety Nets*.

They are manufactured from synthetic fibre knotted lines with a 100mm mesh size. These lines are attached to perimeter cords. Safety nets are usually available in sizes of 4m x 3m or larger, and nets can be joined to cover larger areas.

The label attached to each net will state a maximum fall distance for which the net has been designed. This will be either 1m or 6m.

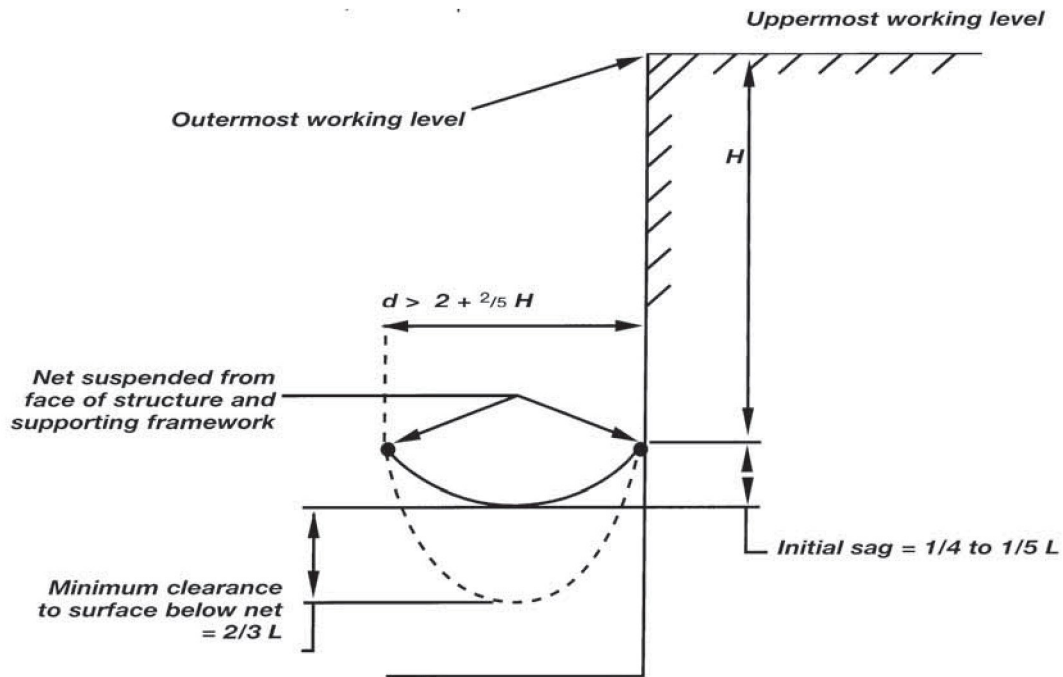
Installation

Prior to the installation of a safety net, the intended configuration, method of attachment and strength of the supporting structure should be verified as adequate by a competent person such as an engineer experienced in structural design. The verification should be in writing and retained on site until the net has been dismantled.

In particular, where nets are to be cantilevered from scaffolds, the scaffold must be designed for the additional loads and additional ties to the scaffold's supporting structure may be required.

The installation design should include detailed information regarding the exact positioning of the net, the fixing and tensioning methods and the erection and dismantling procedure.

Where possible, fabrication of the net assembly should be carried out on the ground or on an adjacent floor and lifted into place with a crane, hoist or purchase.



KEY

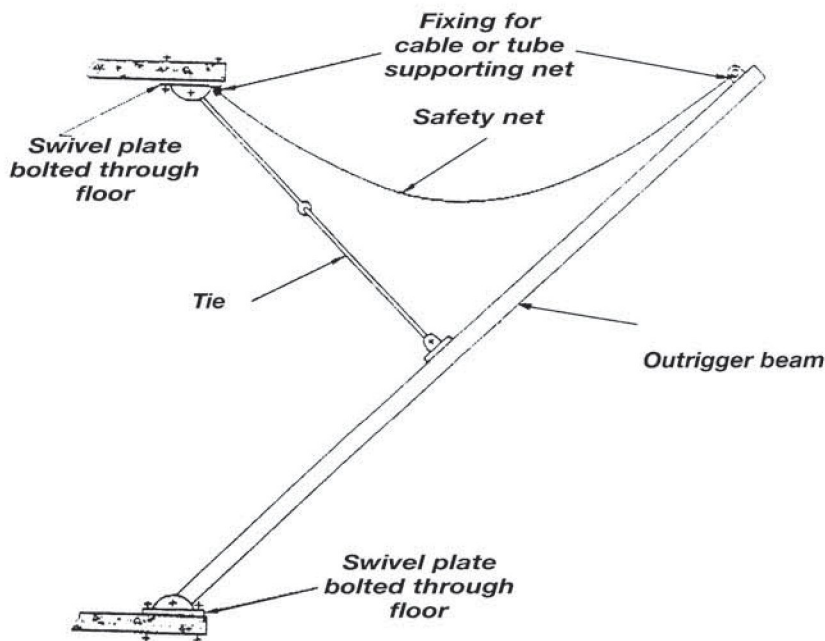
- H* is the vertical distance in metres between net and uppermost working level above net for which the net has been designed
- L* is the length of shortest side of net in metres
- d* is the horizontal projection from outermost working point in metres

NOTES

- 1 Supporting framework not shown
- 2 The minimum net dimension should be 2 m

Nets should be installed as close as possible to the working levels and in no case further below than the maximum fall distance stated on the net's label.

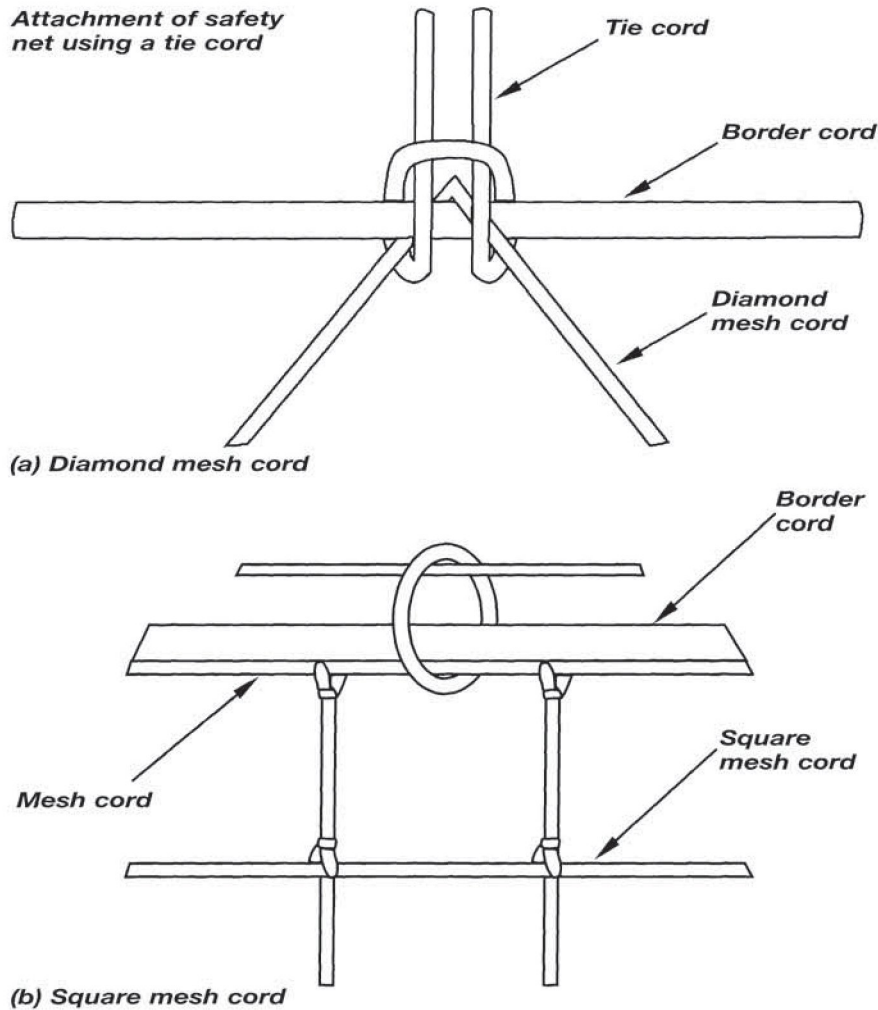
Typical arrangement of outrigger or perimeter nets



(b) Attached to the structure

The gap between a net and the building or structure should be as small as practicable, but never greater than 200mm.

Nets should not be stretched taut when erected. They should have an unloaded sag of between one quarter and one fifth of the length of the shortest side.



Sufficient clearance should be maintained at all times below the net to allow for stretch when a person falls into the net. This clearance should be at least two thirds of the length of the shortest side or 2m, whichever is greater.

When erected, nets should project beyond the outermost working point a horizontal distance of at least two fifths of the maximum fall height plus an extra 2m.

Nets should be sited so that a person who has fallen can be quickly rescued. For example, nets erected adjacent to a working platform, floor or other access point are easily accessible. Where this is not possible, it may be necessary to cut the net to quickly and safely retrieve a fallen person. Where there is any possibility of debris falling into the net, the installation design should allow debris clearance which does not require walking in the net.

Nets should be securely attached to the supporting framework using tie cords, hooks, rings or thimbles equally spaced at intervals not more than 750mm along each side and at the corners. They should be fixed to the border cords and adjacent mesh cords of the net.

Where cords are wrapped around sharp edges they should be packed to prevent damage.

Use and maintenance

A net which is used for the safety of persons should never be subjected to a loading test. The net should incorporate test cords which can be removed and tested in accordance with BS 3913.

After a net is put into use, these tests should occur at regular intervals dictated by site conditions, but in any event, at least every three months.

The test cords should not be used for any other purpose and should remain fixed to the net until they are required for testing. A record of the test results should be kept.

Nets should be thoroughly examined on both sides by a competent person immediately before they are erected. When a net is spread out for examination, particular care should be taken to avoid it coming into contact with cement mortar or other corrosive substances.

The net supporting framework and all anchorages should be inspected by a competent person immediately following erection, at weekly intervals, and immediately following any incident which may affect the strength of the net.

It is important that nets are kept free of all debris which may cause injury to persons falling into them.

The following situations should be avoided wherever possible:

- dragging the net over rough surfaces
- contact of cords with sharp edges
- stacking materials on the net
- accumulation of debris in the net
- persons jumping or throwing objects into the net
- sparks or flame from welding or oxy-cutting, hot gases from blow torches and hot ashes from chimneys or furnaces
- chemical attack
- the supporting framework being struck by moving loads
- unauthorised interference with any part of the net assembly.

Expert advice from the supplier or a competent person should be sought where there is any doubt regarding the suitability of the net following contamination or severe shock loading. Expert advice should also be sought on the serviceability of any net which has been in use for two years or more.

Damaged nets should be repaired only by specialists.

When they are not in use, safety nets should be stored under cover where they are protected from the weather and strong sunlight.

Chapter 15 Safety line systems

Safety line systems are used to prevent falls from multi-storey buildings when work has to be carried out in the absence of safety screens or handrails.

The installer designs the system based on the number of persons on the line at any given time taking into account whether or not energy absorbing lanyards are to be used and any other restrictions on the use of the line system.

Riggers and other users of the systems must also be aware of all the restrictions on the system.

Permanent installations must have any restrictions on the use of the system shown on sign posts at the access points.

Certification

The installation of safety line systems may be carried out or directly supervised by a person with either a Basic Rigging or a Basic Scaffolding certificate or old equivalent.

Specifications

The safety line system may be purpose designed or the following specifications may be used.

Single spans

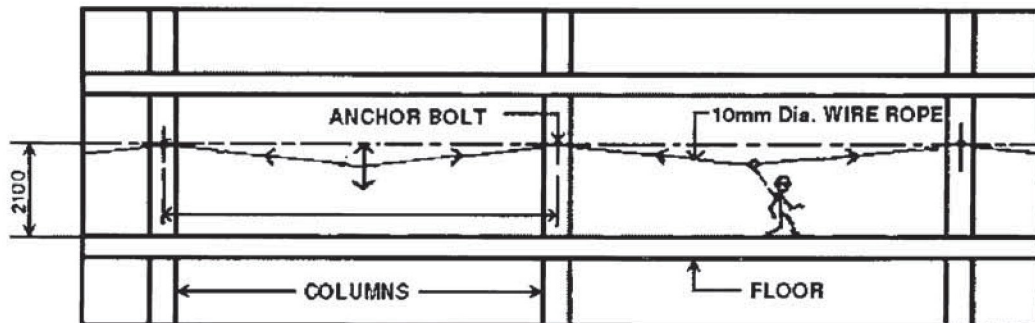
For single spans of four to six metres, where no more than two people are on the line at any one time, and both persons are using lanyards with energy absorbers rated at 600kg (6kN) or less the specifications are:

- FSWR 10mm diameter (minimum)
- sag - approximately 50mm per meter, ie 6m span - 300mm sag • anchorage - capable of supporting an imposed load of 4t (40kN)
- tensioning turnbuckles - minimum 16mm diameter threaded section.

Multiple span

The specification for multi-span systems are the same as a single span system with the following exceptions:

- sag for two or three continuous spans - approximately 30mm per meter, ie 6m spans = 180mm sag
- sag for four or more spans - no minimum sag required but the line should not be over tensioned
- corner supports or intermediate supports where the FSWR is not free to slide through the support end anchorages (ie they should be capable of supporting an imposed load of 4t).

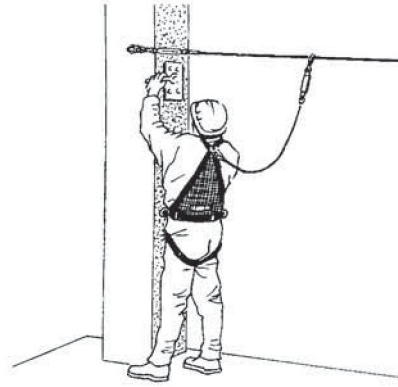


Static line spans

The static line is the supporting safety line attached to the inside of the perimeter columns. The line should be supported at each column or in accordance with an engineer's specification.

The line should be placed to eliminate the risk of tripping. Where practicable the line should be located no less than 2.1 metres above the floor of the work area. The point of attachment to the safety line system should be within reach of the user standing on the floor.

Anchorage and lines between supports should be positioned on the inside face of columns where practicable and used to anchor static lines, or the static line may pass through a cavity **tube** cast in concrete for that purpose.



Static lines between supports must be free of obstructions to allow uninterrupted movement for persons who may be attached to the line.

If a line passes around a column, corner, or other sharp edge, it should be packed to prevent damage to the line.

Do not use bulldog grips on static lines.

Tensioning should be achieved by turnbuckles or other appropriate means such as wire rope pullers and creeper winches.

If ratchet and pawl devices such as creeper winches are used for tensioning, remove them from the system after tensioning is completed.

Joining static lines

One method of joining static lines:

- terminate one end with a thimble and three double saddle clamps and allow a 200mm tail
- the second line should be passed through using a second thimble and three evenly spaced double saddle clips allowing a 200mm tail and shackle between each rope end
- line joins should be located at or adjacent to supports or anchorage points
- lapped joins on lines must not be used under any conditions.

Line systems for vertical travel

When using vertical lifelines (droplines) or other vertical fall arrest systems in connection with work from boatswain's chairs or ladders, only one person should be attached to any one lifeline. Vertical lifelines should comply with AS 1891-3 *Fall arrest devices*.

Termination of static lines

The termination of the static line should be by eye and thimble. Where practicable ends should be secured by one of the following methods:

- double saddle clamps with a minimum of three equal spaces with a minimum 200mm tail past the last clamp
- hand splice with thimble eye
- machine splice with thimble eye
- suitable wedge sockets
- purpose designed fittings such as swaged or pressed fittings.

Lines and fittings may be secured directly to anchorage points with dee or bow shackles which should have a minimum WLL of 2t. The pin of the shackle should be moused (lashed) to the shackle.

Installation of anchorage points

Anchorage points used should be located as high as equipment permits, as it is safer to work below the point of anchorage.

The span between the intermediate supports of static lines should not exceed the engineer's or supplier's specification. All bolts should comply with AS 2317-1984 *Collared eyebolts*.

The following types of anchorages are acceptable when used in concrete:

- Cast-in anchors (in situ). A wall tie (shee bolt) purpose designed. An engineer designed anchorage
- Chemical and friction type anchors. Chemical and friction type anchorages should be positioned so the load from a fall is taken in shear. They should be proof tested in tension to at least one third of the design load prior to use. Collared eye bolts should be used.

All anchorages should be visually checked prior to use.

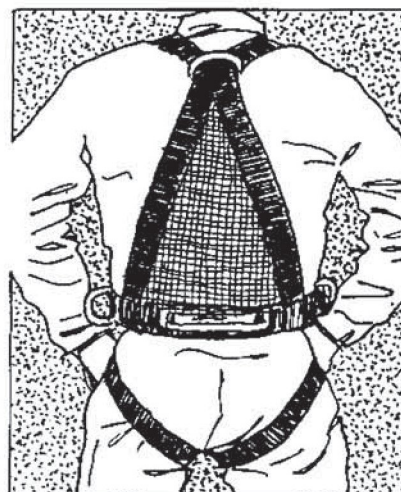
Turnbuckles

Only **framed** turnbuckles of an open type design which allow visual inspection of the condition and extension of the threaded sections should be used.

The frame should be locked or moused to the eye bolt to prevent slackening due to vibration, shock or spin in the line attached. Hook type turnbuckles should not be used. Only clevis or eye type should be used on lifelines.

Harnesses, lanyards and equipment

Body type harnesses and lanyards which comply with AS 1891 *Industrial safety belts and harnesses* should be used. The harness should be connected to the lanyard or lifeline at the top dorsal position.



Approved safety harness

If a life line and rope grab device is used on steeply sloping surfaces, the user needs to have the device located in front. This will allow safe manual operation of the mechanism.

Do not connect into a single D-ring on the side of the harness belt. Both side D-rings may be used for pole straps if a fall of 600mm or more is not possible. Do not use waist type belts.

Safety harnesses should be selected and used in accordance with AS 2626 *Industrial safety belts and harnesses* – *Selection use and maintenance*. Always follow the manufacturer's information and advice, if available.

There should be a minimum of slack in the lanyard between the person and the attachment to the anchorage. The length of the lanyard should restrict the fall distance to a maximum of 1.8m.

Where an anchorage point is above the harness connection point a 1.8m lanyard will achieve this result. Where the anchorage point is below the harness connection point a shorter lanyard, or other means of restricting the fall distance may be required.

Do not use home made lanyards. Do not join lanyards together. If extra reach is needed use an inertia reel or similar equipment.

Do not connect lanyards with inertia reels. Snap hooks or other connectors should have a locking device and be compatible with all anchorages.

Those using safety harnesses should not work alone. In the event of a fall it is vital that the person is rescued as soon as possible to prevent further injury by the harness restricting blood flow.

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

Equipment used with static lines should be compatible with the original system specification, such as manufactured travellers or energy absorbing lanyards.

Inertia reels

Inertia reel systems can be used to arrest falls where workers are required to carry out their work near an unprotected edge. They must comply with AS 1891.3 *Fall arrest devices*.

Inertia reels are not designed for continuous support but become effective in the event of a fall. They should not be used as working supports by locking the system and allowing it to support the user during normal work.

Inertia reels may be less effective for certain applications, eg stopping a person from sliding down an inclined surface.

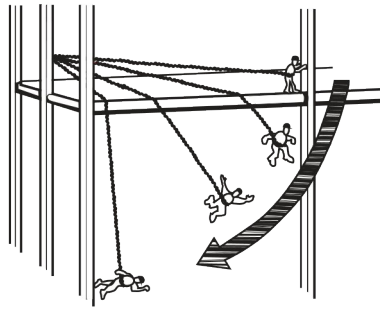
When inertia reel anchorages are located lower than head height or a person is located at a horizontal distance from the anchorage, the line of the inertia reel will strike an edge if the person falls from the structure. The damage this may cause to the line could result in its failure. To avoid this, inertia reels should be used in accordance with the manufacturer's instructions.

Inertia reels may be connected to a static line with a snap hook fitted with a locking device.

Pendulum effect

This is a potential hazard connected with the use of individual fall arrest systems. The pendulum effect may also occur if the positioning of the inertia reel allows for a significant length of unsupported line connected to the user.

Swing down can occur if an inertia reel is extended out diagonally so that the line makes an extreme angle with the perimeter edge of the structure. In this situation, the forces generated in an arrested fall over the edge will cause the line to rotate back along the perimeter edge until it reaches a position directly in line with the inertia reel and at right angles with the perimeter edge.



Pendulum effect:
Following an arrested fall at this extreme diagonal, the inertia line moves back along the roof, dropping the worker dangerously down to the ground.

As the line moves back in this way, the unsupported section lengthens, dropping the attached worker further than the original (arrested) fall distance. If the length of the unsupported line equals the height of the building then the worker will hit the ground. Even if the worker does not reach the ground they may collide with obstructions on the side of the building.

To eliminate the pendulum effect place the inertia reel anchorage point square to the position of the line at the perimeter edge. A mobile anchorage helps here.

Chapter 16 Handling pre-cast concrete

Introduction

Pre-cast concrete is commonly used in a wide range of modern building and construction projects. Precast concrete includes pre-tensioned beams, pre-cast concrete floor and facade panels.

Certification

The placement of pre-cast concrete must be carried out or directly supervised by a person holding a Basic Rigging certificate or old equivalent.

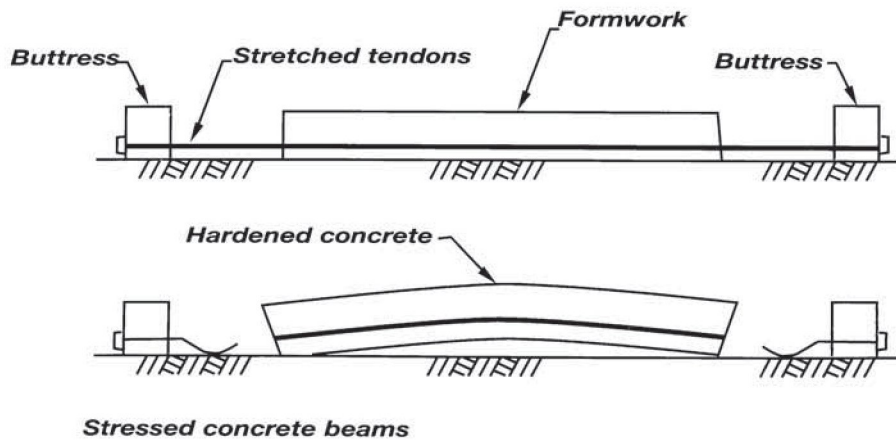
Work associated with tilt up panels is covered under the Intermediate Rigging certificate but excluded from the Basic Rigging certificate. For tilt up panels see Chapter 17.

Pre-stressed concrete beams

Pre-stressed concrete beams are designed so that stressing strands allows the concrete to hold a given load over a larger span.

The strands are often put into the beam in an inverted arc. When placed into position the beam is usually slightly arched, which allows the beam to straighten out when it is loaded.

Pre-stressed concrete beams are very sensitive to the direction in which they can be loaded. They are generally designed to take forces in a vertical downward direction only and have little or no resistance to forces in any other direction. Turning a pre-stressed beam on its side or upside down can cause it to collapse particularly when it is suspended.



Transfer beams

A different hazard applies to a special class of post-tensioned pre-stressed beams known as transfer beams. These are usually located at the first floor level of multi-storey buildings and are designed to transfer loads from the upper storeys to more widely spaced supports below to create large open spaces at ground floor level.

During the construction phase, the tendons in these beams are partially stressed in progressive stages to balance the loads as they increase over the construction period. Final stressing and grouting occur when the building reaches full height.

If no action is taken to reverse the effects of this procedure during demolition, the beam will tend to bow upward an increasing amount as the load from above is reduced. This can lead to local failure of the structure at, or just below, the working level. A reverse bending failure and collapse of the beam well below the working level can cause a collapse of the entire structure.

Riggers must be extremely careful when choosing the slings and lifting equipment because of the dangers associated with handling pre-stressed concrete beams.

The beams should be lifted by their ends, and from as near as possible to the position where they are to be placed.

It is recommended that a spreader beam is used to lift the beams to avoid having slings at an excessive angle. Spreader beams should be properly designed by an engineer to the length required and the weight of pre-stressed concrete beams.

Pre-cast concrete facade panels

Pre-cast concrete facade panels should be delivered to the site sitting on a frame so that they only require one erection crane and can be top lifted. If they are to be stored on site they should be stored on frames.

They should not be erected in high winds.

Although they are usually erected by specialist contractors, riggers should be aware of the hazards.

The lifting inserts must be cleaned out to ensure that the lifting media can be fully bolted.

The lifting media (lugs etc) must be to an engineered design.

Panels should be lifted with a spreader beam so that the pull on the inserts is direct.

The angle between the slings during lifting should not be more than 60° .

Do not work under the panel to put slings around it, if an insert pulls loose.

Contact the panel manufacturer and/or designer to have the insert positively fixed (welded) to the reinforcing steel if it is loose.

People who work outside a handrail, or if a handrail is removed, must be attached to a lifeline and be wearing a safety harness.

One person is to be in charge of the crane when lowering a panel into position.

The crane operator must be instructed to lower as slowly as possible when lowering a panel into final position.

When lowering panels by radio, if any person under any circumstances cuts across the channel, operations must stop until their reason for cutting across is discussed. If that reason is not safety they must be informed not to repeat an extreme safety breach.

Operations must cease immediately if the radio channel being used for giving directions for lowering a panel is cut into from a person not involved in the operation.