

Demolition - Best practice guidelines for demolition in New Zealand

Contents

[Section 1 - Foreword](#)

[Section 2 - Definitions](#)

[Section 3 - General requirements](#)

[Section 4 - Pre-demolition checks](#)

[Section 5 - Demolition safety](#)

[Section 6 - Methods of demolition](#)

[Section 7 - Guidelines for the clean-up of contaminated sites](#)

[Section 8 - Optimising recycling in demolition](#)

[Appendix A - Demolition hazards](#)

[Appendix B - Excavator checklist](#)

[Appendix C - Pre-demolition checklist](#)

[Appendix D - Demolition safety checklist](#)

[Appendix E - Confined space entry permit \(CESP\) \(example\) entry requirements](#)

[Appendix F - DOL/NZDAA Hazardous work notification form](#)

[Appendix G - Sample hot work permit](#)

[Appendix H - Legislative references](#)

[Appendix I - Reference documents](#)

Section 1 - Foreword

These guidelines have been prepared by the New Zealand Demolition and Asbestos Association (NZDAA) to inform employers, employees and others with duties under the Health and Safety in Employment Act 1992 about the precautions and safe practices that should be followed when carrying out demolition work.

It outlines the industry's current best-practice standards and procedures for the safe and efficient demolition of structures and buildings, also incorporating industry learning from the Christchurch Earthquake of February 2011.

The guidelines also contain extensive references to Australian and New Zealand standards, and to appropriate New Zealand legislation.

NZDAA and its members would like to acknowledge the assistance provided by the Health and Safety (Construction) Inspectors and senior management of the Department of Labour for their contribution to these guidelines.

It is hoped that the recommended safe practices will be a useful aid to those involved in demolition to avoid the potential hazards associated with the work.

Diana Stil

President

New Zealand Demolition and Asbestos Association

(Formerly the New Zealand Demolition Contractors Association)

Section 2 - Definitions

A-D

All Practicable Steps

(Health and Safety in Employment Act 1992): The steps taken to achieve the result that it is reasonably practicable to take in the circumstances, having regard to:

1. the nature and severity of harm that may be suffered if the result is not achieved; and
2. the current state of knowledge about the likelihood and severity of harm that will be suffered if the result is not achieved; and
3. the current state of knowledge about harm of that nature; and
4. the current state of knowledge about the means available to achieve the results and about the likely effectiveness of each of those means; and
5. the availability and cost of each of those means.

To avoid doubt, a person required by the Health and Safety in Employment Act 1992 to take all practicable steps is required to take those steps only in respect of circumstances that the person knows or ought reasonably to know about.

ANFO explosives

Acronym for ammonium nitrate/fuel oil, a widely used explosive mixture.

Approved handler

(Hazardous Substances and New Organisms Act 1996): A person who is qualified to handle very hazardous substances. An approved handler may also

provide guidance and assistance to other people handling the substances.

Arc eye or "welder's flash"

(Photokeratitis) A painful eye condition caused by exposure of insufficiently protected eyes to ultraviolet (UV) rays. It is similar to sunburn of the cornea, and may not be noticed until several hours after exposure. Symptoms include increased tears, eyelid twitching, constricted pupils and a feeling similar to sand in the eyes. Symptoms can resolve themselves after approximately 36 hours. It is commonly caused by welding without wearing eye protection.

Balling

Mechanical demolition by the controlled swinging or dropping of a demolition ball suspended from a suitable lifting device.

Blast mat

An absorbent and protective covering of sufficient strength and weight and of fine enough mesh to contain flyrock during blasting operations.

Brittle roofing

Roofing material that may not safely withstand the weight of a person and includes corrugated, flat or troughed asbestos, perspex, plastic material, Pinex, Woodtex, corroded galvanised iron or corroded aluminium roofing.

C&D waste

Construction and demolition waste.

Catchscreen

A protective structure made of suitable materials such as scaffold tubes and planking, and is affixed to the face of the building or to the perimeter fencing to contain falling debris during demolition.

Certificate of Competence

A certificate of one of the kinds referred to in Regulation 27 of the Health and Safety in Employment Regulations 1995, i.e. as a diver, powder-actuated tool operator or scaffolder.

Cherry-picker

A type of elevating work platform, with an open cage bucket or cage at the end of a manoeuvrable vertical boom from which a worker can perform aerial work.

Chute

An enclosed tube used to transfer debris from one level to another, set at an angle to prevent free-falling debris and minimise unnecessary dust dispersal during transfer.

Combustibles

Material that is capable of being set on fire.

Competent person (inspection)

A person conducting inspections who is registered with the Certification Board of Inspection Personnel (CBIP).

CBIP provides a comprehensive competency-based certification service to industry. Certifications include cranes, welding, pressure equipment, elevated work platforms, lifts, passenger ropeways, coatings and non-destructive testing. Website: www.cbip.org.nz.

Concrete crusher

A mobile or stationary plant used to crush concrete for the recycling of concrete debris.

Concrete cutting

A system of concrete cutting techniques used for dismantling or gradual demolition processes (or both).

Confined space

(AS 2865:2009 Confined spaces): an enclosed or partially enclosed space that is not intended or designed primarily for human occupancy, within which there is a risk of one or more of the following:

- a. An oxygen concentration outside the safe oxygen range.
- b. A concentration of airborne contaminant that may cause impairment, loss of consciousness or asphyxiation.
- c. A concentration of flammable airborne contaminant that may cause injury from fire or explosion.
- d. Engulfment in a stored free-flowing solid or a rising level of liquid that may cause suffocation or drowning.

Construction work

(Health and Safety in Employment Regulations 1995):

- 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 partly below, ground level;
 - ii. Any aerodrome, cableway, canal, harbour works, motorway, railway, road or tramway;
 - iii. Anything having purpose of drainage, flood control, irrigation, or river control;
 - iv. Any distribution system having the purpose of carrying electricity, gas, telecommunications, or water;
 - v. Any aqueduct, bridge, culvert, dam, earthwork, pipeline, reclamation, reservoir or viaduct;
 - vi. Any scaffolding; 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 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 in 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.

Controlled substance

A hazardous substance that requires a person with a Controlled Substance Licence to handle it, due to the highly hazardous nature of the products. Controlled substances generally refer to explosives, vertebrate toxic agents (like 1080) and fumigants. Licence holders require a "fit and proper person" check (Police background check) as well as approved handler certification to handle controlled substances.

COPS

Cabin Operator Protective Structure.

CPR

(from the New Zealand Resuscitation Council):

Acronym for cardiopulmonary resuscitation. CPR is the technique of chest compressions combined with rescue breathing. The purpose is to temporarily maintain a circulation of blood or oxygen or both sufficient to preserve brain function until specialised treatment is available.

Crane

(Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways Regulations 1999)):

1. means a powered device:
 - a. that is equipped with mechanicals means for raising or lowering loads suspended by means of a hook or other load handling device; and
 - b. that can, by movement of the whole device or of its boom, jib, trolley or other such part, re-position or move suspended loads both vertically and horizontally; and
2. includes all parts of the crane down to and including the hook or load handling device, and all chains, rails, ropes, wires or other devices used to move the load or load handling device; but
3. does not include lifting gear that is not an integral part of the crane.

Demolition

The deconstruction, dismantling, wrecking, pulling, knocking or cutting down of any building, structure, edifice, plant or part thereof; but does not include such work of a minor nature which does not involve any structural alterations.

Demolition ball

A cast steel weight with eyes and fixings, suspended from a lifting appliance and used to demolish a structure. See also Balling.

Demolition contractor

A person, company or organisation carrying out demolition; an employer within the meaning of section 2 of the Health and Safety in Employment Act 1992.

Dust screen

Heavy duty netting installed on scaffolding or on perimeter fencing to contain excess dust dispersal during the demolition work.

E-H

Electric tools

Hand operated equipment powered by an electric power source such as (but not limited to) drills, blade cutting appliances, disc grinders, electric hammers, floor grinders, temporary lighting, air extraction fans, electric hoists and any other electrical equipment used in the demolition work.

Elevated work platform (EWP)

A protective working platform that is moved into any working position by a power-operated machine to which it is attached. For example: scissor lifts, swing lifts, man cages or baskets.

Employee

(Health and Safety in Employment Act 1992): Any person of any age employed by an employer to do any work (other than residential work) for hire or reward under a contract of service and, in relation to any employer, means any employee of the employer.

Employer

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

Employment agreement

(Employment Relations Act 2000):

Means -

- a. a contract for service; and
- b. includes a contract for services between an employer and a homemaker; and
- c. includes in an employee's terms and conditions of employment in
 - i. a collective agreement, or
 - ii. a collective agreement together with any additional terms and conditions of employment; or
 - iii. an individual employment agreement.

Every employee must have a written employment agreement. It can either be a collective agreement (involving a union) or an individual agreement. For further information on employment agreements, visit the following website: www.dol.govt.nz/er/starting/relationships/agreements/index.asp

Environmental Protection Authority (EPA)

Formerly the Environmental Risk Management Authority New Zealand (ERMA New Zealand), the EPA is the government agency responsible for regulatory functions concerning New Zealand's environmental management. These include national consenting under the Resource Management Act 1991, regulation of hazardous substances and new organisms, ozone depleting chemicals, hazardous waste exports and imports, and assessments of environmental effects in Antarctica.

Excavator

A tracked or wheeled hydraulic digging machine using attachments such as buckets, rock breakers, shears, grapples, pusher arms. Widely used in demolition work.

Factor of safety

Also known as the Safety Factor (SF), it is a term describing the structural capacity of a system beyond its expected or actual loads. The factor of safety describes how much stronger the system is than it usually needs to be for an intended load. The calculation for factor of safety is:

$$\text{Factor of Safety} = \frac{\text{Material Strength}}{\text{Design Load}^*}$$

*The Design Load is the maximum load the part should ever see in service.

Fall arrest device

A self-locking device meeting the requirements of AS/NZS 1891.3 Industrial fall arrest systems and devices - fall arrest devices; and whose function is to arrest a fall.

Fall arrest system

An assembly of interconnected components comprising a harness connected to an anchorage point or anchorage system either directly or by means of a lanyard or lanyard assembly, and whose purpose is to arrest a fall.

Ferrous metals

Metals that contain iron, and are magnetic.

FOPS

Falling Object Protective Structure.

Gantry

A structure covering a public way providing side and overhead protection.

Green Star Project

Green Star is a comprehensive, national, voluntary rating scheme that evaluates the environmental attributes and performance of New Zealand's buildings using a suite of rating tool kits. It is managed by the New Zealand Green Building Council. Website: www.nzgbc.org.nz.

Guardrail

A rail erected to prevent people falling from a working or access platform.

Harm

(Health and Safety in Employment Act 1992): Illness, injury, or both; and includes physical or mental harm caused by work related stress.

Hazard

(Health and Safety in Employment Act 1992):

- a. 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
- b. includes:
 - i. a situation where a person's behaviour may be an actual (or potential) cause (or source) of harm to the person or another person; and
 - ii. without limitation, a situation described in subparagraph (i) resulting from physical or mental fatigue, drugs, alcohol, traumatic shock, or any other temporary condition that affects a person's behaviour.

Hazardous agents or contaminants

(Building Regulations 1992 including the Building Code):

"Hazardous" means creating an unreasonable risk to people of bodily risk or deterioration of health. The agents or contaminants cover potential items capable of causing physical harm or deterioration to health.

Hazardous substance

(Hazardous Substances and New Organisms Act 1996):

Unless expressly provided for otherwise in the Regulations, means any substance -

- a. with one or more of the following properties:
 - i. explosiveness;
 - ii. flammability;
 - iii. a capacity to oxidise;
 - iv. corrosiveness;
 - v. toxicity (including chronic toxicity);
 - vi. ecotoxicity, with or without bioaccumulation; or
- b. which on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased) generates a substance with any one or more of the properties specified in subparagraph (a) of this definition.

Hazardous waste

(draft definition, Ministry for the Environment):

Any waste that:

- contains hazardous substances at sufficient concentrations to exceed the minimum degrees of hazard specified by Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001, or
- meets the definition of infectious substances included in the Land Transport Rule: Dangerous Goods 1999 and NZS 5433:1999 Transport of Dangerous Goods on Land, or
- meets the definition for radioactive material included in the Radiation Protection Act 1965 and Regulations 1982.

Waste is defined as any material, whether it is liquid, solid or gas, that is unwanted and unvalued and discarded or discharged by its holder.

Hoarding

A solid or steel meshed temporary wall structure erected to isolate the work area to provide protection and prevent unintentional entry into the work area by other people.

Hot work

Welding, thermal or oxygen cutting, heating, including fire- producing or spark-producing operations that may increase the risk of fire or explosion.

I-L

kN

A Newton is the derived unit of force; it is equal to the amount of net force required to accelerate a mass of one kilogram at a rate of one metre per second squared. A kilonewton is about 101.97162 kilograms of load.

"Lawful and reasonable instructions"

Instructions to employees given by an employer are considered to be lawful and reasonable if it:

- does not require the employee to perform an illegal act;
- is within the employee's contractual obligations;
- does not require the performance of an impossible task; and
- does not require the performance of a dangerous task^[1].

Local authorities

A branch of government in New Zealand comprised of:

- 11 regional councils
- 67 territorial authorities.

M-N

MDF

Medium density fibreboard, a type of particleboard made of small particles of wood.

Notifiable work

(Health and Safety in Employment Regulations 1995):

1. Any restricted work, as defined in Regulation 2(1) of the Health and Safety in Employment (Asbestos) Regulations 1998:

2. Any logging operation or tree-felling operation, being an operation that is undertaken for commercial purposes.
3. 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 up to any including two full storeys;
 - b. work on overhead telecommunications lines and overhead electric power lines;
 - c. work carried out from a ladder only;
 - d. maintenance and repair work of a minor or routine nature
 - ii. the erection or dismantling of scaffolding from which any person may fall 5 metres or more;
 - iii. work using a lifting appliance where the appliance has to lift a mass of 500 kg 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 a 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 onsite 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.

NZQA

New Zealand Qualifications Authority. Some of their key responsibilities are the delivery of services to quality assure non-university tertiary education organisations and their courses, moderate their assessment activities and processes for national qualifications for NZQA-owned unit standards.

O-P

PCBs (Polychlorinated Biphenyls)

PCBs are a group of 209 possible aromatic chlorinated hydrocarbons. Due to their thermal and chemical stability, ability to mix with oils and fire resistance, they were widely used in transformers, capacitors and coolants. PCBs are highly toxic and are classed as a persistent organic pollutant, meaning that they build up in animals in the food chain. PCBs are a banned substance under the HSNO Act.

Person who controls a place of work

(Health and Safety in Employment Act 1992): In relation to a place of work, a person who is:

- a. the owner, lessee, sublessee, occupier, or person in possession of the place or any part of it, or
- b. the owner, lessee, sublessee, or bailee, of any plant in the place.

Personal protective clothing (PPC)

Any item of clothing that is to be used or is used in a place of work to protect workers from hazards.

Personal protective equipment (PPE)

Any item of equipment that is to be used or is used in a place of work to protect workers from hazards.

Powder actuated tool (PAT)

A hand tool capable of driving a pin, stud, bolt or similar object into or through building materials by means of an explosive force derived from a detonation of a cartridge containing an explosive; and includes every accessory or device that may be used with the tool. NOTE: Operators of these tools must hold a certificate of competency.

Place of work

(Health and Safety in Employment Act 1992): A place (whether or not within or forming part of a building, structure or vehicle) where any person is to work, is working, for the time being works, or customarily works, for gain or reward; and in relation to an employee, includes a place, or part of a place, under the control of the employer (not being domestic accommodation provided for the employee):

- a. where the employee comes or may come to eat, rest, or get first aid or pay; or
- b. where the employee comes or may come as part of the employee's duties to report in or out, get instructions, or deliver goods or vehicles; or
- c. through which the employee may or must pass to reach a place of work.

Principal

(Health and Safety in Employment Act 1992): A person who or that engages any person (other than an employee) to do any work for gain or reward.

Propping

A system of temporary supports to prevent movement or unintended collapse.

Pulling rope

A wire rope used in conjunction with an anchored winch or attached to a tracked or heavy vehicle, to pull down a selected part of a building.

Pusher arm

A steel attachment fixed to an extended boom on mechanically operated mobile equipment.

Q-T

Registered engineer

An engineer registered with the Institute of Registered Professional Engineers New Zealand (IPENZ) or a CPEng (Chartered Professional Engineer).

Road Controlling Authority

An incorporated society with members from the Territorial Authorities, Department of Conservation, Land Transport New Zealand, Local Government New Zealand and Transit New Zealand.

Rock breaker

A hydraulically-operated hammer attached to a machine and used to break up concrete or rock.

Safe Working Load (SWL)

The maximum weight a device such as a platform or crane is designed to support safely under stated conditions.

Scaffolding

(Health and Safety in Employment Regulations 1995):

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

Serious Harm

(Health and Safety in Employment Act 1992): includes death and

1. Any of the following conditions that amounts to or results in:
 - permanent loss of bodily function, or temporary severe loss of bodily function
 - noise induced hearing loss
 - respiratory disease, neurological disease, cancer, dermatological disease, communicable disease, musculoskeletal disease
 - decompression sickness
 - poisoning
 - vision impairment, chemical or hot metal burn of the eye, penetrating wound of the eye
 - bone fracture
 - laceration
 - crushing.
2. Amputation of body part.
3. Burns requiring referral to a specialist medical practitioner or specialist outpatient clinic.
4. Loss of consciousness from lack of oxygen.
5. Loss of consciousness, or acute illness requiring treatment by a medical practitioner, from absorption, inhalation, or ingestion of any substance.
6. Any harm that causes the person harmed to be hospitalised for a period of 48 hours or more commencing within 7 days of the harm's occurrence.

Significant hazard

(Health and Safety in Employment Act 1992: A hazard that is an actual or potential cause or source of:

- a. serious harm; or
- b. harm (being harm that is more than trivial) the severity of whose effects on any person depend (entirely or among other things) on the extent or frequency of the person's exposure to the hazard; or
- c. harm that does not usually occur, or usually is not easily detectable until a significant time after exposure to the hazard.

Silt mat

An inlet protection device used to cover a drainage inlet during the course of construction or demolition.

Site security

Where a secure hoarding has been installed at the site perimeter and has the appropriate warning signs and information signs visibly attached in a prominent location to warn of unauthorised entry.

Shears

A hydraulic cutting unit attached to a machine to cut through concrete, steel and timber.

STMS

Site Traffic Management Supervisor.

Telehandler

Otherwise known as a telescopic handler or extendable reach forklift, it is an industrial truck used to lift large loads to extended heights.

Territorial Authorities

A branch of government in New Zealand. Of the 67 Territorial Authorities, 13 are city councils and 54 are district councils.

Tool box/tail gate talk:

A documented safety briefing carried out at the commencement of each day's work on a demolition site.

Tub grinder (Shredder)

A mobile or stationary plant used to grind and shred timbers, rubber, plastic, light steel, vegetation for the recycling and/or minimising of waste debris.

Toe board

A board placed on the edge around a working platform to prevent tools or materials from falling from the platform.

U-Z

Zero swing tail excavator

An excavator with a house structure (containing the operator's compartment, engine compartment, hydraulic pump and distribution components), whose diameter stays within the width of the tracks through full rotation.

[1] Department of Labour, Wellington, March 2005. Themes in Employment Law: A Lawful and Reasonable Instruction?
www.dol.govt.nz/er/services/law/case/themes/2005-03-lawful-reasonable.asp

Section 3 - General requirements

3.1 General

Demolition must be carried out in accordance with the Health and Safety in Employment Act 1992 and the Health and Safety in Employment Regulations 1995.

It is important that demolition is carried out under the supervision of a suitably experienced and trained demolition supervisor.

All practicable steps must be taken for the safety of employees, and equipment must be operated by competent people. Particular care must be taken when employees demolish unsafe or damaged structures such as brittle roofing, fire-damaged and cantilevered structures.

Where there is a danger to the public, warning signs, barricades or warning devices must be provided and used.

3.2 Duties of principals (clients)

Section 18 of the Act requires principals of demolition projects (clients) to take all practicable steps to ensure that no contractor, subcontractor or employee of a contractor or subcontractor and is harmed while any work is being carried out for the principal.

Steps include (but are not limited to) the following:

1. Provide all available descriptions of the building or structure to be demolished, including:
 - relevant drawings;
 - site surveys including, if applicable, an asbestos survey;
 - engineers reports such as SWLs etc.;
 - current plans of underground and above-ground services;
 - historical use of the building or structure;
 - location of groundwater (if applicable);

- extent, nature and location of hazardous substances; and
 - relationship to surrounding properties.
2. Obtain the necessary approvals, including, if necessary consents, from Territorial Authorities, notify the relevant authorities controlling essential utility services prior to commencement of the work and advise the demolition contractor of conditions such as working hours, noise limits etc.
 3. Define the extent of the work as accurately as possible.
 4. Allow adequate access by those pricing the work so that a thorough site inspection can be carried out.
 5. Ensure that a complete set of building consent documents are given to the demolition contractor and are kept on the site.
 6. Where practicable, provide and insist on documented standards of health and safety performance for the demolition contractor to comply with.
 7. Obtain a demolition plan from the demolition contractor.
 8. Notify adjoining owners before demolition commences and, if necessary, request permission for the use of adjoining air space.
 9. Where appropriate, inspect buildings and record any existing defects.
 10. Locate and notify the contractor of all known hazardous substances and hazardous conditions pertaining to the site.
 11. Maintain a degree of supervision and co-ordination so that significant hazards identified do not cause harm to the contractors or the public.
 12. Select a demolition contractor with the necessary experience, knowledge, training and resources so that the demolition works are completed safely with no injury or damage to contractors, their employees or others.
 13. Monitor compliance by the demolition contractor to applicable environmental, health and safety standards.

3.3 Duties of employers (demolition contractors)

Employers (demolition contractors) to take all practicable steps to ensure the safety of employees while at work.

Steps include (but are not limited to) the following:

1. Ensuring and providing the necessary resources, including manpower, machinery and equipment in order to complete the demolition works safely.
2. Have a systematic method to effectively identify all hazards, including existing and new hazards (preferably before they arise), and implement effective controls to prevent harm to their employees and others.
3. Plan for demolition work and select the appropriate method or methods of demolition to prevent injury or loss.
4. Develop and implement site-specific safety plans based on the demolition method, including emergency procedures. Where necessary, the method and safety plan may need to be altered throughout the duration of a demolition contract to reflect the evolving working environment and conditions.
5. Provide for and ensure the correct use of appropriate personal protective equipment for their employees and, if necessary, site visitors.
6. Inform the principal and other relevant parties of the method or methods of demolition selected and equipment to be used.
7. Obtain necessary work permits such as traffic management plans, confirm that the building or structure to be demolished has the necessary building consents, and notify the Department of Labour of the intended works.
8. Nominate an experienced person to effectively supervise and control the works at all times.
9. Continually monitor the demolition works from start to finish to ensure that the works are being undertaken in accordance with the approved methodology and safety plan.
10. Inspect adjoining properties where necessary, and record the condition of adjacent buildings.
11. Erect all appropriate hoardings, fences and gantries for the protection of the public and other people affected by the work.
12. Ensure that employees have received the appropriate training.
13. Maintain the security of the site.
14. Maintain safe access at all times.
15. Maintain documented records of the demolition job so they are available for inspection.
16. Control the works to ensure that safe work methods are being used at all times.

NOTE | Employers may also have duties as principals to contractors, subcontractors, and employees of contractors and subcontractors. They may also have duties to ensure that other people in or in the vicinity of the demolition site are not affected by the work.

3.4 Employees and self-employed people



Figure 1: Demolition workers on site in Wellington

Employees and self-employed people are responsible for their own safety and health while at work. They must also ensure that their own actions do not harm anyone else.

This includes:

1. ensuring that they do not operate any plant or equipment they are not trained or authorised to use; and
2. complying with the employers' and principals' health and safety rules; and
3. ensuring they wear or use all necessary personal protective equipment and clothing they have been trained and advised to use; and
4. ensuring they participate in the employer's hazard management regime; and
5. ensuring they do not report for work or duty under the influence of alcohol or other impairment-causing substances.

However, these responsibilities do not detract from the employers' or principals' responsibilities.

3.4.1 Duties of employees (demolition workers)

Employees are required to take all practicable steps to ensure their safety and that of others while at work.

Steps include (but are not limited to) the following:

1. Obeying all lawful and reasonable instructions from the employer.
2. Observing all health and safety instructions from the employer.
3. Wearing or using all personal protective clothing and equipment when required as instructed by the employer.
4. Not reporting to work under the influence of drugs and/or alcohol or using drugs and/or alcohol during work hours.
5. Reporting all hazardous conditions/situations to the employer for rectification.
6. Not using any plant or equipment that the employee is not trained or competent in.

3.4.2 Training



Figure 2: Typical components of a training needs analysis.

Adequate training, instruction and supervision are critical to ensuring the health and safety of those working within the demolition industry.

People carrying out demolition work should be trained so they can carry out this work safely and without risk to their own health and safety and that of others. This training must reflect the requirements detailed within these guidelines.

For all demolition contractors, it is important to ensure that the training and instruction given to their employees is relevant and appropriate for the types of tasks and duties their employees undertake.

All employers, including demolition contractors, should undertake a Training Needs Analysis based on the organisation's needs (both current and future), the participants' current experience, training and their tasks and duties.

Training can be provided either by the employer, or outsourced for specialist training (such as workplace first aid, fall-arrest systems and confined space training). If the employer is undertaking the training themselves, instruction should be given by a competent person, and records of training should be maintained.

3.4.3 Supervisors

Supervisors ensure the on-going, efficient and safe running of demolition jobs.

To do this properly, they should have the adequate experience and training in safe demolition procedures as outlined in this guideline.

The demolition contractor should ensure that supervisory personnel have a detailed knowledge of the precautions and procedures outlined in these guidelines. With this knowledge and personal experience, they should assume the following responsibilities, including:

1. effectively implementing the total planned demolition procedure; and
2. performing the demolition set-up; and
3. performing the actual demolition and final clearing operation; and
4. discussing with contract management and document any alterations or changes required to the methodology or HSE plan;
5. ensuring that all necessary measures are taken to reduce the concentration of airborne dust and other airborne contaminants to the lowest practicable level; and
6. ensuring that hazardous fibres and hazardous materials are removed in accordance with regulations and guidelines, and do not contaminate adjacent areas; and
7. ensuring that all workers under their supervision are adequately trained in the safe working practices outlined in these guidelines; and
8. ensuring that people carrying out special tasks, such as hot works, height work, confined space entry, hoisting work, handling hazardous substances and transportation have been suitably trained and are competent or are under the direct supervision of a suitably trained and competent person
9. ensuring that the demolition is adequately supervised and that the operation is carried out in a safe and proper manner in accordance with the precautions listed in these guidelines; and
10. having sound knowledge to determine the correct plant and equipment to execute the demolition works in a safe manner; and
11. ensuring that personal protective equipment is used and maintained in good condition; and
12. ensuring that the demolition site is maintained in a clean condition and that waste is quickly and properly disposed of; and
13. ensuring all people employed by the contractor are encouraged to take part in identifying and reporting any new hazards as they arise during the demolition work; and
14. writing up a site-specific hazard identification and management plan; and
15. managing a tool box safety talk; and
16. completing an incident report; and
17. ensuring that personal hygiene procedures are continually observed; and
18. maintaining accurate and up-to-date site records and information.

Further training for supervisors may include:

1. workplace first aid training;
2. safety supervisor training;
3. use of fall-arrest systems on demolition and construction sites;
4. fire warden training;
5. RTWs - Rollers, Tracks and Wheels driver licence endorsements;
6. confined space entry;
7. permit to work systems;
8. concrete cutting and drilling; and
9. use of specialist equipment such as concrete crushers, tub grinders, separators, etc.

3.4.4 Demolition operators

The demolition contractor must ensure that their demolition operators are properly trained in the correct safe use, maintenance and inspection of all plant and equipment that they are required to operate, including any personal protective equipment and clothing they are required to wear while operating this equipment.

Demolition operators should also be given instruction on the procedures for advising the employer of defective or damaged equipment.

3.4.5 Demolition labourers (employees)

The demolition contractor must ensure that their labourers are properly trained in the correct:

- personal protective clothing and equipment they are required to use;
- operation, maintenance and inspection of all plant and equipment (including hand tools) they are required to use;
- handling of hazardous substances (such as compressed gases) they are required to use, including safe handling and storage procedures; and
- health and safety standards and procedures of the employer, including hazard identification, hazard management and involvement of employees.

Employees carrying out demolition work should have satisfactorily completed the following training:

1. ideally, a minimum of three years practical training under the supervision of a recognised and competent demolition contractor; and
2. correct safe working procedures for all plant and equipment, structured to these guidelines, and conducted by a suitable training provider; and
3. correct safe methods of demolition, structured to these guidelines and conducted by a suitable training provider; and
4. health aspects and hazards associated with hazardous material removal, including the storage, safe handling, transportation and disposal of such materials; and
5. use, care, and maintenance of personal protective clothing and equipment required to safely complete demolition work; and
6. work practices to be followed in undertaking hazardous material removal.

This training should include information for each site-specific safety plan, including:

1. hazard identification and control measure implementation;
2. safe work procedures; and
3. emergency procedures.

The demolition contractor should keep an up-to-date written record of all training provided to each of their demolition workers and ensure that these records are readily accessible.

3.5 Labour hire staff

The use of temporary casual labour hire staff is popular in many industries, the demolition industry being no exception. While the benefits of such arrangements are easily recognised, the demolition contractor is still obliged to ensure the health and safety of such people when they engage labour hire firms (or agencies) to provide staff for their demolition jobs.

When engaging labour hire firms to provide staff for a demolition site, the demolition contractor takes on the obligations of a principal. These obligations require that they:

1. take all practicable steps to ensure the health and safety of the temporary worker while at work; and
2. ensure that the temporary worker is not harmed by any hazard that is or arises in the place of work that they control.

The labour hire firm is responsible for meeting the obligations of an "employer" under the Act; these include the following:

1. taking all practicable steps to ensure the health and safety of their temporary worker while at work; and
2. providing, giving access to, and ensuring that all temporary workers use protective clothing and equipment where necessary; and
3. ensuring that all temporary workers are trained, or supervised by a person who has the knowledge and experience of the work, plant or substance.

For further information on managing temporary staff, refer to the Department of Labour publication Health and Safety Guidelines for the On-Hire Industry (see [appendix 1](#)).

3.6 Safety of people who are not employees

Section 15 of the Health and Safety in Employment Act 1992 (the Act) requires employers to take all practicable steps to ensure that the action or inaction of an employee, while at work, harms no other person, including members of the public or visitors to the place of work.

Examples of practicable steps include, but are not limited to:

- fencing or hoarding off the demolition worksite to prevent unintentional entry by others onto the site; or
- posting "Hazard" and "Danger" signage on fencing and at all site entry points; or
- using a authorised traffic management plan for site traffic; or
- notifying and liaising with neighbouring properties and businesses of the commencement of demolition work; or
- protecting any voids or footpath damage caused by demolition works; or
- installing gantries to protect pedestrians.

3.7 Waste disposal transporters

The demolition contractor should ensure that the operators of transportation vehicles for hazardous substances are properly trained in the correct:

1. transportation of compressed gas cylinders; and
2. loading procedures to ensure that all loads are safely secured, and that loads do not exceed the permitted gross laden weight of the vehicle; and
3. operating procedures while in a contaminated work area to collect waste for disposal; and
4. transporting requirements while transporting contaminated waste to the designated refuse site; and
5. selection, use and maintenance of respiratory protective equipment.

In addition:

1. operators transporting hazardous waste and dangerous goods must hold a current D endorsement on their driver's licence; and
2. vehicle transport bins or trays should be thoroughly cleaned after disposing of hazardous waste.

Section 4 - Pre-demolition checks

4.1 Introduction

During demolition projects, the potential risk of a fatal or serious harm accident is high - to employees, contractors and even to the public. Hazard identification and the promotion of safe methods of work are therefore essential, and these should also be reflected in responsibilities to third parties.

While it may be accepted practice to place conditions of responsibility back onto the principal or agent (commonly known as "tagging"), this does not in any way relieve the demolition contractor from its legal responsibilities. These responsibilities ensure that all precautions are being taken to maintain the continued safety of all people involved in or coming into contact with the demolition work.

The public is primarily concerned with materials falling, or dust billowing from the site onto public roadways or adjacent properties. Two other main concerns are the potential instability of partially demolished structures, and noise emanating from demolition sites.

Hazards that should be identified and controlled appropriately include (but are not limited to):

- falling/flying objects and debris;
- falls from height;
- dust;
- noise/vibration;
- fire/explosion;
- unintentional collapse of the structure;
- hazardous substances and materials; and
- heavy machinery movements, including truck movements on and off the site.

Every demolition job, no matter how small, must be planned. The planning stage should be used to identify the hazards and consider the precautions to be taken. Safety, planned at the start of the demolition process, will always be more cost-effective than safety introduced midway during the project.

Managers (including principals, agents of principals, and employers) of demolition projects must lay a solid foundation for safety by adopting safe systems of work, and employees must co-operate to ensure that their actions do not compromise safety.

4.2 Site inspection

The demolition contractor must check the site, building or structure, its contents and environment for likely hazards. These include:

- asbestos-containing materials;
- PCBs and other toxic substances (including lead, pesticides, timber treatment chemicals);
- hazardous and flammable substances;
- electric power lines, cables or transformers;
- gas supply lines;
- fire alarm and riser services, including water, telephone and electrical;
- fire extinguishers and other compressed gas containers;
- biological hazards, including sewage, rotten matter (food waste, for example), bird guano, fleas, rodent and animal faeces, hypodermic needles and other matter that may pose a risk to the health of employees and others;
- sewerage and storm water supply lines;
- underground tanks, pits, sumps, basements or other voids;
- telecommunications;
- unsafe structural members, including floors, roofs etc.;
- unsafe access routes; and
- traffic conditions.

Recorded evidence of these checks should be held and maintained by the demolition contractor, e.g. on a "Pre-Demolition Checklist" (see [appendix C](#) of this guideline for an example).

Written evidence of an engineer's calculations or reports will be required for any part of an elevated or suspended structure that is intended to hold heavy machinery, live loads, debris and other such materials required for the demolition work.

The site conditions, including interactions with others, should be identified and safety precautions established to ensure the continued safety of all people involved on the site.

In addition, the demolition contractor should identify which materials can be recycled from the structure (if any) and how these will be removed safely.

4.2.1 Adjoining buildings

The demolition contractor should check the relationship and the condition of adjoining buildings. No part of the demolition process is to adversely affect the structural integrity of any other building.

Consideration may need to be given to monitoring, the use of shoring and underpinning, and to the changes in soil condition as a result of demolition.

Special precautions may need to be taken near hospitals and other buildings containing equipment that is sensitive to shock or vibration.

Access to adjoining properties should be agreed to beforehand and should be maintained throughout the demolition process. The level of protection should be no less than that afforded to public places.

4.2.2 Historical use of the building

The building owner or principal must provide the demolition contractor written evidence of the historical use of the building/structure. This does not relieve the obligations of the demolition contractor from confirming such conditions of the building exist.

Those conditions may arise from hazards including:

- hazardous substances;
- PCBs;
- lead;
- asbestos; and
- radioactive substances.

All hazardous substances must be removed prior to the demolition commencing. Check with the site owner to determine if a location test certificate (April 2004 onwards) or dangerous goods licence (prior to 2001, but licences were rolled over until March 2004) has ever been issued for underground tanks.

4.2.3 Public services

All services, either underground or above ground, such as:

- gas;
- water;
- electricity;
- drains;
- fire services and risers;
- telephone cables; and
- fibre-optic cabling

must be located and plans provided by the client/principal (where applicable). They must be maintained by the demolition contractor for reference throughout the contract.

Arrangements must be made to have public services either disconnected or isolated to the site boundary, or suitably protected subject to the approval of the appropriate authority. In some cases, more than one source of supply may be found. Some services may require the:

- issuing of a "close approach" or "close proximity" permit from the utility supplier, or
- use of a utility representative to observe the works.

The demolition contractor must ensure that all disconnections or isolations and the like are confirmed in writing from the utility supplier. Confirmation records are to be kept onsite throughout the demolition works for verification and reference.

All internal power outlets should be tested by the person who has terminated the power supply, and a record of these tests should be kept.

As-built plans for storm water and sewerage disconnection may be required by the Territorial Authority from the demolition contractor to verify that these services have been appropriately disconnected prior to works commencing.

Where contractors, such as drain layers, plumbers and the like are being used by the demolition contractor to deal with these services, the demolition contractor must ensure that the contractor holds the necessary qualifications and is appropriately registered to do the job competently.

Particular care needs to be taken when constructing boundary fences or gantries to ensure that their foundations do not strike public utilities that are still in use. Provision must be made for the safety of pedestrians and vehicles passing the site.

Footpaths must be maintained in a safe condition.

4.3 Dangerous structures

The building owner or principal must provide the demolition contractor with written evidence of the current condition of the building/structure. This does not relieve the demolition contractor from the obligation of confirming that such conditions exist.

If the demolition contractor determines that the structure appears dangerous, the demolition contractor should check with the Territorial Authority, who may know about the type of construction and the cause of damage or weakness. Find out if the Territorial Authority has a site file with notes on any special features.

Conditions warranting concern can include (but are not limited to):

- any previous environmental hazard to damage the structure including earthquakes, tsunami, tornado or other act of nature;
- the structure or building leaning;
- the columns or beams to have cracking, leaning or any damage to compromise structural integrity;
- damage to multi-story block walls with no compacted infill, infill or reinforcing;
- plaster or brick lining cracking;
- obvious stress cracks at building joins and around the foundation/floor base areas;
- stress cracks and obvious signs of deterioration in basement areas;
- the building or structure located on sloping or unstable ground;
- burnt-out structures (refer further in [section 5.4](#) of this guideline);
- deteriorated supports and foundations; or
- damage to pre-stressed concrete slab buildings.



Figure 3: Residential dwelling damaged during the Christchurch earthquake, February 2011

Any buildings showing any structural damage where a hazard presents to demolition workers during the deconstruction process may require the direct input by a suitably experienced IPENZ-registered engineer, which may include:

- sign-off of the proposed methodology developed by the demolition contractor for safety;
- design of any propping or structural reinforcing that may be required to allow demolition workers to conduct their tasks and duties safely on the structure;
- advice regarding any access or egress requirements for safety of the workers during the deconstruction phase (particularly necessary for multi-storey structures); and
- specification of all safe working loading of any floors or structures determined to hold any live loadings, including personnel and debris.

It is important that the demolition contractor maintains accurate records of all communications with the client or other representative regarding any damaged structure.

It is important that the client provides the demolition contractor with as much information as practicable to ensure that any demolition works on structurally-damaged structures is conducted in a safe and healthy manner. Information may include, but is not limited to:

- historical use;
- the age and known construction of the structure;
- any drawings, engineering reports and structural plans of the structure;
- any plans detailing services, including any utility entries into the site;
- any previous works entailing hazardous material removal or management plans (i.e. asbestos-containing materials); and
- any local information pertaining to current storage of hazardous substances including (but not limited to): the location of fire extinguishers, compressed gases, hazardous or flammable materials that could pose potential hazards to the demolition contractor's personnel during the demolition process.

Irrespective of whether a structure is determined to be of a hazardous nature or not, the demolition contractor should still undertake all practicable steps to ensure that there is no unnecessary damage to services or assets during the demolition process.

All practicable steps should still be followed both by the demolition contractor and the client to ensure that where possible no damage occurs to any items outside of the demolition scope.

If the damaged structure is a former food or beverage outlet, the demolition contractor may be required to undertake further precautions to prevent any health risks from exposure to such materials, including rodents. For further information, refer to the Department of Labour Fact Sheet "How to Safely Clean Up Decomposed Food after the Earthquake" (see [appendix I](#)).

4.4 Structural inspection

The building owner or principal must provide the demolition contractor with all known and applicable structural plans so that the demolition contractor can examine them.

It must be understood by the demolition contractor that the original drawings may not be a true record of what was actually built.

Where the nature of the construction is uncertain, a special investigation by the demolition contractor must be carried out, and may include input from specialists such as registered engineers.

Where it is intended to use heavy plant and machinery on roofs and floors, or where it is intended to load debris on roofs or floors, the safe working loads (SWLs) must be determined and calculations drawn up by a IPENZ-registered engineer to ensure that these will not be exceeded.

Propping or strengthening of the floor or other parts of the structure may be necessary. The demolition contractor must obtain the registered engineer's calculations, particularly when propping floors and major load-bearing structures.

Areas where machinery or plant is not permitted must be clearly barricaded to avoid confusion by demolition workers and others as to what area is safe for machinery and what is not.

4.4.1 Roof structures

The demolition contractor must conduct a thorough examination of the roof structure, including the underside, to check for structural integrity and locate potential hazards such as brittle roofing material.

The condition of roof trusses should be checked, and the demolition contractor must identify and mark any bracing that is essential to prevent the roof from unintentional collapse during the demolition process.

It is vital that the demolition contractor checks the nature and condition of roof cladding. Special conditions that will require attention by the demolition contractor include:

- asbestos cement "Super Six" roofing cladding;
- plastic corrugated "ClearLite", fibreglass or similar roofing cladding - plastic/perspex roofing sheeting can be weathered, painted or dirty giving the appearance of solid iron roofing; and
- glass panelling and skylights.

Asbestos-cement sheeting and ClearLite sheeting is liable to shatter without warning under a person's weight, and for this reason these roofs are known as "brittle roofs".

In some cases, the roof structure itself may be unstable due to damaged timber framing.

The removal of asbestos-cement sheeting from a roof should only be undertaken by people who have the knowledge, experience and resources necessary to allow them to work safely at heights, and preferably under the direct supervision of a person who holds a certificate of competency for the removal of asbestos.

If the workers are required to wear fall-arrest harnesses while on the roof, they must be trained in the safe use of safety harnesses and be supervised by a person holding NZQA unit standard 15757.

The demolition contractor should conduct a risk assessment to determine specific requirements for the safe removal of asbestos sheeting and working on brittle or unstable roofs. Consideration should be given to:

- The necessity to have demolition workers on the roof exposed to the risk of a fall. Alternative methods that should be considered include the use of crane/man cages, mobile scaffolding or use of elevated work platforms, where the removal work is done from the confines of the protective working platform.
- If demolition workers must work from the roof, the structural integrity of the building must be considered. Propping may be required. All propping used must be certified by a registered engineer.
- If demolition workers must work from the roof, suitable gangways should be installed to prevent workers from walking directly on the asbestos or Clear Light sheeting. All demolition workers must be wearing suitable fall arrest harnessing.

Chicken wire installed under asbestos sheeting must not be considered by the demolition contractor as an appropriate means of preventing the worker from falling through the asbestos sheeting.

All open voids, including clear sheeting, should be identified and appropriately protected at all times to prevent accidental falls.

4.4.2 Walls

The demolition contractor must examine the building/structure walls. Items that should be checked include:

- identifying and marking any load-bearing walls;
- the construction of the materials of the walls;
- checking whether party- or cross-walls are properly bonded into front and rear walls; and
- structural deficiencies such as those listed in [section 4.3](#).

The demolition contractor should also check the thickness and condition of walls and gables which are to remain after the demolition has been completed, noting any particular reduction in wall thickness.

Any effect on remaining buildings due to the removal of buttressing walls must also be considered. The demolition contractor may need to consult a registered engineer to provide calculations for this.

4.4.3 Cantilevered structures

Cantilevered structures include, but are not limited to:

- balconies;
- cornices;
- canopies;
- power or lighting poles;
- overhead walkways;
- staircases; or
- an addition to a structure which has been cantilevered from the main structure.

These are fixed to a building or structure and their stability is likely to be affected when adjoining structural members in the building are removed. For instance, if a cantilever is mounted to a continuation of the building's roof or floor beams, it may collapse when the beams inside the building are cut or removed.

The cantilevered structure must:

- be identified and removed first before any demolition begins on the main structure, or
- be appropriately propped to provide support and prevent unintentional collapse during demolition, or
- have a supporting scaffolding gantry installed to prevent unintentional collapse during demolition.

Any propping or installation of a scaffolding gantry will require a registered engineer to certify that this is safe, particularly if this structure is intended to be used as a form of public protection during demolition.

Temporary supports may be required during the demolition of cantilevered structures.

Support anchors of the cantilevered structure must not be removed prior to the demolition of the cantilever itself unless the cantilever has been temporarily supported.

Any propping or installation of a scaffolding gantry will require a registered engineer to certify that this is safe, particularly if this structure is intended to be used as a form of public protection during demolition.

Temporary supports may be required during the demolition of cantilevered structures.

Support anchors of the cantilevered structure must not be removed prior to the demolition of the cantilever itself unless the cantilever has been temporarily supported.

Demolition of external cantilevered structures facing public streets, and which are higher than four metres above-ground and offset from the site boundary at a distance less than one half of the height of the building to be demolished may affect the safety of the public.

In demolishing these external cantilevered structures, the areas underneath them should be protected by temporary solid catchment platforms. The protection is to be designed to resist both the anticipated demolition debris loading and to prevent debris from falling to the ground. If this or similar protection cannot be installed, then demolition by cut and lift or other similar techniques must be employed. In all cases, additional precautionary measures must be taken to protect the public by cordoning off the road frontage and providing alternative pedestrian thoroughfare.

4.4.4 Basements, cellars, and vaults

The demolition contractor must assess the building/structure to be demolished for any basements, cellars, vaults and other voids for their effect on the remainder of the structure and adjoining properties.

Consideration must be given to each of the following:

1. Will they be a hazard to people or machines?
2. Will removing the walls threaten adjacent foundations?
3. Will the adjacent ground cave in?
4. Retention of surrounding soil - strutting and shoring measures will need to be implemented during demolition of these structures to prevent unintentional collapse.

4.4.5 Tunnels, sumps and trenches

The demolition contractor must assess the building/structure to be demolished and the surrounding area to locate any tunnels, sumps and trenches that may pose an unintentional collapse hazard to demolition workers, machinery and vehicles. The presence of these is indicative of the historical use of the structure or building.

Precautionary measures include:

- propping of the structural walls and ceiling;
- suitable protection with heavy-duty steel plates;
- clearly locating these structures on any plans and communicating this information to the demolition workers; or
- barricading off the structures where necessary.

The demolition contractor must develop methods to prevent the surrounding ground from collapse or subsidence. The extent of any foundations or footings of structures immediately adjacent or above these structures needs to be clearly defined.

Tunnels, sumps and trenches may contain hazards such as hazardous substances (petrochemicals, biological matter etc.), which may require purging or protecting during the course of the job.

Any entry by demolition workers into these structures must be done under confined space conditions.

4.4.6 Wells and underground storage tanks

The demolition contractor must ensure that the testing of wells and underground storage tanks has or will be conducted to determine if any hazardous or flammable atmospheres or residual hazardous substances are present within the tank and in the surrounding environment.

Any entry into these structures by people must be done under confined space conditions in accordance with AS 2865:2009 Confined Spaces. Any hot works should be avoided, but if it is necessary, they should be conducted under a hot works permit. Refer to [section 5.22.3](#) for more information.

The structure may require cleaning and purging prior to demolition to remove the hazardous/toxic substances. Any cleaning and purging must be done by a contractor who holds the appropriate qualifications to undertake this work safely.

Any methods employed for the demolition of these structures should take into account any fire, contamination or unintentional collapse of the surrounding ground.

4.5 Masonry structures and buildings

The term "masonry" can be applied to:

- solid concrete;
- concrete block;
- brickwork;
- rock;
- pre-cast concrete tilt-slab structures;
- framed structures of pre-cast concrete;
- column beam slab construction; and
- pre-stressed concrete structures.

The demolition contractor must carry out a full investigation to confirm the type of structural framework and look for any signs of damage due to the corrosion of reinforcement or damage to the masonry before determining the appropriate method of demolition.

Where necessary, advice should be sought from a suitably experienced registered engineer.

4.6 Night-time demolition

Due to noise, vibration and other restrictions it is common for councils to limit demolition activities to outside business hours in commercial areas. This requirement often creates the need for demolition work to be performed after-hours.

These guidelines are recommended for night-time demolition:

- Sufficient lighting should be installed in such a manner to clearly illuminate the working area, its surrounds and any hazards that might be present. The lighting should be positioned in such a manner to reduce shadows and dark areas.
- All access to and from the workplace amenities, first aid room, office, storage sheds, rescue equipment and any other part of the site where workers may need to go as part of their duties, should be clearly illuminated.
- Provision should be made for sufficient emergency lighting to enable a safe evacuation in the event of a power failure.
- Mobile communication should be provided at the workforce to contact emergency services in the event of an accident.
- All lighting apart from battery operated backup systems should be protected by earth leakage devices.

4.7 Demolition plan (method statement)

The demolition plan or method statement must be developed by the demolition contractor to incorporate a step-by-step plan on how the demolition contractor intends to safely demolish the building or structure.

It should be developed following careful planning of each stage of the demolition, from mobilisation to demobilisation, and should be in writing. A copy of the intended demolition plan should be provided to the client or principal for their information.

A demolition plan or method statement is considered to be a "live" document, meaning that it is open for change or alteration throughout the course of the job, to recognise any new conditions that may arise. Such changes or alterations can be minimised if the demolition contractor has conducted a thorough check of the building or structure during their pre-demolition check.

In addition, the demolition plan should include (but is not limited to):

- a description of the structure or building, including constructed materials;
- the location of the structure or building, including relationship to surrounding structures/buildings;
- a description of the historical use of the building;
- a description of the works to be undertaken;
- staged description of how the works will be done safely, taking into consideration:
 - safe access by personnel;
 - any temporary platforms required for the works;
 - intended plant and equipment to be used;
 - proximity to adjacent structures and buildings;
 - constraints implemented by the Territorial Authority and/or client;
- notifiable work;
- location of underground services;
- any special conditions such as working hours;
- worksite access;
- any hazardous substances present within the building, their location, extent, type and intended method of removal;
- territorial consents required for the job;
- work permits required (hot works/confined space etc.);
- engineer's calculations and required reports;
- intended site personnel to be onsite, specifically the site supervisor, ticketed/qualified personnel and first aiders;
- temporary structures to be used onsite by the contractor; and
- any other conditions identified through the pre-demolition check.

Where required, a demolition plan or method statement must be submitted to a Department of Labour health and safety inspector.

4.8 Site-specific health, safety and environmental (HSE) plan

Using the information from the demolition plan or method statement, the demolition contractor can develop a site-specific HSE plan that will:

- identify the anticipated hazards associated with each intended demolition stage;
- formulate the appropriate control methods to prevent harm, injury or damage; and
- be used as a tool for effectively communicating these through to the principal and other contractors.

The safety plan can also include information on environmental considerations as discussed in this document.

It is important that the demolition contractor creates and maintains a good process for on-going, effective hazard management and communication throughout the duration of the job to ensure that all hazards are identified and assessed, and that control methods listed in the safety plan are effective and relevant.

In addition, the site-specific safety plan should include (but is not limited to):

- a task analysis or hazard identification register;
- types and location of personal protective equipment and clothing required to be used;
- work permit procedures (hot works, confined space etc.);
- training and certification registers of demolition personnel, including supervisory staff;
- emergency procedures and evacuation plan;
- auditing and assessment for compliance;
- monitoring records (environmental and biological);
- a hazardous substances register including safety data sheets (SDS); and
- induction requirements for site visitors/contractors and employees.

Where required, the site-specific HSE plan must be submitted to a Department of Labour health and safety inspector.

4.9 Hazard management and recording

The Act requires all employers, including demolition contractors, to have an effective system in place to systematically identify significant hazards.

While the Act does not prescribe the manner in which this can be achieved, it is recommended that this system be recorded, checked and monitored for effectiveness.

Many forms across the industry that are used, such as hazard IDs or JSAs (job safety analyses). They all hold common features which are necessary to implement effective hazard identification and management. These are:

- the hazards identified and control methods to be implemented;
- the person responsible for implementing the controls; and
- the date by which these controls must be implemented.

Hazard controls should be developed reflecting the hazard control hierarchy, which are:

- elimination (preferred);
- isolation; and
- minimisation.

Effective hazard management requires consultation, input and communication with employees and others relevant to the work being conducted. Toolbox meetings (or tailgate meetings) and site-specific inductions are recommended.

Section 5 - Demolition safety

5.1 General

Accidents have been caused during demolition by:

1. people falling from unprotected workplaces and through openings;
2. people being struck by falling objects;
3. people being struck by flying objects;
4. sudden collapse of buildings or structures;
5. unprotected electrical cables, wiring or equipment;
6. collision with mobile plant and equipment;
7. fires caused through hot works or burst gas mains;
8. insecure materials in or on the structure;
9. plant being used on elevated slabs without proper precautions being taken;
10. people harmed by cutting equipment; and
11. road accidents caused from overloading or insecure loads during transport.

Safety precautions must be taken to safeguard persons working on the site and members of the public who are in the vicinity, as well as to protect property likely to be affected by the demolition.

5.2 Buildings

To prevent injury from broken glass, all glass should be removed from windows before demolition begins. Window openings on street frontages or adjacent to access ways must be blocked off to prevent unauthorised entry.

Openings in walls, floors, roofs and stairwells, through which people could fall, should be boarded up or be provided with a guardrail and toe-board, or other suitable barrier. Access to areas where flooring has been removed must be barricaded off, and notices erected to warn of the danger at each point of entry.

All stairs or installed ladders must be checked before use. Never assume that they are sound: it may have been years since they were last used. If in good condition, leave them as a means of access for as long as possible.

When dismantling pitched roof trusses, the last frame should be guyed before the second-to-last truss is removed, as its stability depends on the support from adjacent members. As supports and buttresses are removed, bracing should be provided to stabilise the remaining structure.

When demolishing a reinforced concrete floor, it may be necessary to remove a small section first in order to determine the direction of the main steel. Provide support for beams before cutting them free of columns and walls, if necessary. Columns must be guyed before cutting or weakening the base, so that their fall can be controlled. Clear openings should be made in floors to allow debris to pass through.

5.3 Pre-stressed concrete structures

The demolition of pre-stressed concrete structures is hazardous. Professional advice must be obtained from a suitably qualified IPENZ-registered engineer. A demolition plan or method statement is also required.

In general, the only safe way to demolish a structure containing pre-stressed concrete is to dismantle the structure in the reverse order in which it was originally erected. Some buildings will be straightforward, but special care will be needed in the following circumstances:

1. continuous structures over more than one support or cantilevered structures;
2. suspended structures;
3. structures that had been progressively stressed during construction;
4. structures made of pre-cast members stressed together once erected; and
5. shells, ring beams, tension ties and stressed tanks.

Care must be taken in handling pre-stressed components. For example, long "slender" beams may become unstable if allowed to tip onto their sides. In general, pre-stressed beams should only be supported near their ends.

Demolition using "conventional" methods such as balling or concrete breakers may be unsatisfactory due to the possibility of an uncontrolled collapse, or the sudden release of the stressing steel.

Ducts for post-tensioned pre-stressing tendons have been known to "float" up during concreting, causing additional hazards for demolition contractors. It may be necessary to confirm the location of stressing cables or ducts prior to commencement.

5.4 Demolition of fire-damaged buildings



Figure 4: Fire-damaged structure

In general terms, a fire-damaged building will be easier to demolish, owing to the damage and weakening of both building materials and structure. However, the weakening reduces the structure's ability to act as a load platform for plant, people and materials. Great uncertainty exists on what might happen when various actions are taken. Advice from a suitably experienced IPENZ-registered engineer should be obtained before demolishing all but the simplest fire-affected structures.

Caution is needed, as the strength reduction of the various beams, columns and connections is uncertain. Most common structural materials lose strength when subjected to fire. For example, the expansion of beams and trusses during a fire can cause shear failure of their wall and column connections. Thermal bowing of masonry can occur, and can cause unexpected wall collapses.

5.4.1 Inspection prior to demolition

1. Evaluate the fire temperature and locate areas where material strengths appear reduced and deflections are larger than normal.
2. Look for shear failures of connections.
3. Evaluate concrete strengths and identify areas of weakness or collapse.
4. Look for cracked concrete members, even those remote from fire.
5. Check if structural steel requiring compression-flange restraint has lost that restraint: for example, with purlins or floor joists with composite flooring, check for shear failure.

Where loss of strength has occurred in beams, columns, or their connections, precautions must be taken to keep the resulting hazards to a minimum. Additional propping may be necessary to ensure stability.

Before any work starts, ensure that internal areas are well ventilated, and be aware that some debris may be toxic. Take particular care if the building was used to store chemicals.

5.4.2 Temperature effects on materials

Depending on the temperature and duration of the fire, the heat can affect the building materials as shown in table 1.

Table 1: Temperature effects on building materials

Material	Temperature	Effects
Concrete	0-300°C fires	Strength unaffected.
	300-500°C fires	The concrete may turn pink, it appears sound but strength loss will have occurred.
	600-900°C fires	The concrete turns whitish grey and becomes weaker and more friable.
	above 900°C fires	The concrete turns buff, and is weak and friable.
Material	Effects	
Reinforcing steel	Generally okay unless the concrete has spalled off. For pre-stressed concrete, the loss of strength can be substantial - extreme caution is necessary.	
Steel	Structural steels usually become weak in tension while the compressive strength is affected less. High-strength steel is affected more than mild steel. Take particular care when cutting steel after it has been affected by fire. It may spring unexpectedly.	
Timber	The strength is not affected directly, but the loss of cross-sectional area reduces its load capacity.	
Masonry	The compressive strength is probably reduced and tensile strengths substantially reduced.	

5.5 Protection against falls from heights

Fall protection must be provided for all people exposed to a fall hazard, irrespective of the height.

Falls from demolition sites can result from:

- falling through penetrations or open voids;
- falling through fragile or brittle roofs;
- falling from exposed open edges on platforms, stairways, scaffolding and roofs;
- falling out of elevated work platforms;
- failure of plant and equipment;
- incorrect erection or installation of passive fall prevention devices such as scaffolding and guard-railing;
- flooring collapses;
- collapse of ground above cellars/pits;
- falling on any item being inspected, tested, maintained, repaired or cleaned;
- falling from plant and equipment while climbing onto, into or out;
- falling from any surface that is slippery.

The Act mandates measures for controlling the risk of a fall. This is known as the hierarchy of control. Only where it is not reasonably practicable to implement a higher level of control may an employer consider a lower control.

The preferred order of controls is:

1. elimination: i.e. eliminating the need for employees to work at heights by using mechanical means (i.e. removing sections whole to be demolished on the ground);
2. isolation: i.e. installing guardrails and covering voids (i.e. working out of an Elevated work platform);
3. minimisation: i.e. using personal protective equipment such as fall arrest systems (i.e. training specific to work at height).

5.5.1 Regulation 21

Regulation 21 of the Health and Safety in Employment Regulations 1995 states that where there is a risk of employees falling three metres or more, the employer shall take all practicable steps to ensure that there is a means to prevent the employee from falling, and that the means is fit for the intended purpose.

Regulation 21 does not imply that there is no need to manage risks of falls from heights of less than three metres. It is universally acknowledged that serious harm can still occur from these heights; therefore appropriate measures must be taken to avoid harm when working at heights of less than three metres.

5.6 Scaffolding



Figure 5: Bird's nest scaffolding used in demolition and asbestos works

Scaffolding includes:

- tube and clip scaffolding (defined as advanced scaffolding)
- proprietary scaffolding (defined as basic scaffolding)
- suspended scaffolding, including boatswain chairs and swinging stages (defined as suspended scaffolding).

Proprietary scaffolding includes any mobile or aluminium-framed scaffolding (either on castors or not).

Scaffolding is intended to provide safe access and a safe working platform for demolition workers to do their work. Section 18A of the Act requires scaffolding to be supplied, manufactured and installed so that it is safe and fit for the purpose.

Scaffolding should be erected to comply with the standards as outlined in the Scaffolding and Rigging New Zealand (SARNZ) Best Practice Guidelines for Scaffolding in New Zealand (2010) (refer to [appendix I](#)).

Scaffolding used in demolition must be rated as "heavy duty" due to the loadings and conditions that may be imposed on them during demolition works. Suspended scaffolding of any height and both proprietary and basic scaffolding of which any part is erected over five metres must:

- be notified to the department of labour; and
- be erected, altered, maintained and dismantled by a person holding:
 - a basic certificate of competency if proprietary scaffolding, or
 - an advanced certificate of competency if tube and clip scaffolding, or
 - an advanced certificate of competency if a mixture of both tube and clip and proprietary scaffolding, or
 - a suspended certificate of competency if suspended scaffolding.

In addition, any scaffolding such as cantilevered scaffolding used for public gantries, scaffolding erected over public access ways (including driveways) or scaffolding erected on canopies should be certified as safe by a registered engineer.

5.6.1 Scaffolding under five metres

Where scaffolding erected onsite is under five metres in height, the demolition contractor will ensure that:

- the scaffolding has been erected by a competent person, such as a person who has completed training under unit standard 9184 (Erect Non-Notifiable Pre-Fabricated Scaffolding);
- the scaffold is safe for use and fit for the purpose;
- the scaffold has been erected to be compliant with and guidelines of the Best Practice Guidelines for Scaffolding in New Zealand;
- the scaffold is checked weekly or as required to ensure it continues to be safe for use during demolition works; and
- scaffold "safe" tags (Scafftags) have been placed at all entrances to the scaffold and are maintained in good condition.

5.6.2 Scaffolding over five metres

Where scaffolding erected onsite is over five metres in height, the demolition contractor will ensure that:

- the scaffolding has been erected by a competent person who holds a certificate of competency;
- the scaffolder has provided a handover certificate at the completion of scaffolding erection to verify it is safe for use;
- the scaffolding complies with the Best Practice Guidelines for Scaffolding in New Zealand;
- the scaffolder conducts weekly, or as required, inspections of the scaffolding to verify that it continues to be safe for use and fit for the purpose;
- all inspections conducted are recorded in a scaffolding register, which should be maintained onsite; and
- scaffold "safe" tags (Scafftags) have been placed at all entrances to the scaffold and are maintained in good condition by the certified scaffolder.

5.6.3 Guardrails

Where protection at the perimeter of a building, structure or roof opening is provided by a guardrail system, the following recommendations must be observed:

1. The guardrail must be at a height between 900 mm and 1100 mm above the working surface.
2. The guardrail must incorporate a mid-rail and toe-board.
3. Guardrails are to be constructed to withstand a force of 71kg vertically and 46kg horizontally.

Where guardrail systems are intended to be used in conjunction with steel structures or tilt-slab construction, designers and demolition contractors shall plan for the guardrail and/or fixings be attached prior to the supporting part being raised from the ground.

5.6.4 Fall-arrest systems

When using fall-arrest systems, the demolition contractor should consider the following:

1. The training and certification of supervisors to competently supervise such works. Training under unit standard 15757 - Employ fall arrest system on demolition and construction sites must be held by all supervisors for this type of work.
2. Demolition workers also need to be appropriately trained (height training, for example) to use the fall-arrest system correctly and safely.
3. Anchoring points for harnesses/static line set-up must be capable of holding 15kN for a single person and 21kN for two people.
4. Emergency procedures must be prepared in case of an arrested fall.
5. Appropriate checklists for equipment and training/induction of people and equipment must be readily available throughout the removal operations.
6. The system of work should allow for not only those directly involved in the work, but also other people who could be affected.
7. All restraint systems must incorporate a shock absorber lanyard.

Records of equipment checks, emergency procedures and training should be kept and readily available for the demolition contractor.

Systems of work that require the use of individual fall-arrest systems must be used where there is no practical safer alternative, such as scaffolding, guardrails or elevated work platforms, or where a worker is likely to extend beyond the safety guard while executing the work.

Fall-restraint or inertia-reel systems can be used to prevent falls where it is necessary for workers to carry out their work near an unprotected edge. Safety harnesses and lanyards can be used as travel restriction systems to prevent people moving from safe to unsafe areas of the roof.

If safety harnesses, lanyards, static lines or inertia-reel systems are going to be used, it should be first ascertained that:

- the safety harnesses comply with AS/NZS 1891.1:2007 (Industrial fall arrest systems and devices - Harnesses and ancillary equipment);
- inertia reels or other self-locking devices comply with AS/NZS 1891.3:1997 (Industrial fall arrest systems and devices - Fall arrest devices);
- harnesses and other equipment are maintained in accordance with AS/NZS 1891.1;
- static lines and anchorages are designed for strength and movement restraint in accordance with AS/NZS 1891.1; and
- the people required to use the equipment are properly trained in their use and the supervisor directly overseeing the works is trained and certified under unit standard 15757: Employ fall-arrest systems on building and construction sites.

Waist-type belts, including pole belts, are not suitable for any working at height.

As well as being trained to correctly use this equipment, the user of fall-arrest and fall-restraint equipment must visually inspect their equipment before each use to ensure that it is safe and free from defects and damage.

The employer must ensure that an emergency rescue plan has been developed, communicated to personnel and practiced.

It is critically important there is a minimum of slack in the lanyard or safety line between the person and the anchorage attachment. The anchor used should be as high as the equipment permits. The hazard of working above the point of anchorage must be highlighted.

When considering the use of inertia reels, users must bear in mind that they may be less effective for certain applications, such as when arresting a person falling down the inclined surface of a pitched roof. Inertia reels are most effective with an overhead anchor point.

5.7 Temporary supports

5.7.1 General

Temporary supports to the structure or elements of the structure should be provided for any or a combination of the following conditions:

1. when the whole or any part of the structure is subjected to excess loading derived from demolition activities, movement of powered mechanical plant or debris accumulation;
2. when any part of the structure or any element being demolished is not self-supporting; or
3. when the temporary stability of the structure or its elements could be impaired as a result of the demolition activities.

Temporary supports must not be removed until all supported loads have been completely removed.

However, temporary supports should be removed as much and as practicable after demolition. In the case when temporary supports have to remain, the owner, the owner's authorised person and registered engineer must be responsible for routine inspection and maintenance of such temporary works until they are completely removed.

5.7.2 Adjacent buildings

Temporary supports must be provided to adjacent properties including, but not limited to:

- buildings;
- public or private utilities;
- slopes;
- retaining walls; or
- land where the removal of the building or any part of the building being demolished could affect the stability of such properties.

Common features, such as truncated continuous beam, exposed party walls and common staircases must be protected and stabilised. Any temporary supports will require design by a registered engineer.

Safe access to and from adjoining properties should be maintained. Adequate supports must be provided to maintain the stability of common staircases for the adjoining properties' continuous access.

5.7.3 Catch platforms

Catch platforms should be provided on top of covered walkways and adjacent buildings where required.

Catch platforms should also be provided underneath structural elements when the area adjacent to or directly underneath the said structural element requires protection from falling debris or other potential hazard caused by the demolition. These structural elements generally include, but are not limited to, projected canopies and balconies.

Depending on the demolition process, catch platforms may be required underneath special structures such as external architectural features and pre-stressed concrete elements. Each catch platform should be designed by a registered engineer to support the anticipated loading condition during the demolition process.

5.7.4 Incomplete demolition projects

When a demolition project is shut down for a prolonged period before its completion, the remaining structure, if any, should be stabilised by temporary support and/or bracing systems. If required, they should be designed by a registered engineer.

5.7.5 Materials and types for temporary support

The temporary supports used for demolition should be built with structural steel, heavy timber, fill embankments/buttresses, or other material which is considered to be appropriate for the purpose.

5.7.6 Pre-manufactured systems

Pre-manufactured components such as tubular shores, telescopic steel props, framed towers, etc. may be used as temporary supports, provided their design capacity, erection and maintenance requirements are followed in strict accordance with the manufacturer's recommendations.

Where the design capacity of a pre-manufactured component cannot be established by standard structural design and analysis, further tests should be performed to establish the design capacity.

5.7.7 Existing structure

Existing non-structural concrete or partition walls should not be considered as part of the temporary support system, unless it is shown by the analysis of a suitably experienced, IPENZ-registered structural engineer that they are adequate for the purpose.

5.7.8 Used timber

Timber that has been damaged or has deteriorated due to repeated use, insects, decay or chemical corrosion should not be used.

5.7.9 Used structural steel

Used structural steel should not be used unless pre-approved by a suitably experienced, IPENZ-registered structural engineer. Where using structural steel, the actual dimensions of the steel section should be measured, and its section properties should be calculated on the basis of the least cross-sectional area, including appropriate allowances for any existing bolt holes, etc. Where the material sources are not known, material properties should be checked.

5.8 Safety of mechanical plant, tools and personal protective equipment

The Regulations set out general rules relating to the design, manufacture and supply of mechanical plant, tools, and gear for demolition work. Employers must ensure that such plant and equipment is used, adjusted and maintained in accordance with the relevant information and instructions.

Section 18A of the Act also imposes duties on people who:

- hire, lease or loan plant to another person that could be used in a place of work; or
- sell or supply plant (other than for hire, lease or loan); or
- install or arrange plant in addition to either of the above.

Before any person hire, leases or loans plant to another person, they must ascertain from the other person (as far as is practicable):

- whether the plant is to be used in a place of work; and, if so
- what the intended use of the plant is.

If the plant is to be used in a place of work, the person hiring out, leasing or loaning the plant must take all practicable steps to ensure that the plant is designed and made, and has been maintained so that it is safe for its intended use. The duty applies to the loan of plant, with or without money being involved, and however long- or short-term the loan is for.

Where a person sells or supplies plant that can be used in a place of work to another person, the person must take all practicable steps to ensure that the plant is designed and made, and has been maintained, so that it is safe. The duty applies to any intended use that the seller/supplier knows of or could reasonably expect.

If a person sells, hires, leases or loans plant to another person for use in the place of work, and agrees to install or arrange the plant, the person must take all practicable steps to ensure that the plant is installed or arranged safely.

This duty does not apply to plant that is sold to a buyer second-hand and "as is".

5.9 Self-propelled mobile plant

Regulation 20 of the Health and Safety in Employment Regulations 1995 requires every employer to take all practicable steps to ensure that every self-propelled mobile mechanical plant is fitted with:

- a roll-over protective structure (ROPS); and
- a seat belt.

Both the seat belt and the roll-over protective structure fitted to a self-propelled mobile mechanical plant must be suitable for the purpose for which it is to be used.

Operators of mobile plant must use and wear the seatbelt at all times while in the cab.

5.10 Mobile plant and equipment

5.10.1 Operator Protective Structures

Regulation 20 of the Regulations requires employers to take all practicable steps to ensure that all mobile plant and equipment is fitted with:

1. a seat belt; and
2. an Operator Protective Structure (OPS).

In demolition, the minimum recommended requirements for these include Roll-Over Protective Structure (ROPS) and Falling-Object Protective Structure (FOPS). Refer to Table 2: Recommendations for Roll-Over Structures for further information.

Where a roll-over protective structure is damaged, the employer must ensure that no person uses or operates the machine until the roll-over protective structure has been repaired and certified by a registered engineer, or has been replaced by another roll-over protective structure that complies with the manufacturer's specifications.

While there are exemptions to the application of Regulation 20, such as cranes, trucks or machinery of a mass weight of 700 kg or less, the Association strongly recommends that for use in demolition, all mobile plant and equipment be fitted with operator protective structures as recommended in table 2. In certain circumstances (such as in confined spaces) the use of an operator protective structure on a mobile machine may be impracticable. In these circumstances, the employer must undertake an analysis of the work conditions and management controls to prevent roll over and falling debris. The use of ROPS/FOPS on all excavators, traxcavators, bulldozers and loaders used for demolition work is strongly recommended.

Table 2: Recommendations for Roll-Over Structures

Risk of work situation		Low: Level, stable ground	Medium: Road shoulders, stockpiles, low embankments	High: Steep and/or unstable ground, clearing operations, demolition
Risk of plant	Category 1 (High): Rollers, loaders, skid steers, motor scrapers	Caution required, protective structure advisable: TOPS/FOPS/COPS	Protective structure strongly recommended: TOPS/ROPS/FOPS/OPS/COPS	Extreme risk, protective structure strongly recommended: ROPS/FOPS/OPS/TOPS/COPS
	Category 2 (Medium): Excavators, dozers, tractors, commercial lawn mowers	Not essential	Protective structure advisable: TOPS/ROPS/FOPS/OPS/COPS	Protective structure strongly recommended: TOPS/ROPS/FOPS/OPS/COPS
	Category 3 (Low): Graders, road-sweepers	Not essential	Caution required, protective structure advisable: TOPS/FOPS/COPS	Protective structure advisable: TOPS/ROPS/FOPS/OPS/COPS

Abbreviations:

- ROPS Roll-Over Protective Structure
- TOPS Tip-Over Protective Structure
- FOPS Falling Object Protective Structure
- COPS Cabin Operator Protective Structure
- OPS Operator Protective Structure

For further information, please refer to the Department of Labour publication Approved Code of Practice for Operator Protective Structures on Self-Propelled Mechanical Mobile Plant (see [appendix I](#)).

All operator protective structures must be engineer-certified and comply with international standards:

- TOPS (Tip over protective structures) for excavators up to 6000kgs = ISO 12117
- ROPS (Roll over protective structures) for excavators over 6000kgs = ISO/DIS 12117-2
- ROPS (Roll over protective structures) on machines in construction = ISO 3471
- ROPS (Roll over protective structures) on machines in forestry = ISO 8082
- FOPS (Falling object protective structures) for construction machines = ISO 3449
- OPS (Operator protective structures), i.e. grills to prevent objects entering the cabin = ISO 8084
- Earthmoving machinery - hydraulic excavators - laboratory tests and performance requirements for operator protective guards = ISO 10262

When mobile plant and equipment is working indoors or in confined spaces, the equipment must be fitted with carbon monoxide inhibitors to reduce the amount of carbon monoxide created. Air monitoring will need to be conducted and additional ventilation may be required. Employees exposed to the hazard of carbon monoxide need to be informed of that hazard, the signs of exposure, and what to do to prevent or minimise exposure.

The operator should conduct inspections of the mobile plant and equipment daily prior to use. An example of an operator's checklist is attached in [appendix B](#).



Figure 6: Bridge Pier demolition

5.10.2 Safe working distances around mobile plant and equipment

A safe working distance around mobile plant and equipment should be maintained to prevent people from being struck or crushed by the plant, equipment or other materials such as demolition debris.

Ideally, all people in the vicinity of the mobile plant and equipment should make their presence known to the machine operator. High-visibility clothing gives the operator additional visibility of persons in the working area.

Particular attention should be given to the length of the dipper arm or boom and the swing area where a person could be unintentionally struck by an excavator boom, the attachment or any materials being held within. Use of Zero Swing Tail excavators is recommended for use in confined working areas to eliminate the potential for crushing from the counterweight.

No-one should work directly behind any mobile plant and equipment without the knowledge of the operator.

Recommended safe working distances should be based on the size and type of the machine(s) and other hazards onsite, such as falling/flying debris, ground conditions etc.

It is recommended that a safe working distance of a minimum of two metres from the machine or maximum reach of the boom should be observed by everyone working around mobile plant and equipment. Isolation controls may be required to prevent access to the working area. The employer should conduct a hazard assessment to determine whether this is necessary.

5.10.3 Quick-hitches/direct attachment

A quick-hitch is a device designed to facilitate the efficient connection and removal of attachments (such as buckets, grapples and rock breakers) to plant and equipment. It is often affixed to the end of the dipper arm (or boom) of an excavator to enable different attachments to be mounted easily.

There are two classifications of quick hitch:

1. The dedicated quick-hitch: this type of quick-hitch is dedicated to a particular machine attachment or a series of attachments. Its disadvantage is that the quick-hitch is restrictive. The machine will only be able to use the attachments that are compatible to that quick-hitch design.
2. The pin system quick hitch: this is the most versatile as it fits "standard" attachments, which engage two pins. This is the most commonly-used type of quick-hitch system.

"Direct" connection of an attachment (without the use of a quick-hitch system) involves the manual mounting of attachments to the hydraulic lower dipper arm.

Certain issues are associated with the direct method of attachment:

1. Changing an attachment can be time-consuming.
2. There may need to be a number of such changes in a typical working day.
3. The pivot pins can become rusty and difficult to remove (hammer out).
4. Some of the large pivot pins can be very heavy and difficult to handle manually.

The main risk associated with using a quick-hitch device is that the attachment becomes disconnected from the quick-hitch and as a result, falls from the machine.

Several workplace accidents involving quick-hitches have occurred.

Machine attachments, such as buckets, are very heavy and can cause serious injury to a worker should he/she be struck by an attachment in this way. Together with being struck by a moving machine or swinging machine boom, being struck by a disconnected quick-hitch attachment has been found the most common cause of excavator accidents and fatalities.

When working with quick-hitches, other risks include:

1. manual handling risks, when attempting to move an attachment;
2. cuts, abrasions and other injuries to hands, for example: when conducting maintenance or changing attachments - particularly when attempting to insert a pin using a hammer; and
3. injury to feet, limbs or other body parts through attachments falling on personnel in the work area when being disconnected or connected.

Causes of unintentional release of an attachment include:

1. an operator failing to engage the quick hitch properly, due to carelessness or being in a hurry;
2. an operator failing to actuate any secondary locking device;
3. primary or secondary locking mechanisms failing due to wear or poor maintenance;
4. the quick hitch and/or attachment being overloaded; and
5. the quick hitch and/or attachment being run (used) to point of failure in applications they are not designed for.

The main reason for attachment disconnection is due to the quick hitch safety pin not being fitted (refer to OSHA Information Bulletin SHIB 07-22-2005 in [appendix I](#)).

5.10.4 Cranes and lifting equipment

The PECPR Regulations set out obligations of crane controllers, including the design, manufacture and certification of cranes.

1. All cranes, including Hiabs, must be subject to annual visual and operational inspections by an equipment inspector or competent person.
2. All lifting equipment, including man-cages, chains, wire ropes, strops, hooks, spreaders etc. must be checked and certified every six months.
3. A daily inspection should be conducted by the operator to ensure that the crane and all lifting equipment is safe for use.
4. Lifting charts and operator manuals should be available for easy reference and use by the operator and others. These should be kept inside the cab.
5. The operator should conduct a visual inspection of the environment, to ensure the stability of the ground and any overhead services that may create a hazard for the safe operation of cranes.
6. If excavators are used for lifting and are not deemed as the "primary purpose" of the excavator, section 16 of the [Approved Code of Practice for Cranes \(3rd edition\)](#) applies.

For further information, refer to the [Approved Code of Practice for Cranes](#) (refer to [appendix I](#)), available from the Department of Labour.



Figure 7: Cut and crane demolition

5.10.5 Elevated Work Platforms (EWPs)

Elevated Work Platforms (EWPs) are commonplace on construction and demolition sites. They can provide safe, efficient access to height work for workers and a safe working platform for which operations can be conducted.

It is important that the machines are used in accordance with the manufacturer's recommendations, and that the machines are not used outside their specifications.

Persons working in cherry-pickers must wear full body harnesses with fixed-length lanyards (of a length so that a person cannot climb in and out of the basket) and must be connected to an anchor point within the basket at all times.

Due to their instability, particularly on uneven ground, Telehandlers should not be used in demolition work.



Figure 8: Use of an elevating work platform (EWP) in concrete-cutting demolition

5.10.5.1 General

The EWP is to be fitted with side walls or guardrails with mid-rails and toe-boards at a minimum height of 1 metre.

The floor of the platform must be slip-resistant and free-draining.

Platform gates, where fitted, must be able to be secured in position and open inwards or slide sideways and be self-closing.

Before use, ensure that the work platform is set up with stabilisers or outriggers fully extended and levelled. Where necessary, use suitable metal or timber spreaders to provide a firm base.

The stated SWL of the EWP assumes that the machine is set up on firm ground and that the chassis of the machine has been levelled. It may overturn at a lesser load if these conditions are not met.

A self-propelled EWP must never be moved while the platform is elevated. The working platform must be lowered to the cradle position before it is moved. The operator should check the planned route before moving to ensure it is firm and level.

5.10.5.2 Daily operation checks

Daily inspections that should be done by operators on EWPs include:

- tyre pressure/tracks;
- brakes working efficiently and brake fluid level checked;
- fuel/water and oil;
- hydraulic lines for leaks and damage;
- supporting structure is sound and free from cracking and damage;
- powered mechanism for the operating platform is working correctly;
- emergency controls are functioning; and
- any safety equipment, such as harnesses, are in good condition and free from fraying and other damage.

Work platforms should be checked at least once a month and, in the case of a hired machine provided without an operator, at the termination of each hire.

5.10.5.3 Six-monthly checks

The work platform must be thoroughly examined and load tested after an accident, major repair or modification, or otherwise at least once every six months by a competent person experienced in the maintenance and repair of EWP's. A certificate verifying this test should be attached to the EWP.

Where a platform is designated as electrically insulated, electrical insulation tests should be carried out in order to validate the working voltage at intervals of no less than six months.

5.10.5.4 Two-yearly testing of fibreglass boom section

In addition to the six-monthly testing regimes as described in [subsection 5.10.5.3](#), all machines fitted with a fibreglass boom are to be tested at periods not exceeding 24 months using acoustic emission test equipment.

5.10.5.5 Ten-yearly check-up

In addition to the previous tests, machines are to be thoroughly examined at an interval not exceeding ten years from new and thereafter every five years. The examination should include:

- the disassembly and removal of paint, grease and corrosion from critical components to allow a complete and thorough inspection;
- the detailed visual inspection and tolerance checking of all wear components; and
- non-destructive testing of all critical areas for evidence of cracking, fatigue and excessive stress.

5.11 Front-end loaders, backhoes, excavators and bulldozers



Figure 9: Mechanical demolition

When operating any mobile plant and equipment, including excavators and skidsteer loaders, always use the seat belt.

Operators should remain alert to the safety of other people in the vicinity.

Never demolish anything higher than the bucket. When demolishing walls, ensure that there is no one on the other side of the wall.

All other personnel must stay well away from the machine. If other employees need to talk to the operator, they should make eye contact from a safe distance and wait until the machine is turned off before approaching the operator.

Be aware of the load to be carried. If it is too large or heavy, the load can cause the machine to tip or roll. When moving with a load, always keep the load as low as possible to the ground. If the machine begins to tip, lower the load but do not apply the brakes.

The work area should be kept as clean as practicable, bearing in mind the nature of the worksite and the task being carried out.

When dumping the load, the wind direction should be coming from behind the operator.

When stockpiling materials, operators should remain aware of projecting reinforcing steel. This can be hazardous to other employees, and can also damage the equipment if it gets caught in the tracks.

5.12 Trucks

The driver is primarily responsible for keeping equipment in a safe condition. Trailer hook-ups, tyres and safety chains should be inspected before each use.

When trucks are being loaded at the demolition site, the driver should direct the loading from a safe position. The distribution of loads should be as even as possible. Large pieces of debris should be loaded gently onto the truck to prevent damage. When loading near a public thoroughfare, pedestrians must be kept away. The driver must ensure that debris does not overhang the sides of the truck or extend above the legal height. Dry dust should be moistened down.

When loading trucks or trailers, care must be taken not to spill debris over the far side of the truck or trailer. Loading should only be done on the road if permission has been obtained from the Territorial Authority and an approved Traffic Management Plan has been implemented.

When dumping, make sure the ground is level, the alignment of the truck and trailer is straight and there is an adequate fall area as a precautionary measure. Avoid soft spots. Tip trucks have been known to fall over during dumping; all people must stay well clear. The driver should always be in the cab with the doors closed during dumping. If the load does not release, the tray must be fully lowered before the cause is investigated.

Avoid dumping in high winds where practicable. However, if this is necessary, it is best to dump with the rear of the trailer towards the wind.

5.13 Using plant indoors



Figure 10: Use of skid steer loaders inside structures

When using loaders or other plant such as skid steer loaders inside a building being demolished, additional precautions are required.

Lighting must be sufficient to allow plant operators to adequately identify hazards. It may be necessary to have a "buddy" on foot working with the operator, but from a safe distance, to help identify hazards. A clear and understood signal system must be used. Operators must not operate machines at such a speed that adjacent personnel are endangered.

The work area is to be sufficiently ventilated to ensure that vapours or exhaust from plant do not create a hazard to operators and other personnel in the vicinity. Air monitoring may be required if heavy carbon monoxide-emitting machinery is in use. Employees exposed to the hazard of carbon monoxide need to be informed of that hazard, the signs of exposure, and what to do to prevent or minimise exposure.

When working on structural floors, ensure that the floors are strong enough to support the plant and debris that may be deposited. Where "no go" areas have been identified, these should be taped or fenced to avoid confusion to plant operators.

5.14 Plant, tools and equipment

Section 6 of the Act requires employers to take all practicable steps to ensure that all tools and equipment provided for employees is safe for use.

To verify this, the demolition contractor should keep a register to record maintenance data of all tools, equipment, plant and machinery.

5.14.1 Inspection

An essential factor of any equipment safety programme is the enforcement of the daily, weekly, monthly, or regular inspection and maintenance of plant and equipment. The regular inspections are those that are set out in the equipment manuals, which should be consulted.

Records should be kept of all inspection and maintenance activities. Inspections should be carried out by competent employees who have a thorough knowledge of the equipment.

The daily inspections should include a thorough walk-around before climbing aboard the machine. All fluid levels should be checked. Missing bolts, pins, loose fittings and couplings, frayed cables and hoses, loose tracks etc. should be identified and corrected. Cracked paint can be evidence of underlying structural failure. Equipment surfaces and the ground under the machine should be checked for evidence of leaking fluids.

Windscreens should be kept clean. All warning alarms should be in good working condition. When the machine is under any form of maintenance, a tag must be placed on the ignition to prevent the machine being started. Only the person placing the tag may remove it.

The pre-ignition check should include removal of all personal items which might obstruct the operator's movement. Before ignition, all controls should be in neutral, and the controls checked to ensure there is no "tag-out" on the ignition. Such a tag-out might indicate that maintenance employees are under the machine.

After start-up, the equipment should be checked for proper readings and all controls should be tested.

Any faults found during any of the checks should be reported to the employer (person in charge) and corrected before work starts. No matter how important the job is, it cannot be done safely with defective equipment.

Operators must be familiar with parking and shut-down procedures, which should follow the operator's manual. Clutches should be disengaged and brakes left on. Adequate precautions should be taken to prevent unauthorised start-up. Ignition and cabs should be locked if possible.

5.14.2 Maintenance

Maintenance can be hazardous unless carried out carefully and in accordance with safe work practices. It should only be carried out in a safe location.

Before anyone crawls under any machine, the wheels should be blocked and the ignition tagged out. All controls should be in neutral and the brakes applied.

Adequate ventilation must be provided to ensure that employees are not poisoned by toxic exhaust vapours.

Even common items such as batteries and tyres can be hazardous; therefore safe practices must always be followed.

Examples of all practicable steps include (but are not limited to) the steps listed in the following subsections:

5.14.3 Electrical plant and equipment

- All electrical equipment must be tested by a competent person and tagged to verify that it is safe for use.
- Electrical tagging should occur every three months as per the requirements of AS/NZS 3012:2010 Electrical installations - Construction and demolition sites.
- Residual current devices (RCDs) must be used on all electrical equipment.
- Care must be taken when using electrical equipment in or near wet areas.

5.14.4 Powder-actuated tools (PATs)

Examples of these include Hilti and Ramset cartridge guns.

The Health and Safety in Employment Regulations 1995 require operators of powder-actuated tools to hold a current Certificate of Competence.

During the firing of the PAT, operators should ensure that all persons required to be in the vicinity of the firing activities wear suitable eye and hearing protection.

The user of the PAT should ensure that the manufacturer's maintenance instructions are observed to ensure that each tool is kept in good working order and functions correctly and safely.

Every PAT should be:

1. cleaned at least once a day after use;
2. dismantled and examined by the operator for any defects at least once every week while in use; and
3. serviced by a suitably competent person. A complete recorded mechanical inspection by a competent person experienced in the maintenance and repair of PATs every six months.

5.15 Power tools

Table 3: Power tools hazard table

Hazard	Possible consequences	Safe work practices
Excessive noise	Hearing damage	<ul style="list-style-type: none"> • Hearing protection should be worn when working around and with tools that create excessive noise. • Regularly maintain machinery and equipment and keep components well oiled. • Change old or loose parts, vibrating mounts, silencers, etc.
Flying objects, projectiles or sparks	<ul style="list-style-type: none"> • Burns • Cuts/lacerations • Eye damage • hit by moving objects 	<ul style="list-style-type: none"> • Eye protection should be worn when working around tools where there is a risk of flying debris. • Keep moving parts directed away from the body. • If necessary, use grips or clamps to secure articles, or ask for assistance to hold the article to reduce the risk of flying objects. • Screens and barriers may be required
Lack of training	Personal injury	<ul style="list-style-type: none"> • Ensure that the operator is trained and/or supervised by a competent person. • Training should be undertaken, and the following explained: <ul style="list-style-type: none"> ◦ actual and potential hazards and controls ◦ correct use and adjustments of guards and other safety devices ◦ correct work methods to be used ◦ emergency procedures ◦ how the power tool works, and its purpose ◦ pre-start checks and adjustments ◦ how to recognise faults in the power tool ◦ how to stop and start the power tool.
Oil rags and hot debris	Fire	<ul style="list-style-type: none"> • Clean swarf, sawdust and other combustible materials often. • Ensure oil rags are not left lying around and are disposed of in a safe manner, or stored in a sealed, metal container to prevent them from catching fire.
Poor housekeeping practices	<ul style="list-style-type: none"> • Cuts/lacerations • Slips/trips 	<ul style="list-style-type: none"> • Power tools should be stored where they are not a hazard. • Good housekeeping procedures should be followed. • Work areas should be kept free and clear of unused tools. • Sharp-edged or pointed tools should have guards on them when not in use. • Keep electrical cables and tools away from wet areas • Keep electrical cables away from high traffic and vehicle areas
Poorly maintained equipment	<ul style="list-style-type: none"> • Electric shock • Electrocutation • Equipment failure causing bodily harm 	<ul style="list-style-type: none"> • Ensure correct selection of power tools and protective devices. • Do not use domestic grade plugs, cords and multi boxes on demolition sites. • Damaged or worn power cords should be repaired or replaced immediately. • Ensure that equipment is regularly serviced (3 monthly test and tag) by a certified person or electrician. • Daily checks by trained and competent users for safety.
Repetitive use of power tools	<ul style="list-style-type: none"> • OOS (occupational overuse syndrome) • Hand-arm vibration syndrome (HAVAS) 	<ul style="list-style-type: none"> • Organise work so that repetitive and non-repetitive activities can be mixed. • Take frequent short breaks. • Rotate workers between tasks. • Ensure blades are kept sharp and that the tools are regularly serviced.
Working with or around moving parts	<ul style="list-style-type: none"> • Cuts/lacerations 	<ul style="list-style-type: none"> • Keep moving parts away from the body. • Use clamps or vices where possible to hold work. • Always use two hands when operating power tools.
Working with or around power tools	<ul style="list-style-type: none"> • Electric shock • Electrocutation • Fatigue 	<ul style="list-style-type: none"> • Conduct pre-start inspections of tools. • Keep power cords away from sharp objects, oil, grease and hot surfaces. • Always use a RCD (residual current device) or isolating transformer when using electric power tools. • Workers should know how to test a RCD before they use it. • Use a 'dead man's switch' (or other safety device) on power tools that prevents the motor and rotating parts from operating when the operator releases the switch. • Never use power tools when under the influence of drugs or alcohol. Some prescription medication may also have negative effects on the operator. • Ensure chains and blades are sharpened to the manufacturer's specifications.

Power tools pose additional hazards, such as electric shock, particles in the eyes, burns, cuts, and strains. Most hazards can be eliminated by attending to the following rules:

1. Keep power lines and hoses out of passageways. Lines and hoses deteriorate dangerously as materials are dropped, dragged or driven over them. Employees might trip and fall over lines in passageways, presenting the additional danger that the tool may be wrenched out of the operator's control.
2. Keep lines and hoses out of oil, chemicals and heat, and away from sharp edges.
3. Disconnect tools from power sources before making repairs or adjustments.
4. Before turning on the tool, the area should be checked, and potential hazards identified and/or corrected. This permits the operator to concentrate on the work at hand.

5.15.1 Electric power tools

Electrocution, burns, and shocks can be prevented by observing safe work practices. Before each use, electric tools should be inspected for proper earthing, frayed or broken wires and cracked plugs.

Only properly earthed or double-insulated tools should be used on the work site. An isolating transformer or similar approved device should be used for additional protection, particularly when working in damp conditions.

5.15.2 Pneumatic power tools

These tools present special hazards, because their pressurised hoses can be cut or punctured by a careless operator, another employee, or falling debris. Deterioration from contact with heat or chemical agents, or poorly fastened couplings, can also cause an air hose to whip. Particular care must be taken to protect hoses from damage from debris or traffic. Only approved couplings for the type of hose and working pressure should be used, and only with the appropriate coupling devices. Air hoses must have a safety device at the source of supply to lower the air pressure in case of hose failure.

Employees must be informed and made aware of the hazards of compressed air. Pointing or touching the compressed air hose opening can cause air bubbles to get into the blood stream and cause death, damage to ear drums, blow out an eye or inflate part of a body. Blowing clothes with compressed air is hazardous and should not be permitted.

Table 4: Pneumatic tools hazard table

Hazard	Possible consequences	Safe work practices
Compressed air	<ul style="list-style-type: none"> • Explosion • Hearing damage 	<ul style="list-style-type: none"> • Compressed air should never be used to clean off the body or clothing. • Compressed air should not normally be used to clean off machinery or equipment, but if it is required, the following is recommended: <ul style="list-style-type: none"> ◦ use the lowest possible pressure ◦ avoid contact between the nozzle and the item to be cleaned ◦ ensure that PPE is worn, such as safety goggles, face shield and long sleeves to protect the worker's arms ◦ other workers nearby should also wear PPE or be prevented from entering the area. • The environment around compressed air plant should be kept clean and free of debris and other material. • Safety valves and hoses should be regularly inspected. • When using compressed air: <ul style="list-style-type: none"> ◦ the air pressure should be turned off when changing tools or not in use ◦ do not kink the hose to stop the flow ◦ check all connections are tight before turning on air pressure ◦ hoses should be regularly inspected for bulges, cuts and abrasions ◦ the nozzle should be held when turning the air pressure on and off ◦ all worn hoses and connections should be replaced. • Ensure all hoses are put into storage after use.
Working with or around compressed air	<ul style="list-style-type: none"> • Excessive noise • Explosion 	<ul style="list-style-type: none"> • Ensure compressors are in good working order and regularly serviced. • Ensure that hoses are regularly checked for leaks. • Ensure all guards are in place and that air hoses are connected properly. • Ear muffs should be worn when using compressors. • Compressors should be equipped with pressure-relief valves and pressure gauges. • Ensure that the compressor is set to the recommended pressure and cuts in and out when required. • Use only compatible components to reduce the risk of "hose whip" • Use whip checks on all hose connections

5.15.3 Petrol or diesel-powered tools

As well as the hazards associated with the use of flammable liquids, there are dangers from toxic vapours, such as carbon monoxide. Do not fuel an engine while it is operating.

To avoid the dangerous or deadly build-up of toxic vapours, adequate ventilation must be provided when using petrol or diesel-powered tools in enclosed spaces.

5.15.4 Abrasive blade tools

When using abrasive blade tools, it is essential to select the proper blade for the particular material being worked on. Abrasive blades used for cutting concrete, masonry or metal should be examined for cracks or scratches before each use. A blade guard must always be used and should cover a substantial portion of the blade.

The manufacturer's installation and operating instructions must always be followed. Safety goggles must be worn. Operators should avoid pushing the blade too hard as this may cause overheating.

5.16 Cutting and welding

5.16.1 Personal protective equipment



Figure 11: Gas-cutting activity on a demolition site

In addition to fire and explosion hazards, welders and cutters may be exposed to health hazards in the form of intense light rays and toxic fumes or vapours.

The intense flame at the tip of the torch, or the electrode, emits three types of light rays: visible, infrared, and ultraviolet. These rays can cause "arc eye" or "welder's flash".

To prevent damage to the eyes, goggles or safety glasses with impact-resistant glass filters (in accordance with AS/NZS 1338.1:1992 Filters for eye protectors - Filters for protection against radiation generated in welding operations, or other appropriate standard) should be worn during cutting. Barriers or screens may be required to protect workers in adjacent areas from being exposed to the flash. Tinted lenses drastically reduce visibility, and should only be worn while actually cutting. Face shields are required when there is a chance that welding splatter will hit the employee's face.

To eliminate skin damage, employees should wear proper protective clothing. Synthetic fabric should not be worn, because it melts when struck by hot slag. Cuffs and open pockets catch burning metal; therefore clothing with these features should not be worn.

Flame-resistant gloves and safety footwear should always be worn while cutting. Clothes should be kept free from oil and grease, as they increase the clothing's flammability.

5.16.2 Fumes, vapours and gases

Hazardous fumes, vapours and gases are released into the air during welding and cutting (see Table 5: Workplace exposure levels for fumes, vapours and gases). Some of these are released regardless of the material being cut; others depend on the type of metal or its coating.

Two hazardous tasks are cutting through lead-based paint or lead pipes, and cutting in the presence of degreasers. Cutting materials which have been cleaned with a degreaser, or even in the vicinity of a degreasing operation, can produce deadly phosgene gas. Adequate ventilation must be ensured before starting any cutting job.

Table 5: Workplace exposure levels for fumes, vapours and gases

Item monitored	Workplace exposure level	Action if exposure level exceeded
Oxygen (O ₂)	19.5 to 23.5%	Switch off and isolate all equipment and evacuate all personnel from the work area immediately. Re-enter only on approval from site management.
Carbon monoxide (CO)	Not to exceed 400ppm at any time during work	Switch off and isolate all equipment and evacuate all personnel from the work area immediately. Re-enter only on approval from site management.
Lower Explosive Level (LEL)	0 to <5%	Switch off and isolate all equipment and evacuate all personnel from the work area immediately. Re-enter only on approval from site management.

5.16.3 Ventilation

Cutting in enclosed spaces such as tanks, tunnels or small closed rooms demands particular attention to employees' safety.

A hazardous situation can develop because oxygen can easily be replaced by gases or toxic fumes/vapours. A low volume, high velocity fume eductor (a hose attached to a cutting torch or welding gun) can be used to provide local fume removal.

If adequate mechanical ventilation cannot be provided, employees should be equipped with air-supplied respirators and a lifeline, which must be constantly watched by an outside observer.

Cylinders should be kept outside the enclosed space, and gases should be shut off at the cylinder when work stops for more than a few minutes.

A leaky hose or fitting in an enclosed space can easily result in an explosive or oxygen-deficient, or oxygen-enriched, atmosphere, and must be avoided at all costs.

5.16.4 Containers that have held combustibles

Welding and cutting work on containers that have held combustible solids, liquids, gases, or dusts can result in fire or explosion if the containers are not entirely free of these materials.

It is important that a rigorous cleaning process is undertaken and that instructions for cleaning are rigidly followed. Containers which have held any of the following materials are considered dangerous, and hot work should not be started before they are properly cleaned:

- petrol, kerosene, solvents, or light oils;
- acids which react with metal and produce explosive hydrogen gas;

- heavy oils, tars, or solids which release combustible gases when exposed to heat; and
- combustible solids which could form an explosive dust cloud.

As a general rule, any container which has held combustibles should be considered unsafe until established otherwise by an experienced person.

5.16.5 Safe use of cutting torches

5.16.5.1 Cylinder handling

Cylinders should never be dropped, dragged or struck in any way. Pry bars and hammers must never be used on any part of the cutting torch system.

Acetylene and LPG cylinders should always be kept in an upright position and secured. However, high-pressure oxygen cylinders may be laid down on a level firm surface if there is nothing to secure the cylinder in an upright position.

When cylinders are transported or moved at the job site while connected for use, the cylinder valves must be closed, and the cylinders secured in place.

Valve protection caps or other protective devices must be in place when cylinders are not connected for use.

If cylinders are hoisted by crane, they must be secured to a properly designed and certified cradle or platform.

Cylinders must never be lifted by their valve protection caps or with electromagnets.

Oil or grease must never be used on threads due to the risk of explosion.

Hazards relating to gas cylinders are listed in table 6:

Table 6: Hazards when handling gas cylinders

Operation or source	Gas, fume or vapour released
Cutting	Carbon monoxide
Cutting and welding	Ozone
Welding rods	Fluorides
Chrome-plated fixtures	Chromates
Cadmium	Cadmium
Materials cleaned with degreasers	Phosgene gas, hydrochloric acid

5.16.5.2 Cylinder storage

The contractor should set aside separate areas for storing fuel, gas and oxygen cylinders. These areas should be at least six metres apart, outside the range of falling debris, and away from heavily trafficked areas. (Oxygen and acetylene gas cylinders can, however, be stored together provided that this is not done in bulk numbers).

Storage areas should be kept clear of combustibles, including fuels, and be designated as "NO SMOKING" areas.

Cylinders should not be placed where they could become part of an electrical circuit, such as near radiators and piping systems that may be used for grounding electrical equipment. Storage areas should be protected from direct sunlight.

5.16.5.3 Empty cylinders

Empty cylinders should be treated the same way as full cylinders. Empties should be stored in a designated area after the following procedure has been completed:

1. Mark the cylinder "EMPTY" or "MT".
2. Close the valve.
3. Replace the valve protection device.
4. Secure the cylinder.

5.16.6 Torch set-up

Setting up a cutting torch requires careful attention to a detailed procedure. Only properly trained employees should set up this equipment.

There should be no smoking while setting up the equipment.

After removing the valve protection cap, the regulator is attached according to the procedure outlined by the manufacturer.

Pressure regulators should be serviced and tested for accuracy on a regular basis.

No oil or grease should be used on the threads. Flashback arresters are mandatory when welding/cutting with flammable substances, and must be fitted to all cutting torch assemblies.

5.16.7 Hoses and regulators

It is important that the regulators are used only for those gases listed on the regulator. Oxygen fittings have right-hand threads and fuel gas fittings have left-hand threads to prevent accidental switching.

To avoid confusion, oxygen, acetylene, propane and other fuel gases should be called by their proper names, and not by "air" or "gas".

Once the regulators are in place, the hoses (maroon for fuel, black for oxygen) are connected and the torch is attached. Fittings must not be forced. Any sign of wear means a hose must be repaired or replaced at once. Hoses which are kept neatly coiled are less likely to become kinked, tangled or be run over.

Torch valves and fittings should not be oiled or greased. Torches should be treated with the respect deserved by a fine tool and never as a slag hammer.

5.16.7.1 Leaks

A leak test can be performed to assure that fittings and valves are correctly seated.

The test involves pressurising the lines and applying soapy water on each fitting and valve. Leaks, which show up as bubbles, must be repaired. If, when the valve on a fuel gas cylinder is opened, there is a leak around the valve stem, the valve should be closed and the gland nut tightened.

If this action does not stop the leak, the use of the cylinder should be discontinued, and it should be properly tagged and removed from the work area.

If the fuel gas should leak from the cylinder valve and cannot be shut off, the cylinder should be tagged and removed from the work area.

If a leak develops at a fuse plug or other safety device, the cylinder should be removed from the work area.

5.16.8 Start-up procedures

Operators must be properly trained in the safe and correct methods of setting up, lighting and shutting down of cutting and welding equipment.

CAUTION: A squealing sound means that gases have flashed back into the torch. This fire can burn back into the hoses. Torch valves and cylinder valves must be quickly closed, and the cause of the flashback remedied before relighting the torch.

Common causes of flashbacks are:

- improper pressures;
- kinked hoses;
- loose, clogged, or overheated tips;
- faulty or damaged O-rings between the hand-piece and torch head.

Hoses that have been damaged should be replaced.

5.16.9 Safety in arc welding

The hazards encountered in electric arc welding are similar to those encountered in cutting, with compressed gas hazards being replaced by those of electricity.

The dangers of flying sparks must be guarded against, particularly near floor and wall openings where other employees or combustibles may be hidden from view.

Personal protective equipment requirements are identical, except that arc welders are required to wear a welding helmet fitted with the correct shade of filter in accordance with AS/NZS 1338.1:1992 or similar.

The higher intensity of the light rays emitted requires that arc welding should be shielded by screens or curtains.

5.16.9.1 Electric shock

The avoidance of electric shock is, in most cases, within the control of the welder. Therefore, it is particularly important to be aware of and observe safe work practices.

The employer should provide employees with instruction and training on the procedures to avoid electric shock while welding. Printed rules and instructions covering the safe operation of the equipment should be made available to the employees, and supervisors should ensure that these are strictly followed.

Although the voltages used in arc welding are considered to be low, they can be quite dangerous under certain conditions. Mild shocks can cause an involuntary contraction of muscles, which might, for example, cause an employee to fall from a work platform.

Skin that is damp from perspiration or wet working conditions, may be conductive enough to cause violent muscular contractions that could prevent the welder from letting go of the live part. Careful adherence to safe work practices will minimise the dangers of electric shock to the welder and to other employees.

5.16.9.2 Cables

Cables should be inspected regularly for wear and damage. Cables with damaged insulation should be replaced or repaired. Lengths of cable produce heat when in use, so cables should be neatly uncoiled to prevent damage to the insulation.

5.16.10 Liquid oxygen

The use of liquid (cryogenic) oxygen on construction sites is not generally recommended due to the hazards associated with it. However, if liquid oxygen usage is intended, a health and safety inspector may require a formal work method statement and drawings. If required, the drawings should include the complete layout, foundations and fencing, equipment and the work-faces where the oxygen is to be used.

Liquid oxygen bottles vent oxygen when not being used, so they should only be used when large amounts of cutting are taking place.

The bottle must be secured in an upright position.

If a bottle is punctured, all persons should stay well clear, as the liquid in the bottle is -183°C, and will rapidly expand into oxygen gas. This, in turn, may cause the combustion of nearby objects. The cylinder will vent to empty if it is not touched.

All equipment used (including but not limited to vaporisers, valves, flashback arrestors, pressure gauges, etc.) must be in good condition and suitable for its purpose. All proprietary equipment must be used in accordance with the supplier's and manufacturer's instructions.

Training must be given to staff on the correct usage and the hazards associated with liquid oxygen. Adequate signposting should be erected, warning both the employees and any members of the public of the dangers and hazards. Safety data sheets should be freely available to the workforce and (as a suggestion) posted in smoko sheds.

5.17 Chainsaws

Table 7: Chainsaws hazard table

Hazards	Possible consequences	Safe work practices
Carrying and transporting chainsaws	<ul style="list-style-type: none"> • Cuts/lacerations • Slips/trips/falls 	<ul style="list-style-type: none"> • The chainsaw should be turned off or the chain brake activated when walking any distance or over obstacles. • Ensure the chainsaw is carried with both hands so that it can be thrown clear if the operator slips. • Ensure that the saw has a bar cover when transporting it to and from the work area. • All loose tools, saws and fuel containers should be secured during transportation to prevent damage or to stop them from becoming missiles in the event of an accident. • No equipment should be carried in the passenger area of a transportation vehicle. • Ensure that the operator wears personal protective equipment as outlined in this guideline when using a chainsaw.
Ineffective personal protective equipment	<ul style="list-style-type: none"> • Hearing damage • Cuts/lacerations • Slips/trips/falls 	<p>The following personal protective clothing/equipment must be worn:</p> <ul style="list-style-type: none"> • chainsaw mitt • visor or safety glasses • safety glasses, which should be cleaned regularly. Scratched

- glasses must be replaced so as not to reduce visibility
- earmuffs (class 4 or better)
- safety helmet
- high-visibility safety vest/shirt or coat, which should be kept clean
- protective legwear such as chaps
- safety boots/gumboots.

Exhaust vapours

Inhalation of carbon monoxide:

- Headaches
- Drowsiness
- Dizziness
- Unconsciousness
- Death

Conditions that could lead to over-exposure to carbon monoxide include:

- operations carried out in a leaning or squatting position
- working in low wind
- working in areas with no/low ventilation.

Exhaust vapours contain carbon monoxide, which can cause drowsiness and loss of concentration, thus increasing the risk of injury. The following safe practices should be followed:

- Maintain the chainsaw's muffler.
- Ensure that the air/fuel mix is correct and that the saw is accurately tuned.
- Chainsaws must not be operated in poorly ventilated or confined space situations.

Chainsaw kickback

- Cuts/lacerations

Kickback occurs when the upper part of the bar nose contacts a solid object, or is pinched.

Kickback can occur when:

- the bar nose hits hidden limbs or materials
- the saw is boring into a log or timber beam
- the bar nose is pinched during cutting
- the bar nose contacts obscured materials
- the chain is loose
- the depth gauge is too low.

The following practices are recommended to prevent kickback:

- Hold the saw firmly with both hands.
- Ensure the left thumb is wrapped firmly under the front handle and in the mitt.
- Be aware of the location of the guide bar nose at all times.
- Stand to the side when cutting, not directly behind the bar.
- Do not let the guide bar nose come into contact with any object.
- Do not reach or cut above shoulder height.
- Use extreme caution when re-entering a cut.
- Only one item or work piece should be cut at a time.
- Correctly maintain the saw and make sure there are no loose-fitting bolts, nuts or screws.
- Make sure the chain is tensioned and sharpened, and depth gauges are set to manufacturer's specifications.
- Use a safety chain and the correct chain/bar combination.

Cutting with the chainsaw

- Cuts/lacerations

Chainsaw operators should be adequately trained and/or supervised in correct chainsaw operating procedure.

The following pre-start checks should be completed prior to starting work:

- Check that the chain brake is in good working order.
- Check that the lubrication system is working, rev the engine and operate for a few seconds before turning off.
- Check that the chain is properly lubricated.
- Check the throttle control, lock-out throttle, control trigger and on/off switch are operating correctly.
- Check that the chain is sharpened and tensioned to the manufacturer's specifications.
- Check that the chain stops when the throttle control trigger is released.
- Check that all external fittings are secure.
- Check that the high tension lead does not show signs of wear, especially when it passes through the body of the saw.

Three types of force are encountered when cutting with a chainsaw - traction, recoil and kickback.

Ensure that the saw is held correctly and that the proper stance is adopted.

The saw should not be operated when held above shoulder height.

- The chainsaw should not be used if:

- the saw chain does not remain stationary when the motor is idling
- the cutter bar handles or control levers are loose
- any parts are damaged, missing or ineffective
- the saw will not idle correctly.

Holding the saw:

- Place the left hand on the handle and ensure that the handle is gripped between the thumb and finger, with the thumb under the handle.
- Use the mitt. The right hand should grip the gear handle with the index finger on the throttle trigger.
- Maintain control of the saw while the motor is running by using both hands.
- Keep feet firmly planted and slightly apart to maintain a good balance. Do not over-reach and move feet closer to the cutting position.
- The saw should be held close to the body for greater control.
- Position oneself to the side of the intended cut to reduce the risk of kickback.
- The saw should never be used with one hand as it is easy to lose control of the chainsaw in this manner.
- Start the cut at high speed and maintain that speed throughout the cut.
- When the cut is almost finished, the speed should be reduced to avoid a sudden finish with loss of balance and the risk of the guide bar or chain hitting the ground or other objects.
- Ensure the chain tension is regularly checked and the chain is sharpened.

Poor chainsaw maintenance Cuts/lacerations

General maintenance of a chainsaw makes operation safer and prolongs its life. The following is recommended:

- Clean the saw, particularly the air filter, cooling inlets, sprocket cover and chain brake mechanism.
- Clean the guide bar grooves and oil holes.
- Check the guide bar for straightness, burring and wear of the rails.
- Turn the guide bar regularly to ensure even wear.
- Check the sprocket and chain for wear.
- Check the chain for cracked rivets and side links
- Check all nuts, bolts and screws for the correct tension
- Ensure all components are in place.

Refuelling chainsaws

- Burns
- Explosions

The following procedures should be followed when refuelling chainsaws:

1. Stop the motor.
2. Place the chainsaw on a firm/even surface.
3. Fill the oil tank first to allow the saw to cool down.
4. Pay attention to not spill fuel over hot components.
5. Wipe any spilled fuel from the saw.
6. Move at least three metres away from the refuelling point before restarting the chainsaw.
 - Do not smoke when refuelling the chainsaw.
 - Do not use glass or plastic drink containers to keep fuel in. Only properly constructed fuel containers that are properly labelled should be used.

Starting the chainsaw Cuts/lacerations

Never drop-start a saw.

Cold starting:

When cold starting, the following procedure is recommended:

1. Place the chainsaw firmly on the ground.
2. Open the choke.
3. Stand over the saw, which should be pointing to the left.
4. Position the left leg to lower one's hips.
5. Place the right heel on the hand guard of the chainsaw. The operator should be positioned so that the start handle can be reached with a straight arm.
6. Grab the front handle with the left hand. Put the hand in the mitt. Apply a downward force of the saw.
7. Pull the starter cord with the right hand, using short, sharp pulls until the motor fires.
8. Close the choke and pull the starter cord until the motor is going, then release the throttle control switch by squeezing the throttle control trigger.

Warm starting:

When warm starting, the following procedure is recommended:

1. Place the left hand in the safety mitt and keep the left arm straight.
2. Position the saw on the left thigh, pointing left.

3. Step over the rear handle and secure the saw behind the bent right knee.
4. Keep the right foot flat on the ground.
5. Start with short, sharp pulls on the starter cord.
6. If the saw does not start, revert to the cold start method.
7. Once the saw is running, apply the chain brake before moving off with the saw.

5.17.1 Chainsaw cold-starting method

The chainsaw is one of the most dangerous hand tools used in demolition. Serious injuries can result from the kickback reaction that occurs when the nose of the chain comes in contact with a solid object. To avoid being directly in the kickback path, the operator should position their body entirely to one side of the saw.

The operator should never reach above chest height with the saw. A firm grip with both hands is an essential basic handling precaution.

Protective gear, including eye, ear, head and hand protection, should be worn at all times. Protective "leggings" (chaps) are available and should be worn by chainsaw operators.

Chainsaws must never be drop started.

Special precautions may be necessary if working at height.

5.18 Hand tools

Table 8: Hand tools hazard table

Hazard	Possible consequences	Safe work practices
Poorly maintained tools	Cuts/lacerations	<ul style="list-style-type: none"> • Tools which develop defects during use should be removed from service, tagged and not used again until repaired. • Impact tools such as chisels, drills and hammers with mushroom heads should not be used until reconditioned. • Hammers, axes and shovels with cracked, splintered or loose handles should not be used.
Storage of tools	<ul style="list-style-type: none"> • Cuts/lacerations • Slips and trips 	<ul style="list-style-type: none"> • Hand tools should be stored where they are not a hazard. • Good housekeeping procedures should be followed. • Work areas should be kept free and clear of unused tools. • Sharp-edged or pointed tools should have guards on them when not in use.
Working with hand tools	<ul style="list-style-type: none"> • Cuts/lacerations • Excessive noise • OOS (occupational overuse syndrome) • Slips/trips 	<ul style="list-style-type: none"> • Training and information for workers, including safe work practices. • Regular maintenance or replacement of tools • Vary or rotate jobs. • Arrangement of work materials or tools to prevent over-reaching or twisting that could stress muscles. • If the job requires muscle strength, try to arrange the job so that it is performed slightly below elbow level. • Tools/equipment or material should not be thrown or dropped from one employee to another, or from one level to another. • When using sharp tools, never cut towards one's body or hand. • Ensure that workers wear appropriate safety clothing and personal protective equipment such as safety boots, hearing protection and safety goggles.

Common hand-tool injuries can be avoided by observing the following safety rules:

1. Select the right tool for the job.
2. Keep tools in good condition.
3. Inspect tools regularly, and either replace or repair at once if found to be defective.
4. Use tools in a safe manner.
5. Keep tools in a safe place at all times.

5.18.1 Sledgehammers and picks

These are dangerous tools when their heads chip or come loose from their handles. Hammer chipping can be reduced by:

1. replacing a hammer head that is beginning to mushroom,
2. swinging only as hard as is necessary and safe, and
3. hitting the target straight-on, never at an angle.

Hammer heads flying off handles can be eliminated by carefully inspecting handles and wedges for cracks, splinters and looseness.

5.18.2 Chisels

The safe use of chisels begins with the selection of a sharp instrument of the right size for the job, and a hammer of appropriate weight. Chisel heads that have begun to mushroom should be ground to avoid the danger of flying chips. Goggles must always be worn when chisels are in use.

5.18.3 Crowbars

A safe crowbar has a point that grips the object to be moved, and a heel to act as a fulcrum. Makeshift crowbars, such as pieces of pipe or iron bars, should be avoided. They are more likely to slip or break and cause injury.

5.18.4 Shovels

Back injuries are the most serious injuries resulting from the use of shovels. To avoid such injuries, proper attention should be paid to the employee's

stance, their lifting technique, and the way they turn and empty the shovel.

Twisting the spine should be avoided: the legs, rather than the arms, shoulders, and back should be used wherever possible. Employees should use the ball of the foot rather than the arch to push the shovel. That way, if the foot slips, the shovel's sharp corner will not cut the ankle.

5.19 Hazardous substances and dangerous goods

Hazardous substances on demolition sites can become a hazard for demolition workers when inhaled, ingested or absorbed through the skin. Appropriate monitoring and controls may need to be implemented, and the demolition contractor may need to seek specialist advice to ensure their employees are being adequately protected.

Common hazardous substances that can be found and used on a demolition workplace are covered by the Hazardous Substances and New Organisms Act 1996 (the HSNO Act) and its regulations (see [appendix H](#)). These substances include (but are not limited to):

- petrol;
- diesel;
- acetylene compressed gas;
- LPG compressed gas;
- oxygen compressed gas;
- lead;
- asbestos;
- PCBs;
- Silica; and
- explosives.

5.19.1 Flammable substances

Residues from flammable substances may create a hazard for demolition workers and may be found in tanks, vessels and pipes, particularly those used in industrial processes. The client must take all practicable steps to clean and purge items that have historically held flammable substances, or notify the demolition contractor so this can be done prior to demolition work commencing.

5.19.2 Petrol

Petrol is a highly flammable substance, and is widely used in many workplaces. If more than 50 litres of petrol is kept or maintained in any single location for longer than 18 hours, the site must have a location test certificate.

If more than 100 litres of petrol is kept or maintained in any single location for longer than 18 hours, the petrol must also be under the control of an approved handler unless it is secured or locked away. (The 100 litre trigger quantity does not apply to petrol used to power vehicles.)

5.19.3 Diesel

Unlike petrol, the storage and use of diesel from a mobile tanker or container does not require a location test certificate or an approved handler. However, if stored in a container/tanker in quantities greater than 1,000 litres, then secondary containment is required, preferably double-skinned tank construction, or the tanker/container can be externally banded.

5.19.4 Compressed gas cylinders

Compressed gas cylinders are commonplace on demolition jobs, even with the introduction of cold-cutting techniques such as shearing. Should compressed gas cylinders be kept or maintained in any single location for longer than 18 hours, follow the guidelines in table 9.

Table 9

Gas	Trigger Quantity	Location Certificate Required	Approved Handler
LPG	100 kg	✓	✓*
Acetylene	100 kg or 100 m3	✓	✓
Oxygen	200 kg or 200 m3	✓	✓

*If LPG cylinders are being used to power vehicles, and the operator merely exchanges empty cylinders for full cylinders, an approved handler qualification is not required.

During the transportation of compressed gas cylinders, vehicle drivers are required to have a D endorsement on their driver's license.

5.19.5 How to obtain location test certificates/approved handler test certificates

Location test certificates and approved handler test certificates are obtained from Test Certifiers. Test Certifiers are people approved by the Environmental Protection Authority (EPA) to issue certificates that confirm that people, sites or containers are compliant with HSNO regulations.

Go to the following website: www.epa.govt.nz/search-databases/Pages/testcertifiers-search.aspx

Two examples are worked out:

Locating a Test Certifier for a petrol location test certificate in Auckland (example):

1. In the first drop-down box, select "Location Test Certificates"
2. In the second drop-down box, select "Auckland"
3. Select "Search"
4. A list and contact details of test certifiers based in Auckland, as well as a list of test certifiers able to work in Auckland, will be listed.

Locating a Test Certifier for an LPG approved handler test certificate in Christchurch (example)

1. In the first drop-down box, select "Approved Handlers (Class 2-5, 6, 8 and 9)"
2. In the second drop-down box, select "Canterbury"
3. Select "Search"
4. A list and contact details of test certifiers based in Canterbury, as well as a list of test certifiers able to work in Canterbury, will be listed.

5.20 Safe use of explosives

The HSNO Act and its regulations require that only approved handlers with controlled substance licences are allowed to use explosives on demolition work.

5.20.1 Qualifications for explosives personnel

Qualification requirements as an approved handler of explosives for construction blasting are outlined in the HSNO Approved Code of Practice 5-1: Approved Handler Certificates: Explosives. (For further details, refer to [appendix I](#)).

In order to qualify as an approved handler (explosives) for construction blasting, one must achieve:

1. competency in all aspects of the relevant unit standards for construction blasting:
 - 21152: Store explosives for use in extractive industries
 - 17694: Demonstrate knowledge of explosives and their properties
 - 17697: Design blasting layouts and carry out blasting operations for construction work
 - 15247: Manufacture ANFO explosives (optional)
 - 17698: Demonstrate knowledge of blasting layouts for specialist blasting techniques (optional); and
2. practical experience (a minimum of six months experience in the handling, charging and/or firing of explosives in the construction industry; and
3. the minimum number of fired shots, listed as:
 - 20 shots to be fired by the applicant:
 - a. A multiple shot is considered to be a single shot of the required 20 shots
 - b. The 20 shots must be fired within a period of 24 consecutive months; and
4. one of the following units standards:
 - 20645: Describe the requirements of the HSNO Act 1996 relevant to approved handlers; or
 - 20333: Outline the legal and operational requirements of mining and blasting for an approved handler.

5.20.2 Controlled Substance Licence requirements

A Controlled Substance Licence (CSL) is required to possess and handle certain explosives. These explosives are listed on the Environmental Protection Authority's website: www.epa.govt.nz/hazardous-substances/certifications/csl/Pages/What-is-csl.aspx

To be eligible for a CSL, the applicant must:

- have an approved handler's test certificate for explosives; and
- require the explosives for work; and
- be 17 years of age and over; and
- be a fit and proper person (this requires a Police background check).

The Environmental Protection Authority has released a Guide for Controlled Substance Licence Applicants for Class 1 Explosives and Pyrotechnics. (Refer to [appendix I](#) for further details).

5.20.3 Explosives to be approved by the Environmental Protection Authority

Explosives for use in construction blasting must be approved under the HSNO Act. For further information, visit Environmental Protection Authority's webpage on Explosives: www.epa.govt.nz/hazardous-substances/using-storing/at-work/explosives/Pages/default.aspx

5.20.4 Storage of explosives at a demolition site

Explosives above a certain quantity stored at a demolition site for more than two hours must be secured in a hazardous substance location in an approved storage container unless it is under the personal control of an approved handler.

For further information on quantity limits and storage conditions, refer to the Environmental Protection Authority webpage on Explosives (including pyrotechnics and retail fireworks): www.epa.govt.nz/hazardous-substances/using-storing/at-work/explosives/Pages/default.aspx

5.20.5 Underwater blasting

Underwater blasting operations must not be carried out unless the person who prepares and lays the charge ready for firing is an approved handler (Explosives) and holds a Controlled Substance Licence. However, a person in training may prepare and lay charges under the direct personal supervision of a person who is an approved handler in explosives.

Underwater blasting requires the attention of an approved handler and construction diver, but one person may hold both of these qualifications.

No charge of explosives may be fired while any person is submerged due to the danger from water-borne shockwaves. The exploder key must remain in the control of the underwater diver or the diver's attendant while the person is submerged.

All divers engaged in underwater demolition must be medically fit and hold a diving certificate issued by the Department of Labour. For further information refer to DoL publication Guidelines for Occupational Diving (refer to [appendix I](#)).

5.21 Fires and explosion

5.21.1 Fire prevention

The demolition contractor should develop, implement and practice emergency drills and evacuation procedures in the event of a fire during demolition works, particularly for complex and multi-storey buildings where normal exits may be inaccessible.

Welding and cutting operations present a significant fire hazard on a demolition site. Combustible material in the vicinity of welding or cutting work should be removed to a safe place.

The use of flammable gases and oxygen poses additional fire hazards unless strict precautions are taken. Oxygen and acetylene are extremely dangerous: oxygen can set fire to oil or grease by spontaneous combustion without a flame or spark, and acetylene is extremely volatile.

Any demolition sites that set off the trigger amounts for compressed gas cylinders as shown in [table 9](#) of this guideline ([section 5.19.4](#)) must have an approved handler as required under the HSNO Act 1996.

Fire prevention procedures should be carried out for the protection of workers and property. The demolition contractor should ensure that any welding, cutting or other work involving flammable gases are conducted using hot work permits (refer to [appendix G](#) for a sample hot work permit). This will assist in identifying any site issues that may become a fire hazard during these works, and ensure that these works are conducted as safely as possible.

Stand pipes, fire hoses and/or multi-purpose fire extinguishing equipment must be readily available, and employees should be trained in their use.

Where practicable, standpipes and hoses should be set up prior to cutting. Surrounding debris that cannot be removed must be thoroughly wetted down. In general, cutting should be suspended two hours before the daily cessation of work operations if there is a possibility of flammable material catching fire from smouldering.

Oxygen, acetylene or LPG bottles must not be left free-standing. All welding and cutting should be conducted in accordance with the DoL publication

Welding Safety (refer to [appendix A](#) and [appendix I](#)).

5.21.2 Burning

The deliberate burning of buildings should not be used as a method of demolition unless authorised in writing by the Territorial Authority and the New Zealand Fire Service.

Debris must not be burned on the site unless permits have been obtained from either the New Zealand Fire Service or the Territorial Authority, whichever is applicable.

If permission to burn-off has been obtained, care should be exercised in burning any material arising from demolition. Consideration should be given to prevailing winds and any fire restrictions imposed, and adequate fire fighting facilities must be available at all times. All fires should be supervised, and fires properly extinguished at least one hour before site personnel or the appointed fire watcher leaves the site.

Materials that give off toxic vapours or offensive smoke should not be burnt.

5.22 Storage tanks

Note that the requirements of the Hazardous Substances and New Organisms Act 1996 (HSNO) apply if storage tanks contain (or used to contain) hazardous substances.

The contents of storage tanks must not be just "tipped out". The contents must be identified, and a safe disposal method agreed upon.

The hazards associated with removal of storage tanks include:

- explosions;
- fires;
- confined-space entry;
- electrocution;

and for underground storage tanks:

- cave-ins during excavation and while the excavation is unprotected.

Permits to work, including confined spaces and hot works should be used (refer to [appendix G](#)).

After identifying the previous use of the storage tanks (above or below ground) and ensuring that risks of fire, explosion and toxicity have been minimised, the contractor should decide on the technique to be used to render the tank safe to work on, for example:

1. flood the tank with water and seal ventilating holes, or
2. flush out petrol vapour/air mixture by pumping in nitrogen, or
3. insert solidified carbon dioxide (dry ice).

Precautions should also be taken with the associated pipe work and equipment. The displacement of vapours from the vents of tanks during purging must also be considered. Before gas-cutting any tanks, a daily gas-free certificate must be provided. It should be noted that a tank which has been emptied and gas-freed will only remain gas-free for a limited time.

Residues in the form of sludge or other solid material may be present, which can also release gas.

Technical advice can be obtained from the Department of Labour, the New Zealand Fire Service or other qualified agencies such as the Environmental Protection Authority.

A training programme to alert employees to hazards of underground storage tanks could include (and emphasise) flammable liquids, tank purging and inerting, sources of ignition, overhead electrical hazards, buried cables, cave-ins and trench collapse, toxicity, and the use of monitoring devices.

Precautions should be taken when an underground storage tank is removed. If the depth of the excavation exceeds 1.5 metres, the same precautions as required for trenches must be adopted. If the tank has leaked its contents, it may be necessary to remove the surrounding contaminated soil before backfilling.

Refer to AS 2865:2009 Confined Spaces (see [appendix I](#)) and section 5.22 for further information.

5.22 Confined space entry

Fatalities or serious injury from confined space incidents occur as a result of the following hazards (but not limited to):

1. Oxygen levels in the atmosphere below 19.5% in a confined space, which may be caused by:
 - slow oxygenation reactions of either organic or inorganic matter;
 - fire or other rapid oxidation;
 - displacement of oxygen in the atmosphere by another gas; and
 - absorption by stored products, e.g. respiration.
2. Oxygen-enriched atmospheres, which have an oxygen content greater than 23.5%. Atmospheres with enriched oxygen have a greater risk of fire or explosion, particularly when flammable contaminants are present. Causes of oxygen enrichment include:
 - wrongfully purging confined spaces with oxygen;
 - leaking hoses or fittings when using oxy-acetylene equipment;
 - oxygen injection systems (used in sewerage systems); and
 - use of chemicals that release oxygen, such as hydrogen peroxide.
3. The presence of contaminants on the surface or in the atmosphere. Contaminants may come in the form of solids, liquids, gases, vapours, sludges or particulates. The sources of contaminants may include:
 - the manufacturing process;
 - the substance being stored or its by-products (for example, disturbing decomposing organic material can liberate hazardous substances such as hydrogen sulphide, while biological agents such as viruses, fungi or bacteria may be present); and
 - the operation being performed in the confined space (for example, painting with coatings containing hazardous or flammable substances, or welding/brazing with metals that produce toxic fumes).
4. Operation of moving equipment, for example: trapped by augers, crushed by rotating or moving parts such as conveyor belts.
5. Uncontrolled introduction of steam, water or other gas or liquid.
6. Suffocation by solids, such as grain, sand, flour and fertilizer.
7. Drowning in liquids.
8. Electrocution.
9. Explosion or fire.
10. Entrapment.
11. Extremes of temperature.

Additional factors which should be taken into consideration include:

1. Noise caused by using equipment within the confined space.
2. Radiation within the confined space, caused by welding (for example).

3. Manual handling.
4. Trips, slips and falls.
5. Inadequate lighting.
6. Openings obstructed by fittings or equipment that could impede rescue.

AS 2865:2009 Confined spaces lists requirements for entry into confined spaces, which states:

1. No person shall enter a confined space unless -
 - a. review of the risk assessment has been completed in accordance with clauses 3.3.1 and 3.3.5 of the standard;
 - b. written authority is provided to, or completed by, the person responsible for direct control of the tasks in the confined space;
 - c. the written authority includes any risk control measures or precautions necessary, including the number of stand-by persons required, for the safe entry and execution of the tasks;
 - d. they are advised of, understand and comply with the requirements of the written authority;
 - e. a record of their presence in the confined space is maintained;
 - f. signs and protective barriers are erected to prevent entry of persons not involved in the tasks; and
 - g. appropriate and sufficient arrangements have been made for the initiation of emergency response and where necessary, rescue of persons from the confined space.

5.22.1 Additional recommendations for the conduct of hot works in confined spaces

In confined spaces that previously contained dry material capable of creating a flammable or explosive atmosphere when dispersed in air (e.g. combustible dusts), permits to work should be issued only after inspection has ensured that loose dust has been removed from the confined space, and all appropriate surfaces have been cleaned, or the material has been rendered safe (by wetting grain dust, for example).

5.22.1.1 Fire prevention

The following fire prevention measures are recommended:

1. All combustibles in the vicinity of the hot work should be moved to a safe place.
2. A pressurised fire hose or other suitable extinguishing equipment should be available.
3. When hot work is involved, a fire watch should be assigned while the hot work is being performed. This should be for a period of at least two hours after completion of the work.
4. No compressed gas cylinders or associated manifolds, other than those used for self-contained breathing apparatus (SCBA), should be positioned inside the confined space.
5. When gas cutting is suspended for a period of time, such as during lunch breaks or overnight, the torch and cylinder valves should be closed. The torch and hose should be removed from the confined space.
6. When arc welding is suspended for a period of time, such as during lunch breaks or overnight, the power source to the equipment should be de-energised, all electrodes removed from holders and the holders positioned so that accidental contact or arcing cannot occur.

5.22.1.2 Control of fumes and vapours

In a confined space, all surfaces covered with coatings that decompose or volatilise under hot work into toxic, flammable, corrosive or irritant components, should be stripped from the area of heat application. Coatings should also be removed a sufficient distance from the area to be heated in order to minimise the temperature increase of the unstripped metal. Additionally, artificial cooling of the metal surrounding the hot work area may be necessary to limit the size of the area required to be cleaned (Note: typical coatings which may pose a hazard include zinc, cadmium, lead paints and plastics).

Means should be provided to ventilate contaminated air from the confined space and introduce fresh air. The exhaust suction point should be provided as close to the source of hot works as possible.

5.22.3 Permits to work

- Hot work, including on the inside or on the exterior surfaces of confined space should not commence until a hot work permit has been issued.
- The hot work permit should state that appropriate precautions have been taken, and should list the frequency of any tests necessary to ensure that safe atmospheric conditions are maintained.
- Aspects to be taken into account when issuing a hot work permit include:
 - When the area contains or contained a flammable liquid, vapour or gas, the permit should only be issued after inspection or testing has ensured the following factors have been considered:
 - the concentration of flammable vapours or gases in the atmosphere;
 - that liquid and solid residues have been removed to prevent the release of flammable substances that may raise the concentration of flammable substances in the atmosphere;
 - the concentration of flammable vapours or gases within any piping within the confined space or connected to it;
 - LEV (local exhaust ventilation) may be required to ensure that fumes from welding/gas cutting are removed from the working area safely.

A sample hot work permit is located at [appendix G](#).

5.23 Electric shock

All wiring, except where temporary installations are required, should be disconnected before demolition work commences. However, demolition workers should treat all electrical wiring as live until it has been tested as otherwise.

The demolition contractor should obtain written confirmation of the disconnection/isolation of electrical services prior to demolition, and this should be kept within the site file readily accessible.

Any temporary installations should comply with the relevant legislative requirements.

Plant and equipment should be used with care to ensure that no part comes into contact with overhead or underground cables and wires.

5.23.1 Working near overhead power lines

If equipment is operating in the vicinity of aerial power lines, the principal and demolition contractors must ensure, during all stages of demolition, no part of the demolition equipment comes within FOUR METRES of live electric power lines, unless the operator has received written consent from the line owner allowing a reduced distance.

Reasonable notice should be provided for applications for written consent to work within reduced minimum approach distances to the line owner.

Where approval to work closer to overhead power lines has been obtained in writing, the minimum approach distance between a conductor and any mobile plant shall not be less than specified in table 10.

Table 10: Required minimum approach distances (where written consent has been obtained)^[2]

Circuit voltage	Minimum approach distance (m)
Not exceeding 1 kV - insulated conductor	0.15
Not exceeding 1 kV - conductor not insulated	1.0
Exceeding 1 kV but not exceeding 66kV	1.0
Exceeding 66kV but not exceeding 110 kV a.c. or d.c.	1.5
Exceeding 110 kV but not exceeding 220 kV a.c. or d.c.	2.2
Exceeding 220 kV d.c. but not exceeding 270 kV d.c.	2.3
Exceeding 270 kV d.c. but not exceeding 350 kV d.c.	2.8
Exceeding 350 kV d.c. or 220 kV a.c.	4

Consent from the line owner shall also include:

- the section of line to which the consent applies; and
- any other reasonable conditions to be observed when working in proximity to or above the line.

Where practicable, it is recommended that demolition staff meet with local power companies to discuss mutual requirements and expectations when working near overhead power lines.

For further information on safe distances when working in the vicinity of overhead power lines, refer to the New Zealand Electrical Code of Practice for Electrical Safe Distances NZECP 34:2001, available from the Energy Safety Service of the Ministry of Economic Development (refer to [appendix I](#)).

5.24 Health hazards

Demolition holds many hazards to health for demolition workers and others. These include the following:

1. Dust and other non-toxic airborne particles can have severe respiratory effects on demolition workers and others in the vicinity of the demolition.
2. Asbestos dust can be found chiefly in insulation materials, and in fire-protective cladding around structural steel members, partition walls, sprayed ceilings and lagging to steam and chemical plant. All asbestos must be removed from a building or structure prior to demolition commencing. Such asbestos could include asbestos cement siding and roofing, asbestos cement piping, some ceiling materials, acoustic sprays, fireproofing materials for steel or concrete, insulation of ducts, pipes and cavities, etc. All work involving asbestos removal should be conducted in accordance with the Health and Safety in Employment (Asbestos) Regulations 1998 and the NZDAA New Zealand Guidelines for the Management and Removal of Asbestos (2011) (refer to [appendix I](#)).
3. Gas cutting of galvanised steel also gives off toxic fumes. Contractors should take necessary precautions to safeguard against these hazards. (For further details, see [appendix A](#)).
4. Synthetic mineral fibres (SMFs). If SMFs are encountered on a demolition site, safe methods must be followed. The DoL publication Health and Safety Guidelines for the Selection and Handling of Synthetic Mineral Fibres contains useful information (see [appendix I](#)).
5. Lead is most hazardous when it is in the air as a fume or dust, and can be created through operations such as demolishing structures painted with lead-based paints or gas cutting steel coated with lead paint. Refer to the Department of Labour information sheet: Lead in Blood Suspension Level for further information (refer to [appendix I](#)).

Lead poisoning can occur from inhaling fumes during the flame cutting (or "burning") of steelwork coated with lead paint. For further details, see [appendix A](#).

6. Asbestos should be removed before any demolition work commences. For further details about the safe handling and removal of asbestos, refer to the New Zealand Demolition and Asbestos Association's publication New Zealand Guidelines for the Management and Removal of Asbestos (refer to [appendix I](#)).
7. PCBs (polychlorinated biphenyls) are a family of toxic substances with a variety of trade names. They were commonly found in electrical capacitors and transformers, and can be inhaled and absorbed through the skin as dioxins. PCBs are no longer permitted to be used in New Zealand, due to their potential for harm to the aquatic environment and people. However, they may be encountered on sites earmarked for demolition.

Strict rules apply to the handling and storage of PCBs. For further information on the safe handling, storage and removal of PCBs, refer to the Ministry of Health's code of practice Safe Management of PCBs (refer to [appendix I](#)).

8. Silica is hazardous when inhaled, and can be created through the demolition, cutting and crushing of stone, bricks and concrete. One of the diseases caused by silica is silicosis, a progressive, irreversible disease.

Most of the methods used to manage asbestos hazards can be employed to manage silica hazards. Refer to the New Zealand Guidelines for the Management and Removal of Asbestos for further information (see [appendix I](#)).

If demolition work creates silica dust, proper precautions must be taken. These may include:

1. Dust Suppression: suppression of silica dust from the source, either by elimination (substitution of silica products) to isolation (LEV (local exhaust ventilation) to minimisation (personal protective equipment, water suppression).
2. If exposure occurs, emergency procedures include:
 - a. Inhalation: Remove the person to fresh air. Drink water to clear throat and blow nose to evacuate dust. If coughing and irritation develops - seek medical attention immediately;
 - b. Skin contact: Flush with copious amounts of water. Follow good hygiene practices and wash with mild soap and water after each exposure.
 - c. First aid facilities: Eye wash, soap and water

5.25 Vibration

5.25.1 Site or structure vibration

Demolition sites create vibration through the use of heavy plant and equipment that may undermine the structural integrity of surrounding buildings and structures. This can be particularly true of brick and block buildings within close proximity of the demolition work.

Shoring, underpinning or propping may be required, and the demolition contractor may be required to undertake vibration monitoring to ensure that vibration levels do not exceed any local body requirements - if in doubt, refer to the consent or permit for the works for further information.

5.25.2 Earthquakes, wind and vibration

Structures must not be left in a condition in which they could be brought down by a moderate earthquake (up to 5.9 magnitude on the Richter Scale), moderate wind storm or vibration from traffic or plant.

5.25.3 Hand-arm vibration

Hand-arm vibration is vibration transmitted from work processes into workers' hands and arms. It is caused by operating hand-held power tools, hand-powered equipment, or by holding materials being processed by machines.

Regular and frequent exposure to hand-arm vibration can lead to permanent health effects, usually when a person has regular contact with vibrating tools and processes as part of their job.

Hand-arm vibration can cause a range of conditions known collectively as hand-arm vibration syndrome (HVAS), as well as specific conditions such as carpal tunnel syndrome.

It is important to identify the early signs and symptoms of HVAS. The symptoms generally appear after a period of regular exposure to vibrating tools/processes, but it could range from months or years. They include:

- tingling and numbness in the fingers;
- not being able to feel things properly,
- loss of strength in the hands;
- fingers turning white and becoming red upon recovery, particularly in cold and wet situations.

The effects on people with HVAS include:

- pain, distress and sleep disturbance;
 - inability to do fine work or tasks (e.g. assembling small components or fastening buttons);
 - reduced ability to work in cold or wet conditions; and
 - reduced grip strength.
- Methods of reducing the hazard of hand-arm vibration include:
- using suitable low-vibration tools where practicable;
 - ensuring that power tools, equipment and machinery are regularly serviced or maintained in good condition;
 - ensuring that cutting tools are kept sharp so that they work more efficiently; and
 - where practicable, rotating tasks or take breaks in between working with vibrating tools and machinery.

5.26 Noise control

Contractors should ensure that necessary precautions are taken to protect their employees, contractors, the general public and occupiers of adjoining properties from excessive noise.

Employers also have an obligation to protect their employees from harmful noise during demolition. Territorial Authorities may require compliance with the requirements of NZS6803:1999 Acoustics - Construction Noise, however, the possibility of reducing noise from a demolition site is limited.

Demolition contractors can plan his or her work and select appropriate plant, equipment and machinery so that he or she complies with given noise limits.

The best practicable means should be adopted to ensure that noise emission does not exceed acceptable levels as outlined in the project consent or permit issued. Territorial authorities have specific noise levels that the contractor must adhere to; contact these authorities for further information or refer to NZS 6803P:1984 The measurement and assessment of noise from construction maintenance and demolition work.

5.27 Dust control

Demolition work often creates large volumes of dust, which, when windy, can be hazardous to vehicular traffic in busy or densely populated areas. Dust can also be a nuisance and a health hazard to the general public.

To prevent dust generation during the debris hauling, water spraying should be applied. However, the demolition contractor should ensure proper control of water supply and floor drainage systems in order to avoid flooding, which may cause overloading of floors.

The watering down of debris including loaded vehicles, chutes, floors, stairways and other places should be carried out frequently.

Silt run-off caused from watering-down operations should be prevented from entering storm water drains. This can be avoided by using silt mats, catch pit filters, silt fencing, bunding or other types of silt screens.

Erecting dust screens can also help to reduce the hazard.

5.28 Protection of properties

5.28.1 General

Stability treatment should be provided to protect building elements that may be affected by the demolition project. The design of the bracing system should be based on a structural assessment and engineering evaluation in order to provide necessary and sufficient protection for the affected properties.

5.28.2 Party walls and external walls

Party walls that separate the adjoining building and the demolition project should remain and should be protected during and after the demolition project. Redundant party walls should be removed as far as possible. Demolition of structural elements adjacent to the party wall or the external wall of adjoining buildings should be performed by manual methods with extreme care to prevent any damage to the party wall or the external wall.

The party wall or external wall stabilisation and treatment must be applied on each floor immediately after the floor is demolished.

5.29 Protection of traffic

5.29.1 General

The numbers of pedestrian and vehicle movements passing the site must be determined and appropriate traffic-control facilities implemented and protected throughout the duration of the job for the safe access of vehicles.

Any closure of roads and footpaths may seriously impact traffic/pedestrian circulation, and cause disruption to the public. Therefore, as far as practicable, installing precautionary measures may require the demolition contractor to implement a Traffic Management Plan authorised by the Road Controlling Authority (RCA).

Temporary closure of a traffic lane may be required for night work. Temporary closure of a traffic lane may also be considered for exceptional cases where there are no other practical alternatives to safely demolish the building elements, such as projected canopies, balconies or verandas.

5.29.2 Site access

Safety measures for construction access to and from the site should be considered in a demolition project. Proper headroom, sightline, segregation, loading/unloading locations, illumination and other precautions should be provided for the protection of vehicular and pedestrian traffic from the access of construction vehicles. An authorised Traffic Management Plan may be required for heavy vehicular movements.

A person trained in traffic control (STMS) may be required to implement the Traffic Management Plan.

Audible alarms and/or lookouts may be required for vehicles reversing out of the site, especially across footpaths and in tight areas.

Where practicable, a minimum of two access routes should be maintained to the work area to provide an escape route in the event of fire cutting off the primary access.

Access routes to work areas should be clearly marked and well lit, and should be in areas protected from falling debris. Penetrations or openings should be covered; or guarded and clearly identified.

5.30 Discharges to groundwater

Demolition work might pollute the groundwater due to:

- pollution of open water and drinking water wells by hazardous waste tipping; or
- pollution of the ground by leaching from construction and demolition (C&D) waste.

Generally, the pollution of open water and drinking water wells can be avoided by appropriate performance of the demolition work and handling of C&D waste. C&D waste generally contains various materials, some of which may have negative effects on the environment.

To reduce the risk of this occurring, it is important that the principal provides the demolition contractor with as much information about the structure and its environment, including necessary information on sensitive water sources.

5.31 Debris and waste material handling and disposal

5.31.1 Chutes

Debris waste and other materials should not be thrown, tipped or shot down from a height where they are liable to cause injury to any person on or near the site.

No material may be dropped at any point outside the exterior walls unless appropriate safety measures have been implemented.

Where practicable, demolished material should be lowered to the ground and the debris sent down in skips or enclosed chutes. Material should only be dropped when adequate precautions have been taken for the safety of employees, public and adjacent property.

Precautions that should be taken include (but are not limited to):

- barricading or fencing off the area where materials are to be dropped;
- having a competent employee in the area to prevent unauthorised entry;
- ensuring that no other people are in the area during the operation;
- informing everyone on site of the intention to drop materials from heights; and
- ensuring that any materials to be dropped are not constructed of materials likely to shatter or smash, capable of causing widespread damage and possible projectiles.

The employer should ensure that any openings or voids where materials are to be dropped are suitably barricaded, or other measures are implemented to prevent the risk of a fall by employees working in the area.

The NZDAA recommends that a combination of the above measures should be implemented by the demolition contractor if this method is considered.

Existing lift shafts, light wells and openings on floors may be used to convey debris down the building floors. Areas adjacent to the openings of these features where used as a chute or lift shaft should be suitably barricaded when they are not in use. Warning signs should be posted to prevent workers from entering the area.

5.31.2 Lift shafts

Lift shafts may be used to convey debris inside the building once the lifting equipment has been removed. The lower openings to the lift shaft should be adequately protected to prevent the spilling out or bouncing of debris. A substantial gate or guardrail should be constructed at the discharge point of the lift shaft. Any gate constructed must only open inwards, towards the shaft.

Plastic chutes may be used inside floor openings and lift wells to minimise noise and confine the falling debris.

5.31.3 Light wells

All glass in light wells should be taken out or protected before using the area to convey debris.

5.31.4 Openings in floors

Openings in the floor may be used to convey debris. If openings are created on the floor, the total openings should be less than 25% of the total aggregate floor area. Openings should not cut through any structural support elements that may affect the stability of any structural components.

5.31.5 Exterior chutes

No demolition materials should be allowed to fall freely outside the building unless it is confined in a chute. If exterior chutes are used, adequate clear spaces should be provided for their operation.

The chutes should not cause any obstruction to the public. A dust barrier should be provided if the chute outlet is near public access. The chute should be designed and constructed with adequate strength and support to allow the safe conveyance of debris.

If the chute is to be incorporated into a scaffold, this must be designed by a competent person holding the appropriate certificate of competency in scaffolding.

Concrete debris may be pulverised into aggregate size.

5.32 Personal protective equipment (PPE) and clothing (PPC)



Figure 12: Personal protective clothing and equipment for demolition workers

Personal protective equipment and/or clothing must be worn by all people working on or entering into workplaces where demolition is occurring. These include:

- steel capped work boots or gumboots;
- hard hats or bump caps - chin straps may be required;
- hi-visibility vests or jackets (Transit New Zealand-compliant if working on roads);
- hearing protection;
- eye protection; and
- gloves.

Other specialist equipment may be required depending on the tasks and duties of the demolition worker. These include:

- fall-arrest harnesses, lanyard and shock absorbers;
- RPE (respiratory protective equipment);
- disposable coveralls;
- overalls;
- welding helmets, aprons or overalls; and
- spats or chainmesh clothing.

PPE and PPC protect only if they are being used or worn correctly. A number of hazards in demolition work require the use of PPE and PPC because they cannot be eliminated or isolated. Examples range from fall risks to exposure to hazardous substances.

When using PPE and PPC as a control measure for protection against hazards, the employer should maintain a register of issued equipment.

It must be reiterated that where PPE and PPC is required, the employer must provide this for the employee and ensure that they have been adequately trained or instructed in its correct use. The employer does not comply with their obligations under the Act by paying an allowance or requiring the employee to provide their own safety equipment or clothing as part of their employment conditions.

Employees who wish to provide their own protective clothing (not protective equipment) may do so under the following conditions:

- that they genuinely wish to provide the clothing for comfort or convenience (and are not being required to do so by the employer); and
- the employer deems the clothing to be safe and suitable for use in the workplace.

5.32.1 Safety footwear

Safety footwear should comply with AS/NZS 2210.3:2009 Occupational protective footwear - Specification for safety footwear. Safety footwear must be worn to protect against foot injuries caused by:

- objects dropping on or rolled over the front of the foot;
- stepping on nails or other sharp objects;
- slips and falls; and
- chemical exposure.

Well-selected footwear can also protect against rolled ankles when working on uneven ground.

5.32.2 Safety helmets

Safety helmets should be worn to prevent head injuries. The safety helmet should be Type 1 Industrial, and comply with AS/NZS 1801:1997 Occupational protective helmets. The helmet must be replaced if damaged due to severe deterioration, impact. The helmet will require periodic replacement due to ultra-violet (UV) degradation which compromises the structural integrity of the helmet.

Chin straps may be required for employees where there is a risk of the helmet falling off their head during work.

5.32.2.1 Wearing beanies or caps under safety helmets

AS/NZS 1800:1998 Occupational protective helmets - Selection, care and use states that a "liner" for cold conditions can be worn underneath a safety helmet provided that the liner does not reduce the safety characteristics of the helmet. This means that "standard" beanies or caps (everyday street wear) are not suitable to be worn underneath a safety helmet because the thickness of the beanie/cap material prevents the helmet from providing optimum protection around the skull.

Beanies that have been designed to be worn under safety or other helmets (such as mountaineering helmets) are permitted.

5.32.3 Eye and face protection

All eye and face protection should comply with AS/NZS 1337.1:2010 Personal Eye Protection: Eye and face protection for occupational applications. Employees exposed to eye and face hazards when carrying out certain activities such as welding and cutting, or using abrasive wheels and paving breakers, must use safety glasses, goggles, face shields, welding goggles and welding helmets.

5.32.4 Hearing protection

Day-to-day exposure to loud noise can result in permanent hearing loss. Personal protective equipment such as ear muffs, disposable fibre or foam plugs, or reusable foam or rubber plugs should be provided to employees who are exposed to excessive noise levels.

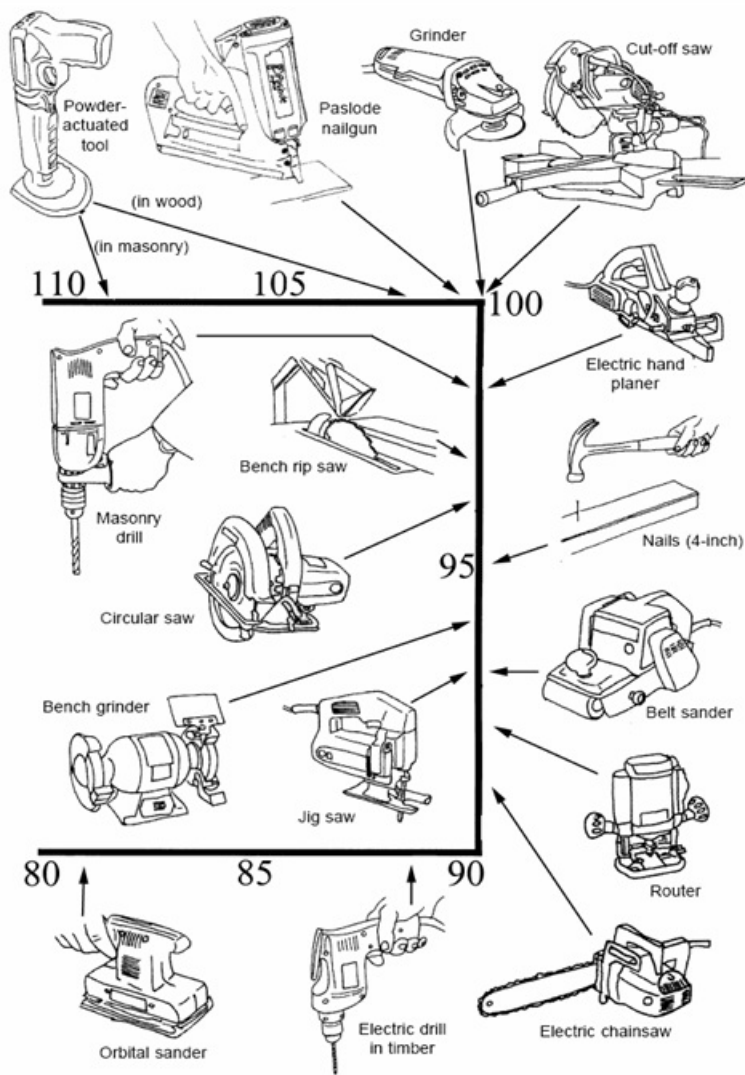
If hearing protection is to be provided, the employer must take all practicable steps to undertake health monitoring to assess the effectiveness of protection provided.

Further information on classes of hearing protectors can be found on [Classifications of Hearing Protectors](#) and the [Approved Code of Practice for Noise in the Workplace](#).

Table 11: Average and peak noise exposure levels

Tools	Average dB(A)	Peak (dB)	Longest exposure without hearing protection (each day)
PAT (powder-actuated tool) into masonry	107-110	147	Nil (based on peak level)
PAT into timber	100-104	143	Nil (based on peak level)
Paslode nail gun	97-104	138	Nil (based on peak level)
Electric grinder (on aluminium)	98-102	123	8 minutes
Cut-off saw	98-102	118	8 minutes
Hand-held planer	96-100	114	15 minutes
Masonry drill (timber then concrete)	96-100	111	15 minutes
Circular saw	94-98	113	15 minutes
Hammer on nail into timber	93-97	131	Nil (based on peak)
Electric drill into timber	87-91	100	2 hours

Noise Levels of Selected Tools in dB



Note: Noise levels shown are indicative averages only. Each tool can produce a range of different noise levels in different circumstances.

Figure 13: Noise levels of selected tools

5.32.5 Respiratory protection

The use of suitable respirators is required whenever employees enter areas where the concentration of dust, asbestos, or hazardous chemicals may exceed the concentrations specified in Department of Labour's Workplace Exposure Standards, or when employees enter areas deficient in oxygen.

The type of respirator must provide protection against the range of hazards the operator is likely to face.



Figure 14: Selection of Respirators

5.32.5.1 Types of respirators

Air-purifying respirators

These respirators draw in inhaled air through a purifying filter. There are two types:

- a particulate respirator which filters out dusts; and
- a gas respirator which filters out certain gases and vapours.

Dust particulate respirators are normally available in half face-piece (i.e. covering the nose and mouth). Gas respirators are available in half- or full face-piece (i.e. covering the eyes, nose, chin and mouth).

Combinations of these respirators are available. However, they do not supply oxygen and must not be used in oxygen deficient environments.

Supplied air respirators

Supplied air respirators deliver a clean supply of air or oxygen from a source outside the contaminated area. These respirators are normally supplied as full face-piece.

Self-contained breathing apparatus

These respirators use an airline to supply clean air from a source that is carried by the wearer, e.g. a compressed air bottle. These are used to give protection in dangerous environments where there is no oxygen, it is very poisonous, or the levels of hazardous contaminants are not known. They are also commonly used for rescue situations. These respirators are normally supplied as full face-piece, and some may form part of a hooded overall set.

(Refer also to A Guide to Respiratory Protection (see [appendix I](#))).

5.33 Drugs and alcohol

Employers should promote a “zero tolerance” approach towards the use of alcohol and illicit drugs by employees and contractors within the workplace, due to the safety-critical nature of the hazards involved with demolition, and the severity of potential consequences.

Employers can do much to overcome the potential hazards of drug and alcohol abuse by exercising sensitivity and by adhering to the following procedures.

In consultation with health and safety representatives (or the employees’ nominee or union representative on sites where no health and safety representative exists), identify whether drug or alcohol abuse constitutes a workplace hazard. If drug or alcohol abuse is identified as a workplace hazard, then:

- assess any factors in the workplace which may lead to an increase in the consumption of drugs or alcohol; and
- establish control measures for those factors using the hierarchy of control measures (eliminate/isolate/minimise).

Demolition contractors should include drug and alcohol policies and procedures in an employee’s employment agreement, particularly if drug and alcohol testing is required pre-employment and post-incident.

A [sample drug and alcohol policy for workplaces](#) is provided at the Department of Labour’s website

5.34 Protection of the public

People walking or driving past any demolition work should be protected from falling objects, projections, dust, excessive noise, welding, cutting and mechanical plant, including trucks and vehicles entering and leaving the site, while work is in progress.

Where people in the vicinity could be endangered by falling debris, a gantry or a protective screen of sufficient strength should be provided over the footpath adjacent to the building.

Gantries must be certified by a suitably experienced IPENZ-registered engineer.

All demolition sites must be adequately fenced or barricaded off to prevent unintentional and unauthorised access onto the workplace during the demolition works. Fences and hoardings should be difficult to climb. In general, they should be at least two metres in height from the ground level on the side accessible to the public.

Fences could be constructed using galvanised chain link netting (50 mm by 50mm) with posts at 2.5-metre centres, and hoardings may be constructed using continuous sturdy cladding.

Signs should be placed at several points around the site to inform the public that demolition is in progress and that danger exists. Traffic controllers should be stationed at truck entrances and exit points when trucks are operating.

During the hours of darkness, warning lights should be used to warn of barricades or debris heaps.

Holes which present a hazard should be securely covered or barricaded off. All footpaths or thoroughfares adjacent to the work site and open to the public must be kept clear and clean at all times.

Traffic Management Plans approved by the regional controlling authority (Transit New Zealand or local authority) should be implemented on all sites where there is heavy traffic movement and when the demolition work impedes on public access ways. Traffic Management Plans may need to be supervised and installed by a Site Traffic Management Supervisor (STMS).

Protection of the road and footpath may be required by the territorial or local authority. Protection methods may include the installation of heavy-duty steel plates.

Road kerbs and storm water drains should also be kept clear of material to prevent flooding. Silt mats should be installed to protect against this.

In busy inner-city areas, the more hazardous stages of demolition should be carried out during non-working hours, for example, during evenings or weekends, when there is a minimum of traffic, or during off-peak working hours when traffic and pedestrians can be more easily controlled.

Footnote

^[2] Reduced Minimum Approach Distances (where written consent has been obtained) from NZECP 34:2001 New Zealand Electrical Code of Practice for Electrical Safe Distances, Energy Safety Service (Ministry of Economic Development)

Section 6 - Methods of demolition

This section describes common ways of bringing down buildings, and includes safety advice. In practice, more than one method can be used to demolish a building.

This section describes common ways of bringing down buildings, and includes safety advice. In practice, more than one method can be used to demolish a building.

6.1 Demolition by hand

Hand demolition is not a quick method, because only hand tools are used. However, cranes and shear legs may be used to hold or lower beams during cutting. Chutes, or crane-and-skip are usually used to get debris safely from the upper stories to the ground.

Safe access must be provided. If work cannot be carried out safely on the building, a scaffold or machine-lifted platform should be used.

Demolish only one storey at a time. It is usually safest to demolish the building in the reverse order to building it, so the roof should go first. Next, part of each floor is taken out so that the debris can fall through. On some jobs, the debris can be dropped down the lift shaft, in which case, guardrails must be provided around openings - refer to [section 5.6.3](#) of this guideline.

Debris must be removed regularly and not allowed to pile up on floors. An overloaded floor could collapse onto the floor below, which in turn, could collapse on the floor below it. Without propping from the floors, the walls of the building could collapse. Walls could also collapse if debris is piled against them.

If people have to work in a place with a fall risk without guardrails or barriers to isolate them from a fall, other protective measures must be implemented, including wearing a properly anchored safety harness. Harnesses are only to be implemented if all other controls cannot be used. The employer shall need to undertake a hazard assessment to effectively determine the appropriate controls beforehand. All persons using any fall arrest systems must be fully trained in the correct and safe use of this equipment. Refer to [section 5.6.4](#) for further information.

At the end of each day, make sure the building is safe. Guying or propping may be necessary to avoid hazards from wind or vibration. If only part of the building is knocked down, make sure that what is left can stand safely.



Figure 15: Multi-storey demolition with ball and crane

6.2 Demolition with the ball

Most structures can be demolished by balling, but it is a skilled practice that cannot be self-taught.

Balling is a viable and effective method of demolition when demolishing multi-storey structures that have suffered structural damage, where all other methods have been considered, and a hazard assessment has determined that this method is the most appropriate.

Hazards associated with this demolition method include, but are not limited to:

- noise;
- dust;
- vibration to adjoining structures/buildings;
- flying debris;
- uncontrolled unintentional collapse; and
- limited waste minimisation.

Trainees must be instructed by trained and experienced people, and work under close supervision until they are competent.

Balling is hard on the machine: not all cranes can swing and control a demolition ball safely. Converted drag lines are the best machines for this work as they are robust and stable. Cranes with hydraulic rams must not be used for balling.

Cranes used for balling should be fitted with a FOPS cab and should be enclosed, strong and debris-proof. Cranes used solely for lifting on a demolition project need not be fitted with a FOPS cab; however operations that could cause flying debris should not be carried out close to the crane.

Some guidelines and warnings are provided:

1. The boom angle when balling should not be more than 60° to the horizontal. The top of the boom should not be less than three metres above the wall being knocked down.
2. The SWL for the machine must be at least three times the weight of the ball.
3. When not being dropped, the ball should be used with a tag line to keep it under control. Swinging the ball by slewing is particularly hard on the machine.
4. This work can be done safely only on very robust machines driven by very skilled operators.
5. The ball should be positively fixed in such a manner to prevent it becoming disconnected by slack in the load line or other causes. These connections should be checked hourly.
6. Beware of a trapped ball: getting it free may overload the crane.
7. Always operate from outside the building.
8. Any other building nearer than a distance equal to half the height of the building being demolished is in danger.
9. Keep the public well away from balling operations.
10. Keep employees clear of the demolition area and make sure that the area is clear each time demolition resumes after a break.
11. Remember that the shocks from a building being knocked down can be felt in any attached building. Avoid damage to attached buildings by detaching them: hand demolition is necessary for this.
12. When a building is being demolished by ball and crane, the crane should provide for sufficient drop height and the ball should be of sufficient weight to enable suitable force to pass through all floor levels of the building.
13. Avoid build-up of debris on floors and against walls.
14. A heavy-duty swivel joint must be provided between the ball and the end of the crane rope.
15. Check the ball, swivel, rope and the rigging hourly.
16. Note the location of all overhead power lines and be aware of these when turning the crane from the normal work face.

6.3 Demolition by pusher arm

Hydraulically-operated excavators and loaders can be fitted with various attachments for demolition work. Excavator buckets, boom-mounted hydraulic percussion breakers and pusher arm equipment have been successfully used with these machines.

The main advantages of such machines are that they are extremely mobile, have a high output, and are able to work on vertical faces and floors above standing level. Their disadvantages are that the machines need adequate access, a firm and relatively flat base to work from, and can only work within the reach of their booms. To operate these machines efficiently, the length of boom when fully extended should be at least 1.5 metres above the height of the building being demolished.

The pusher arm method is not suitable for large buildings on confined sites, but it is good for masonry infill structures. The building is pushed over in stages by a horizontal force from the machine. An arm is fitted to the lower boom instead of a bucket. The arm is extended forward against the facing wall and the force of the excavator pressing forward provides the push.

When using this method, always take the following precautions:

1. Ensure that the site has been secured safely to prevent unintentional entry by unauthorised personnel during demolition.
2. Work from outside the building, and never let anyone enter the building while plant is wrecking the building.
3. Be sure that the operator has been trained in the work, or is being instructed by a trained person.
4. Use hand demolition to get the building to a level where pushing can start.
5. Separate the building from any attached buildings using hand methods.
6. Make sure that debris does not build up too high against the walls: this may push the wall onto the machine.
7. If terraces (ramping) of debris are used to enable the machine and its pusher arm to gain height, ensure that the terraces are well-consolidated and the machine can be maintained level during operation.

6.4 Demolition by deliberate collapse

This method requires engineering expertise to decide which key structural members should be cut or removed to cause a collapse. Once this method has begun, it is likely the structure will remain unstable until it is down. This method is best suited for bridges, silos, chimneys and structures on isolated or heavily controlled and secure sites.

A survey may be required to give the height and radius of the structure so that the fall area can be properly ascertained and protected to prevent unintentional entry during the collapse.

When using this method, always take the following precautions:

1. Ensure that the site is level enough to allow employees to get clear safely.
2. Consider the safety of the remaining parts of the building at each stage.
3. Use this method only where there is plenty of space for the building to fall safely.
4. Instruct workers of their roles, tell them where they are to work and to where to withdraw to before the collapse. Radio-telephone communication is strongly recommended for on-going communication between all personnel.
5. Know the location of every person on the site.
6. Keep the public a distance from the building of at least one and a half times its height. If flying debris is expected, the public will need to be kept back further.



Figure 16: Demolition of silos by pusher arm

6.5 Demolition by wire rope pulling

This method is a form of deliberate collapse. Cables and wire ropes are fixed to key structural members, then pulled down by tractors or winches. It is suitable for detached buildings where there is plenty of surrounding room. The method can be used for timber-framed buildings, bridges, brick, masonry or steel chimneys, and for spires and masts.

When using this method, always take the following precautions:

1. Use wire ropes of at least 16 mm in diameter, and check them regularly. Wire ropes must have a factor of safety of 6.
2. Anchor the machine securely, and set it so that the rope is flatter than 1 in
3. Do not let anyone stand between the tractor and the building, or beside the rope.
4. Have a full ROPS and FOPS canopy on the tractor to protect the operator from broken ropes and falling objects.
5. Never let anyone enter the building while pulling is in progress.
6. Ensure the ropes are properly secured before commencing the pull.
7. Ensure that the pulling ropes are kept clear of overhead power lines, especially when taking up the rope slack.
8. Remember that pylons and masts can twist as they are pulled. If the legs are of different lengths, the pylon could fall at right angles to the pull.



Figure 17: Step-by-step implosion deconstruction (US)

6.6 Demolition by explosion or implosion

Implosion or explosion deconstruction is an effective and efficient method of deconstruction, and can reduce both cost and time to bring dangerous multi-storey structures to ground in comparison to conventional demolition methods.

This is a method favoured in the United States to safely and quickly demolish structures where significant hazards are posed to persons through exposure during the demolition process. In most cases, the building is stripped to structure to allow for clean blasting; however in many cases, where risk to personnel is high, this is not necessary.

In many cases, implosion can reduce the demolition period by up to 80% with the majority of time being spent in both the preparation period and the clean-up following implosion.

Demolition by explosion/implosion is a job for the expert. In New Zealand, HSNO restrictions and requirements for this method must be followed. Any inquiries should be directed to your nearest Department of Labour office.

Most structures, except timber-framed and brick structures, can be demolished this way. Even structures that have been previously compromised can be effectively demolished in this manner; however, the implosion expert will give instructions on any collateral damage that may occur.

The usual method is to cut or disintegrate key structural members by loading drilled holes with explosives, or fixing plaster charges to the outside of these members.

When using this method, always take the following precautions:

1. Have an experienced approved handler (explosives) in charge of the work.
2. Consult with a suitably experienced, IPENZ-registered engineer to ensure that the method planned is feasible.
3. Give a plan of the demolition to a Department of Labour health and safety inspector at least four working days before starting. NOTE | This work is notifiable under the Regulations.
4. Beware of strong columns that may make the building "sit down" rather than topple.
5. Use mats and small charges to stop flying debris.
6. Advise the local authority and New Zealand Police of the proposals, and notify the New Zealand Fire Service.
7. Have safe escape routes open.
8. Keep the public at a safe distance - a minimum of 200 meters from the blast site; however, this is dependent on the type and quantity of the explosives used.
9. Plan and inform all employees of the evacuation plan.
10. Prepare procedures for dealing with misfires, remembering that the building may be grossly unsafe due to being partly demolished.
11. Use electric shot firing.
12. Beware of shock damage from large amounts of detonating fuse.

Environmental effects to be considered if planning demolition by explosives include:

1. shock vibration effect to adjacent properties and to the structural stability of underground and overhead services;
2. adjacent property damage from flying debris during collapse;
3. dust and airborne particles;
4. degree of rubble spread to the vicinity; and
5. traffic and pedestrian management and control.

Note problems with either undercharging or overcharging. Undercharging can leave the structure standing, but in a much weakened condition. Overcharging leads to excessive and possibly dangerous flying debris.

6.7 Demolition using grapples and shears



Figure 18: Demolition of reinforced block building by shears

Power shears may be used to crop and cut through concrete and metal such as reinforcing steel or beams, particularly where there might be a risk of fire, or where the more precise cutting of a torch is not required. An additional feature is the reduction in noise onsite. Care should be taken to ensure that any member to be severed is either effectively supported or, if to be allowed to fall, will not endanger remaining structures or personnel.

Power grapples may be used to handle waste material, either to move it about the site or to load other vehicles when disposing of the waste. As some debris resulting from demolition has a high density, care should be taken to avoid overloading the equipment. Damage to the equipment itself should be avoided. Avoid the risk of the machine overturning as a result of instability induced by a heavy load.

At all times, the machines should only be operated in strict accordance with manufacturer's recommendations.

6.8 High-reach (or Long-reach) demolition excavators



Figure 19: High-reach excavator demolition of multi-storey structure

A high-reach excavator is defined as one that has a particularly long boom, allowing controlled deconstruction of multi-storey or high structures to a safe height where conventional excavators can continue. Boom lengths can vary in size from 19 to over 50 meters and come with a variety of specialist attachments to allow the operator precision and accuracy during the demolition process.

The following is recommended for the use of high-reach excavators:

1. Machines are to be operated in strict accordance with the manufacturer's recommendations.
2. Machines to be operated only by trained and competent operators.
NOTE | An experienced Digger Operator is not a fully trained and skilled High-Reach Operator.
3. High-reach diggers should be operated facing the front of the tracks, NOT SIDE-ON. Side-on will result in rollover or overloading. Some long-reach excavators are fitted with a boom angle warning system to alert the operator of this possibility. If this warning system is installed within the excavator, the operator(s) must not disconnect the system.
4. Machines are to be fitted with ROPS/FOPS.
5. Full written maintenance inspection checks must be performed daily by a competent person before use.
6. High-reach machines are not designed as cranes, nor should they be used to carry out any form of lifting duties except where they are required to grab elements of the structure being demolished.
 - Attachments should be matched to the weight and type of work carried out.
 - Machines have safe operating limits and distances which must be adhered to in order to carry out demolition.
7. Working platforms must be checked for stability before any work can be performed to prevent roll-overs. Any ramps or working platforms constructed from recycled material, such as concrete and rubble, should be inspected by the operator regularly to identify any protruding steel or reinforcing that may obstruct or lock up in the excavator's tracks.
8. The operator must ensure that the machine remains within the prescribed safe working radius at all times. Radius charts should be available for the operator to refer to at all times within the cabin of the excavator.
9. The operator must watch the fall zone, as falling debris/steel can spear or bounce towards his or her operating position.
 - It is important to work within the safe distances of the machine and also maintain a fall zone for the debris to travel to the ground.
 - A tier system and periodic clearing of debris from the fall zone by another machine may be required.

10. operator must avoid overloading his or her working tool as this can cause roll-over.

6.9 Underwater demolition

Divers must also hold a construction diving Certificate of Competence, which is issued by the Department of Labour. Underwater demolition is also notifiable under the Regulations.

The primary danger to divers who are cutting or welding is from electric shocks and explosions of trapped gas in the structure being worked on. Divers must be familiar with the precautions necessary to keep safe when doing this type of work.

Underwater electrical circuits should have a positive on/off switch located where the tender has immediate access. Unless the diver is actually welding, the switch must be in the open or "off" position.

All welding machine frames must be earthed before starting operations. An earth wire should be used to connect the machine directly to the work.

Power supply cables must be kept clear of welding cables. Insulated gloves should be used by the diver during underwater electrical welding or welding operations.

Any underwater compartments containing unidentified or explosive gases, or residues that could release gases, must be purged or flooded prior to cutting or welding operations.

Compartments of structures, which could accumulate welding gas, should be vented prior to the start of operations.

6.10 Other methods

Other methods, including thermic lances, drilling and sawing can be used in conjunction with the methods outlined in this section. These are specialised uses, and must be carried out only by fully trained and competent personnel.

Section 7 - Guidelines for the clean-up of contaminated sites

In addition to discharges to groundwater, where C&D waste has been tipped or dumped at unapproved landfills or sites, it may cause contamination of that site, limiting the future use of that site.

It is estimated that between 50-55% of C&D waste is recyclable^[3], and can be easily extracted for use as a substitute in many applications.

The remainder contains mainly timber, metal, glass, insulation and other materials, which must be treated in accordance with local authority regulations.

7.1 Introduction

Demolition work may include the cleaning up of sites that have been chemically contaminated.

The hazards of these sites can be environmental, or they may present a danger to human health and safety. Contaminated sites can be of variable size and complexity, and for a successful decontamination process, proper evaluation, assessment and management will be required. Further information can be found in the Department of Labour guideline [Health and Safety Guidelines on the Clean-up of Contaminated Sites](#). Also refer to the Ministry for the Environment's Contaminated Land Management Guidelines (refer to [appendix I](#)).

The prevention of exposure to toxic chemicals is the primary concern. Appropriate means to protect demolition employees and the general public must be implemented.

Common and widespread contaminants include hydrocarbons, polychlorinated biphenyls (PCBs), asbestos, sulphates and metals used in paint pigments or coatings. These may be present on almost any site and may range from barely detectable concentrations to relatively high levels.

Important: Information provided in Table 12 should not be taken to mean that other types of site need not be investigated, nor to mean that other contaminants are absent.

Table 12: Industries, sites and contaminants

Industries, Sites and Contaminants		
Industry	Examples of sites likely to contain contaminant	Likely contaminants
Chemicals	<ul style="list-style-type: none"> Acids/alkali works Dye works Fertilisers and pesticides Paintworks Wood treatment plants 	<ul style="list-style-type: none"> Acids Alkalis Asbestos Metals Solvents (such as benzene, toluene) Phenols Special organic compounds Arsenic Chromium
Petrochemicals	<ul style="list-style-type: none"> Oil refineries Tank farms Fuel storage depots Tar distilleries 	<ul style="list-style-type: none"> Hydrocarbons Phenols Acids Alkalis Asbestos Petrol and diesel
Metals	<ul style="list-style-type: none"> Iron and steel works Foundries, smelters Electroplating Anodising and galvanising workshops Engineering works Shipbuilding/ship breaking Scrap reduction plants 	<ul style="list-style-type: none"> Metals, especially iron, copper, nickel, chrome, zinc, cadmium, lead Asbestos
Energy	<ul style="list-style-type: none"> Gasworks Power stations Geothermal power stations 	<ul style="list-style-type: none"> Combustible substances such as coal and coal dust Phenols Cyanides

Transport	<ul style="list-style-type: none"> • Garages • Vehicle builders and vehicle maintenance shops • Railway depots 	<ul style="list-style-type: none"> • Sulphur compounds • Asbestos • Combustible substances • Petrol • Diesel • Asbestos • Lead • Paints
Mineral extraction, land restoration (including waste disposal sites)	<ul style="list-style-type: none"> • Mines and spoil/slag heaps • Pits and quarries • Filled sites • Landfills 	<ul style="list-style-type: none"> • Metals e.g. copper, zinc, lead, gold • Gases, e.g. methane • Leachates
Water supply and treatment facilities	<ul style="list-style-type: none"> • Waterworks • Sewerage treatment plants 	<ul style="list-style-type: none"> • Metals (in sludges) • Micro-organisms • Hydrogen sulphide • Water treatment chemicals including oxidising agents, chlorine
Miscellaneous	<ul style="list-style-type: none"> • Docks, dry docks and quays • Tanneries • Rubber works • Military land • Paper and printing works 	<ul style="list-style-type: none"> • Acids and alkalis • Metals • Organic compounds • Methane • Toxic, flammable or explosive substances • Micro-organisms

Table 13: Site characteristics and possible hazardous contaminants

Site characteristics and possible hazardous contaminants	
Signs of possible contamination	Possible contaminant
A Vegetation (absence, poor or unnatural growth)	<ul style="list-style-type: none"> • Metals • Metal compounds • Organic compounds • Gases
B Surface material (unusual colours and contours may indicate waste and residues)	<ul style="list-style-type: none"> • Metals • Metal compounds • Oily and tarry wastes • Asbestos (loose) • Other fibres • Organic compounds, including phenols • Potentially combustible material including coal and coke dust • Refuse and waste
C Fumes, vapours and odours (may indicate organic chemicals at very low concentrations)	<ul style="list-style-type: none"> • Flammable, explosive and asphyxiating gases, including methane and hydrogen sulphide • Corrosive liquids • Faecal, animal and vegetable matter (biologically active)

NOTE | Other signs of contamination may exist. Adjacent land should be used for comparison.

7.2 Management of contaminated sites

Management of the clean-up must be appropriate for the hazards involved. As a minimum, proper management will include:

- adequate planning and organisation;
- establishing a work plan for each site;
- establishing health and safety plans;
- proper assessment of the site;
- establishing acceptable exposure levels;
- providing appropriate personal protective equipment;
- monitoring the contaminants and the air;
- adequate training and supervision;
- possible medical surveillance; and
- testing and validation regime.

7.3 Site control

Strict control of the site will be necessary to minimise the potential contamination of employees and to protect the public. Elements of site control include the following:

1. Site preparation and defining zones. Defining work zones will assist in managing areas where appropriate protective clothing must be worn and protective equipment used.
2. Decontamination procedures for personnel and plant and equipment. It may be necessary to fully enclose some areas and provide air locks, shower areas and waste recovery.
3. Site security to prevent unauthorised entry to certain areas.
4. Dust suppression/screening.
5. Effective communications.

Strict personal hygiene practices cannot be overstressed. When heat is a problem, provisions need to be made to allow the employees to drink adequate fluids. Emergency procedures need to be planned in advance and contingency plans made.

7.4 Polychlorinated biphenyls (PCBs)

Demolition workers can be exposed to PCBs when dismantling electrical capacitors and transformers or when cleaning up spills and leaks. Personal protective equipment and clothing is required for the handling of PCBs and PCB-contaminated equipment. This includes:

- chemically impervious disposable overalls,
- nitrile rubber gloves,
- safety glasses, and
- rubber boots.

Correct disposal of spills, waste PCBs, contaminated material and protective equipment will prevent PCBs entering the food chain and the general environment. PCBs should not be dumped or hosed away because of their potential to enter the food chain.

If skin contamination occurs, the liquid should be wiped off immediately and the skin washed with soap and water. Water alone is not sufficient.

Organic solvents like kerosene or petrol should not be used to wash the skin.

Capacitors in fluorescent light fittings are usually located behind the backing plate. Metal-cased capacitors usually contain PCBs; a plastic-cased capacitor usually does not.

Unless accurate information on their PCB content is available, all capacitors should be treated as if they contain PCBs.

Fluorescent lights in buildings built or renovated before 1980 are likely to have PCB-filled capacitors.

For further information on storage and disposal of PCBs refer to the Ministry of Health's Code of Practice for the Safe Management of PCBs (for full reference see [appendix I](#)).

7.5 Biological material hazardous to health



In many buildings and structures, particularly those that have been vacant or derelict for a period of time, additional hazards may be present from biological materials, such as the examples given in [Table 8](#).

Employees working in areas with exposure to the contaminants listed in this table must be provided with appropriate personal protective clothing and equipment.

Adequate facilities must be provided for employees to maintain hygiene standards onsite. This can range from hand wash facilities through to full decontamination facilities. The employer should undertake a hazard assessment to accurately determine what level of these will be required for the project.

Table 14: Biological contaminants and associated hazards

Contaminant	Associated hazards
Rat/mice droppings and urine	Leptospirosis: a bacterial disease that affects humans and animals and is highly contagious. In humans, it causes a wide range of symptoms and in some cases an infected person may not show any symptoms at all. Symptoms include diarrhoea, abdominal cramps, severe headaches, chills, muscle aches, rashes, vomiting and jaundice. If not treated, the infected persons can develop kidney damage, meningitis (inflammation around the brain), liver failure and respiratory distress. In rare cases, it is fatal.

Hantavirus Pulmonary Syndrome (HPS): humans can contract HPS by breathing in the aerosolised virus from the faeces and urine of infected rodents. Although rare, it is a serious and potentially fatal disease.

Bird guano Histoplasmosis: a common fungal infection amongst wild birds. It can spread to humans by inhaling spores found in the bird's droppings (either directly from the droppings or from the disturbance of contaminated soil). The primary result of histoplasmosis is acute respiratory illness. Symptoms include fever, chills, muscle aches, cough, rashes and joint pain or stiffness.

Blastomycosis: a fungal infection that is spread to humans by inhaling spores (either directly from bird droppings or from the disturbance of contaminated soil). The primary effect is lesions to the lungs and skin. The disease then spreads to the bones, liver, spleen, and central nervous system. This disease is often found in conjunction with histoplasmosis, tuberculosis, bronchogenic carcinoma or severe pulmonary disease.

Possum droppings and urine Tuberculosis (TB): this is a contagious disease. Humans can contract TB by breathing in the aerosolised virus from the faeces and urine of infected possums. Like the common cold, it spreads through the air. Only people who are sick with TB in their lungs are infectious.

Leptospirosis (see above). Leptospirosis can be contracted from the urine of infected possums.

Black mould (strachybotrys chartarum or strachybotrys atra) Black mould/fungi: these produce spore containing mycotoxins which can be inhaled and absorbed through the skin. Symptoms can range from flu-like to diarrhoea. This can be particularly harmful to the young, old and sick.

Footnote

^[3] Ministry for the Environment: Construction and Demolition Waste www.mfe.govt.nz/issues/waste/construction-demo/index.html

Section 8 - Optimising recycling in demolition

8.1 General

Construction and demolition wastes are one of the largest waste streams in New Zealand.

The optimisation of recycling comes hand-in-hand with the demolition industry, who have become very adept with utilising the latest in recycling technologies to minimise waste to landfill. This also reduces overall costs to both the demolition contractor and their clients.

Demolition contractors and clients should aim to continue to minimise waste to landfill and ensure that, where possible, any items of a historical or cultural nature are able to be salvaged for return where it does not pose a significant risk to the demolition personnel. A hazard assessment, in incorporation with a suitably experienced IPENZ-registered engineer's advice should be conducted to assess this risk.

The demolition contractor should implement a "Waste Management" record. The record should detail information identifying the types of waste, quantities, disposal destination and recycling measures used.

When loading trucks or trailers, care must be taken not to spill debris over the far side of the truck or trailer. Loading should only be done on the demolition site unless permission is given by the Territorial Authority to load on the street.

8.2 Identifying potential end markets

If undertaken correctly, between 90 to 95% of a building can be recycled.

Some of the materials that can be recycled include:

- native and exotic timber: framing, trusses, beams, flooring, sarking, skirting boards;
- wood: laminated beams, plywood, MDF, pine framing and beams;
- architectural salvage: doors, windows, skylights and lead lights;
- fixtures and furnishings: carpeting, carpet tiles, lighting fixtures, ceiling tiles, bathroom and kitchen fittings, plaster cornices & features;
- ferrous metals: structural steel and steel framing members;
- non-ferrous metals: cabling and conduits, plumbing pipe-work and fixtures, motors, ducting and aluminium framing;
- roofing: shingles, slate, corrugated iron, long-run;
- asphalt;
- clean polystyrene;
- chiller and refrigeration units;
- plant and equipment;
- aggregate: concrete (with or without reinforcing), bricks, blocks, stone;
- landscaping: soil, clay, trees, stumps.

The demolition contractor should identify potential end markets for materials.

Ideally, end markets should be located as close as possible to the demolition site to reduce transportation costs and carbon emissions.

8.3 Waste management plan

A waste management plan is a document that lays out the start to finish strategy for optimising recycling on a demolition site.

A waste management plan should:

- identify the types and quantities of demolition wastes to be generated from the job;
- identify how each waste will be managed and marketed;
- provide an overall estimate of the total recyclability of the job; and
- include tracking and reporting to confirm recycling quantities and ultimate end uses.

8.4 Source and co-mingled separation

Overall, optimum recycling capability can be achieved primarily onsite, with all material being sorted either mechanically or by hand into separate piles for removal to identified markets offsite. This measure is commonly known as "source separation".

The alternative is commonly known as "co-mingled" separation. This is where all materials are transported offsite to separate processing depots for separation and recycling.

Table 15: Advantages and disadvantages of source and co-mingled separation

Advantages and Disadvantages of Source Separation vs. Co-mingled Recycling		
Recycling Method	Advantages	Disadvantages
Source Separation	<ul style="list-style-type: none"> Higher recycling rates Lower recycling costs; revenues paid for some materials Often a cleaner, safer worksite 	<ul style="list-style-type: none"> Multiple containers on site Workers must separate materials for recycling More complex logistics Multiple markets; more information to manage
Co-mingled Recycling	<ul style="list-style-type: none"> Only one or two containers onsite No need for workers to separate materials for recycling Easier logistics One market; less information to manage 	<ul style="list-style-type: none"> Lower recycling rates Higher recycling costs

Overall, the New Zealand Demolition and Asbestos Association recommends, where practicable, that source separation be undertaken by the demolition contractor to maximise recycling opportunities from each project.

8.5 Debris recycling

Good site management and practice not only prevents the mixing of the inert portion together with the non-inert portion of the demolition waste, but also facilitates and allows onsite sorting and separation at the source.

The method of selective demolition should be adopted as far as practicable. It involves demolition and removal of wastes of the same category one at a time. The goal is to facilitate recycling of waste capable of beneficial reuse, thus minimising the burden on landfills and public filling areas.

In general, the following should be removed first (other than asbestos and hazardous substances):

- glass panes and windows - extreme care must be taken to ensure that all glass is removed safely, and towards the inside of the building;
- domestic waste such as furniture, household appliances;
- metal components such as window frames, pipes;
- timber components such as doors, wooden floors; and
- other waste such as tiles, asphaltic materials, ceramic products.

The building demolition should begin after all non-structural materials have been stripped and removed.

8.6 Retaining paper trails

It is important that the demolition contractor implements an effective and systematic method for the collection, recording and analysis of all paperwork, including dockets and receipts from recycling and disposal. These will be required to verify quantities and end usage and may also be required for the Client's records, particularly on Green Star Projects.

For further information on waste management in demolition, refer to the Resource Efficiency in the Building and Related Industries (REBRI) webpage: www.branz.co.nz/cms_display.php?s=103&t=1.

Appendix A - Demolition hazards

Hazards	Possible consequences	Safe work practices
Concrete structures	<ul style="list-style-type: none"> Personal injury 	<ul style="list-style-type: none"> Concrete structures should be examined for signs of damage due to reinforcing corrosion or concrete damage. Special buildings include (but are not limited to): pre-cast concrete tilt slab structures, frame structures of pre-cast concrete, concrete beam slab construction and pre-stressed concrete structures. Carry out a full investigation to determine the type of structural framework before demolition begins. Follow the advice of a registered engineer if necessary, and develop a demolition methodology or demolition plan.
Inadequate pre-demolition checks	<ul style="list-style-type: none"> Inhalation of toxic materials Electrocution Fire Explosion 	<ul style="list-style-type: none"> Every demolition job, no matter how small, must be planned, the hazards identified and the precautions to be taken considered. See pre-demolition check example in appendix C.
Public services	<ul style="list-style-type: none"> Electrocution Fire Explosion 	<ul style="list-style-type: none"> Prior to work commencing, all services, either underground or above, e.g. gas, water, electricity, drains, telephone cables, etc. should be located and clearly identified for workers onsite. Ensure all services are either disconnected or diverted at the site boundary, or suitably protected to the approval of the appropriate authority. When constructing boundary fences or gantries, ensure that their foundations do not strike public utilities that are still in use.
Roofs	<ul style="list-style-type: none"> Falls from heights 	<ul style="list-style-type: none"> Check the condition of roof trusses and identify and mark any

		<p>bracing that is essential for stability.</p> <ul style="list-style-type: none"> • Check the nature and condition of roof cladding. If it is brittle, special precautions must be taken to prevent workers from falling through the roof. • All roofs should be treated as brittle because: <ul style="list-style-type: none"> ◦ of 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 may have occurred because of the age, or chemicals in the building have impaired roofing material. • The following factors of the roof are also important to consider: <ul style="list-style-type: none"> ◦ thickness of the material ◦ the span between supports ◦ sheet profile ◦ the design of the supporting structure, e.g. purlins ◦ the age of the material. • Any person required to be on a roof covered with fragile roofing materials should use walkways and crawl boards. • Cover or guard all brittle and dangerous areas.
Mobile plant and equipment	<ul style="list-style-type: none"> • Crushing • Machinery tipping/rolling • Noise • Poor visibility • Trips/slips/falls • Fumes 	<ul style="list-style-type: none"> • Before approaching any mobile plant and equipment, ensure the operator is aware of your presence and has signalled that it is safe to approach. • All people onsite should wear high-visibility vests, shirts or jackets to increase visibility. • Only trained and competent people should operate mobile plant and equipment. • Excavators should be fitted with ROPS/FOPS protection. • Operators should wear seat belts so that they are confined within the structure and not thrown out in the event of a roll-over. • Never leave unattended mobile plant running. • Passengers are not allowed on mobile plant. • Lower the bucket/boom when the excavator is not in use. • To avoid ankle injuries, dismount by climbing down, not jumping down. Use the provided foot and hand holds. • Avoid using petrol or diesel operated plant in confined spaces or poorly ventilated spaces.
Contact with electricity	<ul style="list-style-type: none"> • Electrocutation 	<p>The following precautions should be taken when cranes and mechanical plant are working near overhead power lines:</p> <ul style="list-style-type: none"> • All lines should be treated as live. • A minimum clear distance of 4 metres must be maintained from the lines unless permitted by the line owner. • Efforts should be made to contact the utility owner to determine if electrical lines can be disconnected, isolated, diverted, raised or otherwise protected throughout the duration of works.
Demolition operators	<ul style="list-style-type: none"> • Inhalation • Falling objects • Fire • Explosion 	<p>General work:</p> <ul style="list-style-type: none"> • Structures must not be left in a condition in which they could be brought down by a moderate earthquake, wind storm or vibration from plant or traffic. • Ensure debris (including loaded vehicles, chutes, floors, stairways and other places) is watered down frequently to prevent dust becoming a nuisance or health hazard. • Demolished materials should be controlled-lowered to the ground, and debris sent down in skips or enclosed in chutes. • Material should only be dropped when adequate precautions have been taken for the safety of workers, the public and adjacent property. • Debris should not be burned onsite, unless permits have been obtained. • When loading trucks or trailers, care must be taken not to tip debris over the far side of the truck or trailer. • Deliberate burning of buildings is not a recommended method for demolition. • Portable fire extinguishers should be kept in working areas and maintained in an operable condition. • The site should be checked at the end of each work day to ensure no smouldering material is left that could start a fire.
Welding or cutting work	<ul style="list-style-type: none"> • Fire • Explosion 	<ul style="list-style-type: none"> • All hot work to be conducted using a hot work permit with conditions of the permit satisfied before works being. • When carrying out any cutting or welding work, remove any combustible material to a safe place. • Fire extinguisher equipment must be readily available and workers trained in its correct use. • Standpipes and hoses should be set up prior to cutting. Smouldering debris that cannot be removed should be thoroughly wetted down. • Ensure that compressed air cylinders are not left free-standing.
Demolition operations: people	<ul style="list-style-type: none"> • Falling objects • Falls from heights • Hearing injury/loss 	<p>A trained and experienced person should be constantly in charge during demolition work.</p> <p>Personal protective equipment:</p> <p>Employees should be provided with and use the following PPE as</p>

appropriate:

- Safety helmets and safety footwear must be worn at all times on demolition sites. (Operators may remove their helmets while inside FOPS/ROPS protected cabs).
- Hearing protection (earmuffs, earplugs etc.).
- Safety gloves.
- High visibility vest, shirts or jackets.
- Appropriate respirators for dust and chemicals.

Public safety:

- Where there is a possibility of falling debris, a gantry or protective screen of sufficient strength should be provided over the footpath adjacent to the building.
- For gantries, the roof should be weather-proof and decked with a minimum of 50mm timber planking or equivalent, depending on the span and loading.
- Where there is no danger of falling debris, but there is dust, water, sparks or other demolition hazards, a hoarding or fence erected on the boundaries of the site may be sufficient to protect the public and should be at least two metres in height from ground level.
- Hoardings should be constructed using continuous sturdy cladding.
- Hazards that attract children must be fenced off.
- Signage should be placed at several points around the site to inform the public that demolition is in progress and that danger exists.
- Traffic controllers should be positioned at truck entrance and exit points when trucks are operating.
- During the hours of darkness, warning lights should be used to warn of barricades and debris. Holes which present a hazard must be covered.
- Road kerbs and storm water drains should be kept clear of material to prevent flooding.
- In busy inner-city areas, the more hazardous stages of demolition should be carried out during non-working hours: during evenings or weekends or during off-peak hours, for example.

Demolition operations: structures

- Slips/trips/falls
- Crushing
- Cuts/lacerations

Buildings:

- Remove all glass from windows before demolition begins.
- Window openings on street frontages or adjacent to access ways should be blocked off.
- Openings in walls, floors, roofs and stairwells should be boarded up or provided with a guard rail to prevent falls.
- Areas where flooring has been removed should be barricaded off and notices erected to warn of the danger at each point of entry.
- All stairs or installed ladders should be checked prior to use. Never assume they are sound.
- When stairs or installed ladders are in good condition, leave them as a means of access for as long as possible.
- When dismantling pitched roof trussed, the last frame should be guyed before the second to last truss is removed because stability depends on the support of adjacent members.
- As supports and buttresses are removed, bracing should be provided to stabilise the remaining structure.
- Avoid leaving free-standing walls by reducing the building in small lifts.
- Never leave isolated walls or potentially unstable structures unpropped, unless they are stable against wind and other forces likely to affect them.
- When demolishing a reinforced concrete floor, it may be necessary to remove a small section first, in order to determine the direction of the main steel.
- Provide support for beams before cutting or weakening the base, so that their fall is controlled.
- Clear openings should be made in floors to allow debris to pass through.
- When demolishing pre-stressed concrete structures, professional advice should be obtained from a suitable and experienced registered engineer. A demolition plan or method is required.

Exposure to noise

- Hearing loss/injury

- Excessive noise can be reduced by:
 - putting silencers on jackhammers, or
 - using compressors insulated against noise.
- Maximum acceptable noise levels are 85dB(A) averaged over an eight-hour work exposure period and 140dB for peak noise.

Health hazards

- Inhalation
- Ingestion

- The main hazards to health during demolition are:
 - Exposure to asbestos dust, chiefly from insulation materials, fire protective cladding and lagging to steam and chemical plant.
 - Lead poisoning from inhaling fumes during flame cutting of steelwork coated with lead paint.
 - Exposure to silica dust during demolition operations.
 - Exposure to polychlorinated biphenyls (PCBs) when dismantling electrical capacitors and transformers.
- Ensure there is sufficient ventilation when using mechanical plant in confined or enclosed areas due to the danger of exhaust fumes.
 - Ensure all machinery is maintained to a high standard.

- Replace worn-out exhaust systems.
- Replace damaged manifolds.
- Do not allow exhaust products to blow back onto the operator.
- Mobile plant and machinery should be fitted with carbon monoxide inhibitors to reduce emissions.

Unauthorised access to site	<ul style="list-style-type: none"> • Personal injury 	<ul style="list-style-type: none"> • Barriers and fencing must be installed to prevent unauthorised entry onto the worksite by people, including children. • Where people are permitted to remove or purchase materials from the demolition site, safe access should be ensured.
Concrete structures	<ul style="list-style-type: none"> • Personal injury 	<ul style="list-style-type: none"> • Concrete structures should be examined for signs of damage due to reinforcement corrosion and concrete damage. • Special buildings include (but are not limited to): pre-cast concrete tilt slab structures, frame structures, pre-cast concrete, column beam slab construction and pre-stressed concrete structures. • Carry out a full investigation to determine the type of structural framework before demolition begins. If necessary, follow the advice of a registered engineer.
Dangerous structures	<ul style="list-style-type: none"> • Personal injury 	<ul style="list-style-type: none"> • If there are indications that the structure is dangerous, check with the appropriate authority, as they may have records about the type of construction and the possible damage or cause of weakness.
Inadequate structural inspections	<ul style="list-style-type: none"> • Falls • Overloading • Unplanned structural collapse 	<p>Building plans:</p> <ul style="list-style-type: none"> • Ensure that all available plans of the structure or structures where necessary have been examined. Be aware that the original drawings may not be an accurate record of what was built. • When the nature of the construction is uncertain, a special investigation should be carried out using the advice of a registered engineer. • If heavy plant and machinery is planned to be used on the roofs and floors, or where it is intended to load debris on roofs or floors, the SWLs must be determined by a registered engineer, as propping or strengthening may be required. • "NO GO" areas for plant and machinery should be fenced off to avoid confusion by operators as to where is safe and where is not.

Roofs:

- Check the condition of roof trusses and identify and mark any bracing that is essential for stability.
- Check the nature and condition of roof cladding. If it is brittle, special precautions must be taken to prevent employees from falling through the roof. In particular, care must be taken with corrugated plastic and asbestos cement sheeting.

Walls:

- Identify and mark load-bearing walls and check whether party or cross walls are properly bonded to front and rear walls.
- Check the thickness and condition of walls and gables which are to remain after the demolition is completed. Take particular note of any reduction in wall thickness.
- The effect on the remaining buildings due to the removal of buttressing walls should also be considered. Consult a registered engineer if necessary.

Cantilevered structures:

- The stability of cantilevered structures such as staircases, balconies and cornices, which are fixed to a building, is likely to be affected when adjoining structural members in the building are removed.

Basements, cellars and vaults:

- If a basement, cellar or vault adjoins another property, any party walls or adjoining cellar walls should be inspected to determine if they are strong enough to withstand resultant ground pressure.
- If they are not, the proposed methods of strengthening them should be subject to an assessment by a registered engineer.
- If a basement, cellar or vault is completely surrounded by ground and is to be backfilled, all organic matter should be removed and replaced with inorganic material and consolidated to ground level.
- If a basement has been built in ground with a high water table, adequate precautions should be taken to prevent flotation.

Wells and underground storage tanks:

- Ensure that wells and underground storage tanks are tested for flammable vapours or any other hazardous gases if there is any suspicion that such vapours or gases are present.
- Contents of storage tanks should not be just tipped out until the contents have been identified and a safe method of disposal agreed upon.
- Tanks previously containing flammable liquids require an approved procedure for cleaning and purging.

Fire-damaged buildings:

- Fire reduces a structure's ability to act as a load platform for plant, people and materials. As a result, great uncertainty exists concerning what might happen when various actions are taken.
- It is necessary that a thorough inspection is undertaken prior to demolition commencing. The following should be looked for during the inspection:
- Evaluate the fire temperature and locate areas where material strengths appear reduced and deflections larger than normal.
- Look for shear failures of connections.
- Evaluate concrete strengths and identify areas of weakness or collapse.
- Look for cracked concrete members, even those remote from the fire.
- Check if structural steel requiring compression flange restraint has lost that restraint (purlins or floor joists, for example).
- With composite flooring, check for shear failure.
- Where loss of strength has occurred in beams, columns or their connections, additional propping may be required to ensure stability.
- Before any work starts, ensure that internal areas are well ventilated, and be aware that some debris may be toxic. Take particular care if the building has been used to store chemicals.

Lack of demolition plan

- Personal injury
- Fire
- Electrocuting
- Inhalation of toxic material
- Explosion

- A written demolition plan must be available and contain the following points:
 - The extent of the work.
 - The type of plant to be used.
 - The proposed method of removing each part of the structure including roof, walls, floor and foundations.
- The plan should outline precautions for the safety of employees on site and people in the vicinity, and include emergency procedures.
- The plan should cover dust and noise controls and safety for the public.
- Before work starts a task analysis/hazard identification/job safety analysis should be completed and updated regularly throughout the job.

Appendix B - Excavator checklist

Machine model and Fleet No:			Operator:		
Date of checklist	From:	To:	Site address:		
Start Hours			Finish Hours		
Please ✓ if checked and acceptable			Or ✗ if checked and unacceptable		

Check description	Wed	Thurs	Fri	Sat	Sun	Mon	Tues
Operator aware of all present site hazards							
Correct tension in tracks							
Undercarriage: no damage or leaks in HYD hoses							
No panel damage, and machine in clean, tidy condition							
Nothing stuck in tracks							
Engine oil level normal							
Coolant level normal							
Water level normal							
HYD oil level normal							
Fuel levels okay							
Lube grease nipples and slewing ring							

Check air filters							
Overall inspection for fluid leaks, damage and cracks							
Mirrors and windows clean for visibility							
Survey work area for overhead power lines and other height limitations							
Work area safely barricaded from public							
Enough room for manoeuvring machine							
Check locking pin on EX400 bucket							
Hour meter reading							

Note any other information about machine:

Please give to your supervisor for storing in the job site file. Immediately notify your supervisor or head office should there be a serious hazard concern with the machine.

Appendix C - Pre-demolition checklist

Site address			
Client			
Historical use			
Type of building/structure (levels etc.)			
Constructed materials			
Territorial Authority			
Full demolition		Partial/strip-out	
Anticipated start date	Expected completion date		

	Check	Y	N	N/A	Comments
1	Specs/plans for building provided				
	Service plans available				
	Job Notifiable				
2	General				
	Asbestos-containing material onsite				
	PCBs onsite				
	Hazardous substances				
	Flammable substances				
	Biological matter				
3	Services				
	Electricity				
	Gas				

	Telecommunications				
	Water				
	Storm water				
	Sewer				
4	Dangerous Structures				
	Leaning				
	Cracking				
	Burnt out				
	Damaged				
	Deteriorated				
5	Cantilevered Structures				
	Any cantilevered structures onsite				
6	Basements				
	Any basements, cellars or vaults onsite				
7	Tunnels				
	Any tunnels, sumps or trenches onsite				
8	Wells and Underground Storage Tanks				
	Any wells or underground storage tanks onsite				
9	Special Structures				
	Any pre-cast/pre-stressed concrete slabs/panels onsite				

Appendix D - Demolition safety checklist

Once the demolition has commenced onsite, here are some recommended checks that should be completed by the demolition contractor and site supervisor and maintained throughout the course of the job.

	Requirement	Yes	No
1	Has a competent supervisor, experienced in demolition work, been appointed?		
2	Are all onsite employees sufficiently trained and competent to complete their tasks and duties safely?		
3	Is on-going hazard management being conducted onsite, and communicated through to employees and contractors effectively?		
4	Are all site personnel wearing the correct personal protective clothing and equipment for the work at all times, and is the clothing/equipment being maintained effectively?		
5	Is the site properly enclosed and are protective screens erected?		
6	Have danger notices been erected? Is all access to the site by the public barred?		
7	If required, is there sufficient propping to prevent premature structural collapse or damage to adjacent property?		
8	Are all ladders and other equipment in good order?		
9	Are any floors in danger of being overloaded?		
10	If a crane is in use:		
	(a) are all non-essential personnel (except the crane operator and dogman) clear of the danger area when the crane is being used?		
	(b) are all crane windows properly protected, and does the crane require a FOPS canopy?		

	fitted?		
11	Are pedestrians adequately protected?		
12	Is sufficient watering taking place to keep down dust?		
13	Are there sufficient fire extinguishers or other fire-fighting equipment onsite, and are they readily accessible?		
14	Are good housekeeping practices being maintained, for example: are floors and access pathways clear of unnecessary debris and materials/equipment?		
15	Does all electrical equipment have current test certification and tagging to verify safety for use?		
16	Do plant and equipment being used onsite have daily checks conducted by the operator(s) to ensure proper running conditions and safety for use?		
17	Do all onsite elevated work platforms and cranes have current certification to verify safety for use?		

Appendix E - Confined space entry permit (CESP) (example) entry requirements

This permit must not be destroyed. On expiry or cancellation, this entry permit must be retained onsite for the duration of the works and returned on completion to the Contract Manager for assessment and filing.

CSEP No:	Date of issue:
Worksite address:	
Area:	
Site supervisor:	
Safety officer:	
Monitor type:	Calibration date:
Expiry of permit:	

Record hazards of permit space to be entered				Check or list the measures used to isolate the permit space and to eliminate or control the hazards prior to entry
Hazard	Yes	No	N/A	
1. Lack of oxygen				
2. Oxygen enrichment				
3. Combustible gases/vapours				
4. Chemical contact				
5. Electrical hazards				
6. Mechanical hazards				
7. Temperature				
8. Engulfment				
9. Entrapment				
10.				
11.				

Other work permits required (hot works, etc.)

Pre-entry atmospheric test	Permissible entry levels	Readings: Test 1 (top)	Test 2 (midpoint)	Test 3 (bottom)	Test 4
----------------------------	--------------------------	------------------------	-------------------	-----------------	--------

O ₂	19.5-23.5%				
LEL	0				
H ₂ S	0				
Co	25ppm				
Name or initial of tester					
Test date and time					

Where continuous testing is required, times and results must be recorded on gas monitor check sheet. Testing and recording requirements for this permit is a minimum of four times daily.

Entry requirements

Personal protective equipment required by all persons entering the confined space:	
Internal to external communication methods:	
Ventilation equipment to be used:	
Lighting inside confined space:	
Barriers/shields and signage requirements:	
Rescue equipment to be maintained onsite:	
Other equipment: Note: if there are vehicle or powered machinery works within the confined space, pre-start emission levels must be recorded and regular monitoring or workzones affected must be maintained.	
Names of authorised entrants (full names only, no initials). Daily entrance log must be maintained by hole watch.	
Rescue procedure:	
Name of hole watch:	
Name of certified first aider:	
Location of first aid equipment:	

<input checked="" type="checkbox"/> Pre-entry briefing held	<input checked="" type="checkbox"/> Entrants received training
<input checked="" type="checkbox"/> DoL notified	
Entry authorised by (print name):	
Signature:	Date:

Appendix F - DOL/NZDAA Hazardous work notification form

This is the process for [Notification of Particular Hazardous Work](#).

Appendix G - Sample hot work permit

Hot Work Permit	
Applicable to all operations involving welding and cutting equipment, and other hot work performed on site. The permit must be displayed at the work site and returned upon completion of work.	
Date:	PERMIT NUMBER:
Permission is given to (name):	
of (company):	

to use (type of equipment):			
at (description of site):			
between	am/pm	and	am/pm
Details of works to be performed:			
Description of work:			
Equipment to be used:			
FIRE PREVENTION RULES			
Fire equipment to be provided as follows:			
<ul style="list-style-type: none"> • Fire hose • Fire extinguisher(s) • Mandatory fire watcher 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Combustible material located within 10 metres of the work must be removed or protected with non-combustible curtains, metal guards or flameproof covers.			
Barricades, warning signs and spark/flash screens must be provided to protect other personnel in the area.			
The work area, trenches, pits, etc. must be clear of flammable liquids, gases or vapours.			
All floor and wall openings within 10 metres of the work being conducted must be covered to prevent transmission of sparks.			
The hot work area and any adjoining areas must be patrolled from the start of work until 30 minutes after the work is completed (including rest periods).			
Special conditions (describe):			
WORK ON ENCLOSED EQUIPMENT (Tanks, containers, ducts, etc.)			
<ol style="list-style-type: none"> 1. The equipment must be cleaned of all combustibles. 2. Containers must be purged of all flammable vapours. 			
Signature of person issuing permit:			
WORK COMPLETED AND AREA SAFE			
The work area has been inspected by the permit issuer 30 minutes after completion of work. No smouldering fires were discovered.			
Signature:		Date:	Time:

Appendix H - Legislative references

Legislation controlling demolition work includes (but is not limited to):

- The Building Act 2004
- The Health and Safety in Employment Act 1992
- The Health and Safety in Employment Regulations 1995
- The Health and Safety in Employment (Asbestos) Regulations 1998
- The Hazardous Substances and New Organisms (HSNO) Act 1996
- The Resource Management Act 1991
- The Historic Places Act 1980.

NOTE | For clarity, the following summary of the relevant sections of the legislation uses abbreviated and, in some cases, simplified wording. Please refer directly to the legislation itself for the full provisions of each section.

A summary of the Health and Safety in Employment Act 1992

The Health and Safety in Employment Act 1992's (the Act's) object is to promote the prevention of harm to all persons at work and other persons in, or in the vicinity of, a place of work.

Section 5 sets out the object of the Act, and lists various means contained in the Act to achieve it, including by:

- promoting excellence in health and safety management, in particular through promoting the systematic management of health and safety;
- defining hazards and harm in a comprehensive way so that all hazards and harm are covered, including harm caused by work-related stress and hazardous behaviour caused by certain temporary conditions;
- imposing duties to ensure that people are not harmed as a result of work activities; and
- setting requirements that relate to the taking of all practicable steps to ensure health and safety, and are flexible to cover different circumstances;
- recognising that volunteers doing work activities for other persons should have their health and safety protected because their well-being and

- work are as important as the well-being and work of employees;
- requiring employee participation in the improvement of health and safety and encouraging good faith co-operation in places of work; and
- providing a range of enforcement methods in response to failure to comply with the Act.

The Act also provides for the making of Regulations and Approved Codes of Practice.

Employers' duties (demolition contractors)

Section 6 of the Act places a general duty on all employers to take all practicable steps to ensure the safety of employees while 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.

Hazard management

Section 7 of the Act requires all employers to have in place an effective method for systematically identifying and regularly reviewing hazards in the place of work (existing, new and potential), to determine whether they are significant hazards and require further action.

If an accident or harm occurs that requires particulars to be recorded (see section 25 of the Act), employers are required to investigate it to determine if it was caused by or arose from a significant hazard.

Where the hazard is significant, the Act sets out the steps employers must take:

- Where practicable, the hazard must be eliminated (section 8).
- If elimination is not practicable, the hazard must be isolated (section 9).
- If it is impracticable to eliminate or isolate the hazard completely, then employers must minimise the likelihood that employees will be harmed by the hazard (section 10).

Where the hazard has not been eliminated or isolated, 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.

An employer does not comply with their obligations under Section 10 of the Act:

- by paying an allowance or salary to an employee instead of providing them with protective clothing and equipment, or
- by requiring an employee to provide their own protective clothing and equipment.

Section 12 of the Act requires employers to provide employees and health and safety representatives with information about:

- 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.

This information must be provided in a manner that the employee can understand.

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

Involvement of employees in the development of health and safety procedures

Employers have a duty to provide reasonable opportunities to employees to participate effectively in ongoing processes for improvement of health and safety in their place of work (section 19B).

This applies in particular to the processes set out in sections 6-13 of the Act.

Employees therefore have a right to participate in this process in their place of work. The Act specifies circumstances where a system is required to be in place to properly canvas the views of employees. Safety and health committees and representatives provide a means for such consultation and co-operation, and their establishment is encouraged.

Training for employees

Section 13 of the Act requires that all employers must ensure employees:

- receive appropriate training so they can do their work safely; and
- 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.

People carrying out demolition work should be trained so they can carry out this work safely and without risk to their own health, safety and that of others. This training must reflect the requirements detailed within these guidelines.

Accidents and Serious Harm (records and notification)

The Act requires employers to keep a register of work-related accidents and serious harm. This includes every accident that harmed (or might have harmed):

- any employee at work; and
- any person in a place of work under the employer's control.

Employers are also required to investigate all accidents, harm and near-misses 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 (in practice, the nearest Department of Labour (DoL) office), as soon as possible. In addition, the accident must also be reported on the prescribed form within seven days. Forms are available from the DoL website or from the nearest DoL office.

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

1. save life or prevent suffering; or
2. maintain public access for essential services, such as electricity or gas; or
3. prevent serious damage or loss of property

The DoL office will advise whether it wishes to investigate the accident and what action may be taken in the meantime.

Duties of persons in control of a place of work

Section 16 of the Act requires persons in control of a place of work take all practicable steps to ensure that no hazard, that is or arises in the place of work, affects people:

1. in the vicinity of the place of work; and
2. who are lawfully in the place of work (employees/contractors etc.); or
3. who are in the place of work to undertake activities such as purchasing or inspecting goods for purchase.

Duties of principals (clients)

Section 18 of the Act requires that principals must take all practicable steps to ensure that no contractor or their employees are harmed while doing any work that they have been engaged to do.

Examples of practicable steps for principals regarding demolition work are included in section 3.2 Duties of principals (clients).

Duties of sellers or suppliers of plant and equipment to a place of work

Section 18A of the Act puts obligations on both sellers and suppliers of plant and equipment to a place of work, including hire companies.

Hirers and leasers of plant and equipment must determine if the plant or equipment is to be used in a place of work.

If so, they must ensure that the plant has been designed and maintained so it is safe for use.

Sellers or suppliers of plant and equipment must ensure that the plant has been designed, made and maintained so it is safe for use.

Installers or arrangers of plant and equipment must ensure that the plant or equipment is installed so it is safe for use.

These obligations do not apply if the plant is sold "as is" or is second-hand.

Health and Safety in Employment Regulations 1995

These Regulations require employers to provide facilities for their employees. These include:

1. drinking water;
2. toilets;
3. hand-washing facilities;
4. a means for leaving the place of work safely in the event of an emergency;
5. first aid facilities;
6. adequate lighting so that employees may do their tasks and duties safely;
7. adequate ventilation;
8. adequate means for controlling humidity;
9. facilities to control atmospheric contaminants as closely as possible to their source; and
10. facilities for employees to have meals during work hours in reasonable shelter and comfort, being facilities that are separate from any plant or materials used in the place of work and free from atmospheric contaminants, dirt, noise etc.

These facilities must be located as close as possible to the place of work, be in sufficient numbers, be suitable for their intended purpose and be maintained in good order and condition.

In situations where employees clothing are exposed to contaminants or likely to become wet, suitable changing facilities must be provided by the employer.

Regulation 11: Noise

Regulation 11 sets maximum noise levels for employees to be exposed to while at work. This is 85 decibels averaged over an eight-hour period, or a peak exposure level of 140 decibels.

For further information please refer to the Department of Labour publication Approved Code of Practice for the Management of Noise in the Workplace (see [appendix I](#)).

Regulation 22 - Scaffolding

Regulation 22 requires that where scaffolding has been erected for use, the scaffolding is erected so that it is:

1. safe and fit for the purpose intended;
2. properly constructed of sound material; and
3. constructed with sufficient reserve strength in regard to the intended loadings that will be imposed on the scaffolding.

Regulation 25: Excavations of a hazardous depth

Regulation 25 requires that where any excavation is readily accessible to any person and is of a depth likely to collect enough water to become a hazard to people, then that excavation must be either securely covered or fenced when employees are not in the vicinity.

Regulation 26: Notification of particular hazardous work

Regulation 26 requires that where a person intends to conduct notifiable work, that:

1. notice of this intent is lodged with the nearest office of the Department of Labour to where the work is to be carried out; and
2. the notice shall be in writing; and

3. the notice shall be given at least 24 hours before the time at which the employer intends to start work.

Regulation 27: Certificates of Competence

Regulation 27 allows for the issuing of Certificates of Competence for the following hazardous activities:

- Scaffolding - Basic, Advanced and Suspended;
- Occupational Diver; and
- Powder-Actuated Tool Operator (PAT).

Health and Safety in Employment (Asbestos) Regulations 1998

The Asbestos Regulations set the minimum standards required for working with asbestos-containing material. In-depth information and compliance procedures can be found in the Association's publication *New Zealand Guidelines for the Management and Removal of Asbestos* (see [appendix I](#)).

Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways (PECPR)) Regulations 1999

The PECPR Regulations set minimum requirements on designers, manufacturers, suppliers and controllers of specific plant and equipment, notably cranes, which are being utilised in greater frequencies as an effective and safe method for controlled demolition and the lowering down of demolition debris, plant and equipment.

These obligations include:

- duties in relation to unsafe equipment;
- design verification and information to be provided; and
- certificates of inspections.

Building Act 2004

Section 3 of the Building Act 2004 states that the purpose of the Act is to provide for the regulation of building work, the establishment of a licensing regime or building practitioners, and the setting of performance standards for buildings, to ensure that:

- people who use buildings can do so safely and without endangering their health;
- buildings have attributes that contribute appropriately to the health, physical independence, and well-being of the people who use them;
- people who use a building can escape from the building if it is on fire; and
- buildings are designed, constructed, and able to be used in ways that promote sustainable development.

Building work is defined as work for, or in connection with, the construction, alteration, demolition, or removal of a building.

Section 40 of the Building Act 2004 states buildings not to be constructed, altered, demolished, or removed without consent:

- A person must not carry out any building work except in accordance with a building consent.
- A person commits an offence if the person fails to comply with this section.
- A person who commits an offence under this section is liable to a fine not exceeding \$100,000 and, in the case of a continuing offence, to a further fine not exceeding \$10,000 for every day or part day which the offence has continued.

Section 41 identifies some types of building work where building consents are not required. This includes some Crown-owned buildings, which the Minister of Defence certifies in writing as required for national security, and other building work, as described in Schedule 1: Exempt Building Work; including the following:

1. Construction of any retaining wall that retains no more than 1.5 metres depth of ground and that does not support any surcharge or any load additional to the load of the ground (for example, the load of vehicles on a road).
2. The construction of any wall (except a retaining wall), fence (except a fence as defined in Section 2 of the Fencing of Swimming Pools Act 1987), or hoarding, in each case of a height not exceeding 2 metres above the ground.
3. The construction of any platform, bridge or the like from which it is not possible for a person to fall more than 1 metre even if it collapses.
4. The construction of any temporary storage stack of goods or materials.
5. Building work in connection with any detached building (except a building that is required to be licensed in terms of the Hazardous Substances and New Organisms Act 1996 or a building closer than its own height to any residential accommodation or to any legal boundary) that:
 - a. houses fixed plant or machinery, the only normal visits to which are intermittent visits for routine inspection and maintenance of that plant or machinery; or
 - b. into which, or into the immediate vicinity of which, people cannot or do not normally go; or
 - c. is only used by people engaged in the construction or maintenance of another building for which a building consent is required; or
 - d. (d) does not exceed one storey and does not exceed 10 square metres in floor area, and does not contain sleeping accommodation or sanitary facilities, or facilities for the storage of potable water.

Before issuing a building consent, the Territorial Authority will require a demolition plan and method statement. The application for a building consent must contain provisions for the protection of the public, including suppression of dust, disposal of debris, disconnection from public utilities, suppression of noise, and use of protective structures and fencing.

Demolition work should not commence until the building consent has been issued by the Territorial Authority. It is important that a complete copy of these documents is kept on site.

The Building Code and Acceptable Solutions

The Building Code is referred to in Part 2 of the Building Act 2004. It prescribes functional requirements for buildings, and the performance criteria with which buildings must comply in their intended use.

Compliance Documents are prepared by the Department of Building and Housing in accordance with Section 22 of the Building Act 2004. A Compliance Document is used to establish compliance with the Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

There are several compliance documents that relate to the demolition industry, including those specified in the following subsections:

Clause F1: Hazardous agents on site

Clause F1.1 of the Building Code is to safeguard people from injury or illness caused by hazardous agents or contaminants on a site.

Clause F1.2 requires that buildings be constructed to avoid the likelihood of people within the building being adversely affected by hazardous agents or

contaminants onsite.

Clause F1.3.1 requires that sites shall be assessed to determine the presence and potential threat of any hazardous agents or contaminants.

Clause F1.3.2 requires the likely effect of any hazardous agent or contaminant on people shall be determined taking account of:

- the intended use of the building;
- the nature, potency or toxicity of the hazardous agent or contaminant; and
- the protection afforded by the building envelope and building systems.

Clause F2: Hazardous building materials

Clause F2.1 of the Building Code is to safeguard people from injury and illness caused by exposure to hazardous building materials (including asbestos).

Clause F2.2 requires building materials which are potentially hazardous shall be used in ways that avoid undue risk to people.

Clause F2.3.2 requires transparent panels to be located in areas such as roofs capable of being mistaken for an unimpeded path of travel shall be marked to make them visible (this does not apply to housing).

Clause F2.3.3 requires that glass or other brittle materials which people are likely to come into contact shall:

- if broken on impact, break in a way which is unlikely to cause injury; or
- resist a reasonable foreseeable impact without breaking; or
- be protected from impact.

Clause F5: Construction and demolition hazards

Clause F5.2 of the Building Code requires that building and demolition work be performed in a manner that avoids the likelihood of:

1. objects falling onto people on or off the site;
2. objects falling on property off the site;
3. other hazards arising on the site, affecting people off the site and other property; and
4. unauthorised access by children to hazards on the site.

Clause F5.3.1 requires that suitable construction methods be used to avoid the likelihood of tools or materials falling onto places where people may be present.

Clause F5.3.2 requires clearly-marked barriers of appropriate height and construction (that are difficult to climb and that only have openings as approved by the Territorial Authority) be provided where construction or demolition work presents a hazard in places where the public has access.

Clause F5.3.3 requires that where a site contains hazards that might attract children, the site be enclosed to restrict access by children.

Clause F5.3.4 requires suitable barriers to provide a safe route for public access where lifting equipment creates a risk from objects falling or where a similar risk occurs. (NOTE | Users of this code should consult the Building Act, Building Regulations or Building Code for the most current requirements.)

Acceptable solutions to meet these requirements are found in Clause F5/AS1.

Compliance Documents can be downloaded from the Department of Building and Housing's website. Refer to [appendix I](#) for details.

Approved Codes of Practice

Approved Codes of Practice are provided for in the Health and Safety in Employment Act 1992. They are statements of preferred work practice or arrangements, and may include procedures that could be taken into account when deciding on the practicable steps to be taken.

Their requirements are not mandatory or enforceable as such, but their observance is accepted in Court as evidence of good practice.

Industry-produced guidelines

Guidelines developed by, or in conjunction with, the Department of Labour and industry may not have undergone a formal approval process similar to Approved Codes of Practice, but are nevertheless an important source of guidance for employers and others on how to meet the Act's requirements.

Standards

Standards are living documents that reflect progress in science, technology and systems. All Standards are periodically reviewed and can be used to ascertain all practicable steps to be taken. A number of Standards are referred to throughout this guideline.

New Zealand and joint Australian/New Zealand Standards can be purchased from Standards New Zealand. Refer to [appendix I](#) for details.

Appendix I - Reference documents

NOTE | Every effort has been made to ensure that the documents, websites and webpages listed in this Appendix were correct at the time of publication. However, please note that documents and website addresses not under the control of the NZDAA or the Department of Labour may change without notice.

Statutes and Regulations

Statutes and regulations can be viewed and downloaded online at www.legislation.govt.nz.

1. Health and Safety in Employment Act 1992
2. Health and Safety in Employment Act Regulations 1995
3. Health and Safety in Employment (Asbestos) Regulations 1998
4. Hazardous Substances and New Organisms Act 1996
5. Building Act 2004
6. Resource Management Act 2001
7. Historic Places Act 1980

Approved Codes of Practice

1. Approved Code of Practice for [Powder-Actuated Hand-Held Fastening Tools](#) (1995)
2. Approved Code of Practice for [Power-Operated Elevating Work Platforms](#) (1995)
3. Approved Code of Practice for [Operator Protective Structures](#) on Self-Propelled Mechanical Mobile Plant (1999)
4. Approved Code of Practice for the [Management of Noise](#) in the Workplace (2002)
5. Approved Code of Practice for [Cranes](#) - includes the Design, Manufacture, Supply, Safe Operation, Maintenance and Inspection of Cranes (2010)

6. HSNOCOP5-1: Approved Handler Certificates: [Explosives](#) (2005) New Zealand Extractive Industries Training Organisation (EXITO), Christchurch.

Compliance Documents and Acceptable Solutions

1. Compliance Document for New Zealand Building Code Clause F1 [Hazardous Agents on Site](#)
2. Compliance Document for New Zealand Building Code Clause F2 [Hazardous Building Materials](#)
3. Compliance Document for New Zealand Building Code Clause F5 [Construction and Demolition Hazards](#)

Guidelines and supporting material

1. New Zealand Guidelines for the Management and Removal of [Asbestos](#) (2011) New Zealand Demolition and Asbestos Association, Auckland.
2. Health and Safety Guidelines on the Clean-up of [Contaminated Sites](#) (1994). Department of Labour, Wellington.
3. Health and Safety Guidelines for the [On-Hire Industry](#) (2003) Department of Labour, Wellington
4. A Guide to [Respiratory Protection](#) (1999) Department of Labour, Wellington
5. Best Practice Guidelines for [Scaffolding](#) in New Zealand (2010), Scaffolding and Rigging New Zealand
6. [Contaminated Land](#) Management Guidelines, Ministry for the Environment
7. New Zealand Electrical Code of Practice for [Electrical Safe Distances](#) NZECP34:2001 Ministry of Consumer Affairs, Wellington
8. Code of Practice for the Safe Management of [PCBs](#) (2008), Ministry of Health, Wellington
9. [Controlled Substance Licence](#) Guide for Applicants for Class 1 Explosives and Pyrotechnics (2011), Environmental Risk Management Authority New Zealand
10. ACC Worksafe for [Construction](#) (2005), Accident Compensation Corporation, Wellington.
11. [Demolition](#) Code of Practice No 14 (1991), Worksafe Victoria, Australia.
12. Information Bulletin SHIB 07-22-2005 Hazards of Inadequately Securing Hydraulic Excavator Buckets when Using [Quick Coupling Devices](#) (2005). Occupational Safety and Health Administration, USA.
13. Construction Industry Standards 29 CFR 1926 - Subpart T - [Demolition](#), Occupational Safety and Health Administration, USA.
14. Health and Safety Guidelines for the Selection and Handling of [Synthetic Mineral Fibres](#) (1994) Department of Labour, Wellington.
15. Health and Safety in [Welding](#) (2006) Department of Labour, Wellington.
16. Guidelines for [Occupational Diving](#) (2004). Department of Labour, Wellington.
17. [Workplace Exposure Standards](#) (2011) Department of Labour, Wellington.
18. [Lead in Blood Suspension Level](#) (2010) Department of Labour, Wellington.
19. Easy Guide - [Demolition](#) (2005) REBRI (Resource Efficiency in the Building and Related Industries).
20. Deconstruction [Waste Plan](#) (2005) REBRI.
21. How to Safely Clean Up [Decomposed Food](#) After the Earthquake (2011) Department of Labour, Wellington.
22. [Recycling Construction and Demolition Wastes](#) - A Guide for Architects and Contractors (2005) The Institution Recycling Network, USA.
23. [Hand-Arm Vibration](#) at Work (webpage) Health and Safety Executive, UK.

Standards

New Zealand (NZ) and joint Australian/New Zealand (AS/NZS) standards are available from Standards New Zealand.

Website | www.standards.co.nz.

Australian standards (AS) are available from Standards Australia.

Website | www.standards.com.au.

British standards (BS) are available from the British Standards Institution.

Website | shop.bsigroup.com/.

1. AS/NZS 1891 (set) Industrial fall-arrest systems and devices
2. NZS 6803:1999 Acoustics - Construction noise
3. AS 2601:2001 Demolition of structures
4. AS 2685:2009 Confined spaces
5. BS 6187:2000 Code of practice for demolition
6. AS/NZS 3012:2010 Electrical Installations - construction and demolition sites
7. AS/NZS 2210.3:2009 Occupational protective footwear - Specification for safety footwear
8. AS/NZS 1801:1997 Occupational protective helmets
9. AS/NZS 1338.1:1992 Filters for eye protectors - filters for protection against radiation generated in welding and allied operations

Unit standards

Unit standards can be accessed and downloaded from the New Zealand Qualifications Authority (NZQA). Website | www.nzqa.govt.nz.

1. 15757: Employ fall-arrest systems on building and construction sites
2. 21152: Store explosives for use in extractive industries
3. 17694: Demonstrate knowledge of explosives and their properties
4. 17697: Design blasting layouts and carry out blasting operations for construction work
5. 15247: Manufacture ANFO explosives
6. 17698: Demonstrate knowledge of blasting layouts for specialist blasting techniques
7. 20645: Describe the requirements of the HSNO Act 1996 relevant to approved handlers
8. 20333: Outline the legal and operational requirements of mining and blasting for an approved handler
9. 9184: Erect Non- Notifiable Pre-Fabricated Scaffolding.