



**WORKSAFE VICTORIA**

# **CONCRETE PUMPING**

APRIL 2004

**INDUSTRY STANDARD**











**THE PUMPING OF CONCRETE IS AN EFFICIENT METHOD OF MOVING AND PLACING CONCRETE. THIS BASIC PROCESS IS USED IN THE MANUFACTURE OF PRE-CAST AND TILT-UP PANELS, CONCRETE FORMWORK, SLAB CONSTRUCTION, CONCRETE PAVING AND CONCRETE SPRAYING.**

The construction and concrete pumping industries should be aware of the obligations to protect employees and members of the public under the various Victorian acts, regulations and codes of practice made under legislation relating to health and safety.

**This Industry Standard provides practical advice about the safe operation, maintenance and disposal of concrete pumping equipment. The emphasis is on ensuring a safe working environment whenever this equipment is used. It is not intended to be an all-encompassing design, maintenance and operation manual.**

This document sets out industry-wide guidelines for establishing and maintaining a safe working environment wherever concrete pumping is used.

Advice on the general design, maintenance and operation of concrete pumping equipment can be found in the referenced documents.

This Industry Standard is based on current knowledge and construction methods within the industry and is not intended to exclude other methods or processes that can be shown to meet the requirements of providing a safe workplace.

This Standard was prepared by a committee comprised of representatives from the building industry, industrial unions, the concrete pumping industry, equipment suppliers, the concrete pre-mix industry and WorkSafe Victoria.



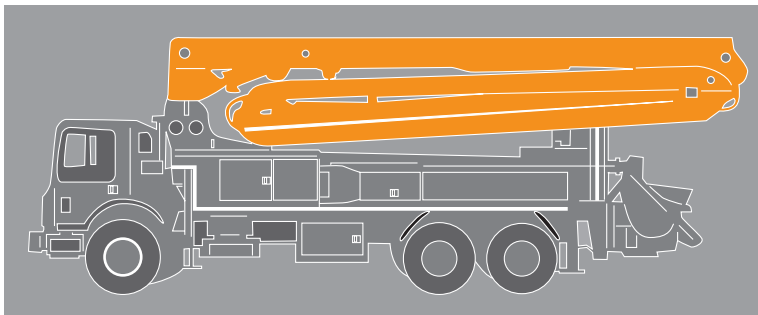
## INTRODUCTION

The committee comprised:

- Concrete Pumping Industry of Victoria
- Concrete Pumping Equipment Australia Pty Ltd
- Construction, Forestry, Mining & Energy Union (FEDFA Division)
- Construction, Forestry, Mining & Energy Union (Construction and General Division)
- Housing Industry Association
- Master Builders Association of Victoria
- Readymix Holdings
- Schwing Australia
- Stewart & Associates Australia Pty Ltd
- WorkSafe Victoria.

Consultation with WorkSafe Victoria ensured overall compatibility with occupational health and safety legislation and technical alignment with Australian Standards.

The Foundations for Safety full committee endorsed this document as an Industry Standard in October 2003. Foundations for Safety is a forum comprising representatives from Victoria's key construction industry stakeholder organisations.



*Truck mounted placing boom.*



### 1.1 PURPOSE

This Industry Standard provides practical guidance on health and safety issues in concrete pumping, to ensure as far as practicable, a safe working environment for persons engaged in the industry. It provides assistance to principal contractors, other involved contractors, pumping contractors and pump operators on how to meet their obligations to provide a safe working environment.

### 1.2 SCOPE

This Industry Standard applies to the supply, acquisition and disposal, inspection, maintenance, registration and safe operation of all types of concrete pumps and associated placing equipment used in pumping or spraying concrete in the construction industry.

### 1.3 RELATIONSHIP TO AUSTRALIAN STANDARDS

This Industry Standard is intended to complement the key Australian Standards dealing with concrete pumps and concrete pumping AS 2550.15 and AS 1418.15.

Unless specifically stated otherwise within this Standard, where any technical conflict arises between a provision of either of the above Australian Standards and a provision of this Industry Standard, the technical provision of the Australian Standard (as amended and reissued from time to time) should prevail.

### 1.4 REFERENCE DOCUMENTS

Documents referenced in this Industry Standard are listed in Appendix A. This appendix also provides a list of suggested documents for further reading.

### 1.5 DEFINITIONS

The definitions of terms used in this Industry Standard are given in Appendix B.



## SECTION 2 - HEALTH AND SAFETY

### 2.1 GENERAL

The *Occupational Health and Safety Act 1985* requires the provision of a safe working environment and the protection of persons at work against the risks to health and safety. To achieve this, it imposes duties of care on employers, employees and others, and requires employers and employees to co-operate in ensuring that workplaces and work practices are safe and without risks to health. Duties are also imposed on the suppliers of plant, including hirers and booking agents. The duties of employers to their employees extends to any independent contractors and their employees, in relation to matters over which the employer has control, or would have had control but for an agreement with the independent contractor to the contrary. Where the duties of different employers overlap, an individual employer's duty is in no way removed or limited under occupational health and safety legislation.

Employers should ensure that all employees have the opportunity to be fully involved in the development of procedures including hazard identification, assessment of risk and control of risk methodology.

Employers have a general duty to ensure the health and safety of employees while at work.

In particular, they must take all practicable steps to:

- provide and maintain a safe working environment
- provide and maintain facilities for the safety, health and welfare of employees
- ensure the risks associated with the set-up and use of concrete pumping equipment are controlled so as to be safe for employees
- implement appropriate inspection and maintenance regimes for concrete pumping equipment
- provide procedures to deal with emergencies that may arise while employees are at work.

An employee, before first commencing work, must be informed by their employer of:

- procedures to deal with emergencies
- hazards they are likely to be exposed to while at work
- hazards they may create while at work that could harm other people



- how to minimise the likelihood of hazards becoming a source of harm to themselves or others
- the location and correct use of safety equipment.

Employers:

- must inform employees of the results of any health and safety monitoring
- are also responsible for the health and safety of people who are not employees
- must take all practicable steps to ensure that employees do not harm any other person while at work, including members of the public or visitors to the workplace.

Employees must take reasonable care for their own health and safety while at work and must also ensure that their actions do not harm or place others at risk. They must co-operate with their employer on health and safety matters and must not interfere with or misuse anything provided by their employer to protect health and safety.

### 2.2 HAZARD AND RISK MANAGEMENT

Occupational health and safety legislation requires an employer to identify hazards and assess the risks in their workplace. Subsequent to this process, there is a requirement to implement, monitor and review risk control measures.

To ensure appropriate hazard management the employer, in consultation with the health and safety representatives and workers involved in the work, shall carry out an assessment of the risks.

#### 2.2.1 Hazard Identification

Employers must have in place an effective method to identify hazards and to determine whether there are significant hazards that require further action. A hazard is an existing, new or potential situation or event that could jeopardise the safe and healthy working environment. The presence of a hazard does not necessarily mean that control measures are required.

#### 2.2.2 Risk Assessment

A risk occurs when a person is within the vicinity of a hazard and exposed to the possibility of harm. In order to assess risk, you must consider the likelihood of harm occurring and the possible



## SECTION 2 - HEALTH AND SAFETY

consequence of that harm. When assessing the likelihood of harm occurring, factors such as how much, how often and over what time period a person is exposed, need to be considered. The assessment should be made on the basis of knowledge and experience of the hazard. Risk is always present when handling, transporting, erecting and operating concrete pumping equipment. Although component failure is rare, the consequences are always significant.

### 2.2.3 Manual Handling Hazards

An employer has a duty to identify any hazard, including hazardous manual handling tasks. These tasks must then be assessed and if a risk of injury is determined, control measures must be put in place. The general term used for a manual handling type injury is musculoskeletal disorder (MSD).

The tasks discussed below are some that have been recognised as likely causes of MSD. These and other manual handling tasks will have to be addressed:

- During set-up the pump workers are required to manually handle items such as timber pads, reducers, pipes and hoses. When handling these items, the terrain or the access to the work area may increase the risk.
- Clambering up formwork or over difficult terrain should not be allowed to occur, a safe means of access for all workers to the pour area must be provided.
- The use of hammers on clamps and the flapper box lever are tasks that if carried out in areas of restricted access may create an increased risk.
- The incorrect positioning of the pump, poor planning, ineffective boom placement, wind forces or oscillation due to pumping may cause the hose-hand to force and hold the hose in the required position to allow precise placement of concrete.
- The laying out of pipes is a task that can require carrying bulky objects. The risk presented by this task can be increased by long distances and the need to manoeuvre pipes around obstacles.
- Bending the back to move beneath objects and stepping over obstructions whilst carrying pipes also increases the risk.
- The location and design of the storage points on the truck for pipes, hoses, reducer, outrigger pads, etc. has a bearing on the postures used and the distance these items must be carried.



- The processes used to clear blockages in pipelines have the potential to create high risk actions. Similarly during clean-up or when removing and inverting the hose reducer to empty out concrete.

### 2.2.4 Cement Hazards

Overseas research has shown that between 5% and 10% of construction workers may be sensitised to cement. Exposure of the skin to cement can cause both irritant and allergic dermatitis.

Irritant dermatitis occurs due to the nature of the substance being abrasive and drying. Allergic dermatitis is an allergic reaction to a component in the cement. Subsequent exposure to cement can lead to repeated episodes of dermatitis which in turn can lead to the person having to leave the industry.

Where components in the cement or any additives to the concrete mix are classified as hazardous substances, the supplier of pre-mixed concrete should prepare and provide, Material Safety Data Sheets (MSDS) which contain all relevant information.

Wet cement can also cause burns when trapped against the skin. Barriers intended to prevent contact, such as gloves or boots, must not allow wet cement to be held against the skin.

Regular washing with soap and water is necessary to remove cement from the skin.

### 2.2.5 Noise Hazards

Continuous exposure to noise, above the 85dB(A) sound pressure level for an 8-hour day, will cause permanent hearing damage. Exposure to louder noise 90dB(A) for a shorter period of 2.5 hours in a day can have the same effect. An indication that the noise level exceeds 85dB(A) is if normal conversation is difficult when standing one metre apart.

Where an assessment shows that noise exposure from all sources is above the limit equivalent to 85dB(A) for an 8-hour day the employer must consider reducing time of exposure, increasing distance from the noise sources and providing hearing protection.

If workers in affected areas are provided with hearing protection to control exposure to noise, it must be worn at all times the noise level exceeds the limit. Audiometric testing is required when hearing protection is provided by the employer to control exposure to noise.



## SECTION 2 - HEALTH AND SAFETY

### 2.3 HAZARD CONTROLS

Where possible, the hazard should be eliminated or the risk of the hazard reduced by changing or modifying the proposed work method, construction method, or by use of alternative equipment.

Where the hazard cannot be eliminated, control measures must be implemented to isolate the hazard and to minimise risk to employees. In these circumstances, measures such as barricading areas of danger, provision of specific safety training and work instructions, use of protective equipment, and posting of warning signs should be implemented.

Such measures should be discussed with employees and evaluated to ensure that they are effective and do not create additional hazards.

The accepted means of planning to prevent injury is to identify, assess and then control the risk. At the control stage, there is a recognised hierarchy of hazard control measures that should be applied.

These processes for managing risk are included in various Occupational Health and Safety (OHS) regulations, and should be followed as part of the hazard management process.

### 2.4 JOB SAFETY ANALYSIS (JSA)

A Job Safety Analysis (JSA) that lists the hazards and includes safe work procedures should be prepared for each concrete pumping operation. A generic JSA may be acceptable or may be modified to reflect specific site situations. The minimum requirements for a job safety analysis include:

- an identification of the hazards
- an assessment of the risks and the control measures required to eliminate or minimise the risks from the hazards
- identification of the person responsible for implementing and monitoring the control measures.

### 2.5 GENERAL TRAINING

To work safely, employees must be trained and instructed in safe systems of work and work practices. Employers must ensure an appropriately experienced person maintains a high level of supervision of employees who are not yet deemed competent to carry out their work safely.



Education and training programs should address the identified occupational health and safety needs of employees and their managers. These programs should provide opportunities for individuals to have their existing skills recognised and to develop new knowledge and skills.

Such training should be in addition to, and not replace:

- general construction industry occupational health and safety induction training
- site-specific induction
- induction on this Industry Standard
- induction on the site concrete pumping JSA
- work activity briefings
- supervised practical experience programs, specific to the tasks being performed by the employee.

Where possible, any education or training program should be complementary to, or part of a program leading to nationally recognised qualification. These programs may need to be delivered by a registered training organisation and could include:

- occupational health and safety training to the industry competency standard as defined by the National Building and Construction Industry Training Board, Construction Training Australia
- First Aid training to the minimum requirements of WorkSafe's *Code of Practice, First Aid in the Workplace*
- identification of hazards and the control of risks, associated with the work practices carried out by employees
- the selection, care and use of protective clothing and equipment.

### 2.6 INCIDENT NOTIFICATION

WorkSafe must be immediately notified in the event of a workplace fatality, an injury requiring medical treatment, or a dangerous occurrence. This includes a failure or malfunction that results in the collapse, overturning, damage to concrete pumping equipment or pipeline or any significant damage to part of a building.

Further information is given in the WorkSafe booklet, *WorkSafe Incident Notification at a Glance* available from [www.worksafe.vic.gov.au](http://www.worksafe.vic.gov.au)



## SECTION 3 - PLANNING AND PREPARATION

### 3.1 GENERAL

Planning and preparation is the first step in ensuring the pumping of concrete is done safely and must involve consultation with all those engaged in the work.

Planning should incorporate the project's total pumping operational requirements. This plan may need to be reviewed each time a concrete pumping operation is scheduled, to take into account any unforeseen circumstances.

### 3.2 PRINCIPAL CONTRACTOR

The principal contractor, in consultation with other involved contractors and the pumping contractor should:

- ensure enough trained and competent workers are available to safely use the pumping equipment
- ensure pumping equipment is well maintained and in a sound mechanical condition
- select the most suitable location for the pump set-up, including:
  - an accessible, reasonably level area with a firm base, able to support the fully loaded working pump and any delivery trucks
  - clearance from obstructions and excavations
  - observing the 'NO-GO-ZONE' restrictions of operating near overhead powerlines
  - the pump's operational safety zone
- if the pump unit or delivery area is set up in the street:
  - observe all local by-laws
  - observe any VicRoads requirements for traffic management
  - ensure the general public is provided with safe and segregated access away from the pumping operation
- have an appropriate method for the collection of residue or waste concrete, before it enters the stormwater drains, which may result from:
  - concrete truck deliveries
  - spillage
  - the wash-out and cleaning of the pump or lines
- set a realistic time schedule for the pumping of concrete, allowing for:



- weather conditions
- capacity of the pump
- volume of concrete
- slab and site limitations
- VicRoads requirements
- local by-laws
- concrete contractor's work capacity.

### 3.3 CONCRETE PUMPING CONTRACTOR



*During planning and preparation locate hazards*

The concrete pumping contractor, after consulting with the other involved contractors, should ensure the most suitable location for the pump set-up is selected, including:

- an accessible reasonably level area within the operating capacity of the equipment
- a firm base able to support the fully loaded working pump and any delivery trucks
- clearance from obstructions and excavations
- observing electricity safety, including the 'NO-GO-ZONE' restrictions of operating near overhead powerlines
- the pump's operational safety zone.

The pumping contractor must ensure that any pumping equipment supplied is in a mechanically sound condition and has:

- permanently fitted legible identification on each piece of equipment



## SECTION 3 - PLANNING AND PREPARATION

- comprehensive operator's instructions or the manufacturer's operation manual(s)
- all the correctly positioned, legible warning and safety signs/stickers required
- all required safety equipment
- an adequate supply of packing for the stabiliser base plates
- an assessment completed of the risks of injury from all associated manual tasks
- current equipment maintenance logbook(s)
- any required transport authority permits and vehicle registration
- detailed maintenance and inspection records available upon request
- WorkSafe Victoria registration or interstate equivalent for:
  - a truck mounted concrete placing boom
  - most industrial pressure vessels, including those used in spraying concrete.

The pumping contractor must ensure:

- enough workers are available to safely pump concrete
- the operator is certificated if required
- safe systems of work are being followed
- Personal Protective Equipment (PPE) is provided and used
- other required safety equipment is supplied
- all workers are adequately supervised.

### 3.3.1 Other Equipment

Each mobile concrete pump should be equipped with all necessary safety equipment, including a:

- stocked First Aid kit (must include eye wash and protective creams)
- charged and current fire extinguisher
- sufficient number of reflective traffic cones (minimum 450mm high).

Additional safety equipment may need to be provided if the pump is set-up on or near a roadway and may include:

- pedestrian warning and diversion signs
- vehicle traffic warning signs
- traffic management equipment.



### 3.4 EQUIPMENT HIRER

A supplier who hires or leases out concrete pumping equipment has duties under the occupational health and safety legislation, including ensuring the pumping equipment is:

- well-maintained and in a sound mechanical condition
- provided with all necessary safe use and operating information
- provided with the required maintenance and inspection records
- registered by WorkSafe Victoria or an equivalent interstate authority for:
  - a truck mounted concrete placing boom
  - most industrial pressure vessels, including those used in spraying concrete.

### 3.5 EMPLOYEE TRAINING AND SUPERVISION

#### 3.5.1 Specific Training

Employers are required to provide information, instruction, training and supervision to employees, necessary to enable them to perform their work in a manner that is safe and without risk to health.

Information, training and instruction should include:

- safe work methods to be used in the setting up and operation of concrete pumping equipment
- emergency procedures
- identification of hazards associated with the use of the plant and equipment
- procedures for inspection and maintenance of concrete pumping equipment
- the use of the manufacturer's operation and service manuals
- the correct use, care and storage of:
  - personal protective equipment
  - other safety equipment
  - equipment logbook and equipment documentation
  - pipeline and hose sections
  - tools and equipment
- electricity safety involving the dangers of:
  - overhead powerlines
  - ground mounted electrical equipment
- the procedures to be adopted in the event of accident or injury.



## SECTION 3 - PLANNING AND PREPARATION

### 3.5.2 Supervision

Supervision must include sufficient monitoring of the work to ensure:

- that it is only carried out by competent workers
- that a truck mounted concrete placing boom is only operated by a (class PB) certificated person
- that agreed safe work practices are being followed
- the use of all protection systems and personal protective equipment.

### 3.5.3 Trainee Workers

The employer should ensure that a worker undergoing training is directly supervised by an authorised person who:

- understands what is required in providing supervision
- is competent in the use of the equipment
- can immediately take action to rectify any dangerous situation
- holds an operator's certificate (class PB) when using a truck-mounted concrete placing boom.

### 3.5.4 Personal Protective Equipment

The concrete pumping contractor should ensure their employees use appropriate personal protective equipment, which may include:

- eye and hearing protection
- leather and rubber work gloves
- both normal and rubber types of safety boots
- safety helmets
- sunglasses (safety type)
- wide brim hats
- sunscreen
- appropriate high visibility or reflective safety vests
- appropriate clothing for the weather conditions.



*Worker wearing personal protective clothing*



## 4.1 GENERAL

Concrete pumping equipment in operation should not create a hazard to the operators, other workers or the public.

## 4.2 ARRIVAL ON-SITE

When arriving on-site the concrete pump operator should be shown the set-up area and the site conditions reviewed with the other contractors involved in the pumping operation. Where any of the conditions under which the pumping equipment is to operate are not satisfactory or if confirmation of the equipment's mechanical soundness is not available, rectification should occur before pumping commences.

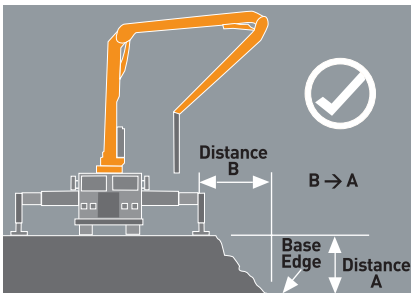
## 4.3 PUMP SET-UP

The concrete pumping area should be reasonably level, solid and free of obstructions, with careful attention paid to positioning of the pumping equipment and any stabilising devices:

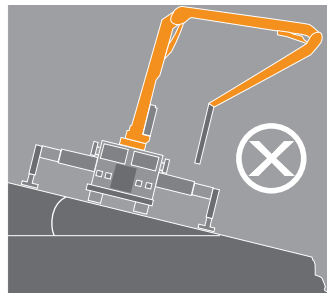
- clear of excavations, trenches or holes in the ground
- clear of inadequately compacted or soft ground
- clear of cellars, basements, pits or back-filled ground, unless approved in writing by a qualified engineer
- clear of overhead powerlines and fixed electrical equipment
- to allow for the safe operation
- to allow for the safe discharge of the concrete delivery trucks.

## 4.4 BOOM SYSTEM SET-UP

The boom placement system should be set-up level or at no greater angle than recommended by the manufacturer as specified in the operator's instruction manual.



Position pumping equipment clear of excavations



Boom should be set-up reasonably level



## SECTION 4 - SET-UP

### 4.5 OUTRIGGERS

Where outriggers are fitted ensure:

- adequate packing of sufficient strength and load bearing area is available for the outrigger stabiliser pads. Packing may include engineered bog mats or suitable timbers. The use of loose softwood timbers is not recommended
- before the boom is erected the outriggers are extended, lowered and locked in position
- wherever possible the outriggers should be fully extended
- if outriggers are not fully extended, the reduced safe operating radius must be known and recorded in the JSA
- the pads are clear of excavations, soft or filled ground or other obstacles liable to interfere with the safe operation of the machine
- regular inspections of the outrigger pads to check for subsidence and loss of stability
- the boom is folded in the travel position before raising the outriggers, when making any positioning adjustments.

### 4.6 PLACING BOOM

A concrete placing boom should not be:

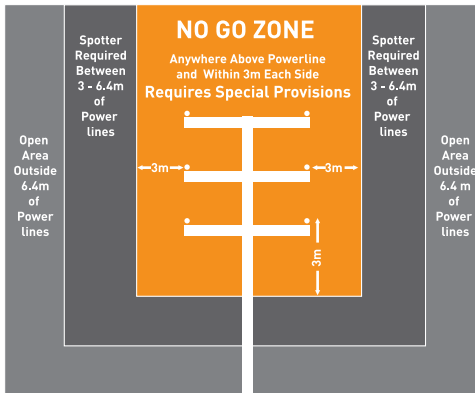
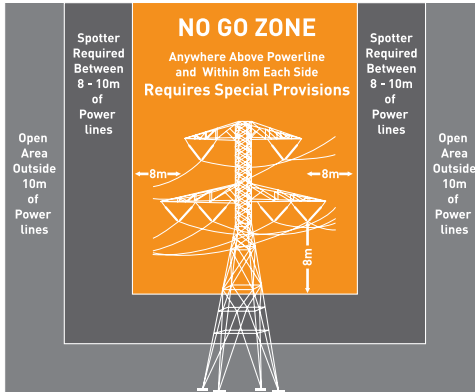
- raised or left extended when winds exceed the maximum safe wind speed for operation, specified by the manufacturer
- raised or left extended during an electrical or thunderstorm
- used as a crane
- used to pump concrete with the rams in tension, unless designed for this purpose
- raised, lowered or moved when there is insufficient light to do so safely.

In addition, any truck-mounted placing boom should:

- have the earth safety chain deployed before operation
- not be raised from the travel position if under a powerline, unless complying with section 4.7.



## 4.7 OVERHEAD POWERLINES AND OTHER ELECTRICAL EQUIPMENT



*No-Go-Zone clearances for concrete placing booms*

Where a concrete placing boom is to be set-up in the vicinity of aerial powerlines the principal and concrete pumping contractors must ensure, during all stages of the concrete pumping operation, no part of the concrete placing boom comes within 6.4 metres of pole mounted powerlines, unless complying with the requirements of the 'NO-GO-ZONE' rules.

The 'NO-GO-ZONE' rules are administered by Victoria's Office of the Chief Electrical Inspector (OCEI) and require that:

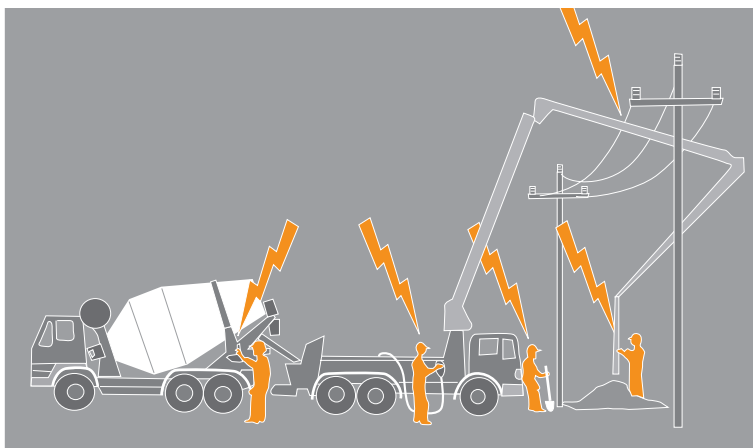


## SECTION 4 - SET-UP

- the boom never be extended over any live aerial powerline
- a trained spotter is in attendance when operating between:
  - 3 metres and 6.4 metres of a pole-mounted electricity cable
  - 8 metres and 10 metres of a tower-mounted electricity cable
- written permission from the local electricity distribution company, which contains any operating restrictions or conditions, is obtained before operating closer than:
  - 3 metres of a pole mounted electricity cable
  - 8 metres of a tower mounted electricity cable.

When any type of concrete pumping is being undertaken, the following should be observed:

- allow adequate ground clearances around sub-stations, service pillars, lighting poles
- the pump or delivery area should not to be set-up under powerlines unless complying with this section
- all powerlines and electrical equipment are considered 'LIVE' unless the distribution company states in writing the electricity has been isolated.



*Look up and live, comply with No-Go-Zone clearances*

Note: Tiger battens **do not protect people** from the risk of electrocution or electric shock, they only provide a useful visual warning for people working in the area of powerlines.



## 4.8 ENCLOSED SET-UP AREA

If the concrete pumping equipment set-up is in an enclosed or semi-enclosed area, special attention should be given to hazards created by the build-up of dangerous exhaust fumes and high noise levels.

### 4.8.1 Fumes

Ensure that engine exhaust gases from the pump and the delivery trucks are directed away to the open air and a build-up of fumes cannot occur in the work area.

### 4.8.2 Noise



*Beware of hazards when set-up in enclosed areas*

An increase to the normal operating noise level may occur due to sound being reflected back from other structures. Prolonged exposure to high noise levels causes permanent hearing damage. Suitable control measures may need to be in place to ensure those persons affected are protected. Persons likely to be affected include:

- all workers in the affected area
- the operator(s) of the concrete pump
- the drivers of concrete delivery trucks
- the operators of other associated equipment.



## SECTION 4 - SET-UP

When positioning the pump, consideration should be given to minimising the effect of the surroundings on workers overall noise exposure.

Note: For further general advice on noise hazards refer to section 2.2.5.

### 4.9 RECEIVING HOPPER

#### 4.9.1 General

The concrete pump should be positioned so the receiving hopper is at a height that allows a gravity flow of concrete from the pre-mix delivery trucks into the hopper. The concrete pump should not be operated unless the opening of the hopper is fitted with a safety grille:

- upon which no one is allowed to stand
- which prevents access to dangerous moving parts
- constructed of parallel or mesh bars complying with AS 1418.15
- which requires a tool to be removed, or
- which is connected to an interlocked cut-out switch designed to stop all moving parts if the grille is lifted.

#### 4.9.2 Hopper Guarding

A correctly fitted hopper grille reduces the risk of whole of body entrapment with the moving parts within the hopper. The grille, due to its design, can not protect against all possible contact with the moving parts. Equipment manufacturers use a range of measures to limit the likelihood of entrapment, including:

- the provision of a safety grille
- separating the operator's controls away from the moving parts
- the height of the hopper lip from the ground.

When working in the vicinity of the hopper, the manufacturer's operating and safety instructions should be strictly observed.

### 4.10 OPERATIONAL SAFETY ZONE

#### 4.10.1 General

Access to areas around the concrete pump and delivery pipeline may have to be restricted; the most appropriate method of isolating the area should be used.



The use of one or more of the following controls should be considered:

- covered walkways
- barricades
- posts and para-webbing
- posts and danger tape or flags
- appropriate signage.

Where the pumping or pipeline set-up is for a longer duration project, the isolation methods should be of a more permanent nature.

#### 4.10.2 Other People

No person, other than those workers directly involved in the concrete pumping operation, should be in the operational safety zone during the concrete pumping operation.

#### 4.10.3 Concrete Delivery Area

The concrete truck delivery area, including the area around the pump hopper, should be set-up to ensure:

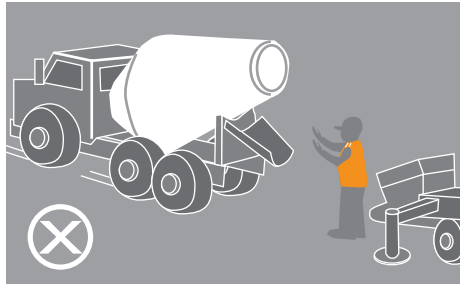
- workers are safe from other vehicles
- when pumping in non-daylight hours adequate lighting is provided
- appropriate signage is posted
- there is clear access for delivery trucks.

Where multiple concrete deliveries are expected and on-site traffic management is not provided, only one delivery truck can approach and discharge into the hopper at a time. When a designated on-site traffic controller is provided the following safety rules should be followed:

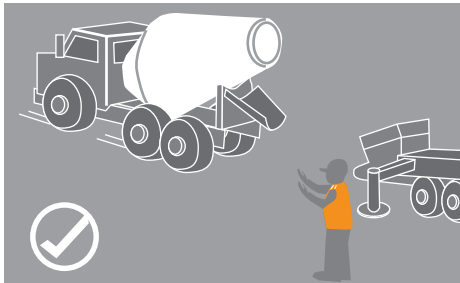
- all personnel connected with the discharging of concrete trucks are to wear appropriate high visibility or reflective safety vests
- all concrete delivery trucks must have operational reversing beepers
- the traffic controller and any truck driver discharging at the pump should be in positions which prevent them from being caught between the hopper and a reversing truck
- before proceeding, the traffic controller should warn the driver at the pump of the presence of another truck being reversed into position
- the traffic controller should be in a position visible to the



## SECTION 4 - SET-UP



Keep clear when truck is reversing into position, don't stand between truck and hopper



Keep clear when truck is reversing into position, ensure you remain in driver's view

- reversing driver and where the hopper area can be observed
- delivery drivers should ensure their vehicles remain clear of the discharge area, until signalled to reverse into position by the traffic controller
- if the driver loses sight of the traffic controller when reversing into position, the driver should stop immediately.

Additional information on the safe reversal of concrete trucks to pumps on construction sites can be found in WorkSafe's Guidance Note - *Hazards of concrete trucks reversing to discharge into a pump.*

### 4.10.4 Public Areas

If concrete pumping equipment or the pipeline is in an area accessible to the general public then the principal contractor will provide adequate control measures to protect the public from any dangers associated with the pumping operation.

#### A. Pedestrian Controls

Where the general public can come into close proximity of any part



of the concrete pumping operation, consideration should be given to:

- directing the public to an alternative footpath, or providing an alternative pathway
- the installation of protective screens to prevent concrete splashing on the public
- the erection of barricades and warning signs necessary to comply with VicRoads or Local Government permit requirements.

For longer duration projects, pedestrian controls should be of a more permanent nature.

## B. Traffic Controls

The principal contractor, in consultation with the pumping contractor, should provide adequate traffic control measures to comply with VicRoads or Local Government permit requirements.

Information on traffic control and management can be found in the *VicRoads Code of Practice – Traffic Management*.

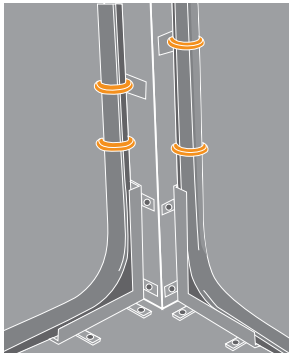
### 4.11 DELIVERY PIPELINE SET-UP

When installing a pipeline system, all individual components must be compatible and comply with the pump manufacturer's specifications for minimum pressure rating and maximum diameter. A pipeline should be installed in accordance with AS 2550.15, ensuring that:

- the pipeline can withstand the rated maximum concrete pressure of the pump during normal operations
- unnecessary bends are avoided
- each section of pipeline is adequately supported and secured to the building to avoid extra load on the pipe clamps
- when changing from horizontal to vertical, the pipeline is fixed to stop movement of the bend or the vertical and horizontal lines which may cause the 90° bend to snap off at the clamps
- cranes or hoist towers, scaffolding or formwork are not to be used to secure the pipeline unless designed for this purpose
- all metal pipes and pipeline components are identified and inspected before installation (refer sections 6.11 and 7.5)
- the designed pressure of the pipeline is compatible with the rated maximum concrete pressure of all pumps to be used on the pipeline during normal operations.



## SECTION 4 - SET-UP



Securely fix pipeline to prevent movement

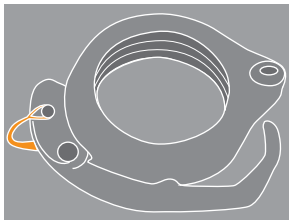
Note: Where a pump fails during operation, a replacement may be required to complete the pour and clean out the pipeline. If a pump of the same or lower (if suitable) pressure rating is not available, a higher pressure rated pump may be used to complete the immediate pour, provided:

- the concrete pressure rating of the pipeline is known
- there is a method of monitoring concrete pressure
- the operator is continually monitoring the concrete pressure
- the concrete pressure does not exceed the pressure rating of the pipeline.

Note: If the manufacturer provides a conversion factor, the pump's hydraulic pressure gauge may be used as an indicator of concrete pressure.

### 4.11.1 Pipe Clamps

All pipe clamps used on any pipeline system must be:



Quick release clamp with locking pin

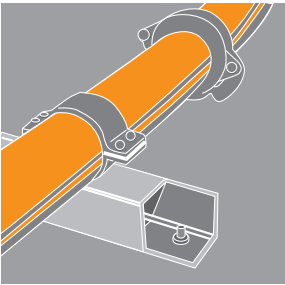
- able to sustain the maximum concrete pressure applied to the pipeline by the pump
- regularly inspected by a competent person for signs of wear or fatigue
- immediately replaced if deformed or damaged.



Quick release pipe clamps may only be used if manufactured with the provision for locking pins and are visually checked prior to each pumping operation. Locking pins, R-type or equivalent, are to be fitted and engaged when quick release pipe clamps are used on fixed or vertical pipelines or:

- where compressed air is used for cleaning pipelines
- the rated maximum concrete pressure exceeds 40 Bar.

#### 4.11.2 Pipeline Movement



Use anchor brackets to restrict pipe movement

The pipeline should be adequately secured to the building or structure, with attention given to the reaction forces generated where high pump pressures are involved. The mounting system should be designed to ensure the pipeline remains in place.

Support brackets in a vertical pipeline should be spaced no more than 3 metres apart, expansion anchors of the high-load slip control type or

other fixing methods of at least the same structural strength should be used if fixed to masonry.

Additional information on masonry fixing can be found in WorkSafe's Guidance Note – *Use of anchors as bracing inserts in precast concrete panels*.

The surging action of the pump should not cause excessive pipe movement. If required, additional anchor brackets or other suitable methods to restrict pipe movement should be used.

#### 4.11.3 End-Hose

The rubber delivery end-hose should:

- be inspected for excessive wear or damage prior to being fitted
- where connected to a boom, secured by a safety chain, sling or other retaining device
- not be longer than specified by the pump manufacturer.

Where concrete pumping has stopped and the hose is being manoeuvred over a work or public area, the operator must prevent concrete falling from the hose outlet. The hose should be fitted with a suitable stop or temporary end cap.

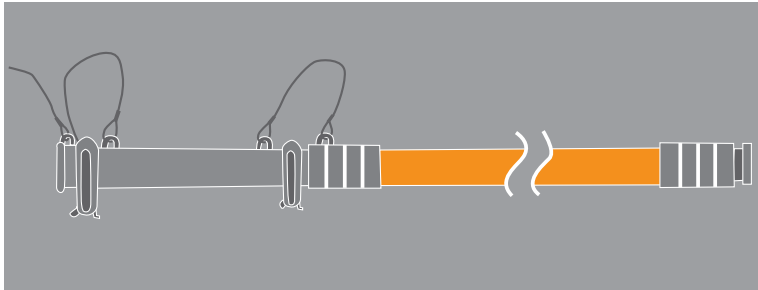


## SECTION 4 - SET-UP

### 4.11.4 End-Hose and Reducer Combination

If the delivery end-hose is replaced by a hose and reducer combination, only those combinations assembled to the manufacturer's instructions should be used, and:

- locking pins are to be engaged on all quick release pipe clamps in the assembly
- each piece must be capable of withstanding the rated maximum pressure of the pump
- each hanging piece is tethered by a safety cable, sling or chain
- the combined weight of all pieces **MUST NOT EXCEED** the weight of the manufacturer's recommended end-hose.



*End hose & reducer with safety slings*



### 5.1 GENERAL

To operate safely any type of concrete pumping equipment it is necessary to have enough workers to control the pumping operation. These workers need not be directly employed by the concrete pumping contractor, but require their employer's authorisation before commencing this work.

### 5.2 COMMUNICATIONS

The effective passing of directions from the hose-hand to the pump operator is essential for the safe pumping of concrete. The following sample methods may be used:

- Non-verbal: A set of standard hand signals which cover all of the pump's operational functions (refer Appendix C).
- Verbal: Standard operational phrases and may include the use of a dedicated two-way radio system.

### 5.3 PUMP AND BOOM OPERATORS

The operator of concrete pumping equipment should be trained in the operation of the type of plant being used and:

- be familiar with the operator's instruction manual(s)
- be able to carry out the daily maintenance inspection
- before pumping commences, carry out a visual inspection of the pipeline
- not leave operating equipment unattended
- not adjust the hydraulic pressure relief setting greater than specified by the pump manufacturer
- know the maximum rated concrete pressure of the pump and pipeline to which the pump is connected
- not pump concrete unless the hopper grille is in the closed position
- not stand or allow any other person to stand on the hopper grille or beneath the raised boom
- be located at the pump controls or if using a remote control have a clear view of either the hose-hand or the hopper
- follow the directions of the hose-hand
- if using hand signals and out of view of the hose-hand be assisted by another worker to relay directions



## SECTION 5 - OPERATION

- if out of view of the hopper have a worker positioned at the hopper to operate emergency systems and control the discharge process
- report defects to the pumping supervisor without delay, if considered to be a hazard to safety, stop pumping operations until repaired
- record daily inspections, defects and repairs in the logbook.

The concrete pumping operator shall have a certificate of competency (class PB) when operating a truck-mounted concrete placing boom.

### 5.4 PUMP OPERATOR/HOSE-HAND

When fitted with remote control facilities, the operator of a mobile concrete pump may operate as hose-hand and also control the concrete pump under the following conditions:

- a site-specific JSA has been completed that addresses all issues relating to this dual function (refer section 2.4)
- a worker is positioned at the hopper to operate the emergency systems and to control the discharge process.

Where a mobile concrete placing boom is to be controlled these additional conditions should be followed:

- any risks, if the equipment is accessible to the public or other workers, have been addressed in accordance with section 4.10
- the boom is visible to the operator and the pump is in audible range
- there are no obstructions which the moving boom may contact during the pumping operation.

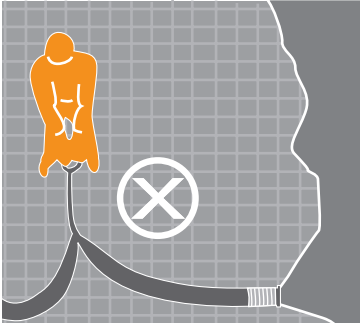
### 5.5 HOSE-HAND

The hose-hand should:

- be able to communicate with the pump operator at distance
- inspect the delivery hose for wear or deterioration before use
- be aware of the dangers and hazards of falling or tripping, particularly while manoeuvring the hose
- if possible, avoid working directly beneath the raised boom by manoeuvring the hose from the side



- be trained in the correct methods of manoeuvring the delivery hose
- not allow other workers to stand directly in front of the delivery hose or beneath the boom.



*Do not allow hose to kink*



*Let the boom do the work*

## 5.6 WORKERS

All workers engaged in the pumping of concrete should be instructed in the concrete pumping JSA. Where it is applicable to the tasks being undertaken, additional instruction may need to include:

- the equipment's emergency shutdown systems
- manual handling procedures relating to concrete pumping
- non-verbal communication if relaying directions
- basic traffic management if directing reversing pre-mix concrete delivery trucks.

Only those workers who are appropriately trained in traffic management and road safety procedures should act as road traffic controllers.

Note: Generally, drivers of pre-mix concrete delivery trucks should not be considered workers for concrete pumping operations, unless trained to carry out this function and authorised to act in this capacity by their employer.



## SECTION 5 - OPERATION

### 5.7 TRAINEE WORKERS

Trainee workers shall be under the direct supervision of a suitably trained or certificated worker who has been appointed to act as supervising worker by the employer and can immediately take action to rectify a dangerous situation.

### 5.8 CONCRETE DELIVERY DRIVERS

When delivering to site it is essential that all concrete delivery drivers follow the directions of the worker(s) responsible for controlling traffic and the concrete discharge process. This is critical when multiple trucks are discharging or manoeuvring at the pump site.

A number of injuries to pre-mix concrete mixer drivers, caused by pump lines and couplings bursting have occurred.

The following actions should be undertaken by drivers working near concrete pumping operations:

- stand well clear of pump lines and couplings where practicable
- wear all required personal protective equipment
- immediately report any safety problems to the pump operator or foreman for action.

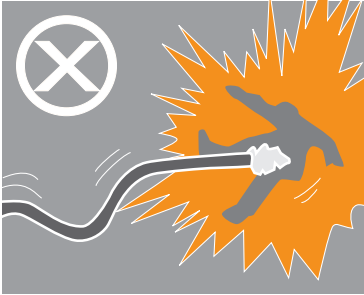
### 5.9 CLEANING OF EQUIPMENT

Cleaning out of residual concrete from concrete pumping equipment should only be carried out by trained workers in accordance with the manufacturer's procedures or the detailed written instructions developed by a competent person. When concrete pumping equipment is being cleaned out, ensure another person is in the immediate vicinity to provide help in an emergency.

#### 5.9.1 Pipeline

When cleaning out any pipeline the following safety precautions should be observed in any clean-out procedure:

- the end-hose to be secured or removed before cleaning to prevent the hose whipping around
- the discharge end of the pipeline to be fitted with a cage to safely catch the cleaning device but at the same time allow the concrete to flow



*End-hose should be secured or removed*



*Keep clear of discharge end of pipe*



*Never dismantle pipeline while under pressure*

- all workers are to be kept clear of the discharge end while the concrete is under pressure
- never attempt to dismantle the pipeline while it is still under pressure.

When compressed air is used to clean the pipeline, the following safety precautions should be applied:

- the air entry point to the pipeline is to be fitted with:
  - a large diameter discharge air ball valve, to allow de-pressurisation (venting) of the line before the removal of the pipe sections
  - a smaller air entry ball valve
  - a pressure relief valve
  - a pressure gauge, to show the air pressure in the pipeline.

### 5.9.2 Semi-permanent Pipeline

Where a semi-permanent pipeline is installed, as in a large construction project, the clean-out procedure(s) should be specifically designed for that installation, taking into account the general requirements in section 5.9.1 and any related specific site conditions.

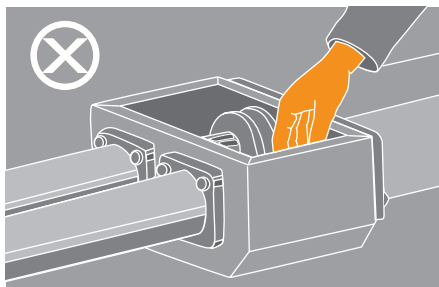


## SECTION 5 - OPERATION

### 5.9.3 Pump and Hopper

When cleaning out the pump or hopper the operator should ensure the manufacturer's cleaning instructions are followed. To prevent the risk of entanglement the following should be considered:

- mechanically locking moving parts in position
- shutting down the equipment
- disengaging the hydraulic pumps
- exhausting accumulated hydraulic or air pressure and allowing time for the pressure to be fully released from all systems
- ensuring the pump is not under pressure before it is dismantled
- not allowing any part of the worker's body to be placed into the pump or hopper while cleaning.



*Dangerous cleaning practices*

Note: Where fitted, the interlocked cut-out switch on the hopper grille should not be relied on to prevent movement of parts during cleaning.



*Dangerous cleaning practices*

### 5.10 PREPARATION FOR ROAD TRAVEL

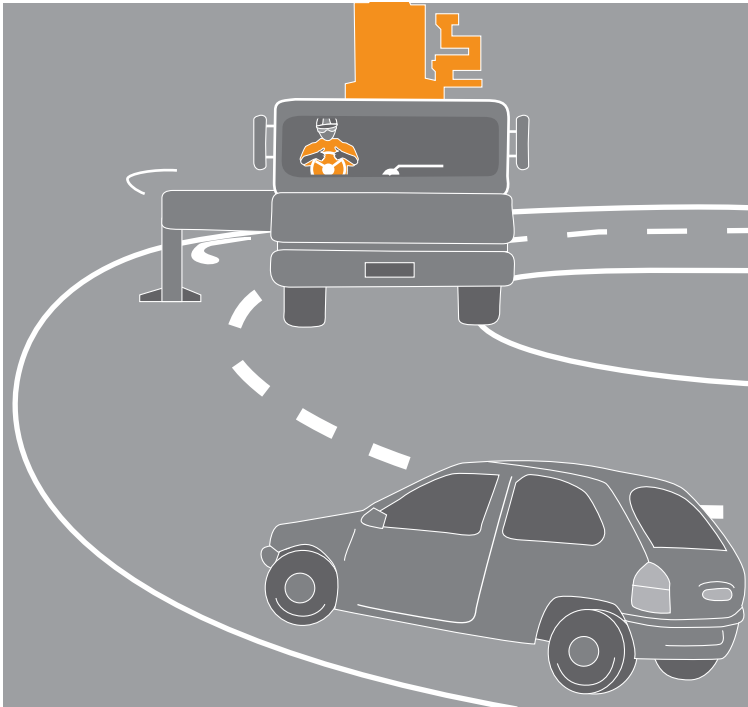
The manufacturer's instruction manual must always be followed and may include:

- the boom being folded and placed in the travel position before the outriggers are retracted and securely stowed in the travel position with locking devices engaged

## SECTION 5 - OPERATION



- any loose components (such as pipes, couplings and tools etc.), must be correctly stowed or restrained on the vehicle as per the *NRTC-Load Restraint Guide*
- all power take off (PTOs) drives to hydraulic pumps for the concrete pump, boom and outriggers are disengaged and the controls put in the OFF position
- before moving, visually inspect the vehicle to confirm everything is secured.



*Confirm everything is secured before moving*



## SECTION 6 - EQUIPMENT

### 6.1 GENERAL REQUIREMENTS

All concrete pumping equipment should fully comply with Victoria's *Occupational Health and Safety (Plant) Regulations 1995* and the 1418 series of Australian Standards including AS 1418.15 – *Concrete Placing Equipment*, or the equivalent overseas standards.

### 6.2 DOCUMENTATION

Any equipment, new, used, imported or of local manufacture, should be accompanied by all the appropriate documentation, including evidence of the compliance required above, which should be retained for the life of the equipment. All documentation, including operation and safe use instructions, should be in English.

### 6.3 WORKSAFE REGISTRATION

All equipment required to be registered under the Victorian *Occupational Health and Safety (Plant) Regulations 1995*, shall be registered with WorkSafe Victoria or an equivalent interstate authority before being used.

In Victoria, the types of concrete pumping equipment which require registration are truck-mounted concrete placing booms and some pressure vessels.

Pressure vessels categorised as hazard level A, B, or C, according to the criteria identified in AS 4343 – *Pressure Equipment – Hazard Levels*, are required to be design notified and/or registered. These pressure vessels are required to be regularly inspected.

Note: As a general rule of thumb, a pressure vessel will require design notification and/or registration if the following calculation equals or exceeds 100.

Vessel storage pressure (MPa) x Volume (litres).

### 6.4 DISPOSAL AND ACQUISITION OF USED EQUIPMENT

When selling or disposing of used concrete pumping equipment, the supplier should identify any components of the plant that are unserviceable. The components of the plant that are unserviceable may constitute a hazard in the operation of the plant. Where plant is identified as not fully serviceable, the supplier shall inform the purchaser in writing that the plant should not be used until the plant is fully serviceable.



The supplier should provide any information in their possession relating to the safe use of the equipment and any inspection, maintenance and repair records.

It is recommended that prior to purchasing any concrete pumping equipment, an experienced engineer or the manufacturer's agent or representative or similar competent person, inspect the equipment and determine if its condition is such that it can be expected to be safe for use or the repairs necessary to make it serviceable.

The purchaser of any registered plant must advise WorkSafe Victoria within 21 days of the change of ownership.

### 6.5 ACQUISITION OF UNSERVICEABLE EQUIPMENT

A person who acquires concrete pumping equipment in need of repair shall ensure this equipment, before it can be returned to service, complies with the *Occupational Health and Safety (Plant) Regulations 1995*. An experienced engineer or the manufacturer's agent or representative or similar competent person, should certify in writing that the unit complies with the appropriate standard(s), and its condition is such that it can be expected to be safe for use until its next scheduled inspection.

Where a record of the maintenance and inspection is not supplied with the equipment, it should be subjected to a major inspection and assessment in accordance with section 7.3.1 and AS 2550.15, to determine the equipment's suitability for use.

### 6.6 PIPELINE COMPONENTS

The manufacturer or supplier must certify that all materials, pipes, hoses and accessories are safe to use in concrete pumping systems and are within the calculated design pressures. When components from different manufacturers are assembled, all components should be compatible, and the pipeline will have the design pressure of the lowest rated component.

### 6.7 HYDRAULIC SYSTEMS

The main hydraulic control panel should be fitted with an easy-to-read accurate gauge that indicates the hydraulic fluid pressure supplied to the concrete pumping equipment. The entire concrete pumping system shall be protected against over-pressurisation.



## SECTION 6 - EQUIPMENT

Where variable pressure is available, the maximum adjustment shall not exceed the manufacturer's recommended maximum safe operating pressure.

### 6.8 CONTROLS

All concrete pumping equipment controls should comply with the relevant requirements of AS 1418.1 including:

- fitment with emergency stop button(s) that immediately stop all movement and pumps
- controls clearly marked with symbols or words to show their function
- where practicable, movement of controls should correspond with direction of motion being controlled
- all controls, when released, return to the neutral position
- where multiple control positions are fitted, be operable from only one position at a time.

### 6.9 EARTH CHAINS

An earth chain should be fitted to all mobile boom pumps:

- made of at least 10mm diameter steel
- either bolted or welded to the carrier chassis
- with at least one metre of length in contact with the ground when outriggers are set up
- with a ground driven spike provided.

### 6.10 IDENTIFICATION

#### 6.10.1 Data Plates and Vehicle Permits

Concrete pumps and associated equipment prior to operation shall have:

- all required vehicle permits and road registrations
- if a truck-mounted placing boom, WorkSafe Victoria or equivalent interstate registration
- legible and permanently marked data plate(s) in prominent position(s), containing:
  - manufacturer's, distributor's or certifying competent person's name
  - date of manufacture or if unknown the date the data plate was issued



- make and model numbers if known
- serial number.

In addition, a concrete placing boom's data plate should include the:

- rated length and height of the boom
- maximum allowable concrete pressure
- maximum length and nominal size of the end (or drop) hose
- maximum nominal size of delivery pipe
- maximum loading, if fitted, of each outrigger leg.

In addition, a concrete pump's data plate should include the:

- maximum hydraulic pressure
- maximum concrete pressure
- capacity of the pump.

A vehicle chassis on which is mounted any concrete pumping equipment shall:

- be road registered if travelling on public roads
- be in a roadworthy condition
- have an engineer's report for any structural alterations
- if required by transport regulations, have a VicRoads or interstate driver's logbook, valid over length and overweight permits.

### 6.11 PIPELINE AND HOSE SECTIONS

Prior to being placed in service, each pipeline and hose component should be clearly and permanently identified with a unique mark or number to distinguish it from other components in the pipeline.

The following information should also be permanently recorded on the pipe or in the pipeline inspection logbook:

- the grade of pipe
- designated pipe diameter
- maximum concrete pressures and minimum wall thickness
- if flexible hose, then the manufacturer's recommended maximum operating pressure.

### 6.12 MANUALS AND LOGBOOKS

The pumping contractor or hirer must ensure the pumping equipment has:



## SECTION 6 - EQUIPMENT

- a copy of the manufacturer's operator's manual, or sufficiently detailed written instructions developed by a competent person, covering:
  - transportation
  - set-up and safe operation
  - emergency procedures
  - minor maintenance and repairs.

Note: Pumping equipment should only be operated under those conditions specifically covered in the above operator's manual.

- a maintenance logbook that contains the information listed on the data plates and has been maintained up-to-date listing:
  - any defects found
  - all repairs carried out
  - details of all equipment inspections
  - details of monthly pipe inspections
- maintenance records that are up-to-date with comprehensive details of repairs, modifications, and inspections and are available upon request
- repair manuals that are kept up-to-date with any additional information from the manufacturer.

The pumping contractor or the principal contractor must ensure the pump operator is trained and competent in:

- the use of the operator's manual or instructions
- carrying out the daily operational inspections
- maintaining the logbook.

### 6.13 WARNING AND SAFETY SIGNS

The pumping contractor or hirer must ensure that all appropriate warning and safety signs/stickers are legible, in good condition and correctly positioned on the equipment.

**WARNING**  
**OUTRIGGERS MUST BE FULLY  
EXTENDED AND ON A FIRM  
BASE BEFORE RAISING BOOM**

*Warning and safety signs must be legible*

**CAUTION**  
**THE CONCRETE  
PLACING BOOM MUST  
NEVER BE USED AS  
A CRANE**



### 7.1 GENERAL

A preventative maintenance and inspection regime is essential for safe and efficient operation of concrete pumping equipment.

#### 7.1.1 Program Types

This maintenance and inspection regime should follow either:

- A. a program designed by a competent person to comply with the requirements of AS 2550.15
- B. a program based on the manufacturer's recommendations in consultation with a competent person. This type of program can only be established where there are verifiable records that:
  - i) the concrete pumping equipment has been continually maintained in accordance with those recommendations since the pump was first put into service
  - ii) the manufacturer, at the time of purchase, had inspected the used concrete pumping equipment and issued a certificate stating it is deemed satisfactory for continued service and has been maintained in accordance with the manufacturer's recommendations since being put back into service.

#### 7.1.2 Program Structure

The maintenance and inspection program should include provisions for:

- pre-operational checks and tests
- routine inspection and maintenance at specified time intervals
- recording in the logbook and maintenance records all:
  - inspections and maintenance
  - defects found and repairs undertaken
  - structural alterations.

### 7.2 ANNUAL INSPECTIONS

#### 7.2.1 General

All concrete pumping equipment should be subject to an annual inspection by a competent person at intervals not exceeding 365 days.

Where there are no verifiable records of previous maintenance, inspection, repairs or modifications, a major inspection should be carried out by the competent person to determine the equipment's suitability for use.



## SECTION 7 - MAINTENANCE AND INSPECTION

### 7.2.2 Criteria

The annual inspection should be in accordance with the defined maintenance and inspection regime and will include a report on specific critical wear and stress areas.

The inspection will also include an audit of the equipment's logbook to:

- determine that the required inspections and maintenance have occurred
- review the record of defects
- ensure the necessary repairs have been carried out.

### 7.3 MAJOR INSPECTION

The purpose of this inspection is to ensure that older equipment is suitable to continue in service.

#### 7.3.1 Assessment for Continued Service

All concrete pumping equipment over six years old that does not meet the requirements of section 7.1.1.B. should be subject to an initial major inspection in accordance with AS 2550.15.

This inspection report, prepared by a competent person, should include:

- a confirmation of visual and selected strip-down of critical components as required or where necessary
- any defects discovered and all remedial actions undertaken to bring the equipment up to standard
- an assessment of the mechanical condition of the equipment
- a review of the existing inspection and maintenance regime to assess its continued suitability and modify as required
- a confirmation of the implementation of the inspection and maintenance regime
- a specified time period (not greater than six years) until the next assessment for continued service.

### 7.4 REPAIRS AND MODIFICATIONS

Any repairs made to concrete pumping equipment should follow the detailed instructions of the manufacturer or the competent person, and as outlined in the maintenance and repair manuals.



All repairs and any replacement of components should be:

- carried out by trained and competent persons
- compatible with the equipment and parts supplied from the manufacturer
- recorded in the logbook
- detailed in the maintenance records.

The fitment of any concrete pumping equipment which involves modifications to a carrier vehicle should comply with the *National Code of Practice – Heavy Vehicle Modifications*.

### 7.4.1 Welding

The welding of any type of concrete pumping equipment or pipeline component should be:

- carried out by a suitably qualified welder
- recorded in the logbook
- detailed in the maintenance records.

Outriggers and concrete placing booms or any other stressed load bearing components should be welded in accordance with AS/NZS 1554 by a qualified welder, competent in welding these high stressed components.

## 7.5 TESTING PIPELINE COMPONENTS

All metal pipes and pipeline components should be checked for wall thickness at frequent intervals and the results of such inspections recorded. Any used components in storage should be tested before being returned to service. Piping that has a wall thickness less than the recommended thickness for the pump's designed maximum concrete pressure should not be used.

### 7.5.1 Criteria

Wall thickness testing should be by ultrasonic test instrument or other suitable method. All testing shall be carried out by competent persons. The test equipment should be calibrated regularly and maintained according to the manufacturer's requirements.

Pipe must not be used if the wall thickness is less than that recommended by the pipe manufacturer for the maximum concrete pressure of the pump. The suppliers of pipes for concrete pumps should be able to provide data on the minimum pipe wall thickness for differing pump pressures. The minimum wall thickness of single



## SECTION 7 - MAINTENANCE AND INSPECTION

wall pipe is dependent on the grade of pipe, the maximum working concrete pressure of the pump and the diameter of the pipe.

Where the supplier's information is not available, minimum wall thickness is able to be calculated using the formula in AS 4041-*Pressure Piping*, refer to section 3.14.3 (a) (1) of that standard for greater detail.

The table below, calculated using the formula in AS 4041, provides default minimum pipe wall thicknesses for 108mm & 133mm outside diameter seamless steel pipes at different concrete pressures. These minimum thickness values cannot be used for pipe with diameters greater than those specified, nor can the table be extrapolated for other grades of pipe.

MINIMUM PIPE WALL THICKNESS [mm]							
Maximum Pressure		Outside Diameter of Pipe					
kPa	Bar	Grade 200		Grade 250		Grade 350/ST-52	
		108mm	133mm	108mm	133mm	108mm	133mm
4,500	45	2.2	2.7	1.7	2.1	1.3	1.6
6,000	60	2.9	3.5	2.3	2.8	1.7	2.1
8,000	80	3.8	N/A	3.0	3.7	2.3	2.8
10,000	100	N/A	N/A	3.8	N/A	2.9	3.5
12,000	120	N/A	N/A	N/A	N/A	3.4	N/A

- Grade 200 pipe thickness values are to be used if the grade of pipe is unknown.
- 120 Bar thickness values are to be used if the maximum concrete pressure of the pump is unknown.
- These requirements are for normal operating conditions, fixed pipeline systems for high-rise developments could use greater pressures and may need thicker pipes.
- Double wall pipe should use as minimum wall thickness, the manufacturer's nominal outer wall thickness.

### 7.5.2 Testing Personnel

A person who carries out testing or inspection of any pipeline component should be competent and have received instruction in the method used, which may include the:



- use of supplied test instruments
- interpretation of test results against the testing criteria
- methods to be followed to achieve consistency of test results
- recognition of double thickness or faulty readings
- visual inspection techniques and inspection criteria
- recording of test and inspection results.

### 7.5.3 Ultrasonic Testing

When using ultrasonic testers it is essential for accurate readings to have the test instrument calibrated for the material to be tested before carrying out any tests. This can be achieved by using a piece of pipe material, of a known thickness, to calibrate the instrument and by following the manufacturer's instructions. The test equipment should be maintained according to the manufacturer's requirements, which may include regular factory calibration and replacement of worn transducers.

### 7.5.4 Test Surface

The areas to be tested on any pipe component should be:

- smooth with no imperfections
- free of weld spatter
- protected from rust
- free from thick paint
- free of concrete residue and dirt.

### 7.5.5 Single Wall Pipe

Single wall pipeline components in regular use should be tested at least monthly. Tests should measure the wall thicknesses at all known high wear areas on components, generally these are close to the ends of straight sections of pipe and on the outer radius of bends. Pump operators may also be aware of other areas of high wear, caused by the component's location within the pipeline.

Pipe sections should be tested at these known high wear areas and at locations within 500mm of each flange. Each location should contain four test points evenly spaced around the circumference of the pipe. For fixed horizontal pipes, one of these test points must be on the bottom of the pipe. Bends or elbows should be tested at three evenly spaced test points along the outside radius.

The lowest thickness measurement of each component should be recorded in the pipeline logbook against the component's unique identification number.



## SECTION 7 - MAINTENANCE AND INSPECTION

### 7.5.6 Double Wall Pipe

The manufacturer's recommendations for the testing of double wall pipe components should be followed. Where the manufacturer recommends no testing prior to a component having pumped a portion of its design life, no monthly thickness testing is required provided:

- the manufacturer's design life, in pumped cubic metres for the component is known
- the manufacturer's recommendation for starting pipe testing, in pumped cubic metres is known
- the component has not pumped either the manufacturer's recommended pre-testing volume, as above, or 60% of the pipe's design life, whichever is the lesser
- an accurate log is kept of pumped cubic metres for the component
- a visual inspection of the internal lining or thickness test of the outer wall is undertaken after every 10,000 pumped cubic metres.

Once the volume of pumped concrete exceeds the manufacturer's recommendation or 60% of the pipe component's design life, whichever is the lesser, then a monthly visual inspection of the internal lining or thickness test of the outer wall in accordance with the manufacturer's recommendation should commence.

Any double walled pipe component should be replaced if:

- wall thickness testing indicates wear to the outer layer
- the inner lining is breached
- a visual inspection detects excessive or abnormal wear to the inner lining.

A record of testing and inspection should be detailed in the pipeline logbook against the component's unique identification number.

### 7.5.7 Pipeline Test Recording

To assist operators in the detection of thickness error measurements, the easy cross referencing to previous wall thickness measurements during the testing process is essential. A suggested method of recording this information is to maintain a test sheet over the life of each component.



This record of pipe component testing may include:

- Single wall:
  - component identification number or mark
  - minimum allowable wall thickness
  - dates of tests
  - monthly measurement for each of the test points
- Double wall:
  - component identification number or mark
  - minimum allowable wall thickness
  - estimated life of component in cubic metres
  - total volume of pumped concrete in cubic metres
  - visual inspections at 10,000 cubic metre intervals
  - volume in cubic metres when monthly testing is to commence
  - monthly test or inspection results.

### 7.5.8 Hoses

Any hose that is used to pump concrete should be visually inspected before every concrete pumping operation.



## APPENDIX A - REFERENCE DOCUMENTS

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#### Acts

- *Occupational Health and Safety Act 1985*

#### Regulations

- *Occupational Health and Safety (Plant) Regulations 1995*
- *Occupational Health and Safety (Noise) Regulations 1992*
- *Occupational Health and Safety (Manual Handling) Regulations 1999*
- *Occupational Health and Safety (Certification of Plant Users and Operators) Regulations 1994*
- *Occupational Health and Safety (Incident Notification) Regulations 1997*

#### Codes of Practice

- *WorkCover, Code of Practice - First Aid in the Workplace*
- *VicRoads, Code of Practice - Worksite Traffic Management*
- *Department of Transport and Regional Services, Code of Practice - VSB 6 - Heavy Vehicle Modifications*

#### Australian Standards

- AS 2550.1 *Cranes, hoists and winches - Safe use - Part 1: General requirements*
- AS 2550.15 *Cranes - Safe use - Part 15: Concrete Pumps*
- AS 1418.15 *Cranes (including hoists and winches) - Concrete placing equipment*
- AS 4041 *Pressure Piping*
- AS 2452.3 *Non-destructive testing - Determination of thickness - Use of ultrasonic testing*
- AS 3920.1 *Assurance of product quality - Pressure equipment manufacture*
- AS 4343 *Pressure equipment - Hazard levels*
- AS/NZS 1554 *Structural steel welding*

Note: Australian Standards are amended and re-issued from time to time.

#### Other Publications

- *Office of the Chief Electrical Inspector- NO GO ZONE Rules for Operating Near Overhead Powerlines for Cranes, Concrete Placing Booms and Excavating Equipment*
- *European Standard pr EN 12001- Conveying, Spraying and Placing Machines for Concrete and Mortar Safety Requirements*
- *Manufacturers instruction and repair manuals*
- *Health and Safety Executive - Cement - Construction Information Sheet No. 26 (revision 2)*
- *WorkCover booklet - WorkCover Incident Notification*
- *WorkSafe Guidance Note - Use for anchors as bracing inserts in precast concrete panels*
- *WorkSafe Guidance Note - Hazards of concrete trucks reversing to discharge into a pump*
- *WorkSafe Alert - Tiger battens on powerlines are a visual warning only*
- *National Road Transport Commission's Load Restraint Guide*

## APPENDIX B - DEFINITIONS



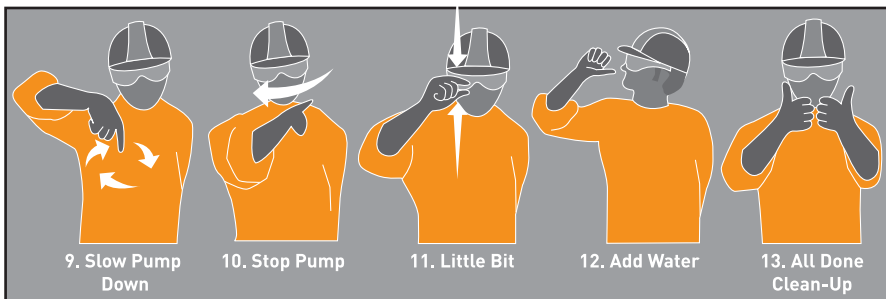
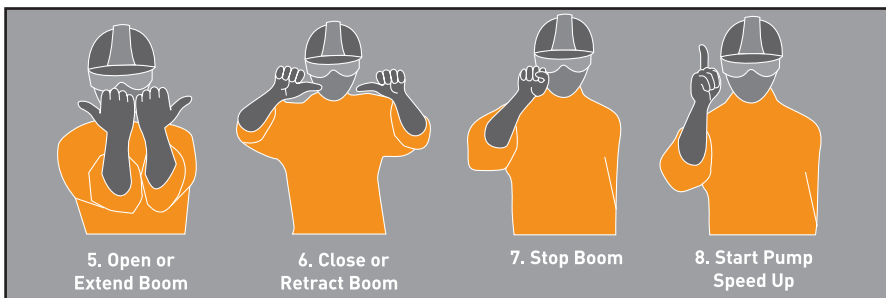
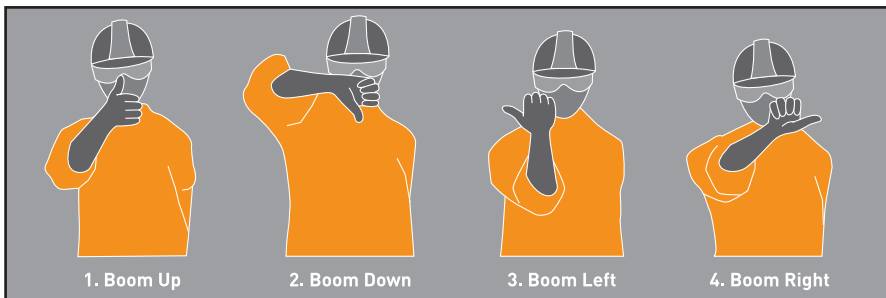
### APPENDIX B - DEFINITIONS

Boom pump	A truck-mounted combination concrete pump and boom system.
Boom	A delivery system that uses a hydraulically operated, folding multi-section boom and attached pipeline to deliver concrete.
Competent person	The person who by their training or experience has the skills and knowledge to carry out the task they are to undertake.
Concrete/Formwork contractor	The person contracted to install formwork and/or to finish the pumped concrete.
Concrete pump	The equipment that applies pressure to the concrete and forces it through the delivery pipeline.
Concrete pumping equipment	Any type of equipment used for pumping concrete.
End-hose	The rubber flexible pipe fitted to the discharge end of the pipeline system.
Hopper	The loading reservoir of a concrete pump.
Hose-hand	The worker who controls the end-hose.
Line pump	A concrete pump connected to a pipeline system.
Mobile pump	A concrete pump mounted on a truck chassis or trailer.
Outriggers	The extendible structural members on a concrete pump used to increase the unit's stability.
Pipeline system	A delivery system which uses rigid or flexible pipe sections coupled together to deliver concrete.
Principal contractor	The person with administrative control over the construction site. It can be the site owner if they are acting as the principal contractor. It generally does not apply to an individual home owner/occupier who engages a contractor for a construction task.
Pumping contractor	The person engaged to provide the concrete pumping equipment with operator(s) and to pump concrete on-site.
Pump operator	The person who operates the controls of the pumping equipment.
Reducer	A pipe that changes the internal diameter of the pipeline.
Static pump	A fixed or skid mounted concrete pump.
Tower boom	A tower-mounted boom system supplied with concrete through a fixed pipeline system.



## APPENDIX C - HAND SIGNALS

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**Foundations for Safety** is Victoria's primary forum for dealing with occupational health and safety issues in the construction industry. Foundations for Safety has brought together State Government regulatory agencies, accident research expertise, construction workers' unions and employer associations representing principle contractors and specialist trade sub-contractors.

It meets in full session every three months and establishes working parties to progress various health and safety initiatives.

At the time of printing, the organisations represented on Foundations for Safety are:

- Air Conditioning and Mechanical Contractors Association
- Australian Industry Group
- Australian Manufacturing Workers Union
- Australian Master Bricklayers Association
- Australian Workers Union
- Building Commission Victoria
- CEPU Electrical Trades Union
- CEPU Plumbing Division
- CFMEU Construction and General Division
- CFMEU FEDFA Division
- Civil Contractors Federation
- Finishing Trades Association of Australia
- Housing Industry Association
- Master Builders Association of Victoria
- Master Plumbers & Mechanical Services Association of Australia
- National Electrical and Communications Association
- National Federation of Bricklayers & Masonry Employers
- Office of the Chief Electrical Inspector
- Plumbing Industry Commission
- Royal Australian Institute of Architects
- Victorian Construction Safety Alliance
- Victorian Crane Association
- Victorian Employers Chamber of Commerce and Industry
- Victorian Trades Hall Council
- WorkSafe Victoria

You can help improve health and safety in the construction industry by providing your feedback on this Industry Standard or on other health and safety issues to any member organisation of Foundations for Safety.



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