

Scaffolding - Best practice guideline for scaffolding in New Zealand

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Process for the review of this document

The general process for the review of the Best Practice Guideline for Scaffolding in New Zealand (BPG) is as follows. This process was followed for this revision.

Formation and composition of review committee

Under the leadership of Scaffolding and Rigging New Zealand (SARNZ), up to nine representatives from SARNZ and stakeholder groups involved with the supply, erection, design, manufacture or use of scaffolding are selected to form the review committee. To this group is added a WorkSafe NZ representative and an independent chairperson. The committee lasts three years and is then dissolved and reformed following the same process.

- Representatives must be able to show they receive direction from the group they represent i.e. they do not represent just their own individual or company interests.
- Only one representative will be from each stakeholder group.
- The committee can co-opt individuals from outside the committee to discuss submissions or to provide technical or other expertise.

Process

1. SARNZ advertises, via the National Press, Gazette and direct mail to stakeholder database and WorkSafe NZ, that a review is to take place and that it will receive submissions for membership of the review committee and for changes or additions to the BPG. SARNZ then receives these submissions.
2. SARNZ and WorkSafe NZ vet nominations and form the review committee as above.
3. The committee meets to discuss and review submissions. This may include breaking into working groups and/or co-opting technical support if required. Submissions are accepted from any interested person, company or organisation.
4. The committee produces a draft revised document and releases it for public comment.
5. The committee reviews public comment and makes additional changes to the draft as needed.
6. Steps 4 and 5 may be repeated as necessary.
7. The revised BPG is approved by the committee and published.

The Committee may decide its own procedures, including resolution of any disagreements or deadlock on the contents of the document, and may, at its discretion, reconvene for urgent or part revisions between scheduled reviews.

Notice of issue

SCAFFOLDING & RIGGING NEW ZEALAND INCORPORATED

The Best Practice Guidelines for Scaffolding was first published in 2002, and revised in 2003. It is an industry led statement of preferred work practices, or arrangements, for the purpose of ensuring the highest levels of health and safety for all those affected by scaffolding activities in New Zealand.

The 2009 Review has been conducted by a committee representing the scaffolding industry, scaffold users, training providers, safety advisors, and the Department of Labour. The review process has been robust with input from a broad range of stakeholders through public consultation. "Best Practice Guidelines for Scaffolding in New Zealand" is a 'living document' which, through regular reviews, will keep pace with changes and improvements in the industry.

SARNZ would like to thank all those who have contributed to the "Best Practice Guidelines for Scaffolding in New Zealand". The broad support of stakeholders confirms this document as the 'current state of knowledge' for scaffolding in New Zealand.

Graham Burke
President
Scaffolding & Rigging New Zealand Incorporated [SARNZ]

The place and context of this document

While compliance with the Best Practice Guidelines for Scaffolding in New Zealand is not mandatory, it represents current best practice in the industry as perceived by the industry itself and may be used as evidence of good practice in court. Its contents should be seen as a comprehensive and authoritative guide to what is considered by the scaffolding industry to be preferred work practice or arrangements, and includes procedures which could be taken into account when deciding on optimal and practicable steps to be taken when scaffolding.

SARNZ, in conjunction with the Best Practice Guidelines for Scaffolding Working Party, has made every effort to ensure that the information contained within this publication is accurate. Even so, SARNZ welcomes your comments and suggestions to improve this document and its contents. It is SARNZ intention to review the Best Practice Guidelines regularly. We believe this document should represent the changing nature of scaffolding and reflect up to date best practice for scaffolding in New Zealand.

Best practice guidelines for scaffolding in New Zealand review committee

The committee responsible for the revision consisted of representatives from the:

- Scaffolding industry
- Certified Builders Association of New Zealand
- Department of Labour
- Master Painters New Zealand Inc
- Opportunity - The Training Organisation
- Registered Master Builders Federation of New Zealand Inc
- Roofing Association of New Zealand
- Scaffolding, Rigging and Industrial Rope Access Industry Training Inc (SRIIT)
- Scaffolding and Rigging New Zealand Inc (SARNZ)
- Site Safe New Zealand Inc and
- Tai Poutini Polytechnic (training provider).

SARNZ wishes to thank the working party and their employers for their commitment, hard work and perseverance in bringing this project to completion.

Formatting in this document

The following formatting conventions are adopted in this document:

- In diagrams and drawings, unless otherwise stated, kickboards are excluded for clarity.
- 'BPG' as used here refers to this document, The Best Practice Guidelines for Scaffolding in New Zealand.
- Wherever practical Department of Labour formatting guidelines are adopted.

Section 1: Introduction

1.1 Definition of key concepts

1.1.1 Scaffolding

For the purposes of this document scaffolding is defined as:

Any structure or framework, swinging stage, suspended scaffolding, or boatswain's chair, of a temporary nature, used or intended to be used for the support or protection of workers for the purpose of carrying out their work or for the support of materials used in connection with any such work. Scaffolding includes any scaffolding erected as such and not dismantled, whether or not it is being used as scaffolding; and also includes any plank, coupling, fastening, fitting, equipment, item or device used in connection with the construction, erection, dismantling or use of scaffolding.

Note that the definition of scaffolding in the Health and Safety in Employment Regulations 1995 under clause 1.3.2 has in view the interpretation of the levels of scaffolding contained in its umbrella legislation, the Health and Safety in Employment Act 1992 and is therefore a little different from that given above.

1.1.2 Scaffolding process

Scaffolding process is defined as:

The planning for and/or the design, erection, inspection, alteration, use or dismantling of any scaffolding and/or related components. This includes all structures constructed using scaffolding components, such as falsework, temporary grandstands, lighting towers and stair access towers. [These have been included in the scope of the BPG if scaffolding components are being used.]

1.2 Design requirements

1.2.1 Principles of design

The design of scaffolds should take into account the following:

- The strength, stability and rigidity of the supporting structure.
- The handling normally associated with scaffolding.
- The safety of persons engaged in the erection, alteration and dismantling of the scaffold.
- The safety of persons using the scaffold.
- The safety of persons in the vicinity of the scaffold.
- The scaffolds fitness for its intended purpose.

1.2.1.1 Standards applicable to scaffolding, scaffolding components and related activities

Relevant standards are those related to:

1. The design and erection of scaffolding.
2. The nature and integrity of structural members.
3. Scaffold components.

This includes but is not limited to the following:

- AS 1577 Scaffold planks

- AS 1664.1 Aluminium structures (Limit state design)
- AS/NZS 1170.0 Structural design actions - General principles
- AS/NZS 1170.1 Structural design actions - Permanent, imposed and other actions
- AS/NZS 1170.2 Structural design actions - Wind actions
- AS/NZS 1170.3 Structural design actions - Snow and ice actions
- NZS 1170.5 Structural design actions - Earthquake actions-New Zealand
- AS/NZS 1554.1 Structural steel welding - Welding of steel structures
- AS/NZS 1554.2 Structural steel welding - Stud welding (steel studs to steel)
- AS/NZS 1554.4 Structural steel welding - Welding of high strength quenched and tempered steels
- AS/NZS 1576.1 Scaffolding - General requirements
- AS/NZS 1576.2 Scaffolding - Couplers and accessories
- AS/NZS 1576.3 Scaffolding - Prefabricated and tube-and-coupler scaffolding
- AS/NZS 1576.4 Scaffolding - Suspended scaffolding
- AS/NZS 1576.5 Scaffolding - Prefabricated splitheads and trestles
- AS/NZS 1576.6 Scaffolding - Metal tube-and-coupler-Deemed to comply with AS/NZS 1576.3
- AS/NZS 1665 Welding of aluminium structures
- AS/NZS 1892.1 Portable ladders-Metal
- AS/NZS 1892.3 Portable ladders-Reinforced plastic
- AS/NZS 1892.3 Portable ladders-Selection, safe use and care
- AS/NZS 3012 Electrical installations-Construction and demolition sites
- AS/NZS 4576 Guidelines for scaffolding
- NZS 3603 Timber structures standard
- NZS 3608 Specification for timber ladders
- NZS 4711 Qualification tests for metal-arc welders
- NZS 4781 Code of practice for safety in welding and cutting

Standards relating to the design use and maintenance of industrial fall-arrest systems and devices include, but are not limited to:

- AS/NZS 1891.1 Industrial fall-arrest systems and devices - Harnesses and ancillary equipment
- AS/NZS 1891.2 Industrial fall-arrest systems and devices - Horizontal lifeline and rail systems
- AS/NZS 1891.2 Supp1 Industrial fall-arrest systems and devices - Prescribed configurations for horizontal lifelines
- AS/NZS 1891.3 Industrial fall-arrest systems and devices - Fall-arrest devices
- AS/NZS 1891.4 Industrial fall-arrest systems and devices - Selection, use and maintenance

1.2.1.2 Task analysis

It is becoming generally accepted that on larger sites clients want a task analysis completed as part of the design process. This is generally provided in conjunction with hazard identification.

A task analysis shows the step by step requirements to erect, alter or dismantle a scaffold for a particular site. A [task analysis form](#) is appended in the last section of this document.

1.2.2 Loads in scaffolding

1.2.2.1 Load combinations

Scaffolding foundations must be able to carry and distribute all the weight of the scaffold, including any extra loads placed on the scaffold. To facilitate this, when scaffolding is designed particular attention should be given to ground conditions (subsidence, water courses, level, the nature of ground materials etc.) and to the loadings on the scaffold.

Scaffolding should be designed for the most adverse combination of dead loads, live loads and environmental loads that can reasonably be expected during the period that the scaffold is expected to be in service.

Load combinations for strength limit states should be in accordance with AS/NZS 1170.0 and its supplements, except that dead and live load combinations need to be as follows:

$2.0G + 2.0Q$ [Where G = dead load and Q = live load (including impact, if any)].

Where environmental loads will be such that work is unlikely to proceed under those conditions, then the loading calculation at that point in time may be restricted to dead loads, expected live loads from stacked materials and environmental loads. When work resumes the loading will change.

For permissible stress design, the sum of the dead and live loads applied shall be increased by 15 percent, to allow for re-use of materials.

1.2.2.2 Dead loads

The dead load (G) is the self-weight of the scaffolding. That is, all structural components and equipment that form the scaffold. It is generally a static load.

1.2.2.3 Environmental loads

Where appropriate, the environmental loads shall include the following:

- Wind loads in accordance with AS/NZS 1170 (and supplements) imposed on the scaffold, including any guardrails, toeboards, stacked materials, screens, sheeting, platform ropes, guy wires and other attachments.
- Snow loads in accordance with AS/NZS 1170 (and supplements).
- Rain and ice loads, where it is considered likely that the scaffold and claddings will be subjected to rain or a build-up of ice.
- Earthquake loads in accordance with AS/NZS 1170 (and supplements).

1.2.2.4 Live loads

The live load (Q) is the temporary loads imposed on a scaffold. These include but are not limited to:

- Duty loads (light, medium, heavy, special) such as persons and/or materials.
- Environmental loads (wind, snow etc).
- Impact loads through short, sudden loadings such as loading materials in/out from a platform and mechanical hoist operation.

Scaffolds should not be used to support formwork and plant, such as hoist towers and concrete pumping equipment, unless the scaffold is specifically designed to do this.

Duty live loads

The live load applied to a working platform is categorised by the following duty conditions:

- Light-duty - a load of 2.2 kN (225 kg) per bay that includes a single concentrated load of 1 kN (100 kg).

- Medium-duty - a load of 4.4 kN (450 kg) per bay that includes a single concentrated load of 1.5 kN (150 kg).
- Heavy-duty - a load of 6.6 kN (675 kg) per bay that includes a single concentrated load of 2.0 kN (200 kg).
- Special-duty - the largest intended load but not less than heavy-duty.

For design purposes the single concentrated load should be assumed to be in the most adverse position within the bay.

AS 1576 elaborates on loads in scaffolding.

1.2.2.5 Load calculations

Calculation used for live loads

Live loads on standards will vary for different bays and platforms. The explanation below relates to calculations for any one particular bay on one platform level.

To calculate the live load on a standard, assume that each standard in that bay supports one third of the duty live load on each platform in each adjoining bay. This is to allow for off centre loading of platforms and concentrated loads placed closer to a standard.

For example, consider a medium duty scaffold.

The live load on any one standard (between two bays each of 4.4 kN - 450kg) based on the worst possible loading in adjacent bays

$$= 4.4 \text{ kN (450kg)} \times 2 \times \frac{1}{3} = 2.9 \text{ kN (300kg)}$$

Assume that the dead load of the scaffold supported by the standard is 3.5 kN (350kg).

Then the design load for this standard

$$= 2.9 \text{ kN (300kg)} + 3.5 \text{ kN (350kg)} = 6.4 \text{ kN (650kg)}$$

Calculation used for non standard soleboard lengths

Now that the design load on the standard is known i.e. 6.4 kN (650kg), the minimum length of the soleboard can be determined for a known ground or floor load capacity.

Assume the ground load capacity is 2500kg/m² and a typical timber plank 225mm wide will be used.

Therefore, the minimum acceptable length of the soleboard is:

$$650 \text{ kg} \div 2500 \text{ kg/m}^2 \div 0.225 \text{ m} = 1.16 \text{ m.}$$

The minimum length soleboard required for the above conditions is thus 1.16m long.

1.2.2.6 Mass of persons and general material

The following table gives the approximate masses of persons and general materials likely to be supported from scaffolds.

Table 1: Mass of persons and general materials for use when scaffolding

Items	Approximate Mass
Bricks	4.0 kg per brick
Cement	40.0 kg per bag
Concrete block 400 x 200 x 200mm hollow	19.0 kg per block
Concrete block 400 x 200 x 150mm hollow	16.0 kg per block
Concrete block 400 x 200 x 100mm hollow	13.0 kg per block
Concrete block 400 x 200 x 100mm solid	16.0 kg per block
Concrete ready mixed wet	2550.0 kg per cubic metre (m)
Concrete in wheelbarrow	140.0 kg
Drums empty 200 litre	13.0 kg
Marble	2700.0 kg per cubic metre (m)
Paint (except red and white lead) five litres	10.5 kg
Paint red and white lead five litres	15.0 kg
Persons single	100.0 kg
Persons plus wheelbarrow with concrete	220.0 kg
Plaster fibrous	1.6 kg per square metre (m)
Plaster bag	38.0 kg
Plywood 17.0mm	10.0 kg per square metre (m)
Sand	2000.0 kg per cubic metre (m)
Shale	2600.0 kg per cubic metre (m)
Steel rods 6.5mm diameter	25.0 kg per 100.0m

Steel rods 10.0mm diameter	67.0 kg per 100.0m
Steel rods 12.0mm diameter	89.0 kg per 100.0m
Steel rods 16.0mm diameter	158.0 kg per 100.0m
Steel rods 20.0mm diameter	247.0 kg per 100.0m
Steel rods 25.0mm diameter	358.0 kg per 100.0m
Tiles terra cotta	3.5 kg per tile
Tiles concrete	3.75 kg per tile
Timber hardwoods	1100.0 kg per cubic metre (m ³)
Timber softwoods	640.0 kg per cubic metre (m)
Water (excluding container)	1.0 kg per litre
Double coupler	1.0 kg
Single coupler	0.6 kg
Joiner	0.8 kg
Swivel coupler	1.2 kg
3.0m laminated timber plank	18.0 kg
48.3mm galvanised scaffold tube 1.0m	4.4 kg per metre

1.2.3 Structures supporting scaffolding

The supporting structure should be capable of supporting the most adverse combination of loads applied by the scaffold during the period of its service. Where the supporting structure is not capable of supporting the most adverse combination of expected loads it may need to be strengthened by propping or other means.

Soleboards and baseplates can also be used to evenly distribute the load from the scaffold to the supporting surface. Both soleboards and baseplates may be required for use on less stable surfaces, such as soil or gravel. The use of soleboards and/or baseplates should be considered in the design of the scaffold.

1.2.3.1 Stability

Scaffold stability may be achieved by:

- Tying the scaffold to a supporting structure.
- Guying to a supporting structure.
- Increasing the dead load by securely attaching counterweights near the base.
- Adding bays to increase the base dimension.

1.2.3.2 Brackets

Prefabricated scaffold brackets

Prefabricated scaffold brackets that are attached to a structure to provide support for a working platform must:

1. Have adequate and suitable means of attachment to provide vertical support and to resist accidental sideways movement.
2. Be stable in the longitudinal direction of the platform under the applied horizontal force and have a factor of safety of not less than 1.5.
3. Be fitted with guardrails, midrails and toeboards on all platforms.

Ladder brackets

Ladder brackets that are used for supporting a working platform for the purpose of painting only must satisfy the following requirements:

1. Brackets are attached to ladders not inferior to the requirements set out in NZS: 3609 Timber ladders or NZS 5233 Portable ladders (other than timber ladders).
2. The ladders used for attaching the brackets do not exceed a maximum working length of 7.8m.
3. The top rung to which each bracket is attached is not more than three-quarters of the ladder's working length from the foot of the ladder.
4. Precautions are taken to ensure that the feet and tops of ladders are so supported that the ladders will not slide sideways or outwards.
5. Only one person works on the platform at one time and, if the platform is being used in a public place, a second worker is on hand to assist if mishaps occur and in setting up and moving ladders, brackets and scaffold planks.
6. The span and quality of the plank used complies with the provisions relating to light-duty working platforms.
7. As a working platform edge protection is required. While this is not impossible to achieve it is suggested that alternative, more practicable and safer methods be utilised such as scissor hoists, tube and clip or proprietary scaffolding.

1.2.3.3 Trestles and tripods

Definitions

A trestle is a self supporting metal or timber stand, incorporating one or more horizontal member, on which a working platform may be laid. Steel trestles are often telescopic and of the folding type.

A tripod is a three-legged stand for supporting one end of a horizontal beam on which a working platform may be laid.

Special requirements

1. The design and construction of steel trestles needs to be to a recognised standard. Refer to AS/NZS 1892.1 Section 6 Particular requirements for trestle ladders and to AS/NZS 1576.5 Prefabricated spliheads and trestles.
2. The loading of working platforms is generally restricted to light duty (225kg). Loadings for planks and manufacturer's instructions must be adhered to.
3. The ratio of height of trestle to spread of legs should not exceed 3. For safe erection and use refer to manufacturer's instructions.
4. The maximum span of timber scaffold planks able to be used on trestles is 2.4m.
5. Trestles should be erected on firm and level ground to provide maximum support.
6. As a working platform edge protection is required. While this is not impossible to achieve it is suggested that alternative, more practicable and safer methods be utilised such as scissor hoists, tube and clip or proprietary scaffolding.

1.3 Legislative and regulatory context

1.3.1 The Health and Safety in Employment Act 1992

Object of the Act

The object of the HSE Act is the prevention of harm to all persons at work and other persons in, or in the vicinity of, a place of work. To do this, it imposes duties on employers, employees, principals and others, and promotes excellence in health and safety management by employers. It also provides for the making of regulations and codes of practice.

Employers' duties

Employers have the most duties to perform to ensure the health and safety of employees. Employers have a general duty to take all practicable steps to ensure the safety of employees at work. In particular, they are required to take all practicable steps to:

- Provide and maintain a safe working environment.
- Provide and maintain facilities for the safety and health of employees at work.
- Ensure that the machinery and equipment is safe for employees.
- Provide protective clothing and equipment.
- Ensure that working arrangements are not hazardous to employees.
- Provide procedures to deal with emergencies that may arise while employees are at work.

Taking "all practicable steps", means taking all steps to maintain health and safety that can reasonably be expected in the circumstances, having regard to the:

- Nature and the severity of the harm that may be suffered if the duty of care is not performed.
- Current state of knowledge about the likelihood that harm of that nature and severity could occur if health and safety is not maintained.
- Current state of knowledge about harm of that nature.
- Current state of knowledge about the means available to achieve safe and healthy results, and about the likely efficacy of taking such action.
- Availability and cost of each of these means, to ensure safety.

Hazard management

Employers must identify and regularly review hazards in the place of work (existing, new and potential) to determine whether they are significant hazards and require further action.

Employers are required to record details of harm or situations that could have caused harm in their place of work. Employers are also required to investigate incidents where serious harm occurs to determine if it was caused by or arose from a significant hazard.

This is particularly concerned with:

- Serious harm; or
- Harm (being more than trivial) where the severity of effects on any person depends (entirely or among other things) on the extent or frequency of the persons exposure to the hazard; or
- Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.

Where the hazard is significant the HSE Act sets out steps for employers to take, namely:

- Where practicable, eliminate the hazard.
- If elimination is not practicable, isolate the hazard.
- If it is impracticable to eliminate or isolate the hazard completely, then the employer must minimise the hazard to employees.

Where a hazard cannot be eliminated or isolated employers must in addition, where appropriate:

- Ensure that protective clothing and equipment is provided, accessible and used.
- Monitor employees' exposure to the hazard.
- Seek the consent of employees to monitor their health.
- With informed consent, monitor employees' health.

Information for employees

Before employees begin work, they must be informed by their employers of:

- Hazards they may be exposed to while at work.
- Hazards they may create that could harm other people.
- How to minimise these hazards becoming a source of harm to themselves and others.
- The location of safety equipment.
- Emergency procedures.

Employers are also required to inform employees of the results of any health and safety monitoring. In doing so, the privacy of individual employees must be protected.

Employers to involve employees in developing health and safety procedures

Employers must provide reasonable opportunity for their employees to participate in ongoing processes for the improvement of health and safety in their place of work.

Training for employees

Employers must ensure employees are either sufficiently experienced to do their work or are adequately supervised by an experienced person. In addition employees must be adequately trained in the safe use of equipment in the workplace, including protective clothing and safety equipment.

Safety of people who are not employees

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

Duties of employees and self employed persons

Employees and self-employed persons are responsible for their own safety and health while at work. They must also ensure that their actions do not harm anyone else. However, their responsibilities do not detract from those of the employer or principal.

Duties of principals, contractors, scaffolding erectors and users of scaffolds

All those involved in the erection, alteration, use and dismantling of scaffolding have responsibilities under the HSE Act, both for the scaffolding process and for the protection of those who use the scaffold in the course of their work. While the actual scaffolding process can vary from project to project, it is up to those involved to clarify their various responsibilities.

Note that a party can have responsibilities simultaneously as both a principal and an employer.

Specific duties of each party to the scaffolding process may include the following.

- A. Property developers, project management consultants, owners, and persons who control the workplace need to ensure that:
 - o Adequately qualified contractors and consultants are employed on the project.
 - o Sufficient monies are available to fund the works and the temporary works so that provisions can be made to protect employers, employees and others against the various hazards that may arise.
- B. Main contractors, project management consultants or subcontractors who engage others or contract for the erection of a scaffold need to:
 - o Plan the work to be carried out from the scaffold and specify any special requirements for the scaffold, e.g. any loads the scaffold may be expected to carry.
 - o Coordinate the erection, use and dismantling of the scaffold.
 - o Ensure the safety of others who may be in the vicinity of the scaffold, including members of the public.
 - o Provide for public protection, including gantries and screening. This may include coordination with local authorities and obtaining permits as necessary.
 - o Provide information about foundation conditions for the scaffold including, if necessary, information about the strength of verandahs and suspended slabs upon which the scaffold is to be erected.
 - o Provide information about the proximity of powerlines and protective methods.
 - o Clearly communicate to the scaffolding erector via specifications, drawings, or other information, the scope and all requirements for the scaffold.
 - o Coordinate/delegate all subsequent inspections and alterations needed to ensure the safety of the scaffold and those using it. This includes the need to ensure that a scaffold register or scaffold record system is kept up to date.
 - o Ensure protection of the scaffold from construction vehicles or other vehicles in the vicinity, including coordination of crane activities over the scaffold.
- C. Scaffolding erection companies must:
 - o Develop a clear understanding of the scaffold required and the work that is to be carried out from the scaffold, including the need for protective gantries, screening, foundation conditions, power cables, etc.
 - o Design and plan the scaffold and the erection process, including coordination with other employers who are in the vicinity, to ensure safety during construction, use, alteration and later dismantling of the scaffold.
 - o Provide a scaffold that complies with the manufacturer's specification and the BPG.
 - o On completion of the erection of the scaffold, inspect and certify that it is safe for use and hand over the scaffold to the principal. The hand over must include any information that could affect subsequent users of the scaffold and any limitations on the scaffold.
 - o Coordinate with the principal on the need for subsequent inspections and alterations as work proceeds on the project e.g. alteration of working platforms, increasing the height of the scaffold, etc.
- D. Users of the scaffold must:
 - o Understand any limitations of the scaffold that could affect their work, e.g. load limits.
 - o Not alter the scaffold in any way.
 - o Liaise with the main contractor or the scaffold erector to have ties, working platforms, etc relocated or altered as necessary.
 - o Carry out their own work so as not to endanger others in the vicinity.

Accidents and serious harm (records and notifications)

The HSE Act requires employers, principals and self-employed people to keep a register of all work-related accidents and serious harm. This includes every accident that harmed or might have harmed a person.

Employers, principals and self-employed people are also required to investigate all accidents, harm and near misses to determine whether they were caused by a significant hazard.

Employers, principals and self-employed people are required to notify serious harm that occurs to people in the workplace, or in relation to the work being conducted to WorkSafe NZ as soon as possible. WorkSafe NZ will advise whether it wishes to investigate the accident and what action may be taken in the meantime.

- [Notify serious harm](#)

1.3.2 The Health and Safety in Employment Regulations 1995

Regulations are promulgated from time to time under the HSE Act. Legally, the requirements of both the Act and its regulations must be complied with.

Regulations may, among other things, impose duties on employers, employees, designers, manufacturers, and others relating to health and safety. These regulations may apply with respect to places of work, plant, processes or substances and may deal with particular problems that have arisen.

The main regulations applying to scaffolding are the Health and Safety in Employment Regulations 1995.

The Health and Safety in Employment Regulations define scaffolding as:

Any advanced scaffolding, basic scaffolding, or suspended scaffolding or any framework or structure, of a temporary nature, used or intended to be used for: the support or protection of persons carrying out construction work or work connected with construction work, for the purpose of carrying out that work or; the support of materials used in connection with any such work. This includes any scaffolding constructed as such and not dismantled, whether or not it is being used as scaffolding, and also includes any coupling, device, fastening, fitting, or plank used in connection with the construction, erection, or use of scaffolding.

Other regulations which may be relevant to scaffolding work include those related to building and construction, product and material specifications, safety, use of dangerous products (including asbestos) and resource management.

Regulations and legislation may be searched and accessed via the link below.

<http://www.legislation.govt.nz/>

1.3.3 Scope of scaffolding work in the HSE Regulations

Basic scaffolding includes:

- Fall arrest systems.
- Free standing modular scaffolding systems.
- Gin wheels.
- Ropes.
- Static lines.

Suspended scaffolding includes:

- Boatswain's chairs, whether hand hauled or mechanical.
- Swing stages, whether hand hauled or mechanical.

Advanced scaffolding includes:

- Basic scaffolding.
- Suspended scaffolding.
- Barrow ramps.
- Bracket scaffolds for tank work and formwork.
- Cantilevered scaffolds.
- Catch nets.
- Hoists that are cantilevered from a scaffold, have a load limit not exceeding 250kg and are used for materials only.
- Hung scaffolding, including scaffolding hung from a chain, tube or wire rope
- Load platforms cantilevered from a scaffold.
- Mast climbers.
- Safety nets for public protection.
- Scaffolding associated with perimeter safety screens or shutters.
- Sloping platforms.
- Spurred scaffolds.
- Tube and fitting scaffolding, including covered ways or gantries made of tube and fitting scaffolding.
- Boatswain's chairs, whether hand hauled or mechanical.
- Swing stages, whether hand hauled or mechanical.

1.3.4 Duty in relation to scaffolding under the HSE Regulations

Scaffolding must be:

- Suitable for the purpose for which it is to be used.
- Properly constructed of sound materials.
- Constructed with sufficient reserve of strength having regard to the loads and stresses to which it may be subjected.
- Sufficient in amount for the purpose for which it is to be used.

These duties are the primary responsibility of the employer under the Health and Safety Regulations.

Requirements of the scaffolder:

- Have a thorough knowledge of the use or uses in regard to the type or types of scaffolding being erected, altered or dismantled.
- Have a thorough knowledge of the erection, maintenance, repair and dismantling in regard to the type or types of scaffolding being employed.
- Have a thorough knowledge of the practices that must be followed in regard to the type or types of scaffolding being erected, altered or dismantled.
- Have suitable training, including recent experience, in the use, erection, maintenance and dismantling of scaffolding in regard to the type or types of scaffolding being employed.

These duties are applied with regard to each class of certificate of competence as prerequisites for its issue or renewal.

1.4 Scaffolding terminology

[A-B](#) | [C-D](#) | [E-F](#) | [G-H](#) | [I-J](#) | [K-L](#) | [M-N](#) | [O-P](#) | [Q-R](#) | [S-T](#) | [U-V](#) | [W-X-Y-Z](#)

A-B

Accessory: A fitting that is able to be attached to a structural member of a scaffold, or to join a structural member to something else.

Access platform: A platform that gives access to and from places of work for persons, materials or equipment.

Act: The Health and Safety in Employment Act 1992.

Adjustable baseplate: A baseplate with an adjustable leg.

Adjustable leg: A threaded bar or tube with nut designed to fit inside a standard to support the load from the standard. Used for levelling in conjunction with a baseplate, U-head or castor.

Adjustable wrench: Crescent or shifter.

Anchorage: Components cast or fixed (temporarily or permanently into the building or structure for the purpose of attaching a scaffold tie and/or a harness system.

Also refers to the holding down system for cantilevered beams when referring to suspended scaffolds or cantilevered scaffold.

Barrow ramp: Scaffold designed with a sloping ramp with cleats to prevent slipping. Used to push a wheel-barrow up and down on. A type of sloping platform.

Basejack: Adjustable baseplate.

Baseplate: A plate of steel that is able to distribute the load from a load-bearing member to a supporting structure.

Bay length: The horizontal distance between two longitudinal-adjacent standards or the horizontal distance between support points on a suspended swinging stage.

Bay width: The horizontal distance between any two transversely adjacent standards or the width of a suspended swing stage.

Beam chaffer: A short length of material, sometimes half round used to protect the sharp edge of a beam when using ropes slings or chains.

Beam clamp: A fitting that is able to secure tube, sling or chain to a universal beam (UB) rolled steel joist (RSJ) or tapered flange beam.

Birdcage scaffold: An independent scaffold generally used to access a large area like a ceiling. Scaffold used to fill in a void.

Building Maintenance Unit (BMU): Prefabricated swinging stage permanently fixed on a building.

Boards: Scaffold plank.

Boatswain's chair: A suspended scaffold of which the platform is a chair or similar device suitable for one person. It can be raised or lowered mechanically or by hand haulage.

Box tie: A tie assembly that is positively fixed to every side of a column or beam.

Brace: A member fixed diagonally to two or more members of a scaffold to provide rigidity to the scaffold.

Bracket: Engineer designed bracket that is attached to a structure to support a scaffold.

Brickguard: A meshed panel secured between standards that hangs between the top guardrail to the deck level. It sometimes incorporates a toeboard.

Butt: A short length of tube commonly fixed to a scaffold and butted up against another structure.

Butterfly coupler: Single double flap coupler.

Butt plank: Standard scaffold planks butted end to end as opposed to lapping.

[Top](#)

C-D

Cantilevered scaffold: A scaffold that is supported on load-bearing members that are extended from the structure and held within the structure by through bolts or propping.

Castor: A swivelling wheel attached to the lower end of a standard, for the purpose of supporting a moving scaffold.

Catch fan: A cantilevered platform or structure attached to a scaffold to contain falling debris and provide protection below the scaffolding. Also used generically for catch platforms & catch screens

Catch platform: A platform attached to a scaffold, to contain falling debris.

Catch screen: A screen attached to a scaffold to, to contain falling debris.

Certificate of Competence: Under New Zealand law a scaffolder requires a current Certificate of Competence to erect, alter and dismantle notifiable scaffolds. Certificates of Competence are issued in Basic, Advanced and Suspended categories and are endorsed for different types of scaffolding.

Chartered Engineer: A Chartered Professional Engineer (CPEng) is a statutory quality mark that indicates a professional engineer's current competence to practice in New Zealand. Chartered Professional Engineers are listed publicly on the CPEng register at www.ipenz.org.nz/ipenz/

Check coupler: A right angle coupler or swivel coupler that is fixed hard up against a load bearing coupler to restrict or prevent slippage of the load bearing coupler along the tube.

Chord: A principal longitudinal member of a scaffold beam or truss.

Column tie: Refer box tie.

Competent person: A person who has the knowledge and skills to carry out a particular task. Skills and knowledge may be acquired through training, qualification, or experience, or a combination of these.

Containment sheeting: Screening attached to a scaffold to prevent the dislodgment of tools and materials from a working platform or to protect the people using the scaffold from the elements.

Counter weight: A weight or series of weights that counterbalance a scaffold against overturning.

Coupler: A fitting that joins two tubes.

Cradle: The portion of a suspended scaffold that incorporates a suspended platform.

Crane: A mechanical lifting machine (tower crane or mobile crane).

Direct supervision: In this context direct supervision means within reach, or within visual contact to ensure immediate assistance can be provided in the event of an emergency.

Dismantle: To disassemble a scaffold.

Dog leg brace: A transverse brace.

DOL: The Department of Labour

Double coupler: A right angle coupler.

Double rope suspension system: A method of suspending a swinging stage or boatswains chair using two ropes per suspension point.

Drop scaffold or Dropper: A hanging scaffold or hung scaffold.

Dunnage: Packing used under a load to allow forklift access or to allow slinging devices to be passed under the load. Can be used to distribute the load or to support part of the load.

Duty scaffold: Live loads permitted on a scaffold bay, (light, medium, heavy or special) people, plant and materials.

E-F

Edge protection: A barrier or system to prevent a fall from height.

Egress: Exit an area or work platform. (Opposite to access).

Electrical conductor wires: Power lines.

End to end coupler: A coupler used to join two tubes end to end (joiner, internal or external).

Erection: To assemble a scaffold.

External joiner: A coupler used to join two tubes end to end that fit over the outside of the tubes (must have a separation plate between the tubes).

Eye bolt: A component that attaches to a structure with an eye to enable something to be secured.

Face brace: A longitudinal brace.

Factor of safety: The ratio between the ultimate and permissible stress.

False standard: A puncheon.

Falsework: Any temporary structure used to support a permanent structure while the permanent structure is not self supporting.

Fibre rope: A natural fibre rope used for hand haulage.

Flange clamp: A load-bearing clamp for connecting tube to a flange of a structural steel member.

Footwear: Safety shoes or boots used on construction sites.

Forkhead: U-Head jack used for supporting and locating a standard over a bearer or a bearer over a standard.

Foundations: The support beneath a scaffold or structure that distributes the imposed loads (ground).

Frame scaffold: A scaffold assembled from prefabricated frames, braces and accessories.

Freestanding scaffold: A scaffold that is not attached to any other structure and is stable against overturning on its own account or if necessary assisted by stabilisers, outriggers, or raker or bolster bays.

Fulcrum point: The point of pivot nearest the outside edge of a suspension rig and about which the balancing moments of a suspension rig are calculated.

[Top](#)

G-H

Gantry: A structure that is primarily intended to support a protection deck or portable building. A gantry can be constructed from scaffolding, structural steel or timber.

Girder clip: A flange clip or beam clamp.

Girder trolley: An assembly that locks over a steel flange but can be rolled along the flange.

Gin wheel: A wheel hung from a scaffold that a rope runs through to raise and lower materials.

Guardrail: A horizontal structural member to prevent persons from falling off any platform, walkway, stairs or landing.

H Frame: A prefabricated frame in the shape of an H.

Hammer: Scaffolders' podger hammer.

Hand balling: Passing equipment from one level of a scaffold to another.

Hand over certificate: A certificate certifying a scaffold safe and giving its individual specifications that the client signs and returns.

Hand rail: A rail to provide handhold on a platform or stairway. It may form part of a guardrail.

[Top](#) Hanging scaffold: A working platform hung by tubes, bolts, fixed rope slings or other methods and not intended for raising or lowering while in use. Also known as hung scaffold.

Height: The distance a person can fall from a scaffold.

Height of scaffold: The vertical distance from the supporting structure to the highest working platform.

Heavy duty: The duty loading of a scaffold to 675kg per bay (men, materials and plant).

Hemping: The process of joining additional standards to the top of existing standards. Also referred to as topping up.

Hoardings: Panels used to partition areas like walkways and perimeter fences - used to contain and protect.

Hoist: Mechanical assembly for raising and lowering personnel or materials (swinging stage motor).

I-J

Inboard: The portion of a suspension rig that is on the inside of the fulcrum (tail length) of an outrigger or needle.

Inside Diameter (ID): The distance across the inside of a circular object, pipe or similar.

Internal joiner: An internal end to end coupler for joining two tubes.

Joiner: A coupler for joining two tubes end to end (external and internal).

Joint pin: Same as internal joiner.

K-L

Keeper clip: A check coupler.

Key: Scaffold spanner.

Kickboard: A toeboard.

Ladder: An appliance on which a person may ascend or descend, consisting of two stiles joined at regular intervals by cross pieces (cleats, rungs steps or treads).

Ladder access tower: An independent scaffold bay attached to a scaffold with internal ladder access provided.

Ladder beam: A scaffold beam with chord stiffeners at right angles to the chords (a beam in the basic shape as a ladder on its side).

Ladder bracket: A bracket scaffold consisting of two or more ladders that support planks by means of brackets, to provide a working platform.

Ladder clamp: A fitting incorporating a bolt and a nut used to secure a ladder to a scaffold tube.

Landing: A level area providing access to a stairway or ladder, or located at an intermediate level in a system of stairways and landings.

Lanyard: An assembly designed to connect a harness to an anchor point.

Ledger: A horizontal structural member that longitudinally spans between adjacent standards.

[Top](#) Level: A device used to find the vertical, horizontal and sometimes 45 degrees of a scaffolding member.

Lever arm: The distance between the fulcrum point and the centre of gravity of a suspension rig.

Lift: The vertical distance from the supporting surface to the lowest ledger of a scaffold or level at which a platform can be constructed.

Also, the vertical distance between adjacent ledgers of a scaffold at which a platform can be constructed (average lift 2.0m).

Light duty: The duty loading of a scaffold to 225kg per bay (men, materials and plant).

Load limiting device: A device that limits the lifting capacity of a scaffold hoist - usually to a load lighter than the stalling load of the hoist.

Loading bay: A platform on a scaffold for the storage of materials and plant. Also known as a loading platform.

Longitudinal brace: A brace in the vertical plane on the face of a scaffold to stop longitudinal movement of the scaffold.

M-N

Mast climber: A mast climbing work platform. A work platform used for temporary purposes to raise personnel and materials to a working position, or to a working floor level by means such as a rack and pinion drive mounted on an extendable mast, which can be tied to a building.

Medium duty: The duty loading of a scaffold to 450kg per bay (men, materials and plant).

Member: Anything that forms part of the scaffold assembly.

Mesh: Screening used on a scaffold to prevent dislodgment of plant and materials and to protect workers from environmental conditions.

Mesh panels: Same as a Brickguard.

Mid rail: A member fixed parallel to and above a platform, between the guardrail and the platform.

Mobile scaffold: An independent freestanding scaffold that is mounted on castors.

Modular scaffold: A prefabricated scaffold assembly with individual components, braces and accessories of set sizes.

Needle: A cantilevered structural member that supports a scaffold.

Ninety degree coupler: A right angle coupler.

Node point: A fixed junction between a ledger or transom and a standard.

Nominal Bore (NB): The inside diameter of a tube (40mm NB).

Notifiable work: Particular hazardous work, as listed in the Health and Safety in Employment Regulations, that must be notified to DOL by way of a written notification form.

O-P

Outboard: The portion of a suspension rig that is on the outside of the fulcrum point (overhang).

[Top](#) Outrigger: The member of a suspension rig that acts as a needle or a component that increases the effective base dimension of a tower and is attached to a vertical load bearing member.

Outside Diameter (OD): The distance across the outside of a circular object.

Parallel coupler: A load bearing coupler for making a lap or splice joint between tubes.

Parapet: A vertical element usually located at the edge of a balcony, roof, bridge or similar.

Parapet hook: A clamp or bracket placed over a parapet from which to suspend a scaffold.

Personnel hoist: A mechanical hoist designed to carry people.

Pintle: A projection at the top of a castor that is used to locate the vertical member of a mobile scaffold (150mm minimum stem).

Plan brace: A brace in the horizontal plane that is attached to standards on opposite sides of a scaffold.

Plank: A component used to form a working platform or deck.

Platform: An elevated surface.

Platform bracket: A bracket attached to a scaffold that allows a platform to be placed between the scaffold and the building or structure.

Podger hammer: A steel tool used for the locking and releasing of typical modular scaffolding fixing devices. May have a tapered locating end for centring holes in two objects placed together.

Prefabricated platform: A framed assembly of one bay length, incorporating a walking surface, that is capable of connecting to its support structure (deck or hatch deck).

Prefabricated scaffold: A scaffold assembly from prefabricated components and manufactured so that the components of the scaffold are predetermined.

Producer statement: A suite of documents (PS1-PS4) to provide Building Consent Authorities (BCAs) with reasonable grounds for the issue of a Building Consent or a Code Compliance Certificate.

Prop: A scaffold assembly used to support a load that is adjustable.

Puncheon: A vertical supporting member supported from another structural member of a scaffold.

Putlog: A horizontal structural member spanning between ledgers or standards (tube transom) that is intended to support a platform.

Putlog coupler: A coupler for fixing a putlog to a ledger (single coupler).

Q-R

Rafter clip: A fitting that is able to fix a timber bearer to a scaffold (e.g. butterfly coupler).

Raker: A component that increases the effective base dimension of a scaffold.

Reduction coupler: A right angle coupler or swivel that is able to join two tubes of different outside diameters (3x2 coupler). It should be marked and clearly identifiable. .

Return: A part of a scaffold set up around a corner of a building or structure.

Return transom: A transom used in modular scaffolding that is able to fix a scaffold return at right angles to the run of scaffold by being secured to or being part of a ledger.

[Top](#)Reveal: Internal side surface of an opening or recess.

Reveal tie: A scaffolding assembly used in compression within a reveal to secure a scaffold to a structure.

Right Angle Coupler (RA): A non swivel load bearing coupler, other than a putlog coupler, for connecting two tubes at right angles.

Roof edge protection: A barrier or system to prevent workers falling from the roof.

[Top](#)

S-T

Safety harness: Fall arrest device for arresting a fall, consisting of harness, lanyard, shock absorber and scaffold hook.

Safety helmet: Protective headwear.

Safety policy: Statement of intent and commitment to provide a safe place of work and is normally signed by senior management.

Safety rope: A secondary rope.

Safe Working Load (SWL): The maximum load placed upon an item or assembly that is deemed safe, which is well below the breaking load, failure load or maximum load permitted on the item or assembly.

Scaffold: Refer to section 1.1 above.

Scaffolder: A person engaged in erecting, altering or dismantling scaffolding.

Scaffolding equipment: Any component, assembly or machine used for the construction of scaffolding.

Scaffolding hoist: A lifting appliance (manually operated or power operated) through which the suspension rope passes.

Screening: Mesh used on a scaffold to prevent dislodgement of plant and materials and to protect workers from environmental conditions.

Secondary rope: A rope not normally carrying the weight of a cradle, suspended work platform or imposed load but rigged for use as a secondary protective device.

Shackle: A rated component with a removable pin designed to connect a "cable" to a supporting structure (e.g. D shackle or Bow shackle).

Shutter bracket scaffold: A bracket scaffold where the brackets are attached to formwork shutters.

Side rail: A stile on a ladder.

Single coupler: A putlog coupler either single blade or double bladed.

Sleeve coupler: An external end to end coupler.

Sling: A lifting device (e.g. web sling, chains, wire ropes and ropes).

Soleboard or soleplate: A member used to distribute a load through a baseplate to the supporting surface or supporting structure.

Sloping platform: Platforms formed when scaffolding is erected at an angle up or down on or from a conventional level scaffold.

Span: The distance measured along a member between the centre lines of support points (e.g., bearers supporting a scaffold plank).

[Top](#)Spanner: A scaffolding tool for adjusting nuts.

Spirit level: A device used to find the vertical, horizontal and sometimes 45 degrees of a scaffolding member.

Spur: An inclined load-bearing member that transmits a load to another structural member of the scaffold or to a supporting structure.

Spurred scaffold: A scaffold that is partially supported by inclined load-bearing members.

Stability: Security of a scaffold against movement and overturning.

Stabiliser: A component that increases the effective base dimensions of a tower and is attached to a vertical load-bearing member.

Stair tread bracket or fitting: A fitting used to fix a stringer in order to support a stair tread to make part of a stair unit.

Stair unit: An assembly of stringers, treads, guardrails and landings used on a scaffold to transport men, material and plant from one level to another.

Stanchion: A vertical member used to support a guardrail, mesh panel or similar.

Standard: A vertical structural member that transmits a load to a supporting surface or structure

Stile: A member in a ladder that supports rungs, steps or treads.

Stillage: A scaffold basket or framework designed to hold scaffolding components.

Stop: An attachment that will limit traversing of a suspended work platform.

Stop end: Guardrails fitted to a scaffold between standards at the end of a bay.

Stringer: An inclined member used to support stair treads.

Strut: A scaffolding member that supports a compressive force.

Stud bracket scaffold: A bracket scaffold of which the brackets are attached to studs of a timber frame building.

Supporting structure: A structure, structural member or foundation that supports a scaffold.

Suspension point: A point at which a suspension rope is connected to a suspension rig.

Suspension rig: A portion of a structure (including a trolley track) that is mounted at a higher level than that of a cradle and supports and positions the cradle.

Suspension rope: A rope carrying the weight of a cradle and supporting the imposed loads.

Swinging stage: A suspended scaffold platform that can be raised or lowered mechanically or by hand haulage.

Swivel coupler: A coupler for connecting two tubes at any angle.

Tank bracket scaffold: A bracket scaffold of which the brackets are able to be attached to the face of a metal tank, duct, boiler, structural beam or similar.

Three by two: A right angle coupler or swivel that is able to join two tubes of different outside diameters (3x2 coupler).

Through tie: A tie assembly that is positively fixed to both sides of an opening through a building or structure.

TopTie: A member or assembly of members used to tie a scaffold to a supporting structure.

Tie bar: A member able to be fixed to the cantilevered end of a pair of platform brackets (hop up brackets) to prevent the brackets from spreading and the planks from becoming dislodged.

Toeboard: A scaffold plank, kickboard or purpose designed component fixed on edge at the edge of the platform to prevent materials falling from the platform.

Toeboard clip: A fitting used to secure a toeboard to a standard or stanchion.

Trainee: A trainee scaffolder.

Transom: A horizontal structural member transversely spanning an independent scaffold between standards.

Transverse brace: A brace in a plane that is vertical and at right angles to the building or structure (e.g. dogleg or parallel brace).

Trap door: A hatch or opening platform.

Traversing suspension rig: A suspension rig mounted on wheels or castors supporting a cradle.

Trestle scaffold: A scaffold consisting of trestles and planks.

Trolley: A wheeled mechanism that is able to support an aerial hoist and is capable of travelling along a suspended track.

Trolley track: A suspension rail that supports and guides trolleys in traversing.

Tube and fitting covered way: An independent tube and fitting scaffold that is primarily intended to provide overhead protection.

U-V

Uhead jack: A fork head jack.

Uniformly Distributed Load (UDL): A load distributed evenly along the length of a member.

Unit beam: A scaffold beam that incorporates diagonal chord stiffeners.

Vessel scaffolding: Scaffolding that is erected around a structure with a curved profile (e.g. a tank or chimney). It generally encompasses the entire face of the vessel.

W-X-Y-Z

Webbing slings: A sling or sling device made of webbing.

Whipping: The wrapping or tying of an end of cut rope to stop fraying or unravelling.

Winch: Mechanical assembly for raising and lowering materials.

Wire rope grips: Bull dog clips.

Working load limit: The maximum working load that may be applied to any component or system, under general conditions of use.

Working platform: A platform that is intended to support persons, materials and equipment.

Section 2: Safety in scaffolding

2.1 Fall prevention

2.1.1 General approach

During the scaffolding process, scaffolders will normally be faced with a potential fall from height hazard. It is essential that all practicable steps are taken to control this hazard and that the hierarchy of control is applied to the hazard management process.

In addition, access and egress to areas of a building or structure where scaffolding is to occur sometimes presents the hazard of a fall. Part of the task analysis process is to identify this and develop controls relating to the hazards.

Safety harnesses must be worn at all times when working on all scaffolds above 5.0m high. They are part of a scaffolder's personal protection equipment. If a safety harness is not being worn, the scaffolder is not adequately prepared to limit the harm that could result from a fall. Preparedness is wearing a harness and being able to secure the lanyard to an anchor point.

The following looks at the hierarchy of risk management options when scaffolding to comply with hazard management requirements (the procedures can be altered to suit any scaffold system).

2.1.2 Eliminating fall hazards

The nature of the scaffolding process means that eliminating the fall hazard will not be practicable in many cases. However, consideration must be given to this method before rejecting it. With good planning (including before you get to the site) you may use elimination as a means of keeping scaffolders free from the risk of a fall. Consider the following (this is not a complete list):

- What are you trying to achieve and for what purpose is the scaffold required? Can the risk of a fall be eliminated by changing the design of the scaffold or the procedure of the work to be carried out from the proposed scaffold?
- The preconstruction of all or part of the scaffold may be possible. The completed scaffold or scaffold components may then be moved into the final position by means of a crane or hoist.
- What about attaching scaffold platforms to a component of the permanent structure on the ground before the structural component is moved into the final position on the structure by means of a crane or hoist mechanism?
- If the scaffold is required you may still be able to eliminate fall risk at points in the scaffolding process, such as altering erection methods and working through a hatch deck when erecting guardrails to the next platform for instance.

Apart from the obvious legal and safety compliance benefits another advantage of eliminating hazards is that it usually leads to more productive and efficient methods of scaffolding.

2.1.3 Isolating fall hazards

Where elimination methods have been considered and discarded as impracticable, methods of isolating fall hazards should be considered. With good planning (including before you get to the site) you may use isolation as a means of keeping scaffolders free from the risk of a fall, including but not limited to the following examples.

1. The use of a power operated elevating work platforms (EWP) to reach areas at height (see figure 1). This is a particularly useful method for the construction of hanging and cantilevered scaffolds. Caution must be taken to ensure that the SWL of the platform is adhered to with regard to carrying of scaffolding equipment. See also AS 1418.10 Elevating Work Platforms, the [Approved Code of Practice for Elevating Work Platforms](#) and DOL guidelines.

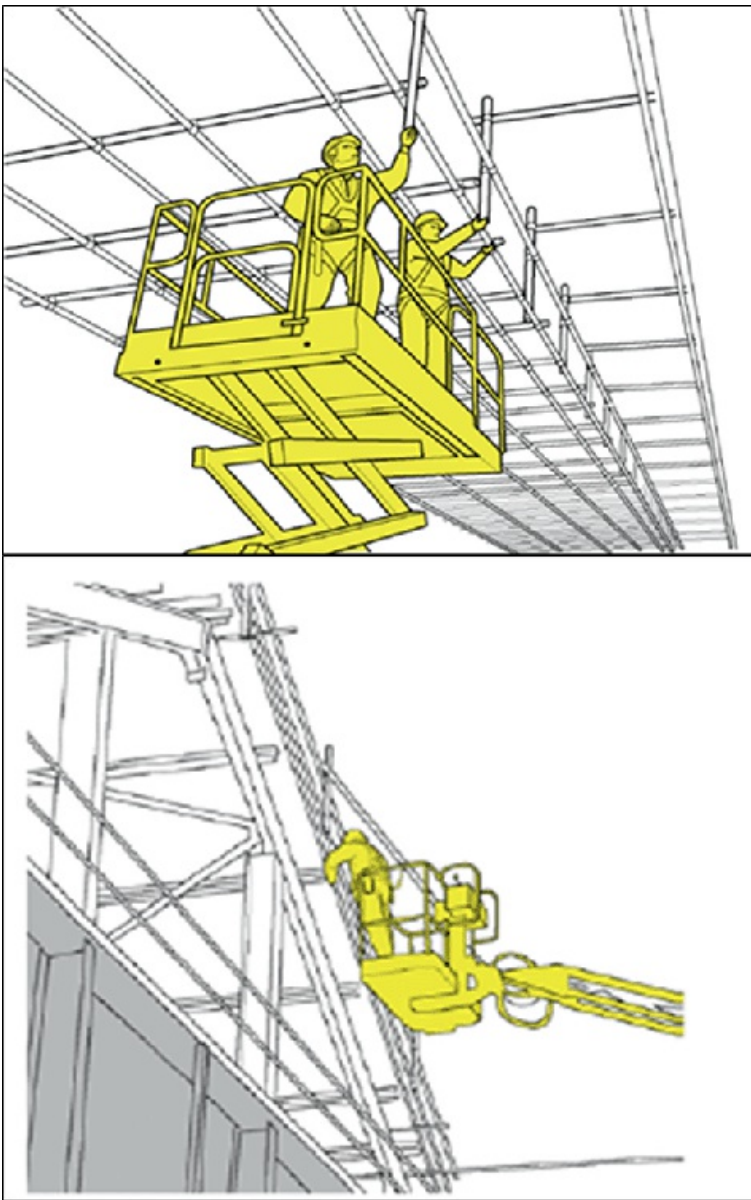


Figure 1: Access by EWP

2. Scaffolders can adopt a method of progressively installing a guardrail from the level below before installing the work platform (see figure 2). The scaffolder can then enter the platform with the edge protection already in place. It is acceptable to preinstall a single top rail from below and complete the mid rail and other components from the platform.

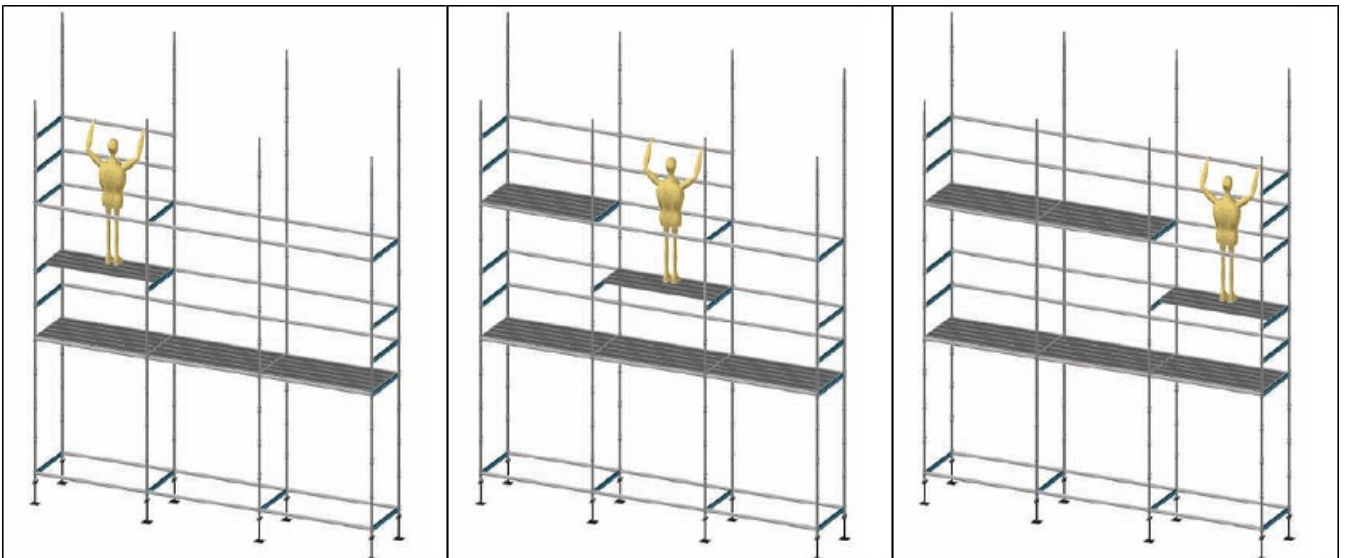


Figure 2: Progressive guardrail installation method

3. Advance guardrail systems can be used to provide edge protection to scaffold platforms until the scaffolders have installed the permanent guardrail (see figure 3). These systems are designed with uprights or stanchions that attach to the scaffold standards and telescopic rails that allow each stanchion to be moved up to the next platform level while the scaffolder remains within the completed platform below. All platforms guarded by temporary proprietary guardrail systems must be fully planked from below before scaffolders move up to that level to install the platform guardrails.

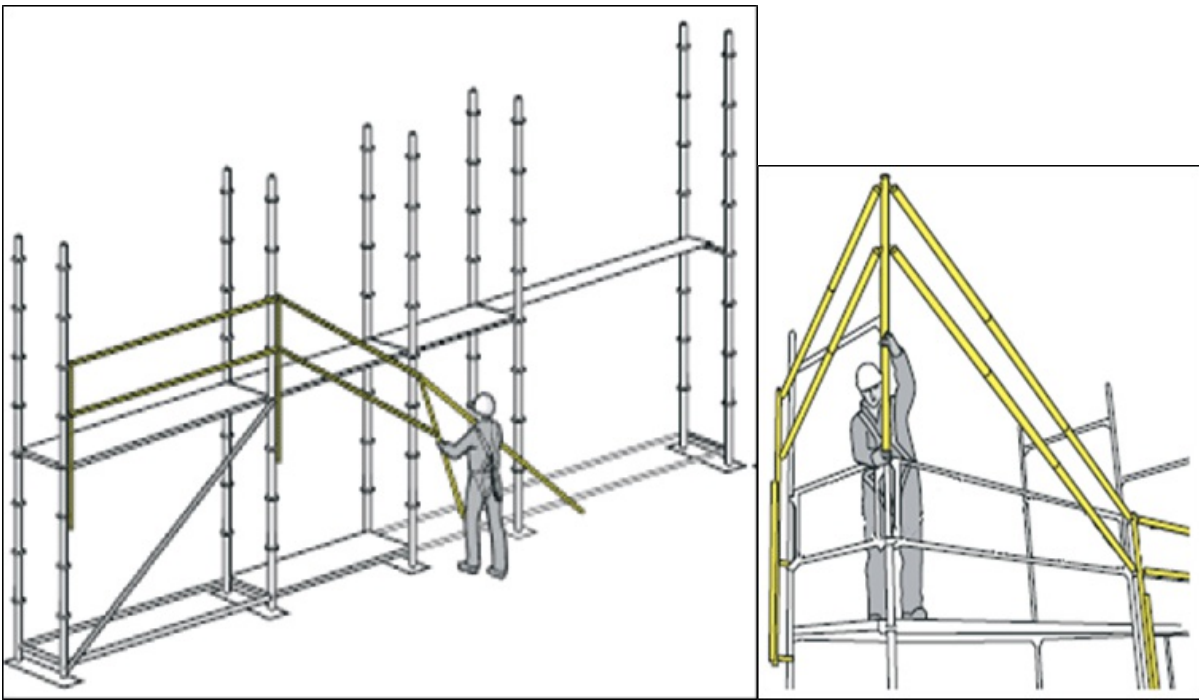


Figure 3: Advanced guardrail system

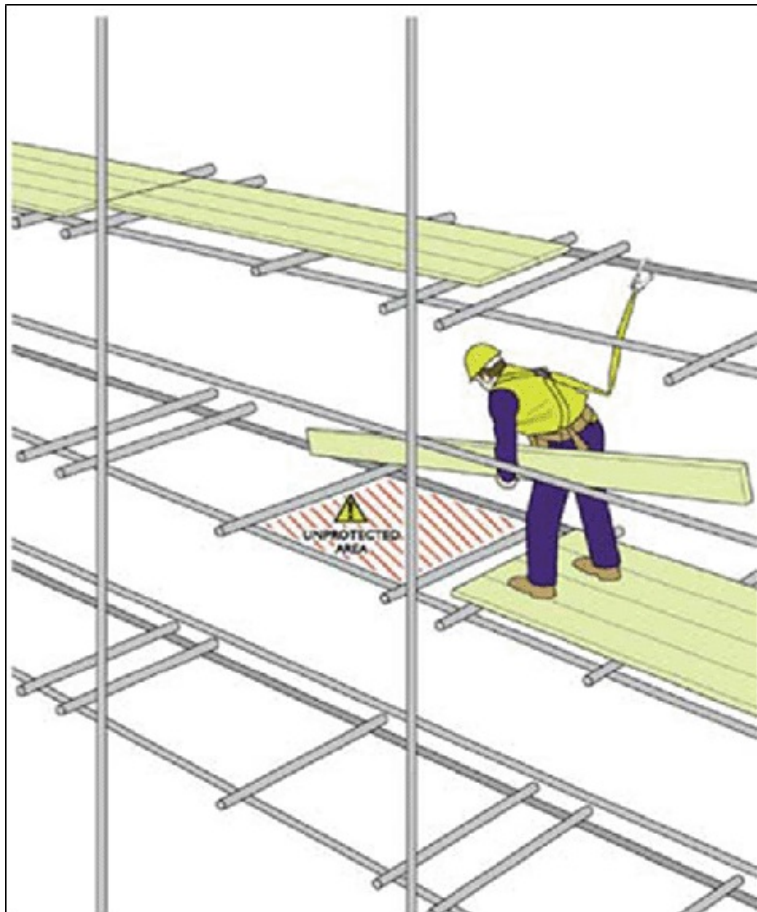
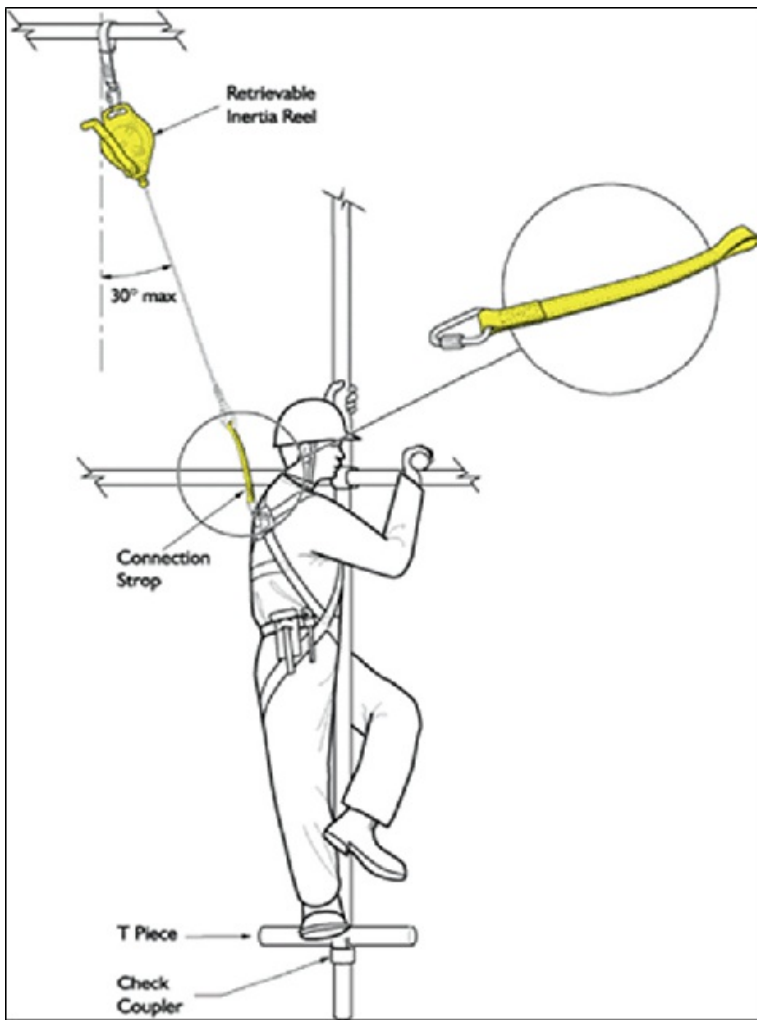
2.1.4 Minimising fall hazards

Minimisation of fall hazards must be considered only as a last resort. Minimisation techniques will not eliminate or isolate the hazard, but are designed to protect workers from the harmful effects that could occur. These methods usually have some impact on the mobility and productivity of the scaffolder as well as requiring higher levels of supervision.

Minimisation can include but is not limited to, one or a combination of:

- Training and inductions.
- Ensuring only highly experienced scaffolders undertake the lead build position.
- Working from fully planked platforms.
- Safety nets.
- Fall arrest systems.

Two main approaches to minimising fall hazards are taken in the scaffolding industry. Firstly, the optimum erection and dismantling procedure is employed. This is known as "the tunnelling method" and is outlined below. Secondly, safety harnesses must be worn by all scaffolders when working on all scaffolds above 5.0m high so that fall arrest systems can be accessed (see figure 4). Note that safety harnesses with a 1.8m lanyard connected to a scaffold below 5.0m high will not arrest your fall before hitting the ground or supporting structure.



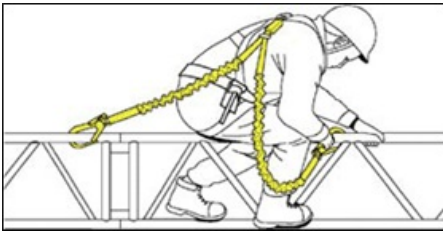


Figure 4: Scaffolders employing fall arrest systems

2.1.5 The "tunnelling method" for minimising fall risk

The standard erection and dismantling procedure for minimising fall risk is to install a single guardrail on the deck above as soon as possible. This is known as the "tunnelling method". This method not only protects the scaffolder but provides a safe platform for others to use during alteration or dismantling. The "tunnelling method" does not add any additional equipment to a scaffold other than a single guardrail on non working platforms. The process is as follows:

- Base out the scaffold and butt plank the base lift (675mm minimum) from below.
- Ladders or stairs should be erected in the same sequence as the platform.
- The scaffolder then climbs onto the planked deck (675mm minimum) using the ladder or stairs.
- Once you are standing on the base lift you can only move along the scaffold the maximum length of your longest ledger (horizontal), i.e. 6.5m for tube.
- Your first priority is to install a single guardrail as soon as possible.
- Equipment is passed to the scaffolder to install the first section of guardrail and/or stop end.
- The scaffolder must hook his/her harness to the inside ledger at foot level before any fittings are attached when working above 5.0m high.
- Staggered standards assist in installing the guardrail as this reduces the need to hem all exterior standards to connect the guardrail to.
- The scaffolder must hook his/her harness to the inside ledger before hemming any standards on a unguardrailed platform above 5.0m high
- Scaffolders must adopt a method of progressively installing a single guardrail as they move from one end of the scaffold to the other. Once you have erected a single guardrail and a stop end you have created a safe zone to work from. All equipment should be received from below in this safe zone then walked out along the scaffold.
- Single guardrails should be left in place on all non working platforms (dummy lifts) to provide a safe environment for altering and dismantling the scaffold.
- Once a single guardrail is installed the lift can be completed without the use of a safety harness - for the rest of that particular lift.
- If you need to raise the planks that you are standing on once you have completed the lift, you must hook your harness to the inside ledger above when raising the planks to prevent falling into the void you have just created.
- The erection procedures above should be used in reverse when dismantling the scaffold.
- It is recommended that the planks be flipped up on their edge prior to removal to protect the eyes of the scaffolder from debris left on the scaffold. This can be done from the deck level itself if one plank only at a time is lifted up onto its edge then replaced to maintain the planked deck.

The procedure above can be applied to all scaffolds. Each type of scaffold has its own requirements but the general "tunnelling method" must be followed.

2.2 Harness systems

Given that fall risk can not always be avoided fall arrest systems must also be employed. Such systems are based around harnesses by which scaffolders are connected to fall arrest devices. With the large selection of belts and harnesses available, it is essential that the correct harness is chosen for the intended use. In particular belts are not suitable for any kind of fall arrest. However, full body harnesses designed for fall arrest may incorporate belts that can be used for work positioning or restraint. Belts that incorporate tool frogs may also be useful and there may be requirements for full body harnesses to accommodate attachments for abseiling, confined space entry, rescue, etc.

When correctly fitted, harnesses should be firm but comfortable. You should be able to slide your hand between the webbing and your body but no more.

2.2.1 When to use anchor points

As described earlier hooking on harnesses does not provide fall protection on scaffolds below 5.0m high or when you can sustain a fall less than 5.0m. Thus in these circumstances the scaffolder is not required to hook the harness to any anchor point. The tunnelling method outlined above should still be used in the scaffold process, however just omit the use of the safety harness.

In all situations other than as described immediately above scaffolders must hook onto the first available anchor point that is at 5.0m or above when:

- Working on an unguardrailed platform.
- Not working within a 675mm wide planked area.
- Climbing up and down the scaffold structure.
- Working directly off the un-planked scaffold structure.
- Hemming.
- Working over a void area.
- Working on a hanging scaffold.
- Working on a cantilever scaffold.

2.2.2 How to use anchor points

Scaffolders should avoid attaching to the scaffold whenever possible. If this is unavoidable you must consider the stability of the scaffold structure with regard to its ability to sustain a fall arrest loading. Safety harnesses should be attached to anchor points on the scaffold above shoulder height. Only if a satisfactory anchor point is not available may it be attached below shoulder height.

Always clip to the following in preferential sequence:

- Transoms supported by the ledgers above shoulder height (connect to the transom or putlog between the ledgers).
- Ledgers supported with load bearing couplers (R/A couplers) above shoulder height.
- Guardrails supported with load bearing couplers (R/A couplers).
- Standards if approved anchor points are known (manufacturers' specifications).
- Transoms supported with load bearing couplers (R/A couplers).

Never hook on to:

- Standards - unless approved anchor points are known (per manufacturer's specifications).
- Ledgers supported by single couplers.
- Ledgers or guardrails within a bay that has a join.
- Transoms below foot level.
- Transoms under slung below ledgers.

The procedure above can be applied to all scaffolds. Each individual type of scaffold has its own requirements but the general procedure must be followed.

2.3 Work positioning systems

A work positioning system is a system that enables a person to work supported in a harness in tension in such a way that a fall is prevented (see AS/NZS 1891.1). Work positioning systems should be designed and rigged to allow a person to work safely and in reasonable comfort.

2.4 Travel restriction/restraint systems

A travel-restriction/restraint system consists of a harness connected by a line to an anchorage. The system should be rigged in such a way that it will stop a worker reaching a position from which a free fall is possible. If a free fall is possible, a fall-arrest system including a harness must be used, not a travel-restriction system.

Equipment should be adjusted to reduce the restrained fall to the absolute minimum. This must be less than 600mm.

2.5 Fall arrest systems

Fall arrest systems are designed to support and hold a person in the event of a fall. They are not designed to support a person while working. This would be a work-positioning system. An evaluation of the different types of equipment combined with a task assessment is needed to make a practical and safe selection for a particular job.

The arresting force applied to the worker should a fall occur must be less than 6 kN (610 kg). Employing a 2 metre lanyard incorporating an energy absorber or a type 2 or 3 fall arrest device should achieve this. For the 2 metre lanyard system the lanyard or anchor line must be attached to the top dorsal position (at chest height) or the frontal chest attachment. Anchorages for a lanyard should be fixed as high as practical but within easy reach. An anchorage at foot level will allow a person to fall the length of the lanyard plus the distance between the anchorage and harness fixing point.

All attachment hardware is to be designed to withstand a load of 15 kN (1530kg).

2.5.1 Hazards associated with fall arrest systems

Problems that may arise while employing fall arrest systems include:

- Attaching to anchors that are insufficient in strength resulting in anchorage failure.
- Employing anchor lines or lanyards parallel to the fall edge resulting in the pendulum effect.
- Attaching to anchors that are too close to the ground resulting in insufficient fall clearance.
- Attaching to anchors that are too close to the fall edge resulting in excessive free fall distance
- Using harnesses in hazardous environments that damage equipment or cause system failure.
- Impeded mobility resulting in scaffolders disconnecting from anchors.
- Incorrect connection of attachment resulting in failure under loading.

The pendulum effect

This is a potential hazard when using individual fall-arrest systems. It results in workers striking the ground or other obstructions during the fall arrest process. The "pendulum effect" requires consideration prior to deciding the location of anchorage points.

Swing down

This can occur if an inertia reel or work-positioning device is extended diagonally so that the line makes an extreme angle with the perimeter edge of the structure. In this situation the forces generated in an arrested fall over the edge will cause the line to rotate back along the perimeter edge until it reaches a position directly in line with the anchorage point of the inertia reel and at right angles with the perimeter edge.

As the line moves back in this way, its unsupported section lengthens, thus dropping the attached worker further than the original (arrested) fall distance. If the length of the unsupported line equals the height above the ground then the worker will hit the ground.

To eliminate the pendulum effect place the anchorage point perpendicular to the position of the line at the perimeter edge. At the most, an anchor point must be within 30 degrees of the work position. A mobile anchorage helps here. The use of second anchorages and belay devices is another way of minimising this effect.

Swing back

In an arrested fall, particularly from a perpendicular edge, a person will swing back into the building structure and collide with any obstructions in the path of the swing. If this situation can arise, the use of an individual fall-arrest system should be re-assessed.

Fall clearance

It is essential that users of fall arrest systems allow sufficient fall clearance in their system design. Free fall distance must be calculated to ensure you do not hit the ground.

A number of factors need to be taken in to account. These may include:

- Height of user.
- Start position of fall arrest devices.
- Lateral offset of anchor point.
- Length of lanyard.
- Shock absorber extension.
- Fall arrest device extension or travel.
- Extension of unusually long anchor lines.
- Static line or temporary lifeline deflection.
- Residual clearance.

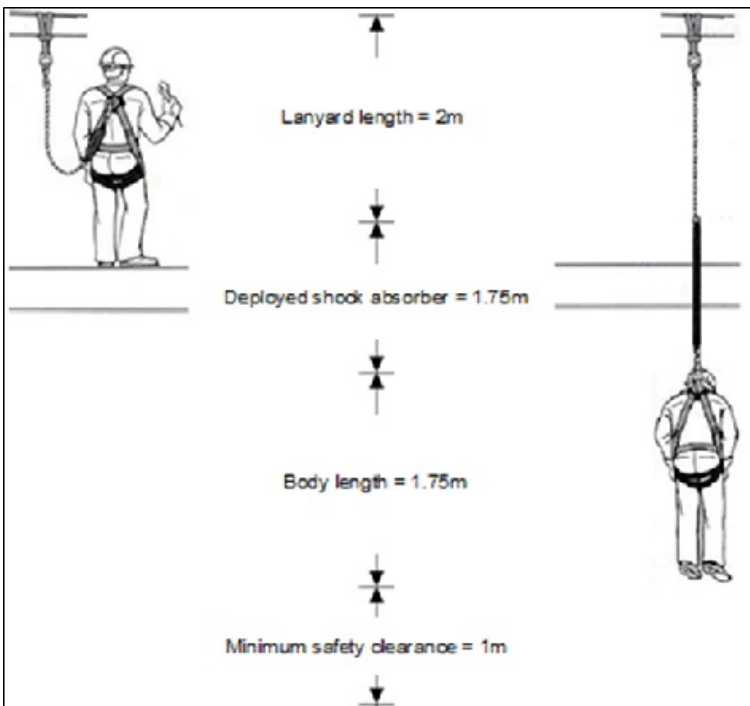


Figure 5: Example of calculation of fall clearance

In figure 5 the total fall clearance requirement when using a 2m lanyard with shock absorber when attaching to an anchor point is 6.5m.

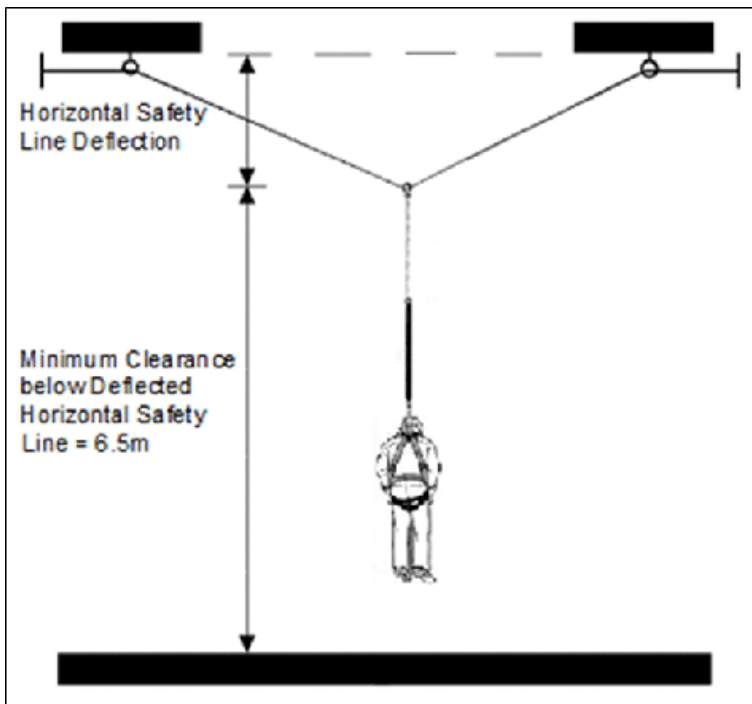


Figure 6: Impact of horizontal safety line deflection on minimum fall clearance

Attaching to a horizontal safety line means additional distance must be included in clearance calculations to allow for deflection of the horizontal safety line, as indicated in figure 6. Manufacturer's information must be referred to so as to determine the deflection of a particular system.

Free fall distance

Free fall distance is the distance someone will fall before the system begins to arrest the fall. Free fall distance must be calculated to ensure rated capacities of your equipment and your body are not exceeded. In all cases the free fall distance should not exceed 2.0m. Distances more than this will exceed the equipment's design capabilities and could result in failure and excessive shock loading to the victim. Fall arrest equipment, specifically harness and lanyard assemblies meeting the requirements of AS/NZS 1891, will not necessarily be capable of arresting falls in excess of 2.0m without compromising the in-built safety factor. It is critical that anyone using fall arrest systems has calculated their potential free fall distance before they set up and begin work.

Free fall distance for a scaffold using a 2m fixed length lanyard is calculated from the following:

$L - S + H = \text{Free fall distance}$.

L = the length of the lanyard before any shock absorber extension.

S = the straight line distance between the anchor point and the point on the edge over which the user falls.

H = the maximum expected height of the harness attachment point when the user is standing up (1.5m).

Examples for calculating free fall distance

See also figure 7 below.

Example 1: $L - S + H = \text{Free-fall distance}$; $2.0 - 2.0 + 1.5 = 1.5 \text{ m}$ ✓ Acceptable

Example 2: $L - S + H = \text{Free-fall distance}$; $2.0 - 1.5 + 1.5 = 2.0 \text{ m}$ ✓ Acceptable

Example 3: $L - S + H = \text{Free-fall distance}$; $2.0 - 0.0 + 1.5 = 3.5 \text{ m}$ ✗ Unacceptable

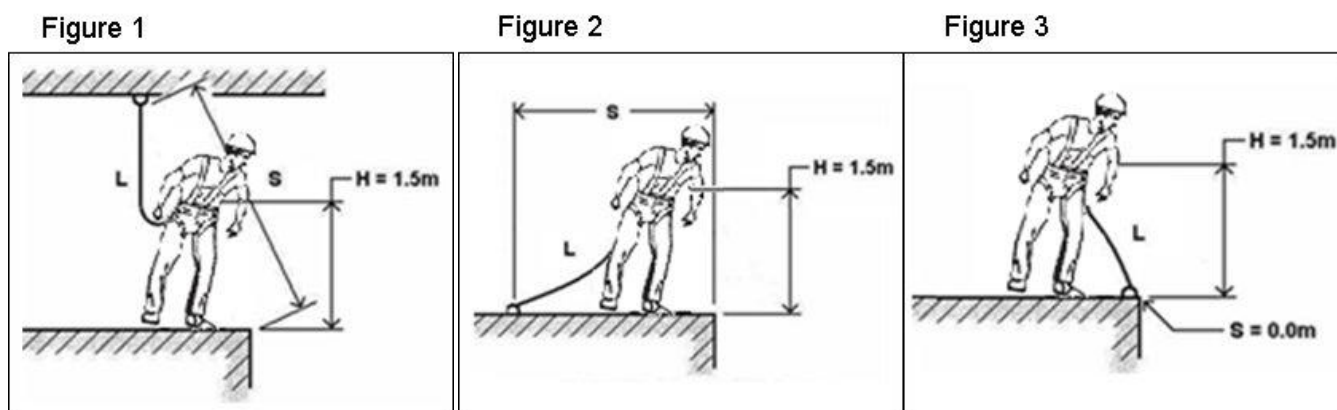


Figure 7: Calculations of free fall distance

2.5.2 Type 1 fall arrest devices (inertia lock rope grab)

This consists of a unit that will slide up and down an anchor line and will lock onto the line in the event of a person falling. In permanent applications non-corrosive rails and stainless steel lines can be attached to structures such as chimneys, towers or vertical ladders. Other types of anchor lines that may degrade over a short-term period should be rigged each time they are needed.

The maximum length of a lanyard used between the harness and a type 1 fall-arrest device, including the energy absorber, is 2 metres. All lanyards should be rigged and used with the least possible slack by keeping the arrest device above head height. Where a vertical ladder rail, or similar system, is being used for a restrained fall the lanyard should be no longer than 300 mm.

2.5.3 Type 2 and type 3 fall arrest devices (inertia reels)

These are spring-loaded reels that fix to an anchorage. An anchor line plays out as a person moves away from the reel and is reeled back as the person approaches. The difference between type 2 and type 3 is that type 3 can be used as a winch to allow a person to be wound back after loading the unit. With this equipment the anchor line is attached directly to the dorsal position on the harness.

Do not use a lanyard in conjunction with a Type 2 or 3 arrest device; the anchor line attaches directly to the harness.

2.5.4 Horizontal lifeline and rail systems

A static line is a horizontal line that is anchored at both ends and rigged so that a fall-arrest device or lanyard can run along its length. AS/NZS 1891.2 sets out acceptable criteria for three types of horizontal lifeline and rail systems. These are: proprietary systems, prescribed configuration systems, and rigid life rail systems. Refer to the standard for further information.

The force on the anchorage points of a static line will be much greater than those on an anchor line because the anchor line is in direct tension along its length while the static line is under tension at right angles between the anchorages. Special shock-absorbing units that attach to the static line are available to reduce this force to an acceptable level (see figure 8). These are not the same units as used in a lanyard. The static line must have a minimum breaking strength of 44 kN (4490 kg) or be an engineered design.

Specialist advice and training is needed in the rigging of static lines.

When using static lines care should be taken to ensure that loose objects between the anchorage and the worker cannot be dislodged by movement of the lines.

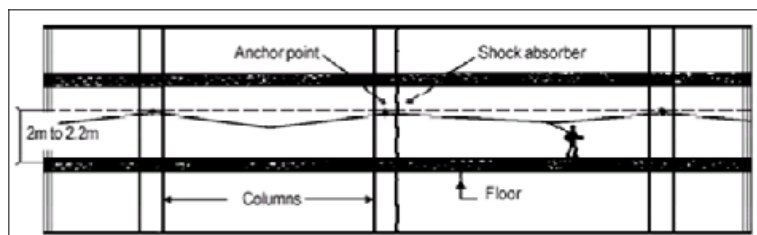


Figure 8: Fixed static line with a shock absorber for use with safety harnesses and lanyards

2.5.5 Design guidelines for static lines

When planning the site layout and sequence of construction for installing a static safety line system consideration should be given to the most appropriate fall-arrest system and method of installation. Do not use guardrails as an anchor; they are not designed to take the forces involved in arresting a fall. The correct tensioning of the static line can be achieved by a framed turnbuckle or a removable ratchet and pawl. The static line must be correctly tensioned. Where a slack static line is suddenly pulled by a person slipping, this could jerk others off balance, causing harm. An over-tensioned line will exert too much force on the anchorage points, and reduce the amount available to arrest the fall.

For guidance on static line systems please refer to AS/NZS 1891.2 Supp1:2001 Industrial fall-arrest systems and devices - Horizontal lifeline and rail systems.

2.5.6 Emergency procedures

This is the most important component of any fall arrest system. The effects of suspension trauma can be serious and strike some people very swiftly. It is essential that an emergency retrieval plan is in place that can be quickly implemented by anyone who may need to rescue a workmate from a suspended situation.

Items that may be included in the rescue plan are:

- Emergency services role in the rescue. Do they know about your operations? Do they have appropriate equipment that they can use for rescue? What will be their response time?
- Have you ever been trained in or ever practised your rescue plan and techniques?
- Does everyone know their responsibilities in an emergency situation?
- Do you have all the necessary equipment on hand, including first aid supplies and a means of cutting a fall victim free from their system?
- How will you reach the victim? Possibly with a crane lift platform, cherry picker, scissor lift or ladder. Is this equipment available? Do you have rope access equipment and trained staff to use it safely?
- Do you have a means of communication?

2.5.7 Longevity and inspection of equipment

All fall arrest equipment must be regularly inspected. The various requirements for the inspection of personal and common use equipment are summarised in table 2 (from AS/NZS 1891.4). A competent person (this would generally be the trained user or qualified supervisor) should check harnesses and equipment prior to every use and a log book should be maintained documenting an inspection at least every six months. Inspection of equipment should include synthetic materials, checking for cuts, burns, fraying, abrasions, chemical contamination, mould or mildew, sun rot, and stretching. Hardware should be checked for cracks, bends, deformity, corrosion, and to ensure that all locks close and engage. Check all sewing and any shock absorbers for signs of loading.

Most fall arrest equipment in New Zealand will have a theoretical service life of about 10 years from the date of manufacture. However, due to the harsh work environments on construction sites, the reality is that equipment may only last a few years before it will have to be discarded. The use of bags or cases for the transport and storage of equipment can be an advantage. Equipment should be carefully stored when not in use.

Keep equipment from exposure to:

- Sunlight.
- Heat.
- Moisture.
- Chemicals.
- Sharp edges and abrasives.
- Heavy objects.

The construction, selection, rigging, and use of harnesses, lines and fall arrest devices must comply with AS/NZS 1891.1: Parts 1 - 4 or equivalent international standard. All equipment except type 2 and 3 fall arrest devices may be inspected by people who are suitably trained to give equipment a careful visual inspection. Type 2 and 3 fall arrest devices must have their 12 month inspection performed by a trained professional. (Contact supplier or manufacturer for details.)

Table 2: Summary of inspection requirements for fall arrest equipment

Activity	Application
Inspection by operator before and after each use	PPE including harnesses, lanyard assemblies, connectors, and fall-arrest devices - including common use devices
3-monthly inspection by competent person	Type 2 and 3 fall-arrest devices - external check only
6-monthly inspection by competent person*	Belts, harnesses, lanyard assemblies and associated personal equipment
12-monthly inspection/service by competent person*	Permanently installed anchorages Type 2 and 3 fall-arrest devices - full service including dismantling where indicated Horizontal lifelines and rails, including integral components and permanently installed mobile attachment devices
In accordance with other standards	Ropes and slings
Inspection on entry or re-entry into service	All items of personal and common use equipment.
Inspection after a fall-arrest (and before further use)	All items that have been stressed as a result of a fall

* Or more frequently if recommended by the manufacturer or supplier

2.5.8 Safety harness inspection list

Table 3: Inspection requirements for safety harnesses

Components	Condition/ faults to be checked
Webbing	Cuts or tears Abrasion damage, especially where there is contact with hardware Excessive stretching Damage due to contact with heat, corrosives or solvents Deterioration due to rotting, mildew or ultraviolet exposure
Snap hooks and karabiners	Distortion of hook or latch Cracks or forging folds Wear at swivel and latch pivot pin Open rollers Free movement of the latch over its full travel Broken, weak or misplaced latch springs Free from dirt and rust
D-Ring	Excessive vertical movement of the straight portion of the D-Ring Cracks, especially at the intersection of the straight and curved portions

	Distortion or other physical damage of the D-Ring Excessive loss of cross section due to wear
Buckles and adjusters	Distortion or other physical damage Cracks and forging laps where applicable Bent tongues Open rollers
Sewing	Broken, cut or worn thread Damage or weakening of thread due to heat, corrosives, solvents or mildew
Ropes	Cuts Abrasions or fraying Stretching Damage due to heat, corrosives, solvents, etc Deterioration due to ultraviolet light or mildew

2.6 Personal protective equipment (PPE)

Industrial safety helmet (hard hats)

Industrial safety helmets complying with NZS 5806 (or suitable approved head protection) must be worn at all times while on site where there is a risk of objects falling from above. In fact hard hats are becoming mandatory on most sites in New Zealand. An elastic chinstrap is recommended to secure the hat and prevent dislodgement by the wind. Hard hats should be replaced after dropping from a height or if there are any visible signs of wear and tear. Follow the manufacturer's instructions for replacement (please check expiry dates).

Safety footwear (safety boots)

Footwear should be comfortable, provide maximum grip and give protection from pinching, jamming and crushing. A range of lightweight flexible footwear with steel or plastic protective toe caps is available (see AS/NZS 2210.1 or 2210.2). Some sites require steel toe caps to be covered to prevent the risk of creating a spark hazard should steel come in contact with the exposed steel cap. Safety boots are becoming mandatory on most sites in New Zealand.

Fall arrest harness (safety harness)

An assembly of interconnected shoulder and leg straps, with or without a body belt, that must be used where there is likelihood of free or restrained fall. The full fall arrest harness in association with a lanyard, which includes a personal energy (shock) absorber, is attached to the harness. The lanyard should preferably have a manulink, karabiner or snap hook designed to attach over a standard scaffold tube. The maximum lanyard length is 2.0m long. Refer to AS/NZS 1891.1. See also [section 2.2](#).

Hand protection (gloves)

Leather or split leather snug fitting gloves are recommended to protect scaffolder's hands. They prevent scaffolding components slipping through the hands and protect against cuts and abrasions. In extreme conditions the wearing of specialist gloves may be required e.g. lined gloves in cold conditions or gloves to protect against acid or caustic spills.

Hearing protection (ear muffs or ear plugs)

Noise has been identified as a significant hazard in the workplace. There are a variety of ear muffs, pads or plugs available. In New Zealand to aid selection a system of classes is used. Classes are numbered 1 to 5 with each class increase representing an additional 5 decibels of protection (see table 4). Some earmuffs can be attached to your safety helmet. Seek advice from your supplier regarding general noise protection.

Table 4: Grades of hearing protection

Class	Attenuation	For use in noise up to:
1	6	Up to 90 dB (A)
2	12	Up to 95 dB (A)
3	18	Up to 100 dB (A)
4	24	Up to 105 dB (A)
5	30	Up to 110 dB (A)

Eye protection (safety glasses)

Safety glasses should have wide vision, UV protection, be scratch resistant and have integral side shields. This gives greatest protection for scaffolders for most conditions (see AS/NZS 1337). See manufacturer's instructions for special purpose glasses.

High visibility vests

Fluorescent vests, polycotton or nylon with 50mm reflective tape allow the wearer to be seen under normal site conditions. High visibility vests should conform to AS/NZS 4602 or EN471, the Transit New Zealand Code of Practice and local authority requirements.

2.6.1 Specialist PPE

When working in some hazardous conditions specialist equipment may be required to ensure safety, for example working in an asbestos environment. Firstly ascertain

what hazardous conditions you will be exposed to. Then establish the specialist equipment you will require to work safely in that environment. Seek specialist advice if required. Safety is paramount. Examples of specialist safety equipment include:

- Breathing Apparatus (BA).
- Disposable overalls.
- Respiratory protective equipment.
- Specialist gloves.

An employer does not comply with the Health Safety and Employment Act by paying an allowance or paying extra wages or salaries instead of providing protective clothing and/or equipment to an employee. If in doubt seek advice.

2.7. Safe working practice

2.7.1 General principles

1. Always remember that you have a duty to work in a safe manner and to ensure the safety of other workers and the public.
2. Always work in a logical sequence.
3. Do not throw materials about. Always consider the safety of others.
4. Always lower materials in a proper manner during dismantling.
5. Ensure all materials are cleared from the site or job location on completion.
6. Complete a daily hazard identification and controls report when on the job.

The Building Act, Building Regulations, Building Code, manufacturers' specifications, engineers' design certificates, and chartered engineers' producer statements where such statements are required to be provided to a Building Consent Authority (BCA) for the issue of a Building Consent or a Code Compliance Certificate in relation to the Building Act 2004, as well as these Best Practice Guidelines, should be considered to ensure that all practicable steps are taken to assure the safety of the structures and of end users.

2.7.2 Before and during erection

1. Examine all materials on arrival at the site or during unloading and put aside any defective or damaged items. These items should be removed from the site as soon as possible and should not be used in the construction of the scaffold.
2. Make sure that all materials to be used are properly stacked in a safe place, especially where work over or near a public thoroughfare is being carried out.
3. Take any and all necessary precautions to ensure that the public are not endangered. This may entail the erection of diversion barriers and signs.
4. Special care should be taken when working in the close vicinity of overhead or adjacent power cables. All exposed cables and wires should be treated as live.
5. Ensure that you are in possession of all necessary permits and instructions or information relating to the job prior to commencing erection.
6. If possible contact someone in authority on site to inform them that you are commencing erection.
7. Always examine the building or structure against which you are scaffolding and if you have any doubts about any aspect of the job, for example, lack of tie positions, unsafe walls or cornices, etc then seek advice.
8. Take care not to obstruct essential services such as hydrants, service manholes or fire exits.
9. Whenever leaving the site or job location, make sure that materials are not left in unsafe locations such as doorways, pavements, kerb sides etc. Always store materials in a safe and secure location.
10. At the earliest opportunity warning signs or notices such as "INCOMPLETE SCAFFOLD" or "UNSAFE SCAFFOLD" should be prominently displayed. Once the scaffold is safe and ready for use "SAFE SCAFFOLD" signs should be displayed at access and egress points.

2.7.3 During the use of the scaffold

During the use of scaffolding it is important to check that:

1. The standards are correctly aligned and properly supported at their bases.
2. There is no undue deflection in ledgers and transoms or putlogs.
3. No essential member of the structure has been removed.
4. All ties and braces are in place and are effective in stabilising the structure.
5. All couplers are tightened properly.
6. All scaffold planks are sound and are properly supported.
7. All guardrails and toeboards are secured in place.
8. All ladders are in good condition, properly supported and secured.

2.7.4 Before and during dismantling

1. Before dismantling examine and check the scaffold to ensure that all ties and bracing are effectively in position and that the scaffold is in a stable condition. If partial dismantling is being undertaken ensure that the remaining portion is fully safe and stable.
2. Suitable warning notices must be placed for public protection.
3. Dismantling should be carried out progressively from the top level downwards. Ties, braces, ledgers, transoms, planks and guardrails must be removed lift by lift with standards following as joint positions are reached.
4. Where a building or structure is being demolished the scaffold should be dismantled to ensure that no more than 4.0m remains standing above the last vertical tie points at any time.
5. Care should be taken to avoid mishandling of materials, all of which should be lowered regularly and not "bombed" during the dismantle.
6. Small amounts of material may be temporarily placed on lower lifts for convenience during dismantling but care should be taken not to allow this material to build up to an unacceptable load. Where such temporary placement at low levels is carried out, it may be necessary to place raking tubes from the ground level to the lower lift in order to stabilise the scaffold.
7. During dismantling ensure that all scaffolding materials are removed from the building and that no loose materials are left on roofs or projecting cornices, etc.

2.7.5 Scaffolding near power lines or electrical conductors

Power lines and conductors are a potential hazard to persons erecting, working from or in the vicinity of a scaffold. No scaffold should be erected closer to any conductors of an overhead electric line at a distance, in any direction, less than that shown in table 5 (from NZECP 34.4.4).

No scaffold should be erected closer than 4.0m to power lines or electrical conductors without approval from the local electricity network company.

Table 5: Minimum clearance distance in any direction for construction of scaffolding near

Line voltage (under normal conditions)	Minimum Distance
--	------------------

Not exceeding 66 kV (maximum span 125 metres)	4.0 metres
Exceeding 66 kV (maximum span 25 metres)	5.0 metres
Any voltage (span greater than 125 metres but less than 250 metres)	6.0 metres
Any voltage (span greater than 250 metres but less than 500 metres)	8.0 metres
Any voltage (span exceeding 500 metres)	Not less than 8.0 metres ^[1]

Recommended procedures

If during your initial site inspection you find power lines or conductors in close proximity to the position of the intended scaffold, you or your client should contact the local electricity network company. This company will give you the expert advice you need.

They may:

- Sleeve the lines.
- De-energise the lines.
- Re-route the lines.
- Shield the lines using moisture resistance non-conductive material.

The electricity network companies are the experts. Ensure that you get written approval from them stating the intended scaffold is safe to erect and that they have taken all practical steps to ensure your safety before any work commences.

Footnotes

^[1] or as agreed with the owner

2.8 Hazard identification and management

The scaffolding industry has long put its workers in hazardous situations to provide safe working areas for other trades and end users of scaffolding structures. The following list shows hazards that have been identified and the controls that need to be implemented in order to provide a safer working environment for scaffolders. This list is not intended to be comprehensive and new hazardous situations will arise that will require new initiatives and controls. This is therefore a reference guide only. Companies and individuals using this list should view it as a base from which to start their own hazard management programme. Appendixed in the final section of this document is a sample sheet that can be used to identify and control hazards - the Hazard identification and controls report.

When assessing hazards associated with scaffolding these can be categorised in one or more of the following areas:

1. [Hazards associated with the design of the scaffolding](#) .
2. [Hazards associated with the construction of the scaffolding](#) .
3. [Hazards associated with the environment in which the scaffolding is situated](#) .
4. [Hazards associated with the use of the scaffolding](#) .

2.8.1 Hazards associated with the design of the scaffold

A significant hazard associated with scaffolding is the collapse of the structure. This has the potential to cause multiple fatalities, both to people using the scaffolding and to others who may be in the area. Structure failure can be avoided firstly by identifying hazards and then implementing controls through the design of the scaffold.

[Top](#)

2.8.1.1 Foundations

Hazard:

Substandard foundation collapses and causes failure of structure.

Control:

- All scaffolding must be erected from suitable foundations
- Bearing areas underneath standards must be:
 1. Level.
 2. Compacted.
 3. Capable of taking all imposed loads - dead, live and environmental.
- All foundations must be stable against subsidence.
- Suitable bearing material such as soleboards and baseplates must be used. Inadequate bearers such as concrete blocks, bricks, undersized timbers must not be used.
- In the case of a sloping foundation additional bracing at the base of the scaffolding may be required.
- In the case of hanging or cantilevered scaffolding the supporting structure must be capable of withstanding all imposed loads.
- Always, if in doubt, seek expert advice such as from a chartered engineer.

2.8.1.2 Standards and ledgers

Hazard:

Incorrect design and construction of standards and ledgers leads to failure of the structure.

Standards and ledgers are load bearing members connected by load bearing couplers. Couplers are tested and have a known load bearing capacity when used in a right angle configuration (unless especially designed, such as swivel couplers). Right angle (90) couplers can fail if standards and ledgers are not square. Incorrect joining of standards and ledgers can also lead to failure of the structure. Incorrect construction of the standards, i.e. floating standards, can lead to uneven bearing on the foundations and can also cause failure of the structure. Standards and ledgers that are erected with over-sized spans can also lead to over-stressing of the structure and

possible failure.

Control:

- All standards must be erected so as to be vertical; all ledgers must be erected so as to be horizontal. If in doubt these members can be checked by the use of a spirit level. Maximum tolerance normally specified is + or - 5 degrees.
- All joints in standards and ledgers must be in the correct position and must be made with the appropriate components.
- Internal joint pins are not rated for tension loads and must not be used in ledgers if possible.
- All [Top](#) standards must bear firmly against baseplates.
- All standards and ledgers must be constructed with the appropriate span for the duty loadings of the scaffolding.

2.8.1.3 Decking

Hazard:

Personal injury caused by inadequate decking.

Serious injuries from scaffolding have been caused by inadequate decking, including:

1. Too narrow working platform for men and materials.
2. The use of substandard equipment.
3. Incorrect spacing of transoms causing trap ends or poor bearing area on planks.
4. Unsecured decking.
5. Insufficient transoms or over length spans causing over-stressing of planks.

Control:

- All scaffolders erecting working platforms must be aware of the intended (or any other possible) use of the scaffolding. Consideration must be given to the number of personnel and any materials that will be stacked or stored on the platform (live load).
- All decking must be suitable for the intended purpose in terms of width, length and height.
- All transoms must be of the correct length (no transom is to have a joiner inserted in the span) and must be suitably spaced to provide adequate support for the end use of the platform. Also the planks must be supported correctly at the ends.

2.8.1.4 Access and egress

Hazard:

Personal injury due to inadequate access and egress.

Inadequate access to and from working platforms can lead to falls and serious harm. Conditions that can lead to this situation include the following:

1. Unsuitable foundation for the ladder.
2. Unsecured ladder.
3. Equipment in poor condition.
4. [Top](#)Incorrect placement of the ladder (inclined angle).
5. Wrong size ladder.
6. Incorrect use of the ladder.
7. Unprotected ladder openings.

Control:

- All ladders must be founded on a level base. All ladders must be secured.
- All ladders must be in good condition and must be free from defects. All ladders must be positioned at the correct angle and must be placed so as to be suitable for access to the required area.
- All ladders must extend a minimum of 1.0m above the working platform, unless adequate guardrails surround the ladder opening.
- All personnel climbing the ladder must face the ladder and use both hands. At no time should equipment be carried up the ladder.
- During busy periods personnel must wait until the ladder is clear before ascending or descending.

2.8.1.5 Edge protection

Hazard:

Personal injury due to inadequate edge protection.

A potentially dangerous situation exists when a person works at height without suitable edge protection. Hazards include the fall of personnel and/or material.

Control:

- All platforms must have suitable guardrails, kickboards and, if required, screening.
- Guardrailing must be positioned on the outside and ends of every working platform or any face of the scaffold that is more than 300mm from the area to be worked on.
- Suitable barriers must be provided to prevent accidental falls through ladder access, deck openings and building facade penetrations.
- All scaffolding must be fitted with guardrails to both ends of the platform.
- Where oversize planks are used on a platform, suitable barriers must be erected so as to prevent personnel standing on trap ends.

2.8.1.6 Stability against overturning

Hazard:

Personal injury due to unstable scaffolding falling.

[Top](#) If a scaffold is erected with too narrow a base there is a risk of the structure overturning. Similarly, if scaffolding is erected with insufficient or inadequate ties then it could collapse if exposed to too much force. Conditions that could cause this situation include:

1. Incorrect base to height ratio for free standing scaffolds.
2. Incorrect base to height ratio for tower scaffolding exposed to high wind loads.
3. Mobile scaffolding being used with unlocked wheels.
4. Insufficient ties for the imposed loads.
5. Inadequate ties.
6. Failure of the supporting structure.
7. Incorrect position of ladder accesses to free standing or mobile scaffolding.

8. Increased environmental loadings due to shade cloth.

Control:

- All free-standing scaffolds must be erected with the correct base to height ratio for the site conditions. This can be achieved through a variety of methods e.g. using raking tubes. [\[2\]](#)
- Consideration should be given to all expected live loads and environmental loads. If in doubt seek the opinion of a chartered engineer. All mobile scaffolding must have the wheels locked prior to work commencing on the platform.
- All ties must be capable of sustaining all expected imposed loads - dead, live and environmental. All ties must be fixed to adequate supporting structures. All ladder access for free-standing or mobile scaffolding should be internal, unless specifically designed.
- Where structures incorporate reveal ties these must account for no more than 50% of ties used. The balance need to be physical ties i.e. lip, lock off, box, or rigid ties.

2.8.1.7 Rigidity

Hazard:

Personal injury caused by collapse of scaffolding due to inadequate bracing

If a scaffolding structure is too flexible this can lead to loosening of the couplers and overloading of the equipment. Similarly if the platform is unstable a collapse or fall could occur.

Control:

- All scaffolding must be adequately braced in both the longitudinal and transverse planes.
- Occasionally the use of plan bracing may be required such as at the base of a mobile scaffold or where too great a span exists between tie points.

[Top](#)

2.8.2 Hazards associated with erecting and dismantling scaffolding

Numerous hazards exist that relate to the construction and dismantling of scaffolding.

2.8.2.1 Loading of vehicles with scaffolding equipment

Hazard:

Personal injury due to manual handling of equipment. This can include back, hand and foot injury.

Control:

- All personnel to use correct lifting procedures. Lift with back straight and legs bent. Lift with load in centre of body.
- Never lift anything too heavy.
- All personnel to be provided with and use PPE e.g. hard hats and safety footwear.

Hazard:

Personal injury due to being crushed by moving equipment.

Equipment such as forklifts have various hazards associated with their use such as:

1. Poor visibility.
2. Overturning of the machine due to overloading, poor ground conditions or incorrect travelling procedure.

Control:

- All personnel using forklifts or other machinery must be suitably qualified. All care must be taken to avoid travelling into blind spots.
- All drivers must be aware of other people in the area.
- All loads must be secure while travelling and travel as close as possible to the ground with the forks either level or tilted back.
- All loads must be correctly centred.

Hazard:

Personal injury due to fall of equipment from a truck.

[Top](#)

Control:

- All equipment must be loaded and transported in the correct manner. Tube must be stacked against restraints.
- Couplers must be bagged or transported in cages.
- Planks must be loaded onto dunnage or laid flat in the case of hand loading.
- System scaffolding must be transported in stillages, pallets or cages, or the equipment must be suitably banded or strapped to prevent movement.
- All equipment must be secured with the appropriate straps or tie downs. All load-binding equipment must be in good working order.
- No trucks are to be overloaded in terms of height or weight.
- In the case of crane loading of equipment, all slinging must be carried out by suitably qualified personnel.
- All cranes must be operated by qualified personnel.
- Only one person to give directions to crane driver.
- All cranes to be set up by the correct method on adequate foundations. No crane should exceed lift limits or be used to drag equipment.

2.8.2.2 Erection and dismantling of the structure

Hazard:

Personal injury due to fall of equipment.

There are several factors that can cause this hazard such as:

1. Incorrect handling of equipment.
2. Incorrect stacking of equipment.
3. Inexperienced workers.

4. Personnel standing underneath equipment being lifted or lowered.
5. Failure to barricade the working area.
6. Unauthorised entry of other personnel into the working area.
7. Failure to use protective equipment.

Control:

- All equipment must be handled in the correct manner - not thrown or dropped.
- No personnel to attempt to lift any equipment that is too heavy.
- When used gin wheels and ropes must be in good condition and properly secured.
- Correct knots, bends or hitches must be used.
- When equipment is being "handballed", proper communication and good visibility must be maintained between members of the chain. Lift or lower equipment from stable, safe positions i.e. behind guardrails, never from an open space.
- No personnel are to stand directly under equipment that is being lifted or lowered. Once equipment is released personnel must move out of the area or seek cover.
- All equipment must be stacked properly and in a tidy manner.
- All equipment must be kept away from exposed areas.
- No area of the scaffolding should be overloaded with surplus equipment.
- All personnel will be supplied with and must use personal protection equipment suitable for the task.
- All areas below scaffolding operations must be suitably barricaded and if required signs must be erected.
- Only personnel involved with the work will be allowed into the area.
- No access will be given to any scaffolding under construction or in the process of being dismantled.

Hazard:

Personal injury due to fall of people from scaffolding.

Although this is very rare in the industry it has been known to happen and the consequences can be severe, even fatal. This hazard can be a double-edged sword. Not only can a person be hurt by falling; there is also the risk that they land on somebody else causing multiple injuries.

Several factors can contribute to this situation such as:

1. Poor communication between workers.
2. Incorrect erection or dismantling procedures.
3. Poor housekeeping during erection or dismantling.
4. Inadequate safety procedures such as poor fall arrest systems or safety harnesses not being used in high risk areas.

Control:

- All personnel must be aware of the activities of others involved e.g. if a portion of scaffolding has been removed and this is not known, danger may be hidden.
- All scaffolding must be checked before dismantling, to ensure it is safe to proceed.
- All personnel must maintain communication lines.
- All scaffolding must be erected and dismantled using the correct procedures. As a general rule work must be completed as the work progresses.
 - Decking and guardrailing must be in place.
 - Ladders must be installed.
 - Ties and bracing must be put in place.
- All equipment not being immediately used must be stacked safely and tidily.
- All personnel must use appropriate safety equipment if required.
- Fall arrest systems must be regularly checked for defects.
- Static lines must be installed by qualified personnel and must be capable of sustaining all loads likely to be imposed on them.
- Fall arrest systems must be used in all void situations such as the erection and dismantling of cantilever scaffolding, hanging scaffolding, etc.
- Safety harnesses must be worn by all scaffolders working on scaffolds above 5m.
- Correctly secure and wear safety harnesses when operating a swinging stage.

Hazard:

Personnel injury due to defective tools and equipment.

This can include injury to hands, eyes, feet and serious body harm caused by:

1. Faulty spanners (which can slip or break).
2. Faulty hammers (which can splinter or shatter).
3. Defective electrical equipment.
4. Substandard planks.
5. Corroded tube.
6. Defective fittings or couplers.
7. Defective ropes and other lifting equipment.
8. Faulty or under strength personal protective equipment.

Control:

- All equipment used in the scaffolding must be in good condition and fit for its intended purpose.
- All defective equipment must be isolated and not used.
- Bent tube must be cut down or discarded.
- Faulty planks must be cut down so as to be safe or discarded.
- Faulty couplers and fittings must be serviced, repaired or discarded.
- Faulty tools must not be used.
- Faulty ropes must be cut down so as to be safe or be discarded.
- Gin wheels must be of solid construction and have a suitable wheel diameter.
- Gin wheels must be free turning and have an appropriate sheave size.
- Gin wheels must be able to be secured according to manufacturer's specifications or accepted industry practice.
- Gin wheels must not be overloaded and must be attached to an appropriately designed and constructed support. Note that additional ties may be required in the scaffolding in order to sustain the imposed load.
- Shackles used to secure gin wheels must be moused and prevented from movement along the support.
- All electrical equipment must be in good condition and regularly checked for defects.
- Electrical equipment, including leads, must be used with isolating transformers, earth leakage circuit breakers or RCDs. These must also be in good condition and regularly checked for suitability.
- All electrical equipment, including leads, must be checked by a qualified person a minimum of every 3 months. Each item must be tagged safe with the date.
- All electrical equipment and electrical installations on construction sites must comply with AS/NZS 3012 Electrical Installations - Construction and Demolition Sites. This required in Regulation 46 Electricity Regulation Compilation 2003.
- Any defective electrical equipment must be repaired by a suitably qualified person.
- All personal PPE must be in good condition and suitable for its intended purpose. Faulty PPE can lead to a false sense of security and must be discarded.

Hazard:

Personal injury due to fall from scaffolding caused by slippery equipment.

This can lead to a variety of injuries from moderate to severe. This could be anything from a slip from the bottom rung of a ladder causing a sprained ankle to a fall from height causing serious injury or death. In addition a person handling equipment could slip and release the gear leading to a hazardous situation for people below.

Control:

No personnel are to carry out operations at height on wet or slippery equipment. Any minor works that can be carried out within the confines of a safe working platform would be permitted, however all due care must be taken.

Hazard:

Personal injury caused by falling debris.

On many occasions trades people using scaffolding are oblivious to the hazard they can create by leaving debris or rubbish on scaffolding platforms. Welders often leave rod ends, slag, used grinding disks, etc. Plasterers, blocklayers and bricklayers often leave dried mortar or block off cuts. Carpenters often leave timber off cuts, nails, screws, etc. This material can cause serious harm if dislodged or dumped from height onto people below.

Control:

- All rubbish must be removed from scaffolding decking as soon as practical, ideally by the trades that caused it. Poor housekeeping is a cause of many incidents.
- When the scaffold deck is being lifted or dismantled all care must be taken to prevent dust and debris falling on people below.
- The area below the scaffolding must be barricaded and people kept out of the area.
- All personnel must use PPE such as hard hats, safety glasses and safety footwear.
- All tubes must also be checked for hidden debris. Welding rods, screwdrivers and other small items can become missiles if released through a tube.

2.8.3 Hazards from the environment in which the scaffold is situated

Often the scaffolding site and its environs create as many hazards as the work itself.

2.8.3.1 General construction work

Hazard:

Personal injury caused by fall of equipment. Possible conditions leading to this situation include:

1. Working in the vicinity of cranes or loads being lifted by cranes.
2. Working underneath, adjacent to, or above building openings.
3. Working underneath or above other trades people.

Control:

- All personnel must be aware of any equipment or material being lifted overhead. No standing or working under crane lifted loads is allowed.
- Only suitably qualified personnel are allowed to sling loads, direct or operate cranes. All slings and chains must be in good condition and must be checked prior to use.
- Under normal circumstances the responsibility for crane lifted loads will remain with the construction management. Lifting operations must not, under any circumstances, be conducted without the permission of the site management.
- Personal protection equipment such as hard hats must be used at all times.
- All personnel must be aware of building openings above and below the work area.
- No equipment is to be stacked near openings.
- [Top](#)All openings must be fitted with guardrails or covers.
- All personnel must be aware of other trades people working in the area.
- Every effort must be made to avoid working in or moving through areas that are occupied by other trades unless this can be achieved in a safe manner.
- All containers used to lift equipment must be of suitable design and strength.

Hazard:

Personal injury caused by contact with compressed air.

Many sites make extensive use of compressed air e.g. to power concrete breaking equipment. If used incorrectly compressed air can cause serious injury or death.

Conditions that can lead to this situation include:

1. Debris or splinters blown into eyes or skin.
2. Contact with compressed air on bare skin can lead to air embolisms, i.e. a bubble of air entering the bloodstream - often causing death.
3. Incorrect or faulty fittings on air hoses which can fail under pressure. This can lead to air hoses moving wildly and coming into contact with workers.

Control:

- All personnel working in the vicinity of compressed air must wear the appropriate safety equipment such as safety footwear, gloves, safety glasses and overalls or wrist to ankle cover.
- No personnel are allowed to tamper with airline hoses or fittings.
- At no time should compressed air be directed at other personnel.

Hazard:

Personal injury caused by contact with live electrical conductors or equipment.

Many sites use temporary power supplies which, if used incorrectly, can be dangerous. Electric shock or arcing can lead to severe injuries or even electrocution (death).

Control:

- Check all plugs, leads and equipment for defects. Faulty equipment must not be used and instead must be repaired by a suitably qualified person.
- All electrical equipment must be used with isolating transformers or similar.
- All leads must be elevated above ground or if this is not possible run through a suitable conduit and protected from crushing.
- All leads and electrical equipment must be checked and tagged three monthly by a suitably qualified person.

- All electrical equipment and electrical installations on construction sites must comply with AS/NZS 3012 Electrical Installations - Construction and Demolition Sites. This required in Regulation 46 Electricity Regulation [Top](#)Compilation 2003.

Hazard:

Personal injury caused by person falling.

Construction sites are inherently dangerous places to work and due to the unfinished nature of the area have many trip or fall hazards. These may include:

1. Obstructed walkways.
2. Trip hazards obscured by poor lighting.
3. Floor openings left with no covers or guardrails in place.
4. Poor access to upper or lower floors.
5. Wet or slippery walkways.

Control:

- All personnel are to ensure that work areas are left in a clean and tidy state.
- All personnel are to leave work areas in a safe condition e.g. covers placed over floor areas and guardrails reinstated.
- No person is permitted to work in poor visibility. Suitable lighting is to be installed prior to commencement.
- Ensure that suitable secured access is used to travel between floor areas.
- All care is to be taken when entering wet areas.

Hazard:

Personal injury caused by crushing from moving machinery.

Construction sites often make use of excavation machinery, hoists, cranes and other mobile plant. This type of equipment can be hazardous if used incorrectly and if safety procedures are not followed.

Control:

- No personnel to enter the blind spot of moving machinery.
- All personnel to be aware of moving machinery and to avoid moving into its path.
- A minimum safe distance must be kept from swinging loads and workers must be aware of the movement of crane hooks.
- All mobile plant must be operated by suitably qualified personnel.

[Top](#)

Hazard:

Personal injury due to inhalation of fumes or asphyxiation.

Sometimes on construction sites, personnel are required to operate in confined spaces. These areas are normally subject to poor ventilation and can become filled with fumes from machinery or processes being carried out on site.

Control:

- A confined space entry induction must be provided before commencing work (refer AS 2865).
- All personnel entering or intending to work in a confined space must make sure that the area is well ventilated and free from fumes.
- Machinery operators must ensure that exhaust fumes cannot enter confined areas and that stationary equipment such as compressors are situated in well ventilated areas.
- Tradespeople carrying out operations that involve the use of chemicals must ensure, if the process is likely to cause potentially hazardous fumes or other conditions, that warning notices and barricades are placed in suitable areas.
- When working in the vicinity of hazardous substances the Hazardous Substances and New Organisms Act 1996 and ERMA Codes of Practice apply.

Hazard:

Personal injury caused by fire.

Fire is always a potential hazard on construction sites. Make every effort to avoid it.

Control:

- All work areas must be kept clean and free of debris.
- All care must be taken when using machinery or processes that cause heat.
- All personnel must be aware of no smoking areas on site and must observe warning signs.
- All personnel when commencing work on site must make sure they are aware of the location of fire extinguishers and fire exits.
- All fire escape doors and fire hydrants must be kept clear of materials and other obstructions.

Hazard:

Personal injury due to collapse of falsework, propping or formwork systems.

Construction sites often make considerable use of falsework, propping and formwork systems. A collapse of one of these systems can lead to serious injury or death.

CoTopditions that can lead to this situation include:

1. Unsuitable foundations.
2. Overloading of equipment.
3. Inadequate bracing or ties.
4. Poor design.
5. Unskilled operators.
6. Unauthorised tampering or interference with equipment.
7. Equipment in poor condition.

Control:

- All personnel involved with the erection, maintenance or dismantling of these systems must be suitably qualified and capable of carrying out the work according to specifications. Normally these systems are subject to calculations and engineering design and all dimensions and specifications must be strictly adhered to.
- No personnel are to interfere or tamper with equipment of this type unless under the direct supervision of a suitably qualified person and under directions from the

project management.

- All equipment of this type must be in good condition, suitably braced or tied and based out on suitable foundations.
- No faulty equipment is to be used.
- All defective equipment is to be repaired by suitably qualified personnel.
- No equipment is to be overloaded and is only to be used for its intended purpose. If in doubt seek the advice of a suitably qualified person such as a chartered engineer.
- The erection and dismantling of this type of equipment has similar hazards to the erection and dismantling of scaffolding systems.
- All care must be taken when working at height, around other trades or working underneath crane lifted material.

Hazard:

Personal injury due to exposure to welding, grinding or gas cutting, operations.

This type of work produces heat, sparks and possibly infra-red rays (the cause of "arc eyes"), hazards associated with fumes and the possibility of falling equipment.

Control:

- All personnel working in the vicinity of these operations are to ensure that the work is barricaded or isolated from them. It is also good practice for tradespeople of this type to erect screens around their work area.
- Never stare at an arc welding operation.
- [Top](#) Move out of any area where the possibility of falling sparks or steel off cuts exists. See also controls for electricity and fire.

Hazard:

Personal injury due to being struck with projectile from powder powered tools or a nail gun.

These tools make use of either explosive cartridges or compressed air to drive a nail or pin into concrete, steel or timber. Consequently the projectile can have the same effect as a bullet fired from a gun. Any body part struck by the nail or pin will suffer at least a puncture wound and possibly other serious injuries.

Control:

- The use of powder powered tools is restricted to holders of a current certificate of competence. These people have been trained in the correct use of the equipment including safety procedures.
- No personnel are to operate this type of equipment unless they are suitably qualified.
- No personnel are to tamper or interfere with this type of equipment.
- No defective equipment is to be used. All faulty equipment must be repaired by a suitably qualified person.
- All firing charges must be kept in a locked, secure area when not being used.
- All specified safety equipment such as safety glasses, hearing protection and safety boots must be worn when this equipment is being used.
- Operators of this type of equipment must be aware of other people in the area and must never discharge the firing unit in the direction of any other personnel, regardless of the material being fired into.
- There have been several occasions where projectiles have passed through the object being fired into, leading to an uncontrolled flight of the nail or pin.

2.8.3.2 Demolition work

Demolition work could be viewed as the direct opposite of construction work. However, when the two industries are examined they have similar hazards. For example, both have hazards due to possible exposure to:

1. Falling equipment or material.
2. Compressed air.
3. Gas cutting and or welding and/or grinding.
4. People falling.
5. Moving machinery.
6. Fire.
7. Live electrical conductors or equipment.
8. Failure of temporary propping systems.

[Top](#)

Hazard:

Injury to feet and hands due to contact with timber with exposed nails.

Demolition work can lead to large amounts of timber being removed from buildings often with nails or screws exposed. This can lead to puncture wounds in hands or feet when dealing with such material.

Control:

All personnel working in the vicinity of timber with protruding nails should wear safety boots and gloves and take all steps to avoid coming into contact with the nails. In the case of an abrasion or puncture wound being sustained, the injury shall be treated immediately with the use of antiseptic and a suitable bandage. The injury must be reported to the supervisor and if necessary further medical treatment must be sought.

Note: There is always a possibility of contacting tetanus or having the wound turn septic if not treated properly. If in doubt seek medical advice.

Hazard:

Personal injury due to scaffolding collapse caused by scaffolding support structure being demolished and suitable alternative ties not being put in place.

In the normal course of events scaffolding will be erected on a construction site as the building progresses or when the building superstructure is complete. This process ensures that the scaffolding can be safely tied as it is erected. In the case of demolition work it is the opposite. Often a scaffolding structure that is being used to assist with the demolition of a building will be completely erected around the structure and then as the building is demolished the scaffolding is progressively dismantled. There have been occasions where scaffolding has collapsed on demolition work due to being left exposed too high above the last tie off points. This can lead to major damage and serious injury.

Control:

- No scaffolding is to be left free standing more than 4.0m above the last tie point.
- All scaffolding is to be erected with suitable bracing. Additional dogleg bracing may be required.
- The scaffolding supervisor must ensure when undertaking contracts associated with demolition work the demolition contractor is aware of the potential hazards associated with free-standing scaffolding.
- The scaffolding supervisor must liaise with the contractor and establish the programme of work.
- The scaffolding supervisor must ensure that sufficient manpower is available to carry out the dismantling of the scaffolding when and as required.
- All surplus equipment must be removed from site as soon as possible. The scaffolding supervisor must ensure that sufficient ties remain in the scaffolding at all times.

Hazard:

Personal injury caused by crushing due to building collapse.

There are several methods used for the demolition of a building. Some are relatively passive such as brick by brick demolition used with some buildings with historical significance. Some are volatile such as the use of explosives or progressive deliberate collapse (felling) of the structure. In the case of the latter there is a real danger that the collapse of the building could become uncontrolled or happen prematurely, possibly trapping workers inside and causing serious injury.

[Top](#)

Control:

- All personnel are to remain outside of any area that may be subject to collapse. Under no circumstances will entry be allowed.
- All personal protective equipment such as safety glasses, footwear, hard hats and, if required, hearing protection, must be used at all times on demolition sites.

2.8.3.3 Work near asbestos

Hazard:

Personal injury due to exposure to asbestos.

Although the risk of exposure to asbestos has been greatly reduced over the last decade, occasionally workers involved in the construction industry will be on a site where asbestos products have been located e.g. refurbishment projects. Most responsible building owners have taken steps to reduce or eliminate these products or alternatively have covered or sealed them so as to reduce the possibility of the release of the fine dust or fibres that can cause asbestosis or other related injuries.

In the demolition industry, workers are more likely to be exposed to the problem of asbestos removal and containment and as such special precautions are required. In some older buildings, asbestos was used for insulation and/or fire proofing as well as a building material for roofing and wall cladding.

The greatest hazard from cladding type products comes when the material is in a dry or cracked condition or is being cut for the purpose of removal. Similarly, hazards exist when insulation or fireproofing material is being scraped off surfaces. The concern is the release of asbestos particles which can lead to medical problems if inhaled.

Control:

- All personnel involved in asbestos removal or handling must be suitably qualified and all controls for the prevention of the release of asbestos containing dust must be carried out at all times e.g. containment, adequate wetting down and approved removal and disposal methods.
- Some work with asbestos is restricted (work with friable asbestos) requiring a Limited Certificate of Competence. This is notifiable work to Department of Labour. Further information can be found in the HSE Asbestos Regulations 1998.
- Occasionally scaffolding will be erected in order to gain access to areas containing asbestos. If this is required then all protective measures employed for the safe removal and handling of asbestos must be taken.
- All personnel who will be exposed to asbestos products must use the appropriate personal protection system for the product.
- All personnel must observe all site safety rules with regard to the asbestos removal programme such as the use of decontamination areas, correct disposal of soiled overalls and the appropriate changeover times for ventilation equipment.
- All personnel engaged in this work will undertake an appropriate induction course and will identify and take all practicable steps to minimise all hazards prior to commencement.
- All respiratory equipment used must be of an appropriate standard for the work being undertaken and must be in good working order.
- All personnel using respiratory equipment must first undergo an appropriate instruction course in the correct use, maintenance, cleaning and, if required, disposal.
- At no time shall any person having been in contact with asbestos be allowed to come in contact with other workers or enter any area where there is a possibility of contamination of the area without the proper decontamination and containment procedures taking place.
- At all times provision must be made for the possibility of emergency access or egress to the area.
- [Top](#) If possible the ends of scaffolding tube used in association with asbestos related work should be taped or blocked in order to prevent the build up of asbestos product inside the tube.
- Before dismantling scaffold must be clean and free from any asbestos particles prior to the work commencing. This work must be carried out by suitably qualified people and may be restricted work requiring notification (as above).

2.8.3.4 Work on ships, offshore installations and bridges

When scaffolding work is required in these areas most of the hazards already covered will need to be managed for example:

1. Hazards associated with the use of cranes and other lifting equipment and moving machinery.
2. Hazards associated with work in confined spaces.
3. Possible hazards associated with the risk of fire.

In addition to these (and many others) there are the unique hazards associated with work over water.

Hazard:

Personal injury due to fall from height into water.

Workers erecting or dismantling scaffolding over the side of a ship, rig or bridge have the added difficulty of trying to carry out their task in a void situation whereby they cannot work from a readily accessible platform.

Control:

- Personnel involved in working in a void situation must wear the appropriate PPE such as safety harnesses and, if required, life jackets.
- All equipment of this nature must be in good working order and regularly checked for defects.
- All equipment of this type must be correctly installed by a suitably qualified person and must be to a standard appropriate for its intended purpose.
- All personnel using this type of equipment must first undergo an appropriate instruction course in the use and maintenance of the equipment.
- All personnel involved in work over water must be fitted with reflective vests or bright coloured overalls.
- Emergency contingency plans must be in place at all times. Consideration must be given to the failure of existing safety systems and the possible requirement to rapidly extract personnel from the water.
- In the case of work over water, operations are not to be carried out unless there is provision for a rescue craft to be readily available in the area.
- No work of this nature is not to be carried out without the permission of the operators of the facility.
- No work of this nature is to commence without an emergency resuscitation procedure being readily accessible.
- Refer to Maritime New Zealand for further information.

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2.8.3.5 Work in chemical plants, factories, storage areas and processing facilities

Maintenance work carried out in these areas can be particularly dangerous due to the processes carried out and also because of the goods produced or stored in them.

Hazard:

Personal injury due to exposure to heat.

Many plants of the type described above have processes that can produce large amounts of heat. Examples include steel mills, smelters and petrochemical plants with reformers.

The two main hazards associated with work adjacent to heat are:

1. The possibility of burn injuries; and
2. The possibility of dehydration and heat sickness.

Control:

- All personnel working in hot areas must use all appropriate safety equipment such as safety boots, overalls, gloves and hard hats in order to prevent skin coming into contact with hot equipment.
- All personnel engaged in this type of work must be supplied with or have ready access to an adequate supply of wholesome drinking water. Each person should have his or her own drinking vessel.
- Personnel working in these areas must take work breaks as and when required.
- Emphasis must be placed on the avoidance of injury or sickness caused by over exposure to heat.
- Emergency plans must be in place at all times with emphasis on the possibility of rapid extraction of personnel from the area.
- Any worker suffering from the effects of over exposure to heat must leave the area immediately and must not return until fully rested and recovered.
- At no time are any personnel to enter hot areas without permission from the plant operator.
- At all times all site safety procedures must be adhered to and any breach of these rules is to be treated as a serious breach of conduct.
- All personnel must take all care when handling equipment that has been exposed to heat.
- All equipment used in the vicinity of hot areas must be suitable for its intended purpose and must be in good condition.
 - Timber planks or other flammable material must be used with caution and material must never be left in a position whereby excessive heat build up could lead to combustion.
 - All rubbish and debris must be removed from the area.
 - Steel decking must also be used with caution and if required must be covered with material that will enable the platform to be used without undue discomfort or heat build up for the end users of the scaffolding.
- Timber planks used in hot areas must be checked regularly for warping or undue deflection.
- All personnel must attend appropriate induction and safety training courses prior to entering hot areas.
- When working in the vicinity of hazardous substances the Hazardous Substances and New Organisms Act 1996 and ERMA Codes of Practice apply.

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Hazard:

Personal injury due to exposure to cold.

Some processing and storage plants make use of refrigeration areas. The degree of cold is dependent on the product being manufactured or stored; however all areas with more than mild refrigeration should be treated as hazardous and precautions must be taken to prevent hypothermia or other cold related injuries.

Control:

- All personnel involved in prolonged exposure to cold areas must use appropriate safety equipment such as gloves, approved footwear and suitable headwear.
- Prolonged exposure to cold may also require the provision and wearing of thermal clothing.
- Personnel involved in work in these areas must take work breaks as and when required.
- All personnel carrying out work in cold areas must take all caution. Cold, wet areas can lead to the formation of ice and workers must take all steps to avoid slipping or losing their balance on the ice.
- Equipment used in these areas can become slippery and difficult to handle. All care must be taken when passing or transporting equipment.
- All equipment used in cold areas must be in good condition and suitable for its intended purpose. If possible decking used in cold areas should be covered with anti slip material such as chicken mesh wire.
- Some plants make use of ammonia as a refrigeration agent. All personnel involved in work near pipes or vessels used to convey ammonia must take all precautions necessary to avoid coming into contact with this type of plant.
- Piping used for cooling systems can become covered in ice and can deteriorate if not regularly maintained. These pipes can weaken due to rust build up and occasionally can fracture, leading to a release of ammonia.
 - At all times in these areas emergency plans must be in place.
- Emphasis must be given to the rapid extraction of personnel and also to resuscitation methods.
 - No personnel are to enter these areas without the permission of the plant operators.
 - At all times all site safety procedures must be strictly observed.
- Workers entering any area where there is a possibility of an ammonia release must carry and be trained in the use of emergency breathing apparatus (BA).
- All personnel entering cold areas must attend an appropriate induction course prior to commencement of work.
- Any person suffering from the effects of over exposure to cold must immediately leave the area and must not return until fully recovered.

Hazard:

Personal injury due to exposure to excessive noise levels.

Many plants make use of machinery or equipment that produces noise in excess of recognised safe exposure thresholds. Prolonged exposure to excessive noise can lead to hearing loss and stress related problems. In general terms a 'high noise area is any area where you cannot communicate to another person 600mm away from you without raising your voice.

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Control:

- All personnel entering a high noise area must use an appropriate hearing protection system.
- The type of equipment used will depend on the level of noise in the area.
- All equipment used must be in good condition and suitable for the requirements of the area.
- All equipment must be manufactured to an approved standard and must be regularly checked for defects.
- Ear muffs must be kept clean and must be well fitting.
- Personnel exposed to high noise levels over a prolonged period of time should have regular hearing tests.

Hazard:

Personal injury due to explosion/s in a work area.

Many plants and storage facilities produce or handle volatile materials that in particular circumstances can become explosive. For instance petrochemical plants produce highly flammable liquids and gases and chemical plants can produce similar substances. Other plants can manufacture products that at first can appear to be relatively harmless but in the wrong condition or atmosphere (or when mixed with other material) may also become unstable or potentially explosive. Examples of products that are highly flammable are methanol, petroleum, CNG, LPG etc.

Dust explosions can also be problematic. A dust explosion will normally occur in a confined space such as a silo or vessel and is actually two explosions that occur simultaneously. The first can be a minor one caused by a spark or exposure to a heat source. This will ignite a small quantity of material and cause a shock wave. This shock wave will hit the wall of the vessel causing the release of more dust into the already heated atmosphere. A second explosion will now occur due to the larger fuel source, oxygen rich atmosphere and heat source. Examples of products that are known to be involved in particle or dust explosions are coal, sawdust, flour, wheat, coffee and aluminium. As mentioned above on the surface these items appear to be unable to cause much harm, but when these products are stored or being transported there is likely to be dust build up.

Control:

- All personnel intending to work in these areas must attend a site induction course prior to commencement of work.
- All personnel must notify plant operators when entering or leaving high risk areas.
- All personnel must obtain necessary permits to enter and work in high risk areas.
- If necessary potential high-risk areas should be gas tested or flushed prior to entry.
- Cellular phones or radio telephones should be checked with the plant operator. Generally they are not permitted in potentially explosive environments.
- All vehicles entering any process or high-risk areas must comply with all permit requirements and if necessary must be fitted with anti spark devices such as rubber battery covers and exhaust covers.
- All vehicles must be of an approved type, suitable for the area and must be in good condition.
- Take special precautions when working in high risk areas e.g. the use of rubber mallets for the erection of system or modular wedge type scaffolding.
- Prior to commencement of work a detailed safety plan must be prepared that includes the identification of all hazards and all measures to be taken to control these hazards. This safety plan must be agreed upon and [Top](#)understood by both workers about to engage in activity in the area and by the plant operators.
- An emergency contingency plan must be in place at all times.
- All personnel must be equipped with and use all appropriate safety equipment and all equipment must be in good condition and free from defects.
- All gas testing or monitoring equipment must be regularly checked and calibrated and must be suitable for its intended purpose.
- If required a safety watch may be positioned on the exterior of a tank or vessel. The safety watch personnel should be trained in evacuation procedures and must be in communication with the plant operators.
- All tanks and vessels must be well ventilated when personnel are working inside these areas. This may mean that external blowers or suction units may have to be positioned at manholes or other openings

Hazard:

Personal injury due to exposure to toxic chemicals, gases or caustic products.

Some plants and storage areas produce or handle substances that can be hazardous either by themselves or when mixed with others or when the composition is changed, for example in the case of a fire in the area. The degree of harm caused by chemicals and gases will depend on the toxicity of the substance, the exposure to it and sometimes the method in which it enters the person.

While gases are inhaled, chemicals can be dangerous in a variety of ways. Some chemicals produce fumes that may be inhaled. Some can be swallowed (ingested) e.g. if a person was working with chemicals without gloves and then failed to wash their hands before eating a small quantity may be passed from the hands to the food to the person. Some chemicals can enter through the skin, either through absorption or by entering a puncture wound or open exposed cut. Organo-phosphates are an example of a chemical that can be relatively harmless if exposed to the skin or alternatively there are some types whereby even a small amount on the skin can be deadly.

Chemical fumes and toxic gases can present similar hazards to explosive gases in that they can accumulate in confined spaces. Some are heavier than air and can build up in pits or ducts or other underground areas. Some are lighter than air and similarly can build up in ceilings or roof cavities.

Control:

- Personnel intending to work in these areas must attend a site induction course before starting work. This must cover all hazards posed by chemicals or gases used in the production processes or that are produced or stored in the plant.
- All personnel must be satisfied that there are adequate controls to prevent any harm coming to them.
- All personnel must notify plant operators when entering or leaving high risk area.
- All personnel must obtain necessary permits to enter and work in high risk areas.
- All vehicles entering high-risk areas must comply with all permit requirements. If necessary vehicles must be washed down or treated to avoid the possible contamination of other areas.
- All wash down areas must be self-contained and must not drain into storm water systems or other open drainage systems.
- If necessary all vessels or tanks must be tested for toxic residue and washed down using approved procedures prior to entering the area.
- All vehicles working in high risk areas must take all caution to avoid damage to any containers, valves or process machinery. Any damage must be reported immediately to the plant operators or appropriate supervisor.
- All personnel must take special precautions when working in high risk areas. This may mean the wearing of disposable overalls or aprons or the wearing of suitable water or chemical proof overalls.
- [Top](#)Other equipment that may be needed includes special gloves, boots, head or face cover, masks, etc.
- All safety equipment must be suitable for its intended purpose and must be in good condition.
- Emphasis must be given to ensuring that no hazardous chemicals come into contact with personnel.
- Some plants make use of various acids for cleaning purposes or other production uses. These substances must be treated with all care and must not be allowed to come into contact with personnel.
- An emergency contingency plan must be in place at all times with emphasis given to extraction of personnel from the area and containment of spilled substances.
- A detailed safety plan must be prepared that identifies all hazards associated with substances in the area. Use should be made of material safety data sheets that show the identity of the substance and the controls needed for its safe use.
- All work areas, especially tanks and vessels, must be well ventilated when working in the area. This may require the placement of external blowers or extraction units.

Hazard:

Personal injury due to exposure to radiation

Some plants make use of radiation producing equipment as part of their processing. The amount of potential exposure with will depend on the type and intensity of radiation produced. An example of a hazard to personnel posed by radiation may be staff working around X-ray equipment e.g. in the medical and non-destructive testing industries. Prolonged exposure to this type of equipment can lead to medical problems.

Control:

- All personnel must attend an appropriate induction course prior to entering and working in any high-risk area.
- All radiation producing equipment must only be operated by trained staff and must be isolated from other personnel in the area. Warning signs and other barriers must be erected and no unauthorised entry is permitted to high risk areas.

2.8.3.6 Work on roof areas

Hazard:

Personal injury due to a fall from or through a roof area of staff or materials. There are many times when working on a roof could be hazardous, for example:

1. A slip on a roof could lead to sliding off an unprotected edge and falling.
2. A slip could lead to the release of equipment, leading to it falling and posing a danger for personnel below.
3. A person working or walking on a brittle roof may stand on a weak area and fall through posing a danger to themselves and other people below. Similarly equipment dropped onto a weak section could also penetrate the area.

Control:

- [Top](#)All persons involved with inspection and work on roof areas must be suitably qualified and experienced in the task/s to be carried out.
- Edge protection should be attached to all roof areas where personnel are going to work or alternatively fall arrest systems must be used. Fall arrest systems such as safety harnesses and static lines must be capable of carrying all imposed loads.
- All personnel using safety harnesses must be trained in their safe use.
- All static lines and safety nets must be installed and checked by suitably qualified personnel.
- Where practical work near guttering and roof edges should be carried out from mobile scaffolding, cherry pickers, scissor lifts, or similar type equipment.
- No work on brittle roofs should be carried out without an inspection to determine all hazardous areas.
- All areas such as skylights, rusted metal sections and other brittle sections should be covered with decking or alternative measures taken to ensure that personnel cannot fall through.
- If decking or working platforms are erected on roof areas measures must be taken to protect personnel during installation and removal. Decking or working platforms must extend to rafters or other roof supports capable of taking all loads.
- A suitable means of access must be maintained on all roof areas.
- All equipment stored on roof areas must be stored in a manner that is tidy, so as to prevent accidental tripping or dislodgement of equipment.
- No equipment is to be stored near roof edges, or on weakened sections of roof.

2.8.3.7 Work near power lines

Hazard:

Personal injury due to electric shock from contact with power lines.

For instance this can occur when:

1. Homes that require painting need scaffolding to be erected in order to gain access to high areas. Workers involved in the erection and dismantling of scaffolding to these areas (and any others with exposed power lines) risk electric shock or death by electrocution caused by contact with wires.
2. Excavation work uncovers underground power lines causing unexpected contact.
3. Personnel using mobile scaffolding, cranes, Hiab trucks and other mechanical plant are unaware of overhead power lines and move parts of the equipment so as to cause contact with the lines.

Control:

- No scaffolding is permitted to be erected within 4.0m of any live power lines without written permission from the local electricity network company or line owner.
- The actual clear distance required depends on the voltage and span of the line, for example any line with a span of 250m requires a clear span of 8.0m.
- Any lines that will pass through or adjacent to scaffolding (within the minimum clearance) will require isolation for the full length of the scaffolding and for a reasonable distance from both ends. Consideration must be given to the movement of lines in windy conditions.
- [Top](#)No part of any movable machinery or plant, such as crane booms or winch lines, Hiab lifting apparatus or mobile scaffolding must be moved or operated within 4.0m of power lines.
- All care must be taken when excavation works or digging out for foundations is being undertaken near underground power lines.

2.8.3.8 Work outdoors

Hazard:

Personal injury due to over exposure to ultra violet radiation.

In recent years over exposure to the sun has been associated with a variety of medical problems from temporary pain caused by sunburn to skin cancers like melanomas. Many of the serious disorders may not be apparent for a number of years and then can cause major problems and in some cases death.

Control:

- The only effective means of preventing problems associated with over exposure to the sun is to stay out of it. Unfortunately most scaffolding work is carried out outdoors and so other means of protection must be used to minimise the risk.
- All personnel working in areas that are likely to cause sunburn must wear suitable protective clothing and use an approved sun block applied to all exposed body parts.
- A person's eyes can also be damaged through over exposure to the sun and hence protective eyewear with UV protection must be worn.

Hazard:

Personal injury due to exposure to high wind conditions.

Work should only be carried out in high winds if it is safe to do so. A hazard analysis should be completed to determine this. For example high wind conditions can lead to:

1. Personnel working aloft losing their balance and falling.
2. Personnel working aloft, losing control of equipment.
3. Dust and debris blowing around and possibly entering the eyes.
4. Loss of control of crane lifted material.

Control:

- Take all measures to avoid the fall of personnel or equipment from height.
- All personnel must make use of safety harnesses or other fall arrest systems while working aloft in high wind conditions.
- All equipment must be stored so as to be safe from dislodgement and all planks must be secured against horizontal displacement and vertical uplift.
- [Top](#)If the scaffolding structure is to be screened, then additional ties may need to be added to the structure. All screened scaffolding in high wind areas must be designed by a chartered engineer.
- No crane lifting operations should be carried out in high wind conditions even with tag lines.
- All necessary safety equipment must be used in high wind conditions. If required to work in a dusty environment the use of safety glasses is recommended.
- If using hard hats then chin straps or similar restraints must be used to avoid hard hats being blown off.

2.8.3.9 Work near roads and heavy traffic areas

Occasionally scaffolding will be required in high risk areas such as motorways, (for bridge repairs or construction) or adjacent to other places with heavy traffic flows, such as on footpath areas next to roadways. Any vehicle movement can be the source of many hazards and personnel involved in work around these areas must take all precautions to ensure their own safety and that of others in the area. Refer to Transit New Zealand Code of Practice and/or any local authority requirements

Hazard:

Personal injury due to vehicle colliding with scaffolding.

"The main cause of accidents at road works is inadequate signposting and lighting and drivers failing to notice road workers" (DOL Guidelines for the provision of facilities and general safety in the construction industry). This can apply equally to scaffolders carrying out operations on or near roadways. If a vehicle were to collide with a

scaffolding structure the consequences could be severe.

Control:

- All steps must be taken to avoid the collision of a vehicle with a scaffolding structure.
- On busy roadways or motorways, scaffolding should be erected behind approved barriers, or alternatively in a position where there is no possibility of impact.
- Scaffolding erected on footpath areas near roadways must be erected at least 500mm from the kerb edge, or whatever minimum distance is required by local authorities, in order to prevent cars or trucks backing into the base assembly.
- If the 500mm clearance is not available or practicable due to space constraints then alternative measures such as crash barriers or fenders must be erected to deflect any traffic. Any system of this nature must be designed and checked by a chartered engineer.
- In the case of scaffolding near roadways suitable lighting must be maintained at all times to illuminate all potential hazards.
- Suitable warning signs should be posted well in advance of the scaffolding area to warn oncoming motorists of the hazards in the area and also of any speed restrictions that may apply.
- Traffic management plans must be in place at all times for work adjacent to high speed areas. If required police and local authorities must be informed of any narrowing of roadways caused by the placement of barriers or other restraints. Particular attention must be paid to permits issued for oversized or over width loads that may be travelling in the area.
- All personnel must be aware of the hazards involved in working over roadways and all care taken to prevent the dropping of equipment into traffic areas.

Hazard:

[Top](#) Personal injury due to vehicle colliding with personnel or pedestrians.

When scaffolding work is being carried out above pedestrian areas adjacent to traffic flows, the scaffolding crew is responsible not only for ensuring their own safety but also the protection of other people in the area. In order to prevent possible harm to others that could be caused by falling objects, personnel will normally erect some form of barrier to prevent pedestrians from entering the area below the operations. In areas limited by space, this may necessitate diverting them onto roadways. This situation can be very dangerous and could lead to people being run over or knocked down.

Control:

- All personnel involved in work alongside busy roadways or motorway areas must make use of high visibility garments.
- All work in these areas should be carried out during low traffic flow times, i.e., between 9.00 am and 4.00 pm, or alternatively from 9.00 pm to 7.00 am if adequate lighting can be maintained. All lighting used in areas adjacent to motorways must be placed in such a manner as to avoid distracting motorists.
- Work near roads must always be approved by the local authority or road owner.
- If pedestrians have to be diverted into traffic flows then all steps must be taken to protect them along the entire alternative route. This may require the erection of temporary hoardings, warning lights or external lighting if the diversion is at night, warning signs, barricades, ramps over obstacle areas, etc.
- It must always be remembered that some pedestrians are disabled and that the alternative route may also be used by people with pushchairs or prams. All steps must be taken to prevent obstacles or trip hazards being put in their way.
- All personnel involved in work near motorways or roadways must have a traffic management plan that will enable not only the safe delivery and pick up of materials and equipment, but also safe access to the area for personnel.
- All care must be taken when handling equipment near these areas. No equipment can be allowed to project into the path of oncoming traffic.

Hazard:

Personal injury due to drivers becoming distracted and colliding with other vehicles.

A major hazard involved with work near roadways is that drivers can become distracted by operations being carried out on the side of the road and lose concentration. This can lead to drivers losing control of the vehicle or colliding with other vehicles.

Control:

- All works being carried out near motorways or busy roads should be advertised by way of signs placed well in advance of the work.
- If necessary speed restrictions should be placed on the area while work is being carried out. Speed restrictions must be realistic and kept as high as possible.
- All signs and barriers must be removed when the work has been completed. Drivers will tend to ignore restrictions that are unrealistic or excessive. If they can see that no work is being carried out in signposted or barricaded areas, then these will soon be ignored as well. This can lead to complacency and a potentially hazardous situation if signs are ignored in an actual work situation.
- It is advisable to engage the services of a traffic management company or a company experienced in such work when undertaking any work in high risk areas.

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2.8.3.10 Work near others under the influence of drugs or alcohol or acting irrationally

Hazard:

Personnel under the influence of drugs or alcohol can be operating with impaired judgement. This can lead to a loss of concentration, which in certain areas can be dangerous or even fatal.

Similarly, people carrying out practical jokes or acting irrationally on a work site can sometimes underestimate the effect of their actions and cause severe harm to other personnel and themselves.

Control:

- No person under the influence of drugs or alcohol should be allowed to carry out any duties at a place of work. Similarly no practical jokes or horseplay should be permitted on any work site.
- Any person found to be in breach of these rules must be removed from the site and face suspension or other serious consequences.

2.8.3.11 Work in dirty areas

Hazard:

Personnel exposed to dirty work conditions can develop infections in existing or new wounds if care is not taken. Similarly, diseases such as hepatitis can be spread through failure to ensure personal hygiene.

Control:

- All injuries must be treated as soon as possible. Scratches, cuts and puncture wounds must be cleaned, preferably treated with antiseptic and properly dressed.
- All personnel must ensure their own personal hygiene. Wash hands before eating and after using the toilet.
- All personnel are to keep lunchrooms and other facilities neat and tidy.
- All rubbish must be removed from lunchroom areas.
- All personnel should have ready access to a first aid kit suitable for the treatment of minor injuries. In case of a serious injury, qualified first aid personnel or medical assistance must be sought.

2.8.4 Hazards associated with the use of scaffolding

Most accidents that occur from use of scaffolding platforms can be attributed to one or more of the following factors:

1. Impatience of the user.
2. Unqualified personnel altering the scaffolding.
3. Poor design or construction of scaffolding.
4. Overloading of the structure.
5. Removal of built in safeguards.

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Hazard:

Personal injury due to unqualified personnel altering the scaffolding.

Often on a work site a scaffold will need altering. If an unqualified or inexperienced worker carries out alterations to a structure there is a risk that they will lose control of the equipment or remove or loosen a vital part of the structure and not replace it. Both of these situations are dangerous and can lead to serious injury.

Control:

- All clients and end users of scaffolding must be made aware of the hazards they may expose themselves or others to if they attempt to alter an existing structure.
- All erecting, dismantling and alteration of scaffolding over 5 metres high must be carried out by suitably qualified personnel.
- When the scaffolding is in use the following may not be removed: ties or braces, decking (unless the area can be suitably barricaded to prevent falls), structural parts of the scaffolding. Also no excavations are to be carried out near foundations. However, this work may be carried out by qualified personnel.

Hazard:

Personal injury due to collapse of structure due to poor design or construction or overloading of the scaffolding structure.

Poorly designed or constructed scaffold structures could be subject to collapse if exposed to adverse conditions. Similarly structures that are overloaded by stacked materials, large numbers of personnel using them, or environmental conditions, could collapse.

Control:

- The DOL is to be notified prior to commencement of notifiable work.
- All scaffolds must be designed and erected by suitably qualified personnel. All existing and possible site conditions must be taken into consideration when designing the scaffolding.
- All loading factors must be taken into consideration when designing the structure.
- No overloading of the structure may be permitted. All loading criteria and restraints must be made known to the client and end users of the scaffolding.
- As soon as erection is completed a full inspection must be made of all work areas to ensure compliance with the client's specifications and statutory requirements. A register for the scaffolding must be completed for notifiable work.
- The scaffold must be checked by a suitably qualified person on a regular basis as per statutory requirements.
- All scaffolding must be erected in accordance with the BPG.

Footnotes

^[2] Raking tubes must be attached with load bearing couplers and be braced back to the scaffold. Swivels, while not recommended, can be used.

Section 3: Generic scaffolding requirements

3.1 Tools of the trade

The tools and equipment commonly used to erect, maintain and dismantle scaffolding are described in this section.

- Scaffold spanner: "Scaffold spanners" or "scaffold keys" are the preferred tool for tightening and releasing nuts on scaffold fittings or couplers.
- Swing over spanner: A standard scaffolding spanner with a head to fit 7/16" or " nuts with the head attached to the handle with a pin or ball and socket assembly. The handle is between 200mm and 250mm long.
- Ratchet spanner: A scaffold spanner similar to a standard socket set ratchet with the head to fit 7/16" or " nuts. The socket is either made as part of the ratchet or is secured to the ratchet. The handle is between 200mm and 250mm long.
- Podger hammer: The standard podger hammer is made of mild steel and has a straight handle between 200mm and 250mm with a tapering podger end of the handle between 30 and 45 degrees to the handle. Podger hammers are the preferred tool for general hammering, tapping in wedges on system scaffolding, locking and releasing the cups on cuplock scaffolding, twisting and tightening the wire on wire ties, etc. Podger hammers can be used for locating or aligning holes on steelwork.
- Adjustable wrenches (crescent or shifter): An adjustable wrench, crescent or shifter is normally used where an obstruction prevents the use of a scaffold spanner. A spanner fits over the nut; an adjustable wrench slides around a nut. The use of an adjustable wrench should be kept to a minimum as it has a tendency to round off the nuts. The arm of an adjustable wrench should be between 200mm and 250mm long.
- Spirit level: A spirit level is usually no longer than 300mm long with level bubbles showing vertical, horizontal and sometimes 45 degrees. They can be magnetic to assist in holding to metal tube during levelling. Spirit levels are used to check that scaffolding members are horizontal, vertical or at 45 degrees.
- Tape measures or rules: A standard retractable tape measure or fold out rule is a useful tool for measuring distance off walls, bay lengths, lift heights, etc.
- Industrial wire nips or cutters: A flat ended set of wire cutters also used to grab, twist and tension wire. These are useful for cutting lashing for planks and cutting and tensioning "steelies" wire for screening.
- Scaffold belts: A scaffold belt is used to carry scaffold tools safely and securely but still allow easy access to the tools. The belt should be made of sturdy leather, canvas webbing or similar. Leather, canvas or wire frogs should be used to secure scaffold spanners, podger hammers, adjustable wrenches and nips. Rules, tape measures, and spirit levels should be secured in pouches to prevent displacement (see figure 9).

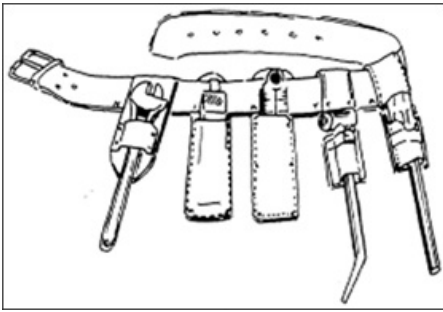


Figure 9: Typical scaffolder's belt

3.1.1 Inspection of used equipment

Used scaffolding equipment should be inspected to identify items that are unsuitable or that fail to comply with relevant standards. Use the supplier's or manufacturer's guidelines to determine the suitability of scaffolding equipment for further use.

Used scaffolding equipment should be checked and graded in the following scale:

- Checked and is suitable for normal operations.
- Repaired e.g. replacing bolts on couplers or replacing wedges on modular scaffolding.
- Reduce length or cut down e.g. shortening of tubes, planks cut down.
- Downgrading e.g. downgrading a scaffold plank to a soleboard.
- Scrapped - taken out of service and disposed of to prevent reintroducing sub-standard equipment back into service.

3.1.1.1 What to look for when equipment is defective

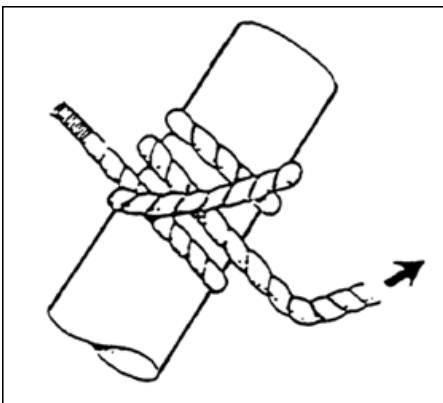
Table 6: Indications that equipment is defective

Item	Flaw or defect
Scaffold tube	<ul style="list-style-type: none"> Outside diameter less than 47.5mm Steel wall thickness for galvanised steel less than 2.9mm Aluminium wall thickness less than 4.2mm Ends cut not square to the axis Ends flame cut Unduly pitted Heavily corroded Distorted, twisted, bent or split
Couplers	<ul style="list-style-type: none"> No manufacturer's or supplier's mark Distorted, stretched or cracked Bent or stretched rivets or pins Threaded blind holes Stripped threads on bolts or nuts Seized bolts or nuts
Baseplates	<ul style="list-style-type: none"> Bent or distorted to prevent an even bearing Thickness less than 6mm Surface area less than 225 square cm (less than 150mm x 150mm) Spigot less than 50mm long
Adjustable leg/ baseplate/castor	<ul style="list-style-type: none"> Extension exceeds 600mm Missing fixed stop enabling less than 150mm length of spigot to remain in the standard Clearance between the inside diameter of the tube and the outside diameter of the spigot of more than 5mm Spigot distorted causing it to jam in the tube Seized nuts Thread damaged
Castors	<ul style="list-style-type: none"> No manufacturer's or supplier's mark Safe working load or working load limit not marked Fitted with pneumatic tyres Wheel diameter less than 125mm Pintle length (spigot) either internal or external less than 150mm Diametrical clearance between the pintle (spigot) and the standard more than 5mm Wheel brake ineffective or missing No means to positively fix castor to the standard.
Prefabricated structural components	<ul style="list-style-type: none"> Ends flame cut Butt welded within its length Unduly pitted Heavily corroded

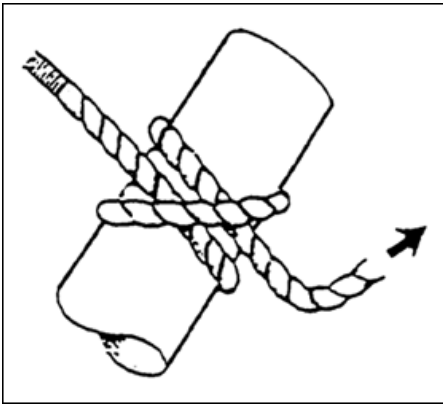
Components	<ul style="list-style-type: none"> Distorted, twisted, bent or split Welds cracked, broken or missing Locking devices damaged, inoperative, unrestrained or missing
Timber planks	<ul style="list-style-type: none"> Width less than 225mm Nominal thickness reduced by 10% Laminations in laminated planks are separating Warped, twisted, broken, split or worn End fixings missing or damaged Painted or treated in any way that may hide defects Deep burns Oil stains or slippery surface Nails projecting Rot of any kind Saw cuts
Metal scaffold planks	<ul style="list-style-type: none"> Width less than 225mm Distorted, twisted, bent, split or crushed Heavily corroded Welds cracked, broken or missing Rivet broken or missing End pieces crushed or missing
Steel wire ropes	<ul style="list-style-type: none"> Safe Working Limit not marked For suspended scaffolding hoists, any visible broken wires For hung scaffolds, more than 10% of the visible wires broken in a length equal to eight rope diameters One or more broken wires immediately below a metallised socket Outer wires worn more than 33% of the nominal diameter Bird caging or bird nesting Core popped Wire rope grips or bull dog clips have been used on the rope Thimbles distorted Evidence of corrosion
Chains	<ul style="list-style-type: none"> Safe Working Limit not marked Links deformed, chipped, nicked, cracked or stretched Nominal diameter or dimension reduced by more than 10% Evidence of corrosion
Shackles	<ul style="list-style-type: none"> Safe Working Limit not marked Crown or pin diameter reduced by more than 10% Bolt used in place of a shackle pin Distortion or overstraining evident Evidence of corrosion

3.2 Common scaffolding bends and hitches

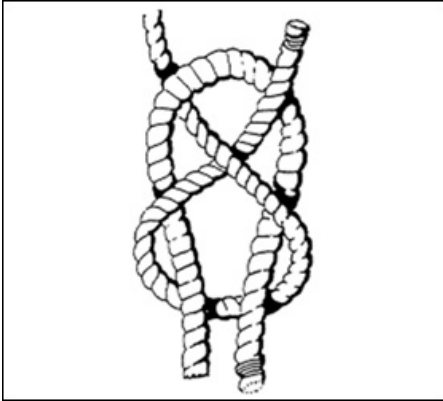
Rolling hitch: The recommended hitch used to raise and lower tube when used in conjunction with a half hitch.



Clove hitch: The clove hitch has been superseded by the rolling hitch as the recommended hitch for raising and lowering tube. If used it should be used in conjunction with a half hitch.



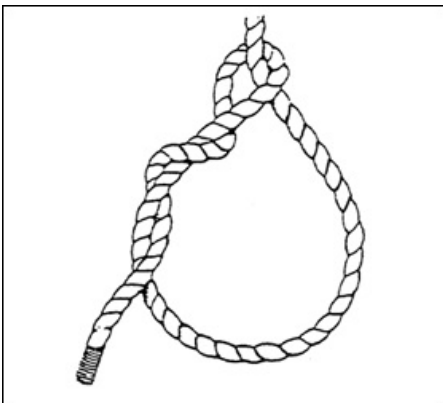
Sheet bend: A simple method of securing two different sizes of ropes together.



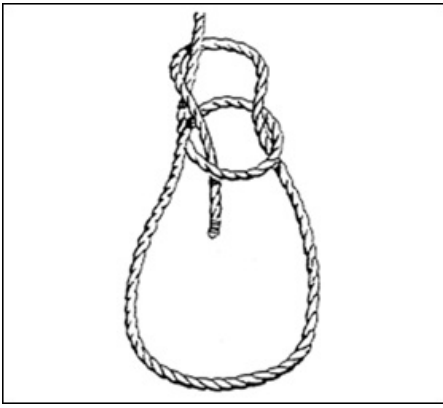
Buntline hitch: Secure method of securing a rope to a ring or tube.



Timber or plank hitch: The recommended hitch used to raise and lower planks or timber. The ropes tail can be wrapped around the noose up to five or six times if required, depending on the thickness of the rope and in conjunction with a half hitch if required.



Single bowline: A very simple method of creating a temporary eye at the end of a rope.



Square lashing: Used to secure a ladder to a tube for example.

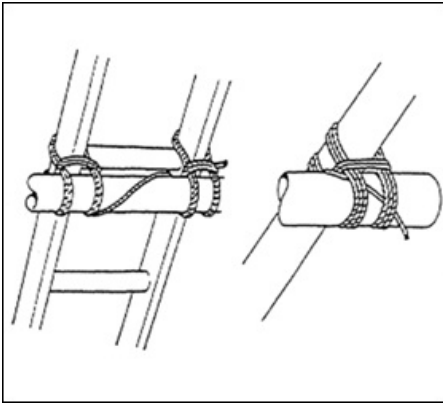


Figure 8 knot: A quick and convenient general purpose knot that is the basis of many other knots.



3.3 Foundations

The foundation of a scaffold needs to be adequate to carry and distribute the loads it will bear.

3.3.1 General information

The foundations of a scaffold must be adequate to carry and distribute the loads imposed at each standard and over the whole loaded scaffold. On hard level surfaces such as steel or concrete standards should be supported on baseplates, however soleboards may not be necessary if the surface does not require protection. When using soleboards, the ground conditions under the proposed scaffold should be checked to determine the soleboard dimensions required to provide an adequate contact area to support the total load transferred down the scaffold standards.

Common types of ground conditions include: concrete floor slabs, tarseal or bitumen drives / car parks, compacted fill, uneven ground / rough terrain, sloping foundations, soft soils / sand. Particular attention must be paid to:

- Scaffolds erected adjacent to trenches and on slopes. Pressure exerted by the scaffold foundation may lead to subsidence.
- Areas prone to run-off or flooding. Water movement or saturation may cause subsidence or undermining.

To determine the size of the soleboard required to support a standard, information on the bearing capacity of the ground and the total design load of the standard is required. The bearing capacity of the supporting surface may be determined using table 7 as a guide.

Table 7: Load bearing capacity of different ground conditions

Ground Conditions	Nominal Bearing Capacity (kg/m ²)
-------------------	---

Soft clay - moulded by light finger pressure	2000
--	------

Sand	5000
Stiff Clay - Moulded by strong finger pressure	7500
Hard Clay - difficult to indent with thumb	10,000
Rock	50,000

If you are unsure of the ground bearing capacity, check with a chartered engineer or have the ground tested to give a pressure bearing capacity.

Two factors determine the total design load of the standard:

1. The dead load of the scaffold. This includes the weight of the standard and all attached components including ledgers, transoms, putlogs, braces, ties, planks, guardrails, and attachments such as sheeting. The weight of common scaffolding components is given in table 1 (section 1.2.2.6).
2. The live load on any one standard based on the worst possible loading configuration i.e. full duty loading in adjacent bays. The single standard live load is calculated as 2/3 of the scaffold duty loading.

3.3.2 Foundations on sloping ground

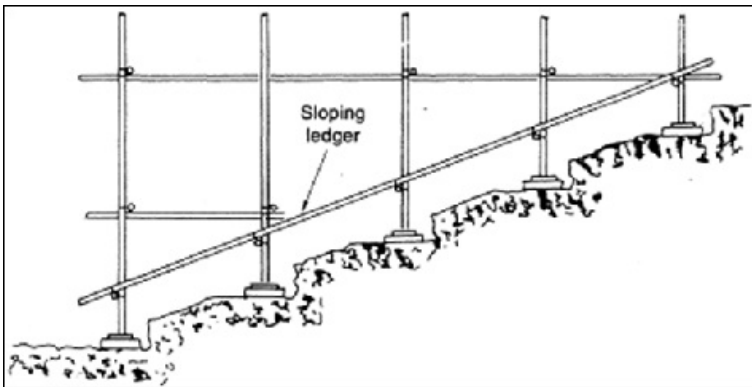


Figure 10: Use of sloping ledger on sloping ground

Alternatively the standards can be held in place by using a sloping brace connected directly to the standards with swivel couplers.

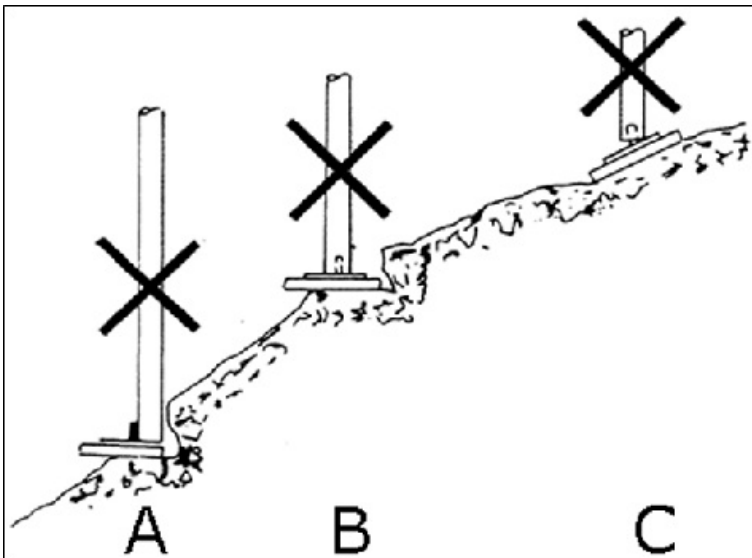


Figure 11: Foundations on sloping ground - how not to do it.

- A. Standards not centred on the baseplate or soleboard
- B. Soleboard not fully bedded
- C. Standard not evenly bearing on baseplate, soleboard and baseplate not horizontal

3.3.3 Soleboards

Scaffolding foundations must be adequate to carry the combined weight of the scaffold, including the imposed loads. Soleboards, also known as baseboards or soleplates, need to be used under most standards in conjunction with baseplates or basejacks. Timber soleboards must not be less than 200mm wide x 500mm long x 38mm deep. The soleboards are used to distribute the load of the standard over a larger ground area than just baseplates or basejacks.

Soleboards must sit flat under the standard. This may necessitate digging into the ground or packing up the ground to give a horizontal bearing surface for the soleboard. Figure 12 shows some different combinations of soleboards and how they can be used to help distribute the point loading on standards.

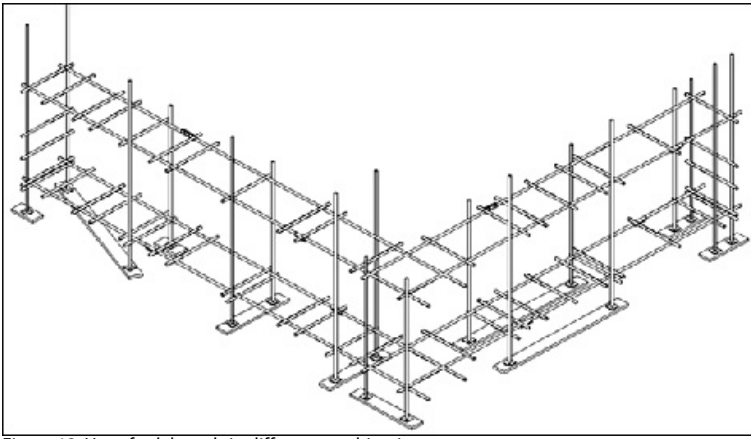


Figure 12: Use of soleboards in different combinations

The formula to determine the ground contact area for the soleboard is:

Vertical Load Bearing Capacity ÷ Minimum Contact Area

For example, assume the scaffold is being erected on a stiff clay surface and each standard has a design load of 860kg. The calculation would be:

$$860\text{kg} \div 7500\text{kg/m}^2 + 0.115\text{m}^2$$

Using a timber scaffold plank 225mm wide as a soleboard means the approximate length for this example is 500mm ($0.225 \times 0.5\text{m} = 0.1125\text{m}^2$).

Soleboards should ideally be made from timber such as pinus radiata, hardwoods or laminated ply. Such materials as stacked timber 100mm x 50mm, concrete blocks, bricks or pallets must not be used. It is generally accepted that standard scaffold planks cut to size can be used for light duty scaffold only. Note that these cut planks tend to split along the laminations if placed upon uneven surfaces.

When the foundation is levelled concrete of adequate thickness or a similar hard surface such as steel, soleboards can be omitted, but baseplates, screwjacks or castors must always be used at the bottom of all standards.

3.3.4 Baseplates

Steel baseplates must be used under all standards that do not have a castor or basejack (screwjack).

Baseplates must be made from steel (usually mild steel) and be a minimum of 225 square centimetres x 6mm thick.

The baseplate must have a central spigot a minimum of 50mm long to centre the standard. The spigot must be sufficient to locate the standard (recommended 16mm).

Generally baseplates have 2 or 4 holes drilled into the baseplate to enable the baseplate to be secured to a soleboard by nails or similar.

Baseplates should always be accompanied by a soleboard unless the baseplate is placed directly on concrete of the correct depth (minimum 100mm) and strength to take the imposed loads, or directly onto steel.

3.3.5 Basejacks

Adjustable basejacks, also known as screwjacks or adjustable baseplates, are used under standards to provide a baseplate with the ability to be adjusted vertically.

The baseplate part of the basejack has the same minimum conditions as the baseplate. The spigot or stem of the basejack which is fixed to the baseplate must not have more than 600mm threaded extension and must have a minimum of 150mm length of spigot or stem to be inserted in the standard. Longer extensions can be used, but these must be to manufacturer's specifications or be designed by a chartered engineer.

It is recommended that the threaded extension, while maintaining a minimum 150mm-spigot or stem in or over the standard, should have a maximum extension that does not exceed half of the total extension. For example a castor with 500mm extension should preferably be kept to a maximum of 250mm extension but can be used out to 350mm extension. The threaded spigot or stem has a threaded section with a positioning nut. The nut generally has a small handle on two or more sides of the nut to assist in turning the nut for adjustment. The spigot or stem must have no more than 5mm clearance between the inside diameter of the standard and the top of the spigot or stem. This is why spacer nuts are placed on the top of the spigot or stem when standard basejacks are used in 60mm outside diameter tubes like shoreload frames. This spacer nut keeps the spigot or stem concentric in the wider diameter standard.

Basejacks can be used in conjunction with a U-head plate to act as a Uhead jack.

Basejacks can also be used horizontally to place a scaffold in compression, as when they are used in conjunction with a tube in a window frame to form a reveal tie. Traditionally basejacks are more commonly used in proprietary system type scaffolds.

Section 4: Tube and fitting scaffolding

4.1 Introduction

Tube and fitting scaffolds are generally not covered by manufacturer's specifications, engineer's certificates or producer statements, hence the need to have general scaffolding requirements for them. These general scaffolding requirements must also be used when altering proprietary scaffolds with tube and fitting components when the manufacturer's specifications or engineer's requirement do not include these alterations.

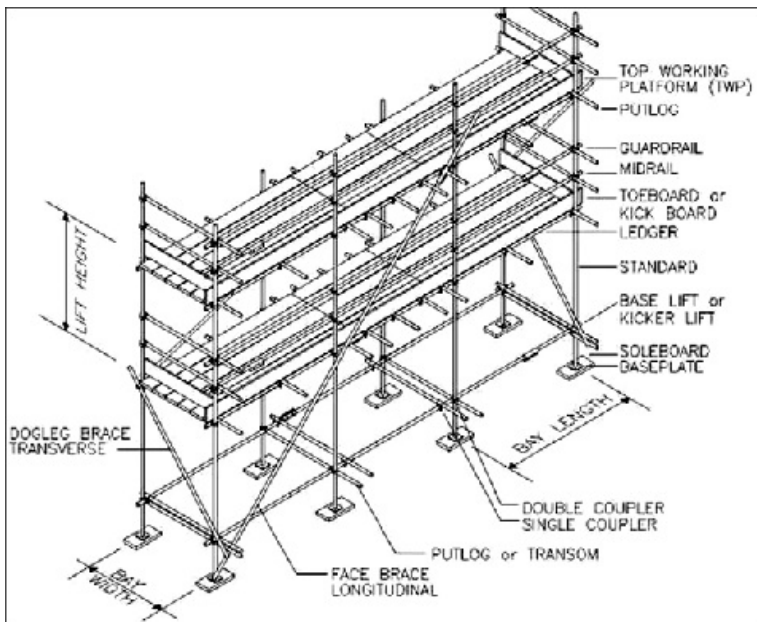


Figure 13: Standard tube and fitting scaffold showing general scaffolding terminology [Inside guardrails have been omitted for clarity.]

4.1.1 General descriptions

Bay length

The horizontal distance between standards running parallel to the work face or in the longitudinal plane of the scaffold. Maximum bay length permitted for non proprietary scaffolds is 2.4m.

Bay width

The horizontal distance between standards running perpendicular to the work face or on the transverse plane of the scaffold. Maximum bay width permitted for non proprietary scaffolds is 1.575m.

Scaffold lifts

The vertical distance between structural ledgers or work platforms.

For clearance purposes a base lift should have a maximum height of 3.0m to the first work platform or structural ledger. Working lifts are generally 1.8m to 2.1m apart. It is recommended that a base lift (or kicker lift) should be used within 1.0m of the supporting structure.

A dummy lift is a level of structural ledgers that does not have a work platform. For instance if a scaffold has working platforms at 2.1m and 6.1m, the 4.1m lift between them is not planked and is called a dummy lift. The Top Working Platform (TWP) is also known as the Top Lift.

Scaffold area

The horizontal length of a scaffold in metres times the average height of the scaffold will give the scaffold area in square metres. So:

$$\text{Length (m)} \times \text{Average Height (m)} = \text{Area (m}^2\text{)}$$

The height of the scaffold may be taken from of the height of the top-working platform or alternatively from the top guardrail.

Example

A scaffold is 10.0m high to the top working platform at one end and 5.0m high to the top working platform at the other end. The scaffold is 24.0m long (see figure 14).

Length: 24m

Average height: $10.0\text{m} + 5.0\text{m} = 15\text{m} \div 2 = 7.5\text{m}$

Area of scaffold: $24\text{m} \times 7.5\text{m} = 180\text{m}^2$

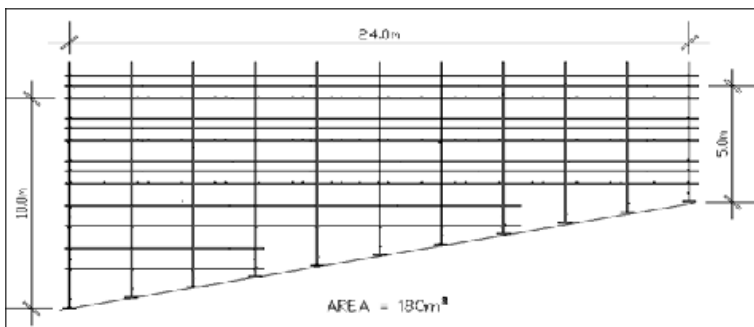


Figure 14: Calculating the area of a scaffold

4.2 Tube and fitting scaffolding components

4.2.1 Tubes

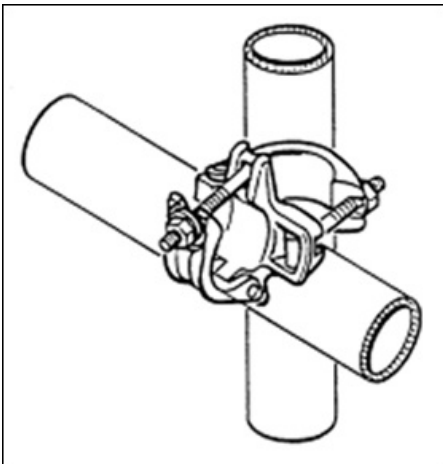
These are the most basic scaffolding components. Table 8 sets out the dimensions and properties of scaffold tubes from relevant standards. Tube loadings are dealt with later.

Table 8: Dimensions and properties of scaffold tubes

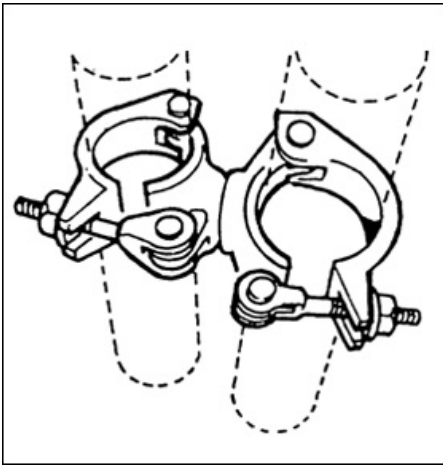
Dimension and properties	Steel tubes to BS 1139 or AS/NZS 1576.3	Galvanised steel tube to BS 6323	Aluminium tubes to BS 1139; or AS/NZS 1576.3
Outside diameter (mm)	48.3 (0.5 tolerance)	48.3 (0.5 tolerance)	48.3 (0.5 tolerance)
Thickness (mm)seamless	4.0 (0.5 tolerance)	3.2 (0.48 tolerance)	4.47 (0.56 tolerance)
Thickness (mm)welded	4.0 (0.8; g - 0.4 tolerance)	3.2 (0.32 tolerance)	
Mass per linear metre	4.37 kg/m	3.56 kg/m	1.67 kg/m
Minimum tensile strength	340 MPa	360 MPa	295 MPa
Yield strength	210 MPa	215 MPa	255 MPa
Radius of gyration	15.7 mm	16.0 mm	15.6 mm
Cross-sectional area	557 mm ²	453 mm ²	615 mm ²
Moment of inertia	138,000 mm ⁴	116,000 mm ⁴	149,000 mm ⁴
Elastic modulus	5700 mm ³	4800 mm ³	6180 mm ³

4.2.2 Fittings (couplers)

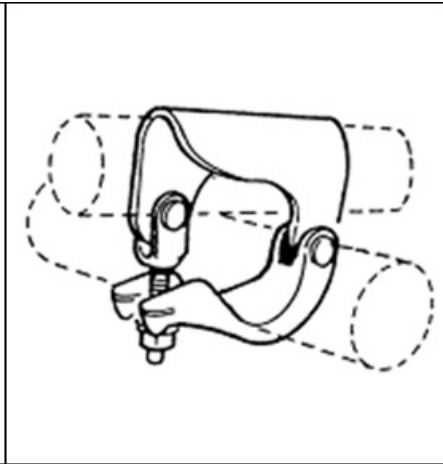
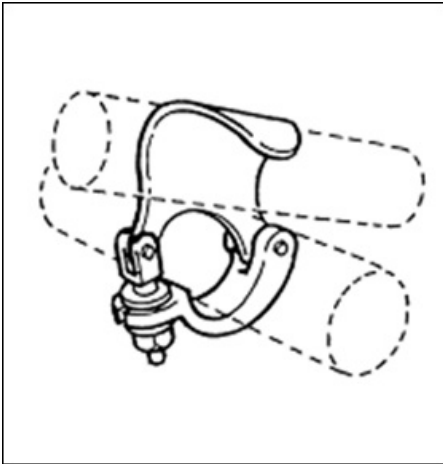
Right angle coupler (R/A), 90 degree coupler or double coupler: The most commonly used load-bearing coupler. Used to connect tubes at right angles. They come in many different designs that have their own preferred use in connecting standards to ledgers. Made of cast, forged or pressed steel. Permissible load (slip along a tube): 6.2kN (630kg)



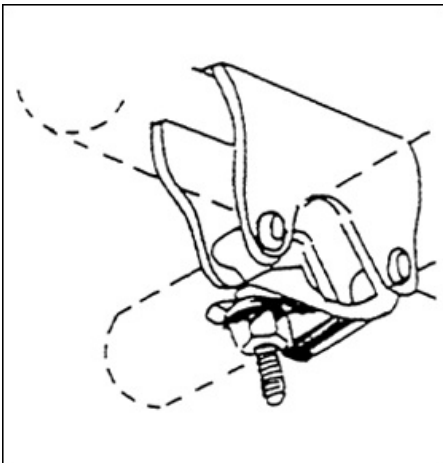
Swivel coupler: Coupler used to connect two tubes together at any angle. Made of cast, forged or pressed steel. Permissible load (slip along a tube): 6.2kN (630kg). Not classified as a load bearing coupler due to the centre pin.



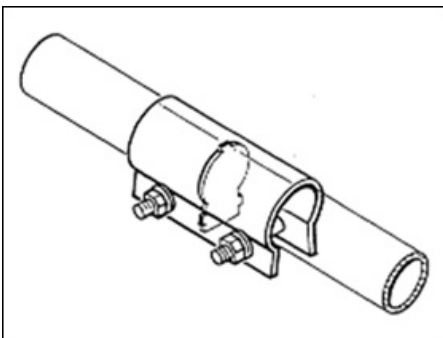
Putlog coupler or single coupler (two types): Coupler used to connect two tubes at right angles (putlogs to ledgers). Made of cast, forged or pressed steel. Permissible load; (force to pull tube axially out of the coupler): 0.59kN (60kg). The axial load permitted on a putlog coupler is 1/10 of the axial load permitted on a double coupler.



Two standard types of putlog coupler are the blade, half hand or pigs ear and the double flap or butterfly. The double flap type is not to be used to connect a putlog to a ledger if inside planks are to be used. Double flaps or butterflies can be used to connect timber to scaffolds.



Sleeve or external joiner: Coupler used to connect two tubes end to end. Each side of the joiner must be individually tightened. The joiner must have an internal partition or stopper to centre the fitting.



Pin or internal joiner: Coupler used to connect two tubes end to end. Has a pin arrangement, which expands in the tube. Must use same thickness tube and same inside diameter (ID). Tube must be circular and regular with the same nominal bore (NB).

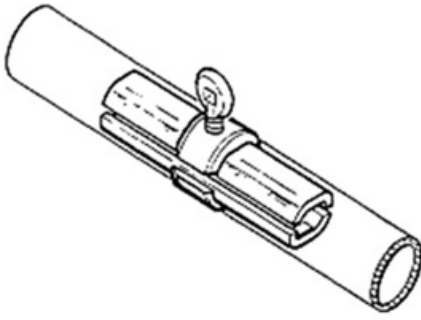


Table 9: Safe working loads for fittings (couplers) to BS 1139 or AS/NZS 1576.2

Description of fitting	Type of loading	Safe working load
Right-angle couplers	Slip along tube	6.25 kN (640 kg)
Swivel couplers	Slip along tube	6.25 kN (640 kg)
Joint pins (expanding spigot couplers)	Shear strength	21 kN (2140 kg)
Sleeve couplers	Tension	3.1 kN (315 kg)
Adjustable baseplate	Axial	30 kN (3058 kg)

4.2.3 Planks

Scaffolding platforms, erected to support workers and/or material are often made of planks. Refer to the following plank standards for quality criteria.

AS/NZS1576.1 Duty loads

AS/NZS 1576.3 Prefabricated platforms

AS 1577 Scaffold planks

AS/NZS 4357 Structural laminated veneer lumber (LVL planks)

AS/NZS 4576 Guidelines for scaffolding

In the absence of a NZ standard it is recommended that planks meet the requirements of AS 1577 or equivalent, with the exception of vertically laminated planks, which should have each laminate the full length of the plank.

Horizontally laminated planks should be manufactured to AS/NZS 4357 and must meet the performance criteria of AS 1577 or equivalent. All plank manufacturers should have a third party auditor to inspect their manufacturing and testing standards. All planks must bear the seal of an independent, nationally recognised third party inspection agency.

Planks in service should be tested in accordance with the manufacturer's specifications and/or the in service plank testing methods described below.

Width: Minimum 225mm wide

Depth: Minimum 38mm deep

Scaffold planks must be visually checked each time they are used on a scaffold. Look for:

- Twists or warping.
- Splits.
- Breaks.
- Wear and tear.
- Saw cuts.
- Notch cut out.
- Nails.
- Deep oil deposits.
- Build up of concrete and mortar.
- Deep burns.
- Rot.

4.2.3.1 General maintenance of planks

Planks should be fillet stacked after each use. This will allow the plank to dry before being stacked under cover ready for use. During the filleting a visual inspection and assessment of each plank can be made identifying any problems as listed above. Planks can be cut down to eliminate the affected areas.

In service plank testing

It is recommended that planks be tested annually through an approved testing machine. This is to ensure all practicable steps have been taken to see that the plank is suitable for its intended purpose. With the removal of NZS 3620 by Standards New Zealand annual testing of planks is recommended as the quality of planks may come into question.

There are three basic tests for planks in use:

1. Simply supported impact test.
2. Cantilevered impact test (refer AS/NZS 4576).
3. Four point bending test as described below.

Four point bending test

A scaffold plank is placed over two rollers 2.4m apart. A UDL load of 2.2 kN (225kg) is applied over a cradle 300mm either side of the centre of the plank. The load should be applied for 1 to 3 seconds on either side of the plank.

The test is successful if the plank carries the load without signs of distress or permanent set. Please refer to the manufacturer's specifications/operating procedures to ensure compliance.

Thus, a scaffold plank should be capable of sustaining a total working load of 2.2 kN (225kg) applied to the full width of the plank at two equal loads 300mm on either side of the centre of the span when it is simply supported at 2.4m centres.

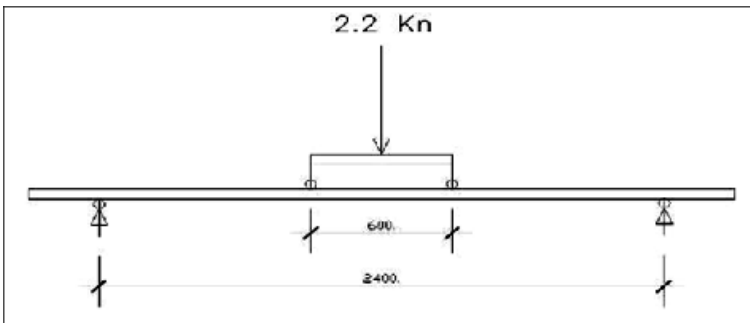


Figure 15: In service testing of scaffold planks for strength

Thus, a scaffold plank should be capable of sustaining a total working load of 2.2 kN (225kg) applied to the full width of the plank at two equal loads 300mm on either side of the centre of the span when it is simply supported at 2.4m centres.

4.3 Basing out tube and fitting scaffolds

4.3.1 Two pole return

Basing out a tube and fitting scaffold can lead to a variety of methods for the placement of standards in a corner or return. It is recommended that two standards are positioned at each corner or return. Figure 16 shows a light duty scaffold with both left and right returns and inside and outside corners. All are two pole returns with a minimum of two standards at each corner.

Rule of thumb: "If the scaffold turns to the right; two standards go on the left. If the scaffold turns to the left; two standards go on the right"

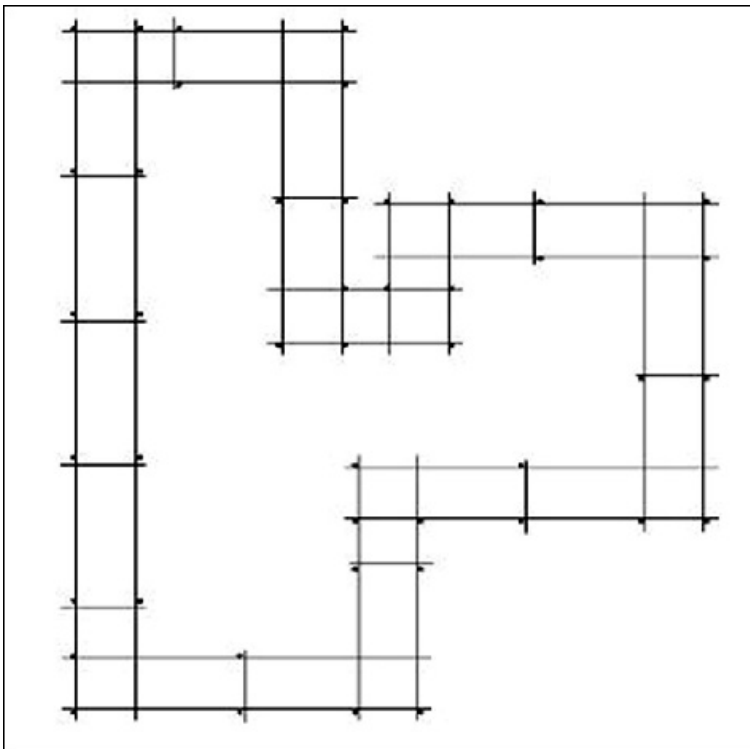


Figure 16: Basing out – two pole returns

4.3.2 Single pole return

Single pole (one standard) corners can be used if a set of standards in one direction are within 2.4m of the external single pole corner and within 1.575m in the other direction i.e. light duty (see figure 17).

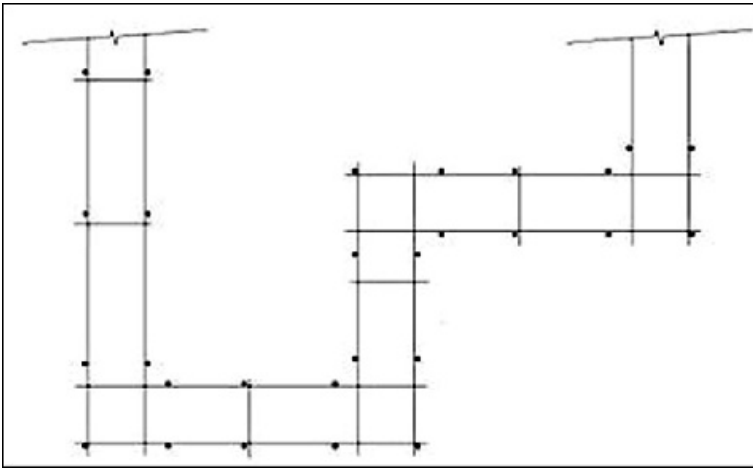


Figure 17: Basing out – single pole returns

Longitudinal bracing (face bracing) must be used in both directions from as low as possible on the single pole return. The longitudinal bracing must run from the bottom of the single exterior standard angling up along each face of the scaffold.

This is to ensure that if the single pole is undermined or damaged the longitudinal bracing will support the corner of the scaffold and transfer the weight of the corner to the other sets of standards - one within 2.4m of the corner and one within 1.575m of the corner.

This method has the advantage of being able to dismantle one elevation or run of the scaffold and not having to add an additional standard to the scaffold. Generally on an external return the two inside standards are positioned approximately 300mm on either side of the building being scaffolded. If one elevation or run is dismantled, the two standards 300mm from the corner are used and only stop ends are required to complete the end of the scaffold. The end user of the scaffold can reach 300mm to the corner of the building.

4.3.3 Basing out over obstructions or trenches

Figure 18 shows how you can base out over an obstruction or trench by using longer soleboards to distribute the load on the standards closest to the trench and to spur up the standards closest to the trench. This will also transfer the load from these standards to standards not affected by the trench.

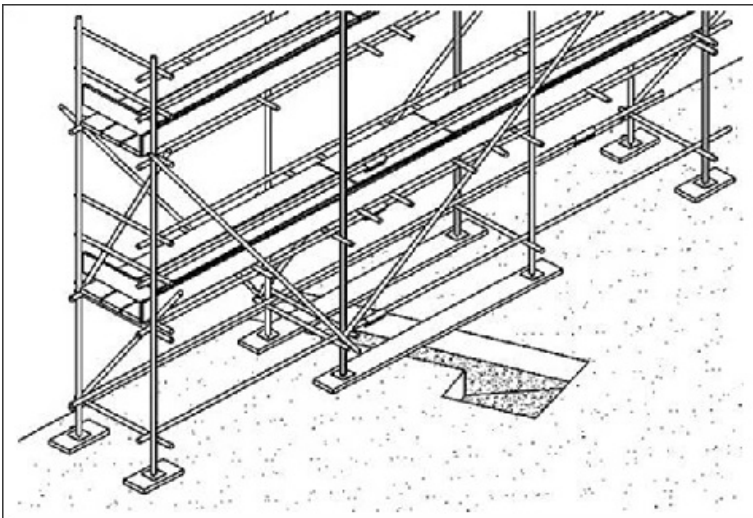


Figure 18: Basing out over a trench

4.4 Staggering of standards and ledgers

4.4.1 Staggering standards

On a tube and fitting scaffold, standards must be staggered if the top working platform is higher than the longest length of tube.

To stagger standards means to erect standards so that only one standard in a pair finishes in any one vertical lift. Ideally use one short standard on the inside with one long standard on the outside, then alternate that on the next set of standards - one long standard on the inside with one short standard on the outside (see figure 19).

Try to keep the standard joints as close as practical above the deck level. This will greatly assist the topping off or hemping of the next standard. Each set of standards should have a putlog within 300mm of the standards.

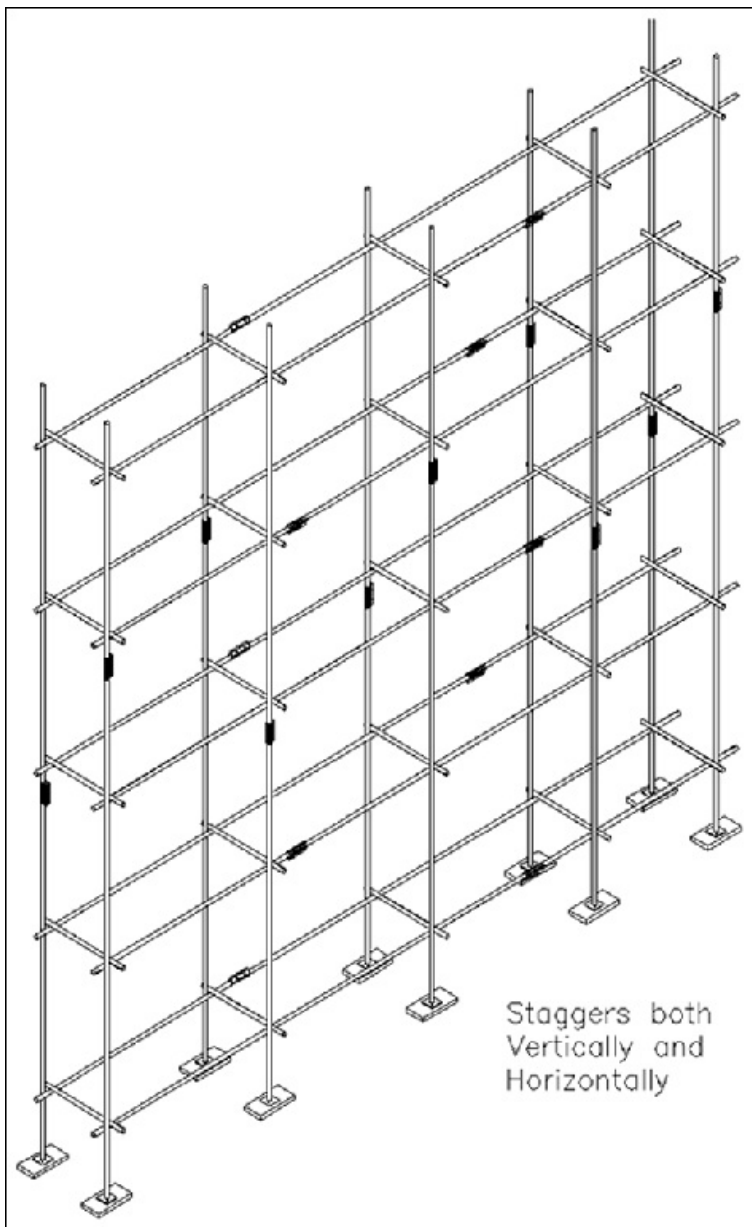


Figure 19: Staggering of standards and ledgers

4.4.2 Staggering ledgers

On a tube and fitting scaffold, stagger the ledgers so that, for example, one inside ledger finishes in a bay and the next ledger finishes in another bay (see figure 19). Try to keep all ledger joints within 300mm of the standards. Guardrails should be staggered in the same way as standards and ledgers.

4.5 Scaffolding ties

A tie is the attachment by which scaffolding is connected to a structure. A tie that is not capable of transmitting tension and compression must be used in conjunction with a spreader or putlog extension. They must be placed close to each other and be adequately held in position.

4.5.1 Requirements for scaffolding ties

Ties are necessary to prevent inward or outward movement of the scaffold and to assist the standards to act as load-carrying members. To facilitate stability ties must be:

- Fixed to the standard as close as practical to the ledger intersection. If ties can't be fixed to the standard they can be fixed across ledgers with double couplers.
- Capable of safely withstanding a horizontal force equivalent to 10 percent of the weight of the scaffold plus the full live load on the area of scaffolding in the vicinity of each tie, and the environmental load.
- Capable of supporting all loads and forces that bear on it. The safe working load on a tie must not exceed one quarter of the breaking load of the tie and anchorage. Also the structure you are tying to must be capable of supporting the loadings placed on it.
- Used with spreaders or extended putlogs to the building or structure where they are of a type that is not capable of transmitting tension and compression, such as wire ties.

Wire ties using 3.14mm black tie wire have traditionally been the accepted tie method. However, where possible, these ties should be replaced with a rigid tie.

4.5.1.1 Tie spacings

It is recommended that ties be spaced at a maximum of 4.8m in the horizontal plane and 4.2m in the vertical. Ideally alternate the ties at every second lift and set of standards. Tie spacings can be increased if required but additional strengthening of the scaffold may be needed. For example, plan bracing a lift at the tie height would mean you could increase the tie spacings to 9.6m in the horizontal. The recommended spacings can also be increased by using raking tubes or raker bays (bolster bays) at the base of the scaffold to increase its base width.

Spacing distances may differ for several reasons. Some examples include:

- Use of screen mesh or other material which adds a wind loading.

- Other environmental loads.
- Lifting appliances attached to a scaffold.
- Through load transfer to the scaffold base, lower standards supporting high dead and/or live loads.
- Use of plan bracing,
- Use of raker bracing to the ground or other substantive support surface.
- Tie systems designed to support proprietary scaffolds.

In most instances these tie spacings are determined by design.

4.5.2 Rigid ties

A rigid tie is a scaffold tube e.g. a prop inner with a baseplate, with the same dimensions and specifications as a standard baseplate, fixed to the end. The tube should be long enough to be fixed to standards and ledgers and butt the building or structure, but can be used from one standard or ledger if necessary. The baseplate has two or four holes of approximately 12mm to 16mm diameter drilled into the plate. The holes are marked through the plate onto the structure or building and the rigid tie slid back through the double couplers to enable the holes to be drilled. The rigid tie is slid back into position and an approved anchor is inserted and then tightened over the baseplate. All ties should be connected to the scaffold with double couplers. Only use load-bearing couplers (double couplers) to attach ties to scaffolds. A rigid tie assembly is shown at figure 20.

Commonly used anchors for rigid ties include dyna bolts, tru bolts, boa coils and chemset bolts. Always follow the manufacturer's specifications and design loads permitted on anchors.

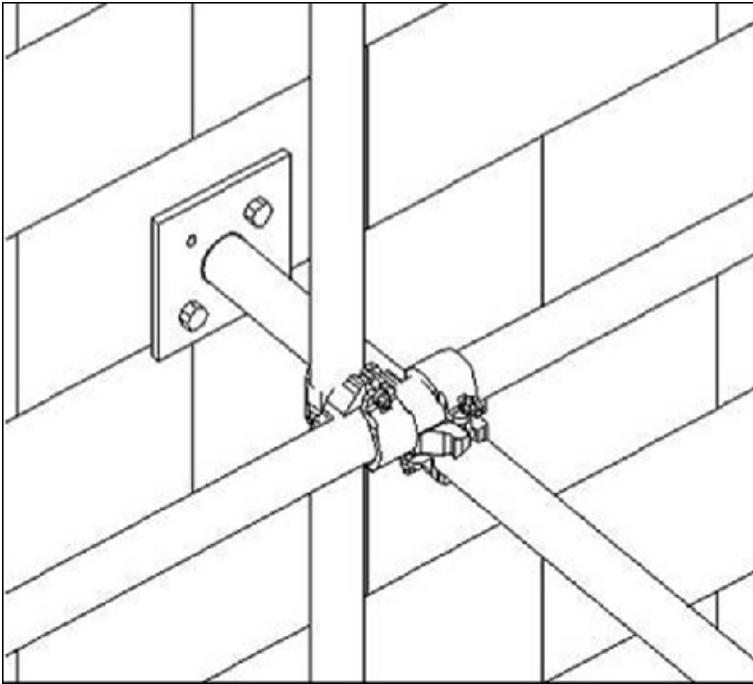


Figure 20: Rigid tie assembly bolted to a wall [\[3\]](#)

4.5.3 Other types of ties

A variety of other tie types are shown in the figures below.

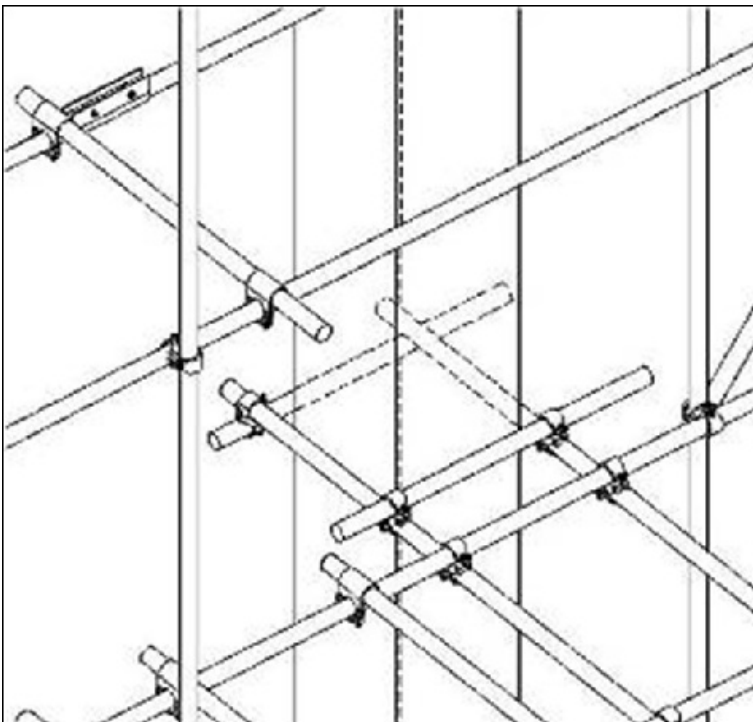


Figure 21: Column or box tie

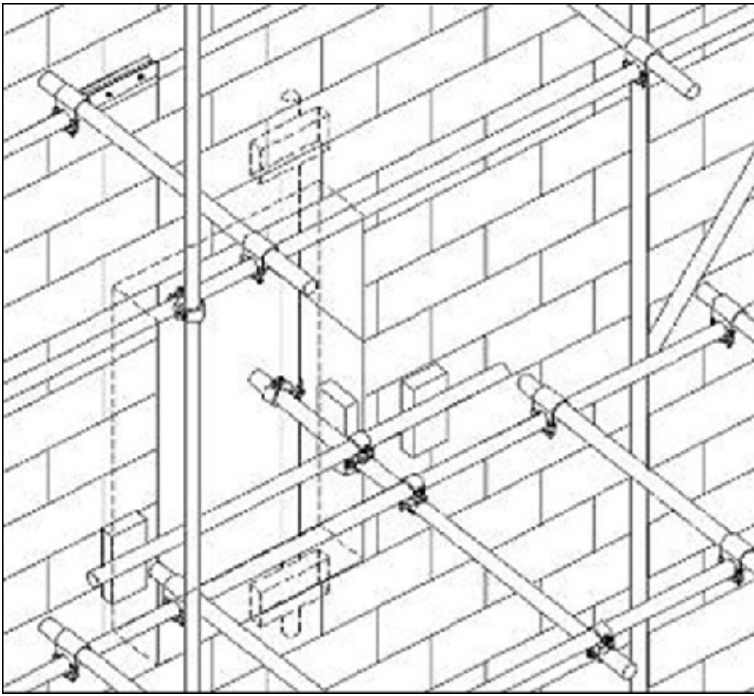


Figure 22: Lip or opening tie

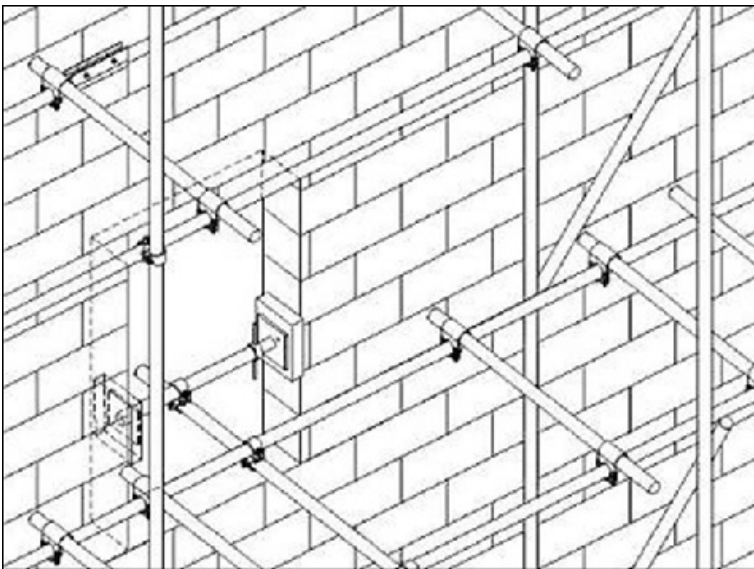


Figure 23: Standard reveal tie

Note that in the reveal tie shown in figure 23 a basejack tube and baseplate have been used

Wire ties

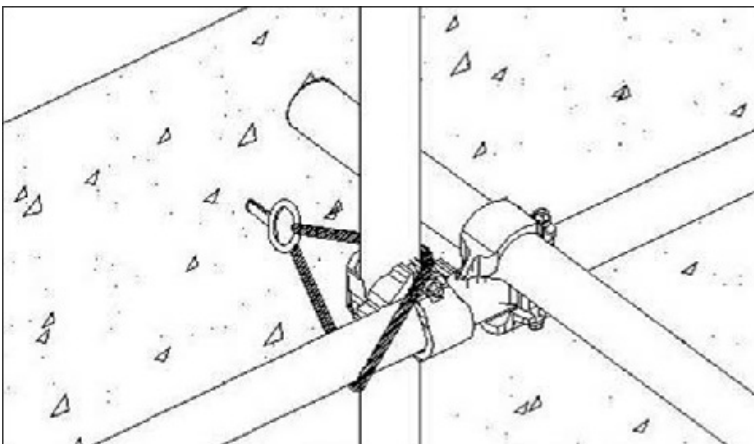


Figure 24: Wire tie system

Figure 24 shows a wire tie system waiting for the wire to be twisted. This will place the wire in tension and the putlog tube butted against the wall in compression. It is recommended that the tube butting the wall be no further than 300mm from the tie assembly.

Loading on wire ties

Tie wire, double 3.14mm "black" wire twisted 2 turns: SWL 160kg or 1.6kN

Tie wire, double 3.14mm "galvanised twisted 2 turns: SWL 160kg or 1.6kN

Tie wire, double 3.14mm "galvanised twisted 3 turns: SWL 250kg or 2.5kN

Tie wire, double 3.14mm "galvanised twisted 4 turns: SWL 300kg or 3.0kN

AS/NZS 4576 requires that each tie assembly have a minimum tensile and compressive working load capacity of 6.0kN (610kg). It is therefore recommended that additional wire ties be used to gain the 6.0kN (610kg) safe working load capacity or, preferably, that wire ties be replaced with rigid ties.

Footnotes

[3] This is the preferred tie method in most circumstances

4.6 Bracing

All scaffold structures should be braced in at least two directions or planes. All bracing should commence as close as practicable to the ground and intersect with the scaffold node points if possible.

4.6.1 Longitudinal bracing or face bracing

Longitudinal bracing or face bracing is usually fixed to the outside of the scaffold to prevent the horizontal movement of the scaffold, also termed "sway brace".

Figures 25 - 28 show different configurations of longitudinal bracing that runs parallel to the work face. Longitudinal bracing can be attached to putlogs or transoms using double or R/A couplers. This is the most widely used method, but on a standard 2.4m long bay x 2.0m high lift the angle of the longitudinal brace is less than 45 degrees to the horizontal. Therefore, alternatively, longitudinal bracing can be attached to the standards directly by using swivel couplers allowing the longitudinal brace to be positioned as close as practicable to 45 degrees (> 40 degrees and < 50 degrees).

Longitudinal bracing should be placed as close as practicable to the base of the scaffold - run the longitudinal brace to the ground if possible. This will add to the stability of the scaffold and reduce any horizontal movement below the longitudinal brace. Generally longitudinal bracing, either dogleg or parallel, is connected from standard to standard in one scaffold bay.

For tube and fitting scaffolds longitudinal bracing should be spaced a maximum of every sixth set of standards (maximum spacing 14.4m) and run to the top working platform where possible. For proprietary scaffolds longitudinal bracing should follow the manufacturer's specifications.

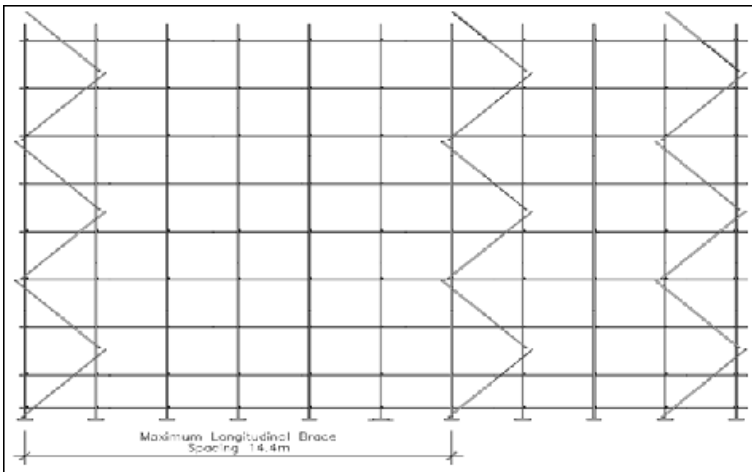


Figure 25: Spacing for longitudinal bracing

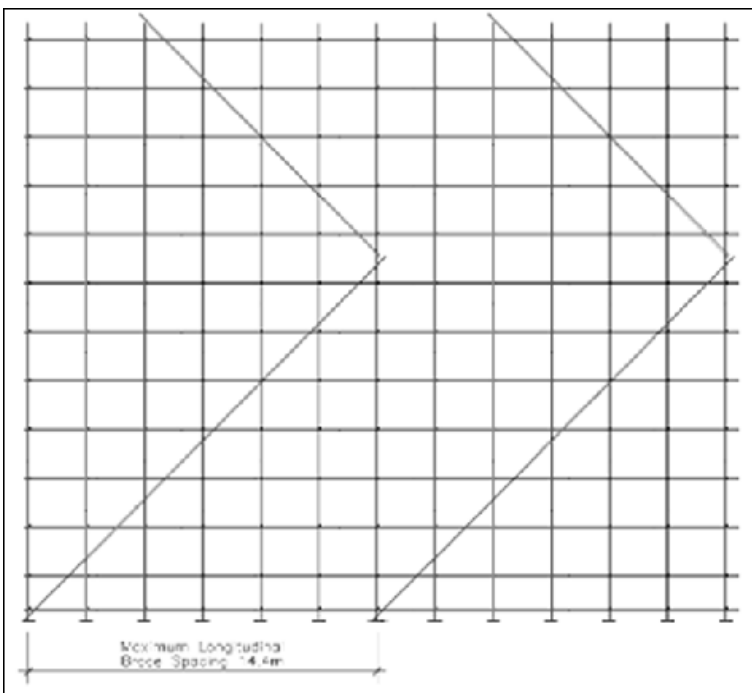


Figure 26: Dog leg longitudinal bracing

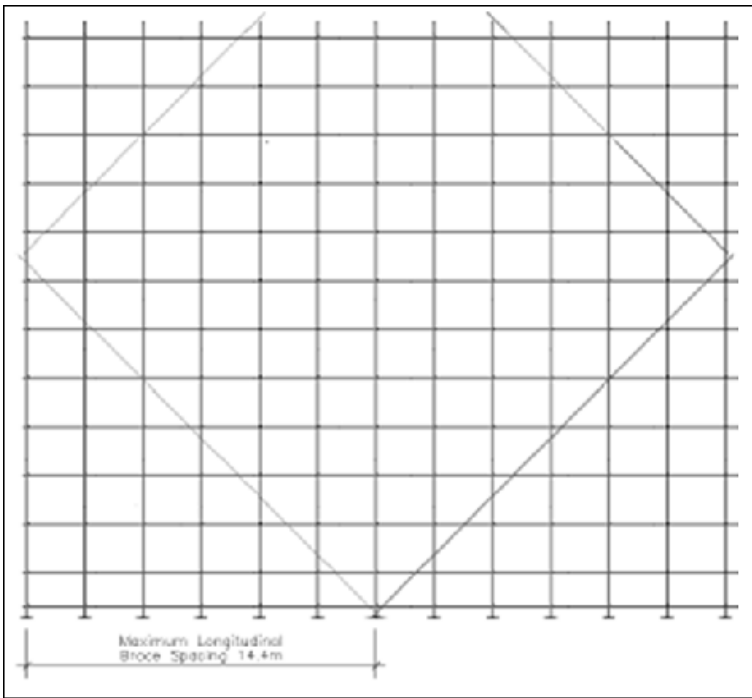


Figure 27: Diamond longitudinal bracing

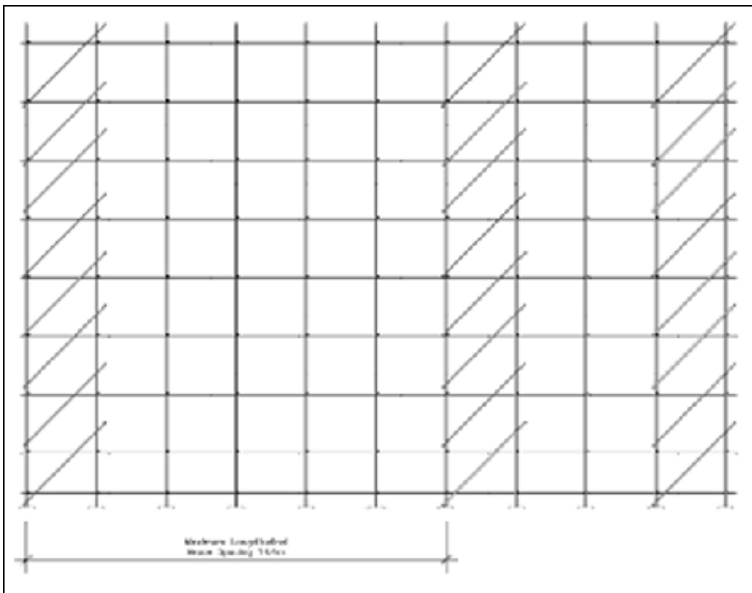


Figure 28: Parallel longitudinal bracing

4.6.2 Plan bracing

Plan bracing is used to stabilise a scaffold in the horizontal plane. Attaching braces across standards as in figure 29 and using double couplers (R/A couplers) follows the same principle as transverse and longitudinal bracing.

On such scaffolds as a tall circular vessel exterior scaffold (chimney scaffold), plan bracing can be used to prevent the rotation of the scaffold when only butt ties can be used against the vessel. Further, when tie spacings cannot be adhered to plan bracing can be used to reduce the number of ties required.

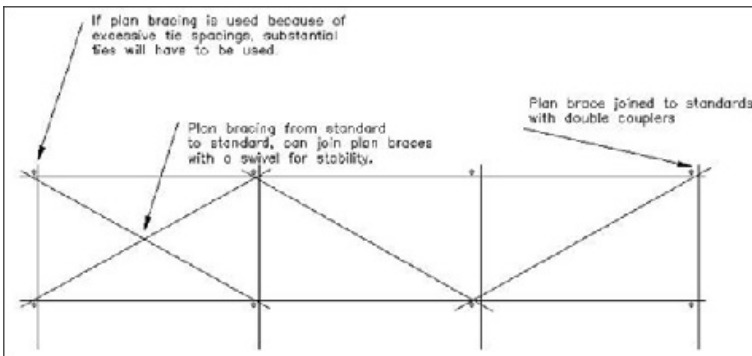


Figure 29: Principles of plan bracing

4.6.3 Transverse bracing

Ideally, transverse bracing should be attached from the underside of the ledger above the lift with a double coupler (R/A coupler) to above the ledger at the platform height. Alternatively, transverse bracing can be attached from the ledger above the lift with a double coupler to the standard with a swivel coupler. This may be necessary to clear kickboards for example. Transverse bracing may also be attached from standard to standard with swivel couplers.

For tube and fitting scaffolds it is recommended that transverse bracing be placed a maximum of every fourth set of standards and run to the top working platform where possible. The frequency of transverse bracing will also be dependent on the tie spacings.

4.6.4 Dog leg bracing

This is the most commonly used form of transverse bracing. When it is impractical to fit ties at vertical spacings, dogleg bracings should be used. Temporary ties may be required to ensure the stability of the scaffold during erection and dismantling. When using dogleg bracing ensure ties are capable of carrying the substantial loads required of them.

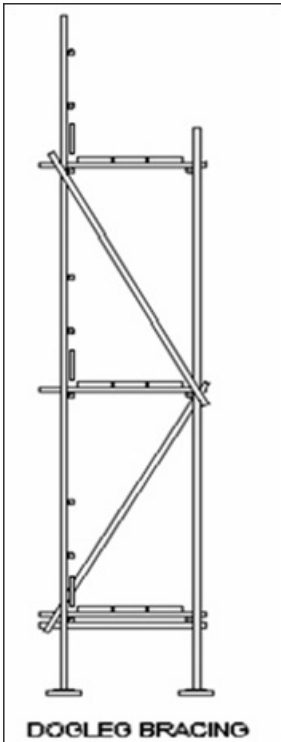


Figure 30: Dog leg bracing

4.6.5 Parallel bracing

When transverse bracing is established diagonally between inner and outer standards on multiple levels it forms a parallel brace, as seen in figure 31.

Ideally get the transverse brace at the base of the scaffold as close as possible to the ground. The stability of the base of the scaffold will be greatly improved if the brace can be either:

- Butted to the base of the wall you are scaffolding; or
- Forced into the surface you are scaffolding from.

It is acceptable on light duty scaffold to connect the lower section of the brace to the standard by using a short butt tube off the standard with double couplers. Then connect the brace with a double coupler as close as practicable to the standard in the event of having no swivels.

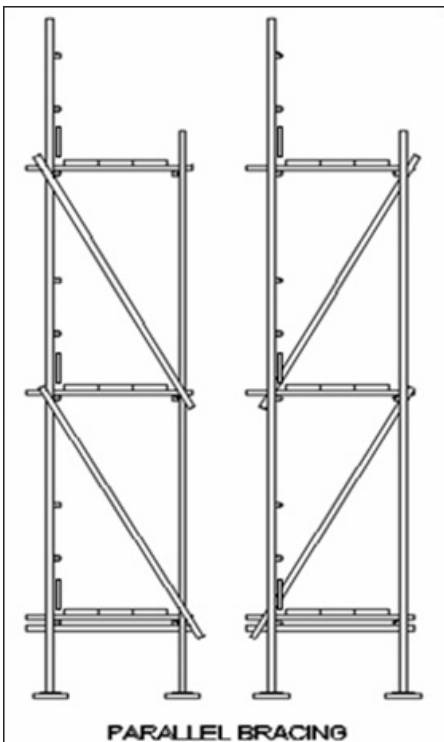


Figure 31: Parallel bracing (shown in two directions)

4.7. Erecting working and access platforms

4.7.1 Specifications of working platforms and access platforms

A platform is a structure or deck on a scaffold to support workers, material or plant.

Working platforms and access platforms (other than suspended work platforms) should be erected using either scaffold planks or prefabricated platform units. Each working platform should be designed and constructed to support the intended loads imposed on it. Every working platform should be decked as close as practicable to the work face of the structure it is being used with.

Working platforms

Working platforms need to be wide enough to accommodate workers, materials and plant - a minimum of 675mm wide (deck width) for non proprietary scaffolds, but maintaining a clear unobstructed access of not less than 450mm wide for all scaffolds. For example, if material or plant 500mm wide is intended to be stacked on the working platform, the working platform (deck width) would have to be a minimum of 950mm wide. This will allow a minimum clear unobstructed access of not less than 450mm.

Access platforms

Access platforms should be a minimum of 675mm wide for non proprietary scaffolds.

4.7.1.1 Proximity to the working face

Planks or decking forming the surface of a work or access platform should be as close as practicable to the work face. The maximum permissible gap between the working platform and the work face is 300mm. As a rough guide, then, a scaffold standard with 48.3mm outside diameter should not exceed 250mm from the work face to the standard. If the scaffold is required to be more than 300mm from the working platform, inside guardrails or an alternative means of edge protection is required (see figure 32).

The maximum gap permitted on a working or access platform itself is 50mm.

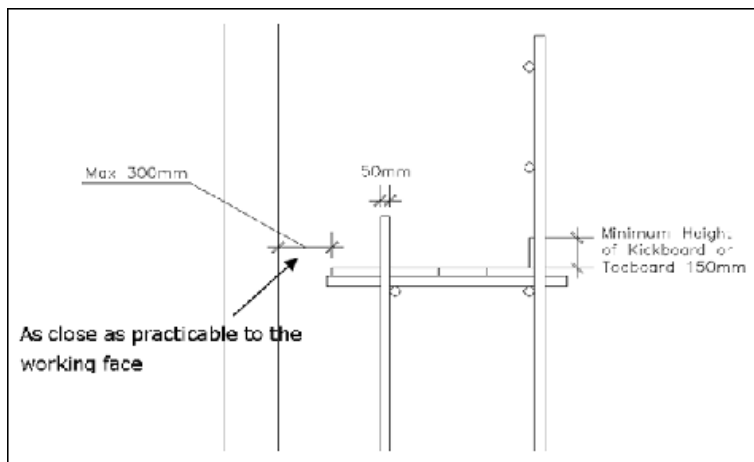


Figure 32: Proximity of scaffolding to the working face

4.7.1.2 Inside planks

On a planked light duty tube and fitting scaffold it is acceptable to have one or two inside planks cantilevered onto an extended putlog tube or transom. Generally on a butt planked scaffold the putlogs are connected to the ledgers with single (putlog) couplers. Do not use double flap or butterfly single couplers on any cantilevered tube unless it is supported by a brace preventing uplift. If you are required to erect three or more inside planks on a butt plank scaffold the cantilevered tube needs to be supported by a brace. Under sling an additional ledger under the cantilevered putlog tubes or transoms with double couplers (R/A couplers) then attach the brace to the lower ledger as shown in figure 33. Planks must be secured to prevent displacement.

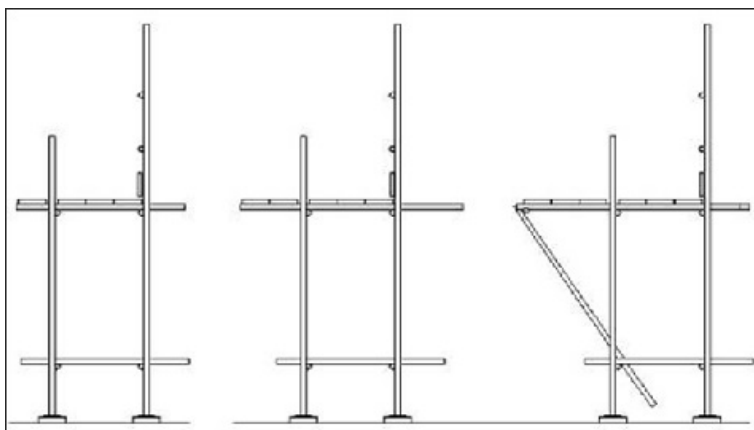


Figure 33: Inside planks and their support

4.7.1.3 Guardrails and midrails

Guardrails, including midrails, must be provided on the exposed sides and end of all working platforms regardless of height. The height of the midrail should be equidistant between the top guardrail and the working platform or alternatively equidistant between the top of the toeboard and the top of the guardrail.

For non proprietary scaffolds, the height of the top guardrail must be no less than 0.9m and no more than 1.1m from the platform.

When secured to the standard or upright member, each guardrail must be capable of independently sustaining at any point a 700N (71kg) vertical force or a 450N (46kg) horizontal force without failure, undue deflection, or permanent reset of the position of the guardrail.

Guardrails for H-Frame scaffolds should have the intersection of the cross braces at approximately 1.0m above the working platform.

The midrail should then be placed at approximately 0.5m above the working platform. Midrails may be excluded on lifts that do not include working platforms.

4.7.1.4 Toeboards or kickboards

A toeboard or equivalent protection must be fitted to the outside and end of every platform. The toeboard must protrude a minimum of 150mm above the working platform to prevent dislodgement of materials and tools.

Toeboard should be secured to standards with wire, single couplers or specialised toeboard fittings. Ideally toeboards should extend no less than 150mm above the intended tools or materials stacked on the working platform e.g. if materials are stacked 350mm high on a working platform, toeboards should be a minimum of 500mm high.

Scaffolds erected in high pedestrian areas should use both toeboards and screening.

4.7.1.5 Maximum height of scaffolds and working platforms

The maximum height of a scaffold constructed in accordance with these guidelines is 33.0m to the top-working platform. Scaffolds that exceed 33.0m in height must be constructed to: a chartered engineer's design statement, certificate or letter; or a producer statement where such a statement is required to be provided to a Building Consent Authority for the issue of a Building Consent or a Code Compliance Certificate in relation to the Building Act 2004; or, for proprietary scaffolds, the manufacturer's specifications.

If the involvement of a chartered engineer is required, generally you will have to provide the following information:

- Detailed plan view, showing dimensions and scaffold bay layout.
- Detailed cross section of the scaffold in relation to the work face, showing transverse bracing and plank levels.
- Detailed elevation showing longitudinal bracing and position of ties.
- Detailed section of the proposed ties and what the ties are connected too.
- Detailed list of scaffold components and their weights.
- Screening information, such as weight and porosity, may be required to work out the wind load on the scaffold.
- The intended use of the scaffold.
- The duty loading of the scaffold.

The engineer may also require soil samples to ascertain the load capacity of the ground the scaffold is to be erected on and for the design of adequate soleboards. Note that if a scaffold exceeding 33.0m to the top working platform is altered structurally by the scaffolder without approval of the engineer the liability for the scaffold design transfers directly to the scaffolder making the unauthorised changes.

For the stability of scaffolds above 33.0m additional transverse bracing (dogleg or parallel), ties and double or secondary standards (installed within 300mm of each primary standard) are generally required up at least one third of the scaffold height. Secondary standards can be attached to the ledgers of the scaffold with double couplers (R/A) or to the primary standards with swivels. Double standards or secondary standards help reduce the loads imposed on the primary standards.

4.7.2 Use of planks in erecting a platform or decks

A platform on a scaffold is to support workers and/or materials and plant. A platform can be made from a variety of materials such as: standard timber scaffold planks, prefabricated ply decks, aluminium grill decks, aluminium space or span decks, steel decks or planks.

For non proprietary scaffolds, the platform must be a minimum of:

Light duty: 675mm wide

Medium duty: 675mm wide

Heavy duty: 675mm wide

All scaffolds must maintain a clear and unobstructed access of not less than 450mm.

Planks or decking forming a platform should be of uniform thickness, slip resistant, pitched at an angle not exceeding 7 degrees to the horizontal (slope 1 to 8) and secured to prevent displacement in normal use and positioned to avoid significant gaps and trip hazards. Planks should be butted not lapped except at returns, curved faces or unusual profiles. Lapped planks other than returns, curved faces or unusual profiles, should be fitted with wedge cleats to reduce the risk of tripping. End overhang of planks must be 80mm minimum to 220mm maximum (see figure 34).

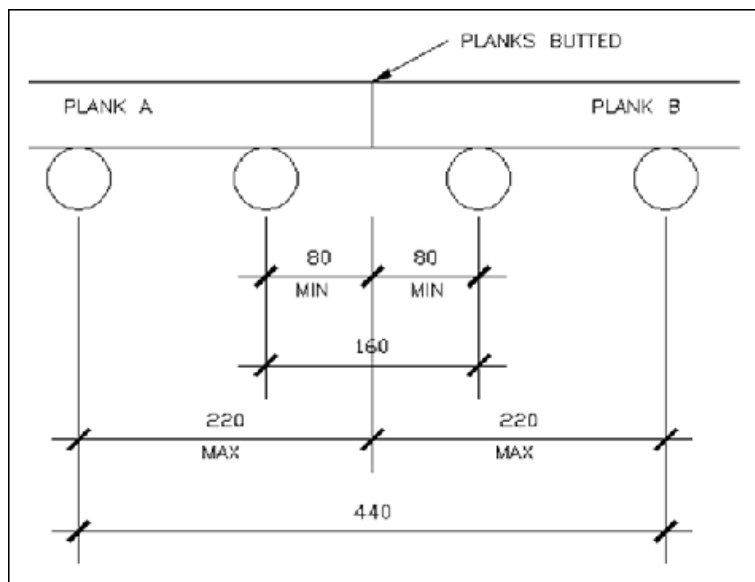


Figure 34: Butted planks

The securing of planks or decking against displacement is achieved by attaching them/it to the scaffold structure (putlog, transom, ledger, or rung etc). This can be done using:

- Lashing or similar.
- Wire.
- Steel or plastic strapping.
- Scaffold fittings.
- Spring loaded hook arrangements etc.

This significantly reduces gaps in working platforms and prevents planks lifting due to trap ends and wind uplift etc. Toeboards running across a working platform can also be used to secure the platform to prevent vertical uplift.

Ideally securing planks and decking will also prevent the unauthorised removal or movement of decking by the end user of the scaffold and at least automatically show if a

plank or decking forming a platform has been moved between inspections.

Plank failure

Plank failure or breakage is a significant hazard in scaffolding. To reduce plank failure butt scaffold planks on a scaffold as opposed to lap planking the scaffold. For example on a light duty butt planked scaffold with 2.4m bays, three putlogs would support 1 x 3.0m long plank (maximum putlog spacing on a butt planked scaffold = 1.42m) but it is recommended that 1.2m be used. On a lap planked scaffold only 2 putlogs support the 3.0m long plank at 2.4m centres.

If a shock (impact) load was applied to a butt plank scaffold and the same shock (impact) load was applied to a lap plank scaffold the risk of a plank failure is significantly increased on a lap plank scaffold due to the greater putlog spacings.

4.7.3 Duty loadings on working platforms

The duty live loading for a scaffold is calculated as the maximum load permitted (men and materials) in any one scaffold bay.

4.7.3.1 Light duty working platforms

The maximum duty loading per bay permitted on a light duty scaffold is 225kg (2.2 kN).

The 225kg is calculated as a Uniformly Distributed Load (UDL) over the full bay. The maximum point load or concentrated load permitted is 100kg per bay as part of the maximum 225kg.

Additional requirements for a light duty working platform

Maximum standard spacing for light duty non proprietary scaffolds (see figure 35):

Longitudinal standard spacing - 2400mm (bay length).

Transverse standard spacing - 1575mm (bay width).

The minimum width of a working platform is 675mm for non proprietary scaffolds while maintaining unobstructed access of 450mm for all scaffolds.

The maximum number of working platforms useable concurrently in any one bay is:

Scaffold height up to 13.5m high - 4 lifts or working platforms per bay.

Scaffold height up to 33.0m high - 2 lifts or working platforms per bay.

Maximum putlog spacing is 2.4m

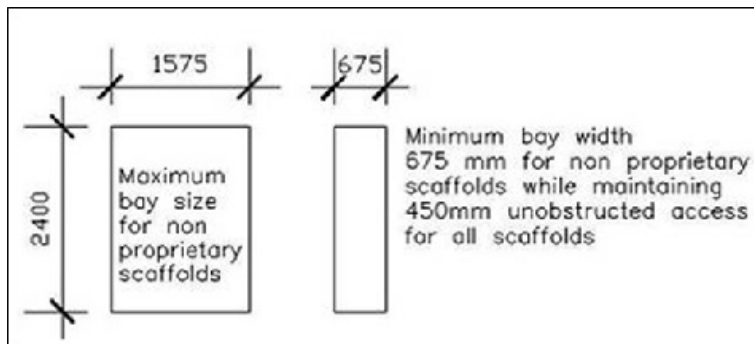


Figure 35: Light duty working platforms - maximum and minimum standard spacings

4.7.3.2 Medium duty working platforms

The maximum duty loading per bay permitted on a medium duty scaffold is 450kg (4.4 kN).

The 450kg is calculated as a Uniformly Distributed Load (UDL) over the full bay. The maximum point load or concentrated load permitted is 150kg per bay as part of the maximum 450kg.

Additional requirements for a medium duty working platform

Maximum standard spacing for medium duty non proprietary scaffolds (see figure 36):

Longitudinal standard spacing - 2400mm (bay length).

Transverse standard spacing - 1275mm (bay width).

The minimum width of a working platform is 675mm for non proprietary scaffolds while maintaining unobstructed access of 450mm for all scaffolds.

The maximum number of working platforms useable concurrently in any one bay is:

Scaffold height up to 13.5m high - 2 lifts or working platforms per bay.

Scaffold height up to 33.0m high - 1 lifts or working platforms per bay.

Maximum putlog spacing is 1.2m

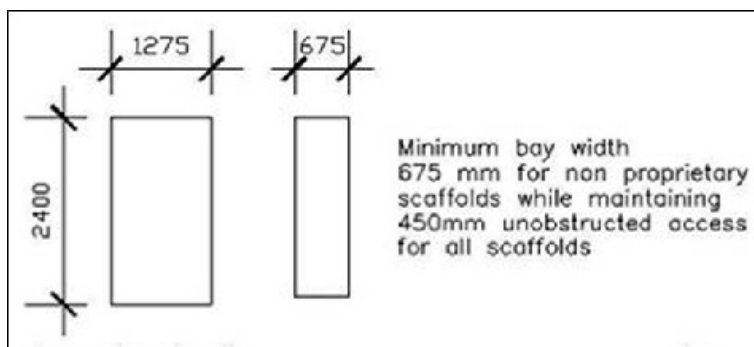


Figure 36: Medium duty working platforms - maximum and minimum standard spacings

4.7.3.3 Heavy duty working platforms

The maximum duty loading per bay permitted on a heavy duty scaffold is 675kg (6.6 kN).

The 675kg is calculated as a Uniformly Distributed Load (UDL) over the full bay.

The maximum point load or concentrated load permitted is 200kg per bay as part of the maximum 675kg.

Additional requirements for a heavy duty working platform

Maximum standard spacing for heavy duty non proprietary scaffolds (see figure 37):

Longitudinal standard spacing - 1800mm (bay length).

Transverse standard spacing - 1275mm (bay width).

The minimum width of a working platform is 675mm for non proprietary scaffolds while maintaining unobstructed access of 450mm for all scaffolds.

The maximum number of working platforms useable concurrently in any one bay is:

Scaffold height up to 13.5m high - 2 lifts or working platforms per bay.

Scaffold height up to 33.0m high - 1 lifts or working platforms per bay.

Maximum putlog spacing is 0.9m

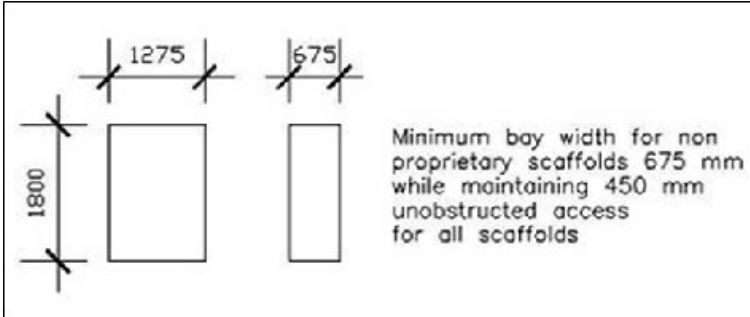


Figure 37: Heavy duty working platforms - maximum and minimum standard spacings

4.7.3.4 Special duty scaffolds

A special duty scaffold is a working platform that does not comply with the general requirements of a light, medium or heavy duty working platform with respect to loadings and/or dimensions. Special duty scaffolds should be notified to the DOL. There is a template for this in the appendix at the end of these guidelines.

Some examples of special duty scaffolds include:

- Bay widths that do not meet the minimum or maximum width requirements.
- Bay lengths that do not meet the minimum or maximum width requirements.
- Lift heights that do not meet the minimum or maximum height requirements.
- The exclusion of one or both guardrails.
- The exclusion of toeboards or kickboards.
- Vertical ladder on non proprietary scaffolds.
- Scaffolds with a gap greater than 300mm to the workface without inside guardrails.
- Limited access scaffolds.
- Concentrated weight scaffolds.
- Special duty loading platforms.
- Special duty cantilever scaffolds.
- Special duty hanging scaffolds.
- Special duty falsework (propping).
- Non proprietary scaffolds over 33.0m.
- Scaffolds erected from proprietary equipment that fall outside the manufacturer's specifications.
- Special duty bridging scaffolds.
- Special duty roof saddle scaffolds.

An example is if you require a single plank scaffold to access a restricted area between two buildings. The regulations require you to notify the scaffold as a special duty scaffold to the DOL stating the reason you cannot provide a minimum of 450mm clear access.

Additionally some special duty scaffolds require the design to be checked by a chartered engineer. For instance:

- Non proprietary scaffolds over 33.0m high.
- Scaffolds that exceed the maximum permitted height for proprietary scaffolds.
- Scaffolds using screening in very high wind areas.
- Scaffolds that require the supporting structure to be checked by a chartered engineer with regard to point loads, tie spacings etc.
- Scaffolds erected directly from a supporting structure, roof, verandah or balcony.

4.7.4 Permitted loads on scaffold tube

4.7.4.1 Galvanised steel tube 48.3mm outside diameter; 3.2mm wall thickness

Table 10 gives the loads that are permitted in New Zealand to be applied to galvanised steel scaffold tubes with 48.3mm OD x 3.2mm wall thickness complying with BS 6323.1. It takes into account a 15% reduction for reuse and the self-weight of the tube.

Table 10: Maximum permitted loads on galvanised steel tube

ClearSpan mm	Tube as a Beam		Tube as a Strut			
	Simply supported beam	Cantilevered beam	Strutlength mm	Concentric load		kg
	Point load kg	UDL kg		Point load kg	UDL kg	
225	917	1835	229	459		
300	687	1373	172	343	300	3870

450	456	914	114	228		
600	343	684	86	171	600	3740
675	304	610				
900	230	456			900	3522
1125	181	363				
1200	170	341			1200	3190
1350	159	301				
1500	134	270			1500	2770
1575	128	254				
1800	110	221			1800	2275
2050	98	196				
2100	94	187			2100	1809
2250	88	173				
2400	82	162			2400	1442
2700	72	143			2700	1164
3000	64	127				

Notes

Cantilevered spans (beam) exceeding 600mm are not recommended.
UDL = Uniformly Distributed Load.

Example

The bold type above demonstrates the following using a clear span of 600mm:

- A 600mm tube simply supported at either end 600mm apart can sustain a maximum Safe Working Load (SWL) at one point (Point load) of 343kg and can support a maximum Uniformly Distributed Load (UDL) of 684kg.
- A 600mm tube cantilevered from a single support can sustain a maximum SWL at one point of 86kg and can support a maximum UDL of 171kg.
- A 600mm tube used as a strut or prop can sustain a load of 3740kg.

4.7.4.2 Aluminium scaffold tube 48.3mm outside diameter; 4.45mm wall thickness

Table 11 gives the loads that are permitted in New Zealand to be applied to aluminium scaffold tubes with 48.3mm OD x 4.45mm wall thickness complying with AS/NZS 1576.3. It takes into account a 15% reduction for reuse and the self-weight of the tube and limits the deflection of beams to 1/150 of the span.

Table 11: Maximum permitted loads on aluminium tube

ClearSpan mm	Tube as a Beam				Tube as a Strut	
	Simply supported beam		Cantilevered beam		Strutlength mm	Concentric load kg
	Point load kg	UDL kg	Point Load kg	UDL kg		
225	1633	3266	3229	354	225	6750
300	1224	2449	199	531	300	6527
450	816	1632	88	236	450	6082
600	612	1224			600	5637
675	544	1007			675	5414
900	354	566			900	4746
1125	226	361			1125	3595
1200	198	317			1200	3159
1350	156	250			1350	2496
1500	126	202			1500	2020

1575	114	183	1575	1834
1800	87	139	1800	1404
2050	68	109	2025	1109
2100	63	101	2100	1032
2250	55	88	2250	899
2400	48	76	2400	790
2700	37	59	2700	624
3000	29	47	3000	505

Notes

Cantilevered spans (beam) exceeding 450mm are not recommended.
UDL = Uniformly Distributed Load.

Example

The bold type above demonstrates the following using a clear span of 450mm:

- A 600mm aluminium tube simply supported at either end 450mm apart can sustain a maximum Safe Working Load (SWL) at one point (Point load) of 816kg and can support a maximum Uniformly Distributed Load (UDL) of 1632kg.
- A 450mm aluminium tube cantilevered from a single support can sustain a maximum SWL at one point of 88kg and can support a maximum UDL of 236kg.
- A 600mm aluminium tube used as a strut or prop can sustain a load of 6082kg.

4.7.5 Butt plank scaffold

When erecting a typical butt plank scaffold the base lift has putlogs connected with double couplers to the standard beneath the ledger. The ledger is connected to the standard with double couplers. The putlogs for butt planking are connected on top of the ledger with single couplers.

This allows for the base lift to have the ledgers connected to the standards and the putlogs under the ledgers to act as check clips. This provides additional strength in both the transverse and longitudinal plane via use of double couplers.

All additional lifts are erected with the ledger connected to the standard with double couplers and the putlogs for butt planking connected to the ledger with single couplers. A putlog must be within 300mm of the standards.

Figure 38 shows putlogs connected to the standards beneath the base ledgers. All the other putlogs are connected to the ledgers with singles.

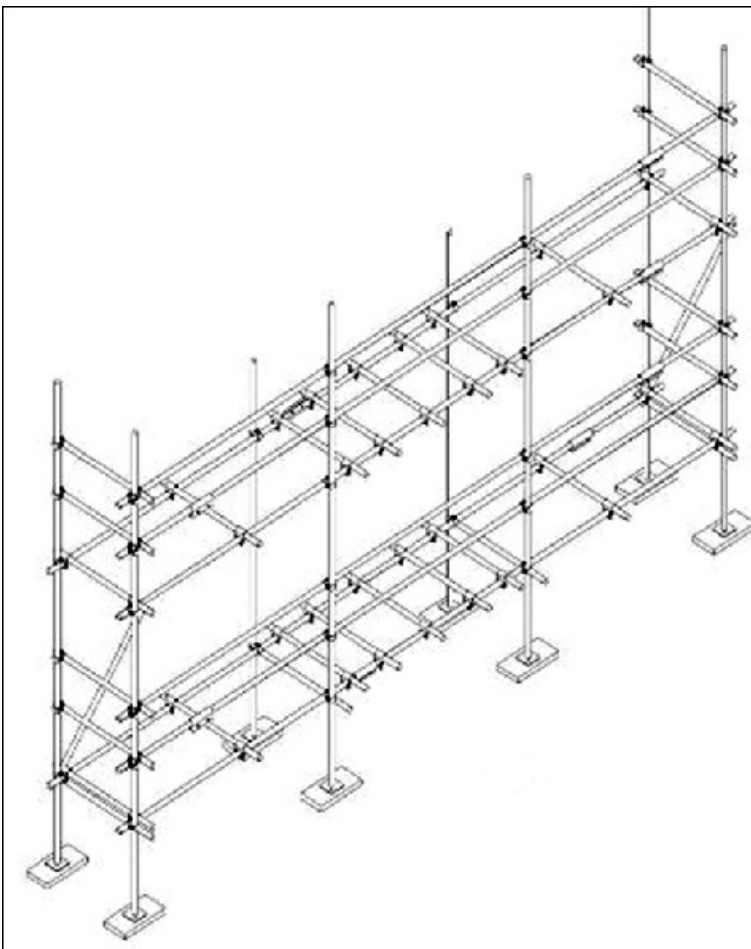


Figure 38: Putlog positioning for butt plank scaffolds

4.7.6 Access to working platforms

Access to working platforms must be adequate and safe for the working conditions and type of work to be carried out. Especially consider the number of people using a

scaffold and whether they need to carry materials or tools to the work platform. Some of the options for providing access to working platforms are outlined below.

4.7.6.1 Ladders

Depending on the application, ladders are traditionally made from aluminium, timber or fibreglass. In providing ladder access to working platforms:

- Ladders should be pitched at a slope of not less than 1 in 4 and not more than 1 in 6. Though it is not recommended, it is acceptable to have a pitched ladder stop at the working platform height if sufficient guardrails (stop ends) are in place that can be used to hold onto for access and egress to and from the ladder.
- If possible ladders should be securely tied to prevent movement top and bottom.
- Ladders should extend at least 1.0m above the working platform, landing or exit point.
- Ladders must be in good structural condition.
- The maximum height between working platforms or landings must not exceed 5.1m or a maximum of 2 lifts.
- Ladders must be offset to prevent a single continuous ladder. This reduces the distance a person could fall to a maximum of 5.1m (2 lifts).
- Where possible ladders should be erected in an independent scaffold bay. This is the preferred method, as it does not interfere with the working platform.
- All ladder access openings in a platform must be protected by either a hatch, gate or by tortured path.

Gaining and securing external ladder access

It is acceptable to secure a ladder to the outside of a scaffold from ground level to the 1st and 2nd lift (5.1m maximum working platform). This is usually achieved by extending a putlog to which the top of the ladder is then secured.

In terms of securing access from an external ladder, there are two options both involving the installation in the scaffold of an inward opening self closing gate or barrier. A prefabricated self closing gate may be installed at the lift height to allow and protect access. This is the preferred method of access for external ladders up to the second lift. Alternatively gaining access to working platforms from a ladder on the outside of the scaffold can be achieved by a short length of tube (approximately 1.2m) with swivel couplers to form a gate arrangement. You lift the gate to gain access to the working platform and put it back in place to maintain the guardrail to prevent falling from the working platform.

Prefabricated ladder gate arrangement

Figure 39 shows an external ladder used up to the second lift of a scaffold (5.1m maximum height) with a prefabricated self closing gate installed at the lift height to allow access. This is the preferred method of access for external ladders up to the second lift.

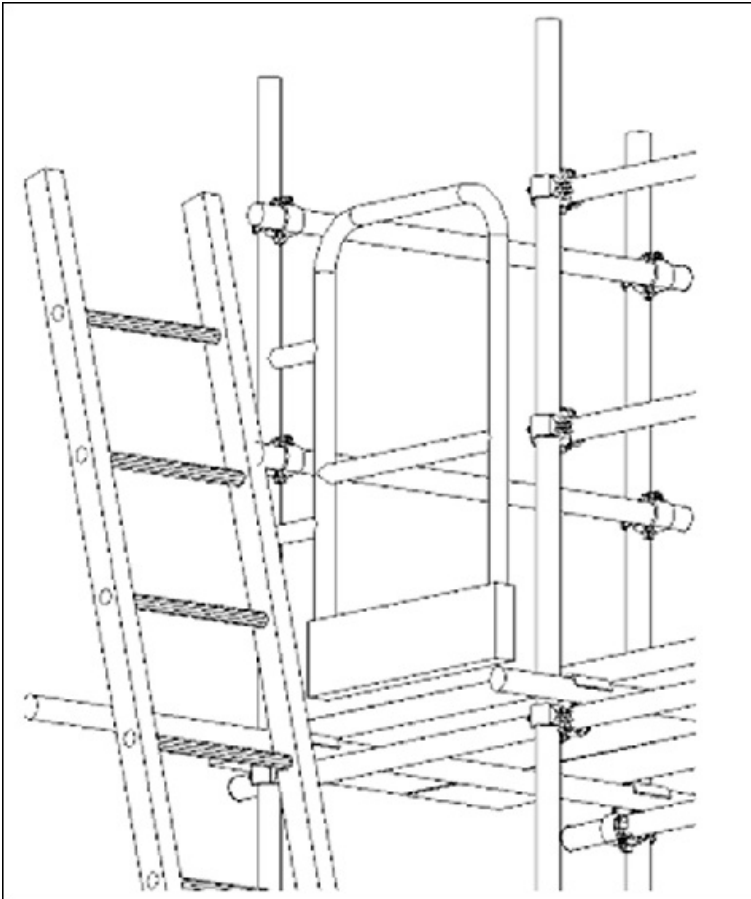


Figure 39: Prefabricated ladder gate

Swivel fitting ladder gate arrangement

Figure 40 shows an external ladder used up to the second lift of a scaffold (5.1m maximum height) with the top guardrail attached with a swivel fitting that can be raised to access the working platform and lowered to protect the working platform. This gate must also be self closing.

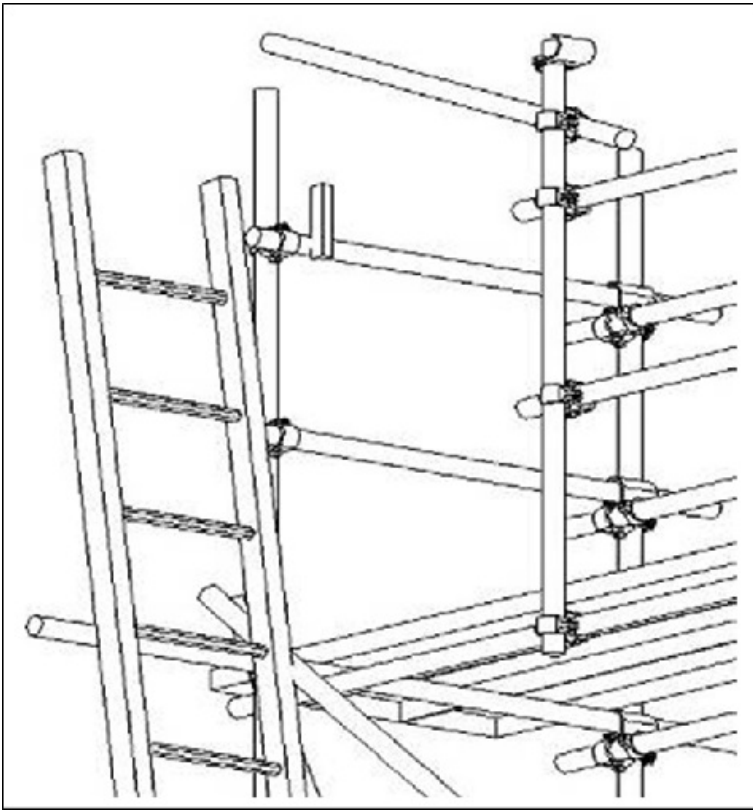


Figure 40: Swivel fitting ladder gate

Gaining and securing internal ladder access

Internal ladder access is acceptable if the ladder access hole is placed in part of the working platform and the minimum 675mm working platform width is maintained. Any hole or void in a working platform must either have adequate guardrails or a trapdoor arrangement must be used. This is to prevent stepping into the hole or void.

Vertical ladders should be avoided if possible. They can be used on a special duty scaffold if access is restricted, such as in a tank or ducting. Guardrailing or trapdoor systems must be used in conjunction with vertical ladders.

Ladder hatch arrangement

Figure 41 shows a ladder protruding through a working platform with a hatch arrangement to ensure that no void is left in a working platform. It may be necessary to support the outside of the hatch if the hatch does not have an outside plank to support it. A single coupler can be attached to the outside ledger to accomplish this. The hinge arrangements can be standard hinges or heavy duty carpet or similar. It is recommended that the hatch be lapped a minimum of 32mm onto the adjacent planks.

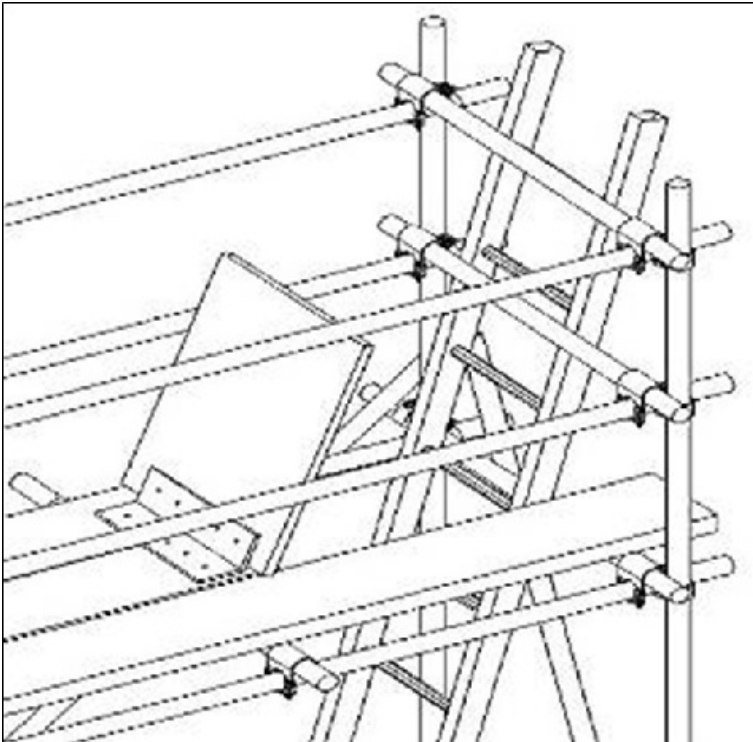


Figure 41: Internal ladder hatch

Tortured path

Above the second lift of a scaffold all ladders must be erected within the framework of the scaffold or in a dedicated ladder access bay. The opening to the work platform can be protected by the ladder hatch arrangement as shown in figure 41. For a dedicated ladder access bay creating a barrier that a person must walk around to access the ladder opening is called a tortured path. This can easily be erected using tube and fittings or proprietary components. The objective is to prevent a person stepping back from a platform into the ladder opening (see figure 42).

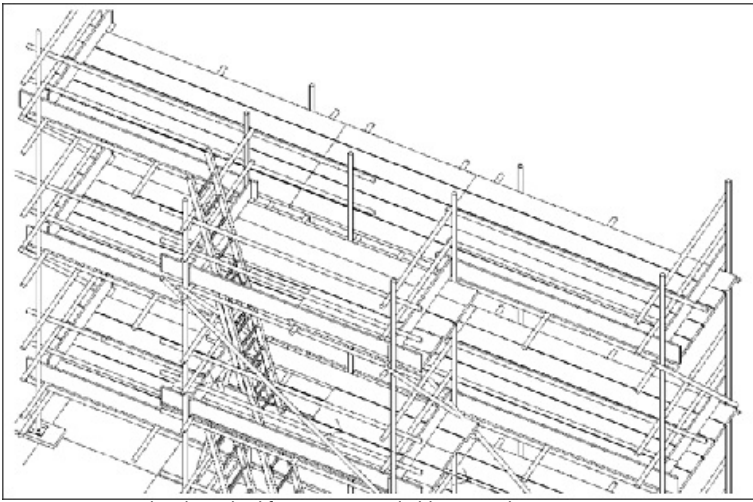


Figure 42: Tortured path method for constructing ladder access bays

4.7.6.2 Stairs

Traditionally stairs are made from aluminium, timber or steel. They usually come in a 'stair unit' comprised of a number of stairs.

Stair units are usually attached to a scaffold by hooking over a tube or by sitting in a transom on a system type scaffold. Other connecting methods, while used, are not as common. Stairs are usually placed in a separate bay against a working platform. Sloping guardrails must be used to give something to hold onto when ascending or descending the stairs.

Stairs generally come in 1.5m lifts as they can be fitted within a 2.4m long bay maintaining the correct step dimensions and landing dimensions to turn around on. Because 1.5m rise stairs do not match normal scaffold lifts it may be necessary to provide a stepping platform from the working platform to the stairs.

Stair units that come in 2.0m lifts must either use a bay length of greater than 2.4m or the landings must be extended or cantilevered from the 2.4m bay.

Stairs can be made up using stair brackets, planks and tubes. While this is acceptable, structures must be checked to ensure all steps are level, secure from movement, and can take the live loads imposed - like a 100kg man running down the stairs! Using ply from the front edge of the top step to the back edge of the lower step forms a complete unit that will prevent the step from rotating forward or backwards.

Access from a stair unit to the work platform must be maintained like a ladder access. A guardrail or gate arrangement must be kept in place to prevent people walking from a working platform into a stair opening.

Figure 43 shows a proprietary aluminium mobile stair access tower.

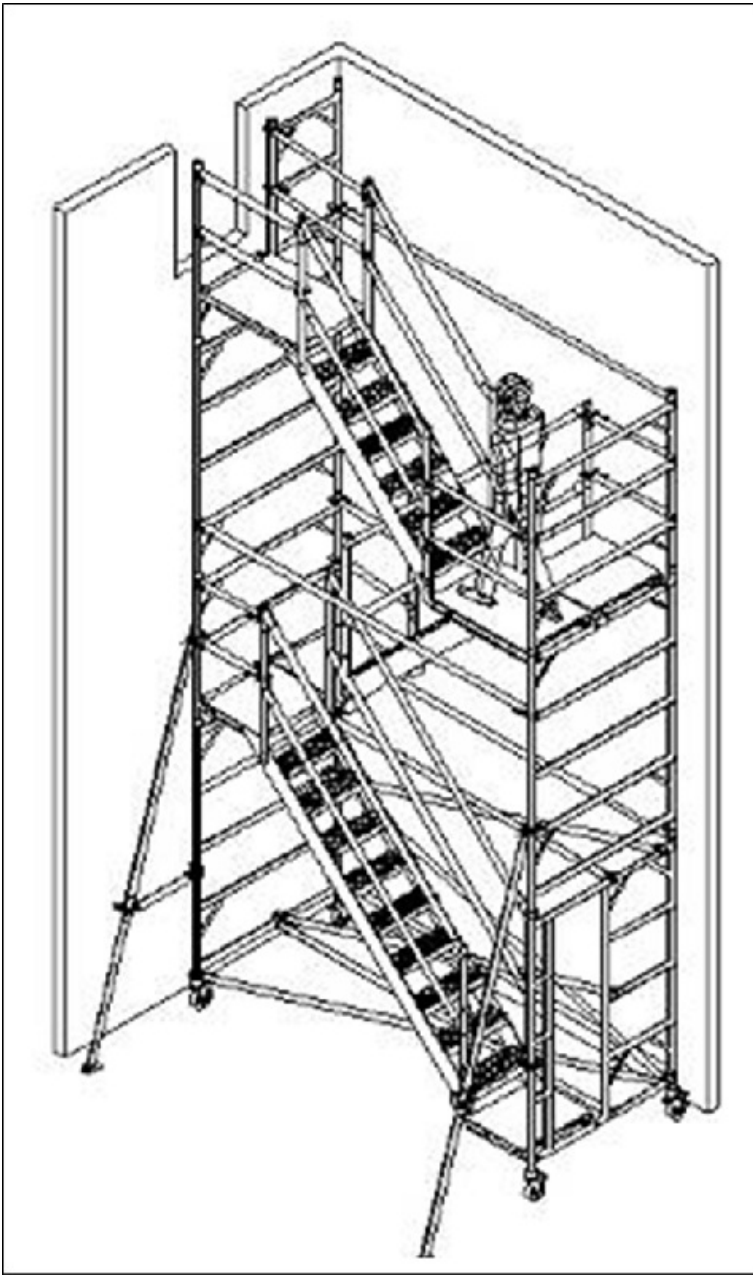


Figure 43: Proprietary mobile stair access tower

Figure 44 shows both a typical external ladder access tower and an external stair access tower attached to the same scaffold. Each forms a separate access bay.

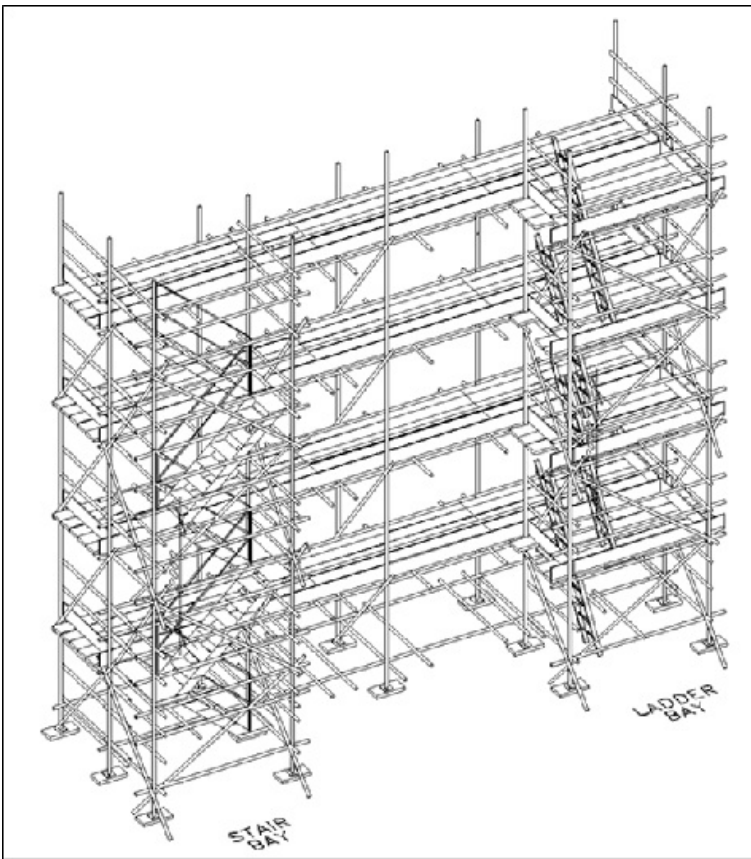


Figure 44: Combined ladder and stair access

Section 5: Proprietary scaffolding

This section covers proprietary scaffolds (modular scaffolds). Proprietary scaffolds have been designed by a chartered engineer as reflected in the manufacturer's specifications for the design and use of the equipment. The manufacturer's specifications must be used in the erection, use and dismantling of proprietary scaffolds.

Proprietary scaffolds can be separated into two specific categories.

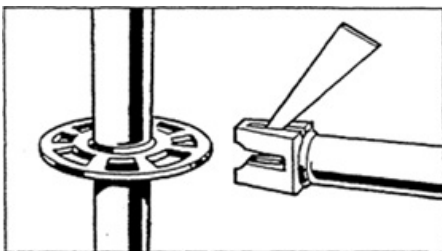
1. Proprietary systems solely comprised of prefabricated components. Here manufacturer's specifications and instructions for safe erection must be followed.
2. Proprietary systems comprised primarily of prefabricated components, but with additional scaffolding components that are not covered by the manufacturer's specifications. Here the additions to the proprietary scaffold should follow the general requirements of the BPG. If this can not be achieved scaffolds constructed using these systems should be classified as special duty scaffolds.

The industry recommends that all special duty scaffolds be notified to the DOL. There is a template for this in the appendix at the end of these guidelines.

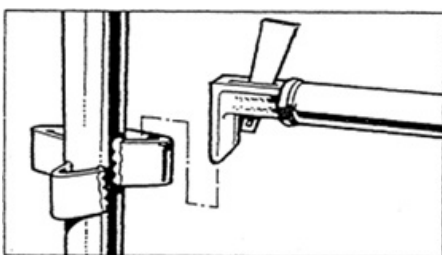
5.1 Modular proprietary systems (prefabricated)

Proprietary equipment has been prefabricated to a unique design for use as scaffolding. Figure 45 shows the node or connection points for four proprietary systems.

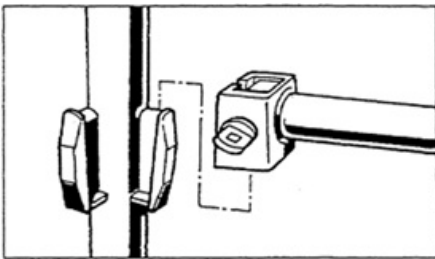
Figure 45: Connection systems for four different prefabricated proprietary systems



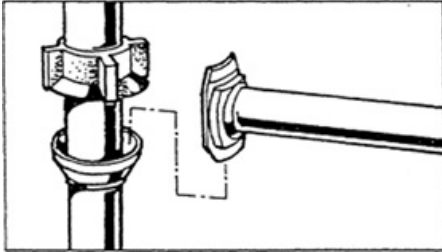
Ring scaffold node or connection point



Kwikstage or system scaffold node



Rapid scaffold node or connection point



Cuplock scaffold node or connection point

Figure 46 shows a standard system or Kwikstage proprietary scaffold showing some general scaffolding terminology

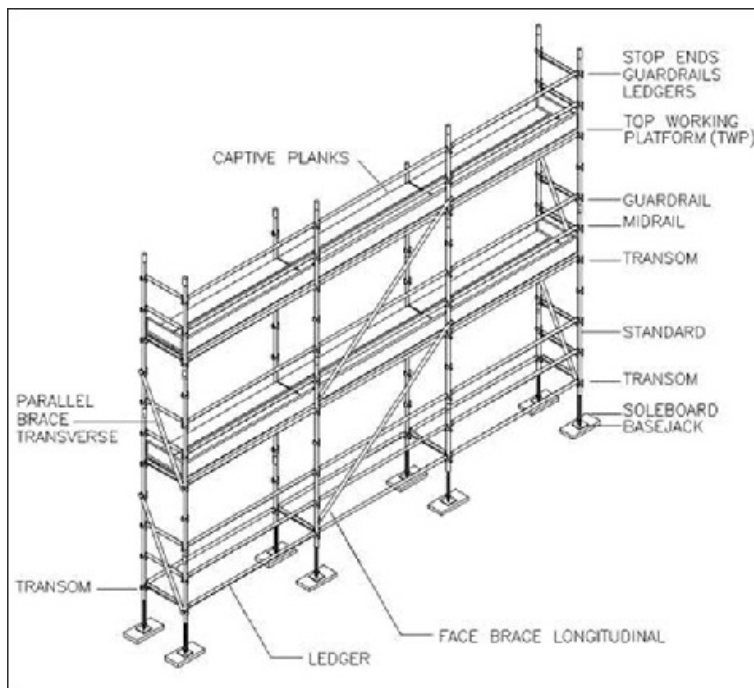


Figure 46: General scaffolding terms applied to proprietary scaffolding

5.2 Aluminium frame and brace tower systems

Aluminium (lightweight) frame and brace proprietary systems are commonly called aluminium towers or aluminium scaffolds. They are either fixed (static) or mobile.

Aluminium scaffolds are generally comprised of the following prefabricated components:

- Castors or basejacks.
- Aluminium end frames (generally with horizontal rungs).
- Aluminium braces - diagonal, horizontal and plan.
- Prefabricated captive decks and hatch decks.
- Aluminium prefabricated ladders or stairs.
- Aluminium outriggers.

All prefabricated aluminium scaffolds must be erected per the manufacturer's specifications and instructions.

Aluminium systems in use today have an extensive range of products that can be used in most scaffolding applications. While aluminium mobile scaffolds are used more than aluminium fixed or static scaffolds, most of these systems utilise the same equipment.

An aluminium scaffold that is more than one bay long must maintain unimpeded access. Climbing through the scaffold's frame rung is not permitted. Walk through frames or space frames must be used. Ladder or stair access must be provided to all working platforms. Always check the manufacturer's specifications, particularly re:

- Erection instructions.
- Maximum loads permitted per bay.
- Maximum height to which the system can be erected.

In the case of a mobile aluminium scaffold, if the lowest working platform using prefabricated decks is above 3.0m from the supporting structure, then plan bracing must be provided at the base of the scaffold. Please note the aluminium frame must be fully decked (captive) at the lowest working platform or a plan brace must be used. Check the manufacturer's instructions.

Particular attention must be taken to ascertain the intended use of the aluminium scaffold, in particular the designed safe working loads per bay. Aluminium is generally

lighter than other scaffolds and is therefore more prone to the impact of uneven loads or wind loads.

When stacked one on top of the other aluminium frames must have a positive connection. This is accomplished by connecting frames with an exterior joiner or locking pin, or by bracing over the frame join on both sides of the frame.

5.3 Proprietary systems with additional components

Proprietary scaffold can be used to create hanging scaffolds, cantilevered scaffolds, bridges, etc. As above, if a proprietary system includes additional scaffolding components that are not covered by the manufacturer's specifications the additional components should be used consistent with the general requirements of the BPG. If this can not be achieved the resulting scaffold must be classified as a special duty scaffold.

5.3.1 Requirements for system combinations

Components from different prefabricated scaffolding systems must not be mixed unless the load capacity of the mixed scaffolding systems has been proved by theoretical analysis or testing in accordance with AS/NZS 1576 and the:

- Components are of compatible size and strength.
- Components have compatible deflection characteristics.
- Fixing devices are compatible.
- Mixing does not lessen the scaffold's strength, stability, stiffness or suitability.

The following system combinations must not be used unless designed in accordance with engineer's requirements or specifications in AS/NZS 1576 or other recognised standards:

- Steel prefabricated scaffolding systems used in conjunction with aluminium prefabricated scaffolding systems.
- Aluminium scaffold tubes used as principal structural members in a steel prefabricated scaffold.
- Steel scaffold tubes used as principal structural members in aluminium prefabricated scaffold. This does not apply to the use of tie tubes or members such as guardrails.

Standards

On a system or proprietary type scaffold (excluding frame scaffolds) standards must be staggered if the top working platform is higher than the longest standard, following the principle of a tube and fitting scaffold. Always follow the manufacturer's specifications for proprietary components.

Ledgers

On a system or proprietary type (tube) scaffold ledgers cannot generally be staggered as they are restricted in length between the standards.

5.3.1.1 Bracket scaffold for tank work or form work

Bracket scaffolds are scaffolds erected from an engineer's designed bracket system designed for the purpose. The brackets are prefabricated and fixed to the perimeter of a tank or vessel. They are usually either welded or bolted to the supporting structure.

Generally a tube and fitting scaffold is erected on the supporting brackets to form a working platform, though this does not exclude a proprietary scaffold system being supported by the brackets. The fixing of these prefabricated brackets needs to be checked as does the suitability of the tank or vessel to support the intended scaffold.

5.3.1.2 Temporary grandstand seating

Temporary grandstand seating is covered under the Building Act and building codes.

Again, if additional components are included in a proprietary system these should be used consistent with the general requirements of the BPG. If this can not be achieved, the resulting scaffold must be classified as a special duty scaffold.

5.3.1.3 Stage platforms

Temporary stage platforms can be erected out of most types of scaffolding. Proprietary stage platforms must be erected per the manufacturer's specifications. Designing and erecting stage platforms to support people and materials generally would be classified as a special duty scaffold and notified as such. These structures may need to withstand considerable loads on a concentrated area and individual bays are difficult to recognise, so all care must be taken in calculating loadings. Temporary stage platforms must also comply with the Building Act and the Resource Management Act.

Section 6: Particular scaffolds and scaffolding structures

6.1 Mobile scaffolds

A mobile scaffold is a type of free standing scaffold supported on wheels, castors or other devices for ease of movement on a firm level supporting structure. Mobile scaffolds can be erected from a variety of components or systems, including:

- Aluminium prefabricated systems.
- Fibreglass prefabricated systems (non conductive).
- Steel frame scaffolds (H frame).
- System or modular steel scaffolds.
- Tube and fitting scaffolds, etc.

Important points

Some important points to remember when dealing with mobile scaffolds include:

- They should be erected, maintained, altered and dismantled by a certificated scaffolder of the correct class if they are more than five metres in height.
- They should be erected, maintained, altered and dismantled by a competent person if less than five metres in height.
- They should be erected to the manufacturer's instructions.
- They should be used on a sound, clear and level surface.
- Ensure working platforms are decked to the full width and adequately restrained against displacement.
- Ensure top and mid guardrails are erected on platforms.
- Erect platform toeboards to prevent items on the platform falling on people below.
- Provide safe means of access to work platforms.
- Where the platform incorporates a hatch door, ensure the hatch is closed except during access or egress.

6.1.1 Stability

All freestanding scaffolds, whether mobile or static, need to be stabilised against overturning forces. Mobile scaffolds in particular are prone to tip over during use for a variety of reasons, including:

- Sudden stops while being moved. This is a key reason why they must not be ridden while being moved.
- Height to the top most platform is greater than three times the minimum base dimension.
- People standing at or near the edge of the platform in conjunction with a sudden movement or action. This creates a temporary high point loading.
- Capacity being based on a distributed load, not a point load at the edge. This means overturning can occur even when the design load capacity of the platform is not exceeded.
- The narrower and lighter the scaffold, the more likely that it will tip over.

General principles to improve stability

1. The height of the top working platform must be no more than three times the minimum base dimension of the structure for scaffolds over 1.8 metres in height.
2. The height of the top working platform must be no more than two times the minimum base dimension of the structure for scaffolds under 1.8 metres in height.

These base to height ratios are only acceptable under normal weather conditions. Additional precautions must be taken if adverse weather conditions are expected. Further, it is accepted practice to use rakers, outriggers, or larger base frames to increase the minimum base dimension.

Mobile scaffolds generally need to be braced on all sides. All mobiles must also be plan braced to prevent the tower from deforming in shape (parallelogram), except in the case of a mobile aluminium framed scaffold where the lowest fully decked platform is below 3 metres high.

Specific recommendations to improve stability

- Position the scaffold as close as possible to the area being worked on.
- Apply the castor brakes while the scaffold is in use.
- Don't ride the scaffold while it is being moved.
- Maintain the height to width ratio.
- Use outrigger bracing.
- Add weight to the scaffold base to improve stability.
- Establish with the manufacturer exactly what the established safe working load relates to.
- Where possible use alternative more stable equipment, such as a scissor hoist.

6.1.2 Non adjustable castors

Castors allow a scaffold to be moved or be mobile. Castors must:

- Be able to support the dead and live loads imposed upon the scaffold.
- Be a minimum of 125mm in diameter and be secured to the standard. This can be done by using an expanding internal spigot that fits into the standard or by using a locking device on a sleeve type external fitting over the standard. This is to prevent a castor from falling out of the standard when wheeled over uneven surfaces.
- Have the SWL (Safe Working Load) clearly shown on them.
- Have some kind of braking or locking system. This can come in a range of types such as screw and compression devices on the actual castor itself.
- Have a minimum 150mm spigot or pintle length (internal spigot length or external socket length) in or over the standard.

6.1.3 Adjustable castors

Adjustable castors have the same requirements as a normal castor but can be adjusted vertically by way of a threaded spigot or stem with a positioning nut. The threaded extension, while maintaining a minimum of 150mm spigot or pintle length in or over the standard, must not exceed 600mm adjustment. Castors can also be used horizontally as a running device to keep a mobile scaffold off a surface.

It is recommended that the threaded extension, while maintaining a minimum 150mm spigot or pintle length in or over the standard, should have a maximum extension that does not exceed half of the total extension. For example a castor with 500mm extension should preferably be kept to a maximum of 250mm extension, but can be used out to 350mm extension. Adjustable castors do not need to be secured to the standard if the spigot or pintle length is greater than 300mm.

As stated earlier, in the following diagrams kickboards are omitted for clarity.

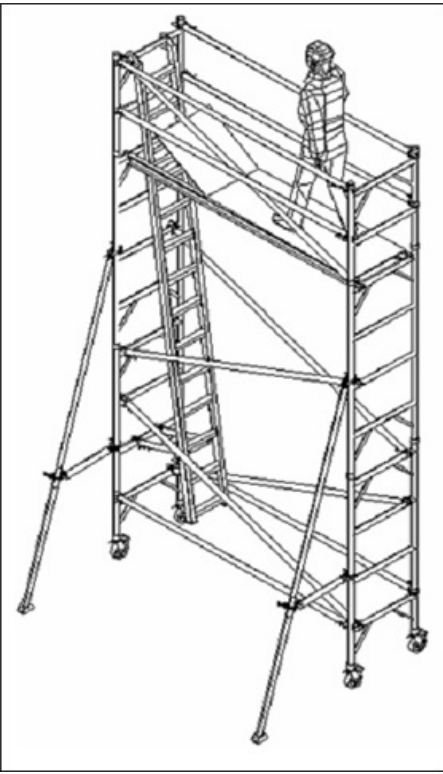


Figure 47: Single deck width mobile with outriggers

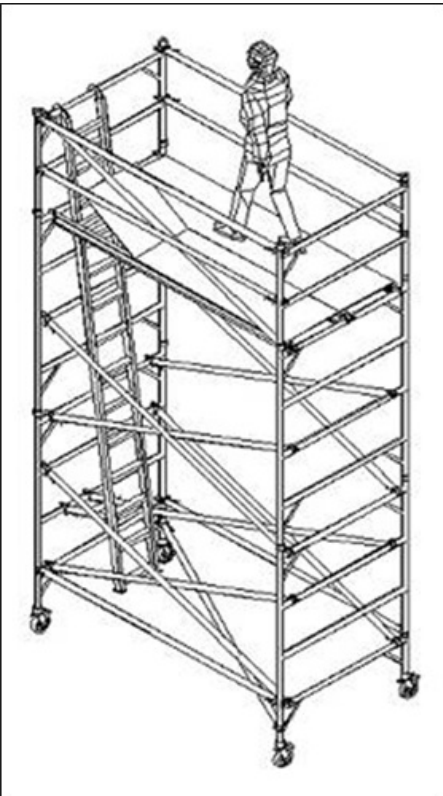


Figure 48: Double deck width mobile

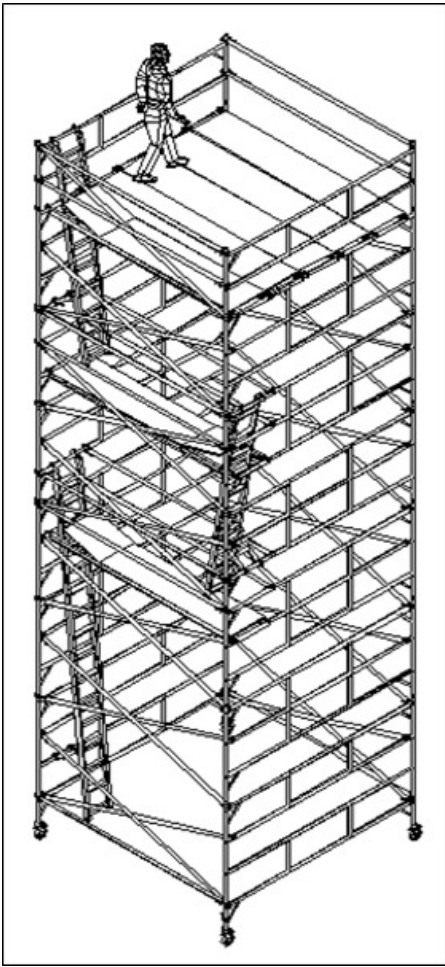


Figure 49: Five deck wide mobile

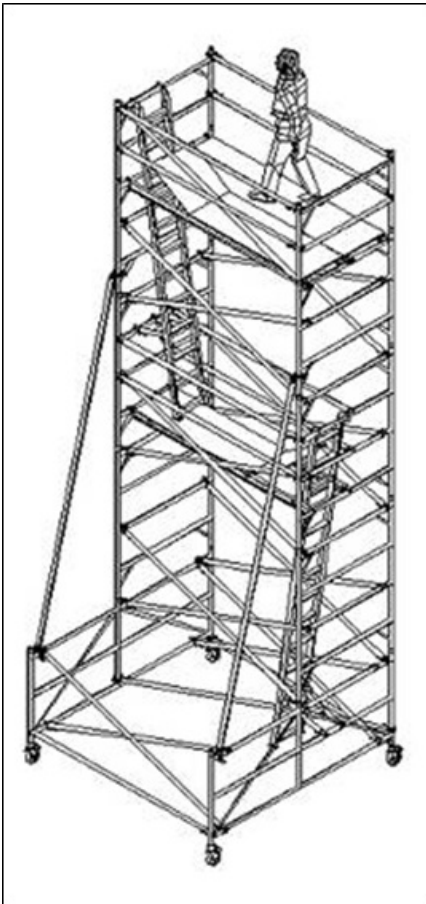


Figure 50: Double deck width mobile. Base extended with rakers

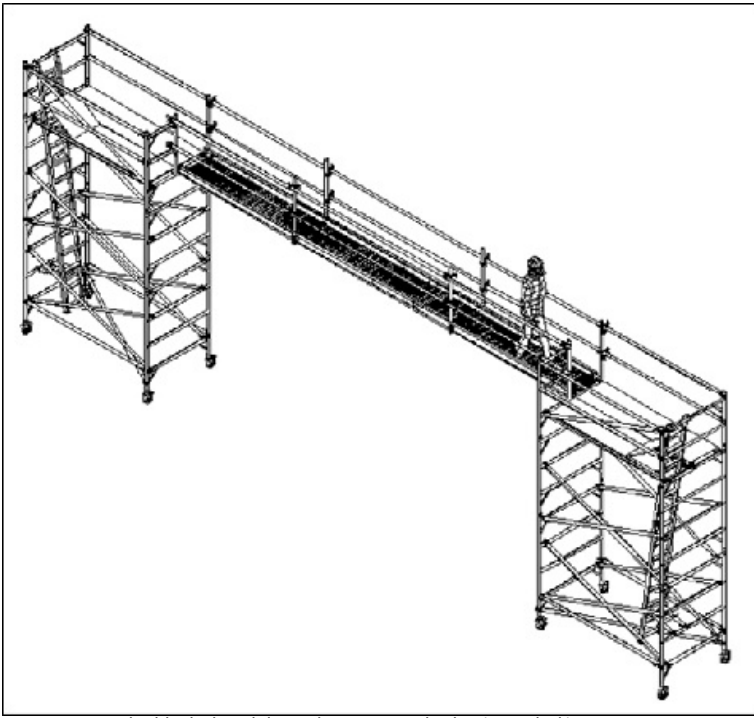


Figure 51: Two double deck mobiles with proprietary bridge (span deck)

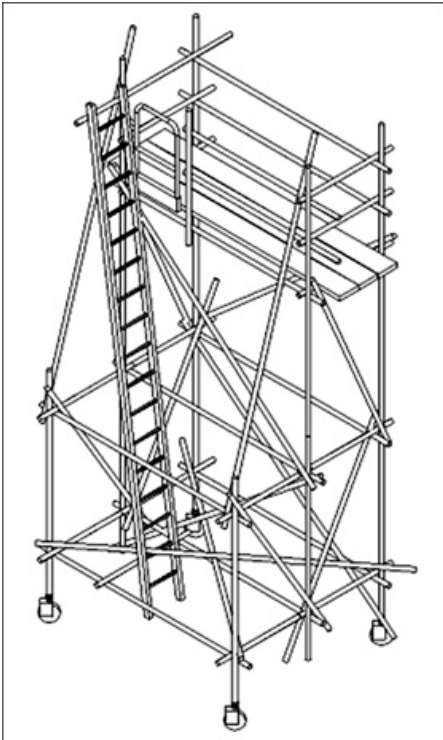


Figure 52: Tube and fitting mobile tower

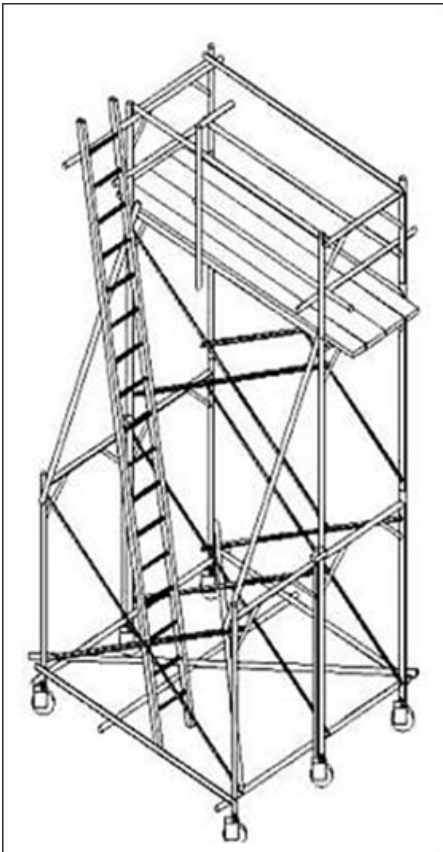


Figure 53: H Frame mobile tower

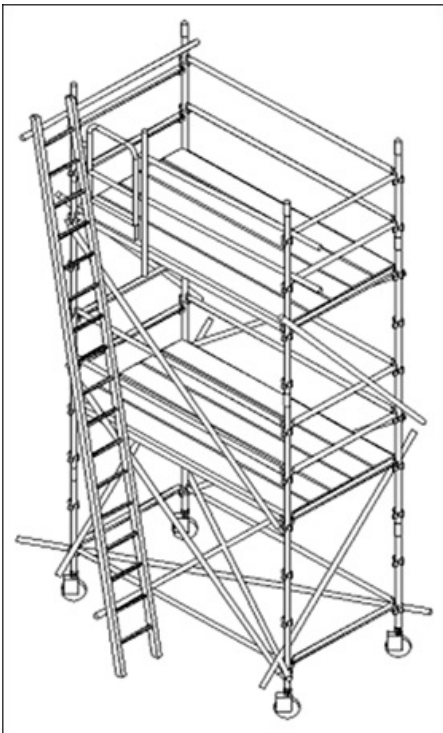


Figure 54: System mobile tower

Note: Only the top lift is a working platform

6.2 Rakers and outriggers

Raking tubes, rakers or outriggers are attached to a scaffold to increase its base width thereby aiding the stability of the scaffold.

Raking tubes must be braced. For tube and fitting scaffolding, ideally attach the tube brace to the standards of the scaffold or to ledgers or guardrails that are connected with double couplers (R/A). Do not attach the raking tube more than 300mm from the standard.

For system or modular type scaffolding, ideally attach the tube brace to the standards of the scaffold or to ledgers or guardrails. Ledgers or guardrails must be locked into place by using a check clip above the joins or pins of the ledgers and guardrails. Do not attach the raking tube more than 300mm from the standard.

The tube brace strengthens the raking tube and prevents it from bending or spreading, see figure 55. Where possible this brace should be above head height. Where the raking tube connects to the ground it is advisable to use a soleboard and baseplate to distribute the point load of the tube. When erecting rakers on soft ground where a soleboard under the raker is not suitable, it is advisable to drive the raking tube into the ground to find a solid base. If this is required a horizontal tube must be connected perpendicular to the raker at ground level using a load bearing fitting. This prevents the raker from being forced further into the ground. Alternatively a tube can be driven into the ground and the raker attached to this tube as close to the ground as possible.

Running a horizontal tube along the raking tube connected with double couplers, then connecting the tube brace to the horizontal tube within 300mm of the raking tube

is acceptable.

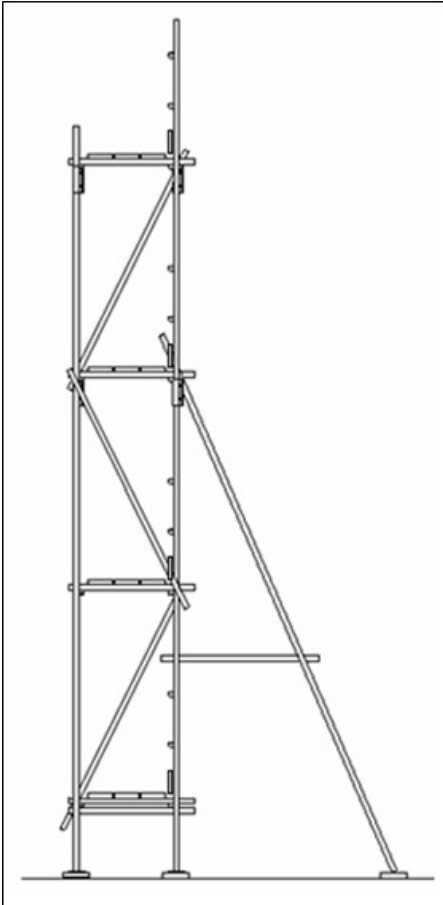


Figure 55: Raker with tube brace

An additional tube can be positioned at the lower working platform height, or as low as possible, for additional stability. Raking tubes may need to be braced in two directions for additional strength.

6.3 Scaffolds for roof edge protection (guardrailing)

This section deals with the provision of roof edge protection using standard scaffolding.

The width of the soffit and the position of the scaffold in relation to the building will determine the method used in order to utilise the outside and inside standards of a scaffold to support the guardrails. A dogleg brace (transverse brace) can be used to stabilise the extended standard. Alternatively, where the roofline, if continued, intersects the inside or outside standard it is recommended that a guardrail be placed within + or - 200mm from this intersection point (see figure 56).

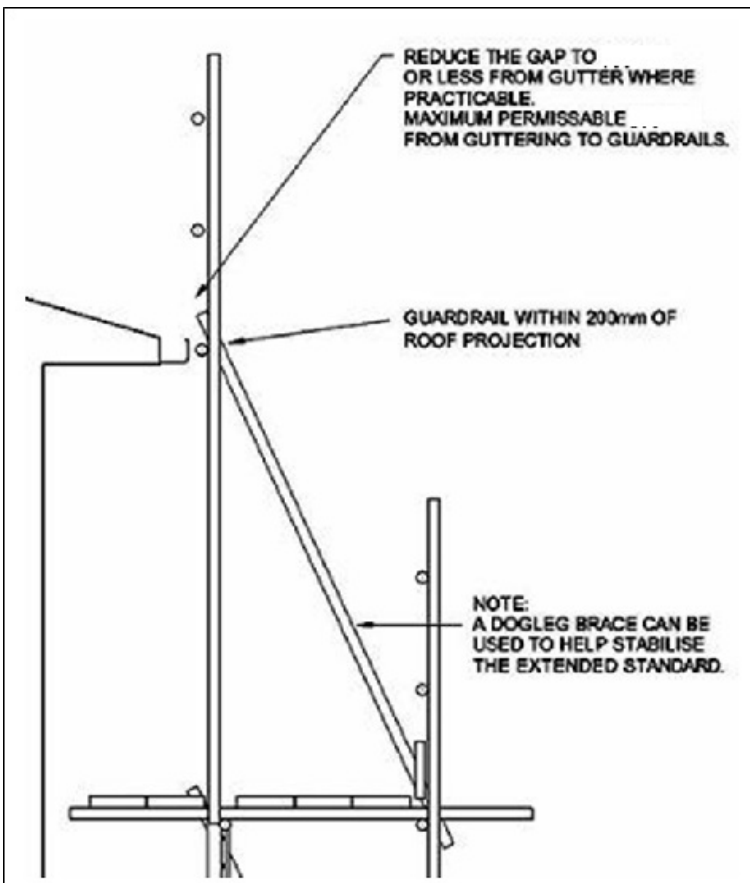


Figure 56: Use of scaffolding for roof protection

6.3.1 Roof pitch less than 25 degrees

A scaffold platform may be positioned to provide roof edge protection. Figure 57 shows the location of the scaffold platform when scaffolding is used to provide guardrailing for roof work and the roof pitch is less than or equal to 25 degrees.

To minimise the risk of serious injury from falling onto a scaffold platform from the edge of the roof locate the platform as near to the gutter line as possible and no more than 1.0m below the lower edge of the roof surface. Guardrails should be spaced at approximately 500mm centres up from the deck with the top guardrail a minimum of 900mm above where the line of the roof pitch intersects the outside standard, as shown in figure 57.

Ensure the scaffold is secured to the building to prevent overturning should someone fall from the roof and strike the guardrails. This can be achieved by tying to the building, using raker bays or raking tubes, or by widening the base of the scaffold.

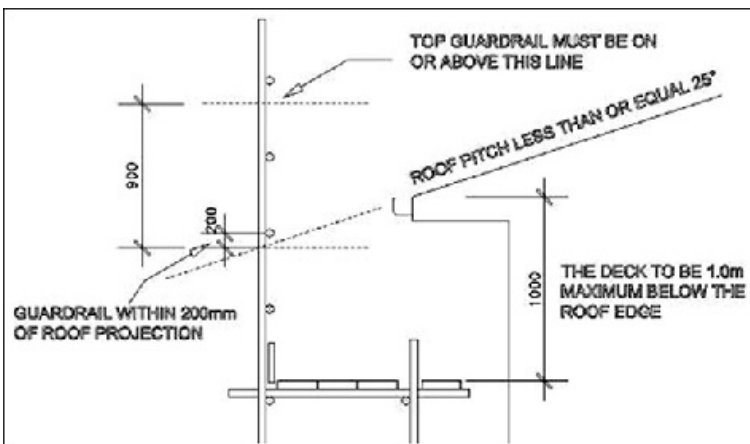


Figure 57: Location of scaffold platform for edge protection (roof pitch 25° or less)

6.3.2 Roof pitch greater than 25 degrees

When a roof slope exceeds 25 degrees the potential for sliding down the roof becomes greater. If a scaffold platform is used to provide guardrailing in this situation it is recommended that the working platform be placed as close as practical to the edge of the roof + or - 200mm. This can also be achieved by using a hop up bracket from the outside standard at the roof edge line. The guardrailing should be fitted as previously shown. It is recommended that a gap of no more than 100mm be left between the deck and the finished gutter. If this cannot be achieved position the deck as close as practical to the gutter, but it must not exceed 200mm from the gutter line to the leading edge of the plank (see figure 58).

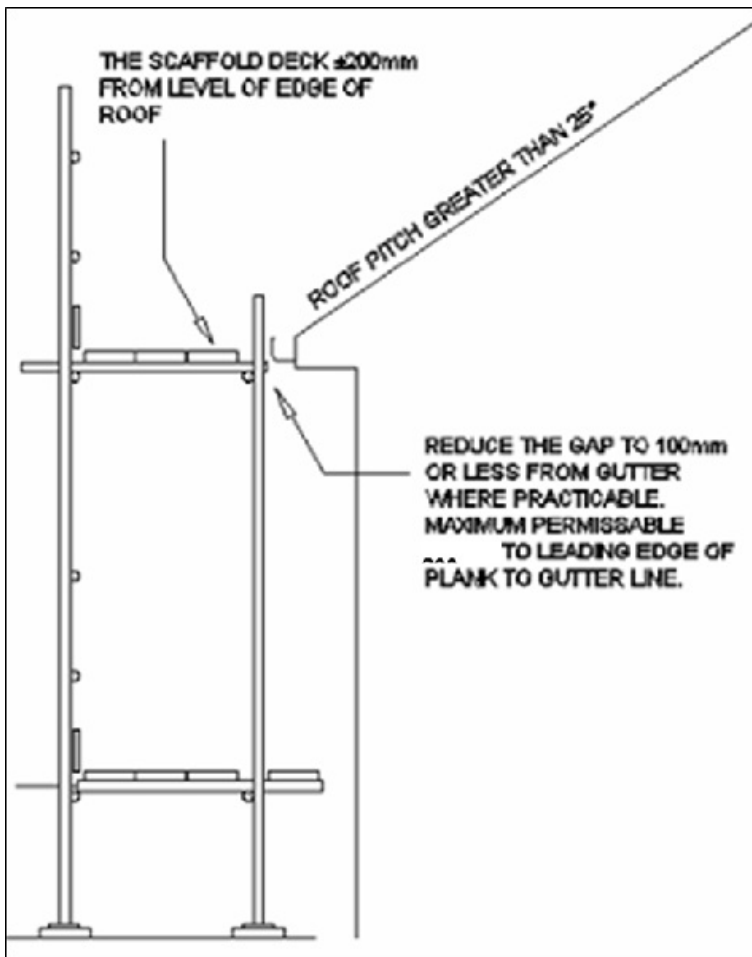


Figure 58: Location of scaffold platform for edge protection (roof pitch greater than 25°)

Ensure the scaffold is secured to the building to prevent overturning should someone fall from the roof and strike the guardrails. This can be achieved by tying to the building, using raker bays or raking tubes, or by widening the base of the scaffold.

6.3.3 Roof edge protection for gable ends

Edge protection must be provided as close as practicable to the gable ends with the scaffold no more than 300mm from the structure. The midrail should be approximately 500mm above the line of the gable (slope of the roof) and the top guardrail 1000mm above the line of the gable.

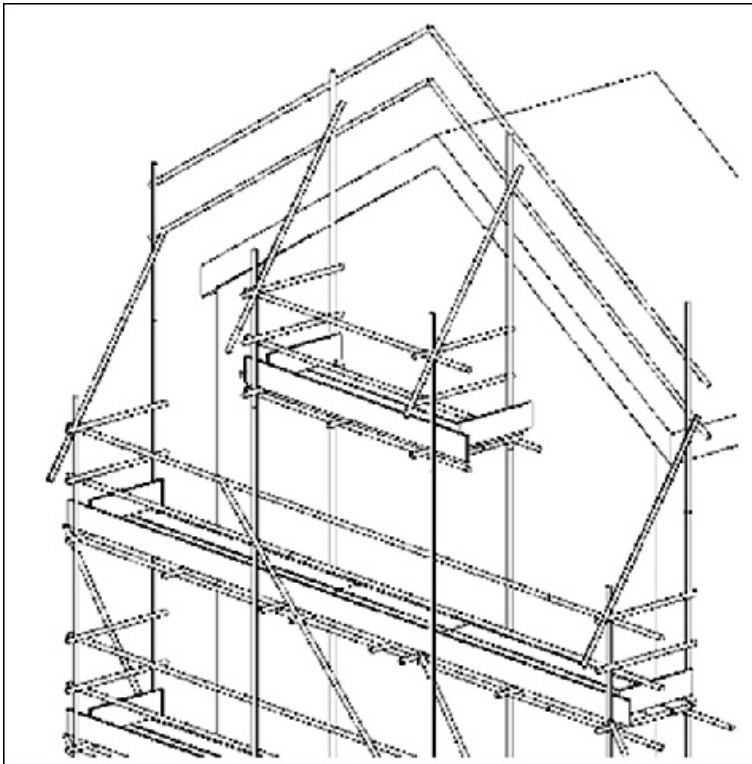


Figure 59: Edge protection at gable ends
Access omitted for clarity.

6.4 Scaffolding over verandahs, gantries or roofs

Scaffolding over verandahs, gantries or roofs can be potentially hazardous due to a variety of different hazards associated with scaffolding on, through or over a structure. In these circumstances, once you have determined the requirements of the scaffold the following shows some of the options available to you:

1. Scaffold directly through the verandah e.g. standards to pass through the verandah.
2. Backprop the verandah directly below each standard. This transfers the scaffold weight through the verandah to the backpropping directly below each standard.
3. Backprop the verandah when the standards and backpropping are not directly in line. This may require using a beam system on top of the backpropping under the verandah and a similar beam system on top of the verandah below the standards. This method is used to transfer the load of the standard along the beam system when the backpropping has to be offset.
4. Scaffold directly on the verandah. An engineer must certify that the verandah can support the imposed loads of the scaffold and the DOL may request to inspect the engineer's certificate.
5. Erect a heavy-duty gantry over the verandah and scaffold from the gantry.
6. Cantilever out a window or opening above the verandah to support the scaffold.
7. Hang a scaffold from the parapet to form a hanging scaffold.
8. Suspend a scaffold (swinging stage) or (boatswain's chair).

It is advisable to get an engineer's certificate on any backpropping required other than backpropping directly below the standards when the verandah supports are clearly shown. It is recommended that all scaffolds erected on verandahs, gantries or roofs be checked by a chartered engineer, thereby transferring the liability to the engineer to state that the verandah, gantry or roof can support the imposed loads.

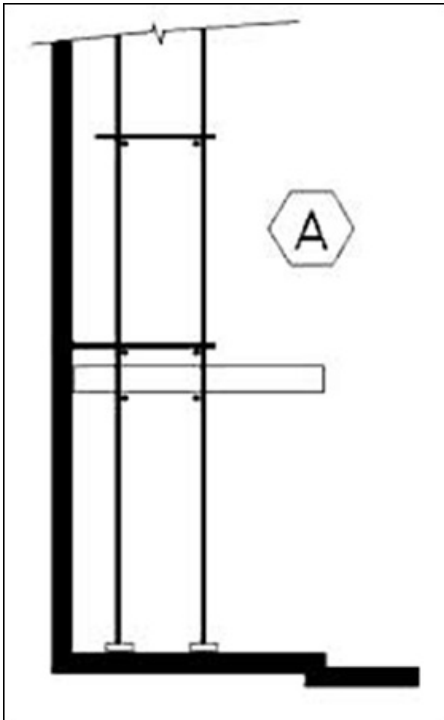


Figure 60: Scaffold through verandah

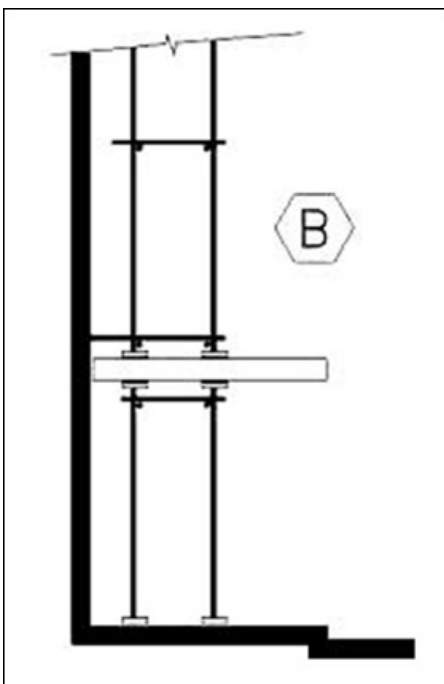


Figure 61: Backprop directly below standards

With backpropping, either an engineer will certify the position and spacing of the verandah support to ensure that the weight of the standards is transferred directly onto the back propping or you will have to expose the verandah supports. Do not assume that the supports within the verandah that are best to be used to transfer weight run perpendicular to the building.

Figure 62 shows one leg of the scaffold going through the verandah. The inside leg of the scaffold is supported by the verandah or load is transferred to the tie. An engineers certificate would be required to ensure the verandah could support the load of the inside standard. It would not be required if you could ensure that the outside standard and the tie arrangement could support the intended load.

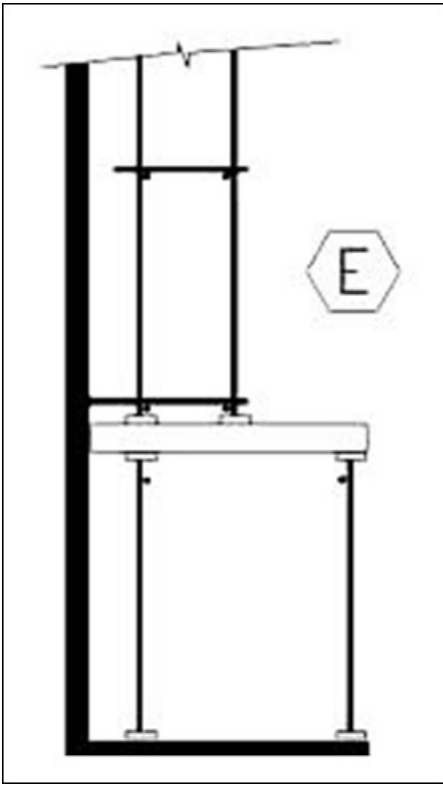


Figure 64: Inside standard directly backpropped, outside of verandah supported

Figure 65 shows a scaffold erected above a verandah with only the outside of the verandah backpropped. An engineer's certificate would be required.

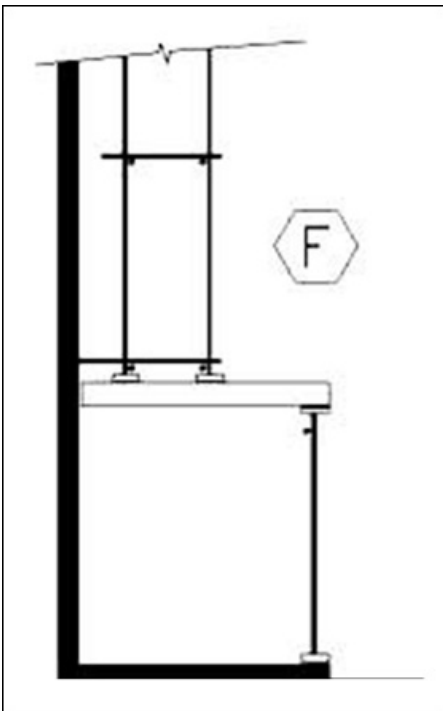


Figure 65: Outside of verandah backpropped

Figure 66 shows a heavy duty steel gantry erected on the footpath with the scaffold erected above. The steel gantry would have to be designed by a chartered engineer.

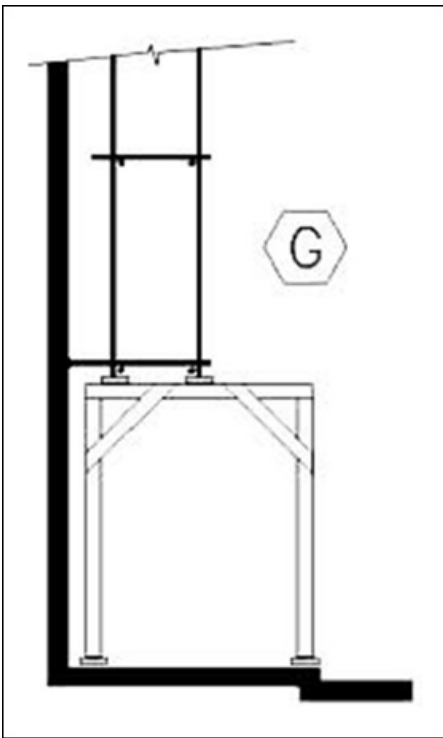


Figure 66: Gantry supports verandah

Figure 67 shows a scaffold erected directly on a verandah. In this circumstance verandahs must be checked by a chartered engineer.

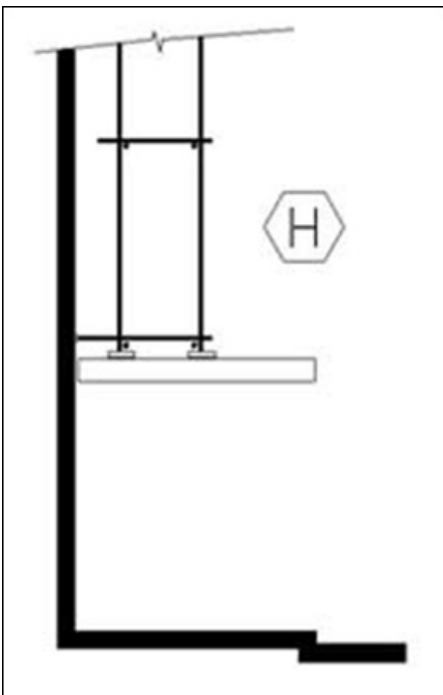


Figure 67: Scaffold directly on Verandah

6.4.1 Supporting structures

The scaffold needs to be designed to ensure that the load placed on the supporting structure under the most adverse circumstances does not adversely affect its structural integrity or the serviceability of the scaffold during the period of its service. Where necessary, the supporting structure needs to be strengthened to ensure it has sufficient strength and rigidity to accommodate the imposed loads. Provision may be required to prevent damage to the supporting structure.

Where soleplates are used they have to be designed to have sufficient strength and rigidity to distribute the load to the supporting structure.

6.5 Cantilevered scaffolds

A cantilevered scaffold is an independent tied standing scaffold constructed in accordance with the BPG but erected from cantilevered beams (RSJ, UB, soldiers, trusses, etc) out from a building or structure. Cantilevered scaffolds using a beam type arrangement (as seen in figure 68) must be designed by a chartered engineer.

Needles should be secured by through bolting (dividag bars), anchoring, or propping between the needle and the floor above. Where possible the inboard part of the needle should be at least 3 times the outboard length. The base of the scaffold should be tied to the needle as close as practical to the locating Uhead jack.

All practicable steps need to be taken to protect the area below the cantilever during the erection and dismantling process. Additional precautions such as full planking and plying the base lift of the scaffold, kickboards and screening should be used to prevent the dislodgement of materials from the working platforms.

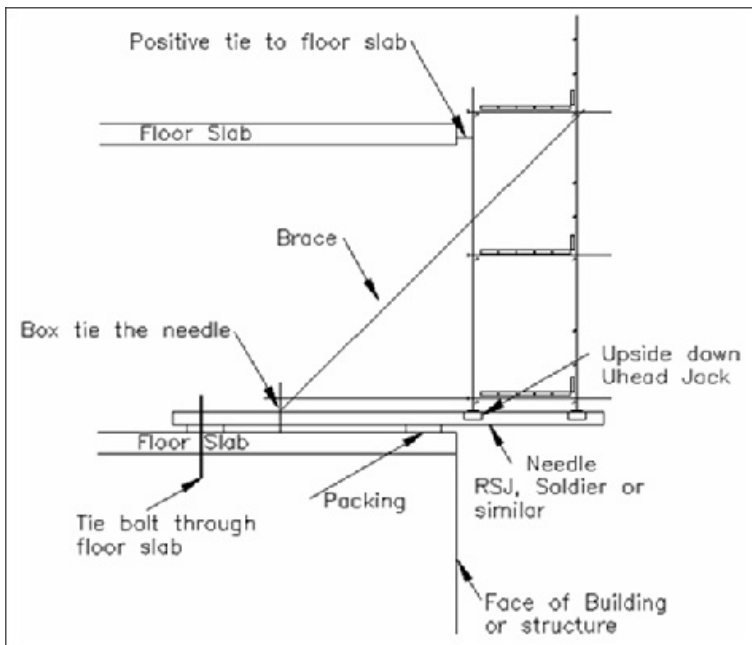


Figure 68: Cantilevered scaffold using a beam arrangement

Figure 69 shows a scaffold erected out a window opening of a building. A propping tower is erected between two concrete floors with a needle transom (tube) extending through the opening. The cantilever effect of the weight of the intended scaffold is transferred to the lower window opening as shown.

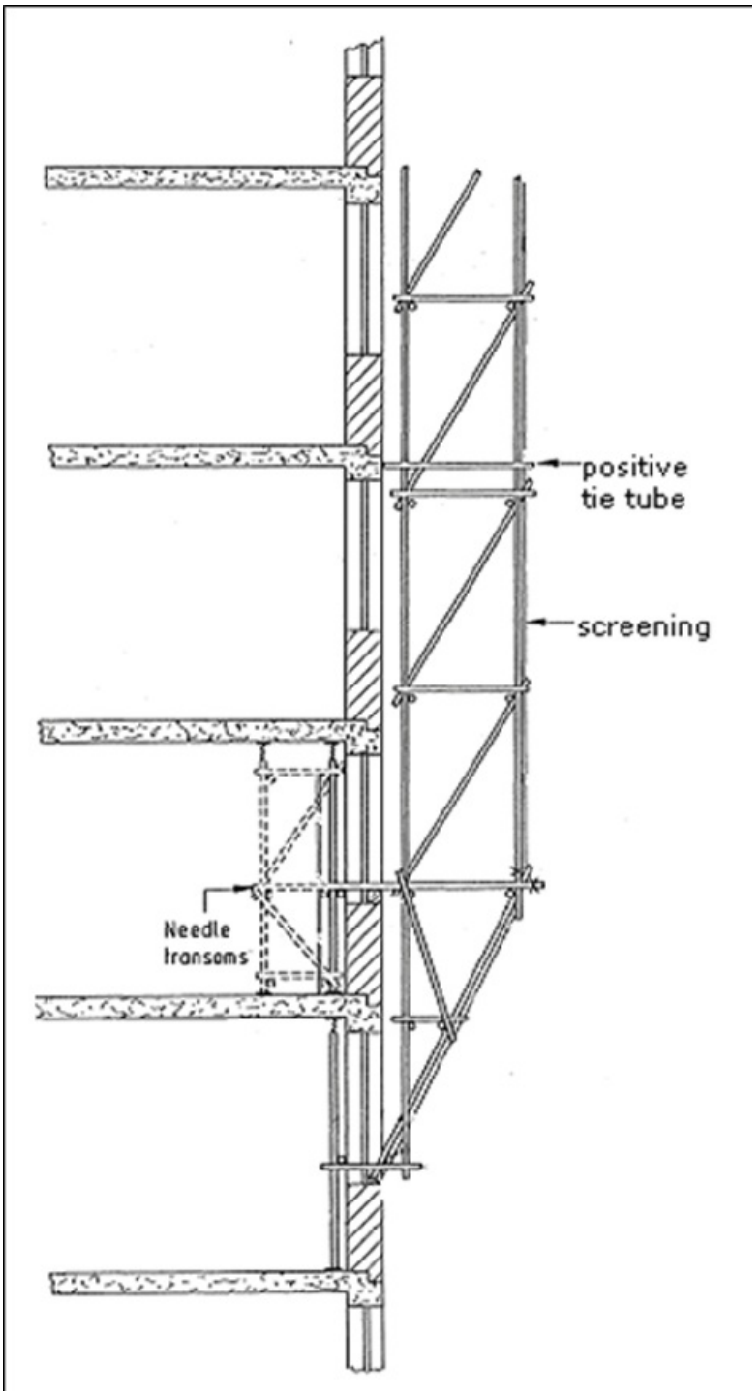


Figure 69: Cantilevered scaffold - use of propping tower for weight transference

Figure 70 shows a proprietary mobile tower with cantilevered working platform. The structure is stabilised by use of a weighted raker arrangement at the base.

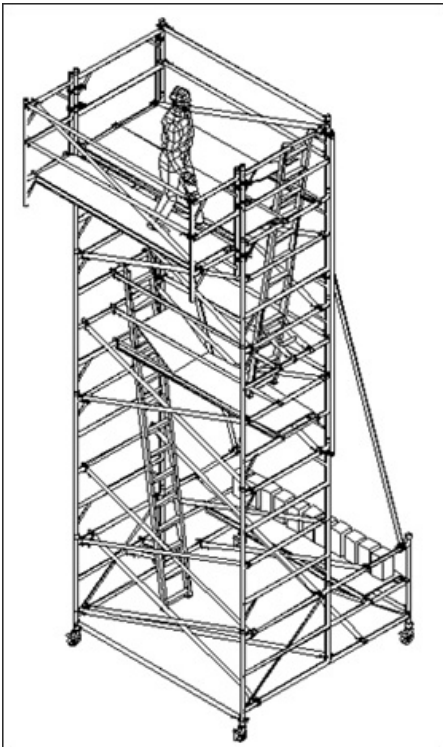


Figure 70: Mobile tower with cantilevered working platform

6.6 Heavy duty gantries

Heavy-duty loading gantries or pedestrian gantries should be designed by a chartered engineer and require the following basic components:

- Primary beams housed in Uhead jacks to transfer load directly down the standard.
- Primary beams connected to the Uhead jacks.
- Secondary beams at no more than 600mm centres.
- Secondary beams connected to primary beams.
- Top surface either plied, planked or both - can use formwork panels.
- Adequate longitudinal bracing.
- Adequate transverse bracing or a rigid tie system to a structure.
- Adequate edge protection (toeboard, guardrails, brick guards or screening).
- Adequate traffic protection for the gantry (water filled barriers, etc).
- Adequate distance from any roadway.

Check with local authorities for regulations regarding distances from roadways, footpath permits and minimum width and clearance requirements for pedestrians.

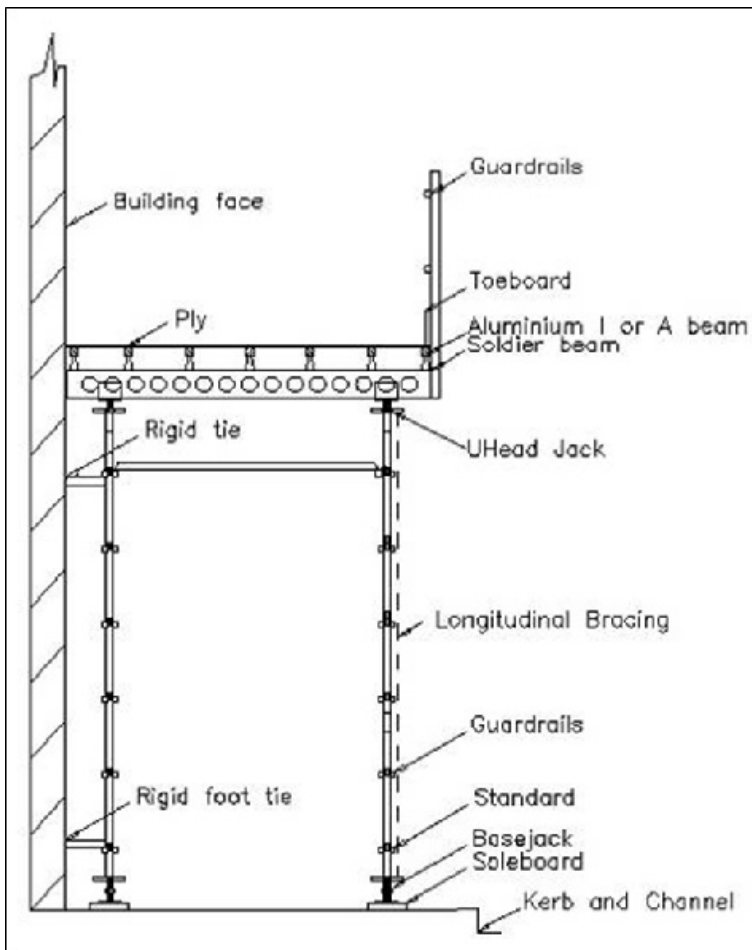


Figure 71: Heavy-duty gantry erected from proprietary scaffolding

6.7 Vessel scaffolds

The term vessel scaffolding is generically applied to all scaffolding that encompasses the entire face of a vessel (e.g. a tank or chimney). Tank scaffolding is commonly used as a particular term to describe vessel scaffolding around a tank. Figures 72 and 73 show a typical plan view and isometric view of a completed vessel scaffold.

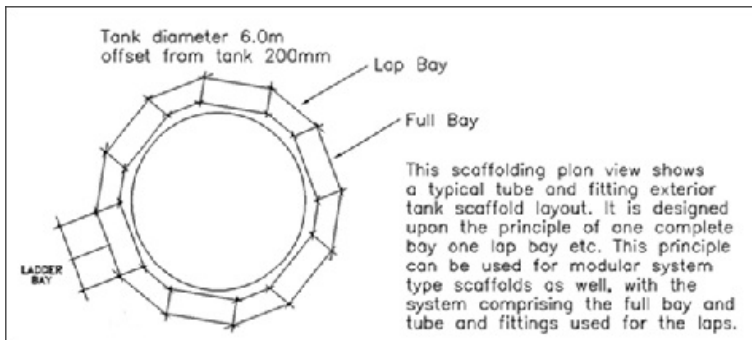


Figure 72: Vessel scaffold - plan view

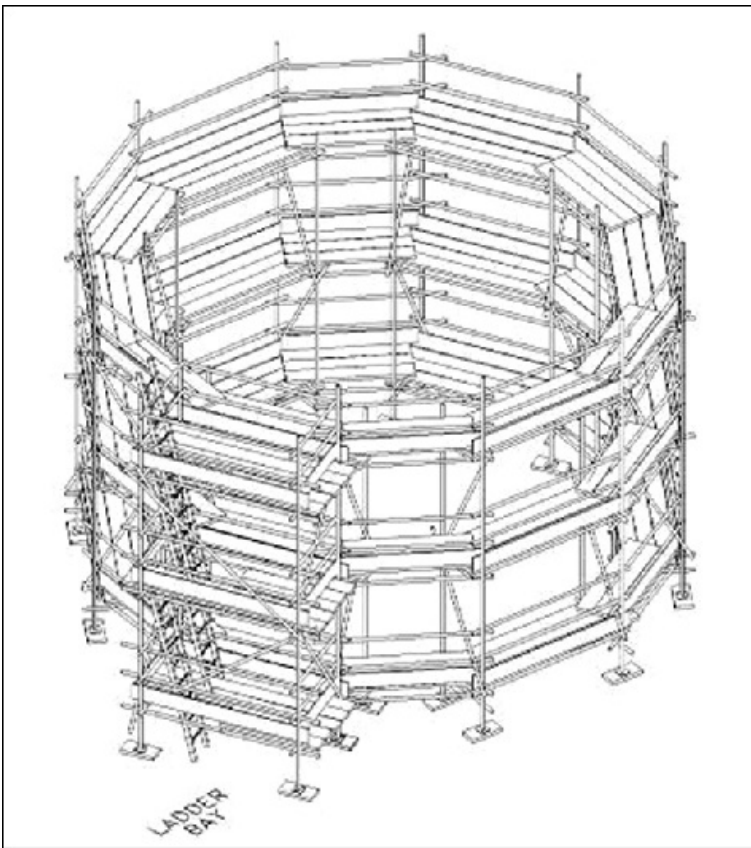


Figure 73: Vessel scaffold - isometric view

6.8 Hanging scaffolds

A hanging scaffold is a scaffold hung from a structure that is static in the vertical plane; it can not be raised or lowered by any means. Hanging scaffolds can be hung from tubes, wire ropes, ropes or chains etc.

Hanging scaffolds are classified as a special duty scaffold and should be designed and notified as such.

Hanging scaffold foundations are opposite to that of a standing scaffold. Particular attention must be paid to whether the structure the hanging scaffold is to be attached to is able to support the hanging scaffold and its intended loads.

6.8.1 Tube and fitting hanging scaffold

Hanging scaffolds must have additional check clips immediately above the suspension point and immediately below the bottom ledger. Generally a 'T bar' type arrangement should be used approximately 1.0m below the bottom ledger for the scaffolder to stand or sit on while the base lift of the scaffold is erected and dismantled. The T bar should have a check clip under it. Using a double coupler with the gate or flap open is not safe. The double coupler is not designed to take a persons weight and it has been known for the gate or flap to shear off the pin.

Beam clamps used to secure tubes to a beam, rolled steel joist (RSJ), universal beam (UB), etc should, where possible, be used in tandem on either side of the beam and ideally create a box tie around the beam.

It is possible to erect a hanging scaffold lower than the longest standard. In a tube and fitting hanging scaffold joiners must never be used to lengthen a standard. However additional standards may be attached to a minimum of two horizontal ledgers or guardrails within 300mm from the standard. Check clips are used above the ledger and below the ledger supporting the standard.

In system type scaffold the standard must be either joined with high tensile bolts or pins and/or spliced together with tube and fittings. A splice arrangement to connect two standards in tension should have at least two parallel couplers on either side of the standards join connecting each standard to the tube.

Steel Wire Rope (without eyes) used as a hanging scaffold should be fixed to a shackle by a wedge type socket together with a wire rope grip (bull dog clip) fixed to the rope tail. Alternatively, a thimble eye splice can be made using a double base clamp or three fist grip rope clamps. Wire rope grips (bull dog clip) should not be used to secure wire ropes that support persons or substantial materials. Wire rope grips must be correctly applied in order that the stresses within the terminal are evenly distributed. Always fit the grips the same way round, with the bridge on the loaded or long part of the rope and the U-bolt on the short part. On any wire rope a minimum of three grips must be used and spaced at a distance, centre to centre of grips, of six rope diameters.

Steel wire ropes or chains secured around the sharp edges of beams should be protected from damage by beam chaffers. Also ledgers supported from the eyes of slings or from shackles should be provided with a coupler on either side of each support point to prevent the ledger from sliding. Shackle pins must be moused to prevent unwinding.

Figure 74 shows a hanging tube and fitting scaffold supported from a beam. As here, always ensure that the putlog or transom above the steel beam is connected with beam clamps or box the beam with tube to prevent movement.

While check clips are placed on the standards above the top putlog or transom, the scaffold must also have check clips below the bottom putlog or transom and below the T bar from which the scaffolder erects the scaffold.

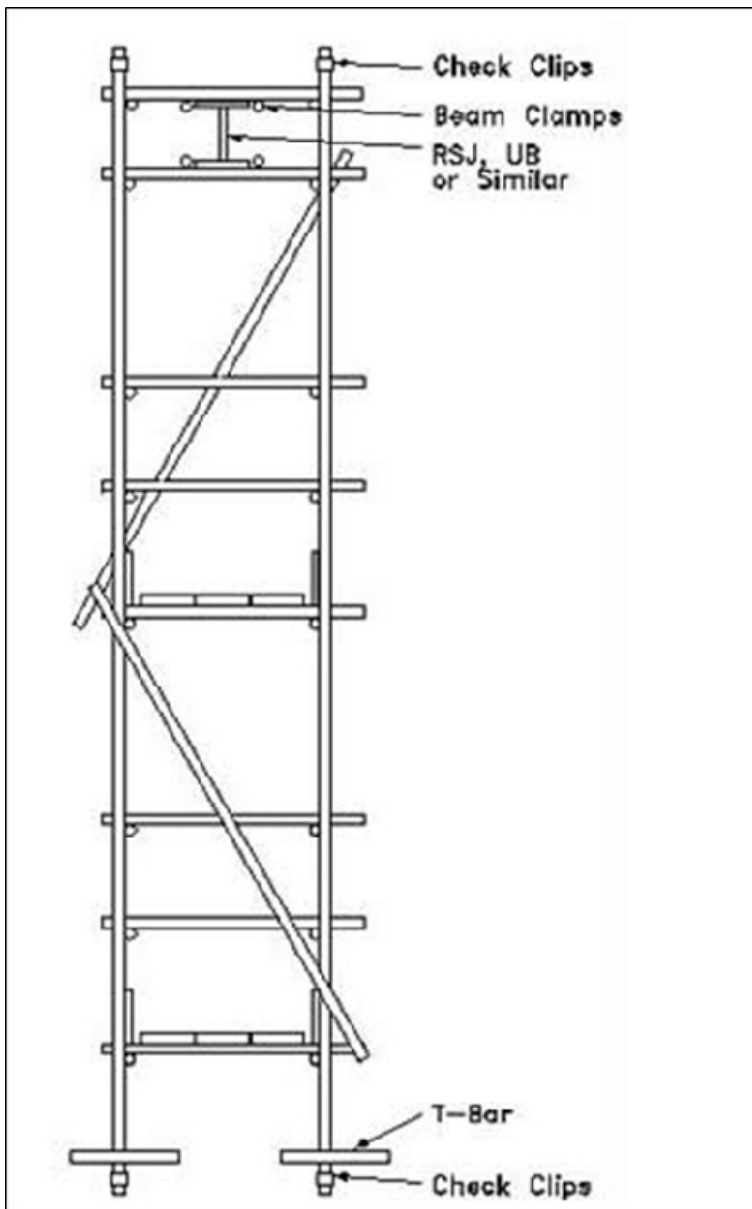


Figure 74: Above: Hanging tube and fitting scaffold hung from a beam

6.9 Screening or containment sheeting

Screening is used for both safety and environmental purposes. Where work is carried out close to pedestrian or vehicular access, scaffolds that are fully screened can minimise both the risk to the public and the area lost to public access. Note that toeboards must still be fitted to screened scaffolds

When selecting screening consider the following:

- What degree of protection is required?
- Is the containment of dust a requirement?
- What chemicals are to be used from the scaffold?
- The degree of flammability of the screening.
- The ventilation of the contained space (porosity).
- The need for light transmission.
- The size of sheets or screen sections.
- The requirements for fixing the screening.

Scaffolds fitted with screening have increased environmental loads (wind loads, rain loads, etc) and increase the dead load of the scaffold. Consequently additional ties are required for screened scaffolds. It is recommended that significant scaffolds or those exposed to extreme weather conditions be designed by a chartered engineer.

The design of a screened scaffold should consider the:

- Weight of the screening.
- Environmental load on the scaffold and the supporting structure.
- Position of the screened scaffold in relation to other structures.
- Fixing in respect to the strength of the screening.
- Ability of the fixing to fail if experiencing forces (especially wind) beyond the capacity of the ties or screening to withstand such forces. A "fail capacity" will prevent the scaffold or structure being damaged.

When fixing screening:

- Only fix screening from fully decked and guardrailed platforms.
- Screening should be fitted to the outside of the scaffold unless specified.
- Flush the outside of the scaffold to prevent tubes etc from protruding.
- Screening should be continuous either by using sufficient overlap (preferable) or by carefully butt joining the screening.
- Always secure the top edge of the screening before fixing the bottom edge.

- Use a tag line in windy conditions to control the screening during fixing.
- Keep the screening sufficiently taut.
- Screening should be lapped under from the top for containment and lapped over from the top for protection.
- Always screen the ends of the scaffold as close as practical to the building or structure to prevent the wind getting behind the screening.
- Screening blown into a scaffold has the scaffold as a framework to support it. Screening blown away from the scaffolding framework only has the ties to support it.

The following are some common materials used for screening or containment:

- Shade cloth.
- Monoflex.
- Shrink wrap.
- Plastic.

Hessian must not be used as screening as it is not fire retardant.

While there are different varieties of shade cloth, wind is able to pass through it depending on the screening's porosity. This not only reduces the wind loading on the scaffold and structure it also allows ventilation and light.

Products such as monoflex, shrink wrap and plastic almost completely contain the scaffold. They can therefore be fixed to create a negative air situation or special containment for asbestos removal. However they greatly increase the wind load and pressure on the scaffold and structure. Ventilation is a problem with these products.

When using proprietary scaffolding that does not have a positive joint between the vertical standards in conjunction with screening, it is recommended that joints be spliced or that additional bracing be provided across the joints to prevent uplift of the join.

6.9.1 Industrial safety nets

Industrial safety nets are sometimes used as an effective means of fall protection for people working at height, particularly where it is not practical to provide scaffolds or temporary guardrailing. They are generally manufactured from synthetic fibre knotted lines with a mesh size of about 100mm. These lines are attached to perimeter cords. Safety nets are usually available in 3.0m x 4.0m sizes or larger.

Each net will have a label that will state the maximum fall distance for which the net has been designed. This is usually between 1.0m and 6.0m.

It is generally accepted that securing a safety net to a building, structure or scaffold requires input from a chartered engineer, as the impact loads applied to a safety net require the supporting structure or scaffold to support these loads.

Refer to BS 3913 for connection methods, possible impact loads etc.

Figure 75 shows a plan view of a safety net cantilevered between two floor slabs. Figure 76 is a section view of the same structure.

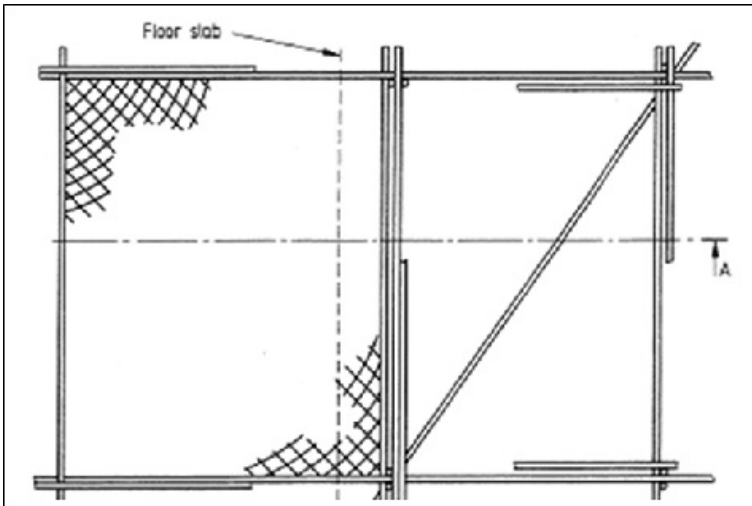


Figure 75: Plan view of safety net cantilevered between two floor slabs

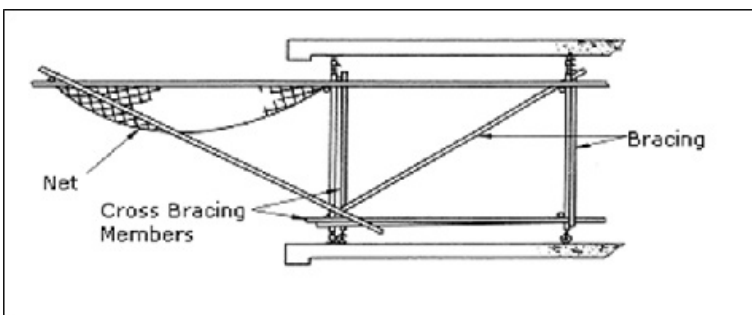


Figure 76: Section view of safety net cantilevered between two floor slabs

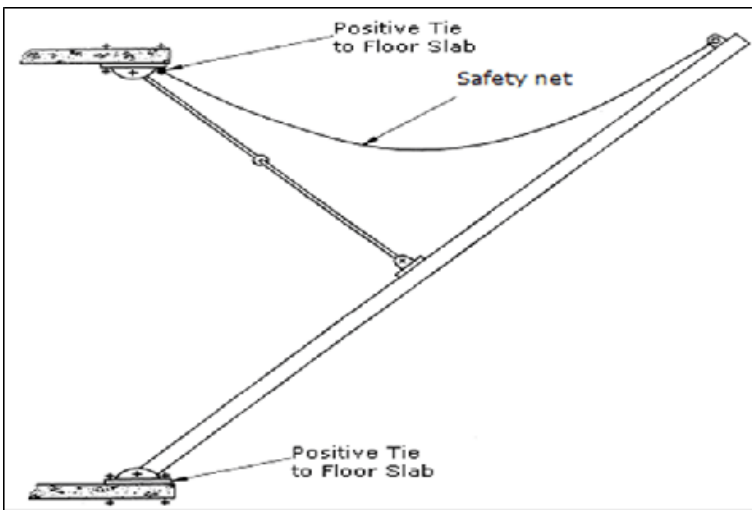


Figure 77: Typical arrangement of outrigger perimeter net

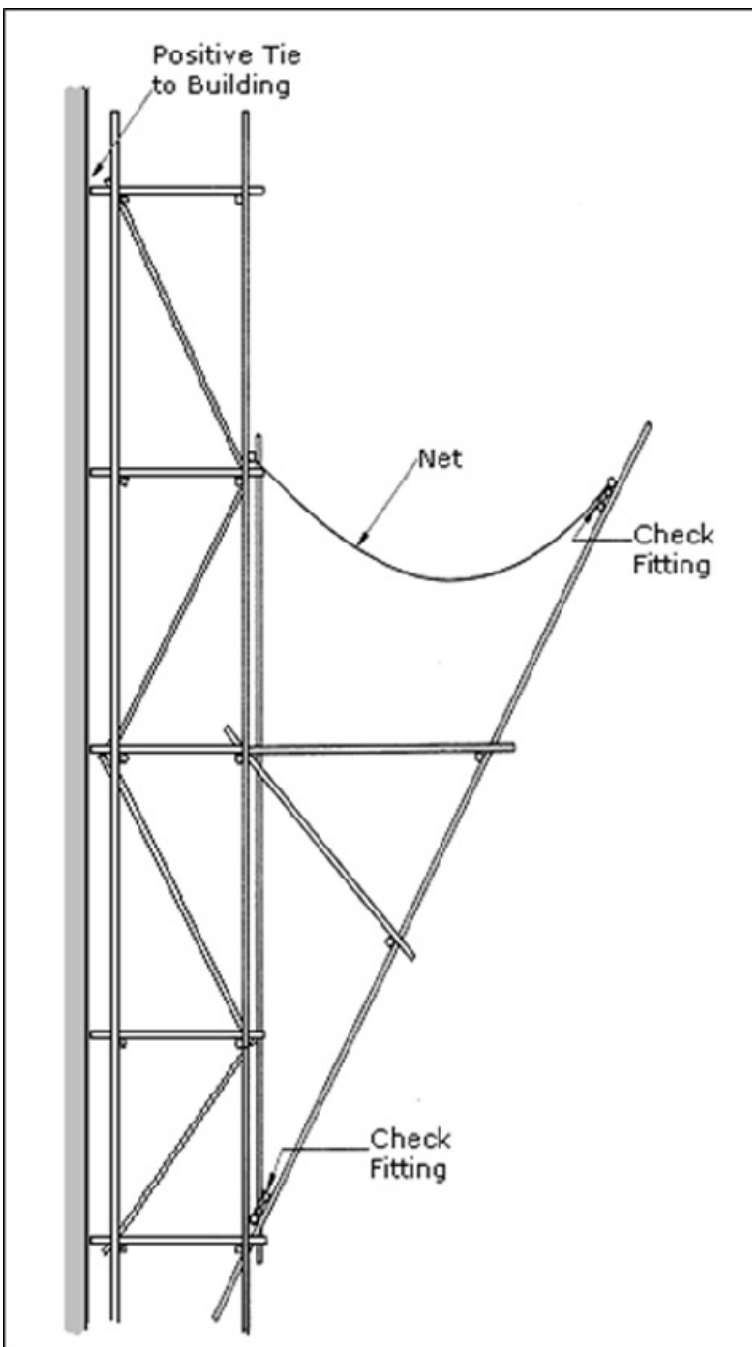


Figure 78: Typical net and its supporting framework

6.10 Mechanical lifting appliances on a scaffold

Hoists, winches and other lifting appliances may be mounted on scaffolding only if the scaffold framework is adequate in strength, or is specially strengthened and tied back, to take the imposed loads, both dead loads and live loads, to a maximum of 250kg.

The strengthening of the scaffold must be calculated as a minimum of at least 2 times the lifting capacity of the appliance.
Where the lifting capacity exceeds 250kg the scaffold must be strengthened in accordance with requirements imposed by a chartered engineer.
Figures 79 and 80 show typical scaffold supported materials or appliance hoists.

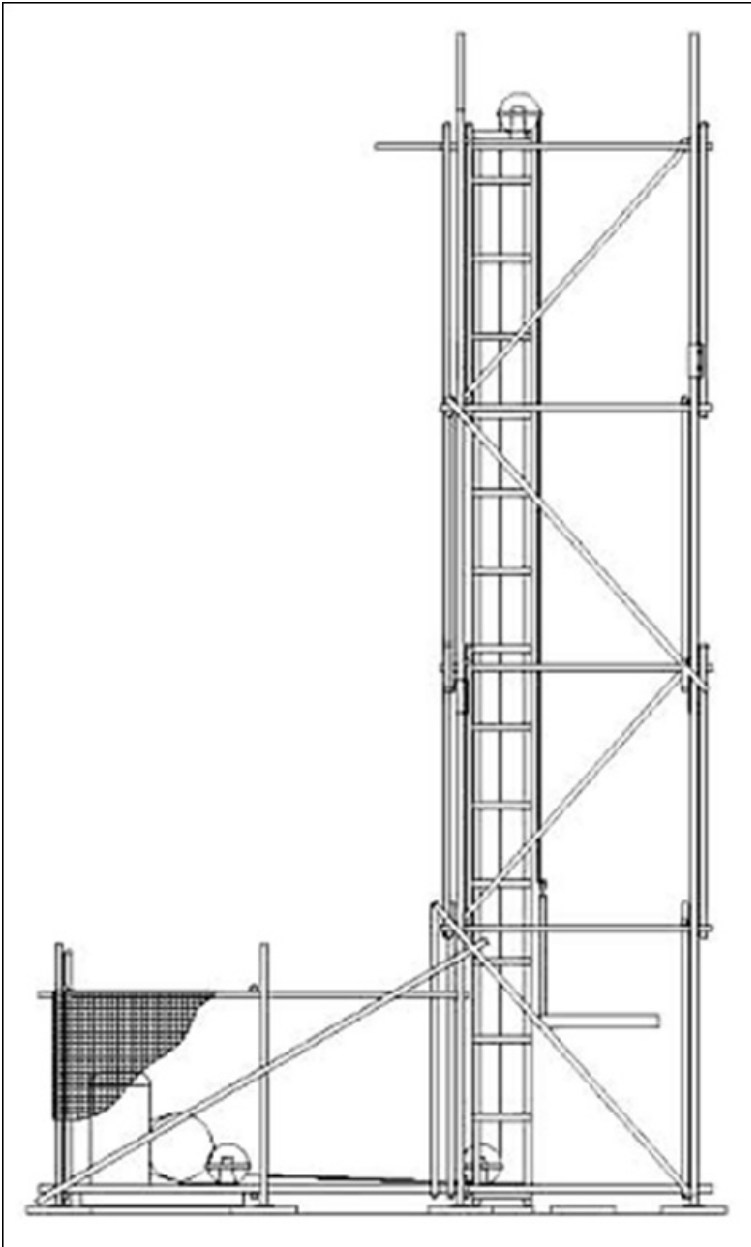


Figure 79: Mechanical materials hoist supported by a scaffold – side view

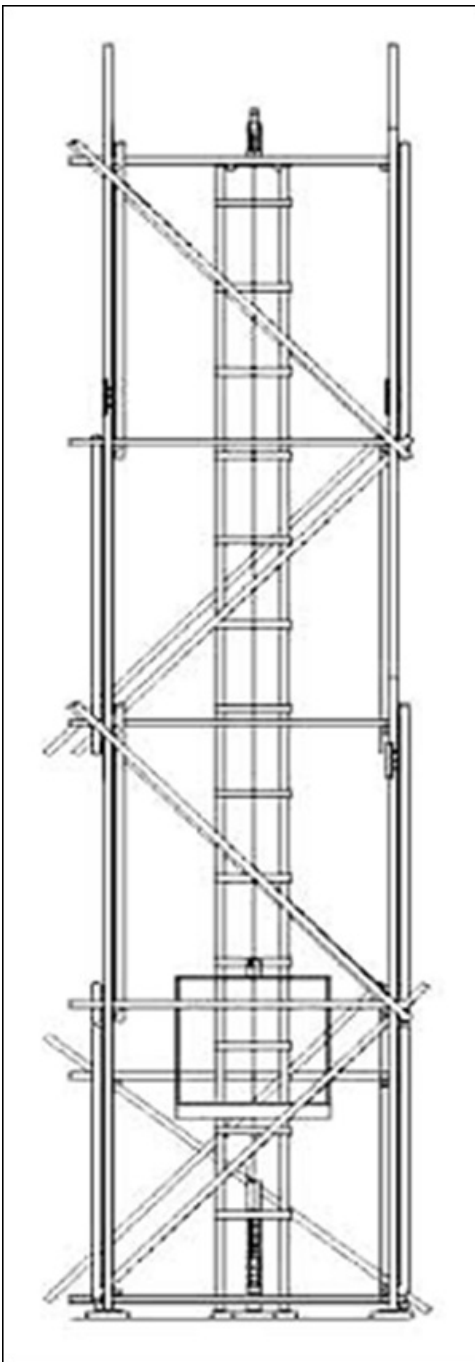


Figure 80: Mechanical material hoist supported by a scaffold - front view

6.10.1 Gin wheels

Gin wheels are used as lifting appliances in conjunction with ropes. They come in a variety of designs such as hook or ring types and are attached to a scaffold or structure to raise and lower a load. The maximum load permitted to be raised or lowered from a gin wheel is 50kg. The scaffold must be made stable enough to compensate for the weight of the intended loads by way of additional ties to the building or rakers.

The rope used for a gin wheel should preferably be a natural fibre rope (manila) with a minimum diameter of 16mm. Smaller diameter ropes can be spliced into this main rope to provide a more user friendly diameter rope to tie onto equipment. It is common to end splice the main gin wheel rope to form an endless rope with two smaller diameter ropes spliced into the main rope for attaching equipment.

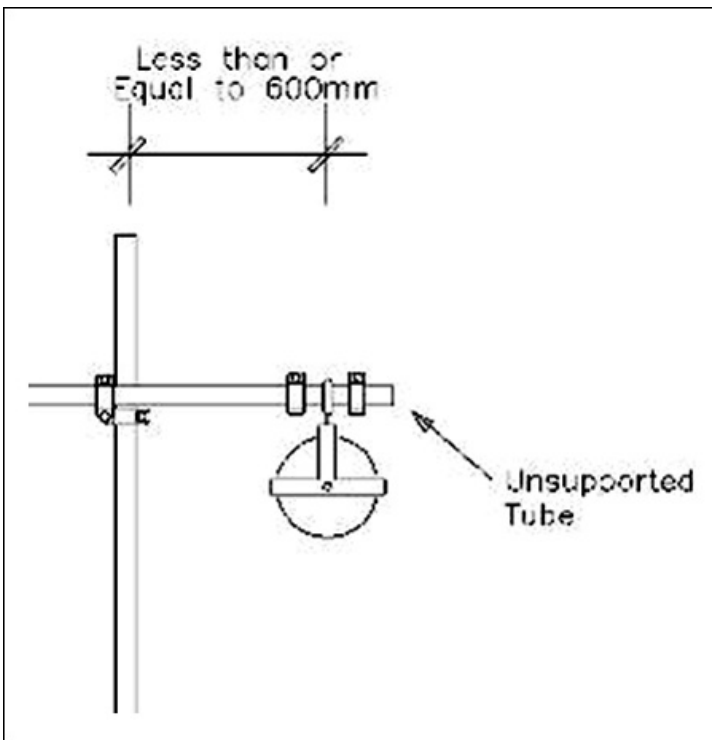


Figure 81: Gin wheel less than 600mm from standard (ring attachment)

If a scaffold tube is cantilevered from a scaffold, including to support a gin wheel, it must be attached to standards using double couplers (R/A). The gin wheel must not be connected to this tube any more than 600mm from the outer standard unless supported by a brace (see figure 81). Here a gin wheel with a ring attachment goes over a scaffold tube but is locked in place with two scaffold fittings. If the gin wheel is less than 600mm from the standard then the tube does not need to be supported. Note that unsupported tube (putlog) must be connected to two standards (excluded for clarity in figure 81).

Figure 82 shows a gin wheel more than 600mm from the standard. The tube supporting the gin wheel must be braced as shown. Be aware of the overturning pressure this will place on the scaffold. Hence an additional tie is included as shown.

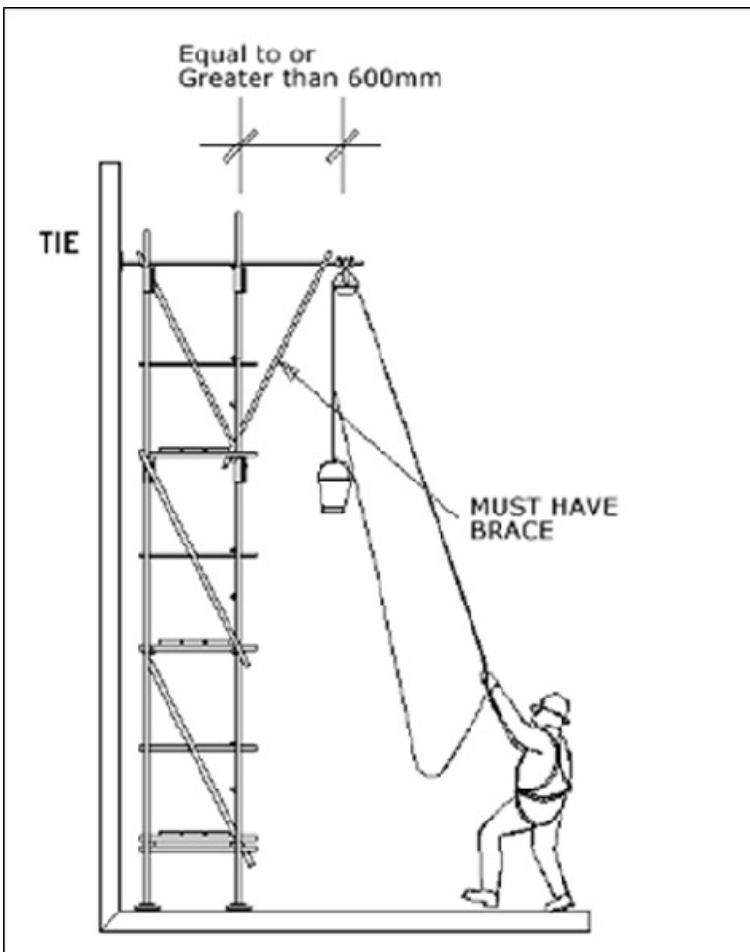


Figure 82: Gin wheel more than 600mm from standard

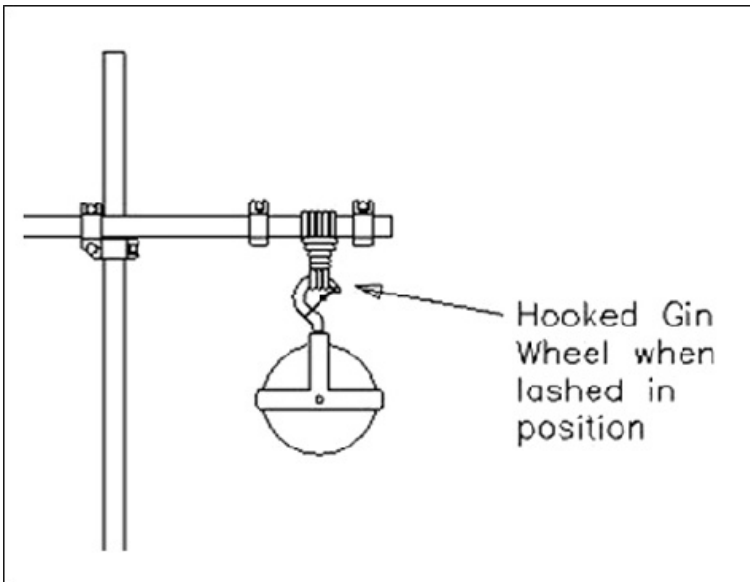


Figure 83: Gin wheel less than 600mm from standard (lashed)

Figure 83 shows a gin wheel with a hook arrangement lashed in position. The unsupported tube (putlog) must be connected to two standards. This is excluded for clarity in figure 83.

6.11 Mast-climbing work platforms

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

When working with mast climbers:

- Always check manufacturer's specifications and instructions.
- If in doubt get a chartered engineer to check anchor points or the means of tying the mast-climber to the supporting structure.
- Check that the safe working load is clearly marked.
- Check the foundation can sustain the intended loads.
- Check that the base of the mast-climber has adequate protection.
- Ensure the mast is erected vertically and all approved ties are in place.
- Include testing requirements, pre-operational checks and servicing requirements.

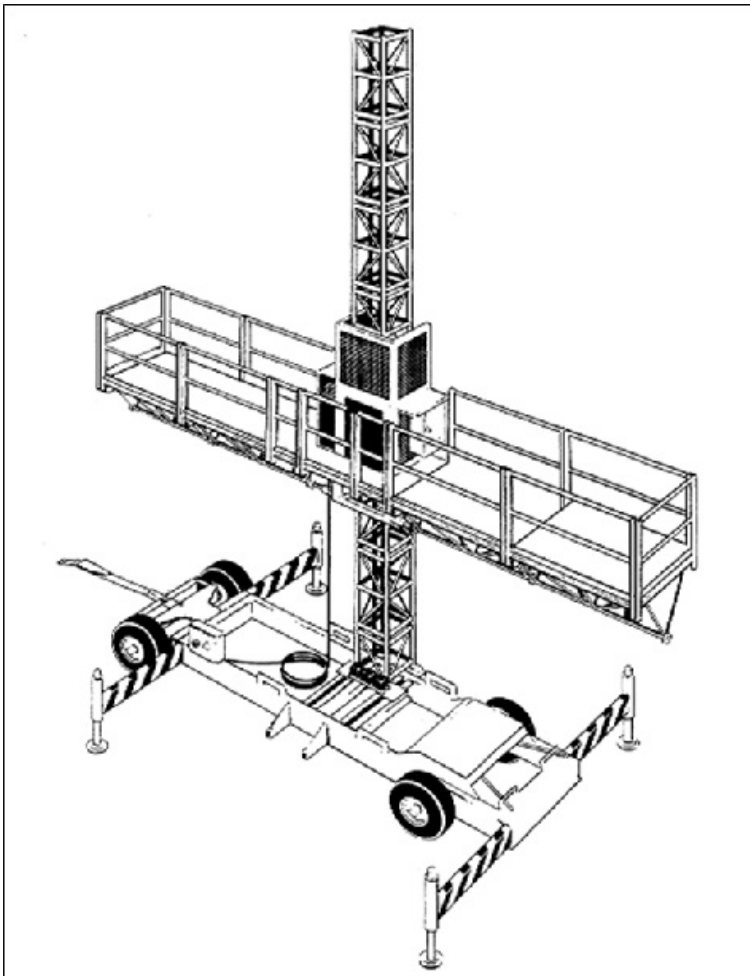


Figure 84: Mast climbing work platform

6.12 Barrow ramps

Barrow ramps are a particular type of sloping platform. They contain cleats alongside an uncleated board or channel. This allows wheelbarrows or wheeled loads to be moved easily while guarding against slipping.

Figure 85 shows a typical barrow ramp erected using tube and fitting scaffold. Note the uncleated middle plank for the wheel of the wheelbarrow to run up and down.

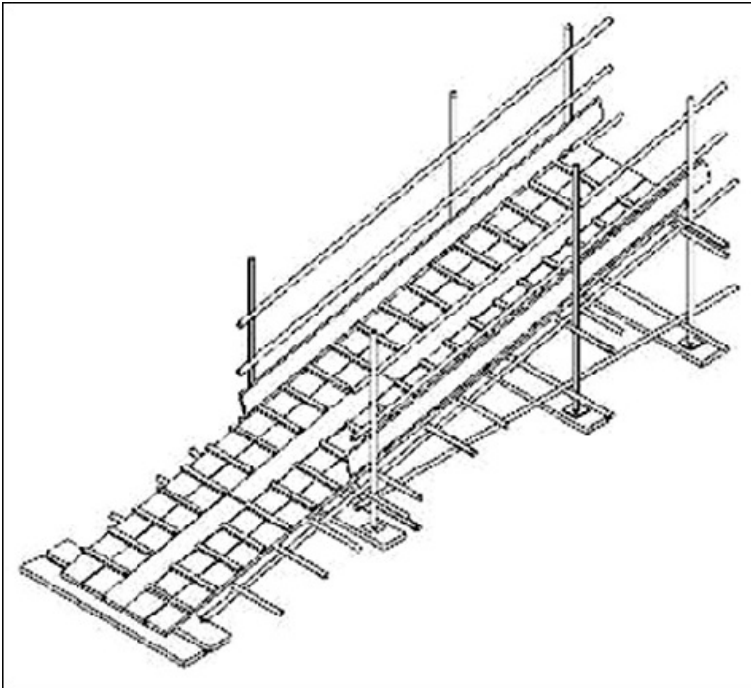


Figure 85: Barrow ramp

For heavy loads such as wheelchairs or concrete laden wheelbarrows gradients of about 1:12 are appropriate. The maximum recommended slope for a cleated barrow ramp is 20° or 1 in 3.

6.13 Falsework or propping

Falsework or propping is used primarily to support a load. It is any temporary structure used to support a permanent structure while it [the permanent structure] is not self supporting.

6.13.1 Types of load

Dead Loads (self weight): The actual weights of the falsework structure, permanent materials (precast, concrete) and stored items (plant).

Live Loads (construction activity): The weight of personnel, impact e.g. heaping of concrete, and tools (small plant).

Environmental Loads (wind, earthquakes etc): Load added by environmental factors such as weather, earthquakes, etc.

Calculating total loading

When calculating floor loads for falsework the general loading used for live loads is 2kN/m (205kg/m). This is added to the combined dead load to give total loading and covers most applications outside the most severe weather conditions.

6.13.2 Units and loadings

Table 12: Measurement units and symbols

Physical Properties	Unit	Symbol
Length	Metre	m
Mass	Kilogram	kg
Area	Square metres	m ²
Volume	Cubic metres	m ³
Density	Kilograms per cubic metre	kg/m ³

The mass of a 1 metric tonne (1,000kg) exerts a force of approximately 9.81kN (kilo Newton). Therefore:

1kg exerts a force of approx 9.81N (Newton)

100kg exerts a force of approx .981kN

To convert kg to N: #kg multiplied by 9.81

To convert N to kg: #N multiplied by 0.102

Table 13: Loadings on scaffold

General loading	
Sand dry/wet	1680 kg per m/ 1920 kg/m
Timber pinus/m	400 - 480 kg
Water per litre	1.0 kg
Concrete wheel barrow approx 0.05m	136 kg
Blocks concrete (400 x 200 x 200)	19 kg per block
Worker average	100.0 kg

Mass of concrete	kg/m
Average	2300
Heavy	3200
Average with 3% steel	2550

6.13.3 Falsework design

When designing falsework establish:

- The structure to be supported.
- A proposed method(s) of falsework.
- By design, the integrity of the falsework to safely support all loadings associated with the work.

In determining what information to consult and how to approach falsework design, no single document provides all the answers. Sources of information for scaffolders, chartered and design engineers include:

- The manufacturer/designer loadings and proven test information (proprietary systems).
- Grade, quality and test results of scaffolding equipment (tube, clip, fittings).
- BS 5975:1996 Code of Practice for Falsework.
- AS/NZS 1170 parts 0 - 3 and NZS 1170.5
- Cement and Concrete Association of New Zealand Guidelines and documents.
- HERA (Heavy Engineering Research Association) publications on structural steel capacity, connections, loadings and use. Structural steel is used as, and/or in conjunction with, manufactured falsework equipment.
- HERA publication, Guide to practical aspects of composite floor system design and construction, including concrete placement. This includes information on controlling deflection of pumped concrete in composite floor systems.
- AS 3828 Guidelines for the Erection of Building Steelwork.
- AS 3610 Formwork for Concrete.

6.13.4 Standard falsework components.

Always follow the manufacturer's instructions and specifications, in particular the maximum safe working loads permitted.

Uhead jack and basejacks

- Maximum safe working load 53 kN (5405 kg) at 200mm extension.
- Maximum safe working load 41 kN (4180kg) at 450mm extension.
- Check manufacturer's specifications.

Adjustable props

Adjustable props consist of four parts:

- The outer tube (60mm OD) with welded baseplate.
- The inner tube (48.3mm OD) with welded top plate.
- The nut and handle.
- The prop pin.

Prop sizes range from 1050mm to 4900mm and can support a safe working load between 8kN (815 kg) and 42.5kN (4335kg) - 32kN (3265kg) on average. Refer to the manufacturer's specifications for safe working loads. Props must be adequately laced in one direction but preferably in two directions. It is recommended that lacing be positioned one third of the distance up the prop inner

Shoreload frames

Traditionally shoreload frames are 1220mm wide and range from 610mm high to 1830mm high. They are constructed from 60mm OD tube and give a safe working load of

between 80kN (8160kg) and 100kN (10195kg) per frame. The shoreload frames are connected with frame braces of different lengths to form a tower. Frames can be stacked vertically on top of each other utilising frame joiners to give the desired height (see figure 86).

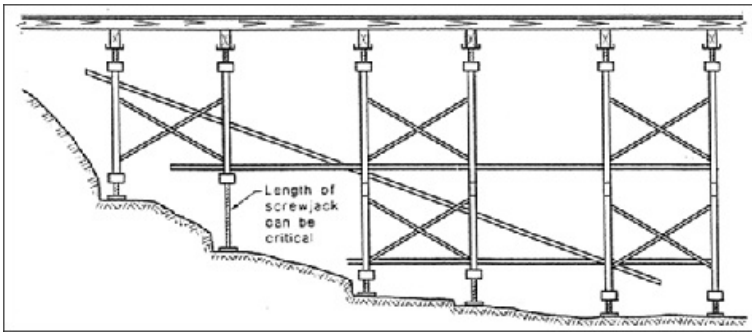


Figure 86: Typical shoreloading set up

Header beams

A number of beams may be used in falsework, including:

- Doka wooden beams.
- Rolled Steel Joist (RSJ).
- Laminated true form beams.
- Universal beams (UB).
- Aluminium A or I beams with a timber infill.
- Timber.

6.13.5 Concrete components

6.13.5.1 Precast

A concrete structure e.g. beam, panel, double T that is poured and set before being brought to the site. The precast can be pre-stressed in the case of shell beams and flat slabs. These traditionally only require propping to support the intended loads.

6.13.5.2 In situ

Concrete poured on site. This traditionally requires propping with primary and secondary beams to enable boxing to be formed to contain the concrete.

Basic propping can be used following the manufacturer's specifications. If there is any doubt concerning ground capacity, loadings etc you must get a chartered engineer to check the design and follow his/her recommendations. Falsework or propping should always maintain a factor of safety of 3 in all aspects of the design.

Traditional scaffolding (tube and fitting, kwikstage system, cuplock, rapid scaff and timber to name a few) can be used for propping. You must follow the manufacturer's specifications in all cases.

Please refer to the section on foundations. While propping is primarily to support a load, it also transfers it to the surface below - to the foundations. Thus, foundations are imperative when propping. In particular the ground capacity and seating of soleboards or bearers must be sufficient for the intended loads

Figure 87 shows how beams should be positioned in Uhead jacks (or similar) to keep the beam centred over the standard or support. The jacks must be rotated against the beam to centre the beam over the standard, prop or similar. The Uhead jack, prop, or similar must then be wedged or chocked to centralise the beam before being placed under load.

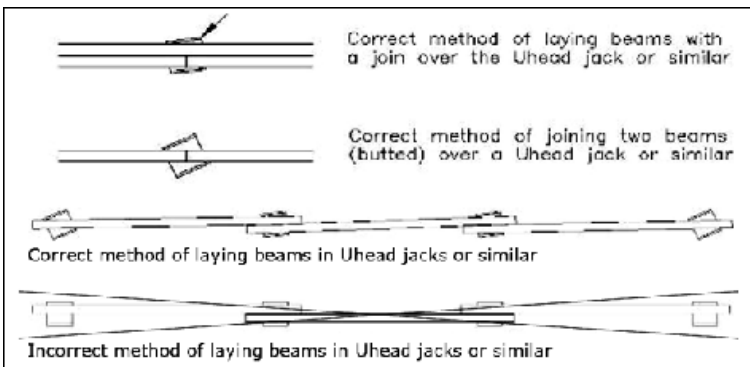


Figure 87: Positioning of Uhead jacks or similar

6.13.6 General falsework workmanship

The following are critical factors of falsework workmanship on site:

- The foundations should be satisfactory.
- The falsework should be constructed in accordance with the design, quality and quantity of components and the safe working loads as detailed in the manufacturer's specifications for components. This includes setting out.
- Tolerances should fall within allowable design limits.
- All connections should be properly constructed.
- Adequate access and egress must be assured.

Importance of detail

Constant emphasis is laid on the importance of careful attention to detail. Falsework usually consists of a comparatively large number of members to produce a supporting structure with multitude connections and junction conditions. The stability and integrity of the supporting structure should not be jeopardised by incorrect assembly of one of the many connections or junctions. Failure to get details right during the initial erection of the falsework could lead to local instability and may endanger the entire falsework structure.

Checking falsework

When dealing with falsework, check:

- The foundations before beginning erection.
- The proposed design of the intended falsework.
- Individual falsework components during the erection process.
- All connections and junctions during the erection process.
- Layout of falsework as per the design.
- All falsework for eccentricity of individual components.
- All falsework is positioned centrally under the intended loads.
- Falsework immediately before loads are applied.
- Falsework immediately after loads have been applied.
- Periodically after adverse weather conditions.
- Before dismantling that the structure is self-supporting.

Checking adjustable props

- Props should be undamaged and not visibly bent.
- Props should be plumb within 1.5 degrees of vertical (not exceeding 25mm out of vertical over a height of 1.0m).
- Props must be placed centrally under the member to be supported and over any member supporting the prop with no eccentricity exceeding 25mm.
- Props must be adequately laced in one direction but preferably in two directions.
- It is recommended that lacing be positioned one third of the distance up the prop inner.

6.14 Timber scaffolds

This section deals with standing scaffolds that comprise standards, ledgers, guardrails and putlogs made of timber.

Quality of timber and fittings

Radiata pine and Douglas fir are suitable timbers for use in timber scaffolding and must be either No 1 framing grade or standard building grade as specified in NZS 3631:1978 Classification and grading of New Zealand timber. Other types of timber may be used if they are of equivalent strength and quality.

All timber used in scaffolding should be preservative treated in accordance with an appropriate commodity specification of the Timber Preservation Authority. Commodity specification C7 is suitable for external scaffolding except when standards and sole plates are in direct contact with the ground in which case it is necessary to treat to commodity specification C3. For indoor scaffolding boron-treated timber is satisfactory. Untreated timber may be acceptable if the timber is sound and unlikely to deteriorate during the life of the scaffold.

Fittings used for connecting joints between standards ledgers and braces must be of adequate strength and be maintained in good condition.

Specific requirements

The design and construction of timber scaffolding for the support of both light-duty and heavy-duty working platforms must be carried out in accordance with sound engineering and trade practices and conform to appropriate New Zealand Standards. The requirements for single-standard (pole) light-duty scaffolds with putlogs cleated to wall or frame and for use up to 5m high are summarised below (see also figures 88 and 89):

Standards: 100mm x 50mm with a maximum spacing of 2.4m.

Putlogs: 150mm x 25mm or 100mm x 50mm for a maximum span of 1.2m or 2/150mm x 25mm for a maximum span of 1.5m.

Bracing: Each standard must be tied to the wall by a putlog and braced longitudinally by a ledger and at least two diagonal braces for the length of the scaffold. An additional diagonal brace at 40 to 50 slope must also be provided for every 20m length of scaffold. The minimum size of the brace is to be 100mm x 50mm or 150mm x 25mm.

Guardrail and midrail: Minimum size 100mm x 50mm.

Kickboards: All timber scaffolds must have kickboards on all platforms

Platform width: A minimum of 675mm wide.

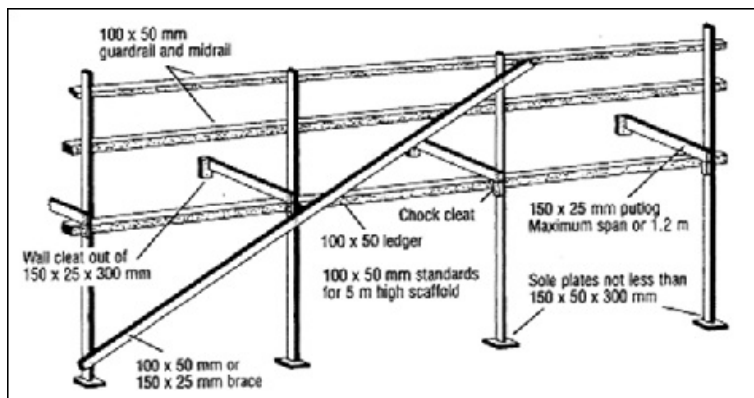


Figure 88: Single standard light-duty timber scaffold – general structure

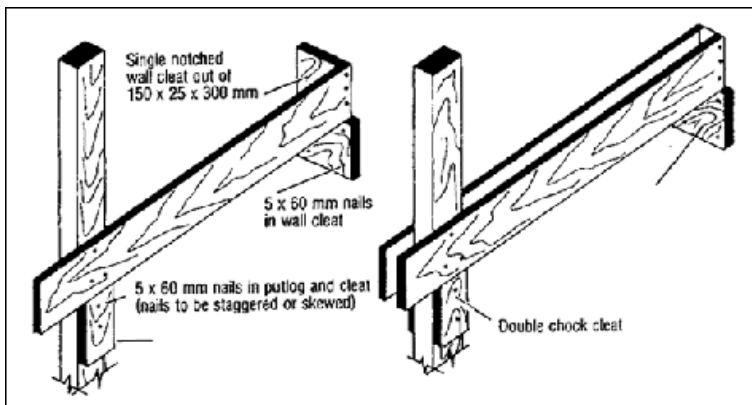


Figure 89: Single standard light-duty timber scaffold - connection point detail

Section 7: Suspended scaffolding

7.1 Scope

7.1.1 Definition

A suspended scaffold is a working platform that:

- Is suspended by ropes from overhead outriggers, needles, parapet hooks or brackets fixed to a building or structure.
- Is capable of being raised and lowered by hand haulage on fibre ropes, or by hoists that are either manually or mechanically operated using wire ropes.

A working platform held by ropes that cannot be raised or lowered, is classified as a hanging scaffold (special duty scaffold), not a suspended scaffold.

7.1.2 Types of suspended scaffolds

The following shows some examples of suspended scaffolds:

- Swinging stage (manual) - This working platform has a minimum of two points of overhead suspension and is raised or lowered by hand haulage, which is controlled from the stage.
- Swinging stage (mechanical) - This working platform has a minimum of two points of overhead suspension and is raised or lowered by power operated or air operated hoists, which are controlled from the stage.
- Boatswain's chair (manual) - This chair has a single overhead suspension and is raised or lowered by hand haulage, which is controlled from the chair.
- Suspended safety chair (mechanical) - This chair has a single overhead suspension and is raised or lowered by a power operated or air operated hoist, which is controlled from the chair.
- Multi-point suspended stage (manual or mechanical) - These are stages that have more than two points of suspension and are raised and lowered by power operated, air operated or manually operated hoists, which are controlled from the stage.

7.2 Motive power

7.2.1 Hand haulage

Fibre rope tackle used for hand haulage must be a minimum of 18mm diameter and preferably be made from natural fibre rope to give a good hand grip. Fibre rope must have a factor of safety of at least 6 when new. Blocks for fibre rope must be made of metal or wood strapped with metal and be no less than 100mm in diameter.

The maximum live load permitted on a hand haul swinging stage is the difference between 360kg and the dead weight of the stage (including the weight of falls and blocks). The relation of width of platform, height of point of suspension on the platform and stage weight must be such that, under a load of 160kg in the extreme position on any side, the cross tilt of the platform is not more than 1 in 6 of the platform width. To prevent end tilt, the overhang of either end beyond the point of support must be such as to ensure that the platform is stable under a load of 160kg at the extreme end.

The total live load permitted on a boatswain's chair must not exceed 115kg. When used by a worker in the seated position, the chair must have a back rail, rope or post not less than 250mm above the seat.

7.2.2 Mechanical haulage

Electric and air operated swinging stages, including cable climbers, need to be controlled from the stage platform or chair. They must have a push button or dead man lever control that will stop and automatically lock the motor and hoist when pressure on the control switch or lever is removed. Each control must be independently operated. Hand operated release to allow faster descent than normal is not permitted.

Ratchet and pawl manually operated swinging stages must have a positive locking device so that the stage can be securely held at any level and the pawl automatically engages when released from the hand control. Wire rope must be of suitable quality and strength with a factor of safety of not less than 10 when new.

The maximum level load permitted on a swinging stage is the difference between 560kg and the dead weight of the stage, including the weight of the hoisting gear or cable climbers. However always check the manufacturer's specifications. No less than two people and no more than three people may use a stage at any one time and the safe lifting capacity must be clearly marked on the hoists. Overload or cut-out switches must be used and must be kept adjusted to provide adequate safeguards should snags be encountered.

The maximum live load permitted on a suspended mechanical chair is 160kg.

The maximum live load permitted on a multi point suspension platform is 240kg, being a maximum of three persons or two persons and materials.

7.3 Anchoring and construction

7.3.1 Anchorages

Hoisting wires or tackle must be anchored to a secure part of the structure, to outriggers (needles), to designed brackets or parapet brackets, or directly to the counterweights.

All structures, parapets, and other supports must be of such condition and design to support the anchorage without danger of failure or distortion and to give a factor of safety of at least 3 under the worst conditions. An engineer's certificate may be required on the suitability of the structure, parapet or support.

7.3.2 Outriggers (needles)

It is accepted engineering practice to use either steel or aluminium outriggers (also called needles) to support mechanical powered swinging stages. For hand hauled swinging stages and boatswain's chairs either steel or timber outriggers may be used.

Design parameters include:

- For a swinging stage with two points of suspension, each outrigger must be designed to carry the entire load of the working platform, including hoists, together with the full live load of persons and materials on the working platform, plus the factor of safety.
- For a swinging stage with more than two points of suspension, each outrigger must be capable of carrying the full dead and live load for each section between suspension points, plus the factor of safety.

Unless specifically designed by a chartered engineer, each outrigger for a mechanically operated swinging stage must be:

- At least equivalent in strength to a 152mm x 89mm x 17.09kg/m rolled steel joist when suspending a maximum load of 400kg.
- At least 3.6m in length when counterweighted.
- Located so as not to project more than 1.5m beyond the outer point of the support on the building or structure (maximum 1.5m outboard from the fulcrum).

The load exerted by the outrigger on the roof structure or parapet needs to be distributed by providing adequate packing at its points of support i.e. the outer or fulcrum end and the inner or counterweighted end.

Needles need to be fixed together to prevent lateral movement of the needle and to prevent overturning with the movement of the stage when it is in use. Alternatively, needles need to be individually secured to prevent movement and overturning.

7.3.3 Stability and counterweighting

Outriggers must be either counterweighted or secured to the building or structure. Where an outrigger is stabilised by counterweights the factor of safety against overturning must be at least 3. Where roof fixings are relied upon as the sole means of achieving stability they must be capable of providing a factor of safety of 3 against uplift.

Needles must be prevented from rolling over or moving laterally due to the movement of the stage. Where counterweights are used to provide stability they must be firmly attached to the outriggers so that they cannot become accidentally dislodged. When strops are used these must be positively secured to the outrigger, which must be provided with stop ends. All shackles must be moused with tie wire through the hole of the shackle and around the shackle itself.

All weights must be stamped or marked with their weight. Sand, water or materials that can run to waste must not be used as counterweights in any form.

7.3.3.1 Counterweighting of outriggers

Where an outrigger is stabilised by counterweights, the factor of safety against overturning must be at least 3.

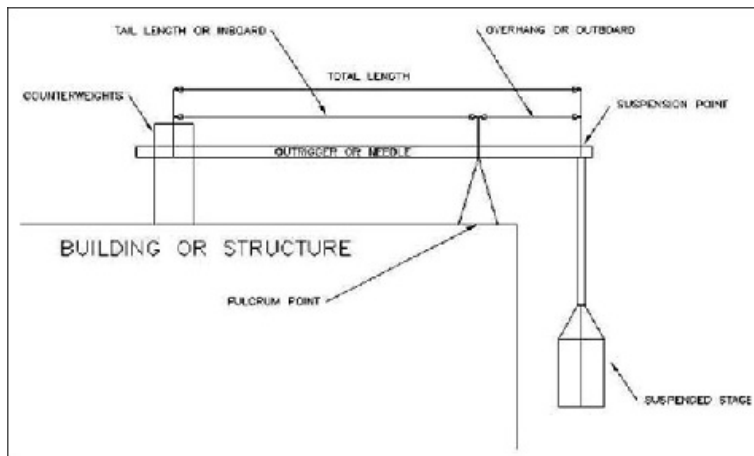


Figure 90: Suspended scaffold showing counterweights

7.3.3.2 Calculating for counterweights

Terms

Suspended load: The greater of the total of the stage, motors, and ropes plus the total live load in kilograms or the maximum possible line tension allowing for the setting of the motor cut out - typically 125% of the rated pulling power of the motor.

Overhang or outboard: Distance from the fulcrum to the suspension point in metres.

Tail length or inboard: Distance from the fulcrum to the counterweights in metres.

Calculation

$$\text{Counterweight} = \frac{\text{overhang (in m)} \times \text{the suspended load (in kg)} \times 3}{\text{tail length (in m)}}$$

For example if the suspended load is 400kg, the overhang is 1.2m and the tail length is 4.5m, the counterweight required for each outrigger is:

$$\frac{1.2\text{m} \times 400\text{kg} \times 3}{4.5\text{m}}$$

$$= 320\text{kg per outrigger}$$

Note that the safety factor is always a minimum of 3 and that each outrigger must be able to support the total combined loads, should one needle fail.

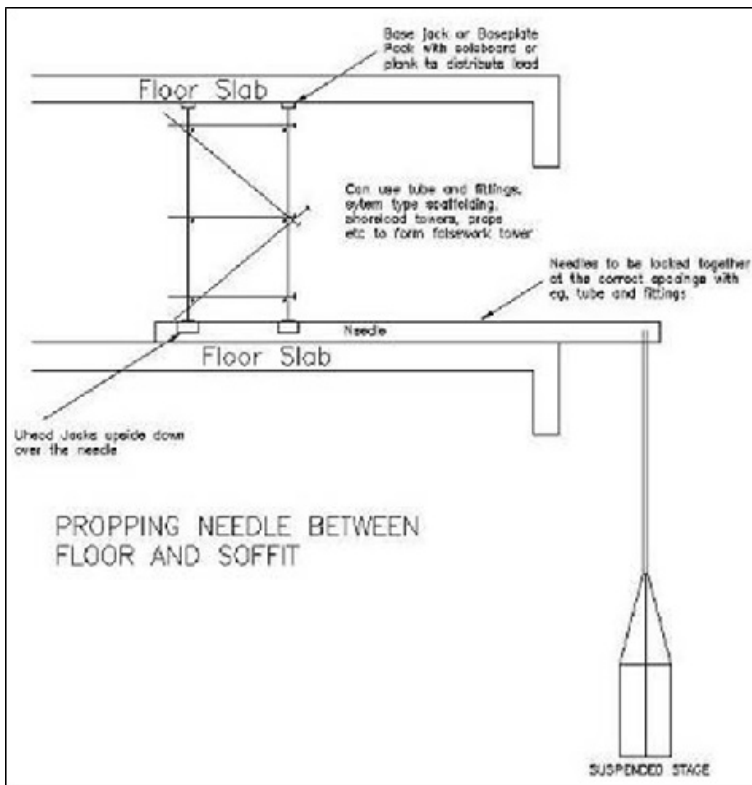


Figure 91: Supporting outrigger between floor and soffit

7.3.4 Propping needles between the floor and soffit

7.3.5 Brackets and parapet hooks

7.3.5 Brackets and parapet hooks

Brackets, parapet hooks, parapet brackets and attachments must be designed by a chartered engineer. A minimum factor of safety of 3 is required on the combined dead and live loading of the suspended scaffold. All welding for these structural components must be done by a certified welder.

Parapet hooks and brackets may only be used if:

- The parapet is structurally sound - get an engineer's certificate if you are unsure.
- The hook fits the parapet correctly.
- The parapet is deep enough to allow at least 300mm of the hook down the inside of the parapet.

If packing has to be used around the parapet to assist in the tightening of the bracket only adequately sized ply should be used. Never use wedges to pack the front or back of the bracket as they can dislodge with the movement of the suspended platform.

7.3.6 Secondary safety for needles or parapet hooks

It is recommended that every suspended working platform supported by needles or parapet hooks have a secondary safety method of securing the needles or parapet hooks to the supporting structure. This can be achieved by using discarded stage wire ropes and wire rope grips or bulldog clips. Lace the wire rope through the needles or parapet hooks and secure the wire rope around part of the structure with 3 wire rope grips or bulldog clips. While this additional safety precaution is not mandatory, it is recommended. It is also recommended that, where possible, needles are laced together.

7.3.7 Grips and shackles

Rope grips or bulldog clips

Always fit the grips the same way around, with the bridge on the loaded or long part of the rope and the U-bolt on the short part of the rope. On a separate wire rope a minimum of three rope grips must be used and spaced at a distance centre to centre of six rope diameters.

Shackles

Both D and Bow shackles used in scaffolding and suspended scaffolding should have their SWL clearly marked and when in use the pin should be securely screwed in and moused to the body of the shackle.

When using a shackle to form a running noose always fit the back of the shackle to the standing or running part of the rope. Mousing of shackles is usually done by using steelies tie wire or similar, as in figure 92.

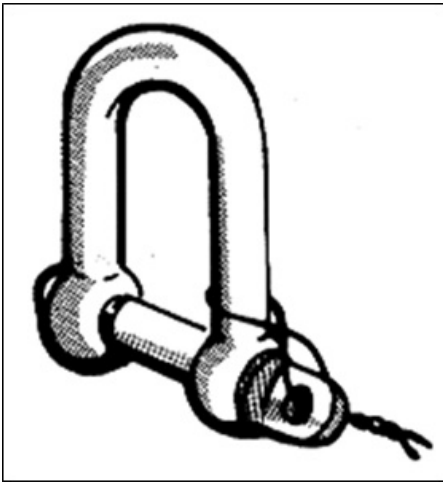


Figure 92: Mousing of shackles

7.3.8 Working platforms, guardrails, midrails and toeboards

Platforms may be made of any acceptable material provided it is strong enough for the purpose and provided that platforms are designed, constructed and assembled according to sound and accepted engineering practices.

Guardrails and midrails must be provided on both sides and both ends of swinging stages.

Toeboards must be provided on all types of suspended scaffolds with the exception of boatswain's chairs.

7.4 Use of safety harnesses and lifelines

Every worker on a suspended working platform must wear a safety harness that is secured to a fixed support or to an independent lifeline, except where the platform is:

- A boatswain's chair that has more than one effective means of support.
- So designed and constructed that it would remain safely suspended notwithstanding the failure of one rope or suspension, in which case the harness may be secured to the platform.

A safety harness worn by a worker must suspend the worker not more than 1.5m below the platform if the worker falls from the platform and must be so designed that the force arresting the fall does not exceed 6kN (610kg).

A lifeline must be used by only one worker at a time and must either extend to the ground or be provided with a positive stop to prevent the harness running off the end of the line. This line must have a minimum breaking strength of 29.4kN (3000 kg) and be of nylon at least 12mm in diameter or of polypropylene, or other equally durable material, at least 16mm in diameter.

Where a platform has only one rope at each support the harness lanyard must be attached by a gravity lock device to an independent lifeline. The independent lifeline may be fixed:

- Directly to an anchor set in the building that will withstand a vertical load of 24kN (2450kg); or
- To a separate anchorage other than the needle supporting the platform.

Where a platform has two independent ropes at each suspension the operator's safety harness lanyard may be attached to a suitable anchorage on the platform.

Two ropes used at each support of the platform may be attached to the same outrigger by separate anchorages.

Section 8: Training and competency

8.1 National certificates in scaffolding

The Health and Safety in Employment Act 1992 requires employers to provide scaffolders with the information, instruction, training and supervision necessary to allow them to work safely.

For scaffolding to be erected, altered and dismantled safely and efficiently, scaffolders should:

- Know the basic relevant rules of physics, mechanics and mathematics as they apply to scaffolding.
- Be able to read and understand suppliers' information, general site plans, design drawings and specifications for scaffolds. An ability to make simple calculations of dead load and live load is often needed for instance.
- Have a thorough knowledge of the scaffolding equipment being used.
- Have a thorough knowledge of the construction methods and design requirements associated with that equipment.
- Be able to identify common hazards at the worksite and be capable of taking effective precautions to control risks to health and safety arising from these hazards.
- Be competent to visually inspect scaffolding equipment for faults.
- Have the physical skills needed for scaffolding construction.
- Be competent in manual lifting techniques.
- Work safely and confidently at heights.
- Correctly use the various tools, ropes and gin wheels.
- Erect and dismantle scaffolding in the correct sequence.

In order to facilitate competency in the above knowledge and skills a series of national certificates based on unit standards has been set up. These are established and maintained by Opportunity - The Training Organisations, the responsible Industry Training Organisation, through its Scaffolding Rigging and Industrial Rope Industry Training Advisory Group. The qualifications are recognised by the New Zealand Qualifications Authority and registered on the National Qualifications Framework.

The national certificates form the basis of a national training programme which combines industry and Polytechnic based training. Tai Poutini Polytechnic is recognised by the Tertiary Education Commission as the national provider of scaffolding training.

The national certificates are progressive, with lower level qualifications being pre requisites to the next level qualification. They are outlined below.

- The National Certificate in Scaffolding (Elementary) (Level 3) [NZQA reference 1352] recognises the skills of a first level scaffolder. The holder of the qualification is able to base out, erect, and dismantle straightforward proprietary and 'tube and fitting' scaffolding structures from given plans. The holder can also assure the compliance of the structures and move safely on them at height.

- The National Certificate in Intermediate Scaffolding (Level 4) [NZQA reference 1463] recognises the skills of a second level scaffolder. Holders of this qualification are able to plan, erect and dismantle complex scaffolding structures. The holder can also assure the compliance of the structures and lead a scaffolding team.
- The National Certificate in Scaffolding (Level 4) with strands in Advanced Scaffolding, and Suspended Scaffolding [NZQA reference 0110] recognises the skills and knowledge required to work as a specialist scaffolder. The term 'advanced' refers to the range of equipment used and the level of competence of the qualification holder. 'Suspended' refers to a specialised area of scaffolding work. Holders of this National Certificate with the Suspended Scaffolding strand are those whose work is in relation to cable supported scaffolds in their various configurations. Holders of this National Certificate with the Advanced Scaffolding strand are those whose work is in the planning and erection of tube and fitting scaffolds to meet the highest demands found in the scaffolding industry. This is the highest level qualification available in this industry.

Note that the industry intends to introduce separate advanced scaffolding and elementary scaffolding qualifications, with appropriate pre requisites, to replace the National Certificate in Scaffolding (Level 4) with strands in Advanced Scaffolding, and Suspended Scaffolding.

Certificates of competence for the different classes of scaffolding as outlined in the HSE regulations are awarded on the basis of holding the appropriate national qualification and having appropriate experience.

Further information

Contact

- SARNZ, Opportunity - The Training Organisation
www.opportunitytraining.org.nz or
- Tai Poutini Polytechnic | 0800 800 411 or
www.taipoutini.ac.nz for further information, particularly on:
 - Training of scaffolders (general).
 - Recognition of prior learning for overseas qualifications.
 - Pre employment scaffolding training programmes.

8.1.1 The training process

Training programmes are structured and include both modularised formal instruction and supervised practical work in the workplace. Skills' training is sequential from generic and less complex tasks, building towards more onerous and demanding skills. Trainees remain employed while training but complete block courses as well as learning with supervisors and accessing expertise from tutors in the work place. Experience is logged and the learning that takes place in practical contexts is reflected on and utilised as part of the training process.

Trainees engaged in the erection, alteration or dismantling of scaffolding must be directly supervised by a scaffolder holding the appropriate class of certificate for that scaffold type. The supervising scaffolder is responsible for monitoring the work and ensuring compliance with regulatory requirements and recommended practice. He/she must be in a position to take immediate charge in the event of an emergency. Safety is paramount.

The appropriate ratio between certificated scaffolders and trainee scaffolders in a gang depends on the level of experience and competence gained by each trainee, the complexity of the scaffolding work being undertaken and the risks associated with any mistakes that may be made by trainees. The ratio should be determined by the employer through consultation with the supervising scaffolder, taking into account any requirements of the regulatory authority. The supervising scaffolder will be carrying out the employer's legal obligation to supervise trainee scaffolders to perform the work safely and without risk to health and safety. It is recommended that only one trainee be under direct supervision in a work crew.

It is expected that the elementary, first level, qualification will take 18 months to two years to complete and subsequent qualifications 12 - 18 months each.

8.2 Certificates of competence

The Health and Safety in Employment Regulations require that anyone who erects, alters, repairs or dismantles any scaffold from which a person could risk a fall of five metres or more, holds the appropriate class of certificate of competence for that type of scaffold.

Certificates of competence are issued by Scaffolding, Access & Rigging New Zealand Inc (SARNZ) under delegated authority from WorkSafe NZ. To be issued with a certificate of competence individuals need to provide evidence of:

- Training to national certificate level or an equivalent international qualification; and
- Recent relevant industry experience; or
- Holding a current certificate of competence requiring renewal and meeting the requirements of regulations 31 and 35 of the HSE Regulations 1995. On going certification requires continued involvement in the industry and proof of continued competence.

Table 14 shows the relationship between qualifications and certificates of competence as it exists in the current regulatory and qualification environment.

Table 14: Certificate of competence structure in the existing regulatory environment

Qualification	Corresponding certificate of competence class / endorsement
Elementary	Basic Certificate
	A. Fall arrest systems
	B. Free standing modular scaffold systems
	C. Gin wheels
	D. Rope
	E. Static lines
	Advanced Certificate
Intermediate	O. Tube and coupler scaffolding
	Advanced Certificate
	C. Barrow ramp

	F. Catch net
	G. Hoist (load not exceeding 250 kilograms)
	J. Mast climbers
	L. Scaffolding associated with perimeter safety screens or shutters
	N. Spurred scaffolding
Suspended	Suspended Certificate
	A. Boatswains chair - hand held or mechanical
	B. Swinging stage - hand held or mechanical
Advanced ¹	Advanced Certificate
	D. Bracket scaffolding for tank and formwork
	E. Cantilevered scaffolding
	H. Hung scaffolding - including chain and wire rope
	I. Loading platforms cantilevered from scaffolding
	K. Safety nets for public protection

Please note that WorkSafe NZ or its authorised issuing agency, in this case SARNZ, may apply additional factors in relation to the award of a Certificate of Competence at their discretion. This could include aspects of experience, commitment to on going training, involvement in professional or trade bodies, etc. For these details refer to <http://sarnz.org.nz/certificates-competence/>.

Section 9: Inspection and documentary needs

9.1 Best practice reference documents

During the development of the BPG a number of documents have been accessed for reference. While they are not often quoted directly, where this is the case we have endeavoured to reference and acknowledge this. However, as a number of individuals have collaborated in the preparation of the BPG this may not always be the case. We apologise for any omissions and invite you to contact us to redress this where it has occurred. Email us at info@bsc.org.nz.

The major documents consulted, including relevant criteria and standards documents, include:

- AS/NZS 4576: 1995 Australian/New Zealand Standard Guidelines for Scaffolding.
- Health and Safety in Employment Act 1992 and associated legislation and regulations.
- A Guide to Practical Scaffolding: The Construction and Use of Basic Access Scaffolding, CITB.
- Guidelines for the Prevention of Falls, Occupational Safety and Health Service of the Department of Labour.
- The Health and Safety in Employment Regulations 1995.
- Hazard Identification and Management in the Scaffolding Industry (Gary Wall).

9.1.1 Standards

Table 15 contains a general list of applicable relevant standards a number of which have been consulted in the preparation of the BPG. Additional information on particular standards and specific referencing are contained at various points throughout this document.

Table 15: Standards relevant to scaffolding

Type of equipment	Standard
Chain	AS 2321, ISO 1835
Classification and grading of New Zealand Timber	NZS 3631
Confined space	AS/NZS 2865
Cranes (including hoists and winches)	AS 1418.2
Eye protection	AS/NZS 1337
Eyebolts	AS 2317, BS 4278
Fall arrest systems and devices (including harnesses)	AS/NZS 1891.1
Fibre ropes	AS 4142.2
Industrial fall arrest systems and devices	AS/NZS 1891.3
General scaffolding requirements	AS/NZS 1576.1
Plywood	AS/NZS 2269

Portable ladders, metal	AS 1892.1
Portable ladders, timber	AS 1892.2, NZS 3609
Prefabricated and tube and fitting scaffolding	AS/NZS 1576.3
Protective/safety helmets	AS/NZS 1800, NZS 2264
Rigging screws and turnbuckles	AS 2319, BS 4429
Safety footwear	AS/NZS 2210.1 or 2210.2
Safety standards for high visibility clothing	EN 471
Scaffold couplers and accessories	AS 1576.2
Scaffold planks	AS 1577
Scaffold tubes	AS/NZS 1576.3
Scaffolding - suspended scaffolding	AS 1576.4
Shackles	AS 2741, BS 3551
Sheave blocks	AS 2089
Slings, chains	AS 3775.1
Slings, fibre ropes	AS 1380
Slings, flat synthetic webbing	AS 1353.1
Slings, wire coil flat	AS 1438
Slings, wire rope	AS 1666, ISO 7531
Split heads or U-heads and trestles	AS/NZS 1576.5
Steel wire rope (SWR)	AS 3569,
Structural design (environmental factors)	AS/NZS 1170 Parts 0 - 3NZS 1170.5
Thimbles for wire rope	AS 1138
Timber ladders	NZS 3609
Tube and fitting scaffolding	AS/NZS 1576.6
Trestles, other than trestle ladders	AS/NZS 1576.5
Wire rope and wire rope grips	ISO 12076; AS 2076

9.2 Notification, inspections and registers

All scaffolds, including suspended scaffolds, that exceed 5.0m in height, or from which a person can fall 5.0m or more, must be notified to the DOL at least 24 hours prior to the commencement of erection work. Please refer to Regulations 2 and 26 of the HSE Regulations 1995, which define notifiable work and set out who is responsible for making the notification.

Before use a scaffold or suspended scaffold must be certified safe by a scaffolder holding the appropriate class of certificate of competence. A scaffold register, or card recording system, must be maintained on site showing who has inspected the scaffold and certified it safe for use per the designated purpose.

All special duty scaffolds must be notified to the DOL. Please refer to the redesigned "Notification of Particular Hazardous Works Associated with Scaffolding" form appended in the last section of this document.

9.2.1 Register/inspection record requirements

Scaffold register/inspection requirements

- For all scaffolding from which a person could fall 5m or more, a scaffold register or similar must be kept on site and be available for inspection.
- When complete the inspection records should show:
 - Project name, address, or other clear identification.
 - The location of the scaffold with respect to site coordinates or the location at the building or structure, so that the scaffolding can be clearly located.
 - Miscellaneous details of the scaffold.
 - A record of each inspection carried out.
- The inspections must be carried out at the following intervals:
 - Before the scaffold is first put to into use.
 - Weekly while the scaffold is in use.
 - After each structural alteration or addition.
 - Monthly while the scaffold is set up but not in use.
 - After any storm or occurrence that could adversely affect the safety of the scaffold.
- The inspection must be carried out by either:
 - A certificated scaffolder of the appropriate class; or
 - A competent person such as a chartered engineer.
- The entries of each inspection in the scaffold register must be made and signed by the person who carried out the inspection.

A scaffold register template is appended in the last section of this document.

Suspended scaffold register/inspection record requirements

1. For all suspended scaffolding, boatswain's chairs, swinging stages, etc a suspended scaffold register or similar must be kept on site and be available for inspection.
2. When complete, the inspection records should show:
 - a. Project name, address, or other clear identification.
 - b. The location of the suspended scaffold with respect to site coordinates or the location at the building or structure, so that the suspended scaffolding can be clearly located;
 - c. Miscellaneous details of the suspended scaffold
 - d. A record of each inspection carried out.
3. The inspections must be carried out at the following intervals:
 - a. Before the suspended scaffold is first used.
 - b. On each day while the suspended scaffold is in use.
 - c. After each structural alteration or change to the nature of the anchorage.
 - d. Monthly while the suspended scaffold is set up but not in use.
 - e. After any storm or occurrence that could adversely affect the safety of the suspended scaffold.
4. The inspection must be carried out by either:
 - a. A certificated scaffolder of the appropriate class; or
 - b. A competent person such as a chartered engineer.
5. The entries of each inspection in the suspended scaffold register must be made and signed by the person who carried out the inspection.

A suspended scaffold register template is appended in the last section of this document.

9.2.1.1 Pre start or pre use checks

A pre start or pre use check may be conducted by an adequately trained non scaffolder before a scaffold in use is first used for the day. This must include a visual check and a jump test. The scaffold must still be checked daily by a scaffolder holding the appropriate class of certificate of competence while it is in use.

Further, all inspections following shifts, alterations or additions must still be carried out by a scaffolder holding the appropriate class of certificate of confidence.

9.2.1.2 Inspection reports

Inspection reports for tube and fitting scaffolds and proprietary scaffolds are appended to this document. They represent a condensed version of the main areas outlined in the BPG giving a quick checklist by which to assess best practices and minimum requirements.

We recommend that all scaffolds are inspected using the appropriate inspection report to show that best practices and minimum requirements have been met. We also recommend DOL Inspectors, Site Safety Officers and the like use the inspection reports when inspecting scaffolds for compliance.

The inspection reports can also be used when checking scaffolds for their register checks.

9.3 Appendix: Documents for use in the field

Appended below are a series of compliance, inspection, notification and safety documents designed to be used in the field to assist in the promotion of best practice in scaffolding.

Please photocopy and use them as appropriate.

Notification of particular hazardous work

- [Online and print forms are available here](#).

Scaffold hand over certificate

The scaffold hand over certificate releases the scaffold(s) to the client. The scaffold(s) have been inspected by the client and has been erected to the client's requirements. All scaffolds have been erected as per the requirements of the Best Practice Guidelines for Scaffolding in New Zealand. The client undertakes to control the use, and users of the scaffold structure(s) while under their control as required by the Health and Safety Act and Regulations.

- [\[form\] Scaffold hand over certificate \[10 KB PDF\]](#)
- [\[form\] Scaffold hand over certificate \[145 KB DOC\]](#)

Hazard identification and controls report

The purpose of this procedure is to inspect the work site for hazards, to eliminate, isolate or minimise the hazard.

- [\[form\] Hazard identification and controls report \[11 KB PDF\]](#)
- [\[form\] Hazard identification and controls report \[153 KB DOC\]](#)

Task analysis worksheet

- [\[form\] Task analysis worksheet \[19 KB PDF\]](#)
- [\[form\] Task analysis worksheet \[150 KB DOC\]](#)

Scaffold register

- [\[form\] Scaffold register \[20 KB PDF\]](#)
- [\[form\] Scaffold register \[172 KB DOC\]](#)

Suspended scaffold register

- [\[form\] Suspended scaffold register \[12 KB PDF\]](#)
- [\[form\] Suspended scaffold register \[67 KB DOC\]](#)

Inspection report: Tube and fitting scaffolds

- [\[form\] Inspection report: Tube and fitting scaffolds \[21 KB PDF\]](#)
- [\[form\] Inspection report: Tube and fitting scaffolds \[102 KB DOC\]](#)

Inspection report: Proprietary scaffolds

- [\[form\] Inspection report: Proprietary scaffolds \[21 KB PDF\]](#)
- [\[form\] Inspection report: Proprietary scaffolds \[103 KB DOC\]](#)