Australian Capital Territory

Work Safety (ACT Code of Practice for Safe Demolition Work) Code of Practice 2010

Disallowable instrument DI 2010 – 228

made under the

Work Safety Act 2008, s 18 (Codes of Practice)

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1 Name of instrument

This instrument is the *Work Safety (ACT Code of Practice for Safe Demolition Work) Code of Practice 2010*

2 Commencement

This instrument commences on 1 October 2010.

3 Approval of a code of practice

Under section 18 of the *Work Safety Act 2008*, having consulted with the ACT Work Safety Council, I approve the ACT Code of Practice for Safe Demolition Work as a code of practice.

Katy Gallagher
Minister for Industrial Relations
3 September 2010

OFFICE OF REGULATORY SERVICES
DEPARTMENT OF JUSTICE & COMMUNITY SAFETY

Safe Demolition Work

CODE OF PRACTICE

October 2010

Contents

1 Introduction

1.1 Title

This is the Safe Demolition Work Code of Practice.

1.2 Authority

This edition is approved as a code of practice, in accordance with section 18 of the *Work Safety Act 2008*, by the Minister for Industrial Relations, as the Minister responsible for the Act, on the recommendation of the ACT Work Safety Council.

1.3 Purpose

This Code of Practice provides practical guidance on achieving the standard of workplace safety required by the *Work Safety Act 2008* (Work Safety Act) with specific reference to the hazards that may be encountered by workers and other persons during demolition work.

An approved code of practice is designed to be used in conjunction with the Work Safety Act and Regulation, but does not have the same legal force. A person or corporation can not be prosecuted for failing to comply with a code of practice. The code should be followed unless there is an alternative course of action that achieves the same or better standard of workplace safety.

An Office of Regulatory Services (ORS), WorkSafe ACT inspector may cite a relevant approved code of practice in a direction, Improvement or Prohibition Notice, indicating the measures that should be taken to remedy a contravention or non compliance with the Work Safety Act or its Regulation.

Any failure to comply with a requirement in an Improvement or Prohibition Notice is an offence.

1.4 Scope

The Safe Demolition Work Code of Practice applies to all premises where demolition of buildings and structures is undertaken.

It should be read in conjunction with *AS 2601: The demolition of structures* and other relevant technical documents.

The Safe Demolition Work Code of Practice does not, however, duplicate specific requirements relating to the use of explosives for demolition in the ACT.

In these cases reference must also be made to the *Dangerous Substances (Explosives) Regulation 2004*. Demolition using explosives may not be undertaken without the prior approval of the ORS. An application for a permit to use explosives must be submitted to ORS, WorkSafe ACT at least 56 days before the intended date of blasting, together with a blast plan as specified in the Regulation. A *Demolition Safety Plan*, as described in part 4 of this Code of Practice, should also be developed and submitted with the application.

It is strongly recommended that if explosives may be used as part of a demolition project this matter should be discussed with WorkSafe ACT in the developmental or planning stages of the project, before lodging a blast plan and *Demolition Safety Plan*.

1.5 Commencement

This Code of Practice commences on the day after notification in the ACT Government Gazette.

1.6 ORS WorkSafe ACT's role and requirements regarding demolition

Unless explosives are used, the approval of WorkSafe ACT is not required for demolition work in the ACT.

However, under the *Building Act 2004* and *Building (General) Regulation 2008,* building certifiers are required to ensure that ORS, WorkSafe ACT has been consulted prior to the commencement of building work that involves the demolition of buildings classified under the Building Code of Australia as Class 2 to Class 9.

WorkSafe ACT inspectors may inspect a demolition site at any time and may examine the *Demolition Safety Plan* developed in accordance with this Code. Failure to develop and follow a *Demolition Safety Plan* may lead an inspector to take enforcement action, requiring measures to remedy an unsafe situation.

If a preliminary assessment of a demolition project indicates a high risk, WorkSafe ACT may audit the demolition project to ensure the persons in control or persons conducting a business or undertaking are meeting their legal responsibilities under the Work Safety Act. Among other things, WorkSafe ACT may require a demolition contractor to obtain the advice of an independent expert.

1.7 Other relevant requirements

Persons who demolish buildings must have a builder's licence issued by the Construction Occupations Registrar within the ACT Planning and Land Authority (ACTPLA) that authorises demolition work.

The demolition of buildings and many kinds of structures require development approval under the *Planning and Development Act 2007* and building approval under the *Building Act 2004* before demolition can begin. Development applications are made to ACTPLA. Building approvals are issued by registered building certifiers who are appointed by the owner as their certifier for each demolition project.

Supporting documentation for the development application and building approval should include a Waste Management Plan addressing the reuse, recycling and safe disposal of demolition material. This plan is assessed by ACT Waste.

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Other agencies or organisations that may have specific requirements in relation to demolition work, and that may need to be notified are:

- Electricity, water, gas, sewerage and telecommunications utility service providers/operators (ActewAGL)
- Emergency services (ambulance, fire and police)
- Roads ACT
- Environment Protection and Water Regulation
- ORS WorkSafe ACT, Dangerous Substances Unit (in relation to the removal of underground fuel storage tanks)

2. Definitions and Interpretations

"**Competent person**" means a person who, through training, qualifications, experience or a combination of these, has acquired the knowledge and skills that are needed for them to correctly and safely perform a specified task.

"**Demolition**" means the complete or partial dismantling of a building or structure. It excludes refurbishment, provided this work does not involve the alteration of existing structural components.

"**Demolition contractor**" means, in relation to any demolition work, the person who directly carries out that work and who is licensed under the *Construction Occupation (Licensing) Act 2004* to carry out such specialist building work under the *Building Act 2004.*

"**Framework**" means a structure constructed of metal, concrete, timber, brick or other rigid materials.

"**Personal protective equipment**" means items of equipment or clothing worn by a worker to minimise or eliminate exposure to specific occupational hazards.

"Person in control" means anyone who has control of the premises, plant or equipment, a system of work, design, import or manufacture; including anyone with authority to make decisions about the management of any of the above.

"**Principal contractor"** means the person who is responsible for the management and control of the site where demolition work is being carried out. The principal contractor may also be the demolition contractor.

"**Special buildings and structures**" means buildings and structures (such as those referred to in Part 7 of this Code of Practice) which, because of the nature of their construction, need to be demolished with particular care. They also include:

- Pre-cast concrete panel and framed structures;
- Stressed skin structures (i.e. buildings that rely on the sheeting, cladding or decking to stiffen and restrain the structural framework);
- Slung structures (i.e. floors) that are in some way suspended from an umbrella type framework, supported from a concrete core; and
- Pre or post-tensioned construction.

3 Responsibilities

3.1 General duties under the *Work Safety Act 2008*

The Work Safety Act establishes general obligations on all persons at a workplace to ensure the health and safety of all persons in the workplace and all other persons who may be affected by the work. However, specific work safety duties are detailed for:

- a person conducting a business or undertaking (e.g. employer, self employed person, subcontractor, franchisor);
- a person in control of the premises;
- a person in control of plant or system;
- a person in control of design;
- a person in control of manufacture;
- a person in control of import and supply; and
- a worker.

3.2 The owner of the building or structure

The owner of the building or structure should:

- Define the extent of the work.
- Ensure the principal contractor has all available descriptions of the building or structure to be demolished. This includes drawings, site surveys, plans of services and information on the nature and location of hazardous materials, the nature of building materials and the building or structure's relationship to surrounding properties.
- Inform the principal contractor of the location and condition of all underground tanks, vaults, wells, voids and structures.
- Secure the site and provide health and safety controls until the principal contractor takes possession.

If no principal contractor is appointed, the owner also has the responsibilities of the principal contractor set out in 3.3 below.

The owner may appoint an agent (such as a project manager or project director) to manage the owner's responsibilities.

3.3 The principal contractor

The principal contractor should:

- Ensure the demolition contractor has all available descriptions of the building or structure to be demolished, including drawings, site surveys, plans of services and information on the nature and location of hazardous materials (Hazardous Substances Report), the nature of building materials and the building or structure's relationship to surrounding properties.
- Ensure all relevant authorities and utility service providers are notified and all necessary approvals are obtained before work commences.

- Notify the owners of adjoining properties of the proposed demolition work.
- Where appropriate, ensure buildings are inspected and any existing defects recorded.
- Ascertain the location of all utility services.
- Verify the location and condition of all underground tanks, vaults, wells, voids and structures, and ensure that any chemicals, volatile fuels and gases contained in them are completely removed.
- Ensure the workplace is secured.
- Ensure that a *Demolition Safety Plan* (as described in part 5 of this Code of Practice) is in place.

3.4 The demolition contractor

The demolition contractor should:

- Erect signage displaying the name and contact details of the principal contractor.
- In consultation with the principal contractor and a structural engineer, develop a *Demolition Safety Plan* for the proposed demolition work including the method or methods of demolition (see part 5 of this Code).
- Inform the owner, the principal contractor and any other relevant parties of the method or methods of demolition selected and the equipment to be used.
- Obtain all necessary work permits and authorisations and provide all necessary notifications concerning the work.
- Nominate a person to supervise the work at all times and implement the *Demolition Safety Plan*. This person must be competent in the type of demolition work needed for the particular project and experienced in the implementation of safe work procedures.
- Ensure an inspection of adjacent properties is undertaken when necessary, and any change in the condition of adjacent properties during the demolition work is reported to the relevant parties.
- Erect all appropriate fencing and overhead protection barriers for the protection of the public and workers at the workplace.
- Ensure workers are consulted and provided with all the information, instructions, training and supervision they need to perform their work safely.
- Provide a designated and identified evacuation plan and assembly point.
- Maintain the security of the site.
- Arrange for the recycling of building waste wherever possible and the disposal of all other refuse and debris.
- Provide appropriate amenities for workers.
- Provide appropriate first aid and emergency services

3.5 Workers

Workers should:

- Carry out their work in accordance with the *Demolition Safety Plan*.
- Report identified hazards and risks in accordance with the process outlined in the *Demolition Safety Plan*.
- Use equipment in accordance with the instruction and training provided.

4. Consultation at the workplace

4.1 Consultation

Persons in control and persons conducting a relevant business or undertaking should consult with workers, the worker consultation unit (if applicable) and work safety representatives working on the demolition project. The principal contractor is responsible for ensuring there is adequate consultation between all parties at the workplace.

The procedures adopted should allow adequate time for workers and their representatives to consider the implications of the information provided and discuss issues with the demolition contractor *before* decisions are made on matters affecting health and safety.

Consultation may take the form of team briefings or "tool box talks".

Consultation should occur at the planning stage of any work as part of the risk management process, and before any subsequent changes to the workplace which might affect health and safety.

The outcome of the consultative process should be documented.

4.2 Multilingual workplaces

The demolition contractor should establish ways of including non-English speaking workers in the consultation process.

The following methods may be used for consulting effectively:

- Organise consultation in groups which share the same language.
- Use interpreters if necessary.
- Use audio/visual aids in appropriate languages.
- When speaking English, keep it simple, and use complete sentences.
- Provide only the essential points.
- Demonstrate the point, if possible.
- Check for understanding.

5 Development of the *Demolition Safety Plan*

5.1 The context

Before the commencement of any demolition work, the site and the building or structure to be demolished must be investigated in accordance with *AS 2601: The Demolition of Structures*.

On the basis of this investigation, a *Work Plan* must then be prepared as set out in *AS 2601*, describing the demolition site and the proposed demolition methods and work processes.

The preparation of a *Work Plan* is a prescribed requirement, under the *Building (General) Regulation 2008*, for all applications for building approvals involving demolition. In other words, the building certifier must ensure a demolition *Work Plan* has been developed in accordance with *AS 2601* before he or she issues a building approval.

One of the most important factors to take account of in the planning stage is the location of all utility services. All electric, gas, water, sewer and other service lines not required in the demolition process should be shut off, capped or otherwise controlled, at or outside the building line, before demolition work starts. In each case, the relevant utility service provider should be notified in advance, and its approval or services gained if necessary.

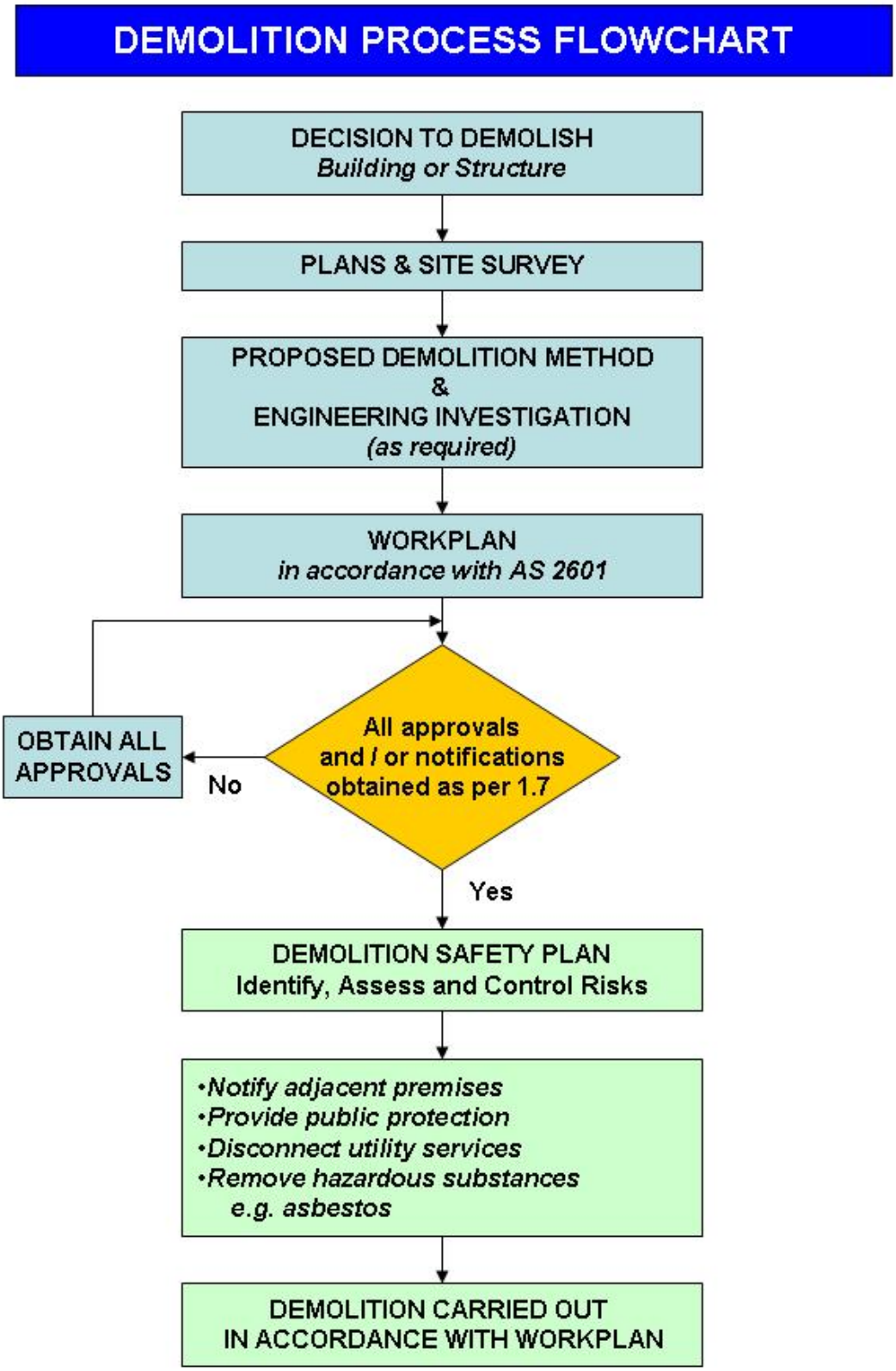
Once the *Work Plan* is completed, a safe system of work should be devised, in conjunction with the principal contractor, the demolition contractor and the structural engineer. The safe system of work should be documented by the demolition contractor in a *Demolition Safety Plan*.

No demolition activity should commence until this *Demolition Safety Plan* is completed.

The *Demolition Safety Plan* should include a copy of the *Work Plan* and should specifically address:

- The processes and outcomes of the risk management process described in 5.2 below.
- The Engineering Investigation Report described in 5.3 below.
- The induction and other training to be provided to workers (see 5.4 below).
- Emergency procedures (see 5.5 below).

The *Demolition Safety Plan* should be kept onsite and made available to all workers. A copy should be given to the work safety representative.


DEMOLITION PROCESS FLOWCHART
DECISION TO DEMOLISH
Building or Structure
PLANS & SITE SURVEY
PROPOSED DEMOLITION METHOD
&
ENGINEERING INVESTIGATION
(as required)
WORKPLAN
in accordance with AS 2601
All approvals
and / or notifications
obtained as per 1.7
No
OBTAIN ALL
APPROVALS
Yes
DEMOLITION SAFETY PLAN
Identify, Assess and Control Risks
•Notify adjacent premises
•Provide public protection
•Disconnect utility services
•Remove hazardous substances
e.g. asbestos
DEMOLITION CARRIED OUT
IN ACCORDANCE WITH WORKPLAN

5.2 Risk management process

"Risk management" is a planned, systematic approach to managing work.

The steps in the risk management process are S.A.F.E:

- See it - Identify the hazards associated with the proposed demolition work.
- Assess it - Assess the potential risks to workers and other persons affected by the work.
- Fix it - Determine and implement control measures to eliminate or reduce the risks.
- Evaluate it - Monitor and review the implementation and effectiveness of the control measures.

This process should be documented as part of the *Demolition Safety Plan*.

Hazard identification

The hazards identified should include those which exist at the workplace before work begins (e.g. a site contaminated by hazardous substances) as well as those which could arise from the plant, equipment, materials and work processes that will be used during the demolition.

Methods of identifying hazards include:

- Inspections of the demolition site and structure, plant and equipment, and direct observation of work processes.
- Consultation with workers, who are usually aware of what can go wrong and why, based on their experience with a job.
- Consultation with specialist practitioners and representatives of industry associations, unions and government bodies, for advice and information on health and safety matters relevant to demolition work.
- Analysis of workplace injury and incident records on demolition and construction sites, to identify where and how injuries have previously occurred.

Risk assessment

Once the hazards have been identified, they should be assessed in terms of their potential to cause injury or illness to anyone at or near the demolition site.

The factors to consider are:

- The *likelihood* that somebody will be injured or illness will occur, and
- The *severity* of the injury or illness that might result.

In other words, the level of risk to health and safety increases both with the severity of the hazard, and with the duration and frequency of exposure to the hazard.

Exposure to hazards may involve hazardous plant, such as moving machinery, and/or hazardous substances, such as asbestos.

Factors to consider when assessing the likelihood and severity of a hazard include:

- The number of people and their movements on the site.
- The layout of the workplace, including the locations of access routes and site sheds.
- The extent and type of work to be carried out.
- The scheduling of the work.
- The training, skills and experience of workers.

Risk control measures

The best way to control a hazard is to remove it. If this is not practicable, the risk should be reduced as much as possible by applying the other approaches in the *hierarchy of controls* listed below.

Control measures near the top of this hierarchy (e.g. elimination) are more effective than those near the bottom, and should therefore be adopted wherever practicable. Control measures near the bottom of the hierarchy (e.g. administrative controls) are more difficult to maintain, and should be regarded only as interim measures until more permanent controls can be implemented.

If elimination of a risk is not possible, the demolition contractor should assess whether the next preferred control measure in the hierarchy (substitution) can be achieved, and so on (through isolation, engineering controls, etc) until the highest-ranking practicable control measure which can be achieved has been identified.

The control measures in the hierarchy of controls are not mutually exclusive. In many cases, it will be appropriate to implement a *combination* of control measures to reduce exposure as much as possible.

The Hierarchy of Controls

Elimination

This control completely removes the hazard and is the ideal solution. For example, the risk of electric shock from contacting exposed wires in a building is eliminated when the power source is disconnected.

Substitution

This is where a hazard is replaced by a less hazardous alternative (e.g. replacing hand held jack-hammers with excavators).

Isolation

This involves separating the hazard from people, either by using physical barriers to contain or enclose the hazard or by a separation in distance or time. An example is the use of enclosed cabins on machinery to isolate the operator from falling material, noise and dust.

Engineering controls

These controls reduce the chance of hazardous contact (e.g. fitting water sprays to jack-hammers to control dust).

Administrative controls

If a health and safety risk still remains, administrative control should be used. This involves using work practices which reduce the risk by limiting the exposure of workers to the hazard. This could involve rotating workers on tasks that are repetitive and strenuous, such as jack-hammering to knock down walls.

Personal protective equipment

Personal protective equipment (PPE) is categorised by the area of the body it protects, and includes protection for the head, eyes, ears, hands, feet and respiratory system. It also includes fall protection devices.

PPE should be relied upon only where other measures fail to eliminate the risk.

It is often difficult to fully protect workers with personal protective equipment, because they may need to wear several items which affect comfort and restrict performance.

But even though workers may be reluctant to wear PPE, it should be available for use at all times.

Where protective equipment is used, the demolition contractor should ensure that:

- PPE is selected to suit the task and the wearer.
- PPE complies with the relevant Australian Standards.
- PPE is readily available, clean and in fully operational condition.
- Workers are trained in the use of PPE, including its selection and maintenance.
- Workers wear the PPE as intended.
- The risk of secondary injury from PPE, such as skin rash or heat stress caused by unsuitable clothing and hot conditions, has been assessed.

Review of controls

Whenever new hazards are identified or work practices change during demolition work, a review should be undertaken to ensure that the nominated control measures remain effective.

5.3 Engineering Investigation Report

An engineering investigation should be carried out, and an *Engineering Investigation Report* prepared and included in the *Demolition Safety Plan* before any demolition commences if:

- plant is to be used on suspended floors;
- there is any doubt about the design or integrity of the structural arrangements;
- the structure has been damaged or weakened by deterioration, fire, explosion or other causes; or
- the demolition project involves a "special building or structure", as defined in 2, such as those discussed in part 8 of this Code of Practice.

The investigation should be carried out by a qualified structural engineer experienced in design and construction. Where appropriate, they should be experienced in the demolition processes and should be registered in the relevant area of practise on the National Professional Engineers Register.

The engineer should investigate the structure by whatever means are necessary and determine as accurately as possible:

- The type of structural system involved.
- "As-constructed" details of the component members.
- The current load-carrying capacity of the structure.
- The likelihood that the proposed methods and sequence of demolition can be executed without causing an accidental collapse of the whole, or part of, the structure.
- Any other details of the structure's strength, construction or contents which might influence the selection of demolition procedures.

A search should be made for engineering details specifying the size, type and configuration of reinforcement and the strength of materials, and the located documents should be referenced.

Floor penetrations and any structural irregularities also need to be located and identified.

To eliminate any uncertainty regarding the composition or quality of structural components, it may be necessary to use one or more of the following methods:

- Core drilling;
- Electronic reinforcement location; and/or
- Exposure of reinforcement.

These investigation techniques should be performed under the direction of the structural engineer, and any resulting loss of strength should be taken into account when ascertaining structural adequacy.

In assessing the current load-carrying capacity of structural members, the structural engineer should take account of:

- The strength and loading requirements of relevant Regulations and Standards relating to the members, both those applying at the time of construction and those applying at the time of demolition.
- Any degradation of the structure materials.
- The capacity of the structure, as a whole or in part, to sustain loads without:
  - premature collapse of any part of the structure, or
  - deformation leading to static instability of the structure or any part of the structure.

In addition to normal ultimate load factors such as the weight of the demolition machines and the weight of the falling debris, the structural engineer should allow an adequate impact factor for impacts and vibrations during demolition work.

The demolition contractor should give every assistance to the structural engineer in the investigation. In particular, when requested, the demolition contractor should provide any cores, load tests, chases or documentation necessary to verify the load-carrying capacity of the structure and the safety of the demolition contractor's proposals.

If propping is to be used to distribute loadings to lower floors, the specified ratings supplied by the prop manufacturer must not be exceeded. Details of the placement of props should be specified by the structural engineer.

5.4 Induction and training

The demolition contractor should identify the training needs and requirements of all personnel and incorporate the training program in the *Demolition Safety Plan*.

The detail and extent of the training program will depend on the hazards and risks associated with the demolition work. Appropriate induction training should be provided for new personnel, including casual workers, and whenever a worker is assigned to a new task or new work area. Training may also be necessary to enable the operators of industrial equipment to meet statutory qualification requirements (Certificates of Competency and/or High Risk Licences).

Training can be formal or on-the-job. It should take into account literacy levels, work experience and specific skills required for the job. Trainees must be adequately supervised until they are competent to perform the work safely.

The demolition contractor should maintain records of the training programs and the competencies attained by individual workers.

5.5 Emergency procedures

Before work commences, the demolition contractor should provide for first aid requirements and prompt medical attention in the case of serious injury. See the First Aid Code of Practice for further information. These emergency procedures should be documented in the *Demolition Safety Plan*.

Contact numbers for emergency services should be prominently displayed. Evacuation procedures should be established and communicated to all workers.

A reliable and effective means of communication should be established between all areas of work and the demolition supervisor, to permit and ensure effective evacuation of danger areas.

Rescue procedures need to be planned where workers are required to:

- work at heights, using individual fall arrest systems; or
- enter confined spaces.

6 Major hazards and controls in demolition work

6.1 Protection of the public

Throughout the demolition project adequate safety should be maintained in public places adjoining the site. Control measures to protect the public include street closures, hoardings, scaffolding and other types of overhead protection, used either singly or in combination.

Where demolition sites adjoin public places and there is a danger of falling debris, the preferred method of protection is heavy-duty perimeter scaffolding (see 6.2.1 below) and heavy-duty coverways or gantries (see 6.1.3 below).

If different methods are used, they should provide protection at least as effective as the preferred method and should be:

- erected before the commencement of demolition work, and
- kept in position at all times during the progress of the work.

6.1.1 Prevention of unauthorised entry

Sufficient hoardings, fencing, barricades and gates should be erected to prevent accidental or unauthorised entry to demolition sites.

Hoardings should be at least 2.4 metres high and should be closely timbered, covered or sheathed.

Perimeter fencing should fully enclose the site and should be:

- Constructed from chain mesh or mesh panels with a minimum wire diameter of 2 mm;
- At least 2 metres high; and
- Properly secured to withstand reasonable impacts and remain upright.

Access openings in the hoarding or fence should have doors or gates which can be locked to prevent unauthorised entry after hours. Doors and gates should not be able to open outwards into public areas.

Potential entry points to the demolition work area should be signposted or labelled in accordance with *AS 1319: Safety Signs for the Occupational Environment*.

Weatherproof safety warning signs, constructed of light-weight material, bearing the words:

DANGER
Demolition Work in Progress

and, where appropriate:

All persons entering site must
report to the site office

should be adequately secured in positions where they are clearly visible to persons approaching the site. Clear direction signs should be erected to indicate the route to the site office.

6.1.2 Site security

When the site is unattended all access to the site should be locked. All cranes, earthmoving machinery and plant should be locked, with keys removed, to prevent

unauthorised use. Oxy-acetylene (Oxy) cutting gear and power tools should be stored in a ventilated, locked room or container.

The building or structure should always be left in a safe and stable condition. Any loose demolition material, such as roof sheets, should be secured in case of strong winds.

6.1.3 Heavy duty coverways or gantries

Overhead protection should be provided for public walkways and for access ways for site personnel, in conjunction with perimeter scaffolding. Coverways can be constructed from scaffolding, fabricated steel or timber and should be designed to withstand a loading of at least 5 kilopascals (kPa).

Demolished or other materials must not be allowed to accumulate on the overhead structure.

6.2 Working at heights

Persons working at heights may be exposed to a risk of falling if the work is not being carried out safely from a "solid construction" surface that is:

- structurally capable of supporting people and materials;
- protected from open penetrations;
- protected at its perimeter and internally to prevent falls to lower levels;
- level and easily negotiable, and
- provided with a safe means of access and egress.

Where persons are either performing work or accessing a work area may fall from a height of less than 2 metres a risk assessment approach must be taken to identifying fall hazards, assessing and controlling the risks. If a person may fall from a height greater than 2 metres a risk assessment must be conducted with a Safe Work Method Statement developed outlining the control measures to be used.

Unless the outcome of the risk assessment establishes an alternative safe work practice, fall protection should be provided for all persons in accordance with the National Code of Practice for the Prevention of Falls in General Construction. Controls should be implemented, wherever practicable, to ensure that all persons work from solid construction.

The demolition contractor should ensure that safe work platforms are used wherever work cannot be performed safely from the ground or from solid construction. Safe work platforms include scaffolding, scissor lifts and elevating work platforms.

6.2.1 Scaffolding for demolition work

The primary functions of scaffolding on a demolition project are to:

- protect the public and workers by containing demolished materials;
- provide working platforms and edge protection for workers; and
- protect adjacent property.

Scaffolding should not be less than heavy-duty classification, unless the demolition contractor can demonstrate that a lighter duty scaffolding is more appropriate for the nature of the work.

Scaffolding should be designed for the most adverse combination of dead loads, live loads (including impact loads) and environmental loads (wind and rain). Some of the factors which may affect scaffolding stability on a demolition project are:

- Wind forces acting on containment sheeting on the scaffold face.
- Water retention in containment sheeting because of rain.
- Progressive removal of building elements, affecting the lateral stability of the upper part of the scaffold.
- Progressive removal of ties and dismantling of the scaffold.

Scaffolding should be designed, erected and used in accordance with *AS/NZS 1576: Scaffolding* and *AS/NZS 4576: Guidelines for Scaffolding*.

Only holders of a Certificate of Competency or a high-risk licence in scaffolding should erect scaffolds used in demolition, irrespective of the height of the scaffold.

Scaffolding should be based on solid foundations. Safe access should be provided. Scaffolding planks and components that are damaged by falling debris should be removed and replaced. Working platforms should be kept clear of debris.

The external faces and ends of the scaffolding should be enclosed for the full height with steel wire mesh and heavy duty, fire-resistant shade cloth, firmly secured and arranged to contain rebounding materials and debris. If this containment sheeting could deflect material onto the scaffold, thus potentially overloading the scaffold, it should be installed on the internal face of the scaffold instead.

Where demolition work is being carried out from the scaffold, ply sheets should be fixed from the working platform to the guardrail.

Scaffolding should be dismantled progressively as the structure is demolished, and should never be free-standing more than 4 metres above the last row of ties securing it to the building or structure. The vertical spacing of scaffold ties may have to be reduced to facilitate the demolition cycle.

Care should be taken to prevent damage to scaffolding from site vehicles and earth-moving machinery.

6.2.2 **Ladders**

Portable ladders should primarily be used only to gain temporary access or to perform short-duration tasks. They should only be used for light work where hand hold and stability can be maintained, and only if it is not practicable to use other temporary work platforms such as trestles, scaffolds and elevated work platforms.

When working on a ladder make sure that:

- It is an industrial grade ladder with a minimum load rating of 120kg. Do not use domestic grade ladders.
- It is on a firm, stable footing secured at the top and bottom, placed at a slope of 4 (vertical) to 1 (horizontal).
- Only one person works from a ladder at a time, and they should never do so over an occupied work area or pedestrian corridor.
- Both hands are always used to ascend and descend.
- All work is done facing the ladder, using tools that are easily operated with one hand.
- Both feet rest on the ladder and are no higher than the third tread from the top plate of a step ladder, or 900mm from the top of a single or extension ladder.
- Three limbs are on the ladder where practicable and tool belts are used to keep hands free.
- Overreaching is to be avoided (i.e. the belt buckle should always be within the stiles of the ladder).

Ladders should also not be used:

- For oxy cutting or hot work (e.g. welding), where vision is restricted, or work involving the use of power tools.
- On elevated floor levels near the perimeter of the building, or near lift shafts or stairwells where there is a danger of a person falling.
- On scaffolding or elevating work platforms to gain extra height.
- In locations where there is a danger of crane-lifted loads or falling debris striking a person on the ladder.
- In access areas, walkways, traffic ways or within the arc of swinging doors.
- In very windy or wet conditions.
- Near an exposed edge or guardrail where, if the ladder toppled, a person could fall over that edge.
- Where it is possible for the ladder or user to come into contact with electrical power lines; in particular, metal or metal reinforced ladders should not be used in the vicinity of live electrical equipment. Such ladders should be permanently markers with “do not use where electrical hazards exist”.

6.2.3 **Elevating work platforms**

Elevating work platforms should be used only on a solid, level surface. The surface area should be checked before use to ensure there are no penetrations or obstructions that could cause uncontrolled movement or overturning of the platform.

Elevating work platforms should not be used in areas where debris may fall on them.

Oxy cylinders should not be carried on boom-type elevating work platforms, because of the dangers of fire. When oxy cutting is being performed from elevating work platforms, care should be taken to ensure that hot slag does not drop onto cutting hoses or cylinders, onto any part of the elevating work platform vehicle or onto people below.

When oxy cylinders are used in scissor lifts, the bottles should be secured in the upright position at the opposite end from the platform controls. A fire extinguisher should be in the scissor lift at all times during cutting.

Persons should never enter or leave a platform while it is elevated. Safety harnesses must be worn, and these should be secured to a stable point when a person is working in boom lifts and cherry pickers. All persons using elevating work platforms should be trained in their use.

More information on the safe use of mobile elevating work platforms can be found in *AS 2550.10:2006: Cranes, Hoists and Winches – Safe use – Elevating work platforms*.

6.2.4 Personnel boxes

The use of a workbox shall be limited to those situations where it is necessary to elevate personnel to perform special tasks of short duration and where it has been substantiated to be impractical to use scaffold or other plant that provides temporary access, such as an elevating work platform. The workbox is not to be used as a means of access to and egress from a workplace instead of a properly designed system, unless a documented risk analysis shows that this is safer than all other alternative means, and the structural adequacy of the landing area has been established. In such circumstances, a safe work procedure must be developed for the operation.

There are requirements for the use of personnel workboxes detailed in the *Scaffolding and Lifts Regulation 1950, AS 2550.1, AS 1418.17* and the *National Standard for Plant* that should be considered in assessing the operation of a workbox.

If it is necessary to use a personnel workbox attached to a crane to reach areas which are difficult to access:

- The box should comply with *AS 1418.17:1996 – Cranes (including hoists and winches) – Design and construction of workboxes.*
- The crane driver must have at least 12 months experience in driving the crane or an identical crane.
- The form "application to work whilst suspended from a crane" must be completed and submitted to ORS, WorkSafe ACT and approval obtained prior to commencing work, as required under the *Scaffolding and Lifts Regulation 1950*.
- It must not be possible to operate the free fall facility in the hoist motion of the crane when the crane is supporting persons.
- The crane driver must remain in the control cabin at all times when the box is raised.

- The crane must be set upon firm, level ground.
- Cranes other than crawlers should be blocked at all times when using a personnel box.
- A clearance of at least 3 metres and up to 8 metres must be maintained between the crane structure, hoist rope, slings and box and any live electrical conductors.
- A dogman holding a certificate of competency or high-risk licence must be in the box at all times it is being used.
- Oxy cutting bottles should not be carried in the personnel box.
- Persons using a personnel box should be attached by safety harness to the hook of the crane.
- Persons should only enter or leave the personnel box from the ground or solid construction.

6.2.5 **Fall protection devices**

Personal fall protection systems use equipment that secures a person to a building or structure. They include lanyard/anchorage combinations, inertia reels, static lines and industrial rope access systems.

Like other forms of personal protective equipment, they should only be used where it is not practicable to use safer alternatives such as scaffolding, perimeter guardrails or elevating work platforms.

If no safer methods of fall protection can be used, personal fall protection systems should be designed to either:

- prevent a person reaching an unprotected edge or opening (travel restraint devices), or
- minimise the risk of injury after a person has fallen from a height (fall arrest systems and safety nets).

The use of personal fall protection systems requires a high level of training and supervision of workers to ensure the equipment is worn and used correctly. The equipment must be designed, used and maintained in accordance with relevant Australian Standards and manufacturer's instructions.

Safety nets can provide a satisfactory means of protection against injury from falling while allowing workers maximum flexibility of movement. They should be constructed in accordance with the British Standard *BS 3813: Specification for Safety Nets* and should be installed by a competent person.

The nets should:

- be hung as close as possible to the underside of the work area, and no more than 2 metres below it; and
- have sufficient tension and clearance to prevent a falling person contacting a surface or structure below the net.

For guidance on the use and maintenance of safety nets, refer to the British Standards Institution Code of Practice *CP 93: The use of Safety Nets on Construction Works.*

Guardrails are an effective form of edge protection. They should be erected by a certified scaffolder and constructed in accordance with *AS 1576: Scaffolding* and *AS 1657: Fixed platforms, walkways, stairways and ladders – Design, construction and installation.*

A risk assessment should be conducted to determine the anticipated loads on the guardrail system, taking account of factors such as:

- The force applied by a falling person
- The pitch of the surface (e.g. on a roof), and
- The length of the rafter to which the guardrail is attached.

Guardrails at the perimeter of the building or around openings in the roof should be at least 900 mm above the working surface and should incorporate a top rail, a mid-rail and a toeboard.

6.3 Protection of openings and penetrations

All penetrations in floors, roofs or any other place where work may be carried out should be protected either by covering them with rigid and fixed material of sufficient strength to prevent any persons or debris falling through, or by installing guardrails and toe boards around the opening.

The open sides of all floors, roofs, stairwells, lightwells, lift shafts and any place from which a person could fall should be provided with guardrails and toe boards, or should be securely boarded up.

6.4 Roof work

The demolition of a roof which consists of asbestos cement or other fragile or brittle material should be performed from suitable work platforms such as boom lifts and scissor lifts where possible, or by the use of a suitable fall arrest system.

If asbestos cement roofing is involved, the work should also be undertaken by licensed asbestos removalists in accordance with the *National Code of Practice for the Safe Removal of Asbestos* and *National Code of Practice for the Management and Control of Asbestos in Workplaces*, as approved in the ACT.

Metal roofs should be carefully inspected for soundness. If not sound, they should be treated as fragile roofs.

Protection should be provided for all persons working on roofs where there is a danger of their falling, including falls:

- through the roofing material;
- from the edge of the roof;
- where roofing has been removed;
- through skylights or penetrations; and
- while accessing the roof.

The methods of protection available include scaffolding, guardrails combined with safety mesh, purpose-built purlin platforms or trolleys, purpose-built roof ladders, safety nets, catch platforms and individual fall arrest systems (see 6.2 above).

6.5 Workplace access

All access to and egress from the site and its amenities and work areas should be clearly marked, well lit and protected from falling objects or material.

Site offices and all amenities should also be located in areas protected from falling debris, and should not be in any area that might be affected by a premature collapse of any part of the building or structure. The level of protection should be no less than that afforded to public places.

6.5.1 Access and egress on structures with two or more levels

Where practicable at least two accesses should be maintained to the work area, in order to provide an alternative escape route if an emergency cuts off the primary access.

If the stairs of the building or structure being demolished are used to access work areas, these stairs, together with any landings and stair railings, should be kept in place and in a safe condition, free from debris or other material.

If safe access cannot be provided by existing stairs and floors, alternative access should be provided by access towers, scaffolding or ladders.

6.6 Structural integrity

6.6.1 Danger of collapse

The building or structure being demolished and all its components should be maintained in a safe and stable condition. Temporary braces, shoring or guys can be added for stability.

Precautions should be taken to ensure that sudden weather changes do not affect the stability of the structure. Poorly braced structures can be blown over and loose debris can become airborne.

Debris should not be allowed to accumulate or fall onto floors to such an extent that a collapse might be caused.

Debris should also not be allowed to accumulate against walls to the extent that adverse lateral loads are imposed.

If any part of any building or structure (including an undemolished part) becomes unstable and there is a danger that it might collapse, all practicable precautions must be taken to prevent persons from being injured by such a collapse.

Further, if there is any risk of injury to persons in an area not under the control of the demolition contractor, the Police must immediately be informed of the danger.

6.6.2 Adjoining buildings

No part of the demolition process should adversely affect the structural integrity of any other building.

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

Lateral support for adjoining structures should be equal to or greater than that provided by the structure to be demolished. Provision should be made for the erection of shoring before the existing lateral support is disturbed.

The layout of the shoring should be designed to enable any new building to be constructed with the least possible interference. The shoring should be checked for effectiveness as the demolition proceeds.

Care should be taken to ensure that other buildings are not adversely affected by vibration or concussion during the demolition process.

Special precautions may need to be taken in the vicinity of hospitals and other buildings containing equipment sensitive to shock and vibration.

No part of the demolition process should cause flooding or water penetration of any adjoining building.

6.6.3 **Removal of debris**

Debris should be progressively removed from the site to prevent any build up of debris which could effect the integrity of a floor of the building or structure, effect site access and egress, become a fire hazard or cause a health hazard.

Demolished materials should not be allowed to fall freely outside the structure unless they are confined within a chute or similar enclosure.

Similarly, demolished materials should not be allowed to fall freely within a structure unless they are confined within a shaft or similar enclosure which is clear of obstructions.

Debris dropping zones should be clearly identified. Any area where there is a danger that persons might be injured by falling or rebounding debris should be fenced or barricaded to prevent entry.

If demolished materials are allowed to fall through internal floor openings in multi-storey buildings, such as lift shafts, the following should apply:

- At the working level, each opening should be protected by an adequate vehicle buffer during the removal of debris by machinery, and guarded by suitable barriers at all other times. Vehicle buffers should be high enough to prevent the machine from riding over them and solid enough to stop a fully loaded machine.
- At all levels below the working level, access to the area through or onto which material is falling should be prevented either by sealing off the opening with planking at least 50 mm thick from floor to ceiling, or by erecting signs and barricades preventing persons from coming within 6 metres of the openings.
- Debris should not be allowed to accumulate higher than the bottom opening of the shaft. The walls of the shaft should be regularly inspected to prevent damage and expansion of the area because of the compression of debris within the shaft.

Large items of demolition debris which would be dangerous to drop down a shaft, through an opening or over the side of the building should be cut into smaller sizes or lowered to the ground in a controlled manner (e.g. using cranes, hoists or conveyors).

Debris chutes should be designed and constructed to prevent the spillage of material and dust while debris is passing through the chute.

Vertical chutes should be fully enclosed with a cover or barrier at the top to prevent a person falling into the chute.

Debris chutes should be adequately secured to the building or structure.

A safe system of work should be implemented to prevent the chute being used when bins and hoppers are being removed or exchanged. Signs warning of the danger from falling or ejected material should be placed at the discharge end of every chute.

Care should be taken to ensure that debris falls freely and does not become jammed in shafts or chutes. Overhead demolition should cease during removal of the debris.

Debris containing hazardous substances

Debris containing asbestos, other hazardous substances or contaminated material should be:

- Kept separate from other debris.
- Wrapped in plastic, or otherwise contained, and clearly labelled.
- Removed from the site as soon as possible by the appropriate disposal authority.

6.6.4 Fire prevention

No person may light a fire, or allow another person to light a fire, on a demolition site.

The deliberate burning of buildings *must not* be used as a method of demolition.

A fire hydrant service or a fire hose reel service should be maintained to each level at all times during the demolition of a building. Access to the fire protection service, including any booster fitting, should also be maintained.

If a sprinkler system is installed in the building being demolished, it should be maintained in an operable condition on each storey as long as possible.

If the existing fire protection service is supplied by water storage tanks that are not available during demolition, a free main or dry riser and associated hydrants will need to be installed and dismantled progressively ahead of the demolition.

Portable fire extinguishers should be kept in working areas at all times and maintained in an operable condition.

The site should be checked at the end of each workday to ensure no smouldering material is left that could start a fire. Many modern synthetic building materials can smoulder for long periods before bursting into flames.

6.7 Hazardous substances

Demolition work frequently includes the cleaning up of sites or structures that contain hazardous substances.

The risks arising from potential exposure to hazardous substances should be identified, assessed and controlled in accordance with the *National Model Regulations* and *Code of Practice for the Control of Workplace Hazardous Substances* [NOHSC: 2007 (1994)].

Before starting any demolition work, all areas of the site, including basements, cellars, vaults and rubbish dumps, should be examined to determine whether:

- There are any items which could be a fire and explosion risk.
- Any previous use of the site might cause a risk because of the nature and/or decomposition of materials.
- There are any toxic, radioactive or other hazardous materials.

Any hazardous substances should be clearly identified so that adequate precautions can be taken to ensure the health and safety of everyone on or near the site. If the nature of the substance cannot be easily and reliably determined, samples should be taken and analysed by a qualified person. Some hazards will need to be removed and disposed of before demolition work begins.

All site personnel must be informed of the presence of hazardous substances, as well as the measures for controlling exposure and safe disposal. Material Safety Data Sheets (MSDS) for hazardous substances should be readily available for reference.

6.7.1 Dust control

The techniques adopted for stripping out and demolition should minimise the release of dust into the atmosphere.

Under certain conditions there may be a risk of spontaneous combustion of deposits of combustible dusts on beams, machinery and other surfaces.

Before commencing the stripping out or demolition of an area of the structure, any existing accumulations of dust in the area should be watered down or collected, placed in suitable containers and removed.

The selection of an appropriate collection technique, such as vacuuming or hosing down, should take due account of the nature of the dust and the type of hazard it presents (explosive, respiratory, etc).

Dust generated by stripping or the breaking of building materials into smaller pieces should be left damp until it is removed from the site or can be otherwise contained. The use of excess water for this purpose should be avoided.

6.7.2 Synthetic mineral fibres

Synthetic mineral fibres are used extensively for insulation. Personal protective equipment should be worn when they are being removed during the stripping out process and dust should be suppressed by damping down. Removal and handling should be carried out in accordance with the *Dangerous Substances Act 2004, Dangerous Substances (General) Regulation 2004, National Standard for Synthetic Mineral Fibres* [NOHSC: 1004 (1990)] and the *National Code of Practice for the Safe use of Synthetic Mineral Fibres* [NOHSC: 2006 (1990)].

6.7.3 Asbestos

If loose asbestos is found in the Hazardous Substance Report (as required in section 3.3), the area should be isolated and the asbestos removed in accordance with the *National Code of Practice for the Safe Removal of Asbestos* [NOHSC: 2002 (2005)] and *National Code of Practice for the Management and Control of Asbestos in Workplaces* [NOHSC: 2018 (2005)]. Removal of loose asbestos from a building must be carried out by the holder of an appropriate Asbestos Removalist licence and requires approval from a building certifier for the method of removal. The removal of the asbestos should be completed before demolition work begins in the affected area.

If loose asbestos is found after the original clearance, work is to cease and an appropriate Asbestos Assessor must re-inspect the site and establish a new Asbestos Removal Plan in accordance with the *National Code of Practice for the Safe Removal of Asbestos* and the *National Code of Practice for the Management and Control of Asbestos in Workplaces.*

Asbestos cement sheets used for roofing or cladding should not be dropped or damaged during demolition because this may release harmful asbestos fibres. Bolts, screws and nails attaching the sheets to purlins or sheeting rails should be removed first, so that the sheets can be removed intact and lowered to ground level in a controlled manner.

6.7.4 Polychlorinated biphenyls (PCBs)

Workers can be exposed to PCBs when dismantling electrical capacitors and transformers or when cleaning up spills and leaks. Care must be taken when handling damaged capacitors to ensure that spillage does not occur.

Personal protective equipment, including gloves made of materials that are resistant to PCBs (e.g. polyethylene, nitrile rubber or neoprene) should be worn when there is any likelihood of exposure to PCBs.

Equipment containing PCBs should be placed in a polyethylene bag and then placed into a marked sealable metal container.

If PCBs cannot be transported immediately for disposal, all containers should be stored in a protected area which prevents any discharge of PCBs to the environment.

6.7.5 Lead

Lead is found in paint, old water pipes and other plumbing fittings, sheet lead, solders, lead flashing, lead light windows and glass.

The precautions which should be taken when demolishing materials containing lead include:

- minimising the generation of lead dust and fumes;
- cleaning work areas properly during and after work;
- wearing the appropriate personal protective equipment; and
- maintaining good personal hygiene and providing clean amenities.

6.8 Other hazards

6.8.1 Electrical safety

Before demolition commences all electrical wiring, apart from the temporary electrical installations, should be disconnected and rendered safe by an appropriately qualified electrician or, where necessary, ACTEW.

All electrical power tools, leads, lighting and power supplies on the site should comply with ACTEW requirements and *AS/NZS 3012: Electrical Installations – Construction & Demolition Sites*.

If perimeter scaffolding is needed on the pavement, adjacent power lines should be covered with Tiger Tails (these are used as a visual warning and do not provide insulation), ACTEW consulted, and scaffolding insulated with non-conductive material.

If the demolition work is being undertaken for refurbishment and there is a possibility of live wires, the areas of danger should be clearly tagged and signposted "Danger Live Wires".

When mechanical plant is being used, and especially when cranes and pusher arms are being used, care should be taken to ensure that no part of the machines comes close to or in direct contact with overhead or underground electricity or telephone cables.

If such a possibility exists, the relevant authority should be consulted and precautionary measures should be implemented.

6.8.2 Noise

Excessive noise can be reduced by:

- Using silencers on jackhammers.
- Using compressors insulated against noise.
- Organising and designing work practices to minimise the number of people exposed and the noise levels to which they are exposed. In some areas, the use of compressors and other plant may need to be restricted to certain hours.
- If excessive noise remains after all other practicable noise control measure have been implemented, appropriate hearing protection should be provided and worn.

Maximum acceptable noise levels are 85 dB(A) averaged over an 8 hour work exposure period and 140 dB(C) for peak noise.

6.8.3 Manual handling

Manual handling tasks must be identified, assessed and controlled in accordance with the *National Standard for Manual Tasks* and the *National Code of Practice for the Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks.*

The risk of manual handling injuries can be controlled by using well-designed plant and equipment, providing a safe work environment and using mechanical equipment such as cranes to lift and move materials.

6.8.4 Broken glass

If there is a risk of injury from the breaking of glass in windows, doors or other openings, all the glass must be removed or the windows, doors or openings must be boarded up before the commencement of the demolition work.

6.8.5 Welding and cutting

All welding and cutting operations should comply with relevant standards. The appropriate personal protective equipment should be supplied and worn. Gauges and hoses should be fitted with flash arrestors and cylinders should be properly secured and supported in an upright position.

Precautions should also be taken to prevent:

- Hazardous fume concentrations when working in confined spaces or poorly ventilated areas.

- Eye damage caused by "welder's flash".
- Injury to persons below or adjacent to welding or cutting operations.
- Structural collapse when cutting supporting members.
- Fire hazards from sparks or slag.

In areas where the floor, walls or ground cover are combustible the area should be protected by spraying the area with water, spreading damp sand, using fireproof welding blankets or applying other suitable means of protection. In cases where a serious fire might quickly develop, a fire watch should be assigned to the area. Fire extinguishing equipment should be readily available. Combustible debris should not be allowed to accumulate.

In cutting, the use of flammable fuel gases and oxygen pose additional fire hazards.

Pure oxygen is extremely dangerous. It can set fire to oil or grease even without a flame or spark, and under some conditions it can explode. Oxygen regulators and fittings should never be oiled, greased or cleaned with oily rags. Oxygen may not be substituted for compressed air.

Fuel gases can be just as dangerous as oxygen. At pressures above 104 kPa or in uncertain mixtures with oxygen, acetylene can explode spontaneously.

7. Demolition methods

7.1. A systematic approach

The sequence in which a building or other structure is demolished can be critical to the safety of the workers and the general public.

The sequence of demolition will depend on the type of construction. Except in special circumstances, buildings and structures should be demolished in reverse order to their construction.

More specifically:

- Demolition should be carried out in reasonably even stages, commencing from the roof or top of the building or structure being demolished.
- Multi-storey buildings or structures should be demolished storey by storey.
- Masonry and brickwork should be taken down in reasonably even courses.
- Every gable and the protruding portion of every chimney should be demolished when the roof is removed, before the ceiling or floor joists are removed.

7.2. General precautions

Access to areas affected by each phase of the demolition work needs to be restricted or made safe.

Restricted areas and safe distances may be required during:

- The dropping of debris.
- The operation of demolition machinery.
- Pre-weakening activities.
- The deliberate collapse or pulling over of buildings or structures.

7.3 Manual demolition methods

Before commencing any demolition work the condition of the floors and walls of the building or structure to be demolished must be assessed so that injury or damage through collapse can be avoided.

No floor or other surface of the building or structure being demolished should be used for supporting workers, plant, equipment and materials unless the floor or surface is known to be strong enough. Care should be taken not to overload floors. If water is used to keep down dust, the increased weight of the debris should be taken into account.

Walls and gables should be demolished course by course. All work should be performed from safe working platforms. Workers should not work from the top of a wall or partition being demolished.

Roof trusses should also be removed from safe work platforms. Care should be taken that the removal of trusses does not cause instability of the walls.

Nails in timber should be removed or bent over flush to prevent puncture wounds.

7.3.1 **Walls**

A wall or partition should not be permitted to stand, unless it is effectively supported against collapse, if:

- its height is more than 30 times its base thickness and the length between buttresses, return walls or the like is more than 45 times its base thickness; or
- it has become unstable or has been weakened.

Any openings in a floor within 3 metres of a wall being demolished should be covered to prevent material falling through.

7.3.2 **Floors and members**

No floor or any members supporting it should be cut or removed until demolition above the floor has been completed and the demolished materials removed.

When jack hammering concrete floors, sufficient reinforcing steel should be left through the floor.

7.3.3 **Vertical structural members (other than chimney stacks and spires)**

If the demolition involves the felling of any walls, columns, piers or other vertical structural members, the demolition contractor must ensure that:

- adequate precautions are taken to ensure there is no danger to persons or property from falling, collapsing or rebounding material; and
- the remaining portion of the building or structure, if any, is strong enough to withstand any loads, impacts and vibration caused by the felling.

Horizontal chases may not be made in masonry or brick walls to facilitate felling.

Reinforced concrete walls may be chased to facilitate felling provided the horizontal chase is made first, followed by any vertical chases. Vertical reinforcing bars should not be cut until the wall is pulled over.

For separate requirements for the demolition of free-standing chimney stacks and spires, see 8.5 below.

7.3.4 **Framework**

Before any framework is demolished or removed, all practicable precautions should be taken to prevent the rest of the building collapsing as a result.

Precautions should also be taken to avoid danger from any sudden spring, twist, collapse or other movement of the framework when it is cut, released or removed.

Members must not be cut until adequate precautions have been taken to support them safely and effectively.

Any framework which is not demolished should be strong enough to remain safely in position, or should be guyed or otherwise supported to ensure that it will be stable in any adverse weather conditions.

Members should be lowered in a safe manner. Tag lines should be provided and used on loads where necessary to ensure safe control of the load.

7.4 Mechanical demolition

All plant and equipment should be:

- Operated by a competent person, who must hold a Certificate of Competency or high-risk licence for the plant being used if this is required by legislation.
- Used and maintained as recommended by the equipment's manufacturer or supplier.
- Provided, where appropriate, with overhead protection conforming with *AS 2294: Earth-moving Machinery – Protective Structures.* Windscreens in earth-moving plant should be shatterproof or guarded by robust steel mesh panels.

All cranes used on the site should be selected and used in accordance with *AS 2550: Cranes, hoists and winches – Safe use, AS 1418: Cranes, hoists and winches Part 1* and *Part 5*, and should be fitted with a load indicator and hoist limiting (anti-two-block) device.

If cranes are used to suspend loads that are to be cut and then lowered to the ground, it is important for the loads to be accurately calculated. It may be necessary to cut samples in order to determine the weight per unit length or area. The safe working load that the crane is capable of handling for the test weighing should be reduced by 50% to allow for miscalculations. A similar approach should be followed where other weights cannot be determined with reasonable consistency and accuracy.

7.4.1 Earth-moving equipment on suspended floors

If it is proposed that mobile equipment will be driven on a suspended floor, the *Demolition Safety Plan* should include details of the size and weight of each piece of equipment and the proposed methods of raising and lowering the equipment and moving it from floor to floor. The *Demolition Safety Plan* should also specify the support to be given to the suspended floor and any other limitations on the operation of the equipment that are necessary to maintain the safety of the operators and other persons.

A guideline proforma for the use of earth-moving equipment on suspended floors is set out in **Appendix 1**.

It has become a common practice to equip an excavator with a hydraulic rock breaker or pulverising attachment and use it to break up walls and floors while other earth-moving equipment is used to organise the rubble. Because of the weight of this machinery, the vibration caused and the build-up of rubble, careful planning and extreme care are needed to prevent a premature collapse of the structure. In particular, the demolition contractor should ensure that:

- An engineering investigation is carried out before work starts (see 5.3 above).
- A safe system of work is devised in conjunction with all the parties involved, and documented in the *Demolition Safety Plan*.
- All the propping used is adequately braced in two directions with a material similar to that being propped. Care must be taken to ensure the props are structurally sound and can safely support the loads to which

they will be subjected, and also to ensure the loads do not exceed the manufacturer's specified ratings.

- Debris is progressively removed from each floor. If machines are being used to tip rubble down a lift shaft or nominated rubble area, vehicle buffers should be provided to prevent the machines from falling over the edge.

Machine access

Rubble ramps to facilitate machine access from floor to floor (i.e. a storey apart) are not permitted. However rubble ramps of a lesser height for access from roughly adjacent floors may be acceptable if certified as safe by the practising structural engineer.

Demolition of walls

When a hydraulic rock breaker is used to demolish walls, at least 900 mm of the wall being demolished should be left intact above the floor level to provide a protective barrier at the perimeter of the building and around all lift wells, stair wells, light wells and any other places where persons could fall. The remaining wall can later be safely demolished from the floor below.

7.4.2 Demolition by wire and chain pulling

If mechanical demolition is to be carried out by chain or wire rope pulling, the pulling medium should be a securely anchored winch or a vehicle heavy enough to apply the required tension without sliding or lifting from the surface on which it is located.

The wire rope or chain should be long enough to ensure that the horizontal distance from the demolition work to the pulling medium is at least twice the height of the highest part to be pulled. No person should be in any position where they could be struck by the wire or chain in the event of a failure. The plant operator should be protected from rope breakage and flying debris.

Before pulling of a wall commences the wall should be cut into appropriate sections having regard to their height, width and construction. If it is not possible to isolate these sections, the chains or wire ropes should be attached to their respective sections prior to the first pull being made. The free ends of the chains or ropes should be left a safe distance from the structure.

Vertical reinforcing bars should not be cut until after the wall has been pulled over.

7.4.3 Machine-mounted impact hammers

A machine-mounted impact hammer is a larger and heavier duty type of hand-held drill, and may be pneumatically or hydraulically operated. When these hammers are used on vertical features such as columns or walls, the columns or walls should not be so high as to create a risk of debris falling onto the machine or operator. When they are used on suspended floors, the precautions as described in 7.4.1 above should be followed.

7.4.4 Power grapples, shears and pulverising attachments

Power grapples and shears are frequently hydraulically operated. Power shears may be used as an alternative to oxy cutting (or the like) to crop and cut through metal such as reinforcing steel or beams, particularly where there might otherwise be a

risk of fire or where the more precise cutting that is possible with an oxy torch is not required. Care should be taken to ensure that any member to be severed is either effectively supported or, if allowed to fall, will not endanger persons or damage the remaining structures.

Areas in which shears are operating should be kept clear of other workers, because of the danger of bolts flying when sheared.

Power grapples may be used to handle waste material, either to move it about a site or to load other vehicles when disposing of the waste. As some of the debris resulting from demolition has a high density, care should be taken to avoid overloading the equipment, both to avoid damage to the equipment itself and to avoid the risk of the machine overturning.

Pulverising attachments to hydraulic machinery are used to break concrete into easily managed pieces about 100 millimetres in size. This reduces noise during demolition and allows quick and efficient removal from the demolition site.

7.4.5 **Drilling and sawing**

Drilling and sawing are used either to remove part of a structure or to produce a potential fracture zone (e.g. by stitch-drilling, or drilling a line of overlapping holes). They are frequently used in conjunction with other methods of demolition, particularly bursting.

These methods can be employed in confined spaces, or for work that requires a high degree of accuracy, or in locations where the noise, dust and vibration resulting from some other methods would be unacceptable. They may be used to cut up floors and suspended slabs into manageable sizes, or to cut holes and slots in parts of a structure. While this is being done the piece to be removed should be adequately supported. The use of these methods avoids damage to the surrounding area.

Running water is usually used to flush out the resulting dust and cool the equipment during use. If it is proposed to adopt this method of demolition, measures should be taken both to provide a suitable supply of water and to collect and safely dispose of the resulting waste water.

Care should be taken to ensure any sparks produced during sawing do not constitute a health or fire hazard.

7.4.6 **Pusher arms**

Mechanical demolition by pusher arm involves the progressive demolition of a wall using a machine fitted with a pusher arm exerting horizontal thrust.

The pusher arm should be used only when the equipment is on firm, level ground. It should not be overloaded, and should generally be used from outside and not inside the building. No person should be in any area near the demolition where there is a possibility of being struck by flying debris.

Pusher arms made of materials other than steel should not be used.

The operator's cabin should be sufficiently robust to withstand impacts from flying debris, with shatter-proof glass in the windows.

The equipment should be operated in a clear space of at least 6 metres.

It should be used only in accordance with the manufacturer's recommendations. On no account should the point where the pusher arm is applied to a wall be more than 600 mm below the top of the wall.

Before the pusher arm is used the height of the wall should be reduced by a hand demolition to a height suitable for the machine being used. The height should then be reduced progressively by pushing small sections to the ground.

If this method is adopted for the demolition of attached buildings, the structure to be demolished should first be detached by hand demolition.

7.4.7 Deliberate collapse

This demolition method involves the removal of key structural members, causing the controlled collapse of all or part of the building or structure being demolished.

Expert engineering advice should be sought before this method is used. It should be employed only on detached, isolated, reasonably level sites where the whole structure is to be demolished. There should be sufficient space to enable equipment and personnel to be removed to a safe distance.

It is usually accepted that buildings and structures which are not carrying their design loads may be pre-weakened prior to deliberate collapse. This pre-weakening should be carefully planned so that despite the removal of redundant members and the partial cutting of load-bearing members, the remaining structure has sufficient strength to withstand wind or impact loads until the deliberate collapse is achieved.

The dead load should be reduced systematically by removing surplus material, machinery, cladding, walls and parts of floors before demolishing the structural frame.

Sometimes heavy loads are left at heights to induce the collapse of the structure after movement is initiated. If this system is adopted, it must be carefully analysed to avoid premature collapse.

7.5 Demolition by explosives

As indicated in 1.3 above, additional requirements, beyond those set out in this Safe Demolition Work Code of Practice, apply if it is proposed to use explosives as part of any demolition.

All uses of explosives are regulated in the ACT. The *Dangerous Goods (Explosives) Regulation 2004* fully set out the requirements for blast plans and for public safety. A pro-forma of the information required may be obtained from ORS WorkSafe ACT. All questions in the pro-forma must be addressed.

The import and storage of explosives is also controlled under the *Dangerous Substances Act 2004*. The Dangerous Goods Unit at ORS WorkSafe ACT should be contacted for further advice and information on (02) 6207 3000.

8 Demolition of 'special' structures

8.1 Lift shafts

8.1.1 Demolition and removal by hand

The lift cage should be taken to the top of the shaft and supported by steel beams inserted through pockets cut into the lift shaft walls.

The lift shaft should be fully decked over on at least two levels before the lift cage and machinery room are removed. The lift doors should be welded shut from the outside or guarded by some other method. Electrical power to all areas of the lift machinery should be disconnected.

Counterweights should be disconnected at the ground or basement level and removed. The unwinding of the lift rope should be done in a controlled manner. Do not leave lift cages at a lower level and allow lift weights to free fall down the shaft.

The lift cage may be removed by crane or by cutting into sections. Safe working platforms should be provided for these procedures.

The lift shaft walls should be demolished from internal scaffolding or a specially constructed internal platform at floor level. The walls should be progressively demolished onto each floor and the debris removed.

8.1.2 Demolition by mechanical means

Lift cages and counter weights should be removed as above.

If the lift shaft is on a perimeter wall, it is important to ensure adequate protection is provided for personnel or adjoining properties.

The walls should be worked progressively down to a height at least 900 mm above floor level, so a protective barrier is left in place to prevent machinery or personnel from falling down the open shaft.

8.2 Basements, cellars, vaults, domes and arched roofs

During the demolition of a basement, cellar, arch, vault or dome frequent inspections should be made to detect any movement. Appropriate action should be taken to avoid any premature collapse.

Only competent persons familiar with these types of structures should demolish them.

If a basement, cellar, vault or void adjoins another property, any party walls or adjoining cellar walls should be inspected to determine whether they are strong enough to withstand the resultant ground pressure. If they are not, the proposed methods of strengthening them should be subject to an assessment by a structural engineer.

If a basement, cellar, vault or void is completely surrounded by ground and is to be backfilled, all organic matter should be removed and replaced with inorganic material, tip spread and consolidated to ground level.

If a basement has been built in ground with a high water table, adequate precautions must be taken to prevent flotation.

8.3 Fire-damaged, ruinous and dangerous buildings

Adequate precautions should be taken during the assessment and demolition of fire-damaged, ruinous or otherwise dangerous buildings or structures.

The effects of heat on steelwork, brickwork, compressed cement sheeting and timber can be difficult to determine. Hazardous substances can also be released from burnt or damaged materials.

Persons should not be permitted to work on fire-affected roof sheeting unless the supporting elements have been inspected and verified as safe by a competent person.

Where possible, these buildings should be demolished by mechanical means or by persons working from elevating work platforms.

8.4 Masonry and brick arches

Masonry and brick arches should be demolished in the following sequence:

- As much dead load as possible should be removed without interfering with the stability of the main arch rings.
- The spandrel infilling should be removed down to the springing line. The load-carrying capacity of many old arches relies on the filling between the spandrels.
- The arch rings should be removed. A single span arch can be demolished by hand by cutting narrow segments progressively from each springing parallel to the span of the arch until the width of the arch has been reduced to a minimum. The arch can then be collapsed. If deliberate collapse is feasible, the crown may be broken by working progressively from the edges to the centre.
- The abutment should be removed.

In multi-span arches, lateral restraints should be provided at the springing level before individual spans are removed. Demolition should then proceed as for a single span.

In situations where debris is allowed to fall to the ground below, supports designed to carry the load (with appropriate allowance for impact) should be erected and the arch demolished progressively.

8.5 Independent chimneys and spires

A detailed inspection and survey are required prior to demolition. Measurements may need to be taken to determine whether there is any deviation from the perpendicular.

The possibility of danger resulting from high wind needs to be considered during all stages of the demolition.

8.5.1 Masonry chimneys

Hand demolition

Hand demolition of masonry chimneys should be carried out from a safe working platform supported by an internal or external scaffold.

If external scaffolding is used, debris should be dropped down inside the chimney. The debris should be progressively removed, in order to restrict lateral pressure on the walls of the chimney. During the removal of debris all demolition work overhead should cease.

Induced collapse

Masonry chimneys should be deliberately collapsed only where sufficient clear space is available. This space must extend in an arc of at least 40 degrees — with at least 20 degrees on each side of the proposed line of fall — to a distance from the centre of the chimney of at least 1.5 times the total height of the chimney.

The chimney should be felled by deliberate cutting away at the base on the side of the line of fall.

8.5.2 **Steel chimneys**

Hand demolition

Hand demolition of steel chimneys should be carried out from a safe working platform provided by an external scaffold.

If guys form part of the structure, an engineer should be consulted before demolition commences.

The chimney should be taken down from the top. The plate should be cut into manageable sizes and lowered to the ground. The internal lining should be demolished progressively with the steel work. If the lining is of concrete, difficulty may be experienced in burning the plate with the lining in position, and the lining should be removed first.

If appropriate the debris should be allowed to fall to the ground internally. The debris should be progressively cleared. During the removal of debris, all demolition work overhead should cease.

Temporary guys must be fixed where necessary. Temporary and permanent guys should be cut systematically as the demolition progresses.

Induced collapse

Steel chimneys should be deliberately collapsed only under the conditions described in section 3.3 and 4.5 of *AS 2601*.

Movement of the chimney should be observed. If the chimney is guyed, two steel wire ropes should be attached at 45 degrees (on plan) to each side of the line of fall before felling. The ropes should be made taut and the guys on the far side of the line of fall should then be systematically severed.

8.5.3 **Reinforced concrete chimneys** (*in situ* and precast)

Hand demolition

Hand demolition of reinforced concrete chimneys should be carried out from a safe working platform provided by an external scaffold.

The chimney should be taken down in sections from the top, in manageable sizes lowered to the ground. The concrete should be shattered by pneumatic tools to

expose the reinforcement, and each section should be supported while the reinforcement is cut.

The lining should be demolished progressively with the shaft. The debris may be allowed to fall to the ground internally.

Induced collapse

Reinforced concrete chimneys should be deliberately collapsed in accordance with the recommendations in 7.5.1 above.

8.5.4 **Glass-reinforced plastic chimneys**

Glass-reinforced chimneys should be demolished in accordance with the procedures for steel chimneys (see 7.5.2 above).

8.5.5 **Spires**

Hand demolition

Hand demolition of spires should be carried out from a safe working platform provided by a scaffold.

Induced collapse

Spires should be deliberately collapsed only when a clear space all around the spire of at least 1.5 times the total height of the spire, measured from its centre, is available for the fall.

Masonry spires

The heavy, solid stone work at the peak of a masonry spire can normally be removed only after release of the central tie rod. It should be reduced to manageable sizes before being lowered to the ground. Where necessary, the stone work above the spire should be supported temporarily in position before the tie rod is released.

Any over-hanging stone work should be supported when the structure above is released or removed.

Below the solid peak of the spire, where the structure is hollow with the sides battened inwards, one complete course should be removed at a time. Temporary bracing should be provided at openings.

The condition of the stone work and the built-up metal cramps should be inspected as work proceeds to avoid any sudden fall of fractured or badly weathered stone.

Timber spires

Timber spires should be inspected before commencing any work to determine whether any rot or other defect is present. This deterioration is particularly prevalent at the foot of timber spires.

Cladding and timbers should be removed progressively from the peak in manageable sizes and lowered to the ground.

8.6 Pylons and masts

Hand demolition

The pylon or mast should be taken down in the reverse order to that in which it was erected.

Demolition by wire rope pulling

The sequence of demolition by wire rope pulling should be as follows:

- A steel wire rope is attached to the spreader near the top of the structure.
- The slack in the rope is taken up by the pulling medium, which must be positioned at a distance at least 1.5 times the total height of the pylon or mast, as measured from the centre of the base of the pylon and mast.
- The two legs near the direction of fall are partially severed.
- The two legs remote from the direction of fall are completely severed. All necessary precautions should be taken to prevent twisting.
- All personnel are cleared from the site.
- The pylon or mast is pulled over.

Only experienced workers should undertake this operation.

8.7 Precast concrete panels

If a wall is composed of a series of reinforced precast panels, the nature and condition of the fixings to the rest of the structure and the jointing between the panels should be established before any demolition of the wall commences.

Where possible, the panels should be removed by a crane in the reverse sequence to that used for their erection.

If the wall acts as bracing in the direction of its length, sufficient temporary bracing in this direction should be provided to the structure, to maintain its stability during and after removal of the panels.

Caution should be exercised if the original lifting points or fittings are to be reused to support a panel during its removal, as they may have deteriorated and corroded.

Before removing any individual panel, it should be fully supported, both vertically and horizontally, above its centre of mass, so as to prevent any sudden rotational movement during its detachment from the supporting structure.

Panels should be lowered to a horizontal position before being broken up.

8.8 Façade retention

The retention of façades should be planned and documented before demolition work commences. The demolition method(s) used should take into account the limits imposed by the planned façade retention.

Before demolition work commences, the façade or footings may need to be repaired and temporary support for the façade may need to be installed. Temporary support may also need to be installed in stages during the demolition work, depending on the design of the support.

Engineering supervision of the various stages of demolition work may be necessary, in order to monitor any façade movement or cracking.

The structure should be inspected after any unusual incidents such as heavy rain or wind, an earth tremor or an accidental impact on the façade or its supports.

8.9 Storage tanks and pipelines

Before a tank is demolished, its previous uses should be determined and appropriate action should be taken to identify and remove any hazards from toxic, noxious or explosive materials.

The tank should be emptied and certified gas-free by a competent person.

8.9.1 General precautions

During the demolition of such structures, the following precautions should be taken:

- Care should be taken with the associated pipework and equipment. Tools used to remove pipes and fittings should be non-ferrous to prevent sparking.
- Appropriate danger notices should be displayed.
- No smoking or naked lights should be permitted in the vicinity.
- A copious supply of water should be used to lessen the risk from sparking.
- Care should be taken to ensure that no flammable, toxic or noxious substances or combustible liquid is allowed to enter any drainage system or watercourse.
- In excavating underground tanks and/or pipelines, attention should be paid to the danger that the surrounding earth may have been contaminated, either by leakage from the tank/pipeline or by spillage.

Additional, special precautions should be taken during the demolition of chemical works, gas works and similar establishments.

It is strongly recommended that these types of works should be examined in conjunction with a chemical engineer, in order to determine the nature of any of the chemical deposits and their influence on the method of demolition or dismantling. The removal of flammable materials and their new locations should be ascertained before demolition.

8.9.2 Containers that have held combustibles

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

It is therefore important to conduct a rigorous cleaning process and ensure 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 and alkalines, which can react with metal to produce explosive or toxic gases.
- Heavy oils, tars or solids, which can release combustible gases when exposed to heat.
- Combustible solids, whose finely divided particles may form an explosive dust cloud.

As a general rule, any container which has held flammable or combustible substances should be considered unsafe until proven otherwise by a qualified person.

Safety precautions consistent with *AS 1674: Safety in Welding and Allied Processes* and *AS 1940: The Storage and Handling of Flammable and Combustible Liquids* must be taken when welding is required.

Appendix 1 - Guideline Proforma for Demolition by Earthmoving Machines on Suspended Floors

Site ……

Address ……

Principal Contractor ……

Structural Engineer ……

Owner ……

Machine Details ……

Number of machines: ……
Mass: ……
Type: ……

Demolition Method ……

Clearing Method ……

Engineering checks include:

– Allowable rubble depth (mm): ……

Are machines to work over rubble? (Yes / No): ……

– Method of moving from floor to floor (Crane / Ramp): ……

– If by ramp, attach calculations for flooring loading: ……

Is propping, or floor strengthening required? (Yes / No): ……
If yes, attach details: ……

– Are there restrictions on machine travel e.g. separation distance or 'no go' areas? (Yes / No): ……
If yes, attach details……

– Attach details and limitations ……

Other Supporting Documents included in this application:

Certification of operators and users of industrial equipment

Nominated demolition work supervisor

Nominated agent of the engineer

……. …….

Demolition Contractor (signed) Structural Engineer (signed)

Appendix 2 – Australian Standards relevant to this Code of Practice

Note: This list is current at the time of publication. Some Australian Standards referenced in this list may be withdrawn or superseded by updated versions.

AS 2601:2001	**The Demolition of Structures**
AS/NZS 1576.1:2010	**Scaffolding – General Requirements**
AS/NZS 4576:1995	**Guidelines for Scaffolding**
AS 1418	**Cranes, Hoists and Winches**
AS 1418.1:2002	General requirements.
AS 1418.2:1997	Serial hoists and winches.
AS 1418.3:1997	Bridge, gantry, portal (including container cranes) and jib cranes.
AS 1418.4:2004	Tower cranes.
AS 1418.5:2002	Mobile cranes.
AS 1418.6:2004	Guided storing and retrieving appliances.
AS 1418.7:1999	Builders' hoists and associated equipment
AS 1418.8:2008	Special purpose appliances
AS 1418.10 (int):2004	Elevating work platforms.
AS 1418.12:1991	Crane collector systems.
AS 1418.14:1996	Requirements for cranes subject to arduous working conditions.
AS 1418.15:1994	Concrete placing equipment.
AS 1418.16:1997	Mast climbing work platforms.
AS 1418.17:1996	Design and construction of workboxes.
AS 2550	**Cranes, Hoists and Winches – Safe Use**
AS 2550.1:2002	General requirements.
AS 2550.4:2004	Tower cranes.
AS 2550.5:2002	Mobile cranes.
AS 2550.6:1995	Guided storing and retrieving appliances.
AS 2550.7:1996	Builders' hoists and associated equipment.
AS 2550.10:2006	Elevating work platforms.
AS 2550.15:1994	Concrete placing equipment.
AS 2550.16:1997	Mast climbing work platforms.
AS 2550.20:2005	Self-erecting tower cranes
AS/NZS 3012:2003	**Electrical Installations – Construction and Demolition Sites**
AS/NZS 1892	**Portable Ladders**

AS/NZS 1892.1:1996	Metal.
AS/NZS 1892.2 1992	Timber.
AS/NZS 1892.3 1996	Reinforced plastic.
AS 1657:1992	**Fixed Platforms, Walkways, Stairways and Ladders – Design, Construction and Installation**
AS 2865:2009	**Confined Spaces**
AS/NZS 1891	**Industrial Fall-Arrest Systems and Devices**
AS/NZS 1891.1:2007	Harnesses and ancillary equipment.
AS/NZS 1891.2:2001	Horizontal lifeline and rail systems.
AS/NZS 1891.3:1997	Fall-arrest devices.
AS/NZS 1891.4:2009	Selection, use and maintenance
AS/NZS 1270:2002	**Acoustics – Hearing protectors**
AS/NZS 1337.0(int):2010	**Personal Eye Protection – Eye and Face Protection**
AS/NZS 1715:2009	**Selection, Use and Maintenance of Respiratory Protective Devices**
AS/NZS 1801:1997	**Occupational Protective Helmets**
AS/NZS 2161	**Occupational Protective Gloves**
AS/NZS 2161.1:2000	Selection, use and maintenance.
AS/NZS 2161.2:2005	General requirements.
AS/NZS 2161.3:2005	Protection against mechanical risks.
AS/NZS 2161.4:1999	Protection against thermal risks (heat and fire)
AS/NZS 2161.5:1998	Protection against cold.
AS/NZS 2210	**Occupational Protective Footwear**
AS/NZS 2210.1:1994	Guide to selection, care and use.
AS/NZS 2210.3:2009	Specification for safety footwear
AS 1674	**Safety in Welding and Allied Processes**
AS 1674.1:1997	Fire precautions.
AS 1674.2:2007	Electrical.
AS 2294:1997	**Earth-Moving Machinery – Protective Structures**
AS 3600:2009	**Concrete Structures**
AS 1940:2004	**The Storage and Handling of Flammable and Combustible Liquids**