SAFETY AND RISK REDUCTION

At Chimes Crane Hire, we are committed to the safety of our clients and to the reduction of risk factors that may occur during our operations.

Risks associated with mobile crane operations

Mobile crane operations may present a risk of injury to persons from:

a. structural failure;
b. crane overturning;
c. contact or collision with other plant and structures; and
d. falling objects.

Structural failure may include the failure of any crane component, such as the boom, jib, hydraulic rams or wire rope. A mobile crane may suffer structural failure if the crane has been overloaded in the structural area of its load chart. Structural failure may occur without warning.

A mobile crane is likely to **overturn** if the crane has been overloaded in the stability area of its load chart. This may be influenced by a number of factors including:

a. poor ground conditions such as unstable ground;
b. failure to use or fully extend outriggers or stabilizers;
c. failure to level the crane;
d. rapid slewing; and
e. high wind conditions.

Contact or **collision** with other plant and structures may occur where sufficient clearances are not maintained between the mobile crane and other plant and structures, such as other cranes, buildings and overhead power-lines.

Falling objects may result from erecting and dismantling activities, and the way loads are secured during lifting operations. Falling objects may present a risk of injury to workers and members of the public.

Load charts, also called rated capacity charts, identify what a crane is able to lift safely. Load charts must be written in English and use metric units. Where the crane has one main load chart, this should be fixed in the operator's cabin in a clearly visible location. Where the crane has numerous load charts (e.g. for different boom and fly jib configurations), the charts should be kept in a book, folder or envelope in the operator's cabin.

Lifting should not take place unless the load charts are in the crane cabin. Although the crane's load moment system may appear to be operating correctly, the load charts must be available to verify that the crane is not being overloaded.

The lifting capacity of a crane is limited by:

a. **structural strength** when the working radius is small; and
b. **stability** when the working radius is greater.

The load charts on most cranes have a bold line or shaded area dividing the chart into two segments. The divided segments shows the crane operator which capacities are limited by structural strength, and which are limited by stability.

Ratings above the line are based on structural strength, while the ratings below the line are based on the stability of the crane. If a crane is overloaded in the structural area of the load chart, a structural or mechanical component of the crane may fail. However, if the crane is overloaded in the stability area of the load chart, the crane may overturn.

The lifting capacities specified on a load chart must never be exceeded, except during testing of the crane by a competent person under controlled conditions.

On some mobile cranes, there may be numerous load charts for differing boom and counterweight configurations. The load charts may be complex and include numerous conditions that must be complied with to ensure the crane can safely lift a load. Two important factors that are often overlooked when reading load charts are:

a. The need to subtract the mass of the hook block and lifting slings from the capacity of the crane at the particular radius, unless otherwise noted on the load chart. For example, if the load chart states the crane can lift 20 tonnes at a given radius, but the hook and lifting gear have a combined mass of one tonne, the load to be lifted cannot be greater than 19 tonnes. This issue becomes critical for heavier hook blocks and lifting gear (e.g. spreader beams).
b. The need to subtract the mass of the fly jib from the capacity of the main hook when lifting from the main hook on the main boom with a fly jib attached to the boom head, unless this is allowed for and noted on the load chart. Capacities of the main boom are generally based on the fly jib being removed. If this issue is ignored, the likelihood of the crane overturning can be very high.

The following are some other areas concerning risk factors for crane operations:

1) Ground factors

Factors that will affect the ability of the ground to provide adequate support include the following:

a. the presence of water, including when it is mixed with the soil as mud, and where it is present under the surface (e.g. underground springs or streams);
b. the type of ground (e.g. clay, sand, rock or a mixture of these);
c. backfilled ground that was previously an excavation or trench;
d. cavities or penetrations in the ground that have been covered but still exist; and
e. continued operation of the crane in one location.

When a mobile crane is being set up, the crane operator can only make a decision based on the surface of the ground. Generally, rock provides the most stable supporting surface for a mobile crane. However, although rock may be present on the surface, it may not extend far below the surface. One way to establish how far rock may extend below the surface is to examine nearby excavations or trenches at the workplace. Rock that extends far below the surface provides a good indication of the ground's integrity. However, this will only provide a reasonable indication of the ground's strength when the excavation is not too far from the crane. Additional risks must be managed when outriggers are positioned too close to an excavation.

Care must also be taken with ground that has a 'crust' on its surface. The surface of this type of ground is usually firmer than the ground underneath. The firm surface may give the perception that the ground is more stable than it actually is. If the ground is punctured by an outrigger, or the end of a crawler track, the softer ground will be exposed, which may cause the crane to overturn.

Where a mobile crane is continuously operated in one location, the ground underneath the outriggers will compact. Additional care must be taken to ensure that the crane has not compacted the ground to the extent that the minimum overturning moment of the crane is reduced (i.e. the crane is more likely to overturn).

2) Crane proximity to excavations and trenches

When cranes are set up close to excavations or trenches, there may be an increased risk of the sides of the excavation or trench wall collapsing, causing the crane to overturn. This risk increases with softer ground, and the presence of groundwater. Additionally, the risk of collapse is greater for vertical cuts in the excavation wall in comparison to walls that have been battered back at an angle. The presence of 'slippery back', where there is a naturally occurring slip plain such as a fracture in the ground, can also increase the risk of excavation or trench collapse.

Generally, the following principles should be applied when setting up mobile cranes near excavations:

a. Where the ground is compact and non-friable (i.e. not crumbling), the distance of any part of the crane support timbers from the excavation should be at least equal to the depth of the excavation (1:1 rule). *For example, for a three metre deep trench in compact ground, the outrigger timbers or pads should be a horizontal distance of at least three metres away from the closest edge of the trench wall.*
b. Where the ground is loose or backfilled (i.e. crumbling), the distance of any part of the crane support timbers from the excavation should be at least twice the depth of the excavation (2:1 rule).
   For example, for a three metre deep trench in backfilled ground, the outrigger timbers or pads should be a horizontal distance of at least six metres away from the closest face of the trench wall.

3) Timbers, pads and bog mats

A variety of materials can be used to distribute the mass of the mobile crane, and the suspended load to the ground. Lengths of timber (timbers) with rectangular cross sections are the most common form. However, timber and plastic pads are also provided for some cranes. For heavier lifts, bog mats, usually consisting of steel plate, are often used under mobile cranes. Timbers and pads are usually provided under outrigger feet, while bog mats may be used under the tracks of crawler cranes or where larger lifts are carried out.

Timbers, pads and bog mats should be of dimensions and materials as specified by the crane manufacturer. If the manufacturer has not provided this information, a competent person should specify the minimum size of the material to be used.

Generally, the following principles should be applied to timbers, pads, steel plates and bog mats:

a. Timbers should have a minimum width of 200 mm and minimum thickness of 75 mm.
b. Timbers should be laid together so that the width of the timber pad is wider than the outrigger foot with no gaps between timbers.
c. Pads should have a minimum thickness of 75 mm.
d. The dimensions of steel plates and bog mats should be determined by a competent person, based on the type of mobile crane.

4) Performing heavy lifts

The likelihood of a mobile crane overturning is greater when the crane is used to lift heavy loads. It is extremely important to ensure the ground has adequate bearing capacity to support the crane when performing the following lifts:

a. bridge beams;
b. tilt-up panels; and
c. other heavy lifts where the load is 50 tonnes or more.

The crane owner should compare the ground bearing capacity with the maximum pressure the crane will apply to the ground for the lift. The maximum pressure applied by a crane is a function of the crane mass, crane configuration (i.e. boom length and centre of gravity) and the mass of load on the hook. The ground bearing capacity must be greater than the maximum pressure applied by the crane to the ground to ensure adequate crane support. If not, then appropriate control measures, such as the use of bog mats, must be in place to increase the ground bearing capacity before the lift is performed.

5) Cranes on outriggers (or stabilisers)

The use of outriggers on mobile cranes helps to provide greater stability to the crane when lifting loads. Irrespective of the ground conditions, timbers or other means of distributing the load should always be placed under the outriggers.

Outriggers should be set according to the manufacturer's operating instructions for the specific type of mobile crane. The outriggers should also be used to help level the crane.

Many cranes are not designed for lifting with partially extended outriggers. If one or more outriggers are not fully extended, the crane may become unstable during lifting operations. In some instances, it may not be possible to fully extend all outriggers. Only cranes that have the manufacturer's approval to lift with partially extended outriggers should be used this way. If a lift is to be undertaken with partially extended outriggers, the correct outrigger configuration, according to the appropriate load chart, must be used.

6) Calculating pressure applied by outriggers

A number of crane manufacturers provide information on the maximum ground pressure that is applied when the crane is at maximum capacity, in the stability range of the load chart.

Different ground types will have different ground bearing capacities. Generally, harder ground, such as rock, is capable of withstanding higher ground pressures than softer ground, such as dry sand. Where the ground consists of a combination of ground types, the poorer ground type should be used for determining the maximum ground pressure

that can be applied to the ground when the crane is set up on outriggers. The table below identifies the maximum permissible ground pressure according to the ground type.

Ground type	Maximum permissible ground pressure, P_{MAX} (Tonnes per m^2)
Hard rock	200
Shale rock and sandstone	80
Compacted gravel (with up to 20% sand)	40
Asphalt	20
Compacted sand	20
Stiff clay (dry)	20
Soft clay (dry)	10
Loose sand	10
Wet clay	Less than 10

Table 1: Maximum permissible ground pressures for various ground conditions.

The greatest force applied by any outrigger to the ground will be:

a. at the point of tipping, just as the crane is about to overturn; or
b. when the crane boom is located directly above an outrigger foot.

A crane will overturn within the stability part of the load chart when the maximum safe working load (SWL) is multiplied by a factor of 1.33. In reality, a crane will not approach this condition, provided the operator does not overload the crane. However, a reasonable approximation for maximum ground pressure applied by the outriggers is detailed below.

Pressure (tonnes per m^2) applied by outrigger feet

$$\mathbf{P_{out}} = \frac{0.65 \times (\text{total crane mass} + \text{lifted load})}{(\text{individual outrigger area})}$$

$$\mathbf{P_{out}} = \frac{0.65 \times (C_M + L)}{\text{area}}$$

When the minimum allowable ground pressure is known, the minimum area required under the outrigger feet can be calculated as follows:

Minimum area required under outrigger foot

$$\textbf{area} = \frac{0.65 \times (\text{total crane mass} + \text{lifted load})}{\text{pressure applied by outrigger feet}}$$

$$\textbf{area} = \frac{0.65 \times (C_M + L)}{P_{out}}$$

To find the length and width dimensions for the outrigger timbers, find the square root of the area (√ area).

The following examples demonstrate the practical application of the above formulae.

Worked example 1

A mobile crane with a total mass of 40 tonnes is lifting a 20-tonne load—20 tonnes is the maximum the crane can lift in the stability range of the load chart. Each of the four outrigger feet on the crane are provided with timbers that are 0.8 m long by 0.8 m wide. Calculate the maximum ground pressure that will be applied to the ground when lifting directly above an outrigger foot.

Lifted load (L) = 20 tonnes

Total crane mass (C_M) = 40 tonnes

Timber area in contact with the ground = 0.8 m x 0.8 m = 0.64 m^2

Pressure applied by outrigger feet

$$P_{out} = \frac{0.65 \times (C_M + L)}{\text{area}}$$

$$P_{out} = \frac{0.65 \times (40 \text{ tonnes} + 20 \text{ tonnes})}{0.64\ m^2}$$

$$P_{out} = \frac{39 \text{ tonnes}}{0.64\ m^2}$$

$$P_{out} = 60.9 \text{ tonnes per } m^2$$

Worked example 2

A mobile crane is to be set up on its outriggers on compacted gravel. The crane has a total mass of 25 tonnes and is to lift a 10-tonne load—10 tonnes is the maximum the crane can lift in the stability range of the load chart. The lift plan requires the load to be slewed above each outrigger foot. Calculate the minimum required area of the timbers to be placed under each outrigger when lifting directly above an outrigger foot.

Lifted load (L) = 10 tonnes

Total crane mass (C_M) = 25 tonnes

Maximum allowable ground pressure (P_{MAX}) for compacted gravel = 40 tonnes per m^2

$$area = \frac{0.65 \times (C_M + L)}{P_{MAX}}$$

$$area = \frac{0.65 \times (25 \text{ tonnes} + 10 \text{ tonnes})}{40 \text{ tonnes per } m^2}$$

$$area = \frac{22.75 \text{ tonnes}}{40 \text{ tonnes per } m^2}$$

$$area = 0.569\ m^2$$

Dimensions of outrigger timbers: $\sqrt{0.569\ m^2} = 0.754$ m

Therefore, length x width of timbers required = 755 mm x 755 mm.

7) Communication

A reliable method of signalling between the crane operator and dogger is essential for safe crane operation. Failure to implement a reliable method of communication may lead to unsafe crane operations and contribute to injury to persons from:

a. dropped loads; and
b. collision with other plant and structures.

An effective means of communication is particularly important where:

a. the crane operator cannot see the load;
b. the crane operator cannot see the load's landing area;
c. the crane operator cannot see the path of travel of the load or the crane;
d. the crane operator is not in a position to make an accurate judgement of distance; and
e. it is possible for the crane to come into contact with overhead powerlines.

Persons using radio equipment should be familiar with the manufacturer's operating instructions. A dedicated radio frequency should be selected for the duration of the crane operations to prevent interference to or from other radio equipment being used in the vicinity of the crane. All persons using the radios are to be aware of the risk of interference and signals from other radio equipment. Work must stop immediately if there is a loss of radio communication.

The safe use of radio communication usually involves:

a. the crane operator and dogger performing an operating safety check to ensure the radios are performing satisfactorily, and a fully charged battery and spare are available;
b. ensuring operators are familiar with the specific procedures for using radio communication for that workplace;
c. adopting a constant talk method between radio users so that all involved persons are aware of the progress of the lifting operations at all times; and
d. ensuring the crane operator normally takes radio instructions from one person only, unless special circumstances exist that require specific arrangements to be in place for the use of more than two radios.

Where radio communication is not or cannot be used, other forms of communication, such as hand signals and bell, buzzer and whistle signals should be used.

Mobile phones should not be used for directing mobile crane operators.

8) Crane siting

The siting of a mobile crane may present a risk of injury to persons, including workers and members of the public in the vicinity of the crane from:

a. the crane overturning due to failure of the crane to withstand the forces likely to be imposed on it; and
b. collision between the crane with other plant and structures at the workplace.

The siting of mobile cranes should occur after careful consideration of the above factors.

Collision between the crane and other plant or structures.

The siting of a mobile crane must consider hazards such as:

a. overhead powerlines and other services;
b. nearby structures;
c. other cranes or high obstructions, including those on adjacent workplaces (e.g. concrete placement booms);
d. other mobile equipment moving within the crane working area; and
e. the vicinity of aerodromes and aircraft flight paths for 'high' cranes.

Mobile cranes should be positioned so that the risk of injury from collision with other plant is minimised. This issue is particularly important where mobile cranes are set up on public roads. In this situation, the traffic control procedures of the road controlling authority must be complied with.

Another way to minimise the risk of injury from collision with other mobile plant and vehicles is to increase the visibility of mobile cranes. One way to increase the visibility of a crane is to permanently mark the crane's outriggers and stabilisers with high visibility hazard striping (i.e. 'zebra striping'). The outrigger beams or hydraulic cylinders should be marked with the hazard striping. The striping should:

a. be at an angle 30-60 degrees to the horizontal;
b. be 40-150 mm wide; and
c. consist of two contrasting colours, one of which is red, yellow or white.

Note that if there is inadequate room on the stabilisers of vehicle-loading cranes, the dimensions of the hazard striping may be decreased.

9) Stabilising and overturning moments

Stability function of load charts

The stability factors allow for variables such as:

a. dynamic factors caused by the crane motion and the load (e.g. for boom movement, application of brakes, swaying of the load); and
b. wind effects on the load and boom.

The stability factor of mobile cranes be based on 75% of tipping for stationary mode, and 66.6% for pick-and-carry mode. All mobile cranes should comply with this design requirement and the stability factor should be written on all load charts for the crane. Where second-hand cranes are imported from overseas, the crane should be stability tested to demonstrate it complies with stability requirements.

When the load chart is based on 75% of tipping, the maximum capacity in the stability range of the load chart will be 75% of the suspended load that will cause the crane to overturn. In other words, the actual overturning load will be 33.3% greater than the load being lifted. Therefore, if a crane's maximum capacity at a given radius in the stability range of the load chart is 10 tonnes, a 13.3-tonne load will cause the crane to overturn. However, it is also possible for a crane to overturn with smaller loads when operating in windy conditions or on sloping ground, or if the crane is not operated smoothly.

Counterweights

The crane counterweight is critical in ensuring crane stability. A counterweight that is too light for a load and boom configuration will cause the crane to overturn in the direction of the suspended load. Additionally, a crane can fall over backwards due to the effect of the counterweight in situations when:

a. the counterweight is too heavy for the boom configuration;
b. the crane is travelling up a slope with the boom luffed up;
c. inadequate timbers are placed under the outrigger pads below the counterweight when the crane is positioned on soft ground; and
d. outriggers are not extended or lowered into position.

On the majority of smaller mobile cranes, the counterweight is fixed and cannot be easily removed. However, on an increasing number of larger cranes, some of the counterweights are designed to be removed for road travel, or when smaller boom and lifting configurations are required. In this situation, it is particularly important to attach the correct type and number of counterweights to the crane for the particular lift to be undertaken.

Counterweights must be secured to the crane in the manner specified by the crane manufacturer. Where counterweights are removable, each counterweight must be clearly and permanently identified with the crane manufacturer's name or trademark and the mass of the counterweight (preferably in tonnes).

Where the crane is fitted with a rated capacity limiter, the data input into the computer must be correct for the counterweight configuration on the crane, and related to that shown on the appropriate load chart. This also applies to the boom configuration being used on the crane.

In some unusual circumstances, additional counterweights are attached to the crane to increase its capacity. This process requires an engineer.

Wind conditions

Strong winds impose additional loads on a crane and affect the crane's stability. A maximum permissible wind speed of 10 m/second (36 km/hour) is specified for mobile crane operation by some crane manufacturers. Crane configurations designed for wind speeds other than 10 m/second should have the design wind speed marked on the rated capacity chart.

Where wind speeds exceed the maximum figure stated by the crane manufacturer for a specific mobile crane, crane operations should cease, and the crane be placed out of service. Crane operators should recognise that dependent on the boom length, the wind speed may be greater at the height of the load compared to the wind speed at the height of the crane's cabin.

A crane manufacturer will generally only specify a maximum wind speed to operate the crane, ignoring the type of load to be lifted. In some cases, there may not be a maximum wind speed specified for the crane itself. Wind speed may be much greater above the ground level than next to the operator's cabin. Also, the effect of wind gusts will have a different effect on the crane than a constant wind. Given these variables, crane operators must base their decision to make a lift on information provided by the crane manufacturer and their experience as a crane operator. If the operator believes it is unsafe to lift the load, written certification should be obtained from the crane manufacturer or an engineer prior to lifting taking place.

Mobile cranes must be operated within their engineered design capacity. To ensure the stability of a mobile crane in windy conditions, the following factors should be addressed:

a. The crane manufacturer should state the maximum wind speed that the crane may be operated in. Generally, the safe operation of a crane becomes difficult to ensure when the wind speed exceeds 36 km/hour, irrespective of the size of the load. However, in many situations, this speed may be excessive, particularly where the load and boom have large surface areas.
b. Where the crane is lifting close to its rated capacity, the wind will have a greater effect on the crane stability and the potential application of a side load on the crane's boom.

c. Where the lift is a non-standard lift, with a suspended load or large surface area to be undertaken in windy conditions, a competent person should provide written advice on safe lifting conditions.
d. Consider attaching wind gauges to mobile cranes or providing another reliable method of measuring wind speed (e.g. handheld wind gauge). Where wind gauges are to be attached to the crane, they should be mounted at the top of the main boom, and calibrated at predetermined intervals, to ensure they provide accurate readings. Guidance on this issue should be obtained from the crane manufacturer or supplier. The provision of wind gauges on mobile cranes is strongly recommended where the maximum rated capacity of the crane is 100 tonnes or greater.

Sloping ground—pick-and-carry cranes

Many crane roll overs occur when pick-and-carry cranes travel with a load along a side slope. This may also occur to telescopic handlers and other mobile plant when travelling with a suspended load. Working on a slope has the effect of either increasing or decreasing the working radius of the crane, which may in turn affect the stability of the crane, and cause the crane to overturn either forwards, backwards or sideways.

Where the centre of gravity of the mobile crane is high above the ground, a minimal ground slope can be a major factor in causing the crane to overturn. This particularly applies when:

a. the boom has a high luff angle;
b. the boom is telescoped out; or
c. the centre of gravity of the suspended load is high.

A side slope of only two or three degrees can have a drastic effect on the stability of the crane. Soft ground, pneumatic tyres and suspension movement will also tend to increase the side angle of the crane and make the risk of overturning greater.

Most manufacturers of pick-and-carry mobile cranes specify the cranes are to be operated on firm level ground. In practice, it can be very difficult to ensure the supporting surface for a pick-and-carry crane does not exceed a side gradient of 1%. This is particularly the case at a workplace where construction work is being performed where the ground condition and slope may be constantly changing. A pothole in the ground will have the same effect as a gradient if the crane's wheel enters the hole.

Where possible, avoid working or travelling on sloping ground. If working or travelling on a slope is unavoidable, consider carrying the load on the uphill side of the crane, regardless of the direction of travel. Travel on a slope should be up or down the slope, not across the slope.

Limiting and indicating devices must be fitted to mobile cranes. The purpose of limiting devices is to stop a specific crane motion before the crane moves out of its limits into an

unsafe situation. Indicating devices are used to visually or audibly warn the crane operator that the crane may be approaching its set limits or an unsafe situation. These devices may be used individually, or together, for specific crane motions.

Limiting and indicating devices are intended as an aid to crane operators. The devices should not be relied upon to replace the use of the crane's load chart and operating instructions under any circumstances. Sole reliance on these devices in place of good operating practices may cause an accident:

Rated capacity limiters:

A rated capacity limiter prevents overloading of the crane by stopping all relevant crane functions when an overload is detected. Rated capacity means the maximum load that may be attached and handled by the crane, and may not include the weight of the hook block, falls of rope, slings and rigging hardware. The load to be raised must include the weight of all lifting appliances that are not permanently attached to the crane. The crane's load chart will provide guidance on any deductions that may need to be made.

Rated capacity limiters must be provided on all mobile cranes manufactured since 2002 with a maximum safe working load of more than three tonnes. The limiter should prevent:

a. hoisting of a load, within the tolerance of 100 to 110% of the maximum rated capacity; and
b. the radius being increased when the load exceeds 100 to 110% at the particular radius.

Motion limiting devices:

Motion limiting devices are used to prevent physical damage to the crane or part of the crane due to movement of the crane or part of the crane past its designed range of motion.

Motion limiting devices must be fitted to a mobile crane to prevent motion out of its service limits. These devices cause braking, including deceleration where appropriate and stopping, when the following extreme permissible positions have been reached:

a. the highest position of the hook (this is generally known as 'anti-two block');
b. the extreme permissible operating positions of the jib (luff limiter); and
c. the end positions of horizontally telescoping or movable jibs.

Working radius indicator:

A radius indicator displays the radius of the suspended load generally measured from the centre of the slew ring. A radius indicator should be fitted on all mobile cranes that were originally designed with this feature. The indicator should be displayed in metres and be accurate to +10% and -3% of the actual radius.

Load indicators:

Load indicators should be fitted to all mobile cranes with a maximum rated capacity of more than three tonnes. Load indicators measure and display the mass of the load being lifted. This indicator assists the crane operator to stay within the load chart and safe working limit of the crane. The load indicator should be capable of displaying the mass of the suspended load at all times.

10) Minimising risk of injury from collision

Failure to maintain sufficient clearance between a mobile crane and other plant and structures may result in a collision between the crane, or its load, with other plant or structures. The possible outcomes from this collision include:

a. damage to crane components, such as the boom, which may seriously weaken the component, leading to structural collapse; and
b. injury to persons in the vicinity of the crane, including workers and members of the public.

10.1 Working near overhead powerlines

Contact with overhead powerlines can pose a risk of electrocution when operating a mobile crane. It can be extremely difficult for crane operators to see powerlines and to judge distances from them.

Before setting up a mobile crane in the vicinity of overhead powerlines, consultation regarding the work and the related risks should occur between the relevant person and the mobile crane operator.

There are two options for working near overhead powerlines:

a. have the powerlines de-energised; or
b. stay outside the exclusion zones.

Where it is claimed that overhead powerlines have been de-energised, the relevant person should ensure written documentation from the relevant electrical entity is available for perusal by the crane owner and members of the crane crew.

Exclusion zones

An exclusion zone is the prescribed safety envelope around a live electrical part. A person must not operate a crane where any part of the crane or the crane's load will enter

the exclusion zone. Exclusion zones vary according to the voltage and the type of overhead powerlines.

A number of factors must be considered when implementing systems to maintain the exclusion zone around overhead powerlines. These include:

a. identifying the minimum clearance distance from the closest part of the crane or its suspended load to the powerline;
b. allowing for sway and sag of the overhead powerlines;
c. ensuring all persons operating plant and vehicles stay outside the exclusion zone at all times; and
d. ensuring a 'spotter' is used when the crane or plant can enter into the exclusion zone.

Sway of overhead powerlines is usually caused by wind, while sag may vary as the temperature of the line varies.

A 'spotter' is a safety observer who has undergone specific training and is competent for the sole task of observing and warning the crane operator against the crane's encroachment into the exclusion zone. The spotter must not carry out other tasks, such as dogging duties.

Devices to minimise the risk from contact with overhead powerlines

There are a number of devices available that either assist in preventing contact with overhead powerlines or reduce the degree of risk in the event of contact. These include:

a. tiger tails;
b. limiting or warning devices; and
c. insulated hook swivels.

The use of **tiger tails** on overhead powerlines acts as a visual aid to highlight the location of the powerline. Only low voltage lines (under 1000 volts) can be continuously covered with tiger tails, which leaves the higher voltage lines on power poles (usually at least 11 000 volts) exposed. Tiger tails **do not** insulate wires.

Limiting or warning devices may be used to prevent the crane boom or load from entering the exclusion zone, or to warn the crane operator before the boom enters the exclusion zone.

Hook swivels that are constructed from an insulating material (e.g. ceramic) may be used to reduce the risk of the dogger being electrocuted in the event of contact with an overhead powerline.

Regardless of whether safety devices are being used, the exclusion zone must not be encroached..

10.2 Working near other plant and structures

A collision between a mobile crane and other plant (e.g. other cranes and mobile plant) and structures (e.g. buildings) may cause injury to persons present in the vicinity of the crane from:

a. dropped loads;
b. overturning cranes; and
c. broken crane components, such as boom sections.

Where two or more cranes or other mobile plant work within a workplace, or share the same airspace, a documented procedure, such as a work method statement for construction work, must be established to ensure sufficient clearances are maintained between the cranes, their loads and the mobile plant.

When cranes operate in adjacent areas, they may share the same airspace. Systems of work should be negotiated between the persons in control from each work area to ensure sufficient clearances are maintained between the cranes. Each work area should nominate a person who has a responsibility to implement a correctly documented system to minimise the risk of injury from a collision.