2016

CONCRETE SLAB FORMWORK

SAFETY GUIDE

Prepared By
Eng. Mohanad Elbornya

CONTENTS

1	INTRODUCTION	1
2	FORMWORK INSPECTION	2
	2.1 Requirement Of Formwork	2
	2.2 Material For Formwork	2
	2.3 Propping And Erecting Formwork	4
	2.4 Checklist For Safe Construction Of Formwork	6
	2.5 Check On Formwork During Concreting	7
	2.6 Striking Or Stripping Of Formwork	8
3	CLEANING OF FORMWORK	9
4	RELEASE AGENTS	10
5	STORAGE	11
6	FAILURES OF FORMWORK	12
	6.1 General Information	12
	6.2 Causes of Failures of Formwork	12
	6.3 Prevention of Formwork Failures	13
7	RISK MANAGEMENT PROCESS	14
	7.1 Identifying the hazards	14
	7.2 Assessing the risks	14
	7.3 Controlling the risks	15
	7.4 Maintaining and reviewing control measures	16
8	TRAINING	17
9	PERSONAL PROTECTIVE EQUIPMENT	18
	9.1 Providing PPE	18
	9.2 PPE and Formwork	18
	9.3 Workers Using PPE	20
	9.4 Training and Instruction	20
10	CRANE AND LOAD HANDLING SYSTEMS	21
	10.1 Loading materials during formwork construction	21
	10.2 Access for persons slinging loads	21
	1.03 Lifting gear	22
	10.4 Lifting formwork materials	22
	10.5 Lifting lugs	22
11	USE OF LADDERS	23
12	EDGE PROTECTION ON THE FORMWORK DECK	24
	12.1 Formwork construction zone physical barriers	24
	12.2 Edge protection on completed decks	24
13	WORKING SAFELY AT HEIGHT	25
14	MANUAL HANDLING OF HEAVY LOADS	26
15	SAFE WORK METHOD STATEMENTS	27
	APPENDIX A – DEFINITIONS	
	APPENDIX B – RISK ASSESSMENT CHECKLIST	
	APPENDIX C – SAMPLE SAFE WORK METHOD STATEMENT	
	APPENDIX D – MINUTES OF INSPECTION OF FORMWORK	

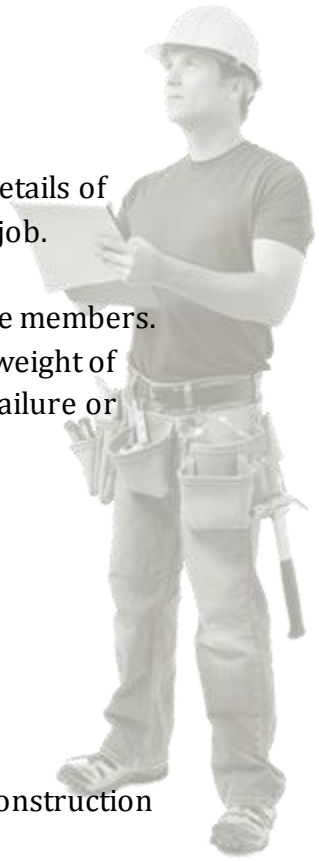
1. INTRODUCTION

The rapid growth of the construction technology in the world has accelerated the improvement of the quality of many buildings.
In opposition to these circumstances, we have sustained severe injuries of manpower such as workers and engineers and physical damages due to collapsing of formwork, which happened recently.
However, we have had little knowledge of formwork failures occurring during concrete construction.

Before starting the work, the safety considerations should be taken into account while preparing for construction of formwork.
The formwork should be designed by an experienced engineer. The under-designed forms are dangerous because form failures are expensive while the over-designed forms are unnecessarily expensive.

This SAFETY GUIDE provides guidance to prevent injury to persons engaged in erecting and dismantling concrete slab formwork and associated equipment.

2 FORMWORK INSPECTION



2. FORMWORK INSPECTION

2.1 REQUIREMENT OF FORMWORK

It is necessary to understand the requirement of formwork before going into the details of materials, erection, inspection and other essential steps for successful and proper job.

The following are the essential requirement:

- To obtain the required shape, size, finish, position and alignment of concrete members.
- To have enough load carrying, or transferring capacity to take pressure or weight of fresh concrete and any other loads, without distortion, deflection, leakage, failure or danger to workmen.
- To have design for quick erection and removal (stripping).
- To handle easily using available equipment or manpower.
- Joist between formwork must be tight enough to prevent leakage of grout.
- To provide easy and safe access for concrete handling and placing.
- To avoid damage to concrete or formwork itself while stripping.

2.2 MATERIAL FOR FORMWORK

- The type of material to be used for formwork depends upon the nature of construction as well as the availability and cost of material.
- Formwork can be made out of TIMBER, STEEL, PLYWOOD, ALUMINIUM or FIBRE-GLASS, used separately or in combination. Timber and plywood are the most commonly used materials for formwork because these can be cut or assembled easily on site.
- All materials and equipment used in formwork construction must be fit for the intended purpose and meet design specifications.
- Materials and equipment must be designed to conform to relevant Standards.
- Materials and equipment must be manufactured in accordance with a quality assurance system that ensures compliance with the design specification.

- **Timber formwork**

  - Most common material used for bracing the member, hence called as the traditional formwork.
  - can easily be cut to size on site. Joist are replaced with engineered wood beams and supports are replaced with metal props. This makes this method more systematic and reusable.
  - Various sizes of members of timber

- ## Plywood

  - This is by far the most common material used for the facing panel. It is easily cut to shape on site, and if handled and stored carefully, it can be used many times.
  - A standard plywood thickness on site is 18mm. This is usually sufficient for most pours.
  - However, if the formwork is curved, a thinner plywood is used to facilitate bending.
  - Thicker plywood may be used when the weight of concrete causes a standard thickness plywood to bow out, distorting the concrete face.

- ## Steel formwork

  - Steel forms are stronger, durable and have longer life than timber formwork and their reuses are more in number
  - Steel forms can be installed and dismantled with greater ease and speed.
  - The quality of exposed concrete surface by using steel forms is good and such surfaces need no further treatment.
  - Steel formwork does not absorb moisture from concrete.
  - Steel formwork does not shrink or warp

- ## Aluminium formwork

  - Often used in pre-fabricated formwork, that is put together on site.

- Aluminum is strong and light, and consequently fewer supports and ties are required.
- The lighter sections will deflect more, but this can be avoided by simply following the manufacturers recommendations.

- **Plastic formwork**

- Glass reinforced plastics (GRP) and vacuum formed plastics are used when complicated concrete shapes are required (e.g. waffle floors).
- Although vacuum formed plastics will always need support, GRP can be fabricated with integral bearers making it self supporting.
- Like steel, plastic formwork can be re-used many times, as long as care is taken not to scour the surface whilst vibrating the concrete.

2.3 PROPPING AND ERECTING FORMWORK

2.3.1 Propping Formwork

Collapses of formwork have been mostly attributable to incorrect propping system.
This can be due to inadequate quality of propping material or improper application.
Steel props are safer than wooden props and their load carrying capacity is more predictable than wooden props. It is very important that steel props are also correctly used and props having defects not used in the supporting system.

The following essential tips are required to be followed at site.

- Defective props should not be used. Props must be properly inspected piece by piece prior to erection. Steel tube props having a bend or crease, extensive surface corrosion, bent or damage head and/or pin and/or base plate should not be used.

- Correct setting up of props is vital. The load carrying capacity of adjustable steel props is considerably reduced if they are erected out of plumb and/or if the load applied is eccentric.
- Bracing should be provided in both direction and sacredly clamped.
- Props at ends must be checked for verticality in each row and the rest can be inspected by visual inspection.
- Runners supported by props should not be off center. Maximum of 25mm off center can be permitted.
- Props should have a firm bearing. Spreaders must be used if the supporting sub grade or base is weak in taking bearing pressure. Spreaders will not required if bearing is directly on concrete.

2.3.2 Erecting Formwork

Formwork is a temporary structural arrangement which is removed as soon as concrete is capable of taking adequate load.

Some general tips which may help avoid serious problems are given below:

- All fixture, fittings and fastenings must be in the right place and each panel to avoid mistakes.
- All tie bolts or wall ties must be tightened.
- Temporary distance pieces must be removed.
- Formwork must be cleaned and checked to ensure that nothing has fallen within.
- Avoid drilling holes or cutting standard panels.
- Any make up or fill in pieces or closure panels should marry with the main formwork. They should be so designed that they can be easily fixed and stripped without causing any damage to themselves and the neighboring panels.
- Holes made in the formwork on site should be neat so that plugging is easier. Timber formwork must be drilled from face to avoid splintering.
- Make sure that inserts, blocking out pieces, boxes and battens are securely fixed.
- Ensure that dirt, wooden shavings, tie wire clippings, nails etc., from the formwork are removed prior to commencement of concreting.
- Ensure that proper walkways, working platforms and approaches are available for free and safe movement of work force.

- Sloping or horizontal top forms are subjected to uplift pressure from freshly placed concrete and therefore need to be firmly restrained.
- Large prefabricated formwork panels must be provided with a spreader or lifting beam to prevent damage or distortion.

2.4 CHECKLIST FOR SAFE CONSTRUCTION OF FORMWORK

A safe practice for formwork during construction at site is important for safety of workmen. Improper erection of formwork can cause damage to structural element as well as pose threat to the safety of workmen.

Following Are The Safe Practices Checklist For Formwork:

2.4.1 Formwork Safety Checklist during Design:

- Formwork should be properly designed for the structural element considered and its working drawing should be available at site.
- Design of formwork should consider all the loads it will experience during casting of concrete structural members.
- Strength of materials used for formwork should be adequate to support structural load as well as other loads imposed on it.
- Formwork design should indicate the rate of concrete pour, height of concrete pour, temperature and sequence and schedule of concrete pours.
- Working drawing of formwork should have detailed dimensions including pouring pocket size, compaction opening and cleanouts.
- Formwork design should consider the safe bearing capacity of soil.

2.4.2 Formwork Safety Checklist during Construction:

Following inspection should be carried out before starting the concreting of structural member:

- Inspection of entire formwork system for details from bottom to top of formwork for proper load transfer in safe manner.
- Inspection of working scaffolds, ladders, runways, ramps and crossings.
- Maintenance of good housekeeping around working area and passage.
- Guarding of peripheral edges and floor openings.
- Adequate space for safe working.
- Safety training of workmen involved in formwork and concreting works.
- Use of all personal protective equipment (PPEs).
- Formwork, rigging inserts and connections checked for correct installation and periodically checked for wear and correct position.
- Removal of all unused and hanging forms, loose materials etc. stored on exposed floors.
- Inspection of all props and shores for adequacy to handle all the loads.
- Removal of defective props.
- Alignment of props such as verticality, height and spacing between props should be inspected.
- All props should be rested on bearing plates.
- Props should be placed on hard bearing surface.

- Safe nailing and firm locking of clamps on adjustable props.
- Lateral stability of formwork and complete fixity at the joint between props when one prop is placed on the top of the other.
- Proper bearing below the stringers and joists at points of supports.
- De-shuttering and removal of props below concrete slabs and beams after development of adequate strength in concrete.
- Construction loads not placed on freshly cast slab or beams while removal of formwork or before concrete attaining required strength.
- Power tools with safety features provided. Rechecking and routine maintenance carried out.

There can be many more checklists for formwork which has not been written here

2.5 CHECK ON FORMWORK DURING CONCRETING

When placing concrete consideration should be given to:

- Adequate provision must be made for the delivery and placement of concrete. Equipment must be
- Appropriate and well maintained.
- Concrete should be placed by competent operatives.
- Joints should be properly prepared and formwork of appropriate quality used with appropriate safety provision.
- Concrete should be placed as close to its final position as possible.
- Concrete should not be allowed to free fall into the formwork from any appreciable height (ideally not more than 2 m). Pipes and chutes should be used to aid placement.
- Concrete, with the exception of self-compacting concrete, must be properly vibrated
- Concrete should be placed in layers, typically 50 mm deep.
- The top surface of the concrete in wall or column forms may contain laitance and this may be
- Removed and replaced with fresh concrete and revibrated.
- Revibration is also desirable to counteract plastic settlement cracking occurring in the near-surface layers of concrete. This process is carried out after completion of initial vibration and before initial set.
- Hydration of cement with water is an exothermic reaction (gives off heat). In large concrete sections
- The heat generated may be significant. The surface will cool quickly whilst the centre remains hot
- For a considerable period. Many specifications require the maximum temperature differential to be
- controlled.
- The moisture and temperature of the concrete must be controlled in the early stages after placement. Adequate provision for curing must be made. This will avoid excessive shrinkage, frost damage and ensure a hard impermeable and resistant surface to the concrete. Leaving the formwork in place, polythene sheeting and curing membranes are common curing methods.

2.6 STRIKING OR STRIPPING OF FORMWORK

- The formwork should be designed in such a manner that it can be struck easily without damaging the concrete or the form itself.
- Formwork must be struck when the concrete has gained enough strength to be self supporting and also be able to carry any other loads that may be put on it.
- The removal time of formwork is generally specified in the drawings or specification. The time will depend on the following factors:
  - Size and shape of the member span of the member (beams).
  - The concrete mix used.
  - The type of cement used.
  - The ambient temperature and weather condition. Curing of concrete prior to removal.
- For beam sides, the forms can be usually removed within 12 to 24 hrs of placing the concrete.

- During cold weather forms should be left for a longer period of time.
- At the time of removal, ties, clamps and wedges should be loosened gradually to prevent the last tie from bending.
- All bolts, nuts, clamps, wedges removed should be collected in a box and not dropped down.
- When lowering large panels of formwork care should be taken to see that they are not damaged by scaffolding or any other projection
- The panels should be rested on the leveled surface so that they are not twisted or misshapen.
- If cranes are used to handle the formwork, the person controlling the operation should know where to sling the formwork and should be aware of correct signal codes to direct the operator.

3 CLEANING OF FORMWORK

- Formwork must be cleaned as soon as it is removed. Timber and ply forms should be cleaned with a stiff brush to remove dust and grout .
- steel scraper on ply or faced are not to be used.
- Timber and untreated ply should be given a coat of release agent when it is required to be stored for a longer period.
- Steel form if required to be stored for a longer period it will also need a light coat of oil to prevent rusting.
- If any repairs are necessary they should be done immediately.
- Any depression, splits and nail holes should be repaired with suitable material followed by light rubbing down.
- Unwanted holes should be over filled with a suitable filler and then sanded down to a smooth surface.

4 RELEASE AGENTS

- The main purpose of treating formwork with a release agent is to make it easy to strike and release the formwork away from the concrete face.
- It is often observed that burnt transformer oil and other cheap oils are used as release agents. They can cause severe stains and also result in inefficient removal of formwork from the concrete surface. It is therefore extremely important to select the right type of release agent.
- Some commonly used release agents are a follows:
  - ***Neat oils with surfactants:*** They can be used on steel, timber or ply faces of the formwork.
  - ***Mould cream emulsions:*** The most general-purpose release agent used on all types of form faces.
  - ***Chemical release agents:*** Recommended for all high quality form finished concrete works.
- As unused and untreated plywood and timber surfaces have a tendency to absorb the coating of the release agent, the surfaces should be given a primary coat of release agent 36 hours before being used and a secondary coat of release agent should be applied just before using it for the first time.
- It is important to apply the right amount of release agent in the form of a thin film. Application can be made uniformly either by brush, roller or best of all by spraying. Too thick or too much application of release agent can stain the concrete while too less release agent can cause difficulty in striking of the formwork.
- In case excess mould oil is put on the formwork surface, by mistake, then the excess amount can be wiped off using clean rag.

5 STORAGE

- Storage of formwork is extremely important.
- Most of the formwork material deteriorates very fast if not repeatedly used and not preserved and stored properly.
- The main aim for good storage is to avoid doing any damage when formwork is not in use.
- If immediate re-use of formwork materials is not required, formwork must not be allowed to lie on site unprotected.
- Panels and plywood sheets after cleaning and oiling must be stored horizontally on a flat leveled base so that they lie flat without twisting and should be stacked face to face to protect the face.
- Large panels are best stored on edge in specially designed racks.
- Loose wailings, soldiers, struts etc., are best stored with their respective panels after numbering them so that they can be easily matched at a later stage.
- Small components such as bolts, clamps, keys, pins, wedges and ties should be kept in boxes.
- Props should be stacked off the ground to prevent them from deterioration due to contamination, mud and moisture.
- Fire extinguishers in working condition should always be made available in easily accessible areas.
- The storage area should be properly protected from rain and moisture. It should also be well ventilated and kept in a tidy condition so that it is easy to get any material required for re-use.

6 FAILURES OF FORMWORK

6. FAILURES OF FORMWORK

6.1 General Information

The failure of formwork is always embarrassing, expensive, and a sad situation for everyone involved in a project.
Safety must be a concern of everyone, workers and supervisors.
Accidents not only affect the workers but also their families.
Everyone in a project must be alert to unsafe conditions, and all work must be performed in accordance with safety regulations and the requirements specified in the form design.

A failure may result in a collapse of part or all of the forms. Also it may result in a distortion or movement of the forms that will require the removal and replacement of a section of concrete.
Sometimes repairs, such as expensive chipping and grinding operations, may be required to bring the section within the specified dimension limitations.

Such failures should not and will not occur if the formwork is constructed with adequate strength and rigidity. Formwork should be designed by an engineer or by someone who has sufficient knowledge of forces and resistance of form materials.

Some states and cities require that forms, other than the simplest concrete structures, be designed by registered professional engineers and that following their erection they be inspected for adequacy by an engineer.

6.2 Causes of Failures of Formwork

There are numerous causes of failures of formwork.

Following is a partial list:

- Improper or inadequate shoring.
- Inadequate bracing of members.
- Lack of control of rate of concrete placement.
- Improper vibration or consolidation of concrete.
- Improper or inadequate connections.
- Improper or inadequate bearing details.
- Premature stripping of formwork.
- Errors in placement of reshoring.
- Improper, or lack of, design of formwork.
- Inadequate strength of form material.
- Failure to follow codes and standards.
- Modifications of vendor-supplied equipment.
- Negligence of workers or supervisors.

6.3 Prevention of Formwork Failures

The safety of workers is a concern of all parties: owners, designers, and contractors. Safety is everyone s responsibility, including workers in the field, supervisors, and top management.

There are many risks in the process of erecting and dismantling forming systems.
Every precaution should be taken to ensure a safe working environment. Below is a partial list of rules that can be used to reduce the potential of formwork failures.

- Prepare a formwork plan that includes detailed drawings and written specifications for fabricating, erecting, and dismantling of the formwork. The plan should be prepared by a person who is competent in the design of formwork.
- Follow all state and local codes, ordinances, and regulations pertaining to formwork, shoring, and scaffolding.
- Post guidelines for shoring and scaffolding in a conspicuous place and ensure that all persons who erect, dismantle, or use shoring are aware of them.
- Ensure compliance of all OSHA rules and regulations.
- Follow all instructions, procedures, and recommendations from manufacturers of formwork components used in the formwork.
- Survey the jobsite for hazards, such as loose earth fills, ditches, debris, overhead wires, and unguarded openings.
- Ensure adequate fall protection for workers during erection of formwork, pouring of concrete, and dismantling of formwork.
- Inspect all shoring and scaffolding before using it, to ensure it is in proper working condition and to ensure workers are using the equipment properly.
- Make a thorough check of the formwork system after it is erected and immediately before a pour, in particular connections between formwork components.
- Never take chances. If in doubt regarding the safety, contact a safety officer and management. It is best to prevent an accident.

7 RISK MANAGEMENT PROCESS

RISK MANAGEMENT

7. RISK MANAGEMENT PROCESS

7.1 Identifying the hazards

The first step to manage risks is to identify the hazards associated with formwork activities. Examples of formwork hazards include:

- Formwork collapse – before, during and after placement of concrete or the structural members to be supported
- Working at height
- Falling objects
- Slips and trips
- Noise
- Dust
- Manual tasks.

7.2 Assessing the risks

A risk assessment involves considering what could happen if someone is exposed to a hazard and the likelihood of it happening.

Many hazards and their associated risks are well known and have well established and accepted control measures. In these situations, the second step to formally assess the risk is unnecessary. If, after identifying a hazard, you already know the risk and how to control it effectively, you may simply implement the controls.

When assessing risks involved with formwork you should consider things like:

- The type of form elements to be used.
- The height of the formwork to be erected.
- The size of the formwork deck or other platforms.
- The location of intermediate working platforms.
- The scheduling of the work.
- The layout of the workplace, including whether there are fall hazards both for people and objects.
- The number of people involved.
- What plant and equipment will be used and the skill and experience required to use it safely.
- What exposures might occur, e.g. noise or ultra-violet radiation.
- Local weather conditions, particularly wind forces.

It should then be possible to select the most suitable work methods and arrangements to eliminate or minimize risks, for example:

- Items of plant and equipment—large structures may require scaffolding or mobile plant to work on suspended floors
- Minimize the working heights for people erecting and dismantling the formwork.
- Safe temporary work platforms where work at height is required
- Plant and material placement and storage to minimize manual handling.

7.3 Controlling the risks

Some control measures are more effective than others. Control measures can be ranked from the highest level of protection and reliability to the lowest. This ranking is known as the *hierarchy of control*.

Eliminating the risk

This means removing the hazard or hazardous work practice from the workplace. This is the most effective control measure and must always be considered before anything else.
If eliminating the risk is not reasonably practicable, you must consider using substitution, isolation or engineering controls, or a combination of these control measures, to minimize the risk.

Minimizing the risk

Substitution

Minimize the risk by substituting or replacing a hazard or hazardous work practice with a safer one. Examples include:

- Using a type of formwork that can be preassembled on the ground and then lifted into position by a crane which reduces the need to work at height and therefore the risk of people or objects falling.
- Using a crane to lift formwork components instead of manual lifting minimizes the risk of musculoskeletal disorders.

Hierarchy Of Control

Isolation

Minimize the risk by isolating or separating the hazard or hazardous work practice from people. For example, isolating people working on formwork from mobile plant with physical barriers will minimize the risk of contact occurring between a person and the mobile plant.

Engineering Controls

Engineering controls are physical control measures to minimize risk, for example install fall prevention devices like guard rails, toe boards and edge protection to minimize the risk of a person or object falling from height.

If a risk then remains, the duty holder must minimize the remaining risk, so far as is reasonably practicable, by using:

Administrative controls

Administrative controls should only be considered when other higher order control measures are not reasonably practicable, or to increase protection from the hazard. These are work methods or procedures that are designed to minimize the exposure to a hazard, for example install warning signs near the formwork activity.

Any remaining risk must be minimized, as far as is reasonably practicable, by providing and

Personal protective equipment

Personal protective equipment (PPE) is the lowest order control measure in the hierarchy of controls. PPE should also only be considered when other higher order control measures are not reasonably practicable or to increase protection from the hazard.

Examples of PPE include hats, hearing protectors and high visibility vests.

Administrative control measures and PPE rely on human behavior and supervision, and used on their own, tend to be least effective in minimizing risks.

Combining control measures

In most cases, a combination of the controls measures will provide the best solution to minimize the risk to the lowest level reasonably practicable. You should check your chosen control measures do not introduce new hazards. For example, protect workers from falls using fall protection devices like guard rails (engineering) and other workers from falling objects by establishing an exclusion zone for the work area (isolation) and providing hard hats (personal protective equipment). You should check your chosen control measures do not introduce new hazards.

7.4 Maintaining and reviewing control measures

The control measures put in place to protect health and safety should be regularly reviewed to make sure they are effective, including then there is a change at the workplace.

For example, control measures should be reviewed:

- When an injury or illness occurs because of a hazard the risk assessment addressed, or failed to consider
- Before making changes to work procedures
- If new information becomes available to indicate a control measure may no longer be the most effective
- When there are changes to who is engaged to carry out work.

Control measures can be reviewed and revised in consultation with workers and their health and safety representatives. Workers are often able to quickly identify and propose solutions to problems when they occur.

Controls should be checked by using the same methods as the initial hazard identification and risk assessment. If a hazard is not eliminated or minimized by the chosen control measures, go back through the risk management steps, review the information and make further decisions about risk control.

When reviewing control measures, a safe work method statement must also be reviewed and revised where necessary.

8 TRAINING

8. TRAINING

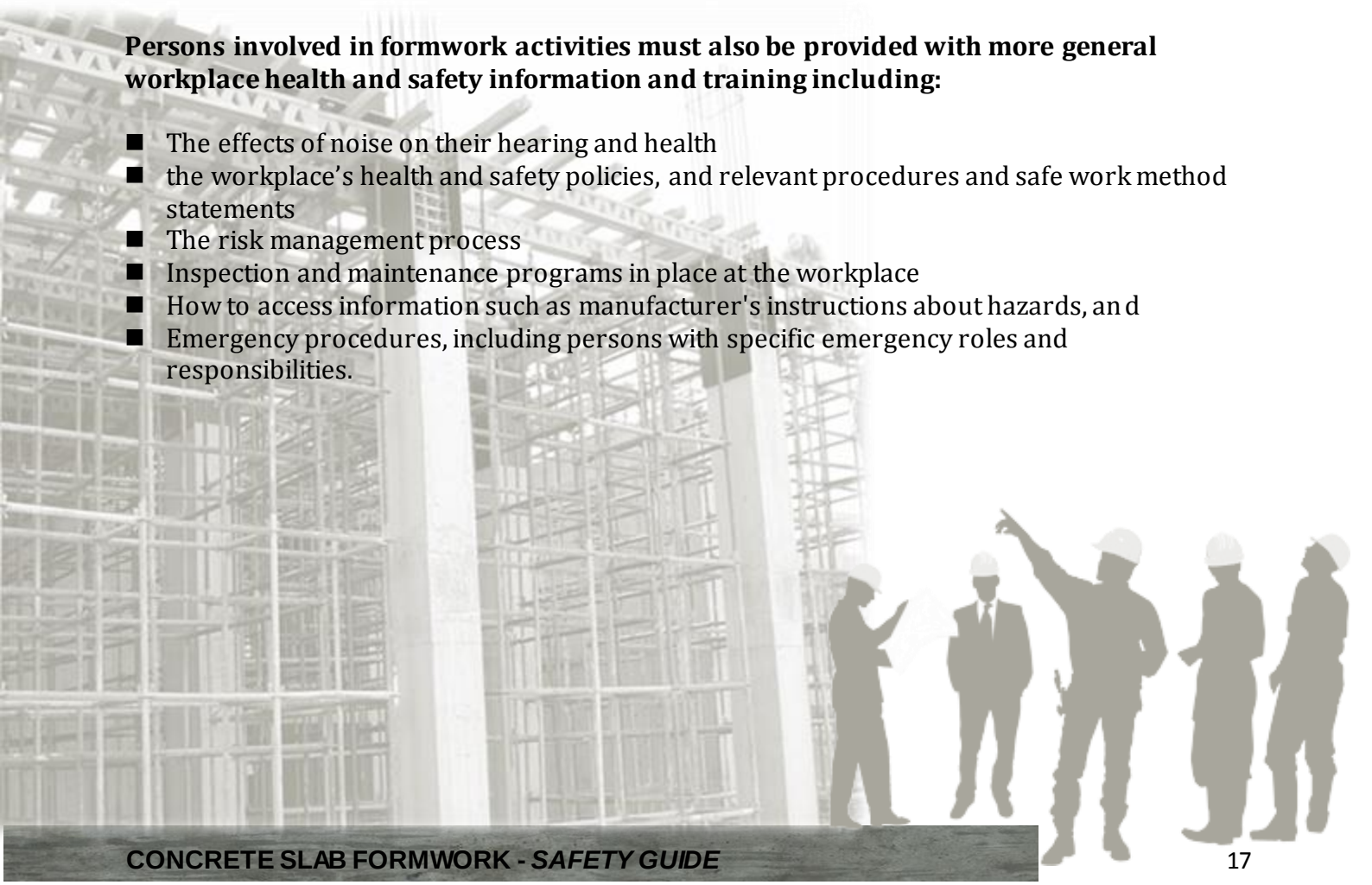
All persons who may be exposed to workplace health and safety risks resulting from formwork construction must be provided with information and training that is specific to the formwork system that is being used.

Such training and information must include details of:

- The formwork system, tasks, activities and components
- The way the manufacturer or designer of the formwork system intended the system to be erected, installed, used, moved, altered or dismantled
- Specific training and information required to undertake or participate in specific tasks or activities
- Control measures to minimize exposure to the risks, correct use of controls, and how to ensure they are kept in full working order
- Safe working procedures, including the use of mechanical aids and devices, where appropriate
- How to use and maintain equipment, including any specific conditions and prohibitions on the use of equipment. Reference must be made to operators' manuals
- Any special safety information needed such as safety precautions for working under certain conditions
- Personal protective equipment required, including instruction in fitting, use, cleaning, maintaining and storing this equipment, and
- Details of how accidents have occurred in the past involving the same work process(s).

Persons involved in formwork activities must also be provided with more general workplace health and safety information and training including:

- The effects of noise on their hearing and health
- the workplace's health and safety policies, and relevant procedures and safe work method statements
- The risk management process
- Inspection and maintenance programs in place at the workplace
- How to access information such as manufacturer's instructions about hazards, and
- Emergency procedures, including persons with specific emergency roles and responsibilities.



9 PERSONAL PROTECTIVE EQUIPMENT

9. PERSONAL PROTECTIVE EQUIPMENT (PPE)

9.1 Providing PPE

Under the Work Safety Regulation all persons that provide PPE as part of their duty to manage risk must ensure, to the extent of their control, that:

- The PPE is adequate for the person it is provided to;
- The PPE minimizes the risk for the person;
- The person is told of any limitations of the PPE;
- The person is given the instruction and training necessary to ensure the PPE minimizes the risk for that person;
- The PPE is properly maintained, and, repaired or replaced as necessary to minimize the risk for the person using it; and
- The PPE is kept in a clean and hygienic condition.

The Work Safety Regulation also sets out specific situations where PPE must be provided. This is where a person should be highly visible because of the nature of the workplace, and, where it is reasonably foreseeable that a person could, while at the workplace

9.2 PPE and Formwork

Before erecting or dismantling any formwork, contractors should assess the risks likely to affect the health and safety of the workers and him/herself, as identified by the risk assessment procedure, and must provide and arrange for the use of appropriate and compatible PPE.
The following PPE should be provided where required by the Work Safety Regulation (because it is mandatory or because a risk assessment indicates it is needed).

Safety helmets

The use of safety helmets may prevent or lessen a head injury from falling objects or a person hitting their head against something. Where there is a likelihood of persons being injured by falling objects and overhead protection is not provided, persons should be provided with (and use) a safety helmet. Safety helmets should also be provided and used where a person may strike their head against a fixed or protruding object or where there is a risk of accidental head contact with electrical hazards.

Eye protection

Where workers are carrying out cutting, grinding, chipping or welding of concrete or metals they should be provided with (and use) eye protection to reduce the risk of eye injury. where persons carry out other work, such as carpentry, where there is a risk of eye injury.
There should be sufficient supervision and monitoring conducted to ensure that employees are provided with (and use) the eye protection.

Safety gloves and footwear

Safety gloves and footwear should be provided when handling materials such as timbers, scaffolding components and steel frames to reduce the risk of injury.

Ear Protection

Persons must be protected from the risk of noise induced hearing loss during their work.

Activities, such as the erection or dismantling of formwork, the clanging and banging of metal on metal, or the use of hammers, create impact noise which can damage hearing immediately. This type of noise is particularly damaging to hearing because of its high impulsive noise levels. Other loud noise, such as that created when using a circular saw, will gradually damage a person's hearing after regular exposures.

For formwork activities, often the only way to protect against noise induced hearing loss is by wearing appropriate hearing protectors whenever noise is produced. The selection of hearing protection is appropriate when the wearer can hear what goes on in the immediate environment.

For most formwork activities a hearing protector with an SLC80 between 15 and 20, or a Class 2 or 3 rating, should be adequate, provided the hearing protector is worn correctly during noisy activities.

Where a risk assessment shows the use of hearing protectors is the preferred option to control the risk of exposure to excessive noise, the use of the hearing protectors must be enforced when persons in the immediate vicinity are exposed to noise during various formwork activities

Dust Protection

While concrete itself is not a hazardous chemical, high levels of silica dust can be produced during formwork processes. A hazardous chemical is generated when power tools cut, grind, chip, scrape, crush or blast materials such as concrete. Silica dust may be created to a lesser degree, by sweeping, cleaning, dismantling building equipment and demolition.

Highly visible dust caused by earthmoving equipment on building sites or other earthworks sites is unlikely to contain hazardous levels of respirable silica dust. On the other hand, hazardous silica dust levels produced by other activities may be barely visible.

Appropriate steps to minimize person's exposure to silica dust must be taken.

Silica dust that is generated during formwork can be controlled by:

- using engineering controls such as dust extraction or a wet process, and
- providing respirators (as a last resort) where dust is likely to exceed permissible levels

Clothing

Clothing should be comfortable in all positions such as standing, bending and crouching and be suitable for the work being done and the weather conditions. Loose clothing or equipment which may snag or create a trip hazard should be avoided where possible.

Protection from sun

Workers should be protected from sunlight/UV radiation by using a sunscreen with an SPF (sun protection factor) rating of at least 15+ and wearing hats, long sleeves and long trousers. If short sleeved shirts and shorts are worn in very hot weather, the exposed parts of the body should be protected by using the appropriate sunscreen.

Persons exposed to reflective surfaces (such as formwork decks) should be protected from the risks of eye damage from the increasing exposure to the sun by UV protection glasses. Even

with protection, there should be sufficient supervision and monitoring conducted to ensure that workers do not have extended exposure to strong sunlight and reflection.

9.3 Workers Using PPE

The Work Safety Regulation requires workers that have been provided with PPE at a workplace to use it. If the worker is given the instruction and training necessary to ensure that the PPE minimizes risk for them and the worker intentionally does not use the PPE, or, does not use it as instructed, they are in breach of the Regulation.
It is also an offence if a worker:

- Intentionally misuses or damages PPE at the workplace; or
- Becomes aware of damage to, a defect in, or a need to clean or sterilize, PPE at their workplace and intentionally does not tell the person conducting the business or undertaking about that damage, defect or need.

9.4 Training and Instruction

Under the Work Safety Act, each person conducting a business or undertaking (contractor) must provide appropriate information, instruction, training or supervision to workers and other people at the business to allow work to be carried out safely. They must also ensure that plant is operated only by workers or other people who are qualified to do so - this may require a high risk work license or a certificate of competency in the ACT.

All persons involved in erecting and dismantling of formwork should be trained to follow systems of work and work practices that enable them to perform in a manner that is safe and without risks to health, and must hold an appropriate high risk work license or certificate of competency (where that is required). Only workers who have received required training and instruction should carry out tasks involved in erecting and dismantling formwork.
The contractor must monitor the systems of work and provide refresher training to ensure that safe systems and work practices are being followed, including the use of PPE.

The work method to be used for erecting and dismantling of formwork and the manual handling of equipment by operators, including control measures based on the risk assessment to prevent injury;

- The correct use, care and storage in accordance with the manufacturer's recommendations of:
  - personal protective equipment
  - tools and equipment to be used
  - individual fall arrest equipment.

- The use of plant and associated equipment including electrical safety and hazardous substances; and
- procedures to be adopted in the event of accident, injury or other emergency.

Safety signs must be used whenever a hazard or danger cannot be avoided adequately or reduced in another way.

10 CRANE AND LOAD HANDLING SYSTEMS

10. CRANE AND LOAD HANDLING SYSTEMS

10.1 Loading Materials During Formwork Construction

Materials, including stacks of ply, forms, bearers and joists, are sometimes lifted onto a deck during formwork erection, and before the deck is signed over. Stacked materials create point loadings which the formwork structure may not be designed to bear. Materials should be stored only where and when the deck is able to bear the load.

Formwork is not suitable for any loading until it is fully secured, that is, the deck is in place with tie-ins and back-propping complete. In practice, some loading often occurs before the deck is completed, for example, unloading pallets of ply and joists used to continue the deck.

To minimize the risk of collapse and other hazards:

- Formwork drawings should clearly identify the maximum (pre-pour) point loadings for the deck.
- Point loadings should not exceed the maximum weight specified by a formwork designer or engineer.
- Crane crews should be notified when an area of deck is ready to take a load, and where that load should be placed.
- Crane crews should not lift materials onto the deck until there is a designated lifting zone.
- Loads should only be placed in the area(s) designated as safe.
- Loads must not be placed on the formwork deck if the formwork documentation prohibits loadings.
- Delivery of materials to the site should be planned so that loads are not lifted onto unsecured decks.
- Prior to persons leaving the site, materials and equipment should be secured to prevent them being moved by wind.

10.2 Access For Persons Slinging Loads

Safe access must be provided for persons slinging and un-slinging loads. Ladders used by doggers while slinging loads should be secured to prevent movement.
A dogger or other person working at two meters or more above the deck must be provided with adequate fall protection, unless the person is performing 'permitted work'.
Use of fall arrest systems for persons slinging formwork loads is usually impractical and is not recommended.

It may be more practical to fit platforms and edge protection to lift forms to protect persons when slinging the loads. The platforms must be at least 450 mm wide. Persons required to access the platforms from ladders should have a safe means of access provided between the ladder and platform. They should not climb over the top of the edge protection.

10.3 Lifting Gear

Basic items that ought to be checked include:

- The lifting gear is tagged and all relevant information listed (e.g. relevant information for a chain sling is grade of chain, safe working load, manufacturer, chain size and Australian Standard marking).
- Lifting hooks are provided with operable safety latches.
- Shackles are prevented from unscrewing (e.g. mousing or similar).
- Lifting eyes and inserts are compatible and the same proprietary brand.
- Lifting slings are not damaged (e.g. excessive wear, damaged strands, cracks, deformation and/or severe corrosion).
- The sling is appropriate for loads being lifted, including adequate capacity and protection from sharp edges.

All lifting gear, including slings, hooks and material boxes, should be periodically inspected for damage and wear. The period between inspections shall depend on the severity of use but should not exceed 12 months. Documented maintenance records for the lifting gear should be available on site.

10.4 Lifting Formwork Materials

Crane-lifted loads should be slung and secured so that the load (or any part of it) cannot fall, as follows:

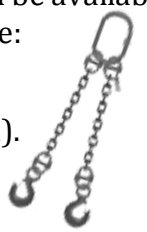
- Safe working load mass should be clearly marked on bins.
- Lifting boxes should be appropriate for the material being lifted, and be engineer-designed and certified.
- Four chains (one in each corner) should be fitted to lift boxes.
- Specifically-designed lifting boxes should be used to lift smaller components (e.g. spigots, U-heads, base plates and couplers). Boxes should have enclosed sides or robust mesh (with openings less than the minimum size of materials being lifted).
- Lifting boxes should be inspected and maintained, and inspection records kept.
- Loads within lifting boxes should be secured against movement.
- Materials should not be stacked higher than the side of the box unless they are adequately secured, but at no time should the box become top heavy.
- Formwork frames should either be tied together or lifting slings should be wrapped around the load.
- Loads of joists or bearers should be strapped together before lifting.
- Use tag lines as required to control loads and well as forms.
- Form ply loads should be strapped together and lifted in a flat position.
- Ensure where possible all loads are supported with dunnage and the load is uniformly distributed over the supporting surface.

10.5 Lifting lugs

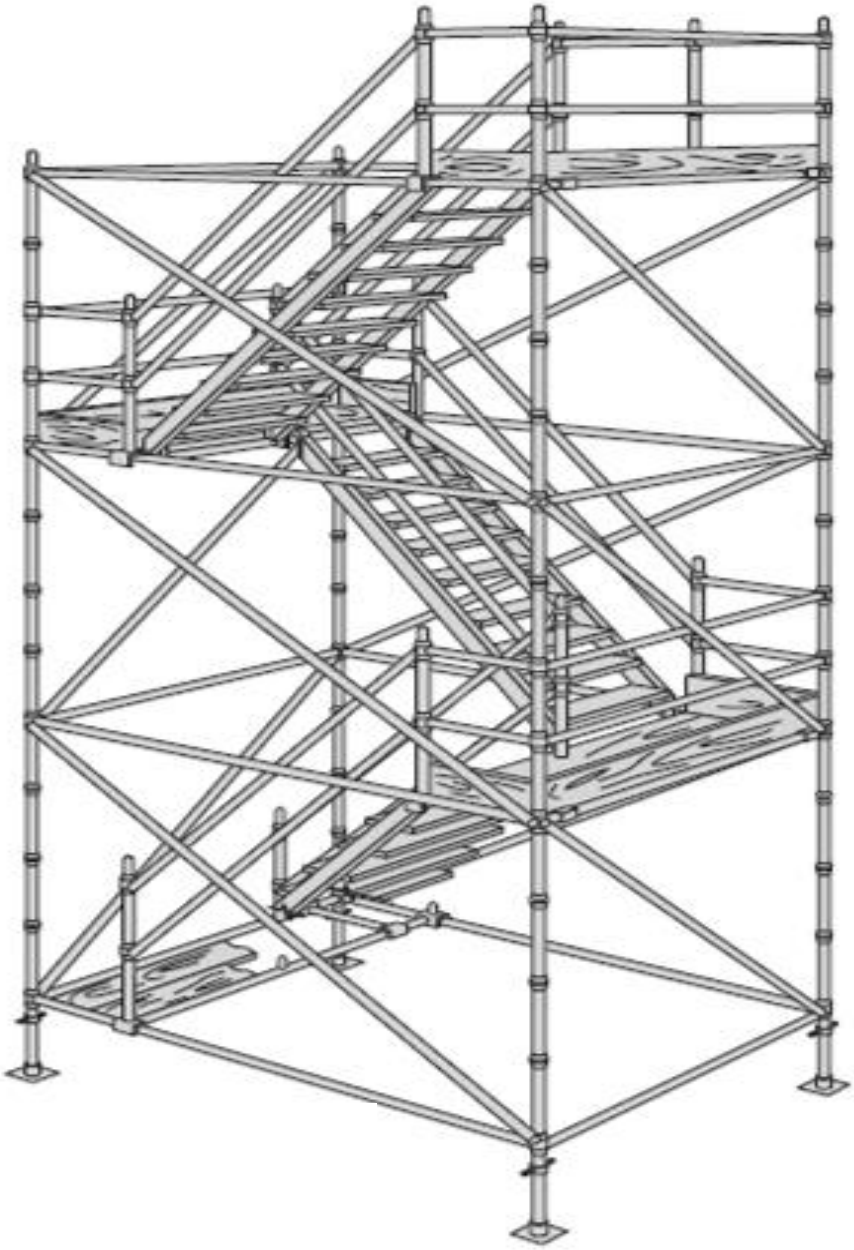
Slings attached to lugs or holes cut into part of the load are often used to lift bins, and slab forms (instead of wrapping the lifting slings around the load).

Information verifying the structural adequacy of the lifting points should be available. The certification should be provided by an engineer who should verify the:

- Structural adequacy of the lifting lug, and
- Means of attachment to the load (usually welded or bolted to the load).



11 USE OF LADDERS

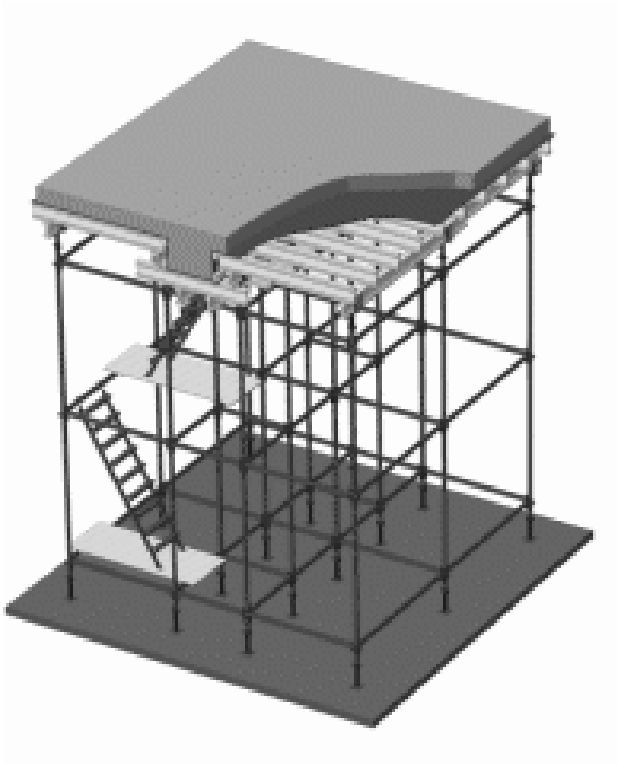


11. USE OF LADDERS

Ladders are used both to gain access onto an area and for persons to carry out permitted work including access and inspection.

Ladders should be secured, either:

- Attached at the top, or
- Held firmly at the base by another person.
- Where practical, alternatives to ladders such as work platforms or stair access systems should be used.
- Other issues regarding the safe use of ladders include:
- A person's feet should not be higher than 900 mm from the top of the ladder.
- Ladders should be set up on a firm, level surface. They should not be used on scaffolding or Elevated Work Platforms to gain extra height.
- Ladders should not be handled or used if they may come into contact with electrical power lines. Metal or metal reinforced ladders should not be used in the vicinity of live electrical equipment (timber ladders often have metal running along their length).
- Ladders must not be positioned above or adjacent to openings or edges where a potential fall could occur. Work platforms with edge protection should be provided in this instance.
- Ladders can only be used if equipment can be operated with one hand. Activities requiring use of both hands must not be performed while standing on a ladder, for example:
- Removing tie bar from wall and column forms during form stripping – this usually requires both hands and/or the use of a 'tie-bar puller'
- Carrying timbers, form ply, props or frames, and
- Using power tools, such as circular saws.



Ladders used for access must extend at least one meter above the accessed surface. Ladders should not be used in access ways or where there is pedestrian traffic, vehicles or mobile plant.

12 EDGE PROTECTION

12. EDGE PROTECTION ON THE FORMWORK DECK

12.1 Formwork construction zone physical barriers

A physical barrier should be provided and maintained to separate the formwork work zone from other workers. This barrier must be rigid, capable of maintaining its integrity in an upright position and capable of supporting signage if required.

The use of flags and tape or unsupported barriers is not acceptable.

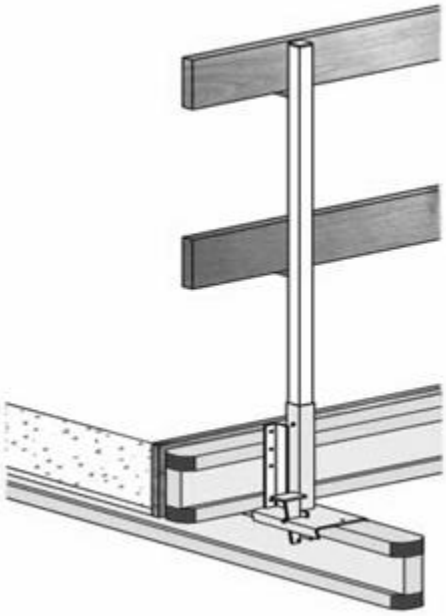
Where the design of the formwork is complex and the profile of the deck is constantly changing, construction of leading edge protection may create more hazards than it would control. In such cases, it may be impractical to provide edge protection, as anyone installing the edge protection would be exposed to the risk of falls. In some situations perimeter edge protection must be installed.

Examples include:

- where there is a change in deck height along the side of the deck being constructed, (i.e. a drop down for a beam) and no joists or form ply have yet been installed at this different height.
- where a leading edge is to be left unattended and access onto the deck is required by anyone other than form workers (i.e. the formwork deck has not been barricaded off and marked with 'keep out' signs).

12.2 Edge protection on completed decks

- The most effective means of providing edge protection on a completed formwork deck is to install perimeter scaffolding.
- Scaffolding is erected prior to the formwork and, therefore, prevents workers falling from the completed deck. The advantages of this system are that edge protection for installers of the final perimeter form ply sheets is already in place, there is no requirement to install edge protection on the perimeter, and no exposure to a risk of falling.
- In some rare situations, it may be impractical to provide perimeter scaffolding. In such cases, edge protection must be installed and the work system used for this installation must include a control measure against the risk of a fall.
- The use of harness systems is discouraged, because it does not provide an adequate level of protection from injury and is an impractical control for the risk of a fall from height in formwork erection.
- In some situations, edge protection can be substituted with an alternative measure, provided this measure prevents a person falling from the edge. One alternative is the provision of a barricade, 1.8 m from the edge with clearly visible 'keep out' signs.



Where scaffolding is over 4 m in height, only licensed and authorized scaffolders may erect, dismantle or alter the scaffolding. Any scaffolding components that are temporarily removed must be replaced at the earliest opportunity. Any gaps between a completed floor and scaffolding, that may exist after the formwork support system is removed, must be covered where there is a risk of a person or materials falling through.

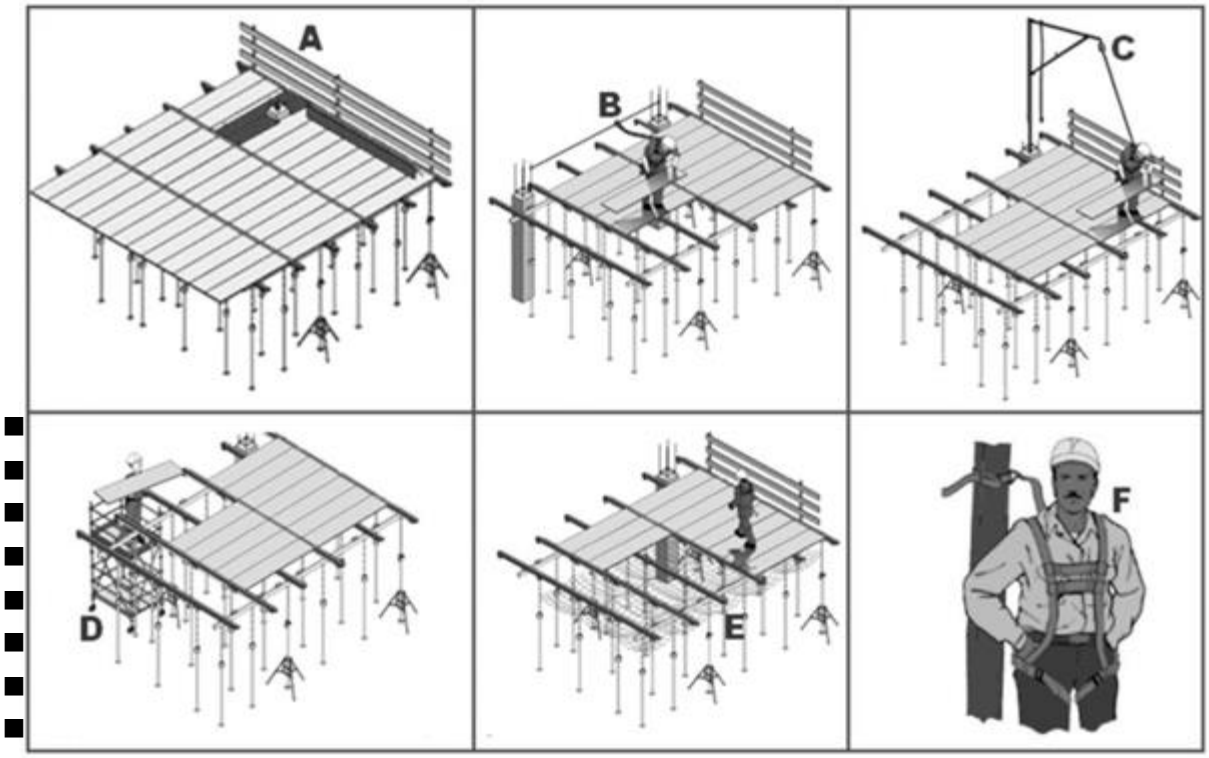
13 WORKING SAFELY AT HEIGHT

13.WORKING SAFELY AT HEIGHT

Working at height has been the most hazardous activity all over the world from time immemorial, and continues to attract the maximum number of accidents and the maximum number of fatalities.

There are many ways in which safety may be ensured while working at height as follows:

A. Guardrail and Toeboard (Fig. A)
B. Work restraint, attachment to lifeline (Fig. B)
C. Retractable lifeline (Fig. C)
D. Auxiliary scaffolding (Fig. D)
E. Safety net below (Fig. E)
F. Safety harness (Fig. F)



Safeguards For Working At Height

- In providing risk control against falling from height, collective control for all workers (A, D, or E) is better than individual control (B, C, or F); fall prevention (A, B, C, or D) is better than 'fall arrest' (meaning termination of a fall before hitting the base) to reduce the effects of fall impact after one has fallen (E or F).
- In terms of hierarchy of safety then, A or D is the best, and F is the worst. The full-body harness (E) also comes with a number of other auxiliary requirements for effective deployment, including proper fit, sufficient fall distance, strong anchorage, and prompt rescue.
- Control measures are required where a person could fall, from any height, onto an object such as frames, reinforcing steel or a rubbish skip.

14 MANUAL HANDLING OF HEAVY LOADS

14. MANUAL HANDLING OF HEAVY LOADS

Manual tasks

Manual tasks include any activity where persons grasp, manipulate, carry, move (lift, lower, push, pull), hold or restrain a load. Nearly all work done during the erection, altering and/or dismantling of formwork involves manual tasks (e.g. erecting formwork frames, handling sheets of ply, unloading vehicles or using hand tools such as hammers or saws).

Manual Handling of Heavy Loads

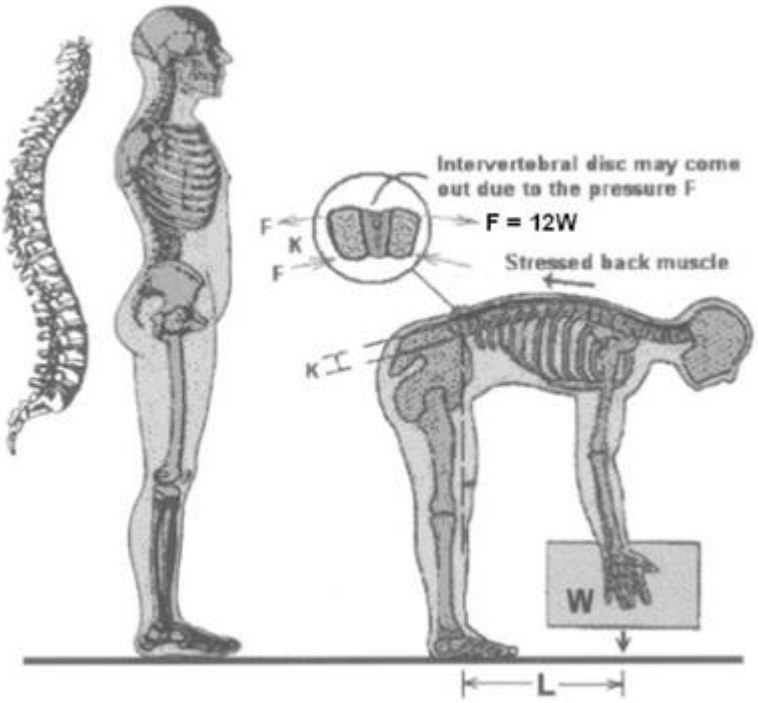
- In formwork - in common with most construction and factory activities - regularly carrying loads larger than about 25kg is an insidious risk, not sudden and dramatic like falling from height, but slowly causing musculoskeletal disorder (MSD) and escalating to permanent damage of the spine over a period of about an year.

- Musculoskeletal disorders (MSD) are among the most common worker complaints.

- If any activity requires lifting and movement of larger loads mechanical aids like trolleys may be provided for moving the heavier weights around; two or more workers may be deployed to lift them on to trolleys, or carry them for short distances.

- Even the simple expedient of rotating the task between different workers would reduce exposure to risk to more tolerable levels.

- Proper procedure to lift heavy loads by squatting and getting up with the load is also easily learnt. Needless to say, this analysis and recommendations for this particular hazard, apply to white collar non-construction workers too, such as office and lab assistants.



Forces On Vertebrae

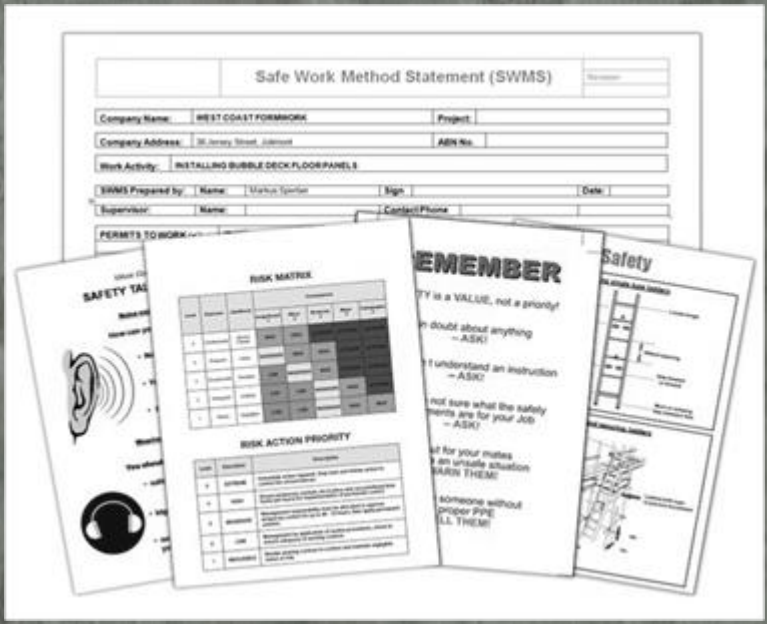
15 SAFE WORK METHOD STATEMENTS

SAFE WORK METHOD STATEMENTS

A safe work method statement must be prepared for high risk construction work before the work starts.

A range of activities defined as high risk construction work may be carried out as part of formwork, including work:

- Involving a risk of a person falling more than 2 meters.
- Involving structural alterations or repairs that require temporary support to prevent collapse.
- Carried Out on or near energized electrical installations or services.
- Carried out at a workplace in which there is movement of powered mobile plant.
- Carried out in or near a shaft or trench with an excavated depth greater than 1.5 meters.



The safe work method statement must:

- Identify the type of high risk construction work being done.
- Specify the health and safety hazards and risks arising from that work.
- Describe how the risks will be controlled.
- Describe how the control measures will be implemented, monitored and reviewed.

Safe work method statements must be developed in consultation with workers and their representatives who are carrying out the high risk work.

APPENDIX A – DEFINITIONS

Formwork:	A structure, usually temporary, but in some cases wholly or partly permanent, used to contain poured concrete to mould it to the required dimensions and support it until it is able to support itself. Note: It consists primarily of the face contact material and the bearers that directly support the face contact material.
Form:	An object used in the casting of concrete walls or columns that has part of its surface in contact with the concrete during the concrete curing process.
Bearer:	The primary horizontal support members for a formwork deck that are placed on top of formwork frames. Bearers are usually constructed from timber but are sometimes constructed from metal, for example in the case of some modular formwork systems.
Catch platform:	A temporary platform located below a work area to catch a worker in the event of a fall and to contain debris falling from a work platform.
Edge protection:	A barrier to prevent a person or thing falling from the edge of: • a building or other structure, or • an opening in a surface of a building or other structure, or • a fall arresting platform, or • the surface from which work is to be done, e.g. a formwork deck.
Competent person:	A person who has acquired through training, qualification or experience the knowledge and skills to carry out the task.
Design engineer:	The engineer that carries out planning and design activities for the formwork. This includes providing the design and documenting all temporary work and special equipment needed for construction on-site.
Engineer:	A competent person that has tertiary qualifications in an engineering discipline relevant to the design activity they are undertaking, for example a civil engineer.
Fall:	A fall by a person or object from one level to another.
Joist:	A secondary horizontal support member for the formwork deck placed on top of bearers, at right angles to the bearers. Joists are usually constructed from timber but are sometimes constructed from metal, for example in the case of some modular formwork systems.
Prop:	A slender structural member placed in a vertical position between two horizontal surfaces and used to support the upper surface.
Certificate of competency:	A document that has been issued by a licensing authority prior to the introduction of the National Standard for Licensing Persons Performing High Risk Work authorizing a person to perform one or more classes of high risk work.

APPENDIX B – RISK ASSESSMENT CHECKLIST

A TYPICAL RISK ASSESSMENT CHECKLIST

The purpose of this checklist is to assist formwork contractors to identify hazards at the workplace and to
develop work procedures that are safe for persons working on and about formwork.
On the following pages is a checklist to assist in identifying some of the common hazards and risks
concerning work on and about formwork.

Hazard identification	NO	YES	Control measures
Is there a risk of falling 1.8m or more?			A system to control risks should he provided for persons exposed to a risk of falling.
Is there an increased risk of falling?			A system to control risks should be provided for persons exposed to a risk of falling.
Is there a risk of falling at the leading edge of the deck?			Use systems, as required by the code, to prevent or arrest falls.
Is the surface condition below the deck, onto which a person may fall, hazardous?			Use systems, as required by the code, to prevent falls.
Are systems in place to prevent objects falling?			Use a system to prevent objects falling onto personnel.
Would the structure exceed a height equivalent to three standard frames?			An intermediate working deck should be provided at a height equivalent to three standard frames and also at each three standard frames thereafter
Are temporary working platforms and intermediate working decks required to be used to stack materials or equipment?			The contractor doing the work should ensure that they are designed to be so used.
Is edge protection necessary?			Edge protection must be put in place prior to carrying out work or progressively as the deck is being constructed and must remain in place until other fall protection safeguards are implemented.
By using fall arrest systems, are new hazards created?			They should be evaluated to ensure that they are effective and safe and that no new hazards are created.
Are safety nets to be used?			Avoid hazards
Does the structure supporting the deck require modification to support safeguards?			Notify the principal contractor. Do not proceed until modifications are complete.
Are the surfaces of materials on which work is to be performed: • wet? • slippery?			Use systems, as required by the code, to prevent falls.
Is access to and from the site unsuitable?			Arrange safe access.
Is access to and from the workplace unsuitable?			Arrange safe access.
Are ladders required?			Ensure ladders meet the requirements of the Construction Safety Regulations by following Appendix 3 in this code.

Hazard identification	NO	YES	Control measures
Are there any electrical hazards within 4.0 meters of the workplace?			Power should be disconnected, insulated or otherwise made safe before proceeding.
Are the climatic/environmental conditions including lighting levels unsuitable for work at the workplace?			Discontinue work until conditions are suitable.
Are there persons who have not received appropriate induction training to carry out the work?			Provide appropriate induction training to carry out the work before proceeding.
Are there any manual handling issues?			Provide systems of work which comply with the recommendations of the OHS (Manual Handling)
Is the plant and tackle required for lifting materials unavailable or unsuitable?			Obtain suitable plant and tackle required for lifting materials.
Are there other persons/trades working at the site?			Provide appropriate physical barriers or clearly display hazard warning signs as appropriate, such as: • PERSONS WORKING ABOVE • NAIL GUN IN USE • ELEVATOR OR HOIST IN USE.
Are portable electric powered tools being used?			Ensure that they are protected by a Residual Current Device (safety switch) before proceeding.
Are there any employees who have not been supplied with the appropriate PPE?			Supply with the appropriate PPE before proceeding.
Are there any persons who have not been adequately trained and instructed in the use of PPE?			Train and instruct all persons in the use of PPE.
Are any personnel unaware of the emergency and rescue procedures in the event of an accident, injury or other emergency (including the means of rescuing persons from safety harnesses following arrested falls)			Ensure emergency and rescue procedures in the event of an accident, injury or other emergency (including the means of rescuing persons from safety harnesses following arrested falls) are in place and known by all personnel.
Are loads or materials required to be moved?			Systems of work must ensure the safety of persons In the vicinity of materials or loads being moved.
Are hazardous substances or materials being used at the workplace?			The contractor doing the work should ensure compliance with the provisions of the OHS (Hazardous Substances) Regulation 1996 so that associated formwork operations do not become a risk to health.
Could noise become a risk to hearing or health?			Noise management provisions should be carried out by the contractor doing the work to ensure compliance with OHS (Noise) Regulation 1996 so that noise levels from machinery or equipment being used do not become a risk to hearing or health.

APPENDIX C – SAMPLE SAFE WORK METHOD STATEMENT

SAFE WORK METHOD STATEMENT (SWMS) – Formwork and Concreting Part 1

Company Details			
Company Name:	Auzcon Pty Ltd	ABN: 431 4488 6359	
Contact Name;	Barney Geldenhuys, Project Manager, mob 0450 117 955		
Address:	86 Campbell Parade, Beachmere, QLD 4510		
Project details			
Project:	Contract No MBRC003349 for MoretonBay Regional Council	Area: Margate Parade, Margate	
Job Address:	Margate Parade , Margate		
Job Description:	Construction of a vertical seawall and Boardwalk		
Activity:	**Concrete Formwork**		
Relevant workers must be consulted in the development, approval and communication of this SWMS		SWMS Approved by:	Page 1 of 14

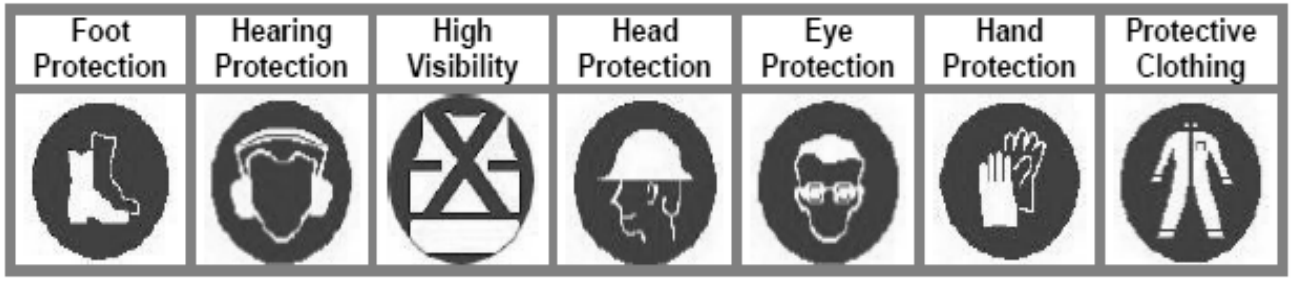
Name;	Signature:	Job Title:	Date:	Name:
				Signature:
				Date:

Personnel responsible for monitoring and managing activity:	Overall Risk Rating After Controls	Fatal	High
		Moderate	Low

ALL PERSONS INVOLVED IN TASK MUST HAVE THIS SWMS COMMUNICATED TO THEM PRIOR TO WORK COMMENCING

- Regular inspections and observations will be conducted by Barney Geldenhuys to ensure SWMS is being complied with.
- Daily Tool Box Talks will be undertaken to identify, control and communicate additional site hazards.
- Work must cease immediately if incident or near miss occurs. SWMS must be amended in consultation with relevant persons.
- Amendments must be approved by Barney Geldenhuys and communicated to all affected workers before work resumes.
- SWMS must be made available for inspection or review as required by WHS legislation.
- Record of SWMS must be kept as required by WHS legislation (until job is complete or for 2 years if involved in a notifiable incident).

Personal Protective Equipment



General:

Safety footwear (rubber boots), gloves, protective clothing (long sleeve shirts and long trousers or overalls). Ensure all PPE meets relevant Australian Standards. Inspect, and replace PPE as needed.

Provide UV sun protection where required, (broad brimmed hat, UV rated clothing, SPF 30+ sunscreen, tinted safety glasses with adequate UV protection).

Where required:

Hearing protection, high visibility shirt or vest, hard hat.

Safety Notes

Formwork is the surface, supports and framing used to withstand the loads imposed by the forms and the concrete and any bracing added to ensure stability.

Main hazards include:

- formwork collapse (before, during and after placement of concrete)
- falling objects
- noise/dust
- manual handling

Task Breakdown	Possible Safety or Environmental Hazards	RB	Control Measures to Reduce risk	RA	Responsible Officer
NOTE: RB = Risk Rating **before** controls implemented - **RA** = Risk Rating **after** controls are implemented.					
Design Specifications	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	F	Designers must: - Fully describe all features of design - Provide SWMS for installation and stripping - Define load areas - define acceptance criteria - Provide for field adjustment - Describe location of weep, vibrator and clean-out holes and inspection openings - Detail sequence of concrete placement, including any slopes, direction of pour and time between pours - Describe strength, stability and stiffness of system - Detail foundation materials - Detail surface type (filling, compaction, drainage) - Allow for loads during construction (such as workers, materials, wind, false decks, rain, water runoff) reduce fall risks where practicable Certification of design must be provided by a competent person All formwork materials (timber/plywood, prefab modules – aluminum, steel or plastic) must meet quality testing criteria as defined in AS 3610. All exposed rebar ends must contain end-caps. Ensure: - Correct size for bar - Fitted correctly - Regular inspections are undertaken to check condition of end caps and to ensure no caps are missing Note: End-caps to NOT provide adequate protection against impalement. Safe systems of work must be in place to prevent persons falling onto rebar ends (capped or not). Examples include guardrails, screens, edge protection of scaffolds, barriers and exclusion zones.	L	Engineer

Task Breakdown	Possible Safety or Environmental Hazards	RB	Control Measures to Reduce risk	RA	Responsible Officer
NOTE: RB = Risk Rating **before** controls implemented - **RA** = Risk Rating **after** controls are implemented.					
Preparation	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	F	Project documentation must be available on site and include (at least): - designs specifications - drawings - loading calculations - plans/elevations - general arrangements - maximum point loadings - component types and spacings - methods of securing structure and components - formply size - minimum stripping times - edge protection - back propping where required - any variations from design and subsequent certification of variations - safe load bearings - timeframes between pours and pour rates	L	Engineer Site Supervisor
Personnel requirements	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	F	**Competency Based Training:** Should include: - site induction - nature of hazards and emergency plans - requirements of AS3610 - Operation of plant/equipment as required - PPE (use, maintenance, storage) - Specific SWMS	L	Site supervisor
Risk Control	Personal injury - crushing - falls - being struck by falling object	F	**Consider:** - edge protection and netting to prevent falling objects - fit for purpose work platforms/scaffolding - traffic management - mechanical lifting - adequate lighting - certificate of competencies where required	L	Site Supervisor

Task Breakdown	Possible Safety or Environmental Hazards	RB	Control Measures to Reduce risk	RA	Responsible Officer
NOTE: RB = Risk Rating **before** controls implemented - **RA** = Risk Rating **after** controls are implemented.					
			- PPE and housekeeping		
Formwork Erection	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	F	All framing must be carried out so that it complies with on site design documentation and any manufacturers' requirements. Inspect all formwork components to ensure acceptable condition as per AS3610. **Traditional** Foundation: - ensure stable base - ensure base plates are provided under props and standards - ensure suitable sole boards are provided	L	All
			Note: Base plates and sole boards may not be required if competent persons deems them unnecessary. Note: If Lapped planks are used, they must be secured against uplifting and slipping.		
Pre-pour Inspection	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	F	Inspection should be undertaken by qualified person to ensure: - safe work practices were/are followed - system complies with requirement of design and project documentation - is adequately braced - is strippable - has adequate connections - correct spacing of frames, props and timbers; - correct joist and bearer sizes; - acceptable jack extensions;	L	Site supervisor Concretor

Task Breakdown	Possible Safety or Environmental Hazards	RB	Control Measures to Reduce risk	RA	Responsible Officer
NOTE: RB = Risk Rating **before** controls implemented - **RA** = Risk Rating **after** controls are implemented.					
			- adequate bracing to ensure stability. The engineer should supply an inspection certificate to verify the structural integrity of the support structure and formwork system		
During Concrete Pour	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	F	Ensure: - continuous supervision of the formwork assembly and concrete placement - Communication between the supervising personnel and the placing crews. - Monitor indicators if installed - if any failure, undue settlement or distortion of the formwork develops, work should cease and - the affected formwork assembly or component strengthened or replaced - concrete is placed and compacted in a manner that ensures specified quality of surface finish	L	All
Dismantling Formwork (Stripping)	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	F	Concrete should be inspected prior to dismantle: Check for unacceptable: - warping - twisting - cracks - blowholes - deviations as per AS3610 -	L	Site Supervisor

Task Breakdown	Possible Safety or Environmental Hazards	RB	Control Measures to Reduce risk	RA	Responsible Officer
NOTE: RB = Risk Rating before controls implemented - RA = Risk Rating after controls are implemented.					
Emergency Plan	Personal injury - crushing - falls - being struck by falling object Collapse of structure Legislation breach	**M**	Must include (at least): - rescue procedures - evacuation points - roles/responsibilities - communication procedures - first aid - use and location of fire protection equipment	**M**	All

SAFE WORK METHOD STATEMENT (SWMS) – Part 2

Formal Training, Licenses required for workers undertaking this task:	Duties of workers undertaking this task:	Training in the following safe work procedures/ SWMS / training modules is required: (All workers to be trained in relevant procedures.)
Example: - License to Perform High Risk Work (operating certain plant, equipment) - TAFE or other recognized training organization	Example: (Name): Operator (Name: Clean-up crew (Name): Supervisor etc	Site-specific inductions Training in this SWMS Nature of hazards / risks Emergency procedures
Details of Supervisory Arrangements for workers undertaking this task:	**Details of regulatory permits/licenses, Engineering Details/Certificates/WorkCover Approvals:**	**Relevant Legislation, Codes of Practice:**

Example: - Competent supervisors for job - Direct on-site supervision - Remote site – communication systems/ schedule - Audits - Spot Checks, etc - Reporting systems	Example: - Local council permits - Building Approvals - EPA approvals/permits - Certain plant to be registered with The Regulator - PPE to comply with relevant Australian Standards	• Work Health and Safety Act 2011 and Work Health and Safety Regulations 2011 • Queensland – Formwork Code of Practice • Australian Standard - AS3610 - 1995 Formwork for Concrete • Australian Standard – AS3600 – Concrete Structures • Australian Standard - AS1379 – Specifications of supply of concrete • NSW Code of Practice for Formwork
Plant/Tools/Equipment: (List plant and equipment to be used on the job.)	**Maintenance Details for plant / equipment used on job** (Include cranes, forklifts, electrical equipment etc.)	
Example: Electric jackhammer	As per manufacturer's recommendations. Electrical tested/tagged every 3 months.	

SAFE WORK METHOD STATEMENT (SWMS) – Part 3 - SIGN OFF

This SWMS has been developed in consultation and cooperation with workers and relevant Persons Conducting Business or Undertaking (PCBU). I have read the above SWMS and I understand its contents. I confirm that I have the skills and training, including relevant certification to conduct the task as described. I agree to comply with safety requirements within this SWMS including safe work instructions and Personal Protective Equipment described.

Name	Qualifications	Signature	Date	Time	PCBU

Review No.	1	2	3	4	5	6	7	8	9
Name and initials									
Date									

APPENDIX D – MINUTES OF INSPECTION OF FORMWORK

MINUTES OF INSPECTION OF FORMWORK

Project:	**Date:**
Contractor:	**No.:**

Division / Building / item(s)

According to Drawing No. :

Applicable standards:

Planned Starting time: Date:

RHV Inspection Report	Date: Time:		
Description	Accept	No	N.A
Inspection works			
- Quality of formwork			
- Stability			
- Position, vertical and perpendicular			
- Form release agent			
- Water stop			
- Form tie			
- Flat and seal			
- Embedded items			
- Chamfer			
- Block-out			

Your submission for approval is subject to following conditions :

☐ Approved ☐ Approved on condition as noted

☐ Amend and resubmit ☐ Not approved as noted

Note:

Witnessed by Owner	Approved by Consultant	Requested by Contractor
Name:	Name:	Name:
Position:	Position:	Position:
Date:	Date:	Date:

CONCRETE SLAB FORMWORK

SAFETY GUIDE

Prepared By: Eng. Mohanad Elbornya