Guidelines for the

Prevention *of* FALLS

To Meet the Requirements of the Health and Safety in Employment Act 1992 and Regulations 1995

ACKNOWLEDGEMENTS

The Occupational Safety and Health Service of the Department of Labour acknowledges the use of literature and diagrams from *SafetyLine* — a practical guide to occupational safety, health and rehabilitation, special Prevention of Falls edition, February 1998, published by Worksafe Western Australia.

Also, a special thank you to New Zealand industry for their contribution to these guidelines.

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Contents

Foreword

The Health and Safety in Employment Act 1992 sets out to promote the management of hazards in workplaces, by requiring employers to identify and control hazards that may cause harm, and for employees and others to take steps to ensure their safety and the safety of others. This law provides, for the first time, comprehensive coverage, and a consistency of approach to the management of safety and health in all workplaces and all work activities.

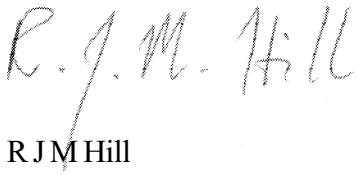
In construction and allied industries falls from heights have been identified as a significant hazard that has lead to many deaths and serious harm. Falls in these workplaces, have accounted for the death of over twenty people since the inception of the HSE Act in 1993.

It is apparent that requirements in legislation and regulations by themselves are not sufficient to stem the tide of these unsatisfactory statistics.

The development of this guideline therefore, is a working document, designed to provide practical advice, on identifying fall hazards and assessing and controlling the risks due to working at heights. It provides advice on options and where to look for additional information about the problem.

These guidelines have been developed over the last two years in consultation with a wide range of industrial interests and groups. I am confident that it will provide a practical solution to the many and varied situations which arise.

It is OSH's intention in publishing these guidelines, to provide another link towards the ultimate goal of the legislation — which is to change people's attitudes and responses to workplace health and safety.



R J M Hill

General Manager

About these Guidelines

These guidelines apply to work carried out from 3 metres or more in height, in places of work covered by the Health and Safety in Employment Act 1992 and the Health and Safety in Employment Regulations 1995. They will assist those with responsibilities under the Act to prevent falls.

These guidelines include relevant sections of the Act and Regulations, namely:

- Section 6: Employers to ensure the safety of employees generally;
- Section 13: Training and supervision
- Section 16: Duties of persons with control of places of work;
- Section 18: Duties of principals;
- Section 19: Duties of employees;
- Regulation 21: Heights of more than 3 metres;
- Regulation 66: Duties of designers of plant; and
- Regulation 67: Duties of manufacturers and suppliers.

A summary of the Act is given in Appendix 1.

The guidelines also include references to further information in support of the guidelines. This includes codes of practice approved by the Minister of Labour under the Act, New Zealand and other Standards, regulations made under other Acts of Parliament, and other recognised statements of good practice.

In this document the terms "shall" and "should" are used. "Shall" is used in places where there is a technical requirement to achieve the desired result. It is used to alert the reader to the need for the guard to have that element. "Should" is used as a way of indicating a preference. It does not indicate a mandatory requirement as other alternatives may achieve an equivalent result. Practices other than those in this guide may be adopted provided the level of safety is equal to or better than those described.

These guidelines promote good work practices and sets out standards for the prevention of injuries to persons at work due to falls. It can be used as a basis for specific workplace programmes or industrial codes for the control of hazards associated with working at heights.

The Act requires the conscious exercise of judgement and discernment by all parties involved in the workplace. The discharge of persons' duties cannot be equated solely with conformity to a code or guide. Employers, principals and persons with control of places of work must actively adopt and promote the principles in the Act.

Safety requirements or methods may be discussed in relation to certain types of work, but could be appropriate in a far wider range of applications. It is important, therefore, that this guideline is used in its entirety. Do not just refer to specific paragraphs in relation to certain types of work.

Scope

While these guidelines are primarily aimed at the construction industry, in relation to the design, building, maintenance and demolition of structures, it also has application to a wide range of work situations where workers are placed in a position from which falls are possible.

The Health and Safety in Employment Regulations 1995, Regulation 21, does not include any employer who employs an employee to carry out any agricultural work in a place of work under the control of that employer.

These guidelines are not designed to cover other OSH publications already covering this work in sufficient detail. Rescue techniques for civil emergency services are also not included in these guidelines. Throughout the guidelines reference is made to other industry standards such as roofing, industrial rope access, electrical and telecommunication reticulation. These industries have compiled their own standards for use in adopting safe practices.

Where a fall from any height could result in harm, some sort of fall protection should be used. Fall protection shall be supplied and used in any place where an employee is at risk of a fall of 3 metres or more. The employer can select the fall protection method that is most compatible with the type of work being carried out.

These guidelines will summarise some aspects of the industry in terms of achieving practicable steps. It is not intended to include all this information but to refer the reader to the relevant document that will include all practicable steps for the relevant industry standard.

References

These guidelines should also be read in conjunction with other relevant codes that may provide more detailed information in certain areas. These include, but are not limited to:

OSH Publications

A Guide to Managing Health and Safety to Meet the requirements of the Health and Safety in Employment Act 1992.

Approved Code of Practice for Cranes and Lifting Appliances

Approved Code of Practice for Power-Operated Elevating Work Platforms

Approved Code of Practice for the Safe Erection and Use of Scaffolding

Approved Code of Practice for Training Operators and Instructors of Powered Lift Trucks (Forklifts)

Building Maintenance Units and Powered Swinging Stages

Guidelines for the Provision of Facilities and General Safety and Health in the Construction Industry

Safeguard Buyers Guide for Workplace Health and Safety Products and Services

Safe Working in Confined Spaces

Standards

NZS 5233:1986 *Specification for portable ladders (other than timber)*

NZS 3609:1978 *Specification for timber ladders*

NZS 3620:1985 *Specification for scaffold planks*

NZS 5802:1978 *Window cleaning safety*

SAA/SNZ HB62.1:1995 *Code of practice for safe erection of building steel work. Low rise*

SAA/SNZ HB62.2:1995 *Code of practice for safe erection of building steel work. Multi-storey*

AS/NZS 4576:1995 *Guidelines for scaffolding*

AS/NZS 1576.5:1995 *Prefabricated splitheads and trestles*

AS/NZS 1657:1992 *Fixed platforms, walkways, stairways and ladders. Design, construction and installation*

AS/NZS 1892.1:1996 *Portable ladders: Metal*

AS/NZS 1892.2:1996 *Portable ladders: Timber*

AS/NZS 1892.3:1996 *Portable ladders: Reinforced plastic*

AS/NZS 4387:1996 *Safety mesh*

AS/NZS 1891.1:1995 *Safety belts and harnesses*

AS/NZS 1891.3:1992 *Industrial fall-arrest systems and devices*

AS/NZS 4488:1997 *Industrial rope access systems*

AS/NZS 4576:1995 *Guidelines for scaffolding*

Part 1: Specifications

Part 2 : Selection, use and maintenance

AS/NZS 1801:1997 *Occupational protective helmets*

AS 6001:1999 *Workijng platforms for housing construction*

AS 2865:1995 *Safe working in a confined space*

AS 4142.3 *Static rescue life lines*

BIS (British Standard Institution) *Code of Practice for the Use of Safety Nets on Construction Work*

BS 3913:1982 *Industrial safety nets*

EN 1891 *PPE against falls from heights: Low stretch kernmantel ropes*

EN 358 *PPE against falls from heights: Work positioning systems*

EN 361 *PPE against falls from heights: Full body harness*

EN 362 *PPE against falls from heights: Connectors*

EN 354 *PPE against falls from heights: Lanyards*

EN 355 *PPE against falls from heights: Energy absorbers*

EN 341 *PPE against falls from heights: Descender devices*

EN 795 *PPE against falls from heights: Anchor devices - Requirements and testing*

EN 813 *PPE against falls from heights: Sit harnesses for rope access work*

UIAA *Union International des Associations d' Alpinisme Label Standards,* Chapter F: Helmets

Other Publications

Code of Practice for Crane Lifted Work Platforms (PCA Power Crane Association of New Zealand Inc.)

Code of Practice for Tree Climbing (Department of Conservation)

Crane Safety Manual (PCA Power Crane Association of New Zealand Inc.)

Guidelines for the Safe Working at Height for Residential and Light Commercial Roofing (Roofing Association of New Zealand Inc.)

Handbook for Temporary Traffic Control and Safety at Roadworks Sites, Transit New Zealand

IRAANZ Industrial Roped Access Association of New Zealand. Certification and assessment scheme and operational requirements

IRATA (UK) *General Requirements for Certification of Personnel Involved in Industrial Roped Access Methods*

Safety Rules: Electricity Industry

The Operation and Maintenance of Elevating Vehicles (Electric Supply Authority Engineers Institute of NZ)

Legislation

Health and Safety in Employment Act 1992

Health and Safety in Employment Regulations 1995

Building Act 1991

Electricity Act 1992 and Regulations 1997

Definitions

Act: In this guide, the Act refers to the Health and Safety in Employment Act 1992 and subsequent regulations.

Accepted International Standard: These standards are normally understood to include ISO Standards, IEC Standards, and other international standards having a similar standing, e.g. CIE, IWTO, ITU and many European Standards produced by CEN, CENELEC and ASME. Advice should be sought before accepting any others.

Anchorage: A component cast or fixed into a building or structure for the purpose of attaching a scaffold or safety line. It can also mean the holding-down system for cantilevered, hanging or suspended scaffolding and platforms.

Anchorage Line: A rigid or flexible line secured to an anchorage point along which a fall arrest device travels, or a flexible line which unreels from a fall arrest device.

Boatswain's Chair: A suspended scaffold where the platform is a chair, or similar appliance suitable for use by one person.

Brittle Roofing: Consists of any flat, trough, or corrugated material such as asbestos cement, plastic or glass, whether reinforced or otherwise, or any other roofing material that, due to its properties, age or weathering, will not safely support a person at all points on its surface.

Bump Rail: A rail or substantial rope barrier suspended at a height of between 0.9 and 1.1 metres to act as a boundary around a work area to prevent access to a hazard. When used as fall protection, it must be at least 2 metres from the fall hazard. Persons shall not cross or work on the wrong side of the barrier without additional protection.

Please note: The barrier must be capable of sustaining, without failure or undue deflection, a force at any point of .69kN (70kg) vertically and .44kN (45kg) horizontally.

Confined Space: An enclosed or partially enclosed space which:

(a) Is at atmospheric pressure during occupancy;

(b) Is not intended or designed primarily as a place of work;

(c) May have restricted means for entry and exit; and may:

  (i) Have an atmosphere which contains potentially harmful levels of contaminant;

  (ii) Not have a safe oxygen level; or

  (iii) Cause engulfment.

(d) Any shipboard spaces entered through a small hatchway or access point, cargo tanks, cellular double-bottom tanks, duct keels, ballast in oil tanks, and void spaces, but not including dry cargo holds.

Construction Work:

(a) Means any work in connection with the alteration, cleaning, construction, demolition, dismantling, erection, installation, maintenance, painting, removal, renewal or repair of:

(i) Any building, chimney, edifice, erection, fence, structure, or wall, whether constructed wholly above or below, or partly above or below ground level;

(ii) Any aerodrome, cableway, canal, harbour works, motorway, railway, road or tramway;

(iii) Anything having the purpose of drainage, flood control irrigation, or river control;

(iv) Any distribution system or network having the purpose of carrying electricity, gas, telecommunications or water;

(v) Any aqueduct, bridge, culvert, dam, earthwork, pipeline, reclamation, reservoir or viaduct:

(vi) Any scaffold; and

(b) Includes any work in connection with any excavation, preparatory work, or site preparation carried out for the purposes of any work referred to in paragraph (a) of this definition; and

(c) Includes any work referred to in paragraph (a) or paragraph (b) of this definition carried out underwater, including work on buoys, obstructions to navigation, rafts, ships and wrecks; and

(d) Includes the use of any materials or plant for the purposes of any work referred to in any of the paragraphs (a) to (c) of this definition; and

(e) Includes any inspection or other work carried out for the purposes of ascertaining whether any work referred to any of paragraphs (a) to (c) of this definition should be carried out; but

(f) Does not include any work in any mine, quarry or tunnel.

Crane-Lifted Work Platform: That portion of equipment from which employees carry out their work which is either attached to the crane's hook block.

Edge Protection: Some form of guardrail or restraint designed to prevent a person reaching or falling over an exposed edge.

Employee: A person employed by any other person to do any work (other than residential work) for hire or reward; and in relation to any employer, means an employee of the employer.

Employer: A person who or that employs any other person to do any work for hire or reward; and in relation to any employee, means an employer of the employee.

Enclosed Work Environment: A work area free from the risk of falls which includes:

(a) A safe means of access or a bump rail placed 2 metres from the edge of the fall edge;

(b) Edge protection such as guardrails around all perimeters and penetrations; and

(c) A fall protection barrier, such as safety mesh or a work platform.

Factor of Safety: The ratio of the load that would cause failure of a member or structure to the load that is imposed upon it in service, and, unless otherwise prescribed or directed, shall be a minimum of three.

Fall-Arrest Harness (Safety Harness): An assembly of interconnected shoulder and leg straps, with or without a body belt, and used where there is likelihood of free or restrained fall.

Free Fall: Any fall or part of a fall where the person suffering the fall is under the unrestrained influence of gravity over any fall distance, either vertically or on a slope on which it is not possible to walk without the assistance of a handrail or line.

Fall-Arrest System: A system designed to support and hold a person in the event of a fall.

Fall Protection Barrier: A barrier other than a work platform that will safely support a person without the risk of falling through.

Guardrail: A rail or barrier secured to standards or upright members, at a height above the work platform of 0.9 (minimum) to 1.100 metres (maximum) and erected along the exposed sides and ends of working platforms to prevent persons from falling. It includes a lower rail that is fixed to standards midway between the guardrail and the platform. A toeboard may be used in place of a midrail.

Handrail: A rail at a height of between 0.9 and 1.1 metres designed to assist a person to retain their balance.

Hazard: An activity, arrangement, circumstance, event, occurrence, phenomenon, process, situation, or substance (whether arising or caused within or outside a place of work) that is an actual or potential cause or source of harm and "hazardous" has a corresponding meaning.

High: In relation to a scaffold, means the vertical height of the actual scaffold.

Height: In relation to a working platform, means the greatest distance from which an article may fall before coming to rest. In determining the distance that an article can fall, no account shall be taken of any obstruction that may delay or stop the fall unless there is no possibility of the fall continuing after the obstruction is reached.

Hung Scaffold : A working platform suspended by tubes, fixed ropes, slings or other methods and not intended to be raised or lowered while in use.

kN Kilonewton: The force needed to accelerate 1000 kilograms by 1 second per second (as an approximation 100 kg hanging on a line will exert a force of 1kN).

Ladder: An appliance consisting of two stiles joined by steps or rungs and designed for the purpose of climbing and descending.

Ladder Bracket: A bracket to be attached to at least two rungs of a ladder, for the purpose of supporting a plank as a work platform.

Lanyard: A line used, usually as part of a lanyard assemble which includes a personal energy absorber, to connect a fall arrest harness to an anchorage point or static line.

Notifiable Work: Means:

(a) Any restricted work, as that term is defined in regulation 2(1) of the Asbestos Regulations 1998;

(b) Any logging operation or tree-felling operation, being an operation that is undertaken for commercial purposes;

(c) Any construction work of one or more of the following kinds:

(i) Work in which a risk arises that any person may fall 5 metres or more other than:

(A) Work in connection with a residential building of up to and including 2 full storeys;

(B) Work on overhead telecommunication lines and overhead electric power lines;

(C) Work carried out from a ladder only;

(D) Maintenance and repair work of a minor and routine nature;

(ii) The erection or dismantling of scaffolding from which a person may fall 5 metres or more;

(iii) Work using a lifting appliance where the appliance has to lift a mass of 500 kilograms or more a vertical distance of 5 metres or more, other than work using an excavator, forklift, or self-propelled mobile crane;

(iv) Work in any pit, shaft, trench or other excavation in which any person is required to work in a space more than 1.5 metres deep and having a depth greater than the horizontal width at the top;

(v) Work in any drive, excavation or heading in which any person is required to work with ground cover overhead;

(vi) Work in any excavation in which any face has a vertical height of more than 5 metres and an average slope steeper than a ratio of 1 horizontal to 2 vertical;

(vii) Work in which any explosive is used or in which any explosive is kept on the site for the purpose of being used;

(viii) Work in which any person breathes air that is or has been compressed or a respiratory medium other than air.

Person who Controls a Place of Work: In relation to a place of work, means a person who is the owner, lessee, sublessee, occupier or person in possession, of the place or any part of it; or the owner, lessee, sublessee or bailee, of any plant in the place of work.

Principal: A person who or that engages any person (otherwise than as an employee) to do any work for gain or reward.

Registered Engineer: An engineer registered under the Engineers Registration Act 1924.

Restrained Fall: Any fall where the person suffering the fall is under less than the full influence of gravity due to the action of a restraint device such as a pole strap, or is sliding down a slope less than that described for a free fall.

Safety Belt: A belt secured around the waist that may include butt or groin straps and is not suitable to arrest a free fall.

Safe Working Load (SWL): The maximum load, calculated in accordance with sound and accepted engineering practice, which can be supported safely under normal working conditions.

Scaffolding: Means any advanced scaffolding, basic scaffolding, or suspended scaffolding or any framework or structure, of a temporary nature, used or intended to be used for:

(a) The support or protection of persons carrying out construction work or work connected with construction work, for the purpose of carrying out that work;

(b) The support of materials used in connection with any such work, and includes:

  (i) Any scaffolding constructed as such and not dismantled, whether or not it is being used as scaffolding; and

  (ii) Any coupling, device, fastening, fitting, or plank used in connection with the construction, erection or use of scaffolding.

Secure Footing: means that the combination of the type of shoes worn and the slope and surface friction of the surface being walked on will prevent the possibility of a person slipping or needing a handrail to assist balance.

Standing Scaffold: A working platform which is supported wholly or partly from its base.

Static Line: In relation to fall protection, means a rope, wire strop, or rail secured between two points and possibly at various points along its length in order to support anchor lines, fall arresters or other fall protection devices. It shall have a minimum breaking strength of 44kN.

Suspended Scaffold: A scaffold incorporating a working platform suspended from overhead and intended to be raised or lowered during use.

Toe Board: A board at floor level designed to retain loose objects on the working platform. On a temporary work platform, it must be at least 225 mm high if it is used to replace a midrail.

Travel Restriction System: A system used to prevent a person reaching a place from where a fall is possible. It can consist of a safety belt and anchorage line.

Work Positioning System: A system designed to provide a primary means of support and restraint to allow work to be carried out in reasonable comfort (see section 9).

Section 1: Design and Organisational Requirements

1.1 Hazard Management

All hazards that any person (including members of the public) could be exposed to as the result of working at heights or falling objects should be identified. Once identified, they should be assessed in terms of their potential to cause harm. To assess this risk, two factors should be considered:

- The likelihood that the situation will develop or the event will occur; and
- The severity of harm that could result.

Once hazards are identified, the hierarchy of control comes into play. These controls are not mutually exclusive but should be used to reduce the risk as far as practicable. They include:

- Elimination: removing the hazard, e.g. organising work so that it is carried out in areas free from falls.
- Isolation: separating the hazard and person, e.g. ensuring that guardrails are in place.
- Minimisation: the least preferred option, involving the use of personnel protection, e.g. fall prevention equipment.

Height Hazard Assessment

Situations where height hazards assessment is needed include:

- Access to and egress from the work area.
- The ability of work platforms to support the required people, tools and other equipment.
- Size of and changes to the level, friction, slope and environment of work platforms.
- Restraints to stop people accidentally slipping or stepping off work platforms.
- Obstructions caused by materials, rubbish or fixed and protruding objects.
- Position of unprotected work platform edges or penetrations.
- Proximity of energy sources such as electricity and gas, etc.

When deciding on the appropriate fall protection, consider:

- In what situations is fall protection required?
- What are the advantages or disadvantages of each type?
- What is the best specification for the installation of the fall protection?
- What degree of training and supervision is required to ensure the correct use?
- How can the system be safely installed?

- What maintenance schedules or skills are needed to ensure satisfactory performance?
- How will the correct work procedures be implemented?

1.2 Engineering and Design

Every principal shall take all practicable steps to ensure that no employee of a contractor or subcontractor or, if an individual, no contractor is harmed while doing any work (other than residential work) that the contractor was engaged to do.

Principals and their agents such as architects and engineers have a responsibility to ensure that the project is designed to be erected, used and maintained without putting persons at risk of serious harm.

These responsibilities will be discharged by specifying a standard that ensures persons can work safely. It should be noted that while architects' and engineers' functions are primarily to design and engineer work to meet the relevant standards, it is not their duty to oversee the work process in its entirety. However, there will be many occasions when a principal has a greater duty to avoid harm, where for instance:

- By agreement or by default, the principal has assumed responsibility for safety in the workplace; or
- The principal knows of unsafe practices and allows them to continue, asserting that the employer alone bears the responsibility.

By being reluctant to point out hazards, which training and experience should make them aware of, principals and others are failing to meet the responsibilities of the Health and Safety in Employment Act and Regulations.

Checklist for Contractors

To comply with the Act, principals and their agents should ensure that the following issues are carefully considered during the designing or planning stages, and the selection and co-ordination of contractors and work schedules:

- Is the contract designed and being carried out in a manner that will reduce hazards to a minimum?
- Can safety be improved by 'building in' features, e.g. guardrails, safety mesh, etc?
- Can future maintenance work be made safer by building in systems, e.g. fall arrest anchors?
- Does the principal have supervisory systems in place to monitor contractor safety performance?
- Does the contractor understand the correct sequence of critical operations?
- Does the contractor have enough information to carry out the work safely?
- Do contractors have the expertise and ability to carry out the work safely?
- Do contractors engaged have valid safety systems in place?

- Will the operations of one contractor create a hazard for other contractors?
- Can fall-arrest systems for future maintenance be built into the structure?

It should be noted that some items listed are not required by the Building Authority Standard.

It is often safer and more economical for the principal to set up and provide for safety requirements, such as scaffolding, rather than for each contractor to provide their own incompatible systems.

1.3 Operational Planning

Operational planning involves developing timetables and systems that include safe work practices during the erection, maintenance, repair and demolition of any plant or building. A co-operative approach between all parties involved is needed. Planning includes:

- Designing building programmes so that walkways, guardrails, and fixing points are installed as work progresses, allowing for safe work methods during construction and future maintenance.
- Planning for work to be carried out at ground level or in areas where falls or hazards are not present.
- Fitting guardrails or brackets to take guardrails and other safety features to formwork and falsework as they are built and before lifting into place.
- Ensuring the structure will take the forces that will be required for the attachment of fall-arrest systems, falsework, scaffold ties, etc.
- Building in safety by using such components as roof safety mesh to provide for the safety of the roofing contractor and future maintenance staff.
- Providing leadership and regular inspections to ensure that safety systems are in place and operating to identify and control hazards.

1.4 Maintenance of Existing Buildings and Plant

Those who own, lease or use buildings or plant have a responsibility for the safety of those involved in its maintenance and repair.

Areas that require regular service and maintenance should be provided with permanent safe access and work platforms. In less frequented areas, permanent anchorages for scaffolding or fall-arrest systems may be appropriate.

Persons with control of places of work should provide training or induction procedures that will make outside contractors aware of the hazards in the area where they are to work. The induction process shall include the hazards in the workplace and emergency systems that the contractor and staff need to know for their protection.

1.5 Training and Supervision of Employees

> **13. Training and supervision** — Every employer shall take all practicable steps to ensure that every employee who does work of any kind, or uses plant of any kind, or deals with a substance of any kind, in a place of work—

(a) Either—

(i) Has; or

(ii) Is so supervised by a person who has,—
such knowledge and experience of similar places, and work, plant, or substances of that kind as to ensure that the employee's doing the work, using the plant or dealing with the substance, is not likely to cause harm to the employee or other people; and

(b) Is adequately trained in the safe use of all plant, objects, substances, and protective clothing and equipment that the employee is or may be required to use or handle.

(Health and Safety in Employment Act 1992)

Supervision includes ensuring that employees receive training and instruction in a language or manner they can understand and remember, as well as having the ability to carry out the work. It also includes monitoring the employee's actions to ensure that the agreed safe work practices are being adhered to, including the use of the correct personal protection.

Employers should have a system for verifying the standard of training, either by using a recognised industrial training organisation or by having their own assessment procedures.

What Employees Need to Know

When fully trained, an employee should know:

- Safe and practical methods of carrying out the work;
- Correct ways to use tools, plant and equipment safely;
- How tools and equipment should be stored or secured;
- Systems in use to protect employees and others from injury;
- Emergency procedures to be adopted in the event of an accident or mishap; and
- The correct fitting, use and storage of items of personal protection or fall protection.

Further Information

Building Act 1991

OSH Publications

A Guide to Managing Health and Safety to Meet the Requirements of the Health and Safety in Employment Act 1992

Other Publications

Safeguard Buyers Guide for Workplace Health and Safety Products and Services

Section 2: General Safety

2.1 Employee Safety

> **6. Employers to ensure safety of employees** — Every employer shall take all practicable steps to ensure the safety of employees while at work . . .
>
> (Section 6. *Health and Safety in Employment Act 1992*)
>
> **21. Heights of more than 3 metres —**
> ...
> Every employer shall take all practicable steps to ensure, in relation to every place of work under the control of that employer, that, where any employee may fall more than 3 metres:
>
> (a) Means are provided to prevent the employee from falling; and
> (b) Any means so provided are suitable for the purpose for which they are to be used.
>
> (Reg. 21. *Health and Safety in Employment Regulations 1995*)

While most falls occur off high structures, they can also occur when employees enter silos, manholes or excavations from the ground or floor level.

Where there is a possibility of serious harm from a fall of less than 3 metres, fall protection is still needed. Consideration should also be given to situations where a person may slide down an inclined surface before reaching a point at which a fall can occur.

An **enclosed work environment** should be planned for and set up at the earliest opportunity. This includes a fall protection barrier such as safety mesh, tile battens or work platform, together with guardrails, safe access or a bump rail placed 2 metres from the edge of the fall.

The employer shall determine that all walking/working surfaces on which employees are to work have the strength and structural integrity to support employees safely. Each employee on a walking/working surface with an unprotected side or edge which is 3 metres or more to a lower level shall be protected from falling by the use of a guardrail system, safety net system, or personal fall-arrest system.

2.2 Public Safety

> **15. Duties of employers to people who are not employees** — Every employer shall take all practicable steps to ensure that no action or inaction of any employee while at work harms any other person.
>
> *(Health and Safety in Employment Act 1992)*

Other people working on the site and the general public around the site must be protected from site hazards. Activities must be co-ordinated to provide a safe environment for all people legally in the area.

Co-ordination could include:

- Providing traffic control or barriers to prevent access under work areas.
- Preventing the craning of components, or employees working, over public or access areas.
- Completing floors, decks or work platforms so that there is a fully decked platform protecting people at lower levels.

- Providing safety screens around the work platforms to prevent objects from falling outside building confines.

2.3 Protection from Overhead Services

Working at heights often brings employees close to overhead conductors. Minimum clearances from these services must be maintained as set out in the Electricity Regulations. The minimum distance between conductors and any person or plant is 4 metres unless the power network operator has granted a permit allowing a lesser distance. Such permits should be kept at the work site.

2.4 Access and Egress

All persons shall be provided with a safe means of access and egress to their work area. Steps, stairs, ladders, platforms and walkways or suitable mechanical plant shall be provided. Suitable access should take into account environmental conditions such as weather and lighting, what people may have to carry, and other relevant factors.

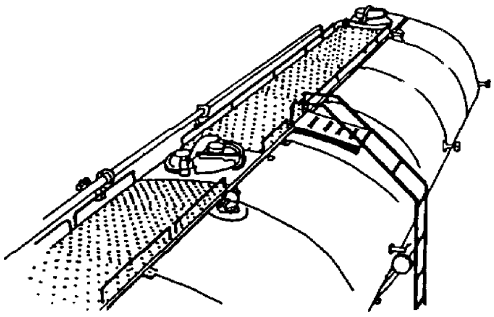


Fig. 1 Milk tanker with hatches

Serious injuries may result from falls from large trucks or tankers, while accessing or opening tank hatches; from road transporters, while accessing the top of freight containers; and grain transporters, while fitting "hungry boards" to increase grain storage capacity or using vacuum loaders. Where people are required to gain access to high areas of trucks, road transporters, tankers and rail transportation for the purposes of securing, restraining, loading or unloading freight and, where there is a risk of falling, employers must provide a safe system of work for people to get to and from the work area. This could be the provision of steps, permanent access ladders, walkways and guardrails. Wherever practicable, as much work as possible should be carried out at ground level.

Access to and egress from large items of plant, such as large vehicles and earthworks equipment (bulldozers, scrapers, graders, excavators, etc.) and heavy equipment, including during manufacture and maintenance operations, may result in fall injuries.

Employers must give consideration of the equipment and facilities available at both the initial loading point and the unloading destination to ensure safe access and egress is provided to employees involved in the operation.

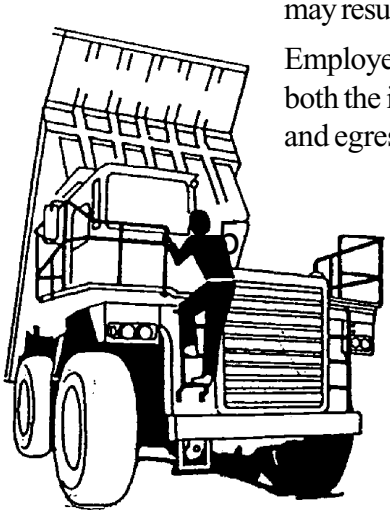


Fig. 2 Large rear dump truck

2.5 Access to Confined Spaces

Access to, and working in, confined spaces present a unique series of hazards. These hazards must be carefully assessed and controlled before any person enters such a space.

Access to confined spaces must be to high standard.

Employees entering and working in confined spaces often have to wear respiratory protection. This can reduce peripheral vision. It is therefore important that ladders, steps, handrails, etc. are built

to a regular pattern and to a high standard. Distances between rungs and steps, and positions of hand holds and guardrails, must be spaced at regular distances and heights. (See Fig 3.)

Before entering such spaces, the possibility of harm must be fully assessed and emergency systems put in place. The wearing of harnesses and life lines should be considered as necessary both to prevent falls and for emergency rescue.

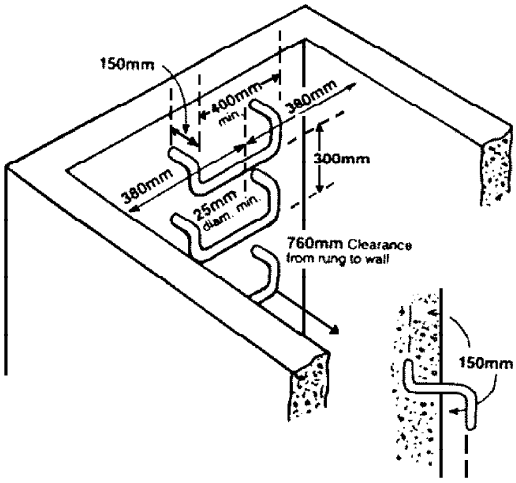


Fig. 3 Access to confined spaces must be to a high standard. AS 2865:1995

2.6 Personal Protective Equipment

Personal protective equipment (PPE) shall be worn where there is the possibility that failure to wear such equipment could result in serious harm. Such equipment should comply with the relevant New Zealand Standard, or an acceptable international Standard.

Specialist PPE will be needed in certain circumstances. Different types of gloves will be needed for handling chemicals and handling steel; respiratory protection will vary for hazardous dusts, fumes and solvents.

Employees shall wear and use PPE when needed or instructed to do so by a person with authority.

Employers shall ensure that the personal protection provided is:

- Suitable for its intended use;
- Correctly sized and fitted to the individual user;
- Used by employees who are trained in its use and understand its performance;
- Correctly stored when not in use;
- Cleaned and checked at regular intervals, usually every time it is used;
- Disinfected and sanitised before use by another person; and
- Used by everyone that needs protection.

Appropriate personal protective equipment must be provided and used.

Fig. 4 Appropriate personal protective equipment must be provided and used

2.7 Emergency Planning

Emergency planning is required in order to prevent further loss or injury after an accident or natural disaster.

Planning may involve simply providing first aid facilities and emergency phone numbers, but it could also require specialist rescue equipment, training and evacuation exercises.

Questions that emergency planning should answer include:

- How to reach an injured worker and get them to medical help, remembering that they could be suspended in a harness or trapped in a confined space.

- What first aid and medical equipment is required on site, taking into account number of workers, distance to medical services and inherent hazards.
- How to provide the necessary information and protection for emergency personnel.
- How a fire or chemical spill is to be contained.
- How to account for all persons in the event of an emergency evacuation.
- How to secure the site in an emergency to prevent further loss.
- How to disconnect or isolate all energy sources, e.g. gas, steam.

Further Information

Standards

AS/NZS 1657:1992 *Fixed platforms, walkways, stairways and ladders. Design, construction and installation*

OSH Publications

Safe Working in Confined Spaces

Other Publications

Building Industry Authority and Building Act 1991— Clause F5

Electricity Act 1992 and Regulations 1997

Electrical codes of practice

Handbook for Temporary Traffic Control and Safety at Roadwork Sites, Transit New Zealand.

Section 3: Permanent Fixed Access and Platforms

3.1 General

Permanently installed steps, stairs or ramps, etc. shall comply with the Building Act and Local Authority requirements. A building permit will usually be required. The requirements and standards for access and platforms varies considerably, depending on usage, so this section is for basic guidance only.

All access ways and stairs must have a minimum head clearance of 2.1 metres vertically above the stair nosing.

Doorways should not open directly onto a stair or ramp. A level landing or platform is required.

For open-sided stairs and ramps, the minimum width is 685 mm. When enclosed between walls, etc., the minimum width is increased to 815 mm, and where two persons have to pass, the minimum width is 1 metre.

Guardrails should be fitted to all exposed edges.

3.2 Handrails, Guardrails and Toeboards

Handrails are provided to assist balance; guardrails to prevent falls. The top rail should be 0.9 to 1.0 metre above the floor or front of the stair nosing. For guardrails, a midrail shall be fitted. A toeboard should be fitted anywhere there is a danger of tools or materials being lost over the edge.

3.3 Stairway and Ramp Landings

Landings shall be placed so that stairs, ladders or ramps are divided into approximately equal sections. The minimum width and depth of a landing shall be the width of the steps or stairs; this shall be clear of any swinging door or other obstruction. Landings shall be level, with guardrails fitted.

3.4 Ramps

Ramps are safer than stairs or ladders for small changes of level, as people do not have to place their feet so accurately. In addition, ramps can be used by barrows, hand trucks and other means of transport. The slope of the ramp is determined by the type of surface to give a good grip and the type of loads to be carried. For guidance:

- For reasonably slip-resistant surfaces subject to wetting: 1 vertical to 10 horizontal, under 6^{o}.
- For reasonably slip-resistant surface not subject to wetting: 1 vertical to 8 horizontal, 7^{o}.

- For ramps steeper than 8^0, cleats or specialist non-slip surfaces are needed. Such ramps should not be used by trucks and trolleys. These ramps should only be used for special purposes such as up the side of conveyors. The maximum slope is 1 in 2.7, 20^o.

3.5 Stairways

Treads and risers on any stairway must be of uniform dimensions. The rise of each tread and the going (depth) will be governed by available space but should comply with the following criteria:

- The pitch of the stair should be between 30^o-50^o from the horizontal.
- The height of the rise and depth of the going of each step should approximate the formula, 'twice the rise plus the going equals 600 mm' e.g. rise of 160 mm, going of 280 mm, 2 x 160 + 280 = 600 mm.

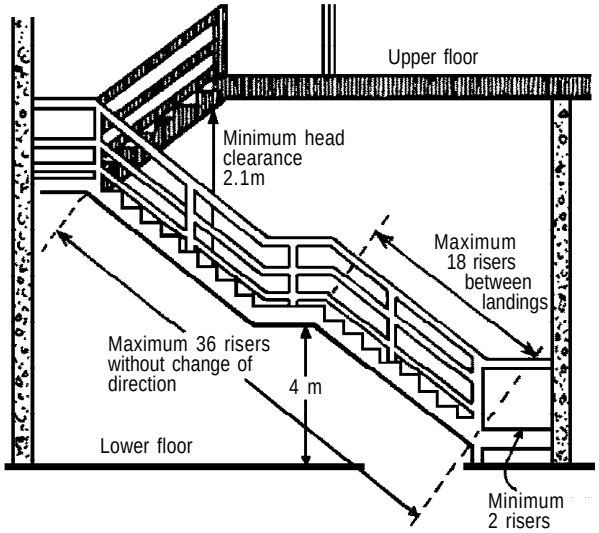


Fig. 5 Stairways

The maximum number of stairs between landings should be 18, with no more than two flights without a change of direction.

The depth of any landing should be at least equal to the width of the stair.

Guardrails shall be provided on the open side of all stairs. Handrails must be provided on one side of all closed stairs. Stairways wider than 1 metre shall have hand or guardrails on each side.

The nosing of each tread should extend 25 mm over the riser and be of a non-slip material.

Service stairs around plant or machinery, etc. may not be able to meet these criteria but every effort should be made to do so. Failing this they should be built to the dimensions and pitch of a step or tread ladder. Spiral stairways should be avoided if at all possible.

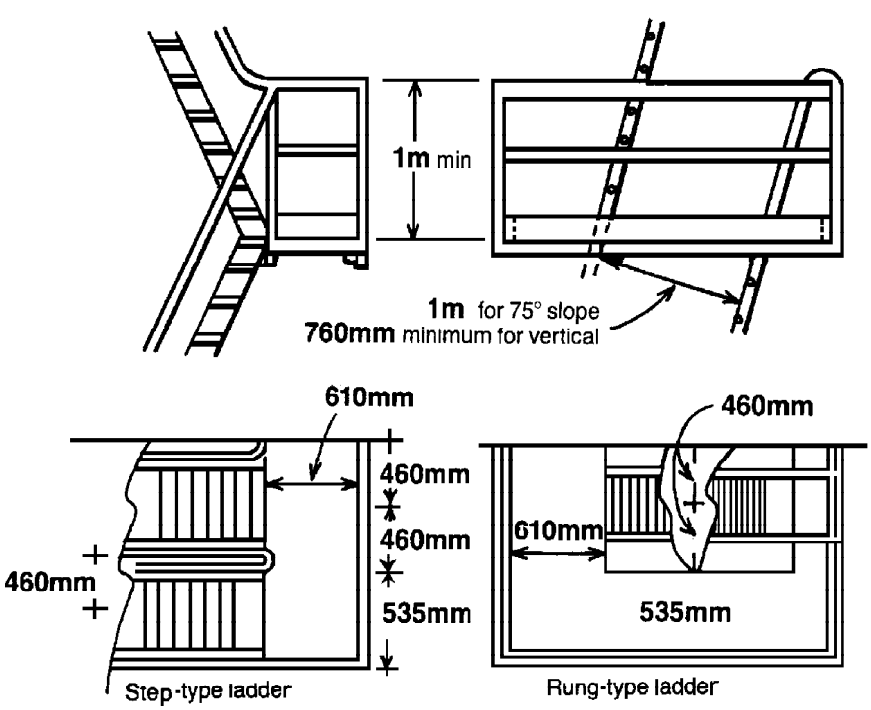


Fig. 6 Intermediate landings

3.6 Fixed Tread or Step Ladders

These ladders should be pitched at an angle of 60°-70°. Treads should be at least 100 mm wide, with a rise of between 200-250 mm. Guardrails should be fitted at a minimum height of 0.9 metres vertically above the nosing of the treads. Other requirements include:

- Maximum length of 6.1 metres.
- Minimum width of 460 mm with the distance between guardrails of 535-760 mm.

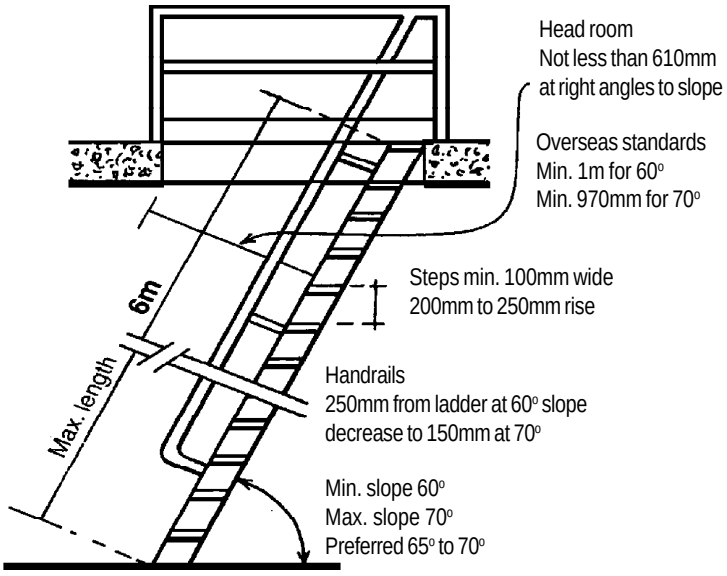


Fig. 7 Step or tread ladders

3.7 Fixed Rung Ladders

Rung ladders should be pitched between 70°-90°. The rungs should be 250-300 mm apart with a width of 400 mm. Other requirements include:

- A clear distance of 150 mm behind the ladder.
- All ladders above 6 metres in height and steeper than 75° shall be fitted with cage guards or hoops and straps from 2.5 metres in height.
- All ladder stiles should extend 1 metre above the step-off point unless suitable hand holds are provided.
- Reverse climbing ladders shall have a clearance of 760 mm between the ladder and structure.
- The maximum length of a vertical fixed ladder between landings should be 9 metres.

Where cage guards or hoops are not possible, a fall-arrest system shall be used. A corrosion-resistant anchor cable or rail, generally stainless, is attached to the ladder or access. The climber wears a harness attached to a type 1 fall-arrest device (inertia lock) which is free to slide up or down this rail or cable.

The wearer shall have specialist training in the use of this equipment.

The lanyard between the harness and the inertia lock should not exceed 300 mm.

Where a safety rail such as above is not fitted, rung grippers and hooks should be used while a type 1 arrest device is rigged. The grippers are hand-held and attached to a safety harness by short lines. The grippers latch on to the ladder rungs and as the climber ascends, the grips are released and moved from rung to rung. If the hand slips, the gripper stays in position.

Synthetic lines shall not be installed as a permanent anchor line, they will be rigged for each operation. (See Fig. 8)

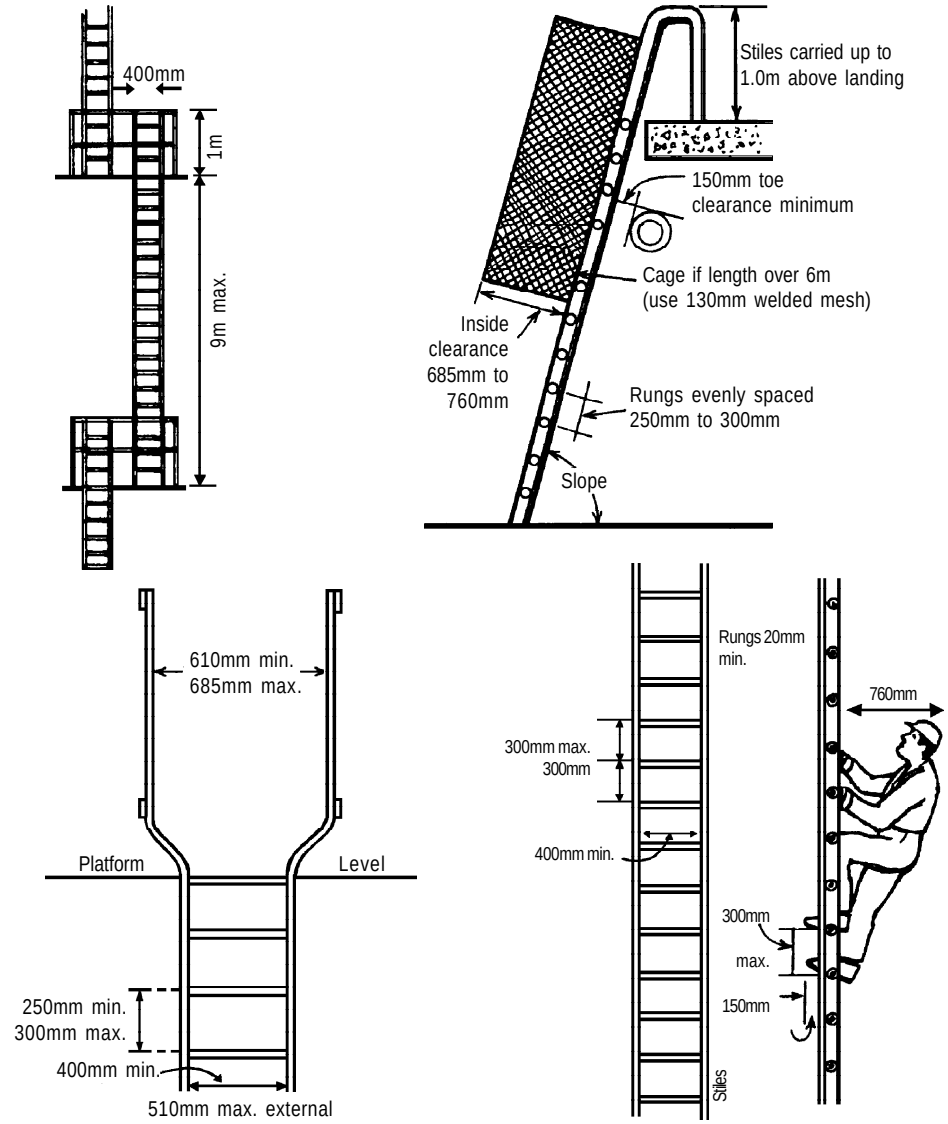


Fig. 8 Fixed rung ladders

3.8 Permanent Fixed Roof Ladders and Crawl Boards

Fixed crawl boards and roof ladders may be used to provide permanent access to a work positioning system, or to service plant on pitched or brittle roofs. Crawl boards shall have a minimum width of 450 mm with a hand rails. On brittle roofs, guard rails should be permanently installed. Crawl boards shall have a non-slip surface or cleats, depending on their pitch. Always check that permanent access complies with the Building Act.

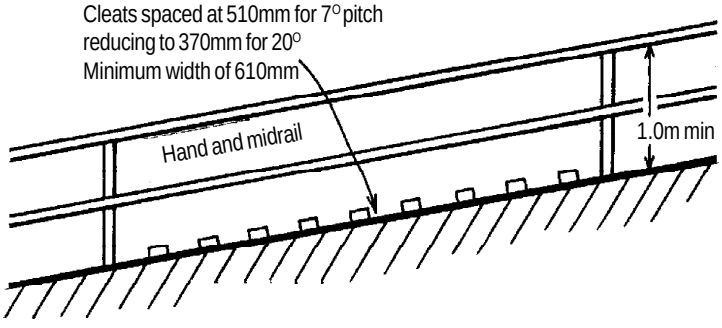


Fig. 9 To climb a roof of 7° to 20°

Section 4: Temporary Non-Fixed Access and Platforms

4.1 General

All ladders, steps, trestles and working platforms shall comply with the relevant New Zealand Standard or other accepted international Standard. Those that do not have a Standards mark are generally of light construction and not suitable for use in a workplace.

- Ladders and steps used to gain access to a step-off point should extend 1 metre past the step-off point unless some other form of adequate handhold is provided.
- The ladder shall be secured against movement sliding at top and bottom while in use.
- The single rung or step of a ladder should not be used to support one end of a plank upon which a person has to work.
- Ladders and steps are designed for the use of one person only at any one time.

Before using any ladder, ask yourself:

- Is using a ladder the safest and best work method for the job?
- Is the ladder in good condition and suitable for the type and height of work?

While using a ladder:

- Do not carry a load that will prevent both hands from being able to hold or grab the rungs.
- Do not over-reach — the waist should always remain within the confines of the stiles.
- Unless there is a secure handhold, do not stand on a rung or step that is closer than 0.9 metres from the top of the ladder or steps while working.
- Always ensure that all loose tools or other items have been removed from the steps or rungs before moving the ladder.
- Where the ladder encroaches onto a passage or roadway, place cones or barricades around the base.

Ladders shall be withdrawn from service immediately on suspicion of any structural damage such as:

- Bent or twisted stiles;
- Loose, bent, worn, or split rungs or steps;
- Loose, bent or disconnected braces between steps and stiles or backframe;
- Damaged or missing locking bars;

- Missing rivets or non-slip feet.

All ladders shall be set up on a firm level surface unless a secure method is used to ensure an even distribution of weight between the stiles. In the case of a step ladder, this includes the back frame.

4.2 Perimeter Protection

Perimeter protection shall be provided on the exposed edges of all work areas from which a fall of more than 3 metres is possible. Guardrails, including midrails and toeboards, are the preferred option. However, in some situations other systems may be appropriate:

- The height to the top of the guardrail shall be between 0.9 and 1.1 metres.
- A midrail is not mandatory on a working platform where a 225 mm high kickboard or equivalent is fitted.
- The guardrail shall be before or vertically over the edge of the platform except:
  - on scaffolds, the guardrail shall be within 200 mm horizontal distance of the edges of the platform.
- It must be capable of sustaining, without failure or undue deflection, a force at any point of .69kN (70kg) vertically and .44kN (45kg) horizontally.

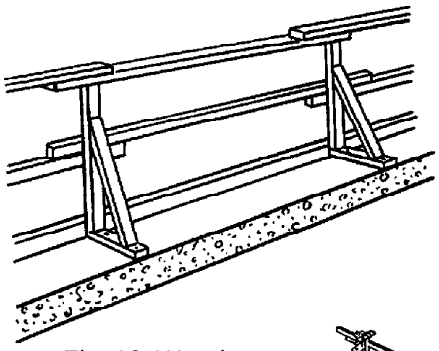


Fig. 10 Wooden guardrail with midrail and toeboard

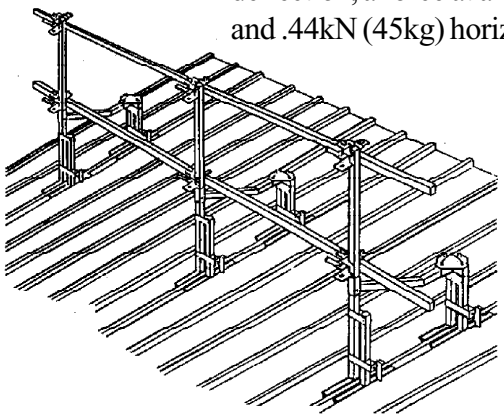


Fig. 11 Proprietary guardrail system

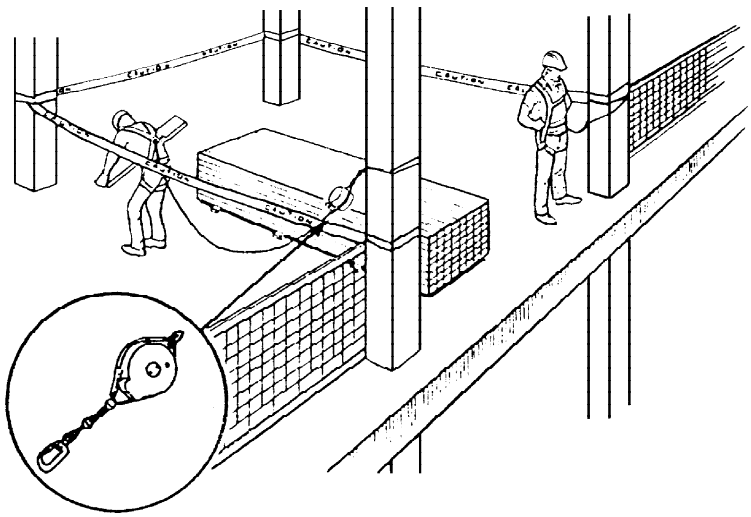
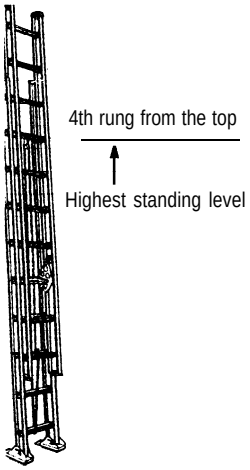


Fig. 12 Fall restraint system

4.3 Single and Extension Ladders



The maximum length of a single ladder is 9 metres and the maximum length for an extension ladder is 15 metres.

- Ladders should be set up at an angle of 1 horizontal to 4 vertical, about 14° to the vertical.
- They shall never be used horizontally as a work platform.
- A ladder is to support one person only.

Ladders must be secured against movement at the top and bottom to prevent the possibility of displacement. It may be necessary for one person to hold the ladder until another can climb up and secure the top.

Fig. 13 Extension ladder

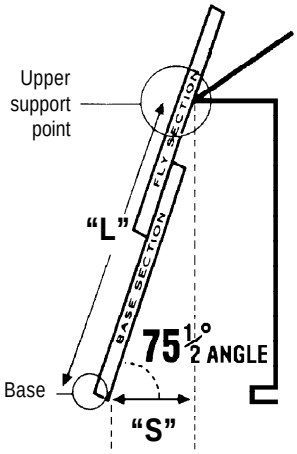


Fig. 14 Extension ladder set-up
4 to 1 ratio: "S" = 1/4 of "L"

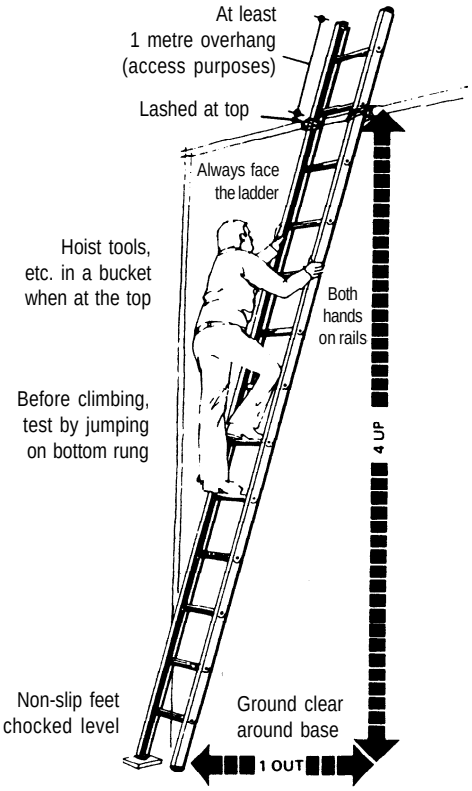
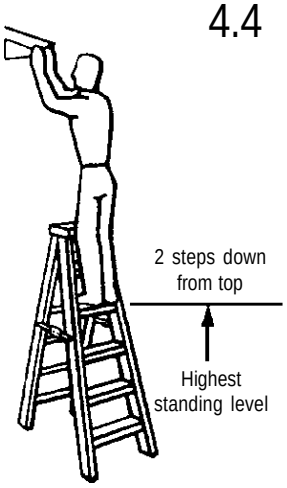


Fig. 15 4 up - 1 out gives the right slope

4.4 Step Ladders



A step ladder is a self-supporting ladder not adjustable in length, having flat steps and a swinging back stay that is held in place by a secured locking bar.

The maximum height for a step ladder is 6.1 metres. When such ladders are used incorporating a plank, thereby creating a working platform, they shall be fitted with the industry guarding standard and additional bracing to ensure stability where they are used above 3 metres or more in height.

Step ladders must be set up on a firm level area. Sole plates will be needed on soft ground.

Fig. 16 Step ladder

4.5 Dual-Purpose Ladders

A dual-purpose ladder is a step ladder where the back frame is fitted with rungs and can be hinged to provide an extension. When the ladder is in use either as a step ladder or extended, the two sections must be securely latched by a locking bar or solid catch.

4.6 Ladder Brackets

Ladder brackets are used to support a single plank between two ladders and should comply with the following requirements:

- The brackets are used on a pair of single ladders not exceeding 3 metres in height. Brackets are not really suitable above 3 metres because of the difficulty of incorporating a guardrail system.

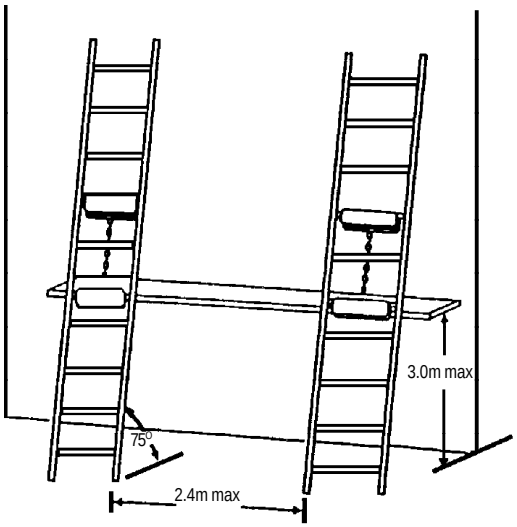


Fig. 17 Example of an acceptable ladder bracket scaffold

- The bracket is supported on two ladder rungs.
- The bracket is attached to the ladder so the working platform is less than three-quarters of the ladders length from the foot.
- Fall protection must be provided if the platform is more than 3 metres high.
- The working platform shall be slung under the ladder.
- Only **one person** is to be on the platform at any one time.
- The maximum span of a plank shall be 2.4 metres and it should comply with NZS 3620:1985.

4.7 Trestles and Tripods

A trestle is a self-supporting metal or timber stand including horizontal members designed to support one end of a light-duty work platform. It may be folding or telescopic. The design and construction of steel trestles should comply with AS/NZS 1576.5 or other accepted international Standard.

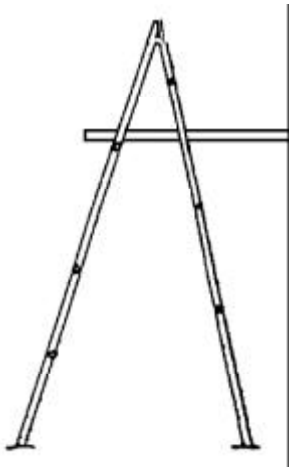


Fig. 18 Light-duty trestle. Maximum height: 3 m; maximum loading: 160 kg

Fall protection shall be provided if the height of the work platform on trestles exceed 3 metres.

The working platform between the trestles shall comply with a light-duty working platform (160kg).

Each trestle must be capable of supporting the total live load.

The legs of the trestle or tripod must be set up on firm level ground.

Sole plates shall be used on soft ground.

The planks should be centralised on the trestles.

4.8 Cantilevered Temporary Work Platforms

This type of structure generally comprises of a structural steel platform supported at one end on a floor slab. The other end is cantilevered out over the edge and used as a support for employees, scaffolding or a loading platform. A registered engineer's design certificate should be obtained.

Requirements include:

- Fall protection or perimeter edge protection must be provided for persons on the platform.
- The design must be such that the necessary stability is achieved by the use of a through the floor U-bolt or equivalent system providing adequate horizontal and vertical restraint.
- The bearing surface of the floor on which the platform sites must be structurally adequate and with no irregularities that will create false fulcrum points or cause instability.
- A notice clearly stating the safe working load shall be prominently displayed on the platform.

4.9 Roof Ladders and Crawl Boards

Temporary roof ladders and crawl boards should be of the same standard as for permanent installations. However, other forms of fall protection may be more appropriate. Roof ladders should be used on roof pitches over 30 degrees. The bracket on the top of a crawl board or roof ladder should be sufficiently deep to reach over the ridge and lap the roof framing.

Fig. 19 Bracket on roof ladder should reach over the ridge

Further Information

Standards

AS/NZS 1576.5:1995 *Prefabricated splitheads and trestles*

AS/NZS 1657:1992 *Fixed platforms, walkways, stairways and ladders. Design, construction and installation*

AS/NZS 1892.1:1996 *Portable ladders - Metal*

AS/NZS 1892.2:1996 *Portable ladders - Timber*

AS/NZS 1892.3:1996 *Portable ladders - Reinforced plastic*

AS/NZS 4576:1995 *Guidelines for scaffolding*

NZS 3620:1985 *Specification for scaffold planks*

Section 5: Scaffolding

5.1 General

All scaffolding must comply with the *Approved Code of Practice for the Safe Erection and Use of Scaffolding* (OSH), and AS/NZS Standards.

Scaffold construction requirements are complex and people should refer to the above code of practice for more information as required. The employer shall ensure that a certificated scaffolder holding the relevant scaffold certificate issued under the Act is in direct charge of the erection, structural modification, or dismantling of any scaffold more than 5 metres above the ground. Being in direct charge means being at the site of work and able to immediately advise or take control of the work.

The employer shall ensure that all scaffolding is suitable and safe for employees to use.

5.2 Standing Scaffolds

For any scaffold over 5 metres in height, the scaffolder shall complete a scaffold register before the scaffold is used. This register must be seen and understood by the employer of any employee using the scaffold.

The scaffolder or a competent person (registered engineer) must inspect the scaffold each week it is in use and after any occurrence that could affect its stability or safety and again complete the register.

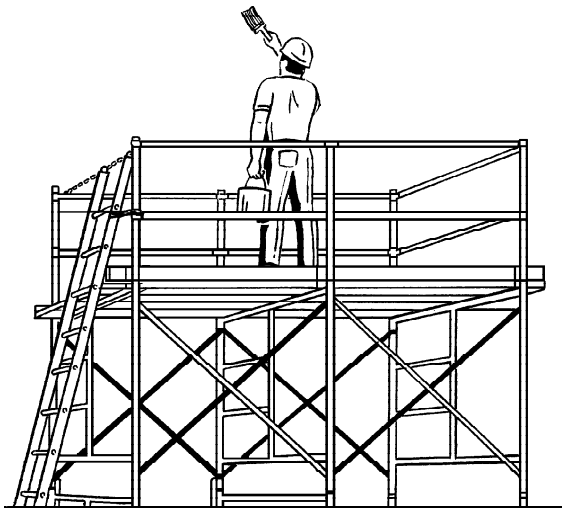


Fig. 20 Typical standing scaffold with perimeter protection

The person inspecting the scaffold shall ensure that:

- All guardrails and working platforms are in place on all areas in use;
- Safe access is provided to all working platforms;
- Sufficient scaffold ties and braces are in place;
- All load-bearing members are in the correct place and properly secured with the correct fittings;
- Working platforms are fully decked and planks secured against movement; and
- Perimeter protection or guardrails are correctly fitted. Guardrails, and planks may be fitted by a competent person.

If any instability or structural damage is found, the scaffold should not be used until referred to the certificated scaffold for repair.

Detail of standing scaffold are contained in the *Approved Code of Practice for the Safe Erection and Use of Scaffolding.*

5.3 Suspended Scaffolds and Boatswains' Chairs

The certificated scaffolder shall complete the scaffold register when the scaffold is built and after any structural alteration. The scaffolder or a competent person (registered engineer) shall inspect the scaffold and complete the register every day the scaffold is used.

Employers must ensure that:

- Workers on the suspended scaffold are fully conversant with all the controls and emergency descent procedures; and
- All employees in the stage or boatswain's chair must wear a safety harness that is secured to an anchorage independent of the stage rigged so the arresting force that does not exceed 6kN.

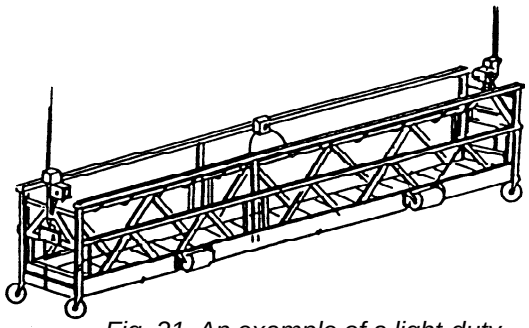


Fig. 21 An example of a light-duty suspended stage with two wire ropes to each winch. A vertical life line should be used.

Where the stage has two independent means of support at each support point, the person may use a 2 metre lanyard attached to the stage.

Persons and equipment placed on the platform shall not exceed the SWL of the stage.

Provision shall be made for the safety of those who may be in the vicinity of or under the stage. The use of barriers or gantries under the stage should be considered.

5.4 Hung Scaffolds

Hung scaffolds can present a variety of special problems:

- Suspension points from which the scaffold is hung shall have a safety factor of 3.
- Wire ropes or chains used as hangers shall have a safety factor of 5.
- Hangers constructed of scaffold tube shall have check clips fitted.
- While building or dismantling hanging scaffolds, scaffolders shall wear a fall-arrest system.
- A scaffold register, as for a standing scaffold, must be completed and be available.

5.5. Special Scaffolds

Special scaffolds are those scaffolds that due to their construction, design, expected live loads are not built to match the *Approved Code of Practice for the Erection and Safe Use of Scaffolding*. Expert advice from a registered engineer or certificated scaffolder should be sort before such scaffolds are built and used. Every employee using the scaffold shall be informed of its maximum safe live load and any other requirements for its safe use.

5.6. Scaffold Brackets

A range of scaffold brackets are available to attach to timber studs or suitable wall anchors. Brackets shall meet the same specifications as standing scaffolds in relation to live loads, guardrails and other safety requirements.

Further Information

Standards

AS/NZS 4576:1995 *Guidelines for scaffolding*

NSZ 3620:1985 *Scaffold planks*

OSH Publication

Approved Code of Practice for the Safe Erection and Use of Scaffolding

Section 6: Mechanical Plant for the Support of Personnel

6.1 General

A wide range of mechanical plant is used for the support of persons at work. All such equipment shall be designed and built to New Zealand or other recognised Standards.

All such equipment must be designed, built and maintained so that if a loss of hydraulic pressure occurs, the machine will remain stable. For mechanically-operated machines, a positive locking system to prevent inadvertent movement shall operate.

Climbing out of platforms at a height should be strongly discouraged. Where it is essential, fall protection must be provided. This may be achieved by stabilising the platform then disconnecting the safety line from inside the bucket and reconnecting it to a point on the structure before the person climbs out.

Care must be taken to ensure that any personnel bucket does not rest or become lodged on any ledge or sill. This can cause the bucket to drop suddenly, resulting in damage or injury.

Mechanical plant must not travel with a person in the bucket or platform unless it is specifically designed to do so.

Work carried on by persons in the platform, such as pulling or pushing on items outside the platform, can have the effect of increasing the live load. This factor must be taken into account when calculating whether the total live load is within the SWL.

All tools and materials lifted onto the platform should be within the confines of the guardrails unless a full engineering and hazard assessment is carried out to ensure safety.

6.2 Power-Operated Elevating Work Platforms

The design, construction, maintenance and use of all types of elevating work platforms must comply with the *Approved Code of Practice for Power-Operated Elevating Work Platforms* (published by OSH).

Power-operated work platforms such as cherry pickers, scissors, hoists, etc. are specialised pieces of equipment often designed for particular types of operation. It is essential that the correct type of machine is selected for the intended work. The operator must be trained to operate that particular type of elevating work platform.

Before use the employer should ensure that:

- The machine has been inspected and tested within the previous six months;
- The machine is set up level on firm level ground;

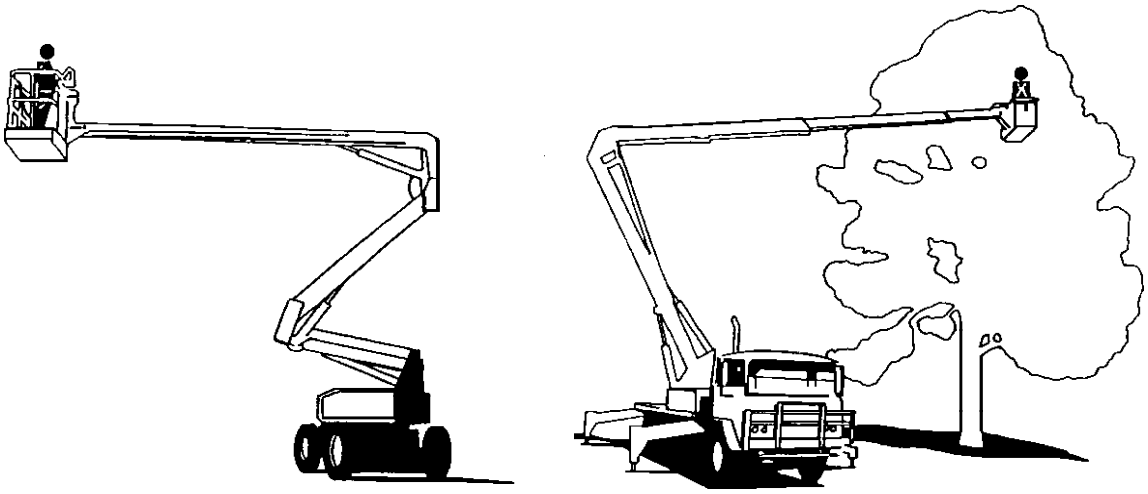


Fig. 22 Power-operated elevating work platforms

- It is used so that machine or operator will be further than 4 metres to power lines (see paragraph 2.3);
- The machine's operation will not create a hazard, e.g. the boom will not swing out and block roads; and
- The machine will not be overloaded or used as a crane. (Each person, plus light tools, is deemed to weigh 100 kg.)

Persons in the bucket of a platform on the end of a boom must wear a safety harness with a lanyard attached to the machine. The line should be just long enough to provide free movement within the confines of the bucket.

6.3 Forklift Platforms

Work platforms may be constructed to be raised or lowered using a forklift. It is necessary that such platforms are properly constructed and only used on forklifts that are maintained in accordance with the *Approved Code of Practice for Training Operators and Instructors of Powered Industrial Lift Trucks (Forklifts)* — published by OSH.

Fig. 23 An example of an engineer-designed mancage, with safety harness and lanyard assembly, correctly positioned on forklift tynes

Requirements include:

- Platforms shall be fitted with guardrails, intermediate rails and kickboards. Any gates must open in and have a spring-loaded latch.
- A 2.0 metre high guard that is sufficiently wide to prevent any contact with the lifting mechanism shall be fitted to the back of the platform.
- The tilt lever should be locked out or made inoperable or, alternatively, a fall-restraint system introduced using a full harness and short lanyard, allowing free movement only within the platform confines.
- Operating instructions and the SWL of the platform must be attached in a prominent position.

- The platform must be secured to the forks in such a way that it cannot tilt, slide or be displaced.
- The forklift operator must be competent and remain at the controls at all times while the platform is in use, unless there is an independent means of access and egress to the platform.

6.4 Crane Lift Platforms

Where no other practical and suitable method is available, a working platform may be suspended from a crane. It is essential that the crane operator and the person using the platform discuss the operation and maintain direct communication by line of sight or by telecommunication at all times.

Minimum safety standards include:

- The crane must be fully operational, complete with the correct inspection certificates.
- The crane operator must remain at the controls at all times when the platform is in use and operate the crane within the manufacturer's recommendations.
- The crane shall be inspected by the operator daily while in use.
- Cranes lifting suspended work platforms from the hook shall be fitted with two anti-block devices.
- Cranes with automatically-applied brakes to the hoist or twin lever-operated hoists can operate with two hooks.
- Where a crane is to be used, has multiple hoist drums and is fitted with a hoist system that allows either hook block to free fall, it is recommended that the hook block not in use be removed and the wire stowed.
- The platform shall be designed and built by competent people. A registered engineer's certificate may be required and shall comply with clause 5.5 in the *Approved Code of Practice for Power-Operated Elevating Work Platforms.*
- The platform must be fitted with a guardrail, midrail and toeboard.
- Any gate fitted should open in and be locked while the platform is in use.
- A notice shall be attached to the platform stating its SWL, plus any relevant instructions for rigging or use.
- Occupants in the platform must wear a safety harness and lanyard. The lanyard shall be as short as practical, allowing for free movement within the platform. The lanyard shall be attached to the crane hook block in such a way that it cannot be dislodged, even if the platform becomes unstable or detached.
- Where the platform is fitted with an overhead frame for protection from falling objects, lanyards cannot be attached to the hook block. Under these circumstances the cage shall be securely fixed to the crane hook block, not just put on the hook, and the lanyards attached directly to the platform.

- A crane should not lift a work platform and another load together.
- All shackles shall be moused and the hook must have a safety latch.
- All cranes must have power load-lowering capability.

6.5 Vehicle Extension Arms

Platforms have been fitted to a variety of mechanical plant. In these cases a design certificate from a registered engineer with experience in this field shall be obtained. Such certificates must show that the platform meets the criteria for a power-operated work platform in relation to stability, strength and safety, and provides operating instructions and its SWL.

The machine must be set up and used in accordance with paragraph 6.6 Knuckle Hoist Platforms.

6.6 Knuckle Hoist Platforms

Personnel buckets can be fitted to a variety of truck-mounted hydraulic hoists such as haibs. They shall be used and maintained in compliance with Electricity Engineers Association of NZ *Guide for Power Operation and Maintenance of Elevating Work Platforms* and the *Approved Code of Practice for Power-Operated Elevating Work Platforms* (OSH). A registered engineer's design certificate may be required.

Employers shall insure that:

- Workers in the bucket wear a safety harness with a lanyard rigged in such a way that is just long enough to allow free movement within the bucket;
- The bucket must be prevented from tilting more than 1 unit vertical to 6 units horizontal while in use;
- Unless controls are fitted in the bucket, the machine operator must remain at the controls and in direct contact with the occupant at all times;
- Workers must be aware of and not exceed the SWL;
- A mechanical and safety inspection of the bucket support boom and all associated mechanical equipment shall be carried out every six months;
- Electrical isolation tests should be carried out if the machine is used for electrical reticulation work;
- The machine must be set up on firm level ground with all stabilisers extended to the ground.

6.7 Building Maintenance Units

A building maintenance units (BMU) is an item of plant which consists of a structure or trolley installed permanently on a building or structure and designed to raise or lower a cage or swinging stage. The design of these units is covered by the Building Act 1991 and *A Guide for Building Maintenance Units and Powered Swinging Stages* (published by OSH).

Principals, persons in control of the workplace and employers shall take all practicable steps to ensure that the BMU is only used within its design criteria by competent persons. Manufacturers shall supply maintenance and operating instructions which shall be available to all relevant parties. Safety harnesses and lines shall be worn. (See Fig. 24)

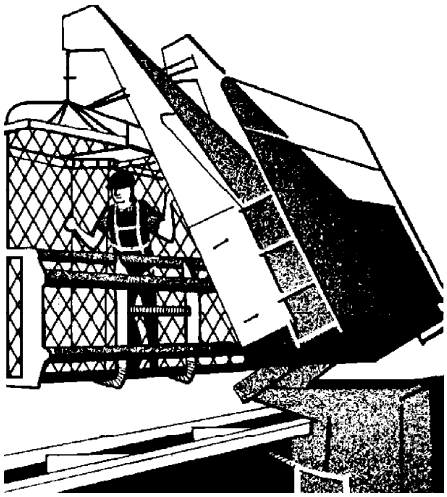


Fig. 24 Building maintenance unit

Further Information

OSH Publications

Approved Code of Practice for Cranes and Lifting Appliances

Approved Code of Practice for Power-Operated Elevated Work Platforms

Approved Code of Practice for Training Operators and Instructors of Powered Lift Trucks (Forklifts)

A Guide for Building Maintenance Units and Powered Swinging Stages

Other Publications

Code of Practice for Crane-Lifted Work Platforms, published by the Power Crane Association of New Zealand (Inc.)

Power Crane Safety Manual, published by the Power Crane Association of New Zealand (Inc.)

The Operation and Maintenance of Elevating Vehicles, published by the Electric Supply Authority Engineers Institute of NZ

Legislation

Building Act 1991

Section 7: Safety Nets

7.1 General

Safety nets must comply with BS 3913:1982 *Industrial safety nets* and be used in accordance with British Standard Institution (BSI) *Code of Practice for the Use of Safety Nets on Construction Work*, or other accepted international Standard. Safety nets shall be rigged by a competent person who can demonstrate specialised training in this field.

Safety nets suspended under work areas may be a satisfactory means of protection in the event of a fall, while also allowing the maximum flexibility.

Unless safety nets are cantilevered horizontally, at least (2+H/5) outside the work area (where H = the vertical distance in metres between the net and the outermost working point) perimeter protection will still be needed.

Nets must be inspected daily for signs of wear or damage and rejected if any is found.

Nets must be stored in dry shaded areas with good air circulation.

Nets must be protected from combustible materials, chemicals, welding slag or any damage.

Further Information

Standards
BS 3913:1982 *Industrial safety nets*

BIS (British Standard Institution) *Code of Practice for the Use of Safety Nets on Construction Work*

Section 8: Safety Lines, Belts and Harnesses

8.1 General

The construction, selection, checking, rigging, and use of all belts, harnesses, lines and fall arrest devices shall comply with AS/NZS 1891.1:1995 *Safety belts and harnesses,* or other accepted international Standard.

An evaluation of the work method should be carried out in order to select the most appropriate work method and fall-arrest equipment.

All equipment shall be regularly inspected and tested to ensure it complies with NZ Standards.

Equipment must be given a careful visual inspection every time it is used.

Always ensure that the equipment is being used in conformity with the manufacturer's instructions.

The rigging of static lines, anchorage lines and restraints is a skilled operation that shall be carried out by trained and competent personnel.

People using such equipment must be trained or supervised to ensure that all belts or harnesses are correctly fitted, with lines properly anchored and adjusted.

When a person wearing a safety line moves around, the line may move across the work area and get tangled around obstructions. This could jerk or jam the line and overbalance the wearer. The line may also hook under and dislodge objects such as roofing tiles or loose bolts, causing them to fall and create a hazard.

Where work operations such as gas cutting, grit blasting, or using sharp cutting tools is being carried out, precautions shall be taken to prevent wear and damage to any of the equipment. Protection could include using short steel wire lanyards, protective covers around lines, or other measures.

Where chain or wire lanyards are used they must be used in conjunction with a personal energy absorber.

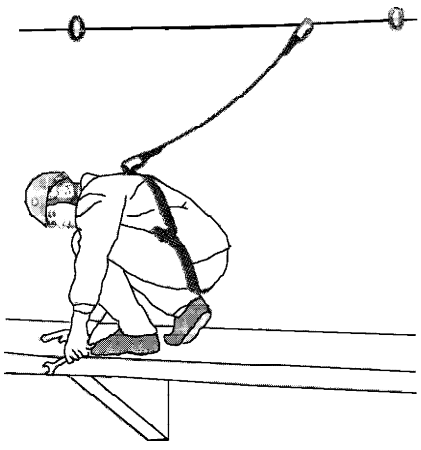


Fig. 25 Restraint system

8.2 Travel-Restriction Systems

A travel-restriction system generally consists of a safety belt or harness connected by a line to an anchorage. The system shall 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.

Travel-restriction systems may include safety belts fitted with groin or butt straps for greater comfort such as pole straps used by electrical linesmen where they risk a restrained fall.

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

8.3 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.

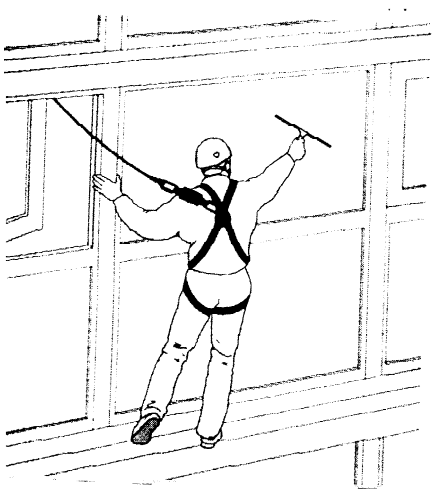


Fig. 26 Fall arrest

The arresting force applied to the worker should a fall occur must be less than 6 kN using a 2 metre lanyard with a personal energy absorber (tear web) or a type 2 or 3 fall-arrest device should achieve this.

The lanyard or anchor line must be attached to the top dorsal position (at chest height).

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 shall be designed to withstand a load of 15 kN.

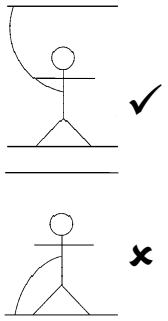
Emergency procedures must be in place so that a person suspended after a fall can be recovered before physiological injuries can occur.

Fall Factor:

Is the length of the fall divided by the length of the lanyard assembly, e.g:

1. Length of lanyard is 2 metres, length of fall is 2 metres, fall factor equals 1.
2. Length of lanyard is 2 metres, length of fall is 4 metres, fall factor equals 2.

Maximum fall factor allowed is a fall factor of 1



Harnesses which incorporate integral tool frogs or pouches may have an advantage.

The simplest form of restraint is to use a structural member as an anchorage. Loop an 8 mm wire complying with AS 1394 or webbing sling around a structural member and fasten its two ends and the anchor line or lanyard together with a suitable D ring or karabiner. A sleeve over the line may be necessary to prevent damage.

A horizontal rail and trolley system fixed to the building or structure can be used as an anchorage. Refer to 10.8 Window Cleaning for further detail.

8.4 Static Line and Anchorage Techniques

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. The force on the anchorage points of the static line will be considerable greater than those on an anchor line. This is 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. These are not the same units as used in a lanyard.

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

The static line must have a minimum breaking strength of 44 kN unless it is an engineered design.

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.

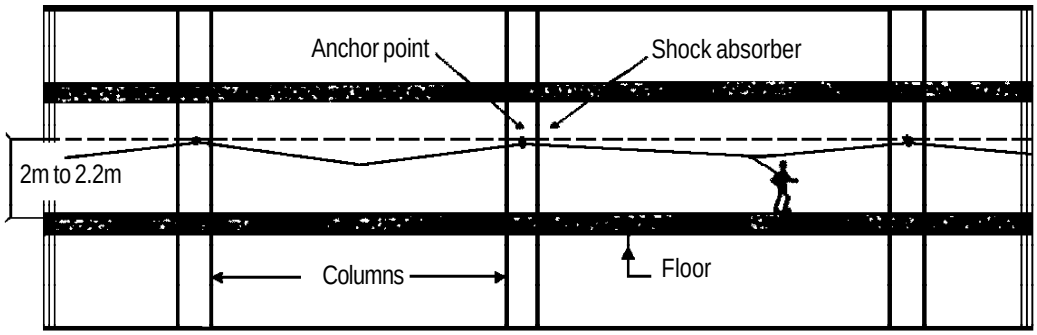


Fig. 27 Fixed static line with a shock absorber for use with safety harnesses and lanyards

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.

Care must be taken to ensure that loose objects between the anchorage and the worker cannot be dislodged by movement of the lines.

Do not use guardrails as an anchor: they are not designed to take the forces involved in arresting a fall.

8.5 Type 1 Fall-Arrest Device (Inertia Lock)

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 shall 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 shall be no longer than 300 mm.

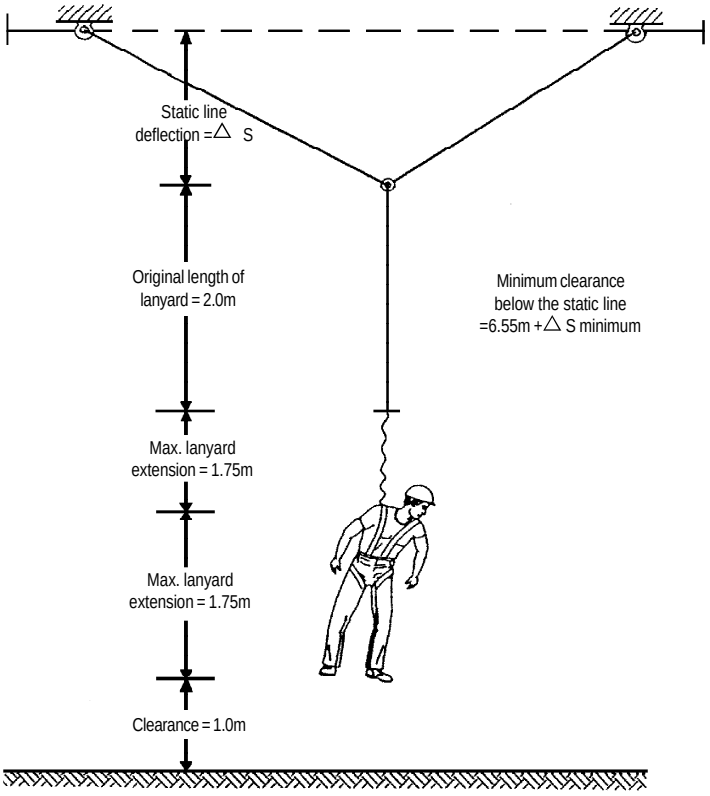


Fig. 28 Required minimum clearance below the level of the line anchorages

8.6 Type 2 and Type 3 Fall-Arrest Devices (Inertia Reels)

These are a 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 types 2 and 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 anchorage line attaches directly to the harness.

Pendulum Effect

This is a potential hazard with the use of individual fall-arrest systems.

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.

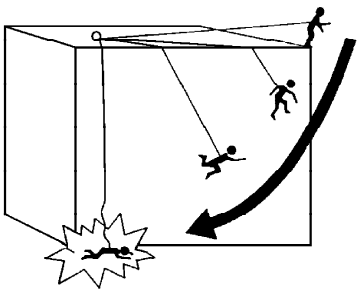


Fig. 29 Swing down

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 of the building, 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. A mobile anchorage helps here. The use of second anchorages and belay devices is another way of minimising this effect.

Swing Back

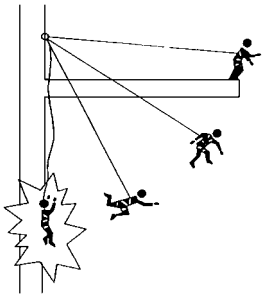


Fig. 30 Swing back

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.

The "pendulum effect" requires consideration prior to deciding the location of anchorage points.

8.7 Work-Positioning Systems

Work-positioning systems are designed to provide the primary means of support and restraint for the user. They shall be design and rigged to allow a person to work safely and in reasonable comfort.

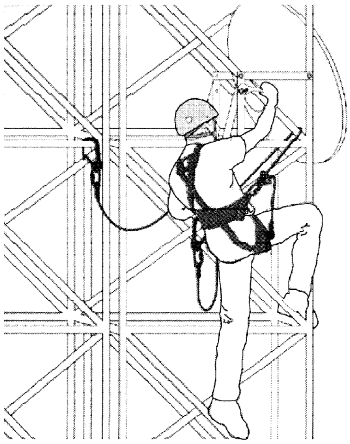


Fig. 31 Work positioning

A full harness and safety system shall be used as for a rope access system. (Refer to section 9.)

Further Information

Standards

AS/NZS 1891.1:1995 *Safety belts and harnesses*

AS/NZS 1891.3:1992 *Industrial fall-arrest systems and devices*

AS 1394

EN 353, 363, 364 and 365

Section 9: Roped-Access Systems

9.1 General Requirements

This section states some of the most critical requirements but is not comprehensive or a prescription for a safe industrial roped-access site.

Industrial roped-access systems are a specialised form of work positioning system used to gain access to a workplace by ascending or descending twin ropes fixed to secured anchorages. A combination of descenders and various types of ascenders and rope grabs are used while the person is supported in a harness.

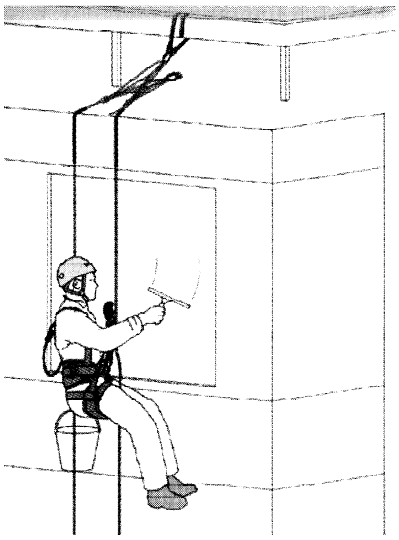


Fig. 32 Roped access

The selection, rigging and checking of all rope access components and assemblies shall comply with AS/NZS 4488.1 and AS/NZS 4488.2 *Industrial rope access systems,* or another accepted International Standard.

Systems should only be used in situations from which workers can be rescued promptly. Whatever the type of harness, motionless suspension is not physiologically safe and can rapidly lead to faintness and serious blood circulation problems. **Brain damage or death can occur in under 10 minutes.**

Employees or self-employed persons carrying out this work need to be physically fit and, to ensure safety, they must have a high standard of training and experienced supervision.

Personnel setting up and using such equipment shall be able to demonstrate their level of expertise and experience. Personnel with training, but without significant experience, should have experienced close supervision.

A comprehensive training and certification scheme, compatible with international industry practice, is being initiated by IRAANZ (the Industrial Roped Access Association of New Zealand).

An operational emergency system and plan, including any necessary (and compatible) rescue recovery equipment, shall be **immediately** available on site and the required persons shall be trained in its use.

A minimum of two trained industrial roped-access operatives shall be present on site at all times while industrial roped access methods are being used. The second person needs to be present in order to trigger or provide backup and emergency assistance as detailed in the emergency plan. To be effective the workers must be in reasonably constant visual contact with one another.

Work shall not start where high winds and environmental factors will result in a serious hazard.

All operators shall be required to carry at all times while suspended means of both ascent and descent regardless of the anticipated nature of the job.

All tools and other items shall be attached by a cord to the employee or the harness, unless another effective method is used to stop presenting a falling hazard. Any item over 8 kg or of a shape that is difficult to handle shall be

lowered and supported on a separate line. Care must be taken to ensure that any item dislodged does not fall and create a hazard for those below.

All suspension equipment must be individually identified and should be checked on a daily basis by a competent person. Many equipment items will have specific inspection and maintenance requirements and inspection and service records will need to be kept.

9.2 Anchorages

The structural adequacy of anchorages shall be assessed by a competent person. In some cases engineering advice will be needed:

- Anchorages shall be capable of holding a minimum ultimate force of 15kN in all directions in which the anchor might be loaded in use.
- If two person's load might be transferred to one anchorage, it shall be able to hold 21kN.
- Friction or chemical anchors should not be used without being inspected and proof loaded.
- Permanent anchorages specifically installed for industrial rope access (or fall arrest) work shall be clearly labelled as such and marked with their ultimate (failure) load. Annual inspection and proof loading will be required.
- Needles, brackets and parapet hooks shall comply with the same standards as for scaffolding, and must not be subject to any shock loads.

9.3 Ropes and Rigging

The industrial roped-access system is based on a twin rope concept with independent primary (working) ropes and secondary (safety, backup) ropes.

- Each rope (working and safety) shall be attached to two independent anchorages, via two independent sets of attachment hardware. If an anchorage is unquestionably adequate, or engineer designed and tested for such purpose, both sets of attachment hardware might be connected to the one anchorage.
- The safety rope shall be attached to separate anchorages to the main rope, unless the anchorages are unquestionably adequate or engineer designed and tested for such purpose. Separate attachment hardware shall be used for both ropes.
- All ropes shall be a minimum of 10.5 mm in diameter and shall have a minimum ultimate strength of 25kN. Ropes should be of kernmantle construction. There is currently no AS/NZS standard for ropes for industrial roped access, however, users might consult EN 1891:1998 *Personal protective equipment for the prevention of falls a height: Low stretch kernmantle ropes*, or AS 4142.3 *Static rescue lines*.
- Working and backup ropes will normally be of static (low stretch) type. Dynamic ropes have specialist purposes within industrial roped access work but should not be used as main support or backup ropes.

- All ropes and equipment should be individually identified and checked on a daily basis by a competent person.
- All ropes shall be protected from fraying or wear. When they come into contact with sharp edges or rough surfaces, sleeves, radius protection or other means of protection should be used.
- Ropes shall not show any significant signs of abrasion or other damage. The kern must never show through the outside mantel or sheath.
- Slings shall meet appropriate standards and shall have minimum ultimate breaking strengths of 24kN.

Note: Inadequate rigging can create unacceptable and dangerous loadings in industrial roped-access equipment. Correct training and experience is essential.

9.4 Harnesses and Lanyards

The harnesses used shall be a one-piece full-body harness or a sit harness used in conjunction with a chest harness that is firmly attached to the sit harness.

Constant monitoring of safety standards and equipment is essential. All equipment and techniques should conform with AS/NZS 4488.

Lanyards and lanyard assemblies are usually used to connect the user's harness to the backup device on the safety rope. They will also be used for fall-arrest purposes.

- All harnesses should be rated for fall arrest and should allow the user to be comfortably supported in a semi-sitting position. Harnesses should conform with AS/NZS 1891.1 or equivalent.
- If swing chairs (suspended seats) are used, they must not be an integral part of the safety system.
- Lanyards must have a minimum breaking strength of 15kN and should comply with the requirements of AS/NZS 1891.1.
- The overall length of lanyards in industrial roped-access systems should limit the maximum possible lanyard freefall to 600 mm.

9.5 Descenders

Descenders shall be designed and constructed to safely and effectively control the speed of descent. This control should be exercised by means of an adjustable rope path through the device using a dead-man-type handle. The descender shall be capable of holding the operator with their hands free. It shall not be able to be removed from the rope while the rope is under tension.

9.6 Rope Grabs (Ascenders and Backup Types)

Ascenders shall have similar safety requirements as descenders. They shall not be removable under tension and be of a dead-man-type that grips the rope in a downward direction.

Ascenders shall be constructed so that it is not possible to move the device down the rope without a deliberate hand action. They shall not damage the rope in normal use.

Backup-type rope grabs, when deployed, must not damage the rope or slip down the rope more than 1.5 m, and must keep the peak-arresting force below 6kN.

9.7 Safety System

A complete safety backup system, independent of the main system, shall be in use. It should be capable of arresting any fall within 600 mm (excluding the effect of any energy absorber deployment) with a maximum arresting force of 6kN.

Normally the safety system will be comprised of a backup-type rope grab connected to a second static rope, independent of the working rope.

This system must be rigged so that it automatically comes into operation if the main system malfunctions.

A person must be securely attached to both ropes before moving off a roof or landing.

All persons should wear a safety helmet while working in suspension or where a fall situation is possible. A helmet meeting the requirements of AS/NZS 1801:1997, including an enhanced chin strap which will ensure the helmet remains securely on the head during a fall, is recommended. (UIAA certification would be acceptable.)

9.8 Connectors

Snap hooks and karabiners shall be of the self-closing type and self- or manual locking to reduce the possibility of involuntary opening. They shall be capable of being opened only by at least two deliberate and concurrent actions.

9.9 Public Safety

An exclusion zone must be established at the base of every worksite open to the public to prevent access. This zone is to be adequate, allowing for the type of work being carried out and the prevailing conditions.

Further Information

Standards

AS/NZS 4488:1997 *Industrial rope access systems*

Part.1. *Specifications*

Part 2. *Selection, use and maintenance*

AS/NZS 1891.1:1995 *Safety belts and harnesses*

AS/NZS 1891.2:1995 *Fall-arrest devices*

AS/NZS 1891.3:1992 *Industrial fall-arrest systems and devices*

AS/NZS 1801:1997 *Industrial safety helmets (medium protection)*

AS 4142.3 *Static rescue life lines*

EN 1891 *PPE against falls from heights: Low stretch kernmantel ropes*

EN 358 *PPE against falls from heights: Work positioning systems*

EN 361 *PPE against falls from heights: Full body harnesses*

EN 362 *PPE against falls from heights: Connectors*

EN 354 *PPE against falls from heights: Lanyards*

EN 355 *PPE against falls from heights: Energy absorbers*

EN 341 *PPE against falls from heights: Descender devices*

EN 795 *PPE against falls from heights: Anchor devices. Requirements and testing*

EN 813 *PPE against falls from heights: Sit harnesses for rope access work*

Other Publications

IRAANZ Industrial Roped Access Association of New Zealand. Certification and assessment scheme and operational requirements (pending).

IRATA (UK) *General Requirements for Certification of Personnel Involved in Industrial Roped Access Methods.*

UIAA *Union International Des Associations d'Alpinisme Label Standards*, Chapter F: Helmets

Section 10: Building Construction and Plant Maintenance

10.1 Excavations

When walkways are provided to permit employees to cross excavations deeper than 3 metres, such walkways shall be fitted with guardrails. Bump rails shall be erected 2 metres back from such excavations where guardrails are not in place. When the public have access to the edge of any excavation, barriers or guardrails shall be erected to prevent falls. Where excavations contain water, they shall be effectively fenced to prevent access by children.

10.2 Hoisting or Unloading Areas

Every person working in a hoist area or on a load-landing area must be protected from a fall of more than 3 metres by a guardrail or other fall protection. If guardrails or portions of a guardrail are removed to facilitate hoisting operations or landing of lifted materials, and the worker must work close to or lean out over the edge, that person shall use a fall-arrest system.

10.3 Holes and Pits in Floor Areas

Any hole in a work area can cause serious injury from falls, regardless of its depth. All holes or penetrations in floors or work areas shall be covered with a secured cover, built to the standard of a light-duty platform or such greater load that could be imposed on it. Where such covers are not practical, guardrails or barriers shall be erected around all sides. Where persons are working in such pits, fall protection should still be in place.

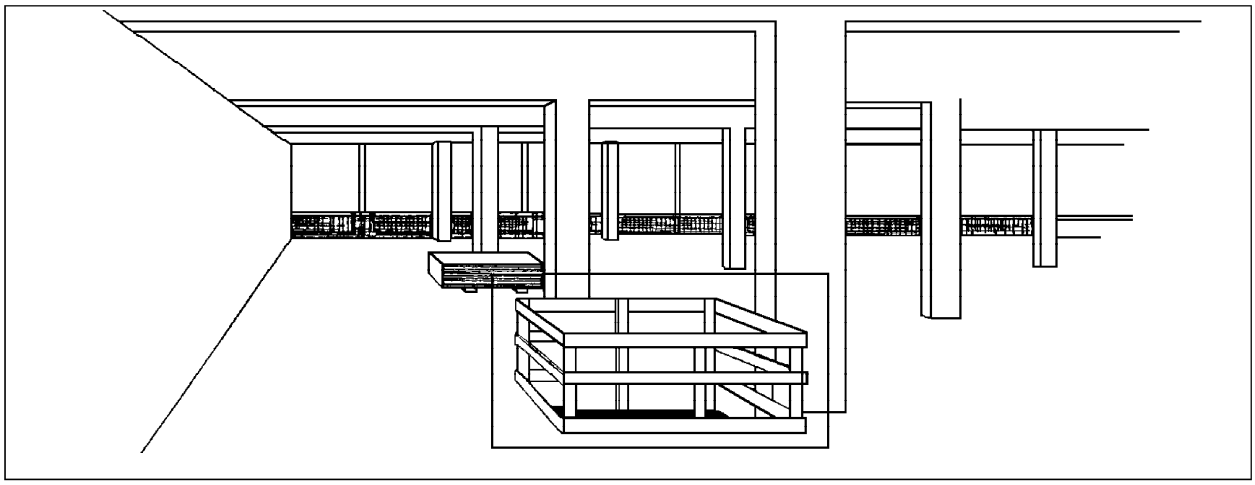


Fig. 33 Guardrails at all openings

10.4 Wall Penetration

When a wall penetration for a door, window or other service leaves an exposed edge from which a person could fall more than 3 metres, such wall penetrations shall be fitted with a guardrail.

10.5 Floor and Work Platform Perimeter Edges

The exposed edges of all floors and work platforms from which a fall of 3 metres is possible shall be fitted with guardrails and mid rails. Kickboards or toeboards shall also be fitted if objects can fall from the edge and endanger others below. Where guardrails are impractical, other means of fall protection shall be available and used. While erecting such guardrails, employees shall use other means of fall protection such as harnesses and lines. Bump rails 2 metres back from an exposed edge may be used where the employer can ensure no person will climb over between the bump rail and the edge.

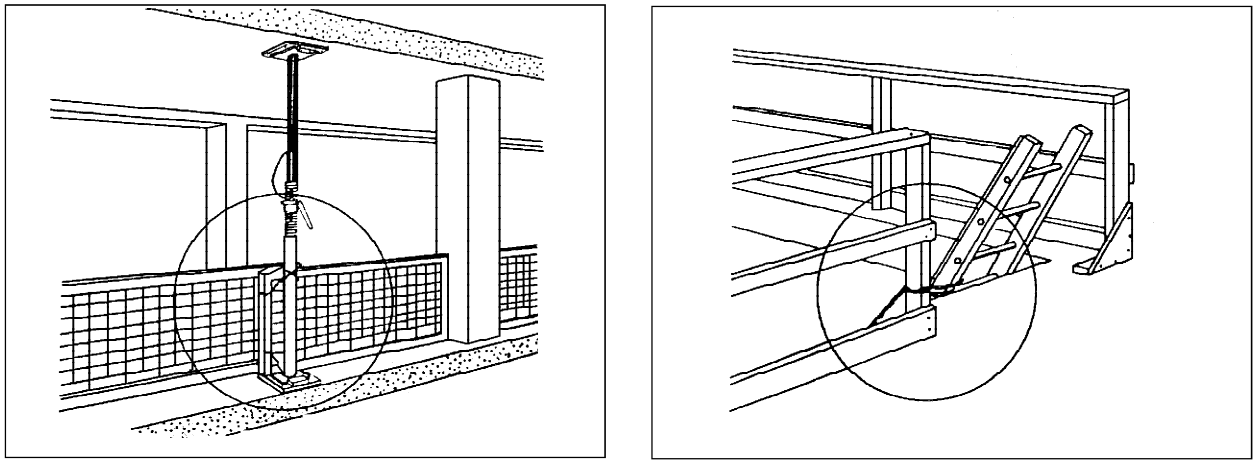


Fig. 34 Tie-off

10.6 Lift Shafts and Ducting

Lift shafts and other similar ducts having wall or floor openings shall have such openings fitted with guardrails and toeboards unless a fitted with a cover suitable for use as a fully-decked working platform. Persons who work in shafts shall use a fully-decked working platform, or shall use a fall protection system, to prevent a fall of more than 3 metres.

10 7 General Maintenance

Maintenance and cleaning of exterior plant or equipment, such as windows or air-conditioning equipment, on roofs and ledges, etc. requires safe access and fall protection. Employees should be trained in the use of equipment and fall-arrest systems as required.

Individual employees may be sent to do maintenance work where the employer may not be fully aware of all the circumstances until the employee has found the fault. Under these circumstances, the employee needs full training in hazard assessment and control so that the employee, on behalf of the employer, can make the correct choice of fall protection to suit the conditions.

10.8 Wall Maintenance and Window Cleaning

All window cleaning systems should comply with NZS 5802:1978 *Window cleaning systems.*

Window sills and ledges used to stand on must have a minimum width of 150 mm and a maximum slope of 1 in 12. Suitable safety harnesses and lines shall be worn. All the window should be within easy reach of the cleaner without the need to overreach or stand on tiptoe.

The design, installation and maintenance of permanent anchorages, rails, trolleys and travelling ladders, etc. shall be approved by a registered engineer.

The engineer shall take into account the effects of age, climatic conditions, impact and wind loading in the design.

All outriggers, stages and boatswains chairs shall comply with the *Approved Code of Practice for Safe Erection and Use of Scaffolding*.

BMUs shall comply with the Building Act and relevant codes.

Rolling ladders and similar equipment must be secure and stable. When secured on ledges or spandrels where persons risk a fall of over 3 metres in height, a fall-arrest system shall be used.

All access equipment should be inspected every 6 months or before use. Such inspections should be recorded. Any repairs shall be done by competent people to the satisfaction of the design engineer.

10.9 Roof and Roof Plant Maintenance

Where regular maintenance of plant or equipment needs to be carried out on roofs, ramps, crawlboards, access ladders should be installed and comply with Section 3: Permanent Fixed Access and Platforms.

Brittle roofing is a major hazard and cause of serious harm:

- Translucent and brittle roofing materials may have weathered to become almost indistinguishable from their surroundings.
- Brittle areas may have been painted to match the rest of the roof.
- Corrosion because of age or chemicals in the building can impair roofing material so it can no longer support the weight of employees.

All roofs should be treated as brittle until a close inspection reveals otherwise.

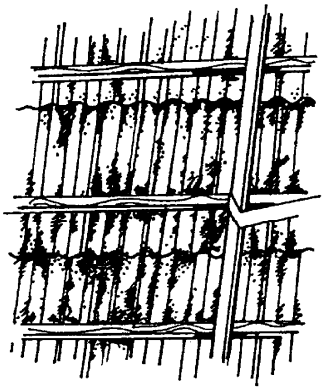


Fig. 35 Severe deterioration of roofing materials may not be readily apparent from the upper surface. Inspect the underside of brittle roofing materials for hazards.

Roofs that need regular cleaning or maintenance and that provide secure footing should be fitted with permanent perimeter protection and access ladders. Any skylights or other brittle areas in such roofs should have safety mesh or strong covers fitted under or over them, or guardrails fitted around each side of the suspect area.

A bump rail may be used provided it is successful in keeping all people at least 2.0 metres away from the brittle areas.

Fig. 36 Danger signs to be fixed at points of access to the roof

Where an employee is required to work closer than 2 metres to the edge of any roof or from where a fall is possible, fall protection or edge protection must be provided.

As a minimum standard on roofs from which a person may fall 3 metres or more:

- On completed roofs that provide a secure footing, edge protection, fall protection or bump rails 2 metres from the edge shall be used.
- On roofs that do not provide secure footing, or are steeper than 30 degrees, fall protection, work positioning systems or permanently installed access and platforms shall be used (see Section 11).

Further Information

OSH Publications

Approved Code of Practice for Safety in Excavations and Shafts for Foundations

Standards

NZS 5802:1978 *Window cleaning systems*

Other Publications

Guidelines for Safe Working at Height for Residential and Light Commercial Roofing — issued by the Roofing Association of New Zealand Inc.

Section 11: Structural Steel Erection

11.1 General Safety

Rigging work is a high-hazard occupation requiring a high standard of knowledge and careful planning in order to achieve an adequate level of fall protection. Employers shall assess the work and decide on the methods of fall restraint and the equipment needed. This equipment must be on site before any erection work starts.

All persons involved in steel erection shall be competent at rigging and in the use of work positioning and fall-arrest systems. Plant, equipment and systems used shall comply with the relevant sections of this guide.

Employers should endeavour to provide an enclosed work environment by the use of scaffolds, elevating work platforms or cages of various sorts.

11.2 Workplace Safety

The erector will check with the principal or main contractor that footing concrete, holding down bolts, etc. have reached the specified strength to allow erection to start.

Each structural component shall be carefully placed and braced in position as work proceeds. Temporary bracing and propping shall allow for seismic and wind loads that may occur during construction.

While climbing around the steel, riggers should not carry equipment in a way that does not leave their hands free. Lines and bolt bags or tool frogs can be used to carry small items, or equipment can be lifted with lines. Throwing up bolts, etc. can cause a hazard to the rigger and to other people if the rigger misses a catch.

Safe access equipment and plant could include:

- Work platforms, crane lift platforms or correctly built scaffold and work stages;
- Temporary lightweight work platforms that can be attached or hung to the steel work;
- Temporary work platforms that can be erected and used later for ceiling or pipework erection;
- Safety nets that can be slung under floors;
- Harnesses and anchorage techniques for fall-arrest systems;
- Remote release shackles.

11.3 Reducing Work at Heights

When possible, the need to work at heights should be avoided or reduced to a minimum. Alternative means of erection which may reduce this need could include:

- Connecting as much steel work as possible on the ground or from a working platform;

- Planning for connections to be at points that are safe and easy to reach;
- Using remote-release shackles and systems on lifting gear;
- Fixing anchorage points to steel work for fall-arrest systems before the steel components are in place.

11.4 Access to Places of Work

Careful consideration should be given to the hazards involved in climbing on to structural steel. Planning could consider the following:

- The erection sequence should be designed so that permanent stairs, floors, landings and wall panels, etc. are installed as soon as possible as work progresses.
- Fixing temporary ladders to steel components or temporary stairs to sections should be done before erection.
- Access to hazardous areas should be restricted to persons directly involved in the erection process.
- Crane lift platforms, scaffolding or other means of access may be needed. Before climbing out of an elevating work platform, that person should be secured to the new workplace by a lanyard.
- Walking on the top of the steel should be avoided if at all possible. Where it cannot be avoided, a fall restraint shall be used.
- Straddling the beam should be done with great care. It should occur only when a person is able to place each foot on the bottom of the flange and have both hands gripping each side of the top flange. The beam should be sufficiently free of obstructions to allow for safety and easy movement. Where work needs to be carried out from this position, a fall-arrest system shall be in place.

11.5 Slinging Loads

Only experienced dogmen should sling loads for craneage. The dogman should check the weight and the radius of the load from the crane to ensure the lift is within the crane's capacity.

Dunnage should be used in order to prevent steel chains or wires slipping on steel components.

Tag lines should be used to assist in controlling loads during lifting and positioning. This is particularly important when the load is received by riggers who have little freedom of movement.

The dogman should have continuous communication with the person receiving the load.

The use of remote-release shackles can considerably reduce the need to climb out on the steel.

Multiple lifts of more than one steel member or bundle at a time are not advisable. It should only be allowed when the slinging methods used avoid any chance of entanglement and the lower load is removed first. The slings are hooked up to prevent entanglement and to prevent an overhead danger while the next load is being handled.

Section 12: Roof Erection and Fixing

12.1 General Safety

Principals and employers should liaise to provide an integrated fall protection method for all persons working on the roof. This should be less hazardous and more economic than every contractor installing their own system. See other sections of this guide for relevant information.

Hazards include:

- Brittle roofing such as skylights, asbestos cement or translucent sheets;
- Roof surface, slippery surfaces from roll form dress, paint finishes or dew and rain;
- Roof pitch and projections such as pipework and flashings;
- Any roof penetration larger than 600 mm by 600 mm;
- Any roof edge.

Persons on a roof shall wear the correct type of footwear to grip the roof surface. Natural rubber, flexible-soled shoes are usually best.

As a minimum standard for all roof areas over 3 metres high:

- For areas that do not have a fall-protection barrier, a fall-arrest systems shall be used;
- For surfaces that have a fall-protection barrier and provide a secure footing, an edge-protection system, travel-restriction system or a fall-protection system shall be used;
- For all roof areas that do not have a fall-protection barrier or secure footing, a fall-protection system shall be used.

A fall-protection barrier can be tile battens or roof framing at less than 500 mm centre to centre, roof safety mesh or a work platform.

On completed roofs or where persons are kept more than 2 metres from any fall hazard by a bump rail, edge protection may be unnecessary. A bump rail consists of a rail or tensioned rope supported on posts at a height of 0.9 to 1.1 metres.

Note: A bump rail shall not be used on a roof of greater than 5^{o} pitch.

Where a bump rail is not practical, edge protection, travel restriction systems, or a fall-arrest system shall be used. Edge protection can include scaffolding, scissor hoists or a guardrail system.

The ability of a surface to provide a secure footing will vary depending on the roofing material, environmental conditions and the type and condition of the roofer's footwear.

For the correct type of shoes in good condition on a clean dry surface, the following is a guide that gives the steepest pitch that will provide a secure footing:

- Tile battens at 350 centres where the ball of the foot can be centred on the batten — 75°.
- Chip-coated, concrete or unglazed roof tiles — 36°.
- Powder-coated metal tiles, long-run or glazed tiles — 30°.

12.2 Access

Safe access must be provided to all roof areas where work is to be carried out. Such access must take into account the tools or equipment that need to be carried up. Ladder towers are preferable to ladders. Ladders are not sufficient where persons are expected to use their hands to carry materials up onto the roof. Ladders must be secured to prevent displacement sideways and slipping out from the base. All access equipment must comply with the relevant NZ Standards.

12.3 Edge Protection

Edge protection consists of a system equal to or better than a guardrail. A number of proprietary systems are available that will attach to structural roof members by clamping onto the underside of eaves, rafters or purlins. These systems may be erected from a ladder or the erector will need fall protection.

On roofs over 45°, pitch edge protection shall include a level platform two planks wide at eaves height, or it shall be higher than a guardrail with extra ties to the building and infill panels to prevent people falling over or sliding under the rails.

Perimeter scaffolding erected around the building may provide edge protection provided it complies with the previous two paragraphs. A mobile scaffold or scissor hoist may be adequate, provided that it extends for at least 2 metres on either side of a line directly up the slope of the roof to where persons are working. It must also sustain the additional overturning moments of a person sliding down a roof onto it, which may rule out lighter scaffolds and scissor hoists unless ties or additional stability is provided. Care must be taken to ensure that such mobile scaffolds are constantly moved as work progresses.

12.4 Safety Mesh

Safety mesh shall comply with AS/NZS: 4389:1996 *Safety mesh* in both its manufacture and installation.

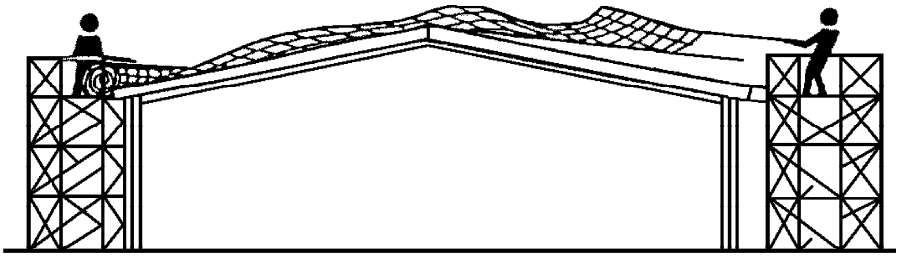


Fig. 37 Means of installing safety mesh across the roof prior to fixing it in position

When correctly installed, safety mesh will provide a fall-protection barrier for roof workers at the time of construction and for future maintenance workers where the roof contains skylights or other brittle roofing. It may be fixed over roof penetrations to prevent the need for guardrails.

Edge protection and safety mesh provides an enclosed work environment. Mesh should be pulled over the roof by ropes or other methods, otherwise a fall-arrest system will be needed during its installation.

12.5 Hoisting Roofing Materials

Bundles of roofing materials should be placed evenly along the roof to reduce the need for 'walking' the sheets. When hoisting a bundle of roofing, workers receiving it on the structure must have safe mobility to avoid the load. Short lanyards that restrict movement may not be acceptable.

Where safety mesh is fitted, roofers should keep at least 2 metres from any perimeter edge unless restriction systems or edge protection is in place.

All bundles should be securely banded while being lifted by a crane.

Tag lines should be used to control the swinging of the bundles while they are out of reach.

Wearing leather gloves while moving sheets or bundles will reduce cut and slash injuries.

Long lengths should be lifted using a strongback, particularly if being lifted by a helicopter because of its down-draft.

12.6 Concrete and Clay Tile Roofing

Tile battens placed at less than 500 mm apart may provide protection from falling through the roof framework provided they are of sufficient strength to span roof framing members. Battens may provide a safe platform for the batten fixer provided that work starts at the lowest point and moves up the roof. Care shall be taken to work or walk on the battens over the supporting framework to eliminate the possibility of failure. Where the roofer needs to walk up the roof framing before battens are fixed, fall protection should be provided.

Roofs of under 30^{o} will generally provide secure footing subject to the correct footwear being worn. This allows the tiler to place tiles while standing on a lower row.

On roofs over 30^{o}, it is often possible for the tiles that are not fixed to be slid up under the one above, thus forming a series of penetrations that can be used as footholds for access up the roof. This allows the placing and pointing of ridge tiles, etc. If this is not possible, a work-positioning system will be required.

Where tile battens or tiles provide a fall protection barrier, edge protection is necessary if a fall of more than 3 metres is possible.

12 7 Brittle Roofing

Protection from falling through a brittle roof shall be provided.

Before working on any roof, employers and self-employed people need to inspect the roof from its underside for structural soundness. Skylights of matching roof profile are a particular hazard as they may weather or be painted and so match the surrounding roof areas.

A common belief exists that it is safe to walk along the line of nail heads or roof bolts above the purlins. In reality, this is similar to walking a tight rope.

Fall protection shall be provided where roofing material is brittle, corroded, and no fall-protection barrier is installed.

Where only part of the roof area is brittle, i.e. skylights, such areas shall be treated as penetrations with secure covers or guardrails.

Where persons walk along internal gutters, such gutters must be 450 mm wide or fall protection should be provided.

12.8 Purlin Trolleys

Trolleys designed to travel on top of the purlins and support materials and/or the roof fixers may be suitable for use when installing large new roofs.

The trolley shall have a secure holding brake and a device to prevent dislodgement from the purlins.

Where the trolley supports workers, it shall be fitted with harness anchorage points.

Prior to using any such a trolley on the roof structure, engineering advice should be sought for the trolley design and acceptable weight limits on the purlins.

Further Information

Standards

AS/NZS: 4389:1996 *Safety mesh*

Other Publications

Guidelines for Safe Working at Height for Residential and Light Commercial Roofing — issued by the Roofing Association of New Zealand Inc.

Section 13: Fall Prevention in the Electricity Supply Industry

The Electricity Supply Industry safety book titled *Safety Rules — Electricity Industry* provides guidance on fall prevention for persons working at height in the New Zealand electricity generation, transmission and distribution industry.

Note: Current policy and practice concerning fall prevention while gaining access is being reviewed by the ESI against the requirements for taking all practicable steps specified in the Health and Safety in Employment Act 1992 and the Health and Safety in Employment Regulations 1995. Any changes in this area will be published in due course and appropriate information will be included in subsequent editions of these guidelines.

Further Information

Safety Rules — Electricity Industry issued by the Electricity Supply Industry

Section 14: Broadcast and Telecommunication Structures

14.1 General Safety

Climbing work is a high-hazard occupation, requiring a high standard of experience and training and careful planning in order to achieve an adequate level of fall protection. Broadcast and telecommunication structures include steel monopoles, steel lattice towers and wooden poles. In all situations where a person may fall 3 metres or more, climbing protection for the employee or contractor is required. All persons involved in a rigging activity shall be competent at rigging and in the use of fall-arrest systems.

14.2 Workplace Safety

- Work that requires traversing of open steel work is to be carried out by approved climbers.
- Only experienced climbers are to undertake work on structures in a free-fall situation.
- All climbers that work in a free-fall situation shall wear a full harness in compliance with AS/NZS 1891.1: 1995 *Industry fall-arrest systems and devices: Part 1. Safety belts and harnesses.*
- All climbers will use belayed static lines or be attached to the structure by a lanyard at all times, unless working from platforms of cages.
- All maintenance and construction activities will fall under the scope of this work.
- In a situation where the climber is working alone, there must be a ground support person who is able, in an emergency, to summon assistance. Refer to Section 9.1 for general requirements.
- Definition: A climber will undertake rigging functions on a broadcast or telecommunications structure.

Further Information

AS/NZS 1891.1:1995 *Industry fall-arrest systems and devices: Part 1. Safety belts and harnesses.*

Appendix 1: Health and Safety in Employment Act 1992

1.1 The Principles of the Act

The principal object of the Health and Safety in Employment Act 1992 (HSE Act) and the Health and Safety Regulations 1995 (HSE Regulations) is to prevent harm to employees at work. To do this it imposes duties on employers, employees, principals and others, and promotes excellent health and safety management by employers.

1.2 Approved Codes of Practice

"Approved Codes of Practice" are provided for in the HSE Act. They are statements of preferred work practice arrangements, and may include procedures that could be taken into account when deciding the practicable steps to be taken. Compliance with approved codes of practice is not mandatory. However, they may be used as evidence of good practice in court.

1.3 Guides

Guides are provided to set out preferred methods and standards. They should be complied with unless other methods that result in the same standards are used. However, they may be used as evidence of good practice in court.

1.4 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 machinery and equipment is safe for employees;
- Ensure that working arrangements are not hazardous to employees; and
- Provide procedures to deal with emergencies that may arise while employees are at work.

Taking "all practicable steps" means doing what is reasonably able to be done in the circumstances, taking into account:

- The severity of any injury or harm to health that may occur;

- The degree of risk or probability of that injury or harm occurring;
- How much is known about the hazard and the ways of eliminating, reducing or controlling it; and
- The availability, effectiveness and cost of the possible safeguards.

1.5 Hazard Management

Employers must identify and regularly review hazards in the place of work, whether existing, new or potential, to determine whether they are significant hazards and require further action. Employees must be given the opportunity to take part in this process.

"Significant hazard" means a hazard that is an actual or potential cause or source of:

- Serious harm; or
- Harm (being more than trivial) the severity of whose effects on any person depends (entirely or among other things) on the extent or frequency of the person's 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 Act sets out the steps employers must take:

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

In addition, employers must, 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; and
- With informed consent, monitor employees' health.

1.6 Information for Employees

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

- Hazards employees may be exposed to while at work;
- Hazards employees may create which could harm other people;
- How to minimise the likelihood of these hazards becoming a source of harm to themselves and others;
- The location of safety equipment; and
- 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 employee must be protected.

1.7 Training of Employees

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

1.8 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 at work, including members of the public or visitors to the place of work.

1.9 Employees' and Self-Employed Persons' Duties

Employees and self-employed persons have a responsibility for their own safety and health while at work . They must also ensure that their actions do not harm anyone else. However, these responsibilities do not detract from the employers' or principals' responsibilities.

1.10 Principals and Persons who Control Places of Work

Principals and persons who control places of work must take all practicable steps to ensure the safety of persons in the place of work.

1.11 Recording and Notifying Accidents and Serious Harm

The HSE Act requires employers to keep a register of work-related accidents and serious harm. This includes every accident that harmed or might have harmed someone. Employers are also required to investigate all these accidents to determine whether they were caused by a significant hazard.

Employers are required to notify serious harm that occurs to employees while at work to the Secretary of Labour, through the nearest OSH office, as soon as possible. The accident must also be reported using the prescribed form within 7 days. (Forms are included in the *Workplace Accident Register*, available from OSH offices and selected stationers.)

If a person suffers serious harm, the scene of the accident must not be disturbed unless to:

- Save life or prevent suffering;
- Maintain public access for essential services, e.g. electricity or gas;
- Prevent serious damage or loss of property.

The OSH office will advise whether it wishes to investigate the accident and what action the employer may take in the meantime.

1.12 Heights of More than 3 Metres

Regulation 21 of the Health and Safety in Employment Regulations 1995 states:

Heights of more than 3 metres

(1) In this regulation, the term "employer" does not include any "employer" who employs any employee to carry out any agricultural work in a place of work under the control of that employer.

(2) Every employer shall take all practicable steps to ensure, in relation to every place of work under the control of that employer, that, where any employee may fall more than 3 metres —

(a) Means are provided to prevent the employee from falling; and

(b) Any means so provided are suitable for the purpose for which they are to be used.

1.13 Qualifications

The HSE Act requires that, in certain circumstances, the person directly in charge of the work must hold a certificate issued under the HSE Act. In direct charge means being in sight of and being immediately able to control work as it proceeds. This includes:

- All standing scaffolding where workers risk a fall of 5 metres or more;
- All suspended scaffolds; and/or
- Use of a powder-actuated tool.

1.14 Notification of Work

Work that is, or at any time in the future will become, "notifiable" as defined in the Act must be notified to the nearest Occupational Safety and Health Service office of the Department of Labour. Such notification must include:

(a) The nature and location of the work;

(b) The name, address and contact details of the employer;

(c) The intended date of commencement and duration of the work.

The notification must reach an OSH office 24 hours before work commences. Where the work is required by an emergency, the notification should be sent as soon as possible (Reg. 26). Notifiable work is described under "definitions".

Appendix 2: Fall-Arrest Systems Design Guidelines for Static Lines

For guidance on safe use of fall-arrest systems, the following specifications are based on use by 1 or 2 persons only.

Single-Span System

The following system specification may be used instead of using an engineer-designed system for single spans of 4 to 6 metres. No more than 2 persons are to be on the static line at any one time, and all persons are using lanyards with personal energy absorbers or another system to reduce deceleration forces to 6kN. The system specifications are:

Static line: 10 mm (minimum) diameter flexible steel wire rope (6 x 19 to 6 x 24 galvanised), minimum breaking load 44 kN, secured with a hard eye and saddles to prevent damaging the wire.

Sag: Approximately 50 mm per metre, i.e. 6 m span = 300 mm of sag. This sag is most important as greater tension will increase the forces exerted on the anchor.

Anchorage: Capable of supporting an imposed load of 44 kN.

Multiple-Span System

The specification for a multi-span system is the same as a single-span system with the following exceptions:

Sag for 2-3 continuous spans: Approximately 30 mm per metre in 6 m = 180 mm.

Sag for 4 or more spans: No minimum sag required but line should not be over-tensioned, and span not to exceed 6 metres.