

A handbook
for workplaces

Working safely with bridge and gantry cranes

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WorkSafe Victoria is a trading name of the Victorian WorkCover Authority.

The information presented in *Working safely with bridge and gantry cranes* is intended for general use only. It should not be viewed as a definitive guide to the law, and should be read in conjunction with the *Occupational Health and Safety Act 2004* and the *Occupational Health and Safety Regulations 2007*.

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Introduction

Operating a bridge or gantry crane is skilled work. When the safe work principles in this guide are not followed, there is potential to cause fatalities, injury or property damage.

The guide covers the powered operation of bridge and gantry cranes in all configurations. Powered operations include traversing, travelling, hoisting (raise and lower are considered to be one operation) and rotation.

It is expected that employers, health and safety representatives (HSRs), health and safety committees, employees and WorkSafe inspectors will use this guide to form an opinion about suitable health and safety risk controls, under the test of 'reasonably practicable'.

This guide is not a substitute for training. This guide does not cover the specifics that a bridge and gantry crane operator, dogging or rigging person would need to know to perform their job competently and safely.

A general overview of guidance material can be found in Appendix A.

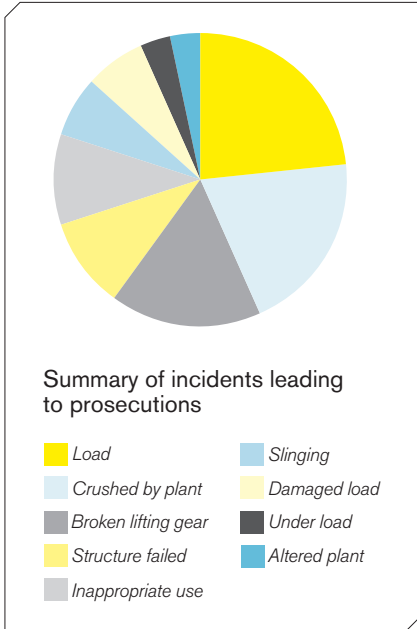
Occupational health and safety legislation in all states requires employers to:

- ensure risks associated with plant and their operations are eliminated or reduced so far as is reasonably practicable
- ensure supervisors and employees, including independent contractors, are trained and provided with information on:
 - the nature of hazards associated with the plant, and
 - the safe operation of plant.

Operating cranes safely is a critical function. Costs associated with crane incidents have been significant due to a combination of reasons:

- fatalities
- serious injuries
- property damage
- fines
- increased premiums
- lost time, and
- training.

Introduction



From 1999 to 2004, there were 27 crane-related prosecutions resulting in more than \$1.1 million in fines. Of these, four were related to fatalities. A further three cases were referred for trial to the County Court.

This table gives a breakdown of crane-related fines, including bridge and gantry cranes, but excluding electrocution and toppling incidents

Prosecution type	Number	Total fines	Average fines
Employer (OHS Act 2004)	21	\$1,153,000 approx	\$55,000 approx
Employer (Dangerous Goods Act 1985)	2	\$19,700 approx	\$9,900 approx
Individual, including managers	4	\$22,850 approx	\$5,700 approx

It should be noted that eight of the prosecutions relate to plant failure. This guidance primarily deals with inspection, maintenance and disposal of plant to make quality requirements clear.

There were three prosecutions relating to inappropriate use of plant. Using plant for its intended purpose is a fundamental safety requirement.

It should be noted that the potential for prosecution exists when there is failure to comply with the law and not just when an incident occurs.

How to use this guide

This guide provides a range of information that can be used to decide the most effective solutions for providing safe bridge and gantry operation.

Many of the tasks outlined in the following pages are presented in two columns.

Work practices undertaken in bridge and gantry operation that are deemed to be unacceptable under occupational health and safety (OHS) legislation are highlighted in the **red** column. To avoid exposing employees and contractors to risk of injury or illness, the practices described in these columns must not be allowed to happen.

Common risk control solutions to prevent exposing employees or contractors to unacceptable work practices are highlighted in the **green** column. These solutions are regarded as 'reasonably practicable' for most bridge and gantry operations where this work is undertaken, and therefore would be expected to be implemented when required. That said, the risk controls listed in the green column are not the only way to control risks. If an alternative way to control risks is used, it should, as a minimum, achieve the same standard as set out in this guide.

Unacceptable Work Practice	Risk Control Solutions
Work practices in the red column must not be used in bridge and gantry operations. An employer who allows these work practices to be used is likely to be in breach of OHS legislation.	The solutions in the green column are the most effective at reducing risk and should be the aim of all workplaces.

1.

Equipment

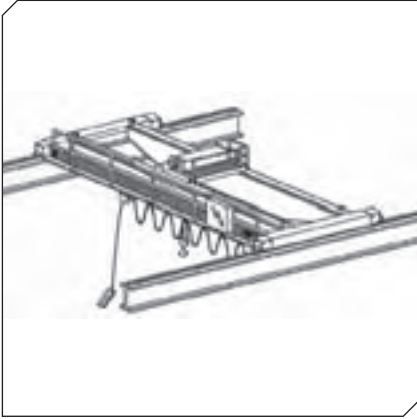
Bridge and gantry cranes

Slings and accessories

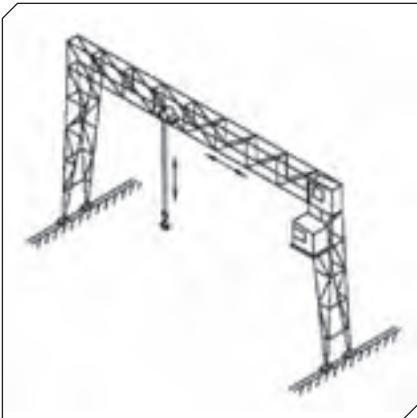
Specialised lifting equipment

Magnetic, vacuum and friction

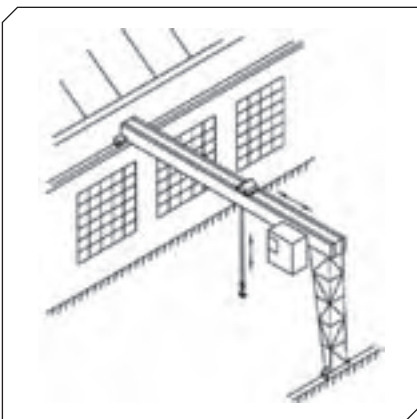
Custom and home made



A bridge crane.



A gantry crane.



A gantry combination crane.

Bridge and gantry cranes

This guide covers bridge and gantry cranes such as those shown (left).

A bridge and a crab (winch trolley assembly) run on two fixed overhead binary runways.

A bridge crane (or overhead travelling crane) is defined as a crane comprising a bridge beam or beams mounted to end carriages at each end, capable of travelling along elevated runways and having one or more hoisting mechanisms arranged across the bridge.

A gantry crane comprises a bridge beam or beams, which are supported at one or both ends by legs mounted to end carriages, capable of travelling along runways and has one or more hoisting mechanisms.

Bridge and gantry cranes may be operated from within a cabin mounted on the crane bridge or remotely from the ground, either through a hard-wired pendant control or radio control.

The major components of bridge and gantry cranes are:

- the runways
- the bridge
- the hoist unit
- the crab or hoist trolley used to transverse the load
- the winch drum and hoist rope
- the rope termination points, the hook and hook block, which may contain one or more sheaves
- the braking systems
- the 'crane operating area'
- the electrical supply and its isolation points
- the provision of access for service and maintenance/repairs, and
- the load limiting devices, which prevent the rated capacity being exceeded.

Crane controls

It's advisable they:

- have 'fail-safe' control buttons (i.e. constant pressure type)
- have appropriately labelled function buttons
- are of waterproof construction, and
- are fitted with a manually reset emergency stop button.

Additional for cabin controls

Modern cabin controlled bridge and gantry cranes will normally have joysticks to control all movement on the crane.

Cabins may be cramped in design. Ensure controls are protected so that the operator getting in and out of the cabin seat will not cause accidental operation. Dead man's brake pedal or mechanical protection of joy stick control levers can prevent this.

Additional for pendant controls

All hard wired type of pendant controls must:

- be energised by extra-low voltage (i.e. not greater than 50V AC or 12V DC), and
- have the support cable and catenary insulated from the crane structure.

Additional for radio, microwave and infrared controls

All radio, microwave and infrared controls must:

- limit the reception range to within a distance that provides good visual interface with the operator
- be able to be automatically de-energised when unable to receive a signal within 550 metres
- be able to be de-energised when interfered with by other signals
- be able to be de-energised when the stop or emergency buttons are activated.

Where there are high risk areas it is critical that the bridge and gantry crew are operating from a safe area. This can be done by operating the bridge and gantry crane from a viewing platform or ensuring the controls will only work in a predetermined safe area.

Lockouts

To operate bridge and gantry cranes safely, it is crucial there is an ability to lock them out. The following are examples of when a bridge or gantry crane may need to be locked out:

- when not in use, to prevent unauthorised use
- when being worked on, to ensure safety of maintenance staff or operators
- when deemed unfit for use either following an incident, inspection or prior to commissioning or
- when people are working near potential power sources, such as buzz bars and electrical tracks.

Lockable isolation switches

Lockable isolation switches should also be fitted to other plant within the 'crane operating area', such as column mounted jib cranes.

Interlocking devices

Interlocking devices prevent more than one piece of plant being operated in any one area at the same time. Interlocking devices can be used to prevent two bridge and gantry cranes operating on separate runways in the same 'crane operating area' at the same time. This can be where the runways are either above and below each other or crossover each other. This could require a bridge or gantry crane to be limited to a set area or parked whilst the other one is working in a designated area.

Safety devices

There are a number of devices which can be fitted to bridge and gantry cranes to improve their safety:

Anti-collision devices

Anti-collision devices prevent two or more bridge and gantry cranes operating on the same runway from colliding with each other.

Deceleration devices

Deceleration devices, such as limit switches and two-stage decelerators, slow the bridge or gantry crane down regardless of what control is being pressed when a travelling crane is approaching the end of the runway, to prevent end stop collision or over run.

Load-limiting devices

All bridge and gantry cranes should be fitted with load-limiting devices. Load-limiting devices assess the load and prevent lifting should the rating capacity of the plant be exceeded.

Anti-fall devices

Anti-fall devices, such as anti-drop plates, should be fitted to bridge and gantry cranes to prevent falls of plant in the event of failure.

Minimum working height

The minimum clearance above working mezzanines is 1.8 metres.

Access to ladders and platforms

Service platforms should be provided for all bridge and gantry components that require servicing. Where a permanent structure is not provided, a mobile device, such as a cherry picker, can be provided so long as it remains available at all times. Work platforms should have fall protection incorporated.

The work platform should be designed so that tools and parts can be accessed without needing to be carried up ladders (three points of contact).

Service areas should be isolated from power sources. For further information, see AS 1418.3 – 1997, *Cranes, hoists and winches – Bridge, gantry, portal and jib cranes*.

Signage

The crane classification and working load limit of the crane must be displayed on each bridge and gantry crane.

Selecting bridge and gantry cranes

Prior to purchasing a crane, the employer should consult with key staff, including health and safety representatives (HSRs). This consultation should be documented and cover the range of tasks, operational requirements and any hazards or barriers that need to be considered. This should include:

- type, size and weight of loads
- operational parameters
- frequency of use (e.g. 24 hours a day, 6 days a week)
- physical constraints of the workplace
- required separation distances from other plant
- required separation distances from people
- impact caused by the weather, and
- correct classification of the bridge and gantry crane.

Where a bridge or gantry crane is configured with a multi-hoist mechanism and is intended to simultaneously use both hoists to lift a load that exceeds either hoist capacity, each hoist must be de-rated by 20%. This is only for when there are not load limiting and movement controlling devices installed that will prevent either hoist from being overloaded. **Such applications should be discussed with the crane manufacturer prior to purchase.**

Consultation should also consider safety within the workplace after the bridge or gantry crane is purchased. This should include:

- what new risks will be introduced to the workplace?
- what engineering controls will need to be introduced?
- what new safe systems of work will need to be developed?
- what specific training, instruction and supervision will be required for the new plant?

A formalised job safety analysis and a risk assessment should also be completed.

This consultation, job safety analysis and the risk assessment should form the basis of discussions with the supplier of the bridge and gantry crane.

Example:

It is determined that the crane needed must have: 5 tonne capacity, 15 metre span and a two speed all motion capacity. The crane will operate 24 hours a day, 7 days a week.

In this case, see the table below for two options:

Costs	A: Standard crane	B: Production crane
Purchase	\$30,000	\$45,000
Service	\$600pa	\$1,800pa
Repair	\$6,000pa	\$2,000pa

In this example, crane choice 'A' is not designed for that frequency of use, whereas crane choice 'B' is more suited to the work and represents a safer choice.

Crane 'A' is designed to do less operating cycles than crane 'B' is. The example shows that due to overuse, the repair costs of crane 'A' are running much higher than would be expected.

Source: Engineering Buying Advisory Service.

Commissioning bridge and gantry cranes

When occupying existing premises, a bridge or gantry crane can be already installed. A common mistake is to use the bridge or gantry crane for any purpose. The employer has a responsibility to determine the plant is fit for purpose prior to commissioning it.

It is recommended the employer contact the manufacturer of the crane to find out what the cranes limitations are. If this is not practicable, a competent person should be contacted for this purpose.

Alterations to crane

Where the intended use of the crane has changed, it should be assessed by a competent person for suitability for its intended purpose. This assessment will be conducted when:

- recommissioning a crane that has no maintenance records
- recommissioning a crane that was designed and built to unknown standards
- upgrading or modifying a crane's capacity, and
- increasing the crane's duty cycle.

Inspection

Inspections should be carried out by competent person(s) at intervals to keep the bridge and gantry cranes in a safe condition. This is to be determined by the designer, manufacturer and/or the supplier of the plant's recommendations in relation to its frequency of use. The following inspections should occur as a minimum unless otherwise stated by the designer, manufacturer and/or the supplier of the plant:

- **'pre-operational inspections'** prior to the use of the bridge and gantry crane on each shift
- **'periodic inspection'** based on the duty cycle, but should not exceed 12 months between inspections
- **'major inspections'** to determine the bridge and gantry cranes suitability for continued use – this should occur at intervals not exceeding 10 years for mechanical and 25 years for structural, or more frequently where recommended by the designer, manufacturer and/or the supplier of the plant or when deemed necessary by a competent person, and
- **'third-party inspections'** it is recommended that third party inspections are conducted at a frequency in accordance with the inspection table below:

Inspection table

Crane classifications	Recommended minimum service requirements							
	C1	C2	C3	C4	C5	C6	C7	C8
	M1	M2	M3	M4	M5	M6	M7	M8
Operating hours per day	≥0.5	>0.5 – 1	>1 – 2	> 2 – 4	>4 – 8	>8 – 16	>16 – 20	>20
Routine maintenance service, weeks	12	12	12	12	8	8	4	4
Third part inspections, years (optional)	3	3	2	2	2	1	1	1

Source table 7.2.1 Australian Standard AS 2550.3 – 2005, *Cranes, hoists and winches – Safe Use – Bridge, gantry, portal, jib and monorail cranes.*

- When the manufacturer's recommendations are different in relation to third party inspections, the following should apply:
 - The manufacturer's recommendations apply when the manufacturer recommends inspections occur more frequently than the recommendations listed in the table.
 - The recommendations in the table apply where the manufacturer recommends inspections occur less frequently.

Note: See Maintaining plant, page 29.

Repair

The task of repair is a technical area that requires liaising with various people. This is to ensure the bridge or gantry crane remains fit for purpose and has not been inadvertently modified from its original intended task. Some points to consider include:

- The manufacturer's recommendations must be sought prior to repairs to the bridge or gantry crane being undertaken.
- Where it is not practicable to contact the bridge or gantry crane manufacturer, a competent person or engineer must make a written assessment on the suitability of repair and/or replacement parts.
- Where the competent person or an engineer is in doubt over the safety of plant when conducting an assessment, they must err on the side of caution.
- The bridge or gantry crane structure or mechanical components may become worn or damaged before their scheduled inspection. When this constitutes a hazard and repair is deemed viable, the repair should be undertaken as per this section. Where damage or wear is to such an extent that repair is not viable, the component or structure should be replaced or the crane decommissioned.
- Immediately withdraw from service bridge and gantry cranes that have safety-related defects.
- Repair must be carried out by a qualified person in accordance with directions from either the manufacturer or the competent person.
- Repair must be carried out under supervision of a competent person.
- Repaired components must be appropriately tested prior to being returned to service.
- Where a competent person's report recommends the bridge or gantry crane be scrapped, the crane must be locked out to prevent further use prior to decommissioning.
- Decommission any bridge or gantry crane that cannot be repaired or is not going to be repaired.

Records

A bridge and gantry crane service record book should be kept for each crane. The book should contain the following as a minimum:

- significant events concerning safety in relation to the bridge or gantry crane
- significant events concerning operation of the bridge or gantry crane
- documentation in relation to inspections by competent persons, and
- documentation in relation to maintenance.

Slings and accessories

Slings

A range of lifting gear is available to lift loads. The selection of lifting gear should take into account the manufacturer's recommendations, nature of the load, the potential for damage to the lifting gear or the load itself, the operating environment and the suitability for the type of lift being undertaken.

Synthetic Slings

- Synthetic slings are popular because of their strength, flexibility, good elasticity, and are relatively light and easy to handle.
- Synthetic slings are mostly used with loads that require protection from damage or because of their ability to provide good friction on slippery loads.
- The working environment must dictate the appropriate synthetic sling for the job. Synthetic slings are often made from polypropylene, polyester, polyamide, nylon or any combination of these.
- Synthetic slings are prone to damage and deterioration – sufficient inspection must be undertaken to ensure that slings are discarded prior to them becoming unsafe to use.

Chain Slings

- Chain slings are the most common load attachment hardware due to their comparative strength and durability.
- Chain slings can be identified by their markings or 'grade', which class them by their order of tensile strength.

Flexible Steel Wire Rope Slings (FSWR)

- Flexible steel wire rope slings are, in basic terms, a bunch of wires twisted together and wrapped around a core. Wires are bunched in groups, each bunch called a strand.
- Flexible steel wire rope slings are extensively used for lifting loads.

Fibre Rope

- Fibre rope should not be used for slinging.

Note: The wire rope that forms part of the crane's hoisting mechanism is not covered individually in this guide. This wire rope is referred to when talking about servicing of the crane. The standards relevant to maintaining wire ropes and their discard criteria can be found in AS 2759 – 2004 Steel wire rope application guide. This work should only be undertaken by a competent person.

Accessories

There are many accessories that are designed to be used with bridge and gantry cranes. This section provides a basic overview of good safety principles for lifting accessories.

From the hook to the load, the lifting gear can be made up of many parts. The weight of the load must not exceed the Working Load Limit (WLL). The weight of all the lifting gear must be calculated as part of the load for this purpose.

The working load limit of lifting gear is only as great as the part with the lowest working load limit.

To keep it simple, it's good working principle to ensure safety by configuring the arrangement where the sling is the accessory with the lowest rating and has a rating appropriate for the load to be lifted.

For example:

If the Working Load Limit (WLL) of:

- The hook is 2 tonnes.
- The shackle is 2 tonnes.
- The ring is 2 tonnes.
- The sling is 1 tonne.

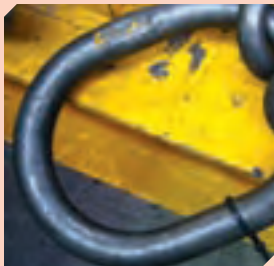
Then the WLL for the lift is 1 tonne.

General

Unacceptable Work Practice

All slings and accessories

- Slings and accessories are not labelled with the Working Load Limit (WLL).



Examples of worn, illegible labels.

Risk Control Solutions

All slings and accessories

- Each sling and accessory is labelled with the Working Load Limit (WLL).



Examples of labelled accessories.

- There is a formalised training procedure in place for operators.
- There are standard operating procedures in place for the selection, inspection, use, disposal and storage of slings and accessories.
- Unlabelled slings and accessories are not used.
- There is a system to report any damage that may have occurred to slings.

General (continued)

Unacceptable Work Practice

Synthetic slings



This synthetic sling's label is illegible.

Risk Control Solutions

Synthetic slings



These slings are labelled with their WLL and other appropriate information.

- Colour coding is not relied on as an indication of Working Load Limit (WLL) for synthetic slings.
- Synthetic slings labels include:
 - the material they are made from
 - month and year of manufacture
 - identifying mark to indicate batch no. and test certificate, and
 - manufacturer's identification.

General (continued)

Unacceptable Work Practice

Chain slings

- Chain slings are not tagged with their working load limit and identifying markings.



An ungraded chain showing effects of twisted links and stretched ring.

Risk Control Solutions

Chain slings

- Each chain sling is tagged with its WLL.



The WLL is indicated by the tag.

- Chain slings are graded and have identifying markings.



Note: Grade HA8 stamped in the link.

Selection

Unacceptable Work Practice

Slings and accessories

- No criteria are used for the selection of slings and/or accessories.

Risk Control Solutions

Slings and accessories

- The recommendations of the manufacturer are taken into account when selecting the appropriate slings and accessories.
- Each sling and accessory is designed and selected for the task being performed.
- The Working Load Limit (WLL) of the slings and accessories is matched to the load and other lifting equipment.

Inspection

Unacceptable Work Practice

All slings and accessories

- Slings and accessories are not inspected prior to each lift.
- Slings and accessories are not inspected by a competent person.
- There are no records of inspection by competent person(s) for each sling and accessory.

Synthetic slings



Examples of damaged synthetic slings.

Chain slings



Examples of worn chain showing wear in excess of 10% and stretching of the links.

Risk Control Solutions

All slings and accessories

- Slings and accessories are inspected prior to each lift.
- Slings and accessories are inspected by a competent person at least every three months.
- A record of every inspection by a competent person and the details of periodic inspections is recorded in an inspection record system and kept for each sling or accessory for its life.

Synthetic slings

- The following signs of damage (as a minimum) are looked for during each inspection of synthetic slings:
 - external wear on the cover
 - local abrasion
 - internal wear
 - damage to protective coating or sleeve
 - damage from high temperatures
 - sunlight degradation
 - chemical attack
 - label damage
 - deterioration of stitching
 - damage of any lifting eyes
 - damage at the connection to any terminal attachments, and
 - damage to any end fittings.

Chain slings

- Each tag is checked so the grading indicated matches the grading of the chain that it is attached to.
- Each individual chain link is inspected.
- The following signs of damage (as a minimum) are looked for during each inspection of chain slings:
 - wear, either internal or external, of more than 10%, and
 - signs of wear, twisting, stretching, nicks or gouging.
- Any worn links are measured to determine the degree of wear, which should not exceed that allowed for by the manufacturer.

Inspection (continued)

Unacceptable Work Practice

Flexible steel wire rope slings



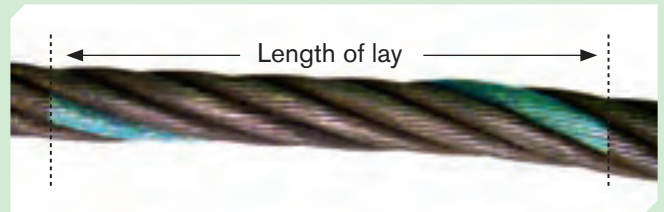
Examples of damaged flexible steel wire rope slings.

- Flexible steel wire rope slings are used with broken strands.

Risk Control Solutions

Flexible steel wire rope slings

- The following signs of damage (as a minimum) are looked for during each inspection of flexible steel wire rope slings:
 - observe the construction and lay of the rope
 - check for signs of rope wear, fatigue, damage and stretching
 - check the whole rope for multiple broken wires in the one spot (cut)
 - check the talurit or swaged splices for fatigue, corrosion, wear and broken wires where the rope enters a splice, and
 - check the whole rope for broken wires (max 10%) in any length of its lay.



Length of lay is where one strand travels around and back to its starting point.

Disposal

Unacceptable Work Practice

Slings and accessories


- Damaged and unlabelled slings and accessories are not immediately disposed of.

Risk Control Solutions

Slings and accessories

- Damaged and unlabelled slings and accessories are not used or repaired, but are clearly marked to indicate rejection, rendered inoperable and disposed of appropriately.
- See Appendix D for information on flexible steel wire rope.

Storage

Unacceptable Work Practice	Risk Control Solutions
<p>All slings and accessories</p> <ul style="list-style-type: none"> There is no designated area for the storage of slings and accessories. 	<p>All slings and accessories</p> <ul style="list-style-type: none"> Slings and accessories are stored off the ground on a properly designed rack in a clean, dry and ventilated place.  <p><i>Store slings and accessories properly.</i></p>
<p>Synthetic slings</p> <ul style="list-style-type: none"> Synthetic slings are exposed to agents that can affect their quality. 	<p>Synthetic slings</p> <ul style="list-style-type: none"> Synthetic slings are stored where they cannot be exposed to: <ul style="list-style-type: none"> – direct sunlight – ultra-violet light – extremes of heat – sources of ignition – contact with alkaline substance, or – chemicals.
	<p>Chain slings</p> <ul style="list-style-type: none"> Lightly oil chain slings before any prolonged storage. Never heat or heat-treat chain slings.
<p>Flexible steel wire rope slings</p> <ul style="list-style-type: none"> Flexible steel wire rope slings are exposed to corrosive substances. 	<p>Flexible steel wire rope slings</p> <ul style="list-style-type: none"> Flexible steel wire rope slings never come into contact with corrosive substances.
Fibre rope slings	
Unacceptable Work Practice	Risk Control Solutions
<ul style="list-style-type: none"> Fibre rope slings are available and/or used for lifting. 	<ul style="list-style-type: none"> Fibre rope slings are not used for lifting.

Specialised lifting equipment

The principles covered in the sling and accessories section of this guide apply to specialised lifting equipment. This section only covers additional requirements.

Magnets, vacuum and friction lifting attachments are often referred to as non-positive lifting attachments. Exclusion zones need to be set up to protect people from falling loads. Specialised training and work procedures are critical to minimise the risks associated with this type of equipment.

Workplaces often modify and use homemade lifting equipment. It is essential that this equipment be designed and tested so as to ensure safety.

See: Appendix E – example of procedures for custom and homemade accessories.

Magnetic, vacuum and friction

Unacceptable Work Practice	Risk Control Solutions
<p>General</p> <ul style="list-style-type: none"> Controls in use do not prevent accidental release of load. 	<p>General</p> <ul style="list-style-type: none"> Controls have a guard or supplementary push button to prevent accidental release of load. Lifting is conducted in exclusion zones. Warnings are fitted to indicate: <ul style="list-style-type: none"> batteries are in use batteries are low on power, and magnet not operating at full power.
	<p>Selection</p> <ul style="list-style-type: none"> Magnetic, vacuum and friction lifting attachments are selected with an adequate design factor to its rated capacity, taking into account: <ul style="list-style-type: none"> size of load shape of load, and mass of load.
<p>Inspection</p> <ul style="list-style-type: none"> Testing is not conducted daily to ensure: <ul style="list-style-type: none"> back-up batteries are charged and working warning devices are working to indicate power and battery failure, and power, battery and control interlocking devices are working. 	<p>Inspection</p> <ul style="list-style-type: none"> Critical testing is conducted daily to ensure: <ul style="list-style-type: none"> back up batteries are charged and working warning devices are working to indicate power and battery failure, and power, battery and control interlocking devices are working.

Custom and home made

Unacceptable Work Practice

General

- Customised and homemade lifting equipment is not designed by an appropriate engineer.

Risk Control Solutions

General

- Customised and homemade lifting equipment is designed by an appropriate engineer.
- Customised and homemade lifting equipment is fit for purpose.
- Customised and homemade lifting equipment is designed to be a fail safe attachment (only attach one way).
- Customised and homemade lifting equipment is designed with a deliberate action release.



This is an example of a custom made lifting accessory. This accessory has been certified for a rated capacity. It has been designed, tested and commissioned in accordance with Appendix E.

2.

Environment



Plant layout

Workplace traffic

Noise

Housekeeping

Lighting

Bridge and gantry crane operation can be affected by the environment of the workplace. This in turn can affect the overall health and safety of all employees. Plant layout and other physical situations need to be considered and addressed to ensure workers are not placed at risk.

Plant layout

The layout of plant should always be considered from a health and safety perspective, as well as from a production perspective. Bridge and gantry cranes run on runways, which gives the employer complete control of the crane operating area. The workplace should be set up so that a crane operator has the load in full view at all times.

The following matters should always be considered:

- the 'crane operating area' of the bridge and gantry crane
- the location of slings and other crane accessories
- the location of designated raw material and delivery areas
- raw materials are stored in an easily accessible area close to the start of the production area
- linear workflow through the production line
- clear areas of work
- elimination of blind spots
- traffic management and identified segregation
- the location of workstations, and
- manual handling of loads and lifting equipment.

Workplace traffic

A documented traffic management plan is crucial for resolving many hazards and risks. The plan should include bridge and gantry crane hazards and risks. The plan needs to address hazards and risks where bridge and gantry crane work interacts with worker, pedestrian, vehicle or other plant movements. This includes where multiple cranes operate on the same runway.

Traffic hazards that should be addressed include:

- pedestrian exclusion zones
- designated traffic zones
- loading and unloading zones
- right of way
- incident reporting and investigation
- blind spots
- site layout
- signage
- workstations in the 'crane operating area', and
- trapping spaces.

The involvement of HSRs and other employees – particularly a dogging or rigging person and/or bridge and gantry crane operator – is an essential part of this process. This involvement should result in many ideas and possible solutions.

The Traffic Management Plan should be regularly reviewed and updated when workplace changes or equipment upgrades occur.

Refer to WorkSafe Victoria's guidance booklet – *Forklift safety. Reducing the Risk*.

Noise

Bridge and gantry cranes can be located in a variety of workplaces. The noise from surrounding areas can impact on the safe operation of this plant. The noise regulations are to protect people from noise-induced hearing loss. There may be other noise-related hazards that impact on safe bridge and gantry crane operation. These hazards should be identified, assessed and controlled.

Where there is background or nuisance noise, an assessment should be conducted. Any identified hazards and/or risks should be controlled.

Background or nuisance noise can cause a hazard or risk as it can become a distraction or cause problems with communication. Background noise becomes an issue where it impacts on the effective communication of the bridge and gantry crane crew. Noise can also be a hazard when a worker is working within the 'crane operating area' and cannot hear that the crane has commenced work in the area.

Housekeeping

By implementing a good housekeeping plan, workplaces are kept clean and free of waste. Risk of injuries occurring due to slip, trips and falls, together with injuries resulting from hitting stationary objects, is also reduced. A tidy well laid out workplace can also increase work efficiency. Working zones in the 'crane operating area' particularly need to be kept clean and free of waste.

Items should be stored correctly with no parts protruding onto walkways. Electrical leads should not be on the floor; tools should have designated areas for storage; and bins for waste should be readily available and be easy to empty.

Structured programs that focus on organisation, cleanliness and standardisation can be introduced to the workplace to assist with this. Cleanliness can be maintained in a 'clean as you go' manner. Good housekeeping sets a clear environment that helps identify hazards and risks more effectively.

Lighting

The quality of lighting in a workplace has a significant effect on safety and productivity. Lighting should be sufficient so all areas of travel are lit for the crane operator to clearly observe the load and hazards at all times. Lighting also needs to be sufficient so that the bridge and gantry crane crew can perform tasks such as slinging correctly and safely.

The following actions can improve the lighting within the workplace:

- making full use of natural light by installing windows and skylights
- ensuring overhead and fixed lighting is at appropriate levels and is well-maintained and replaced when needed
- using task lighting with a flexible arm to enable light to be directed to the spot where light is needed, and
- painting ceilings and walls a lighter colour will allow more light to be reflected and assist in increasing the light within the workplace.

Refer to Australian Standards AS 1680 *Interior Lighting*.



Clear and well-lit work areas allow the crane operator to clearly observe the load.

3.

Work procedures

Information, instruction, training and supervision

Licences

Supervision

Information, instruction and training

The plant

The workplace

Planning the work

Production

Maintenance

Operating plant

Pre-operation

Operating the bridge and gantry crane

Parking plant

Maintaining plant

Reporting faults

General maintenance

Preventative maintenance

Recommissioning

Information, instruction, training and supervision

Each workplace will vary from other workplaces. This variation can occur in the workplace itself, the plant and/or the procedures. Bridge and gantry cranes vary significantly from one to another, as there are many makes, types, models and capacities. Each of them is designed for a specific range of work.

Licences

Competencies are required to operate all cranes. The following indicates whether a licence is also required:

- A licence is not required for bridge or gantry crane operation, providing that:
 - it is remotely controlled by way of pendant or radio, and
 - the crane does not have any more than three powered operations.
- A dogging licence or rigging licence is required when:
 - the operator exercises judgment in the selection of slings, the weight of the load or its centre of gravity, or
 - where there is a need to direct the bridge and gantry crane operator in the movement of the load.

Note: It is recommended that for bridge and gantry crane operation, the crane operator maintains line of sight with the load at all times.

Site specific training is required when employing a bridge and gantry crane operator or a person with a dogging or rigging licence. This training will need to cover (as a minimum) the specific equipment to be used and the site procedures.

Supervision

Safety supervision (supervision) is different from production supervision. The employer must supervise to ensure that employees do what is required for their own health, safety and welfare, including that of others.

Employees may fail to understand and follow instructions because:

- the instructions may not have been clearly expressed
- the system of work may not be sufficiently and clearly defined
- the system of work may not be practicable
- the relevance or importance of elements of systems of work may not be appreciated
- employees may not appreciate the dangers of not using or following safeguards, or
- work pressures, environmental conditions or other distractions may lead to inattention.

An employer may be in a position to personally supervise. The employer should ensure proper supervision is being undertaken where this task has been delegated. This can be done by reports from the person delegated. Supervisors must be competent, know how to best use specific risk controls and be supported in this role.

Where a person is being trained to acquire competencies and/or licences they must be provided with direct supervision. The supervisor of a trainee must be authorised by the employer and be a suitably competent person. Where the trainee is being trained in relation to licensed work, the supervisor must hold the relevant licence.

Information, instruction and training

It is recommended that formal training be undertaken by anyone responsible for the supervision or operation of bridge or gantry cranes, sling selection, lifting techniques and directing a crane operator.

Providing information, instruction and training is an important means of controlling risks. To be effective, training must be task specific and competency based.

Induction must be provided to all people who work on or in the vicinity of bridge or gantry cranes.

Health and safety representatives (HSRs) and any deputy HSRs must be allowed to attend OHS courses. They are entitled to attend an initial five-day HSR's course, as well as an annual refresher course with the training provider of their choice. The HSRs may also attend other training as is approved or conducted by WorkSafe Victoria.

The plant

Unacceptable Work Practice	Risk Control Solutions
<ul style="list-style-type: none"> No operator's manual is available on site. Employees do not have access to the operator's manual. Operators are not trained because they were employed in the role with a previous employer. 	<ul style="list-style-type: none"> Employers provide an operator's manual that includes the crane manufacturer's recommendations. Employers ensure the employee understands the instructions given in the operator's manual. Employer ensures crane operators are trained about the specific plant in use at the workplace, including: <ul style="list-style-type: none"> lockouts safety devices emergency stops operation, and maintenance requirements.

The workplace

Unacceptable Work Practice	Risk Control Solutions
<ul style="list-style-type: none"> There are no standard operating procedures in place. 	<ul style="list-style-type: none"> Standard operating procedures are in place. Crane operators have been inducted and are familiar with the area they will be working in, including: <ul style="list-style-type: none"> interlocking between plant, and exclusion zones in high risk areas. Supervisor(s) ensure that crane operators and dogging and rigging persons are familiar with any operating procedures and other site rules, including: <ul style="list-style-type: none"> emergency and evacuation procedures are in place, and procedures are in place for reporting faults, hazards and risks.

Planning the work

Safe operation of a crane can be achieved by planning the job prior to starting. This should be done for all work, including simple operations.

Production

Unacceptable Work Practice	Risk Control Solutions
<ul style="list-style-type: none"> • Loads need to be lifted over: <ul style="list-style-type: none"> – employees (in workstations) – pedestrians – mobile plant – structures where people could be inside (offices, etc.) – dangerous goods, including storage areas, and – obstacles that could be caught in the load. 	<ul style="list-style-type: none"> • The job is planned so that bridge and gantry crane operations do not lift loads over: <ul style="list-style-type: none"> – employees (in workstations) – pedestrians – mobile plant – structures where people could be inside (offices, etc.) – dangerous goods, including storage areas, and – obstacles that could be caught in the load. This is achieved via: <ul style="list-style-type: none"> – workplace design – exclusion zones – barriers – warning systems – work procedures, and – scheduling of work times. • All jobs are planned prior to starting them. • The job is planned so that travel paths and loads do not cause blind spots or crush points. • Exclusion zones are set up in high-risk areas, such as foundries where molten metal is moved and where magnetic, vacuum and friction lifting equipment is used. • Plans are clear about what plant and work processes have right of way over others. • Plans should be formalised in writing to form part of the standard operating procedures.

Maintenance

Unacceptable Work Practice

- Maintenance tasks are done on an adhoc basis during busy production times.

Risk Control Solutions

- Maintenance tasks are planned to eliminate interaction with bridge and gantry crane operation.
- A job safety analysis is prepared for all maintenance activities prior to work commencing.
- The work area is inspected prior to work commencing.
- Work conducted above or on bridge and gantry cranes is only done whilst the crane is locked out, an exclusion zone is set up, and the area is well signed.



Sign to indicate that work is being undertaken above. This work could be on or above the crane.

Operating plant

The task of operating bridge and gantry cranes is hazardous work. This work needs to be carefully planned and conducted by competent and trained personnel in accordance with specifically developed standard operating procedures to ensure safety.

Pre-operation

Unacceptable Work Practice

- Plant is not labelled with the Working Load Limit (WLL).
- There is no formalised training and refresher training procedure in place for operators.
- There are no standard operating procedures in place for plant.
- There are no pre-operational checks completed.

Risk Control Solutions

- Each piece of plant is labelled with the Working Load Limit (WLL).
- Formalised training procedure, including refresher training, is in place for operators.
- Standard operating procedures are in place for the inspection, use, repair, discarding and storage/parking of all plant.
- Pre-operational checks are conducted on all plant, including:
 - lockouts
 - safety devices, and
 - emergency stops.
- Where pre-operational checks identify uncontrolled hazards, the bridge or gantry crane is not put into service until it is safe to do so.
- Provide emergency exit from cabin.

Operating the bridge and gantry crane

Unacceptable Work Practice

- Operators are not trained, competent or don't hold the required licences.
- Crane operators are able to access high risk areas.
- Safety supervision is not adequate for the tasks being performed, the hazards that exist and the skills of the operators.

Risk Control Solutions

- Operators are trained, competent and hold the required licences.
- Exclusion zones are set up in high risk areas, such as foundries where molten metal is moved and where magnetic, vacuum and friction lifting equipment is used.



An example of a temporary exclusion zone.

- Appropriate safety supervision is provided for all crane operations.
- All malfunctions and hazards are recorded in the log book and repaired.
- Unsafe bridge and gantry cranes are appropriately disabled, tagged out, electrically isolated and not operated.
- The load is in full view (line of sight) of the operator at **all** times.
- Sufficient competent and appropriately licensed personnel are available to assist the operator where required.
- Bridge and gantry cranes are operated within their limits.

Operating the bridge and gantry crane (continued)

Unacceptable Work Practice

- People travel, work under or go under suspended loads:
 - crane operator
 - employees (in workstations),
 - pedestrians, and
 - mobile plant.

Risk Control Solutions

- Clear and defined pathways are provided and maintained for operators.
- Standard operating procedures are in place that prevent people from travelling, working or going under suspended loads:
 - crane operator
 - employees (in workstations)
 - pedestrians, and
 - mobile plant.



A clear path of travel.

Parking plant

When not in use, bridge and gantry cranes need to be parked. Parking bridge and gantry cranes in designated areas can prevent accidental damage. The bridge and gantry crane also needs to be secured to prevent unauthorised use.

Unacceptable Work Practice

- There are no procedures for parking bridge and gantry cranes.
- There is no designated parking area.
- No procedures are in place for preventing unauthorised use.

Risk Control Solutions

- Bridge and gantry cranes are driven to the designated parking area and parked.
- Crane is left in its unattended configuration.
- Isolate the crane using the established isolation procedures.
- Activate the storm brakes where fitted.
- Cabins, where fitted, are locked.
- Ensure that all controllers are isolated (where applicable).
- Isolation and other keys are removed to prevent unauthorised access.

Maintaining plant

In the introduction to this guide, we covered the effects of poor maintenance in relation to prosecutions. This is a critical area and planning these tasks goes a long way to reducing the associated risks. Supervision is another area that is critical in achieving safety in relation to maintenance tasks.

Reporting faults

Unacceptable Work Practice

- Faulty plant is not reported, recorded or tagged.
- Faulty plant continues to be used.

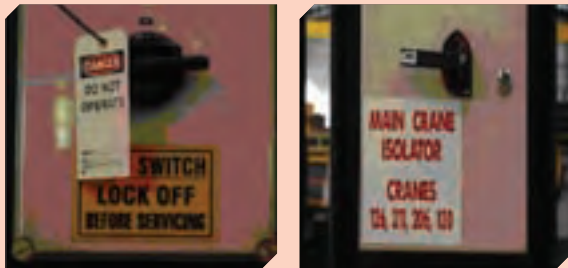
Risk Control Solutions

- Defective plant is noted in the logbook and reported to the supervisor or an authorised person.
- Defective plant is locked out, clearly marked to indicate rejection and rendered unusable pending a decision on how serious the fault is and whether the crane is repairable.
- Only competent people repair faults.

General maintenance

Unacceptable Work Practice

- There are no procedures for maintenance.
- Maintenance procedures are not followed.



Main isolation switch locked out with a cable tie and is incapable of being locked.

Risk Control Solutions

- There is a maintenance procedure that takes into account the recommendations of the manufacturer.
- Only competent people carry out maintenance tasks.
- The maintenance procedure is followed by all competent person(s) carrying out maintenance on the crane and accessories.
- Before carrying out any maintenance procedure on the crane, the main isolator should be switched off and locked in position.



Main isolation switch isolated and locked in the 'OFF' position.

General maintenance (continued)

Unacceptable Work Practice

- 'Lockout' procedures are not available or are not used.
- Workers are not able to lockout plant with their own lock.
- Any person can remove another person's lock.

Risk Control Solutions

- Each person involved in the maintenance work attaches their own lock to the appropriate switch.
- **No person is able to remove another person's lock.**
- Where there is more than one crane on a runway, all cranes will be shut down whilst maintenance work is carried out on a crane.
- Access platforms are provided for servicing bridge and gantry cranes.



Access platform for servicing the bridge and gantry crane.

Preventative maintenance

Unacceptable Work Practice

- There is no preventative maintenance procedure in place.
- Preventative maintenance procedures are not followed.

Risk Control Solutions

- Preventative maintenance is carried out regularly as specified by the designer or manufacturer of the plant or a competent person and is as per the maintenance procedure.
- Routine maintenance is conducted at least every three months unless specified by the designer or manufacturer of the plant or a competent person.
- The out-of-life maintenance is scheduled prior to the plant reaching its end of design life.

Recommissioning

Unacceptable Work Practice

- There are no formalised start up procedures in place.
- Start up procedures are not followed.

Risk Control Solutions

- There is a recommissioning and testing procedure that has been undertaken prior to restarting a bridge or gantry crane that has been decommissioned.
- Visual inspections are done to ensure that no other maintenance people are on or near the crane.
- All tags are removed once it is safe to do so.

4.

Information and guidance

General

- Employees can contact their union.
- Employers can contact their industry association.
- WorkSafe Victoria publications can be obtained by phoning WorkSafe on toll free **1800 136 089** or emailing **info@worksafe.vic.gov.au**.
- Visit WorkSafe Victoria on **www.worksafe.vic.gov.au**.

Legislation

- *Occupational Health and Safety Act 2004*
- *Dangerous Goods Act 1985*
- *Occupational Health and Safety Regulations 2007*

Other publications

- WorkSafe – *Consultation on Health and Safety: A Handbook for Workplaces*
- WorkSafe – *Your health and safety guide to Consultation*
- WorkSafe – *A Guide to Safety in the Metal Fabrication Industry 2007*
- WorkSafe – *A Guide to Safety in the Wood and Wood Products Industry 2007*
- WorkSafe – *Machinery and Equipment Safety – An Introduction 2007*
- WorkSafe – *Your health and safety guide to Managing Young Workers*
- WorkSafe – *Safety Tips for Young Workers*
- Australian Standard AS 2550.1 – 2005, *Cranes, hoists and winches – Safe Use – General requirements*
- Australian Standard AS 2550.3 – 2005, *Cranes, hoists and winches – Safe Use – Bridge, gantry, portal, jib and monorail cranes.*
- Australian Standard AS 1418.1 – 1997, *Cranes, hoists and winches – General requirements*
- Australian Standard AS 1418.3 – 1997, *Cranes, hoists and winches – Bridge, gantry, portal and jib cranes*
- International Standards ISO 4309 – 2004, *Crane wire ropes – methods for examination*
- Australian Standard AS 1353 – 1997, *Synthetic Web Slings*
- Australian Standard AS 4497 – 1997, *Synthetic Round Slings*
- Australian Standard AS 3776 – 2006, *Lifting components for Grade T chain slings*
- Australian Standard AS 1666 – 1995, *Wire Rope Slings*
- Australian Standard AS 2759 – 2004, *Steel wire rope application guide*
- Australian Standard AS 4991 – 2004, *Lifting Devices*
- Australian Standard AS 2549 – 1996, *Cranes (including hoists & winches) – Glossary of terms*
- Australian Standard AS 4024.1 – 2006, *Safety of Machinery*

For copies of the above Acts and Regulations, go to **www.dms.dpc.vic.gov.au** or phone Information Victoria on **1300 366 356**.

5.

Credits

WorkSafe Victoria wishes to thank the following organisations and their representatives for their valuable contributions to the development of this guide:

Australian Industry Group
Australian Manufacturing Workers Union
Australian Steel Institute
Australian Workers Union
Department of Industrial Relations QLD
Fabricated Metals OHS Working Party
National Union of Workers
Structural Steel Fabricators Association
Victorian Employers Chamber of Commerce & Industry
Workcover NSW

Thanks also to all the workplaces that participated in the *Fabricated Metals Industry Strategic Planning Day* in June 2007 in order to write this publication; as well as those who provided photographs:

All Lifting and Safety
Austin Cranes
Bullivants Handling Systems
Kenworth Trucks
Newskills
Valve Tech Engineering Pty Ltd

Appendices

Appendix A – An introduction to guidance material

The legal framework

There is a legislative framework that sets minimum requirements for controlling risk and for consultation in the workplace. This guide shows ways to comply in Victoria with the *Occupational Health and Safety Act 2004* (the Act) and relevant sections of the *Occupational Health and Safety Regulations 2007*. The rest of this Appendix gives a brief introduction to matters which are regulated by the Act.

Consultation

All employers are required to consult with their employees. This includes consultation with an independent contractor and any employees of the independent contractor. Employers must consult health and safety representatives (HSRs) where they exist. Consultation must cover hazard identification, risk assessment and risk control, as well as any proposed changes in the workplace, plant, substances or work processes that could impact on the health, safety or welfare of workers.

It is recognised that employee input and participation through consultation improves decision-making on health and safety. Apart from being a legal requirement, consultation between employers and employees is an essential part of effectively managing health and safety at work and a valuable means of improving health and safety and productivity outcomes.

There are many positive outcomes from consultation. Employers become more aware of hazards and occupational health and safety (OHS) issues experienced by employees. Employees can provide input and suggestions about how to solve OHS hazards and risks, and contribute to determining how work can be done more safely and efficiently. Effective consultation can often lead to employees taking more 'ownership' of risk controls. This in turn leads to better adherence of control measures.

See the further information and guidance section for references on consultation, page 31.

Representation

Employees are entitled to, and should be encouraged to, be represented in relation to occupational health and safety.

Elected HSRs have been an important feature of occupational health and safety in Victoria since 1985. It is widely acknowledged that HSRs can make a real difference in occupational health and safety. There is often a better safety culture with hazards and risks being raised, and better health and safety outcomes often achieved.

Issue Resolution

When a health, safety and/or welfare issue arises in relation to bridge or gantry crane operation, the employer and employees affected must attempt to resolve it. The employees are entitled to be represented by their HSR in this process.

Section 73 of the OHS Act details how health and safety issues are to be resolved at the workplace. The employer or their representative (i.e. manager, supervisor) and employees affected by an issue must try to resolve health and safety issues using agreed workplace procedures. The employer or representative attempting to resolve health and safety issues must be sufficiently senior and competent to act and make decisions. If the issue can't be resolved, a WorkSafe Victoria inspector can be called in to assist in this process.

For more information on the duty to consult, please refer to the WorkSafe Victoria's publications *Guides Talking Safety Together* and *Consultation – A User's Guide*.

Contractors

Employers' legal duty to provide and maintain a safe work environment applies to employees, contractors and labour hire workers.

Young workers

Young Victorian workers aged between 15 and 24 are more likely to be injured at work than any other age group. Young workers must be properly trained, supervised and provided with sufficient information so that they can work safely. Supervision especially needs to be tailored for young people's needs. See [worksafe.vic.gov.au/youngworkers](https://www.worksafe.vic.gov.au/youngworkers).

Reasonably practicable

When determining 'reasonably practicable' controls, Section 20 of the *Occupational Health and Safety Act 2004* outlines what you **must** take into account when deciding if something is 'reasonably practicable'. Specifically, the factors to be taken into account are:

- the likelihood of the hazard or risk eventuating
- the degree of harm that would result if the hazard or risk eventuated
- what the person concerned knows, or ought reasonably to know, about the hazard or risk and any ways of eliminating or reducing the hazard or risk
- the availability and suitability of ways to eliminate or reduce the hazard or risk
- the cost of eliminating or reducing the hazard or risk.

It's important to understand that all the factors listed above have to be taken into account when deciding if something is 'reasonably practicable'.

For further information, refer to the WorkSafe Position *How WorkSafe applies the law in relation to Reasonably Practicable*.

Appendix B – Terms used

Bridge and gantry crane: section 1 of this guidance gives a definition of bridge and gantry cranes.

Competent person: a person who has acquired through training, qualifications, experience or a combination of these, the knowledge and skills enabling that person to correctly perform the required task.

Control cabinet: is usually mounted on the bridge beam or end carriage and contains the main contactor, directional contactors and other ancillary electrical equipment. The crane isolator that turns off all motions of the crane is usually mounted on or near this cabinet. Note that this switch does not turn off the electrical supply to the crane.

Crab: is an assembly comprising of a trolley supporting one or more hoisting units arranged to travel across a bridge or gantry crane.

Crane: an appliance intended for raising or lowering a load and moving it horizontally. The use of the word 'crane' in this guidance refers to all cranes and is not limited to bridge and gantry cranes.

Dogging person (dogger): a person qualified to sling and direct loads.

Duty cycle: is the workload experienced by the bridge and gantry crane, working environment, frequency and severity of use.

Grade: indicates the strength of chain or flexible steel wire rope.

Hoist unit: contains the hoist motor, gearbox, rope and rope drum, hoist brake and the hoist limit switches.

Load factor: the fraction of the safe working load created by a particular slinging method.

Load Limiting Device (LLD): a device that will prevent the lifting of loads in excess of the working load limit.

Isolation switch: is usually located near the access ladder or maintenance platform. This switch isolates the crane from all electricity supply and should have the capability of being locked in the off position.

Plant: the use of the word plant in this guidance refers to all bridge and gantry cranes and accessories. It may also apply to other mobile plant.

Rated capacity: the maximum gross load that may be applied to the crane or hoist or lifting attachment while in a particular working configuration and under a particular condition of use.

Safe Working Load (SWL): refer to 'Rated capacity'.

Sling: lifting gear made from synthetic, chain or flexible steel wire rope.

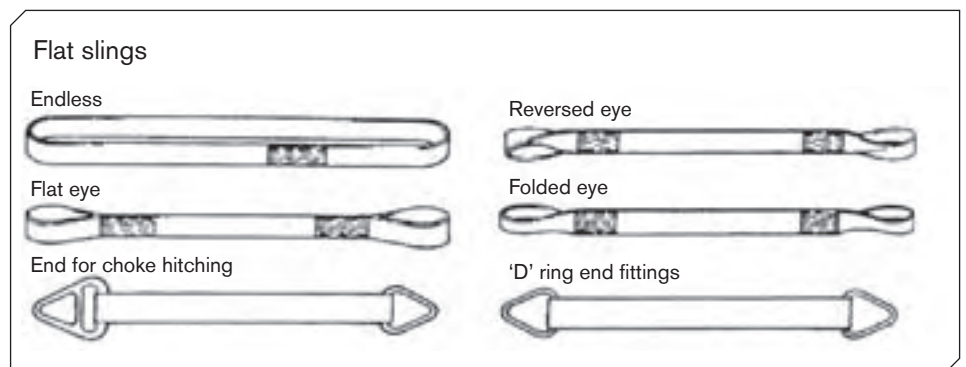
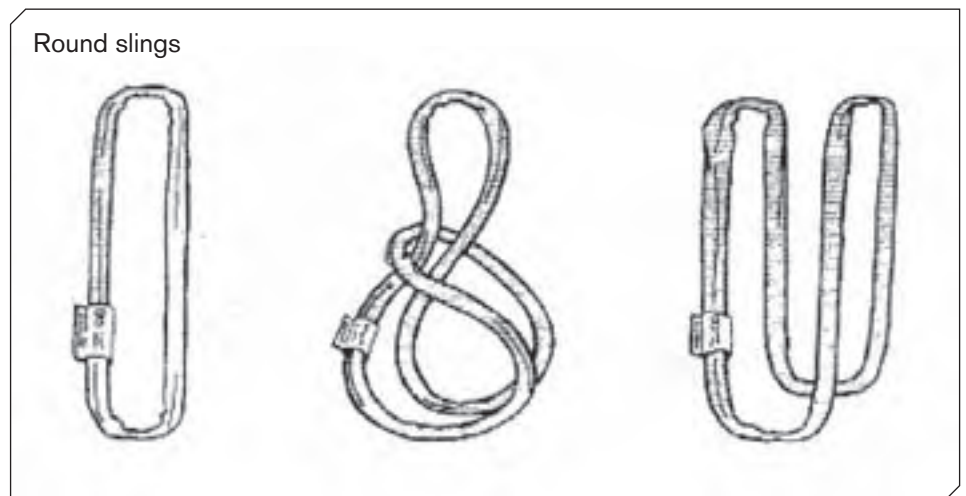
Traverse travel: is the movement of the crab from one end of the bridge to the other.

Work Load Limit (WLL): refer to 'Rated capacity'.

Appendix C – Flat webbing and round synthetic slings

Flat webbing and round synthetic slings are in common use for lifting in Australian industry. They are made from nylon, polyester, polypropylene or aramid polyamide, and should comply with Australian Standard AS 1353 *Flat synthetic-webbing slings*. Each sling must be fully labelled in accordance with AS 1353 and must include the Work Load Limit (WLL).

Types of synthetic slings and fittings



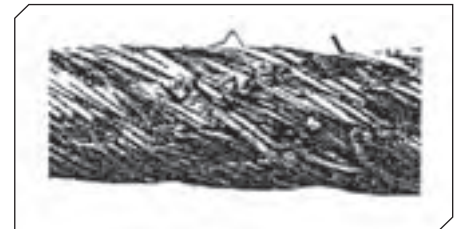
All slings are labelled with the WLL. Slings that do not have a label must not be used.

Appendix D – Discard criteria for flexible steel wire rope

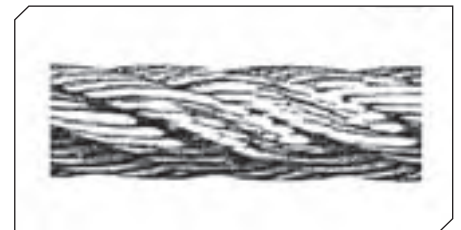
The following are examples of damage to flexible steel wire rope slings. Flexible steel wire rope slings that show these signs of wear, even to a lesser extent, should be discarded.

It should be noted that wire rope that is part of the crane (craneage) is not covered individually in this guide. This wire rope is referred to when talking about servicing of the crane. There are totally different standards with regards broken wires in relation to these parts, refer to Australian Standard AS 2759 – 2004, *Steel wire rope – Use, operation and maintenance*. This work should only be undertaken by a competent person.

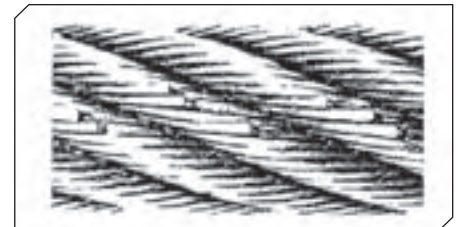
1. Mechanical damage due to rope movement over sharp edge projection whilst under load.



2. Localised wear due to abrasion on supporting structure. Vibration of rope between drum and jib head sheave.



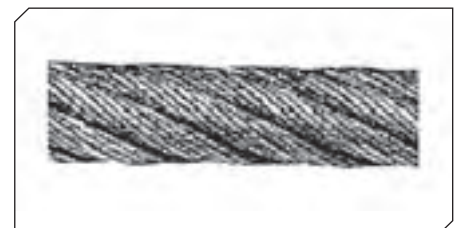
3. Narrow path of wear resulting in fatigue fractures caused by working in a grossly oversize groove or over small support rollers.



4. Severe wear in Lang's Lay caused by abrasion at cross-over points on multi-layer coiling application.



5. Corrosion of severe degree caused by immersion of rope in chemically treated water.



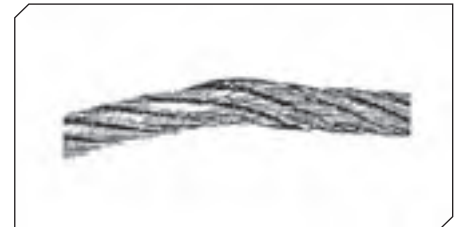
6. Typical wire fractures as a result of bend fatigue.



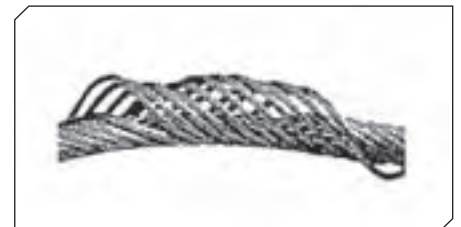
7. Wire fractures at the strand or core interface, as distinct from 'crown' fractures, caused by failure of core support.



8. Typical example of localised wear and deformation created at a previously kinked portion of rope.



9. Multi-strand rope 'bird-caged' due to torsional unbalance. Typical of build-up seen at anchorage and of multi-fall crane.



10. Corrosion of severe degree caused by immersion of rope in chemically treated water.



Appendix E – Example of procedures for custom and homemade accessories

Below is an example of an in-house procedure for labelling and certifying custom and homemade lifting accessories. The plant is tested, stamped and accompanied by a certificate of compliance from a NATA approved tester.

SERIAL#:	VWA023	CERT#:	96413
DATE:	15 MAY 08	TESTED BY:	Cert Lifters Pty Ltd
W.L.L.:	30 KG	COMPONENT DESCRIPTION	Battery lifter
DEPT USED:	Engine dress up		
		WEIGHT	10 KG
DESCRIPTION OF LIFTING EQUIPMENT:			
Box tube assembly with Eyelet Two bars with hooks			
APPLICATION OF LIFTING EQUIPMENT			
Used for lifting truck batteries into truck engine-bay on assembly line.			
			

Appendix E – Example of procedures for custom and homemade accessories (continued)

There is also a work procedure sheet that explains how to use the accessory correctly. There is also a training procedure for the lifting accessory.

Title: Lifting truck batteries into truck engine-bay on assembly line.

Equipment required: Battery lifter (serial #: VWA023)

1. Obtain battery lifter VWA023 and place on crane hook
2. Ensure that there are no employees, pedestrians or mobile plant in the working zone
3. Bring the battery lifter VWA023 over to the battery storage area
4. Lower the battery lifter VWA023 to the battery height
5. Align the battery lifter VWA023 hooks with the battery strap
6. Gently raise to check that the battery strap is securely attached to the battery lifter VWA023 hooks
7. Re-do step 2 and then gently move the battery to the truck engine bay
8. Lower the battery into the battery holder
9. Release the battery from the battery lifter VWA023
10. Re-do step 2 and return the crane to its parked position and initiate parking procedures
11. Remove the battery lifter VWA023 and place in the designated storage rack

WorkSafe Victoria

Advisory Service

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