Building and Construction

Carry out general demolition of minor building structures

Learner Guide

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Demolition [1]

What is demolition work?

Any work that is connected with the demolition of a structure is classified as 'construction work' under the WHS Regulations and therefore the relevant requirements relating to construction work must be complied with.

'Demolition work' means to demolish or dismantle a structure or part of a structure that is load-bearing or otherwise related to the physical integrity of the structure, but does not include:

a) the dismantling of formwork, falsework, scaffolding or other structures designed or used to provide support, access or containment during construction work, or
b) the removal of power, light or telecommunication poles.

A structure is anything that is constructed, whether fixed or moveable, temporary or permanent, and includes buildings, sheds, towers, chimney stacks, silos, storage tanks.

Demolition is about dismantling all of a building so something else can be put in its place, or part of a building so that alterations can be made.

It is important to plan this process, to think about:

- occupational health and safety requirements

[1] Source: Safe Work Australia, as at http://www.google.com.au/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CCgQFjAA&url=http%3A%2F%2Fwww.safeworkaustralia.gov.au%.....c8af/index.htm?guest=true, as on 25th February, 2014..

- personal protective equipment that will be needed
- what can be salvaged for re-use or recycling
- what needs to be done
- how the demolition will be carried out.

The demolition of an element of a structure that is load-bearing or otherwise related to the physical integrity of the structure is 'high risk construction work'. A safe work method statement (SWMS) must be prepared before the high risk construction work starts.

Demolition work that is notifiable under the WHS Regulations involves:

- demolition of a structure, or a part of a structure that is load-bearing or otherwise related to the physical integrity of the structure, that is at least 6 metres in height
- demolition work involving load shifting machinery on a suspended floor, and
- demolition work involving explosives.

Other definitions relating to demolition work are listed in *Appendix A*.

Demolition work in Victoria

The Victorian Building Authority (VBA) is improving awareness about the requirements and responsibilities involved with doing demolition work.

Demolition work can only be done by registered builders (and owner-builders in some circumstances[1]). Members of the public can't undertake demolition work and therefore must engage a registered builder.

There are specific steps that must be followed by registered builders when doing partial or full demolition work, including getting a building permit.

Partial demolition refers to the permanent removal of structural elements of a building (for example, a load-bearing wall). Full demolition refers to the complete destruction of a building.

Applying for a building permit for demolition work

Registered builders must have a building permit to demolish or remove part of a structure. The permit must comply with the requirements of the *Building Regulations 2006* (the Regulations).

Responsibilities of registered builders when proposing demolition work

The Regulations state registered builders must:

- Apply for a permit – and this application must include a written description of the demolition or removal procedure in their application. In accordance with regulation

304 of the Regulations this must also include engineering details or other information which shows that any remaining parts of the building will be structurally stable after the proposed demolition or removal works are done.
- Not start demolition work until the relevant building surveyor (RBS) has issued a building permit.

The Regulations state that if successful in obtaining a building permit for partial or full demolition works, registered builders must:

- Implement precautionary measures in accordance with Australian Standard (AS) AS 2601—2001, The Demolition of Structures. This is a technical document which can't be fully covered here but can be purchased through the Standards Australia website.
- Not start demolition work until these measures have been inspected and approved by the RBS.
- Review progress of demolition work and take further precautions during the demolition when a need is identified.

Precautionary measures

VBA advises registered builders to use a checklist to ensure everything necessary is done before they start demolition work. Worksafe Victoria provides an easy-to-use checklist on its website - http://www.worksafe.vic.gov.au/forms-and-publications/forms-and-publications/demolition-operations-checklist.

VBA also advises people to use AS 2601—2001, which can reduce the risk of injury and property damage. Part 2 of the standard has a procedure for site and structure inspection for before work starts and it has a work plan for documenting precautions and the demolition.

VBA recommends registered builders prepare a work plan as this can be shared with workers and they can use it to gain a clear understanding of the precautions and the project. The work plan can be attached to the building permit as the written description of the demolition work (Regulation 304).

Responsibilities of the RBS

When assessing a building permit application, the RBS must:

- Ensure the registered builder has lodged adequate documentation about the demolition process (Regulation 304). The documents must include engineering details about the structural stability of any remaining parts of the building.
- Review the application for a building permit and approve it if satisfied that it complies.
- Inspect the site and precautions before demolition work starts.

Exemptions

The RBS can exempt demolition work from the measures set out above (under Regulation 607) if they deem demolition work is minor. In considering whether to grant an exemption the RBS must consider the structural stability of the building that will remain after demolition.

Building Commission

MG/09

Minister's Guideline — Issued June 2006

Issuing of building permits (demolitions/removal) and the owner builder

This replaces previous *Minister's Guideline MG/09* issued June 2005

Pursuant to section 188(1)(c) of the Building Act 1993 (the Act) I hereby issue the following Guideline concerning the functions of municipal building surveyors and private building surveyors in respect of section 24(1)(c) of the Act. Note that section 188(7) of the Act provides that municipal building surveyors and private building surveyors must have regard to this Guideline in carrying out their functions.

A relevant building surveyor must not issue a building permit for the demolition or removal of a building under section 24 of the Act unless:

the person nominated as the builder on the application for a building permit is a registered building practitioner in the appropriate category or class having regard to section 176(7) of the Act.

If the owner is nominated as the builder it is the owner who must demonstrate that he or she has the necessary knowledge, experience, equipment and storage facilities to properly conduct the demolition operations as required by Regulation 304 of the Building Regulations 2006. It will be expected in these circumstances that it will be rare for a building permit to demolish a building to be issued to an owner builder.

ROB HULLS MP
Minister for Planning

Who has duties in relation to demolition work?

A **person conducting a business or undertaking** has the primary duty under the WHS Act to ensure, so far as is reasonably practicable, that workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

A person conducting a business or undertaking has more specific obligations under the WHS Regulations to manage the risks associated with the carrying out of demolition work. These duties include:

- preparing a Safe Work Method Statement (SWMS) for the proposed work, or ensuring a SWMS has already been prepared by another person, before any high risk construction work commences
- obtaining a copy of the asbestos register for the workplace before demolition work is carried out
- if there is no asbestos register, must:
  - not carry out the work until the structure or plant has been inspected to determine whether asbestos or asbestos containing materials (ACM) are fixed to or installed in the structure or plant
  - ensure that the determination is undertaken by a competent person, and
- if asbestos or ACM are determined or presumed to be present, inform the occupier and owner of the premises (if domestic premises) and the person conducting a business or undertaking with management or control of the workplace.

For clarity, the person conducting a business or undertaking that has management and control of the demolition work is sometimes referred to in this Code as the 'demolition contractor'.

A **principal contractor** for a construction project (a project where the cost of the construction work is $250 000 or more) has additional duties, including to:

- take all reasonable steps to obtain a copy of each SWMS before any high risk construction work commences, and
- prepare a written WHS management plan for the workplace before work on the construction project commences.

Designers of structures must ensure, so far as is reasonably practicable, that the structure is without risks to health and safety. The design must take into account the health and safety risks during the proper demolition of the structure. Designers must give the person who commissioned the design a written safety report that specifies the hazards relating to the design of the structure (see sections 3.3 of this Code).

Officers, such as company directors, have a duty to exercise due diligence to ensure that the business or undertaking complies with the WHS Act and Regulations. This includes taking reasonable steps to ensure that the business or undertaking has and uses appropriate resources and processes to eliminate or minimise risks that arise from the construction work.

Workers have a duty to take reasonable care for their own health and safety and that they do not adversely affect the health and safety of other persons. Workers must, so far as the worker is reasonable able, comply with any reasonable instruction and cooperate with any reasonable policy or procedure relating to health and safety at the workplace.

What is involved in managing the risks of demolition work?

In order to manage risk under the WHS Regulations, a duty holder must:

a) identify reasonably foreseeable hazards that could give rise to the risk

b) eliminate the risk so far as is reasonably practicable

c) if it is not reasonably practicable to eliminate the risk – minimise the risk so far as is reasonably practicable by implementing control measures in accordance with the hierarchy of risk control

d) maintain the control measure so that it remains effective, and

e) review, and if necessary revise risk control measures so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety.

This Code provides guidance on how to manage the risks associated with demolition work by following a systematic process that involves:

- identifying hazards,
- if necessary, assessing the risks associated with these hazards,
- implementing risk control measures, and
- maintaining and reviewing the effectiveness of risk control measures.

Guidance on the general risk management process is available in the *Code of Practice: How to Manage Work Health and Safety Risks.*

Consulting workers

The WHS Act requires that you consult, so far as is reasonably practicable, with workers who carry out work for you who are (or are likely to be) directly affected by a work health and safety matter. If the workers are represented by a health and safety representative, the consultation must involve that representative.

Consultation with workers and their health and safety representatives is required at every step of the risk management process. In many cases, decisions about construction work and projects are made prior to engaging workers, therefore, it may not be possible to consult with workers in these early stages. However, it is important to consult with them as the demolition work progresses.

Consultation may include discussions on the:

- demolition methods
- type of risk control measures
- interaction with other trades
- safe work method statements
- provision of appropriate amenities
- procedures to deal with emergencies.

Consulting, co-operating and co-ordinating activities with other duty holders

A person conducting a business or undertaking must consult, co-operate and co-ordinate activities with all other persons who have a work health or safety duty in relation to the same matter, so far as is reasonably practicable.

A demolition worksite will often be shared by various people, such as structural engineers, mobile plant operators and asbestos removalists. They should exchange information about the risks associated with the demolition work and work together in a co-operative and co-ordinated way so that all risks are eliminated or minimised so far as is reasonably practicable.

Further guidance on consultation is available in:

- *[draft] Code of Practice: Managing Risks in Construction Work*, and
- *Code of Practice: Work Health and Safety Consultation, Cooperation and Coordination*.

Managing Risks in Demolition Work

IDENTIFYING HAZARDS

Some examples of demolition specific hazards include:

- uncontrolled structure collapse – demolition work needs to be planned and undertaken so as to achieve the controlled demolition of a structure
- essential services, including the supply of, gas, water, sewerage, telecommunications, electricity, chemicals, fuel and refrigerant in pipes or lines - the exact location of these and other underground services, such as drainage pipes, soak wells, and storage tanks, must not present a health and safety risk, and
- hazardous chemicals – these may be present in demolished material or in the ground where demolition work is to be carried out.

ASSESSING RISKS

When assessing a demolition risk you should consider things such as:

- the structure to be demolished
- the method of demolition
- the scheduling of the work

- the layout of the workplace, including whether there are fall hazards both for people and objects
- what plant and equipment will be used and the skill and experience required by the people who will use it safely
- what exposures might occur, such as to noise or UV rays
- the number of people involved, and
- local weather conditions.

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

- items of plant and equipment – large structures may require scaffolding or powered mobile plant to work on suspended floors
- stockpiling arrangements at the workplace, for example, the location and control of demolished material to control dust, and
- transport of the demolished material, including access to the workplace, the length and nature of the haul route, and the type of load shifting equipment to be used.

CONTROLLING THE RISKS

The hierarchy of risk control

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest. This ranking is known as the *hierarchy of risk control*. You must always aim to eliminate a hazard, which is the most effective control. If this is not reasonably practicable, you must minimise the risk by:

- *Substitution* – for example, using a material hoist or craning the material from one level to the other will eliminate the risks of a musculoskeletal disorder resulting from manually carrying materials or tools up and down multiple levels
- *Isolation* – for example, use concrete barriers to separate pedestrians and powered mobile plant to reduce the risk of collision
- *Engineering* – for example, fitting an open cab excavator with a falling objects protective structure to minimise the risk of being struck by a falling object.

If risk remains, it must be minimised by implementing *administrative controls*, so far as is reasonably practicable, for example install warning signs and establish an exclusion zone. Any remaining risk must be minimised with suitable *personal protective equipment*, such as providing workers with hard hats, steel cap boots and high visibility vests.

Administrative control measures and personal protective equipment rely on human behaviour and supervision, and used on their own, tend to be least effective in minimising risks.

Training, information, instruction and supervision

A person conducting a business or undertaking must provide any information, instruction training or supervision necessary to protect all persons from risks to their health and safety arising from work carried out.

A person conducting a business or undertaking must not direct or allow a worker to carry out construction work unless the worker has successfully completed general construction induction training.

Training specific to the excavation work and to the site should also be provided to workers, including:

- the nature of the hazards and risks
- how the work is to be carried out safely, including the contents of the SWMS
- site emergency procedures.

A competent person should supervise the excavation work. Workers in a supervisory role (for example, a leading hand or foreman) should be experienced in the type of demolition being carried out and authorised to ensure it is carried out in accordance with the SWMS.

Further information is available in Chapter 8 of the *[draft] Code of Practice: Managing Risks in Construction Work.*

REVIEWING RISK CONTROL MEASURES

Control measures should be reviewed regularly to make sure that they remain effective.

There are certain situations where you must review your control measures under the WHS Regulations and, if necessary, revise them. A review is required:

- when the control measure is not effective in controlling the risk
- before a change at the workplace that is likely to give rise to a new or different health and safety risk that the control measure may not effectively control
- if a new hazard or risk is identified
- if the results of consultation indicate that a review is necessary, or
- if a health and safety representative requests a review.

Common review methods include workplace inspection, consultation, testing and analysing records and data. When reviewing control measures, SWMS and the WHS Management Plan must also be reviewed and revised where necessary.

Planning Demolition Work

Demolition work should be carefully planned before work starts to ensure it can be carried out safely. Planning involves identifying hazards, assessing risks and determining

appropriate control measures in consultation with all relevant persons involved in the work, including the principal contractor, demolition contractor, structural engineers and mobile plant operators.

A demolition plan should be prepared for all demolitions where there are a number of other persons conducting a business or undertaking (for example, subcontractors) involved. If the demolition contractor is also the principal contactor, the demolition plan should be incorporated as part of the WHS management plan.

Appendix B provides further information on what a demolition plan might include.

NOTIFIABLE DEMOLITION WORK

A person conducting a business or undertaking who proposes to carry out the following demolition work must give written notice to the regulator at least 5 days before the work commences:

(a) demolition of a structure, or a part of a structure that is loadbearing or otherwise related to the physical integrity of the structure, that is at least 6 metres in height

(b) demolition work involving load shifting machinery on a suspended floor, or

(c) demolition work involving explosives.

The height of a structure is measured from the lowest level of the ground immediately adjacent to the base of the structure at the point at which the height is to be measured to its highest point.

The type of information which would normally be included in the notification would be:

- the name and contact details of the person conducting the business or undertaking
- if the high risk work is in connection with a construction project, the name and contact details of the principal contractor for the project or of the principal contractor's representative
- the name and contact details of the person directly supervising the work
- the date of the notice
- the nature of the demolition
- whether explosives will be used in carrying out the work and, if so, the licence details of the person who is to use the explosives
- when the person conducting the business or undertaking reasonably believes the work is to commence and to be completed, and
- where the work is to be carried out.

In the circumstances where an emergency services organisation directs one or more of its workers to carry out notifiable demolition work for the purposes of rescuing and/or providing first aid to a person, the organisation must provide a written notice to the relevant regulator as soon as practicable before or during the demolition work, or if this is not practicable after the demolition work is carried out.

PRINCIPAL CONTRACTOR

Where the value of construction work exceeds $250 000, the construction work is considered a construction project and a principal contractor must be identified. There can only be one principal contractor for a construction project and this will be either the person commissioning the construction work or a person in control of a business or undertaking that is appointed as the principal contractor by the person commissioning the construction work.

The principal contractor has a range of duties in relation to a construction project, including:

- preparing and reviewing a WHS management plan
- obtaining SWMS before any high risk construction work commences
- putting in place arrangements to manage the work environment, including falls, facilities, first aid, an emergency plan and traffic management
- installing signs showing the principal contactor's name, contact details and location of any site office, and
- securing the construction workplace.

It is possible that the demolition contractor may be the principal contractor. This might occur, for example, where there is significant demolition work required and there is a clear separation between the demolition activity and any subsequent building work. In this case the demolition contractor, as the principal contractor, must comply with all the duties of a principal contractor.

Further guidance on principal contractor duties is available in the *[draft] Code of Practice: Managing Risks in Construction Work.*

DESIGNERS

Designers have a duty in the WHS Act to ensure, so far as is reasonably practicable, that the structure is designed to be without risks to the safety of persons in relation to the proper demolition or disposal of the structure.

The designer of a structure or any part of a structure that is to be constructed must give the person conducting a business or undertaking who commissioned the design a written report that specifies the hazards associated with the design of the structure that, so far as the designer is reasonably aware:

(a) create a risk to the health or safety of persons who are to carry out construction work on the structure or part; and

(b) are associated only with the particular design and not with other designs of the same type of structure.

This is particularly important with modern designs where 'limit state' design techniques are used by the structural designer. In this approach, the designer considers the structure in its completed form with all the structural components, including bracing, installed. The completed structure can withstand much higher loads (for example, wind and other live loads) than when the structure is in the construction or demolition stage. With this in mind it, is necessary for the designer to provide guidance to the demolisher on how the structure will remain standing as it is demolished or dismantled.

The principal contractor (or the demolition contractor if there is no principal contractor) must take all reasonable steps to obtain the designers safety report.

For demolition work, there may be a number of designer safety reports available, including:

- the report prepared for the original construction of the structure (if available)
- any reports prepared for subsequent additions or alterations to the structure (if available), and
- where a designer is engaged for the demolition work, the report provided to the person commissioning the design of the demolition work.

Designers who develop demolition specifications or procedures for the demolition of a structure where the work includes high risk construction work or notifiable demolition work should consider the possible work methods available and associated health and safety risks. Designers should then take into account the proposed demolition method and control measures available when producing any final design documents for the demolition of a structure.

If as-built design documentation is not available, or there is a concern that the structure has been damaged or weakened (for example, by fire or deterioration), or plant is to be used on suspended floors, then a competent person (for example, a qualified structural engineer) should conduct an engineering investigation and deliver an 'engineering investigation report'. Some of the issues that may be considered when undertaking an engineering investigation are listed in *Appendix C*.

The following design matters should be taken into account when considering demolition risks:

- the stability and structural integrity of the structure at all stages of demolition, including assembled portions, single components and completed sequentially erected braced bays
- the maximum permissible wind speed for partially demolished structures
- the effect of the proposed demolition sequence on stability
- the stability requirements for all components of the structure as it is sequentially demolished according to the structural engineer's requirements
- the competent persons assessment of loadings at all stages of demolition
- the provision of clear instructions for temporary bracing
- the plant to be used for the work, including the size, type, position and coverage of proposed demolition crane(s) should be indicated on a site plan; locations such as unloading points and storage areas (if any) should be shown
- the need to ensure that the ground is compacted to any design specifications to enable plant to be moved and used safely at the workplace
- the proposed methods for handling heavy, bulky or awkward components
- the need for specific lifting arrangements to be detailed on structural member drawings to facilitate safe lifting
- the handling, lifting, storing, stacking and transportation of components, depending on their size, shape and weight, and
- the provision of safe access and safe working areas.

Further guidance on the safe design of buildings and structures can be found in the *[draft] Code of Practice: Safe Design of Buildings and Structures*.

Technical standards

Demolition specifications and procedures should be designed in accordance with acceptable engineering principles and published technical standards. Engineering principles would include, for example, mathematical or scientific procedures outlined in an engineering reference manual or standard.

PREPARING SAFE WORK METHOD STATEMENTS

If the demolition is or involves high risk construction work, a SWMS must be prepared before the work starts. The SWMS must:

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

One SWMS can be prepared to cover all the high risk construction work being carried out at the workplace by a contractor and/or subcontractor. For example, demolition work might involve a number of types of high risk construction work, such as work that:

- involves a risk of a person falling more than 2 metres
- involves, or is likely to involve, the disturbance of asbestos
- involves structural alterations or repairs that require temporary support to prevent collapse
- is carried out on or near a confined space
- involves the use of explosives
- is carried out on or near pressurised gas distribution mains or piping
- is carried out on or near chemical, fuel or refrigerant lines
- is carried out on or near energised electrical installations or services
- is carried out at a workplace in which there is any movement of powered mobile plant.

Further guidance on SWMS and an example SWMS template is available in the *[draft] Code of Practice: Managing Risks in Construction Work.*

Sample Safe Work Method Statement

See http://www.workcover.nsw.gov.au/formspublications/publications/Documents/swms-for-demolition-work-WC03833.pdf

Company name: ABC Demolition [ABN] 123 Mortar Street, Standard Course, ACT 2600 Phone: (02) 1234 5678	**Principal contractor:** XYZ Contracting Services 8910 Management Road, Projectville, ACT 2666 Phone: (02) 9876 5432
Work activity: Demolition work – not workplace specific	**Work location:** Potters Hut, Brick Street, Pottery, ACT 2600
Works manager: Fred Bloggs	**Contact phone:** 0400 111 111

Hazard number	High risk construction work	Yes
1	Involves a risk of a person falling more than two metres	☐
2	Involves demolition of an element of a structure that is load-bearing or otherwise related to the physical integrity of the structure	☐
3	Involves, or is likely to involve, the disturbance of asbestos	☐
4	Involves structural alterations or repairs that require temporary support to prevent collapse	☐
5	Is carried out in or near a confined space	☐
6	Is carried out in or near a shaft or trench with an excavated depth greater than 1.5 metres or is carried out in or near a tunnel	☐
7	Involves the use of explosives	☐
8	Is carried out on or near pressurised gas distribution mains or piping, chemical, fuel or refrigerant lines or energised electrical installations or services	☐
9	Is carried out in an area that may have a contaminated or flammable atmosphere	☐
10	Involves tilt-up or precast concrete	☐
11	Is carried out on, in or adjacent to a road, railway, shipping lane or other traffic corridor that is in use by traffic other than pedestrians	☐
12	Is carried out in an area at a workplace in which there is any movement of powered mobile plant	☐
13	Is carried out in an area in which there are artificial extremes of temperature	☐
14	Is carried out in or near water or other liquid that involves a risk of drowning	☐
15	Involves diving work	☐

	Task	What high risk construction work does this task involve?	What are the hazards and the risks?	What are the control measures?
1	Delivery of plant	Movement of powered mobile plant.	Workers and others being struck by powered mobile plant including delivery vehicle and forklift used for unloading.	Prepare and implement workplace traffic management plan and make available to workers: • exclusion zone for mobile plant to be clearly identified (signage and barricades as per site plan) and controlled during vehicle loading/unloading operations.
		Work in or adjacent to a road, railway, shipping lane or other traffic corridor that is in use by traffic other than pedestrians.	Workers and others being struck by vehicles in adjacent road or traffic corridor.	Dedicated, trained road traffic controller(s) to direct traffic entering and leaving site and control traffic (pedestrian and vehicle) on adjacent pedestrian footpaths and roadways. This includes: • using portable traffic signals and/or temporary safety barriers to direct/control traffic flow as required.
			Vehicles in adjacent road or traffic corridor being struck by falling objects.	Plant delivery vehicle to be unloaded on-site (not from public roadway).
2	Demolishing the building or structure	Movement of powered mobile plant.	Workers and others being struck by powered mobile plant.	Prepare and implement workplace traffic management plan and make available to worker. Establish exclusion zones and keep unauthorised people outside of potential collapse zones and areas affected by rebounding material. Install overhead protective structure where work is adjacent to public.
			Workers and others being struck by vehicles in adjacent road or traffic corridor.	Systematic and progressive demolition of structure starting from the top. The demolition procedure is prepared and is appropriate for the demolition method to be used. The procedure should be specific for the site and sequential starting from top of structure.
		Involves demolition of an element of a structure that is load-bearing or otherwise related to the physical integrity of the structure.	Workers and others injured by structural collapse.	Temporary braces, propping, shoring or guys may need to be added to ensure that stability of the structure is maintained so as to prevent the unexpected collapse of part or all the structure. A wall is not to be permitted to stand unless it is effectively supported against collapse. This includes checking whether the wall to be demolished is providing support for other walls.

	Task	What high risk construction work does this task involve?	What are the hazards and the risks?	What are the control measures?
	Demolishing the building or structure (continued)	Structural alterations or repairs that require temporary support to prevent collapse.		Where demolition work is undertaken on a suspended concrete slab: • prepare and implement a sequential demolition plan specific to the site and approved by a competent structural engineer. Specifically, the plan should consider the rate of demolition and outline the load capacity limits of floors, ramps or other suspended slabs. If temporary supports are required, their specification and positioning should clearly be shown in the plan • consider the method for moving plant from floor to floor. If using ramps, the loads on the structure should be verified. In particular, the ramp's specifications, location and the placement of temporary supports should be documented in the demolition procedure • consider the means for clearing rubble from floors or other suspended slabs to prevent a build-up of rubble in excess of that specified in the demolition plan • the installation of temporary supports must be according to manufacturer's instructions and the installation of their positioning must be according to: o specifications in the demolition procedure o instructions on when to remove rubble to prevent slabs being overloaded o instructions on where a ramp is to be used and whether it needs temporary supports o the prescribed distances between machines when they're located on slabs.
		Demolition involving the use of explosives.	Workers and others being struck by debris.	Only a licensed competent person must be engaged to undertake demolition work involving explosives and the development of a blast management plan. They must also be responsible for all aspects of the use of explosives in the demolition. WorkCover NSW must be notified prior to their use.
		Demolition carried out in an area that may have a contaminated or flammable atmosphere.	Exposure to hazardous materials in structure.	All areas of the workplace, including basements, cellars, vaults and waste 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 of and/or decomposition of materials • there are any toxic, radioactive or other hazardous chemicals present. Any hazardous materials, including explosives, should be clearly identified. Refer to the chemical's safety data sheet (SDS) or the label of the chemical's container.
			Exposure to asbestos containing material (ACM).	Where ACM is identified, stop the work activity and inform the occupier/owner of the premises or PCBU with management and control. A licensed asbestos removal contractor may be required to remove ACM.
			Workers and others struck by debris from explosion. Workers and others burnt by fire.	

Task	What high risk construction work does this task involve?	What are the hazards and the risks?	What are the control measures?
Demolishing the building or structure (continued)	Demolition carried out in or near a confined space.	Workers and others affected by hot environment – eg heat stroke and dehydration.	Where work is being undertaken in a confined space, do the following: • Complete a written risk assessment that details: o whether the work can be done without the need to enter the confined space o the nature of the confined space o hazards regarding the concentration of oxygen or the concentration of airborne contaminants o the work to be undertaken and the method of working o the type of emergency procedures. • Prepare a confined space entry permit and issue it to the worker entering the area. • Put signage, a communication system and emergency procedures in place. • Ensure that trained and competent workers use PPE. • Ensure that there are specific controls for: o plant and services o atmosphere o flammable gases and vapours o fire and explosion.
	Demolition carried out in an area in which there are artificial extremes of temperature.	Workers and others affected by cold or hot environment – eg frost bite.	Monitor thermal comfort level. Provide UV protection (sunscreen and long sleeve shirts). Ensure regular rest breaks and supply of drinking water. Shorten work periods and/or cease work in extreme cold/hot temperatures.
	Demolition carried out in or near water or other liquid that involves a risk of drowning.	Workers and others at risk of drowning.	All drowning hazards such as water filled open penetrations and excavations must be fenced or securely covered to prevent entry. Powered mobile plant and materials are not to be operated or stored within 2 metres of an open trench.
	Demolition that involves diving work.	Workers and others being exposed to rapid depressurisation.	A written risk assessment must be conducted by a competent person before diving work is carried out. Diving work must be undertaken and supervised by trained and competent divers, as per a diving plan, and a diving log must be kept.

Task	What high risk construction work does this task involve?	What are the hazards and the risks?	What are the control measures?
Demolishing the building or structure (continued)	Movement of powered mobile plant.	Being struck by powered mobile plant.	Prepare and implement workplace traffic management plan and make available to workers: • exclusion zone for mobile plant to be clearly identified (signage and barricades as per site plan) and controlled during vehicle loading/unloading operations. • dedicated, trained road traffic controller(s) to direct traffic entering and leaving site and control traffic (pedestrian and vehicle) on adjacent pedestrian footpaths and roadways. This includes: • the use portable traffic signals and/or temporary safety barriers to direct/control traffic flow as required. Plant delivery vehicle to be unloaded on-site (not from public roadway). Powered mobile plant and materials are not to be operated or stored within 2 metres of an open trench.
	Demolition work that is carried out near a trench with an excavated depth greater than 1.5 metres.	Falls into excavations.	All open penetrations must be fenced or securely covered.
	Demolition work carried out on or near: • pressurised gas distribution mains or piping • chemical, fuel or refrigerant lines • energised electrical installations or services.	Coming into contact with essential services.	All electric, gas, water, sewer, steam 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 is started. Notify utility agency in advance and obtain approval to shut down. Any service retained for the demolition work should be adequately protected as required by the relevant authority – eg the protection of overhead electric lines. Obtain current information on the services prior to commencing work and: • have regard for the information • keep the information readily available for inspection under the WHS Act • make the information available to any principal contractor and subcontractors • retain the information until the excavation is completed or, if there is a notifiable incident relating to the excavation, two years after the incident occurs. The available information about existing underground essential services may not be accurate. Therefore, it is important that demolition methods include an initial examination of the area to be demolished.

	Task	What high risk construction work does this task involve?	What are the hazards and the risks?	What are the control measures?
	Demolishing the building or structure (continued)	Demolition work carried out at more than 2 metres.	Workers falling from height.	Workers do not work from the top of a structure that is being demolished.
			Falls from heights from unsecured ladders.	For demolition work activity where there is a risk of a person or object falling less than 2 metres, use fully decked heavy duty frame trestle scaffolds, with bay lengths of 1.8 metres or less.
			Tools and materials falling from heights while not secured to person conducting the work.	For demolition work activity where there is a risk of a person or object falling greater than 2 metres, use heavy duty modular scaffolds with brick-guards.
			Fragile/brittle roofs.	Scaffolds from which a person or object can fall more than 4 metres must be constructed and certified by a licensed scaffolder. For all scaffolds: • platforms are not to be loaded with more than 100 bricks per bay (or 400kg of blocks) • no scaffold alterations are to be undertaken except by a licensed scaffolder • access to scaffold platforms is to be via stairs or ladder towers. Ensure ladders are secured top and bottom before accessing to work area. Secure tools and material while on ladders. Before working on the roof, it should be inspected to determine whether it is structurally sound. This includes determining whether it is made of any brittle material and whether it is fragile in certain areas.
		Construction work that is carried out on or near energised electrical installations or services.	Workers coming in contact with and/or receiving electric shock from overhead electric lines. Plant/equipment contacting overhead electric lines.	The exclusion zones and approach distances to overhead electric lines at the locations and distances specified on the demolition plan are to be clearly identifiable and enforced by a dedicated controller.
3	Work completion	Work carried out at more than 2 metres in height. Structural alterations or repairs that require temporary support to prevent collapse.	Injuries to public from unauthorised access to workplace – eg falls from heights greater than 2 metres, structural collapse.	All scaffolding and site fencing is secure and serviceable. All entries and exits must be locked at the end of each day. Emergency contact details to be in prominent place at workplace.

DEMOLITION LICENSING

A licence is required to undertake some demolition work. Demolition licensing is part of the National Occupational Licensing System (NOLS) and you will need to seek advice from your local WHS regulator and the National Occupational Licensing Authority (NOLA)[2] as to whether you or any other person undertaking the demolition work will require a licence for the work to be undertaken.

Other licences

Depending on the type of work being done there may be a need for persons to hold the relevant license, for example to carry out asbestos removal work, high risk work or use of explosives.

ASBESTOS REGISTERS AND LICENSING

The WHS Regulations require the person with management or control of a workplace to ensure all asbestos or asbestos contaminated material (ACM) at the workplace (or assumed present) is identified by a competent person and an asbestos register is prepared for the workplace. The asbestos register must be kept up-to-date.

[2] Note: This system is in transition www.nola.gov.au

The WHS Regulations require a person conducting a business or undertaking who commissions the removal of asbestos at the workplace to ensure asbestos removal work is carried out only by a licensed asbestos removalist who is appropriately licensed to carry out the work, unless specified in the WHS Regulations that a licence is not required.

There are two types of licences: Class A and Class B. The class of licence required will depend on the type and quantity of asbestos or asbestos containing materials (ACM) or asbestos contaminated dust or debris (ACD) that is being removed at a workplace as set out in Table 1 below.

Table 1 – Asbestos Removal Licences

Type of licence	**What asbestos can be removed?**
Class A	Can remove any amount or quantity of asbestos or ACM, including: • any amount of friable asbestos or ACM • any amount of ACD • any amount of non-friable asbestos or ACM
Class B	Can remove: • any amount of non-friable asbestos or ACM (Note: A Class B licence is required for removal of more than 10m^2 of non-friable asbestos or ACM but the licence holder can also remove up to 10m^2 of non-friable asbestos or ACM). • ACD associated with the removal of non-friable asbestos or ACM (Note: A Class B licence is required for removal of ACD associated with the removal of more than 10m² of non-friable asbestos or ACM but the licence holder can also remove ACD associated with removal of up to 10m² of non friable asbestos or ACM.
No licence required	Can remove: • up to 10m^2 of non-friable asbestos or ACM • ACD that: - is associated with the removal of less than 10m^2 of non-friable asbestos or ACM, or - is not associated with the removal of friable or non-friable asbestos and is only a minor contamination.

Further information on the duties associated when removing asbestos is available in the *Code of Practice: How to Safely Remove Asbestos*.

ADJACENT OR 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 work.

Lateral support for adjoining structures should be equal to or greater than any provided by the structure to be demolished. Before the existing lateral support is disturbed, provision should be made for the erection of temporary supports, which will need to be checked for effectiveness as the demolition proceeds.

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 to any adjoining building.

ESSENTIAL SERVICES

One of the most important elements of pre-demolition planning is the location and disconnection of all essential services. Essential services include the supply of, gas, water, sewerage, telecommunications, electricity, chemicals, fuel and refrigerant in pipes or lines. The principal contractor or demolition contractor must ensure, so far as is reasonably practicable, that essential services at their workplace are without risks to health and safety.

Any construction work that is carried out:

- on or near pressurised gas distribution mains or piping;
- on or near chemical, fuel or refrigerant lines; or
- on or near energised electrical installations

is defined by the WHS Regulations as high risk construction work and a SWMS must be prepared before this work commences.

All electric, gas, water, sewer, steam 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 is started.

In each case, any utility agency involved should be notified in advance and its approval or services, if necessary, obtained. Any service retained for the demolition work should be adequately protected as required by the relevant authority (for example, the protection of overhead electric lines).

Underground essential services

Where there are underground essential services and these might be disturbed by the work, for example as a result of excavation for demolition purposes, the WHS Regulations require the demolition contractor to obtain current information on the services prior to commencing work and:

- have regard for the information
- keep the information readily available for inspection under the WHS Act, and
- make the information available to any principal contractor and subcontractors, and
- retain the information until the excavation is completed or, if there is a notifiable incident relating to the excavation, 2 years after the incident occurs.

NOTE: The available information about existing underground essential services may not be accurate. Therefore it is imperative that excavation methods include an initial examination of the area to be excavated (for example, sampling the area by way of 'potholing').

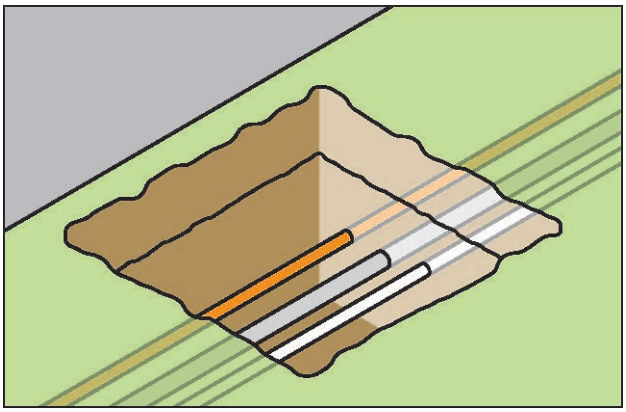


Figure 1: Underground essential services

Further guidance on underground essential services and how to locate them is available in the *[draft] Code of Practice: Managing Risks in Construction Work.*

The first part of the demolition process is to be sure you know what needs to be done.

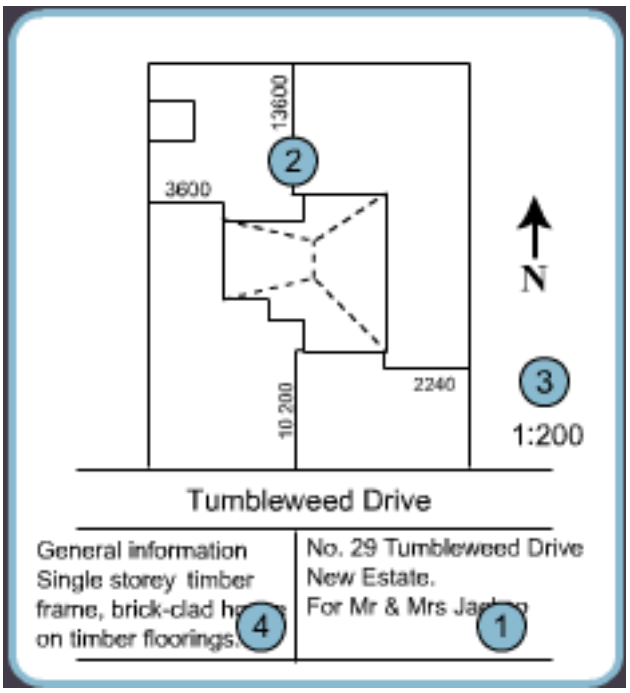
Demolition of large commercial properties and multi-storey buildings requires a detailed demolition plan. Your site supervisor would use this to work out what needs to be done. The demolition plan includes details of:

- how the demolition will be carried out and the major items of equipment to be used

- methods for handling and disposing of demolished materials, especially hazardous materials
- hoardings, fencing, overhead protection and scaffolding that will be used
- other precautionary measures to protect adjoining properties from damage.

A sample of part of a demolition plan for a multi-storey building can be found at www.info.gov.hk (Adobe Acrobat required to view document).

For most residential properties, you can find out what needs to be done from site plans and written job specifications.



1. Tells you where the building is. Make sure you have the right plans and the right house!

2. The distances between the building and the boundaries are shown. This tells you how much access you have along the sides and around the back.

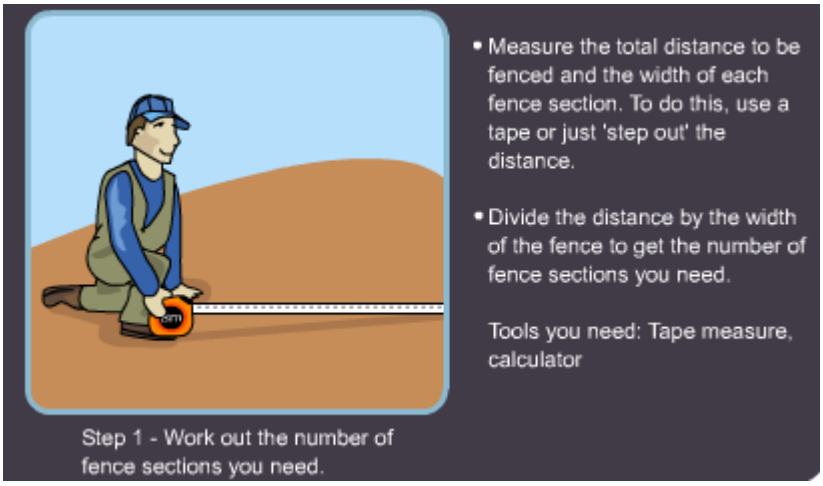
3. The site plan is a scale drawing. You can use the plan to help you decide where to store waste materials and materials to be reused. You can also use it to help decide where fencing or other barriers should be erected to protect the public.

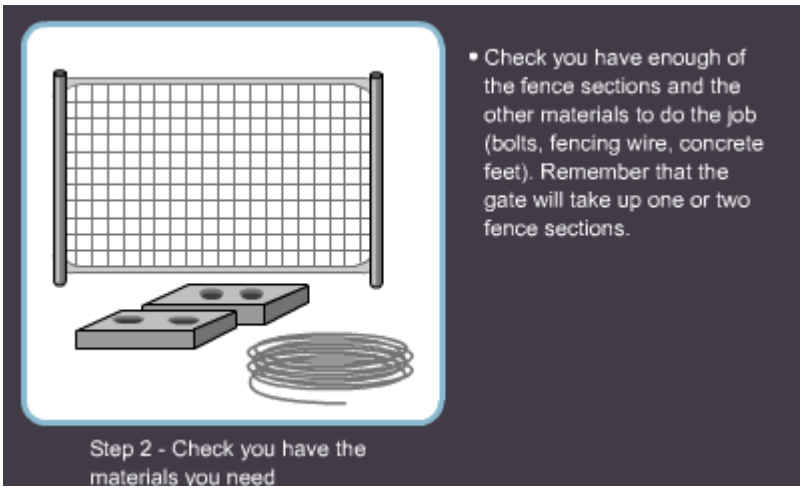
4. This tells you what the building is made of. Different types of materials (such as weatherboard or brick) are demolished differently.
   For a multi-storey building, the height of the building is also shown.

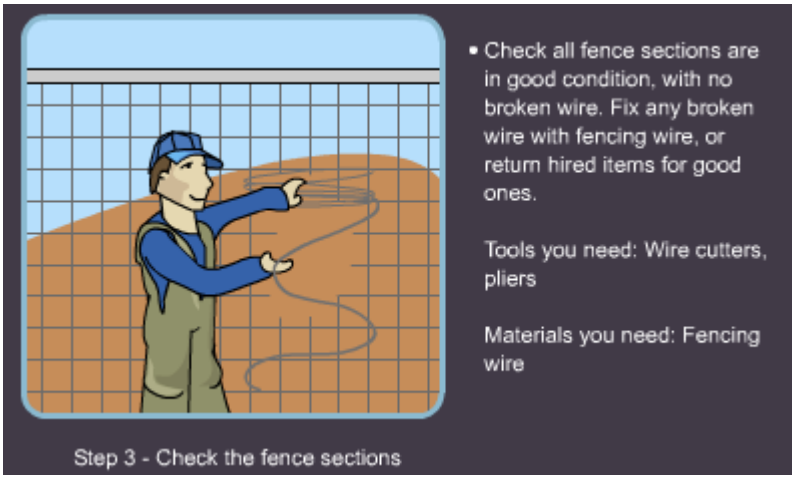
Putting up temporary steel fencing

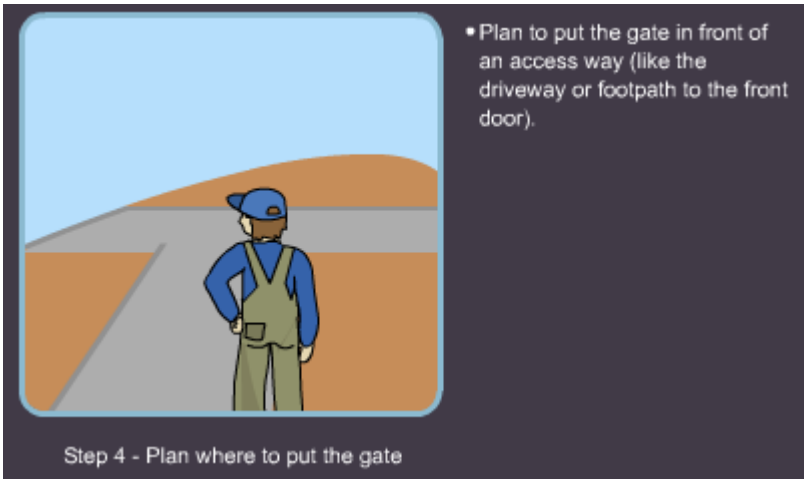
How to put up temporary steel fencing

We often need to put up some temporary steel fencing to stop the public wandering onto the site.









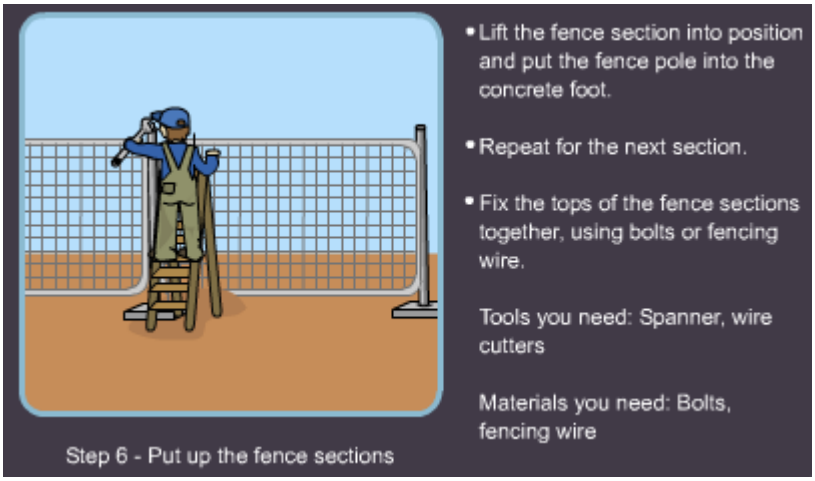
- Plan to put the gate in front of an access way (like the driveway or footpath to the front door).

Step 4 - Plan where to put the gate

- Clear and level the ground for the concrete feet and put two concrete feet in the correct positions. If you are fixing one end of the fence to something existing (like the edge of a timber fence), you might only use one concrete foot.

Tools you need: Shovel

Step 5 - Put the concrete feet into position

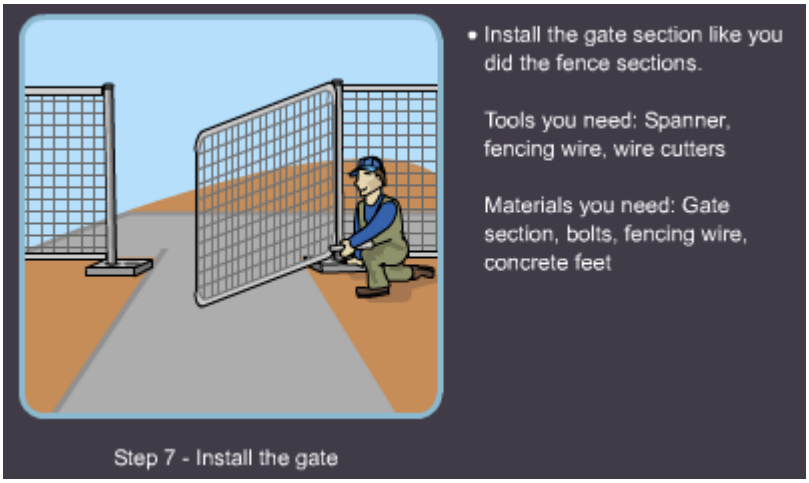


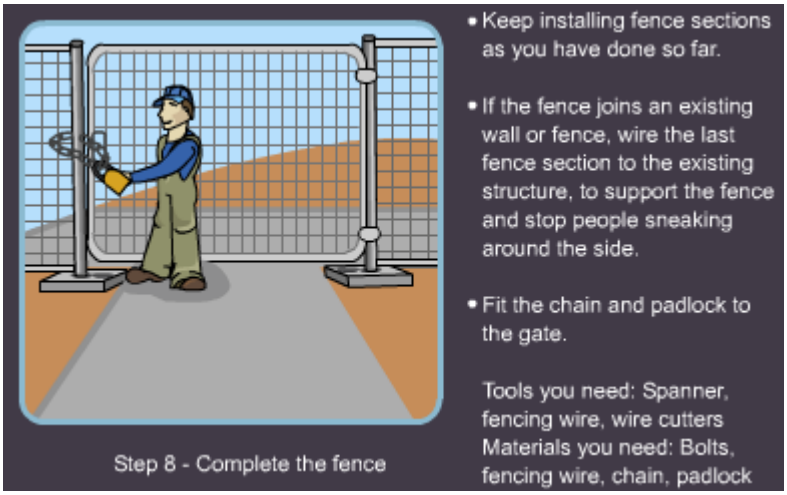
- Lift the fence section into position and put the fence pole into the concrete foot.
- Repeat for the next section.
- Fix the tops of the fence sections together, using bolts or fencing wire.

Tools you need: Spanner, wire cutters

Materials you need: Bolts, fencing wire

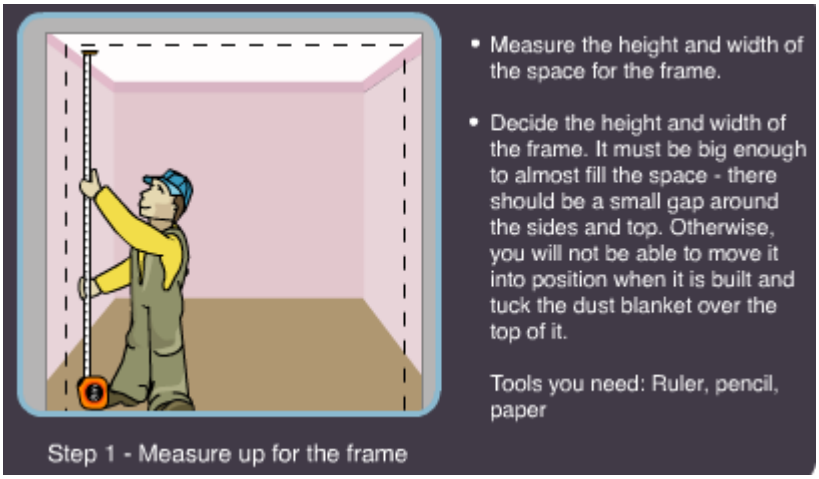
Step 6 - Put up the fence sections

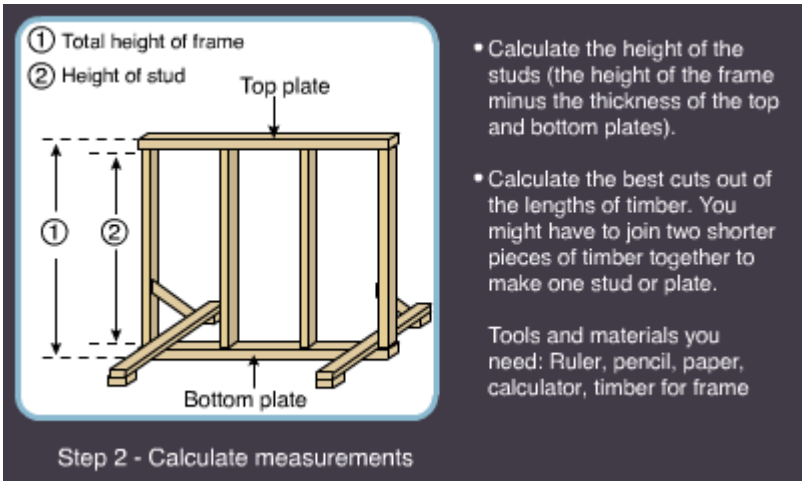




Building a simple frame and installing dust blankets

If only part of a building is being demolished, you may need to wall off the demolition area so the rest of the building can be kept dust free.

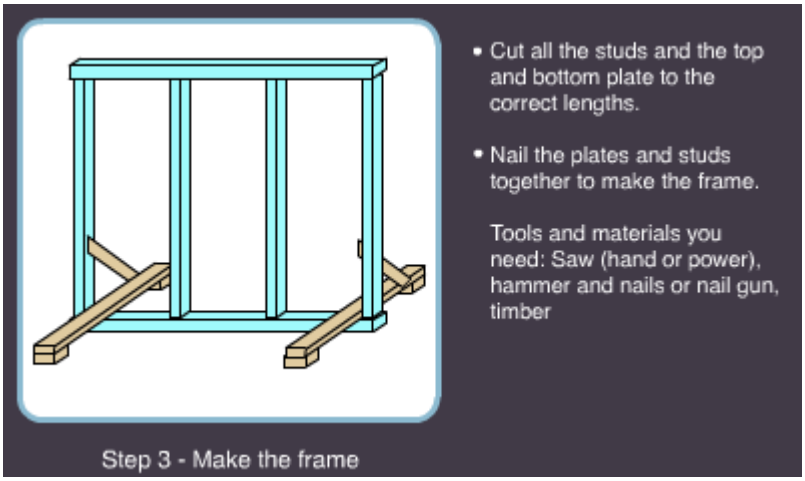




Step 2 - Calculate measurements

- Calculate the height of the studs (the height of the frame minus the thickness of the top and bottom plates).
- Calculate the best cuts out of the lengths of timber. You might have to join two shorter pieces of timber together to make one stud or plate.

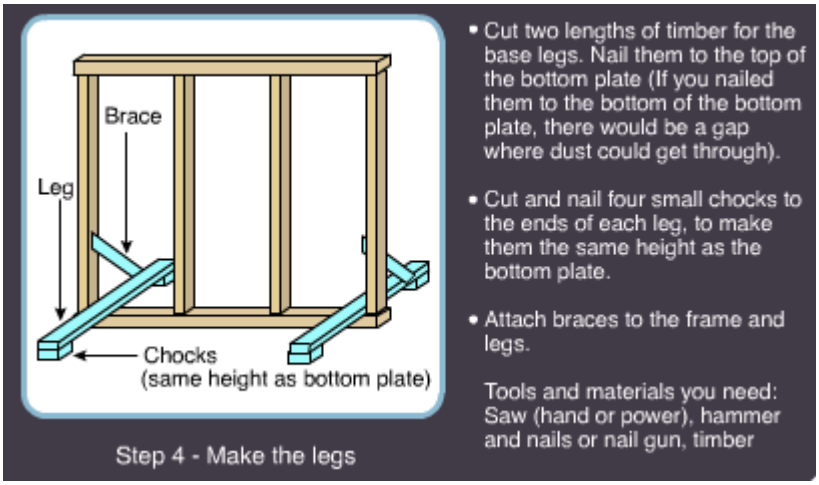
Tools and materials you need: Ruler, pencil, paper, calculator, timber for frame



Step 3 - Make the frame

- Cut all the studs and the top and bottom plate to the correct lengths.
- Nail the plates and studs together to make the frame.

Tools and materials you need: Saw (hand or power), hammer and nails or nail gun, timber



Step 4 - Make the legs

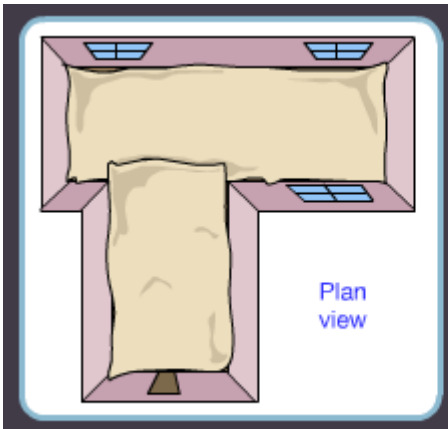
- Cut two lengths of timber for the base legs. Nail them to the top of the bottom plate (If you nailed them to the bottom of the bottom plate, there would be a gap where dust could get through).
- Cut and nail four small chocks to the ends of each leg, to make them the same height as the bottom plate.
- Attach braces to the frame and legs.

Tools and materials you need: Saw (hand or power), hammer and nails or nail gun, timber

- Pick up any timber off cuts and put them in the waste bin.
- Disconnect power tools and put all tools away in the correct place.
- Sweep or vacuum up any sawdust.

Tools you need: Broom, shovel, vacuum cleaner

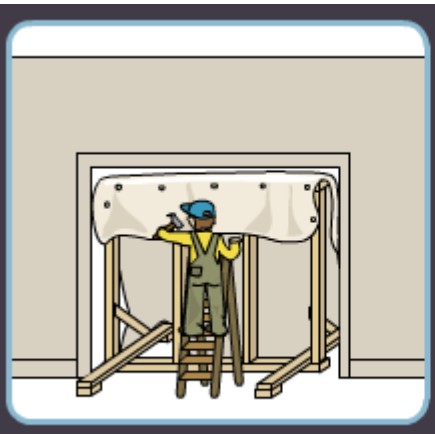
Step 5 - Clean up



- Choose a dust blanket that's the right size for the area. Too small is no good, because areas will be unprotected. Too big and you might trip over it, or get things caught in it.
- Use more than one dust blanket for odd shaped areas. Overlap blankets to make sure areas to be protected are well covered.

Materials you need: Dust blankets

Step 6 - Install dust blankets on the floor



- Put the frame into position.
- Hang the dust blanket so that one end touches the floor. The opposite end goes up over the frame (between the ceiling and the frame, in the small gap you left at the top).

Step 7 - Hang the dust blanket on the frame

Demolition Methods

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

- Generally, the things that were installed last, like appliances, electrical fittings, taps and other valuable bits of plumbing come out first.

- Benches and cupboards come next, which may be able to be reused. Work carefully! Don't scratch, dent or chip things that will be used again.

- Wall tiles and floor coverings come next. Windows may be removed before this is done to lessen the chance of breakage. Use the right tools and techniques - usually, use the smallest tool for the job. For example, you wouldn't use a pneumatic pick to remove tiles – it's too big and powerful.

- Plasterboard walls are next, and then you're down to the frame, floor and brick walls. Use minimum force - too much force can send pieces of building material flying, and causes more noise and dust than necessary.

The demolition sequence will depend on things like the type of construction, location, and demolition method(s) selected. Buildings and structures should generally be demolished in reverse order to their construction, that is, by 'sequential demolition'. In particular:

- sequential 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, and
- masonry and brickwork should be taken down in reasonably even courses.

There is a range of demolition methods that may be used, either separately or in combination. Control measures should be selected on the basis of the demolition method(s)

used. However, no matter what method is used, the building or structure to be demolished and all its components must be maintained in a safe and stable condition so as to prevent the unexpected collapse of part or all the structure. Temporary braces, propping, shoring, or guys may need to be added for stability.

Further information on demolition methods can be found in AS 2601: The demolition of structures.

MANUAL DEMOLITION

Manual demolition includes any technique where hand tools, such as jackhammers, sledge hammers, and picks are used.

Manual demolition encompasses many of the hazards present with major demolition activities. A SWMS must be developed for any high risk construction work that is undertaken as part of the demolition work.

Before commencing any demolition work, the condition of the roofs, walls and floors of the building or structure to be demolished must be assessed so that unexpected collapses do not occur.

Where concrete members are being demolished manually, the reinforcement shall not be cut while breaking of the concrete is in progress.

Where post and pre tension demolition work is undertaken competent person advice should be sought as to demolition sequence.

Areas where debris will fall should be barricaded off and signs erected to prevent persons from entering before demolition starts.

Roofs

Where it is not practicable to demolish a roof using mechanical means or to remove the roofing from work platforms below the roof, then careful consideration should be given to the most suitable method of protection for workers engaged in the removal of the roofing. For example, roof trusses should be removed using safe temporary work platforms. It is important that the removal of trusses does not cause wall instability.

The risk of falls of persons or objects is an important consideration for roof work. should be referred to so that adequate control measures are selected and implemented.

Prior to commencing roof demolition or dismantling, you should consider:

- structural stability
- condition and strength of the roofing material and the identification of fragile roofing
- identification of fragile panels or skylights in solid roofs
- crane access
- safe worker access and egress
- fall protection requirements including issues such as perimeter protection, the availability and strength of anchor points for static lines, inertia reels and lanyards and the suitability of roof structure for the use of safety nets
- means of rescuing persons from safety nets or safety harnesses
- methods of raising and lowering equipment and materials
- assessment of manual handling problems
- electrical safety including the location of nearby power lines, and
- worker competency and training needs.

Fragile roofs

Before working on the roof, the roof should be inspected to identify that it is structurally adequate to work on and whether there is any brittle material or if the roof has a fragile aspect to it (for example, a skylight or worn section).

Brittle or fragile roofing material can include roofing made of asbestos cement, cellulose cement, glass panels, fibreglass, acrylic or other similar synthetic moulded or fabricated material used to sheath a roof or contained in a roof.

If asbestos cement roofing is involved, the work must be undertaken in accordance with the asbestos related requirements of the WHS Regulations. Further information can be found in the *Code of Practice: How to Safely Remove Asbestos*.

Where it is necessary for work to be carried out or adjacent to any part of a fragile roof, you should consider:

- inspecting the underside of the roof to determine the extent of the fragile roof material, the existence of any safety mesh and its fixings, and the structural soundness of the roof material
- completing the work from a temporary work platform
- providing temporary walkways as a means of access to and egress from any work area on the roof where permanent walkways are not provided

- securing and fixing of cleats to walkways on high pitch roofs (for example, where the slope of the roof exceeds 1:6)
- providing temporary roof ladders for steep roofs (for example, in excess of 35 degrees), and
- providing other fall protection as necessary (for example, work positioning or fall arrest system).

Roof access

The person who has the management or control of a workplace where persons are employed to work on roofs has a responsibility to ensure that the access from the ground to the actual work area is safe and without risk to health. Access arrangements may include personnel hoists, scaffolding, temporary work platforms and ladders.

Purlin trolleys

Purlin trolleys are plant designed to travel on top of purlins (horizontal beams running along the length of a roof) and can be used to support material and roof workers. They are sometimes used during the removal of roof coverings.

Purlin trolleys should be provided with a holding brake and a device to prevent their accidental dislodgment from the supporting purlins. Where it is intended that the roof workers be supported by the trolley, the trolley should be provided with suitable safety harness anchorage points.

Before a purlin trolley is placed on a roof structure:

- a competent person (for example, a structural engineer) should have considered whether the roof structure is suitable for the particular purlin trolley and its operational loads, and
- the purlin trolley should be designed and constructed to withstand the loads placed on it and for the purpose of the safe movement of materials and/or persons across the roof surface.

Walls

Glass should be removed from the windows, doors or openings before the commencement of the demolition work.

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

If the demolition work involves the demolishing course by course of any walls, columns, piers or other vertical structural members, the demolition contractor should ensure that:

- risks to persons and property from falling collapsing and rebounding material are eliminated or controlled, and
- the remaining portion of the building or structure, if any, can withstand any loads, impacts and vibration caused by the felling.

Floors and members

All floors and other surfaces used to support workers, plant, equipment or materials should be assessed as capable of supporting the load. Suspended floors and their supporting members should not be loaded by workers, plant, falling or accumulated debris/materials to the extent that there is excessive deflection, permanent deformation or danger of collapse. If water is used, the increased weight of the watered debris should be taken into account. For further information refer to *AS 2601: The demolition of structures*.

Openings in floors, through which a person may fall, shall be properly guarded or boarded over and the boarding secured against accidental removal. Drop zones should be isolated and/or guarded to protect workers and the public from falling objects.

When jack hammering concrete floors, sufficient reinforcing steel should be left in position as protection against collapse or to prevent persons falling through the floor.

Frameworks

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

A competent person (for example, structural engineer) should undertake an assessment to determine the necessary supports required when cutting members. Members should not

be cut unless they are supported safely and effectively. Measures should be taken to prevent sudden spring, twist, collapse or other movement of the framework when it is cut, released or removed.

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.

Framework members should be lowered in a controlled manner. Tag lines should be used on loads where necessary to ensure control of the load.

MECHANICAL DEMOLITION

Mechanical demolition involves the use of powered mobile plant, such as excavators, cranes, loaders and bulldozers. There may be a mix of hand and mechanical demolition methods applied.

Demolition should be planned to be systematic and sequential. That is, a structure should generally be demolished in the reverse order to which it was constructed.

Working on suspended floors

Suspended floors and their supporting members should not be loaded by workers, plant, falling or accumulated debris/materials to the extent that there is excessive deflection, permanent deformation or danger of collapse. If water is used, the increased weight of the watered debris should be taken into account.

If it is proposed that powered mobile plant will be operated on a suspended floor, the demolition contractor should ensure that a competent person (for example, a structural engineer) verifies and documents:

(a) the type, size, weight and usage of any specified plant
(b) that the floor is capable of sustaining the static and live loads of the plant (including attachments) and demolished materials, without excessive deformation or collapse, either:
    - without additional support from below, or
    - with specified propping to be applied from below so that the loads carried do not exceed their manufacturer's specified rating

(c) it is moved between suspended floor slabs by:

- appropriate hoist equipment, or
- a fabricated ramp.

If load shifting equipment is to be used on suspended floors as part of the demolition work, a notification must be made to the relevant WHS regulator.

When using powered mobile plant on suspended floors, the principal contractor should review the demolition SWMS to confirm that:

- where plant has been specified in the SWMS, another piece of plant of the same type and usage may be substituted for it provided that the substituted equipment is neither larger nor heavier than the specified equipment
- effective communication will be maintained between the equipment operator and the demolition supervisor while the equipment is operating
- debris is progressively removed from each floor
- buffers are used to prevent the plant from falling over the edge where plant is used to push/tip materials into a nominated areas, and
- guarding, hoarding and/or exclusion zones are used to protect persons against the risk of being struck by falling debris and materials.

Load shifting equipment should, as far as practicable, be located on a beam. Skid steer loaders using a breaker may not be appropriate to be used on suspended floors with their limited reach.

It is important to consider the load created when large or multiple pieces of plant are used for this purpose so as to ensure that any partially demolished structure can support the loads. For example, the use of an excavator with a hydraulic rock breaker or pulverising attachment to break up walls and floors while other load shifting equipment is used to shift the debris on a suspended floor will result in a higher load. Because of the weight of the plant, the vibration caused by its operation and the build-up of debris, careful design and planning is needed to prevent a premature collapse of the structure.

Demolition of walls

When mobile plant (for example, an excavator with 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 or objects could fall. The remaining wall can later be safely demolished from the floor below. All remaining sections of walls should be identified and highlighted as buffers for edge protection.

Guarding, hoarding and/or the exclusion zones should be used to protect workers and/or the public against the risk of being struck by falling debris and materials.

Walls should not be laterally loaded by accumulated rubble or debris, to the extent that they are in danger of collapse.

Using plant and attachments

All plant attachments should be pinned and secured as per manufacturer's requirements. The plant fittings used in demolition should be designed for and fit for purpose. Do not overload equipment to avoid damaging the equipment itself and prevent the risk of plant overturning.

When plant is used to demolish 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 plant or operator.

Ensure that any member to be severed (with grapples, shears or pulverising attachments) is either effectively supported or, if allowed to fall, will not endanger persons, plant or damage the remaining structure.

Exclusion zones should be established where necessary to protect the safety of people who are working on or in the vicinity of the demolition work. No person should be in any area near the mechanical demolition where there is a possibility of being struck by flying debris. Areas in which shears are operating should be kept clear of workers, because of the risk of smaller pieces of metal (for example, bolts) flying off when sheared.

For further guidance on the safe use of plant refer to the *[draft] Code of Practice: Managing the Risks of Plant in the Workplace.*

INDUCED COLLAPSE

Induced collapse involves the systematic/sequential removal of key structural members and the application of a force to result in the controlled collapse of all or part of a building or

structure. Expert advice should be sought from a competent person before this method is used.

Induced collapse methods should only be used on detached, isolated structures on reasonably level sites. There must be sufficient clear space into which the collapsing material will fall. The space must be large enough to contain the collapsed material and enable equipment and personnel to be removed to a safe distance prior to the collapse.

For further information on induced collapse methods refer to *AS 2601: The demolition of structures.*

Load reduction

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 framework members and/or the partial cutting of load-bearing members, the remaining structure has sufficient strength to withstand wind or impact loads until the actual collapse is initiated.

Dead load can be reduced systematically by removing surplus material, machinery, roofs, cladding, walls and parts of floors before demolishing the structural frame.

Sometimes heavy loads are left at height to induce the collapse of the structure after movement is initiated. If this system is adopted, it should be carefully analysed and documented by a competent person (for example, a structural engineer) to avoid premature collapse.

Wire rope, slings and chain pulling

If using wire rope, slings and chain pulling to demolish a structure, the pulling medium should be a securely anchored winch or plant designed for towing and heavy enough to apply the required tension without sliding or lifting from the surface on which it is located.

The wire rope, sling 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 rope, sling or chain in the event of a failure. The plant operator should be protected from rope breakage and flying debris. Exclusion zones should be established where necessary to protect the safety of people who are working on or in the vicinity of the demolition work.

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.

USING EXPLOSIVES

Any construction work that involves the use of explosives is defined by the

WHS Regulations as high risk construction work and a SWMS must be prepared before this work commences.

Explosives must not be used to induce the collapse of any structure unless approved by the appropriate authority.

All possession, storage, handling and use of explosives must be carried out in compliance with the relevant dangerous substances/goods or explosives legislation applicable in your state or territory.

The transport of explosives must be in accordance with the *Australian Code for the Transport of Explosives by Road and Rail.*

A competent person experienced in the controlled application of explosives for the purpose of carrying out the demolition should be consulted before deciding whether explosives may be used for demolition.

If explosives are used in demolition a licensed shot firer experienced in using explosives for demolition must be engaged and be responsible for all aspects of the use of explosives in the demolition.

If explosives are used in demolition work, a notification must be made to the relevant WHS regulator (see section 3.1 of this Code).

If using explosives the following issues should be considered:

- the type of structure and its location
- the ability to create and secure a large enough exclusion zone to protect the public and other structures
- air shock, noise and dust if the explosives are to be used above ground; also the type of day has to be considered as air shock will vary with cloud cover
- prior to the blasting of any structure or part of a structure, a complete survey should be made by a qualified person of all adjacent improvements and underground utilities
- when there is a possibility of excessive vibration due to blasting operations, seismic or vibration tests should be taken to determine proper safety limits to prevent damage to adjacent or nearby buildings or other property
- utilities require special consideration, and the proximity of underground and overground services should be carefully considered before blasting operations are carried out. Consultations should be carried out with the authorities responsible for concealed underground works (for example, pipes, cables)
- the preparation of a structure for demolition by explosives may require the removal of structural columns, beams or other building components (see sections 4.1 and 4.3 in this Code), and
- extreme caution should be taken during this preparatory work to prevent the weakening and premature collapse of the structure.

Demolition of Special Structures

'Special structures' are, because of the nature of their construction or condition, complex and/or unusual. Special structures include:

- pre or post-tensioned construction
- pre-cast concrete panel and framed structures
- stressed skin structures (that is, buildings that rely on the sheeting, cladding or decking to stiffen and restrain the structural framework), and
- slung structures (for example, floors or roofs) that are in some way suspended from a framework, supported by a structural core.

Special structures will require proper planning and care to be demolished safely. An appropriate demolition method and sequence should be selected and documented prior to the work commencing. A demolition plan and an assessment by a competent person of the proposed demolition method may assist with this process. A SWMS must be prepared where structural elements are to be demolished.

PRE AND POST-TENSIONED CONCRETE

Pre-tensioned concrete contains tendons (wires, strands or bars) that have been tensioned before the concrete is placed.

Post-tensioned concrete contains tendons that have been tensioned after the concrete has hardened.

Tensioned tendons require controlled removal because the high level of potential energy stored in the tendons poses a risk to the health and safety and can cause damage to property. It is also important to ensure that structural stability is retained during and after tendon removal, prior to the final demolition of the concrete element.

The tendons can be subject to corrosion that weakens them and decreases the structural integrity of the building. Damage is not usually evident externally, even if strand breakage is extensive and conditions can vary widely even within an individual structure.

Before demolishing pre or post-tensioned concrete elements, review all available documentation on the building or structure including:

- building plans, designs and specifications to understand the type of tensioning used, the load carried, anchorage points and number of tendons
- any construction photographs to obtain information on anchorage details, the construction sequencing, and any other measures may affect moisture access.

The condition of the concrete and tendons should be considered before and during demolition, for example, by:

- conducting a visual inspection to confirm loads, obvious deviations from the original design and waterproofing details
- assessing conditions throughout the building, as well as utilising selective testing in representative areas to assess any weakening or breakage of tendons
- measuring humidity within tendon sheathing and analysing any sheathing contaminants
- removing, inspecting and testing a small number of tendons to assess their condition, and
- continuing to monitor tendon tension.

Suitable control measures should be implemented, such as using steel plates or other restraint measures, at locations adjacent to pedestrian areas or where concrete cover is reduced. This will help to minimise the risk of personal injury or property damage arising from the unexpected release of stored energy in tendons.

FIRE-DAMAGED, RUINOUS AND STRUCTURALLY UNSOUND BUILDINGS OR STRUCTURES

An assessment should be undertaken to identify asbestos, hazardous materials and structural integrity issues relating to fire-damaged, ruinous or structurally unsound buildings or structures. The person conducting a business or undertaking should request a written report by a competent person specifying the hazards associated with the design and the current state of the structure.

Control measures should be taken, as far as is reasonably practicable, during the assessment and demolition stages. Where possible, fire damaged, ruinous or structurally unsound buildings or structures should be demolished by mechanical means.

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

LIFT SHAFTS

The combination of the lift shaft structure and the lift plant (including the lift cage, winders, counter-weights, electrical supply and controls) can make these complex structures. Some of the issues to consider are:

- unwinding cables from lift drums prior to the removal of drums
- preparation to remove lift cage and machinery room elements, including temporary support of the lift cage(s) and electric power disconnection
- the provision of temporary decking in the lift shaft
- removal of counterweights at ground level, and
- the progressive demolition of the lift shaft walls onto existing floors and debris removal, and
- the presence of asbestos on the brakes and clutches of older lifts.

BASEMENTS, CELLARS, VAULTS, DOMES AND ARCHED ROOFS

During the demolition of a basement, cellar, arch, vault or dome frequent inspections should be made to identify whether there has been any unplanned movement. If unplanned movement is detected, appropriate action should be taken to avoid any uncontrolled collapse.

If a basement, cellar, vault or void adjoins another property, any adjoining walls should be inspected by a competent person 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 competent person (for example, a structural engineer).

If a basement has been built in ground with a high water table, measures should be taken, as far as is reasonably practicable, to prevent any collapse as a result of hydraulic pressure, uncontrolled water inrush or flotation.

MASONRY AND BRICK ARCHES

Masonry and brick arches should be demolished in a sequence that allows for the removal of as much of the dead load material as possible without interfering with the stability of the main arch rings. The spandrel infilling should only be removed down to the springing line as the load-carrying capacity of many old arches relies on the filling between the spandrels. In multi-span arches, lateral restraints should be provided at the springing level before individual spans are removed.

INDEPENDENT CHIMNEYS AND SPIRES

A detailed inspection and survey should be completed prior to the demolition of a chimney or spire. In particular, the condition of the structural material, which can range from stone and brick to steel, timber and concrete, needs to be assessed to identify any faults, such as fractured or badly weathered stone or rotten timbers.

Measurements may need to be taken to determine whether there is any deviation from the perpendicular. The possibility of chimney instability resulting from inclement weather (for example, high winds) needs to be considered during all stages of demolition work.

Due to their height, it is common for chimneys to be demolished by hand or through induced collapse. Temporary supports may be required to ensure that premature collapse does not occur.

Hand demolition should be carried out progressively from the top of the chimney and from safe working platforms.

Due to their height, control measures that need to be considered when demolishing chimneys or spires include:

- temporary work platforms
- falling object protection
- exclusion zones, and
- dust control.

Induced collapse will require sufficient clear space, approximately 1.5 times the total height of the chimney and of sufficient width depending on the type of structure.

PYLONS AND MASTS

If using hand demolition, a pylon or mast should be dismantled in the reverse order to that in which it was erected. If another method is used, such as demolition by wire rope pulling, planning including the provision of adequate clear space will be required.

PRECAST CONCRETE PANELS

If a structure is composed of a series of reinforced precast concrete panels, an inspection of the fixings to the rest of the structural elements, jointing between elements, and the lifting points or fittings should be undertaken to establish their nature and condition before any demolition of the structure begins.

Where possible, the panels should be removed by a crane in the reverse sequence to that used for their erection. Wherever panels act as bracing, for example along a wall, sufficient temporary bracing should be provided to the structure, to maintain its stability during and after removal of the panels.

The original lifting points or fittings should not be reused to lift and/or support a panel during its removal if they 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.

For further guidance on precast concrete elements, refer to the *Code of Practice: Tilt-up and Precast Concrete Elements in Building Construction [under development].*

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.

Use guarding, hoarding and/or exclusion zones to protect persons against the risk of being struck by falling debris and materials.

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

Supervision by a competent person (for example, structural engineer) during various stages of the 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 accidental impact on the façade or its supports.

STORAGE TANKS AND PIPELINES

Before an above ground or underground storage tank and/or associated pipelines are removed or demolished, any previous use should be determined and appropriate action taken to identify and remove any hazardous chemicals. Delivery lines and vent pipes should be purged. The tank should be emptied and certified by a competent person as being free of gas, flammable vapours or other hazardous chemicals.

If work is to be undertaken on storage tanks then it is necessary to determine whether they are a confined space for the purpose of the work. There are specific requirements in the WHS Regulations for working in confined spaces and further guidance can be found in the *Code of Practice: Confined Spaces*.

General precautions

During the demolition of tanks and pipelines, the following precautions should be taken:

- ensure that no flammable or toxic substances or combustible liquid is allowed to enter any drainage system or watercourse
- if excavating underground tanks and/or pipelines, check the soil surrounding the tank/pipe to ensure it is not contaminated, either by leakage from the tank/pipe or by spillage, and
- hot work (for example, welding; oxy-acetylene cutting) should not be undertaken where there is a chance that flammable material may be present as a result of leakage/spillage or after cleaning out the tank/pipe.

Hazardous facilities

Special precautions should be taken during the demolition of major hazard facilities (MHF), chemical works, gas works and similar establishments. These types of facilities should be examined in conjunction with a competent person (for example, chemical engineer), in order to determine the nature of any of the plant, 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 any demolition work starts.

Containers that have held combustibles

Welding and cutting work on containers that 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 any instructions for cleaning are followed. Containers which have held any of the following materials are considered unsafe and hot work should not be started before they are properly cleaned:

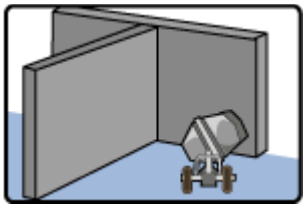
- petrol, kerosene, solvents, or light oils
- acids and alkalines, which can react with metal to produce explosive or toxic gases
- heavy oils, tars or solids, which can release combustible gases when exposed to heat, and
- combustible solids, whose finely divided particles may form an explosive dust cloud.

Any container which has held flammable or combustible substances should be considered unsafe until confirmed otherwise by a competent person.

Further guidance on safety precautions that can be taken when welding is available in the *[draft] Code of Practice: Welding and Allied Processes*.

Controlling Risks in Demolition Work

Demolition might look dangerous, but by knowing about hazards and how to minimise them, you can make your work as safe as possible, for yourself and for other people.



Asbestos is a mineral that was once mixed with concrete and used to make wall panels, insulation and pipes. These products were strong, flexible and fire resistant. Asbestos fibre was also used for insulation.

Unfortunately, asbestos fibre or dust can cause cancers and scarring of the lungs and is not used any more. Demolition involving asbestos is done by specialist workers. For the national code of practice for the safe removal of asbestos, go to www.nohsc.gov.au.

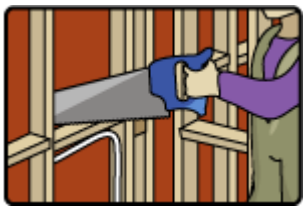
Power leads should be kept away from water. This may involve them being elevated to keep them off wet ground.

Demolition work makes dust. For your health, and to keep the rest of the house clean, keep the dust to a minimum.

Dust from synthetic mineral fibres (used in particle boards) can damage your lungs. If you need to cut through materials like these, wear a dust mask.

Noise is a big problem in the building industry. The tiny hair cells in your inner ear can be destroyed by sudden very loud noise (like a gun blast) or by the noise of tools and equipment over a long period. The first warning sign of noise damage is a ringing sensation in the ears.

If you cut through a gas line, you might poison yourself, or even blow up the house! A licensed plumber must isolate the plumbing connections before demolition begins.



If you saw or hammer through a live electric cable, you might kill yourself!

A licensed electrician must isolate the electrical connections before demolition begins.

Fire can start at any time on a building site - and if the water has been disconnected, you might be in real trouble! If water is disconnected, have portable fire extinguishers ready to use and know how to use them.

Many serious accidents happen when people fall off roofs. When working on a roof, make sure there are guardrails around the edge of the roof and around openings such as stairwells, skylights and so on. Safety nets and various other safety devices are also available to make working on roofs less hazardous.

Stored gas and toxic chemicals should be removed from the demolition area. If toxic chemicals are disposed of, this should be done in accordance with EPA regulations.

THE BUILDING OR STRUCTURE TO BE DEMOLISHED

The person conducting a business or undertaking in control of the demolition work should consult with the designer and/or the principal contractor if appointed where reasonably practicable, to obtain a written report specifying the hazards associated with the design and the structure in the planning stage of the demolition work. Specific hazards may be outlined in a demolition plan.

The building or structure to be demolished and all its components must be maintained in a safe and structurally stable condition so as to prevent the unexpected collapse of part or all the structure. Temporary braces, propping, shoring, or guys may need to be added to ensure that stability of the structure is maintained.

The position, depth and type of basements, wells and underground storage tanks should also be determined as should the contents of any storage tanks.

Adjoining properties and structures also need to be considered, as do the existence of easements, right of way, boundary walls and other encumbrances.

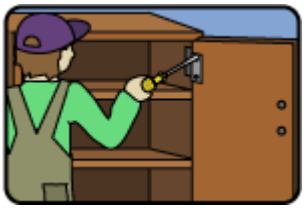
Below you will find some tips on how to demolish a building.

Plumbing fittings

- A licensed plumber must isolate the plumbing connections before demolition begins.
- Undo fittings using plumbers' wrenches.
- Undo mounting and securing brackets using wrenches, screwdrivers and spanners.
- Protect, label and store fittings for reuse.

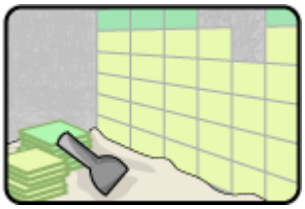
Electrical fittings

- A licensed electrician must isolate the electrical connections before demolition begins.
- Undo fittings using screwdrivers. Mounting brackets aren't normally reused.
- Protect, label and store fittings for reuse.



Benchtop cabinets

- Look carefully to see how the item has been installed and understand how the different parts are joined together.
- Remove any plumbing fittings.
- Remove all doors, drawers, hinges.
- Undo any internal screws or bolts that hold the item together.
- Remove any panels that come away.
- Undo mounting or fixing brackets.
- With most items, this should get you down to the frame. Don't break up nailed or glued frames unless absolutely necessary.

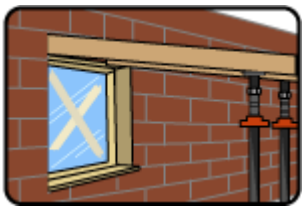


Wall and floor tiles

- Put down dust blankets so tiles falling from walls fall on the blankets.
- Chip tiles off using a bolster. Catch wall tiles as they fall and stack them, or put them in a wheelbarrow for disposal.
- Clean up as you go with a dustpan or vacuum cleaner.

Plasterboard

- Remove all fittings (see above).
- Put down dust blankets so pieces of plasterboard falling from walls fall on the blankets.
- Remove plasterboard with a crowbar or claw hammer, with as little force and breakage as possible.
- Clean up as you go with a dustpan or vacuum cleaner.



Windows set in brickwork

- Tape the window glass with crosses, so that if it breaks it stays together.
- Make sure that anything supported by the brickwork or timber frame (like roof beams) is supported some other way before demolition begins. For example:
    - remove three or four bricks above the window, to make equally spaced holes in a line, just above the window opening
    - put strong timber beams about 2 m long through the holes
    - support the timbers at both ends with adjustable props, screwed up so that the timber beams take all the load of whatever is above the window.
- Remove small amounts of brickwork around the window frame using a bolster and hammer. Work from the inside if possible, so rubble falls outside.
- Carefully remove the window, trying not to break the glass.
- Use a crowbar to pull apart nailed timber.
- Be careful with nails sticking out. If timber is to be reused or stored, remove all nails.

Timber frames (eg to remove an internal wall)

- Support the top of the frame (and any load on top of it, like roof beams) with adjustable props before starting to demolish the frames.
- Remove the noggings from the frame, then the uprights.
- Replace the timber support cross beams with single adjustable props at every load bearing point.

Concrete floors

- Remove all floor coverings.
- Cut an outline of the area to be broken up with a diamond-tipped electric saw.

- Break out the concrete to be removed with a pneumatic chisel.
- Remove all rubble as you go.

Roof tiles

- Make sure scaffolding is in place around the edge of the roof.
- Lash a ladder in place to the roof.
- Set up a chute or similar enclosure to take the tiles to ground level without dropping them.

HAZARDOUS CHEMICALS

Demolition work may involve workplaces or structures that contain or have contained hazardous materials, including chemicals. Hazardous materials include lead, asbestos, polychlorinated biphenyls (PCBs), contaminated dust, synthetic mineral fibres, and combustible materials:

The risks arising from potential exposure to hazardous materials should be identified, assessed and controlled in accordance with the WHS Regulations. Exposure standards that must be observed for hazardous chemicals are set out in the manufacturer's Safety Data Sheet (SDS), Hazardous Substance Information System or in the *Workplace Exposure Standards for Airborne Contaminants*.

Before starting any demolition work, all areas of the workplace, including basements, cellars, vaults and waste 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 of and/or decomposition of materials, and
- there are any toxic, radioactive or other hazardous chemicals present.

Any hazardous materials, including explosives, should be clearly identified to ensure the health and safety of everyone on or near the workplace. In identifying hazardous chemicals, the person conducting a business and/or undertaking or the principal contractor should refer to the chemical's Safety Data Sheet (SDS) or the label of the chemical's container.

The person conducting a business or undertaking and/or the principal contractor at a demolition workplace must inform all workers and other persons at the workplace of the presence of hazardous chemicals, and the control measures for exposure and safe disposal. SDSs for hazardous chemicals should be readily available for reference.

Appropriate, clean facilities and amenities must be provided for workers to minimise risks where there are hazardous materials present.

Further specific guidance on hazardous chemicals can be found in the *[draft] Code of Practice: Managing Risks of Hazardous Chemicals.*

Asbestos

Any construction work, including demolition work that involves or is likely to involve the disturbance of asbestos is defined by the WHS Regulations as high risk construction work and a SWMS must be prepared before this work commences.

The person conducting a business or undertaking with management or control of the demolition work has specific responsibilities in regard to identifying whether asbestos is present and informing others if it is.

Where a structure is to be demolished, the WHS Regulations require that a person conducting a business or undertaking carrying out demolition work must:

(a) obtain a copy of the asbestos register for the workplace from the person with management or control of that workplace, or

(b) if there is no asbestos register must:

- not carry out the work until the structure or plant has been inspected to determine whether asbestos or asbestos containing materials (ACM) are fixed to or installed in the structure or plant
- ensure that the determination is undertaken by a competent person, and
- if asbestos or ACM are determined or presumed to be present, inform the occupier and owner of the premises (if domestic premises) and the person conducting a business or undertaking with management or control of the workplace.

If a domestic premise is to be demolished, the person with management or control of workplace, structure or plant must ensure that all asbestos that is likely to be disturbed by the demolition work is identified and, so far as reasonably practical, removed before the demolition work is started.

When planning demolition or refurbishment, review and consider:

- the location of asbestos in relation to the proposed demolition or refurbishment
- if there are inaccessible areas that are likely to contain asbestos
- whether asbestos is likely to be damaged or disturbed as a result of the demolition or refurbishment work – if yes, can it be removed safely before work commences?
- type and condition of asbestos present
- amount of asbestos present
- method of demolition or refurbishment and how will it affect the asbestos, and
- the nature of the ACM (friable or non-friable).

Demolition of part of a building, structure, or plant can be carried out to access in-situ asbestos so it can be removed safely. For example, part of a wall may be demolished to access asbestos located in the wall cavity so it can be removed before further demolition.

Building and construction workers can expect that, in workplaces where asbestos is fixed or installed, all asbestos has been identified so far as is reasonably practicable. If there is any uncertainty about the presence of asbestos or if any part of the structure or plant is inaccessible and likely to be disturbed, it must be assumed that asbestos is present.

Further specific guidance on managing asbestos when demolition and refurbishment work is being carried out can be found in Chapters 7 and 10 of the *[draft]: Managing Risks in Construction Work* and in the:

- *Code of Practice: How to Manage and Control Asbestos in the Workplace,* and
- *Code of Practice: How to Safely Remove Asbestos*.

Lead

Lead is found in paint, old water pipes and other plumbing fittings, sheet lead, solders, lead flashing, lead light windows and glass. The age of a structure may be directly related to the amount of lead that can be present (see *Table 2*).

Table 2 – Lead sources

Approximate Date of Construction	Sources of Lead Hazards
1920 - 1978	Paint
1920 - 1978	Plumbing
1923- 1986	Automobile exhaust (may accumulate as ceiling dust)

If it is suspected that the structure contains lead based paint, a test for the presence of lead should be conducted.

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.

Further information can be found in *AS 4361.1: Guide to lead paint management-Industrial applications.* Testing can recognise dried paint film with more than 1% (by weight) to be lead-containing paint.

Synthetic Mineral Fibres

Synthetic mineral fibres are used extensively for insulation in building walls and ceilings as well as on items such as air-conditioning duct work. The specific material should be identified and controls implemented relevant to the manufacturer's instructions.

Personal protective equipment should be provided to workers and worn when insulation is being removed during the demolition process and dust should be suppressed by damping down.

Polychlorinated biphenyls (PCBs)

Workers can be exposed to PCBs when dismantling electrical capacitors and transformers or when cleaning up spills and leaks. Appropriate controls should be implemented when handling damaged capacitors to ensure that any spillage does not contact workers and is appropriately cleaned up and disposed of.

Any equipment or parts 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.

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

WORK AREA SECURITY

Exclusion zones

To protect workers undertaking demolition activities, exclusion zones should be considered to prevent unauthorised personnel entering work areas.

A system to prevent falling objects impacting on workers must be implemented to protect the safety of people who are working on or in the vicinity of the demolition work. In particular, any area where a falling object might reasonably be expected to land should be designated an exclusion zone. The enclosed and/or protected area should extend horizontally to a safe distance beyond the overhead work area.

Planning for exclusion zones should take into consideration:

- erecting secure impassable barricades with adequate signage and appropriate lock out procedures to prevent pedestrian or vehicular access to the area, and
- providing information to workers and other persons at the workplace advising them of the status of the exclusion zones, and

- providing a level of supervision that ensures that no unauthorised person enters an exclusion zone.

Exclusion zones and safe distances may be required during:

- the stripping, removal and/or dropping of debris
- the operation of demolition plant or equipment
- pre-weakening activities for a deliberate collapse, and
- the deliberate collapse or pulling over of buildings or structures.

Public access and protection

Adequate public safety must be maintained in public places and areas adjoining the workplace as the work progresses (e.g. roads, walkways). Where demolition work is adjacent to a public place and there is a risk of falling debris, a method of protection should be selected and:

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

Control measures to isolate the work from the public may include installing hoarding such as security fencing, containment sheets and mesh, an overhead protective structure, road closures and specified exclusion zones.

Overhead protective structures should be provided for public walkways in conjunction with perimeter fencing. Overhead protection may be constructed from scaffolding, fabricated steel or timber, and should be designed to withstand an appropriate load.

Unauthorised entry to a demolition workplace can expose persons to a number of hazards that, if not controlled, could result in fatalities or serious injuries. The person conducting a business or undertaking who controls the workplace, who may be a principal contractor or demolition contractor, must ensure, so far as is reasonably practicable, that the workplace is secured so as to prevent unauthorised access. Monitoring of access and egress points for the workplace should be conducted during the work.

Further information on security fencing, falling materials, overhead protection and hoardings can be found in *AS 2601: The demolition of structures.*

PLANT AND EQUIPMENT

A range of plant and equipment typically used for demolition work includes:

- powered mobile plant (see section 6.5 below)
- personnel and/or materials hoists
- air compressors
- electric generators
- jack hammers
- hydraulic jacks
- oxy-acetylene (gas cutting/welding)
- concrete saws and corers
- scaffolding
- ladders, and
- many types of handheld plant, including: angle grinders, power saws, hammers, hydraulic jacks and pinch/lever bars.

All plant and equipment should be:

- used or operated by a competent person – if a high risk work licence is required to operate the item of plant (for example, a crane) then an appropriate licence must be held by the operator of that plant, and
- used and maintained in accordance with the manufacturer's or supplier's instructions.

Further general guidance on plant can be found in the *[draft] Code of Practice: Managing the Risks for Plant in the Workplace.*

POWERED MOBILE PLANT

The use of powered mobile plant such as cranes, excavators and bulldozers, requires the preparation of a SWMS before work commences.

A high risk work licence is required to operate some types of powered mobile plant.

Whenever powered mobile plant is to be used for demolition work, traffic management arrangements should be implemented for the workplace. Further guidance on traffic management is available in the *Code of Practice: Traffic Management within a Workplace [under development]*.

Cranes

Cranes may be used in demolition work for a number of purposes, including:

- lifting and lowering plant and/or materials

- lifting and lowering personnel work boxes, and
- holding suspended loads.

Cranes require a licensed operator. An operator may also need other competencies for specialist work.

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. Where this occurs, the safe working load of the crane should be reduced by 50% to allow for miscalculations in the test weighing. A similar approach should be followed where weights cannot be determined with reasonable consistency and accuracy.

REMOVAL OF DEBRIS

The person conducting a business or undertaking and/or the principal contractor in control of the workplace must ensure so far as is reasonably practicable that the storage, movement and disposal of construction materials and waste at the workplace is without risk to health and safety.

Debris should be progressively removed to prevent any build up that could affect the integrity of a suspended floor of the building or structure, affect workplace access and egress, become a fire hazard, or cause a health and safety hazard.

Demolished materials should not be allowed to fall freely unless they are confined within a chute (or similar enclosure), shaft and/or exclusion zone.

A debris drop is a debris pile that is enclosed and where the risk of an object striking workers or the public has been eliminated. Debris drop zones should be clearly identified and any area where there is a risk that a worker or other persons at the workplace might be injured by falling or rebounding debris should be fenced or barricaded to prevent access.

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

- at the working level, each opening should be protected by an adequate vehicle buffer during the removal of debris by mobile plant, and guarded by suitable barriers at all other times. Vehicle buffers should be high enough to prevent the mobile plant from riding over them and solid enough to stop the fully loaded mobile plant, and
- 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 guarding from floor to ceiling, or by erecting signs and barricades to prevent persons coming near the openings.

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 and to ensure that debris falls freely and does not become jammed in shafts or chutes.

Overhead demolition should cease during removal of the debris bins. Signs which warn of the risk from falling or ejected material should be placed at the discharge end of every chute.

FALLS

A person conducting a business or undertaking must manage the risk of a fall from one level to another that is reasonably likely to cause injury to the person or another person.

In managing the risks of falls, the WHS Regulations require the following control measures to be implemented where it is reasonably practicable to do so:

1. eliminate the need to work at heights by performing work at ground level
2. carry out the work on solid construction that includes a safe means of access and egress
3. minimise the risk of fall by providing and maintaining a safe system of work including:
    - using fall prevention devices (for example, temporary work platforms and guard railing) or
    - work positioning systems (for example, industrial rope access systems), or
    - fall arrest systems such as catch platforms.

Any construction work, including demolition work that involves a risk of a person falling more than 2 metres is high risk construction work and a SWMS must be prepared before this work commences.

Fall prevention devices

Fall prevention devices include perimeter guard rails, the protection of openings with solid covers and temporary work platforms.

A risk assessment should be conducted to determine the anticipated loads on the perimeter guard rail system, taking into account factors such as the:

- force applied by a falling person or object
- pitch of the surface (for example, on a roof), and
- length of the rafter to which the guard rail is attached.

If there is a risk of persons or objects falling through openings and voids made in walls or floors during the demolition work, then the openings must be protected.

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 guard rails and toe boards around the opening.

The open sides of all floors, roofs, stairwells, light-wells, lift shafts and any place from which a person or object could fall should be provided with guard rails and toe boards, or should be securely boarded over and secured against unauthorized or accidental removal.

Temporary work platforms include scaffolding, elevating work platforms, and work boxes. Falling object protection can include covered ways, gantries and catch platforms.

<u>Scaffolding</u>

Scaffolding is often used for demolition work to:

- protect the public and workers by containing equipment, tools and demolished materials
- provide safe access and working platforms for workers, and
- provide barriers to protect adjacent property.

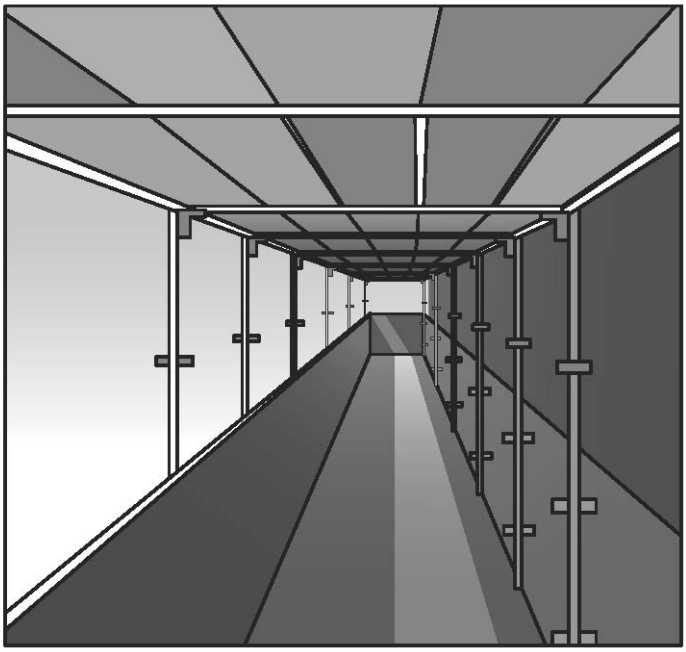


Figure 2: Perimeter scaffolding with falling object protection

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

- the vertical spacing of scaffold ties securing it to the building or structure
- the location of containment sheeting to prevent material/objects falling onto the scaffold
- wind forces acting on containment sheeting on the scaffold face
- water retention in containment sheeting because of rain
- demolished material on scaffolds – this should be removed to maintain a safe working platform and ensure it is not overloaded
- progressive removal of building elements, affecting the lateral stability of the scaffold, and
- progressive removal of ties and dismantling of the scaffold.

Elevating work platforms

Elevating work platforms (EWPs) are available in a wide variety of types and sizes. They include scissor lifts, cherry pickers, boom lifts and travel towers. Units powered by internal combustion engines are not suitable for use in buildings or areas with poor natural ventilation unless appropriate artificial ventilation is provided.

Some EWPs are designed for hard flat surfaces only, while others are designed for operation on rough terrain.

For demolition work:

- elevating work platforms should not be used in areas where debris may fall on them
- hot work (for example, welding/oxy cutting) should not be carried out from boom type elevating work platforms due to the risk of fire
- where hot work is to be undertaken from an elevating work platform:
  - a fire extinguisher should be carried on the platform at all times
  - ensure hot slag does not drop onto cutting hoses or bottles or onto any part of the elevating work platform vehicle
  - oxy/acetylene bottles in scissor lifts should be secured in the upright position at the opposite end from the platform controls.

Work boxes

A work box is designed to be supported by a crane, hoist, forklift truck or other mechanical device to provide an elevated work area for persons working from the box.

The use of a work box should be limited to those situations where it is necessary to elevate workers to perform special tasks of short duration and where it is not practical to use scaffold or other plant that provides temporary access, such as an elevating work platform.

The work box 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.

Work positioning systems

A work positioning system involves the use of equipment, other than a temporary work platform, that enables a person or thing to be positioned and safely supported at a location for the duration of the work being carried out.

Work positioning systems are designed to restrict a work area and may not be designed to act as a fall arrest system. Work positioning systems include:

- industrial rope access systems - used for gaining access to and working at a workface, usually by means of vertically suspended ropes, and
- travel restraint systems – consist of a harness that is connected by a lanyard to a suitable anchorage point or static line, with the system set up to prevent the wearer from reaching any edge from where a fall may occur.

Fall arrest systems

A fall arrest system is intended to safely stop a worker falling an uncontrolled distance and reduce the impact of the fall. These systems should only be used if it is not reasonably practicable to use higher level controls, or in conjunction with higher level controls that might not be fully effective in preventing a fall on their own.

Fall arrest systems include:

- catch platforms
- industrial safety nets, and
- individual fall arrest systems, including lanyard/anchorage combinations, inertia reels.

Ladders

Ladders should only be used when it is not reasonably practicable to use a higher level fall risk control measure.

Extension or single ladders should only be used as a means of access to or egress from a work area, not as a working platform. Consider whether an elevating work platform or scaffolding would be safer.

Further guidance on controlling the risk of falls is available in the *Code of Practice: How to Prevent Falls at Workplaces.*

ELECTRICITY

Any construction work that is carried out on or near energised electrical installations or services is high risk construction work and a SWMS must be prepared before this work commences. Contact with overhead electric lines has the potential to cause serious life threatening injuries or death.

Electrical power sources, whether overhead or underground can be a major hazard. In addition to direct electric shock and possible electrocution, contact with overhead electric lines can lead to a variety of hazards including arcing, explosion or fire causing burns, unpredictable cable whiplash and the electrifying of other objects (for example, signs, poles, trees or branches).

Specific control measures must be implemented when work is done in the vicinity of electric lines. The local electricity supply authority should be consulted and appropriate control measures implemented. Before demolition commences, all live electrical wiring and/or components (apart from any temporary electrical installations provided for the work) should be disconnected, isolated, or clearly marked and rendered safe by a competent person (for example, electrical engineer) or, where necessary, the local electrical supply authority.

More detailed guidance on managing risks associated with electricity is available in the *[draft] Code of Practice: Managing Electrical Risks at the Workplace.*

FIRE PREVENTION

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

If a sprinkler system is installed in a structure to be demolished, it should be maintained in an operable condition at each storey, as long as is practicable. Portable fire-extinguishers should be kept in working areas at all times and maintained in an operable condition.

Fire hazards from welding and cutting

Welding and cutting operations present a severe fire hazard unless precautions are taken.

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, laying fireproof blankets or other suitable means of protection.

In cases where a serious fire might quickly develop, a fire spotter should be assigned to the area. Fire extinguishing equipment should be readily available, and all workers trained in its use.

Combustible debris should not be allowed to accumulate to the extent that it can become a fire hazard.

Further guidance on welding is available in the *[draft] Code of Practice: Welding and Allied Processes* and in *AS 1674.1: Safety in welding and allied processes - Fire precautions*.

Quality Assurance

What is quality assurance?

Quality assurance is a set of policies and procedures that a company has in place so that jobs are done to a required standard.

The quality assurance requirements of a company's operations in demolition are likely to include the following.

Planning prior to commencement of demolition

A site inspection would be carried out to identify the following, which would be put together to form a demolition plan.

- What needs to be demolished?
- What can be salvaged?
- Access.
- Potential hazards.
- Protection of workers.
- Protection of the public and of adjoining properties that will be required.
- How hazardous materials and rubbish will be removed.

Operations during demolition

- Demolition plan followed.
- Safe processes adhered to.
- Salvageable materials handled and stored appropriately.
- Debris removed progressively from site.

At conclusion of demolition

- All debris cleared from site.
- Site left in safe state.

- Tools and equipment cleaned, checked and put away.

Putting up temporary steel fencing

Step 1 - Work out the number of fence sections you need

Measure the total distance to be fenced and the width of each fence section. To do this, use a tape or just 'step out' the distance.

Divide the distance by the width of the fence to get the number of fence sections you need.

Tools you need: Tape measure, calculator.

Step 2 - Check you have the materials you need

Check you have enough of the fence sections and the other materials to do the job (bolts, fencing wire, concrete feet).

Remember that the gate will take up one or two fence sections.

Step 3 - Check the fence sections

Check all fence sections are in good condition, with no broken wire. Fix any broken wire with fencing wire, or return hired items for good ones.

Tools you need: Wire cutters, pliers.

Materials you need: Fencing wire.

Step 4 - Plan where to put the gate

Plan to put the gate in front of an access way (like the driveway or footpath to the front door).

Step 5 - Put the concrete feet into position

Clear and level the ground for the concrete feet and put two concrete feet in the correct position. If you are fixing one end of the fence to something existing (like the edge of a timber fence), you might only use one concrete foot.

Tools you need: Shovel.

Step 6 - Put up the fence sections

Lift the fence section into position and put the fence pole into the concrete foot.

Repeat for the next section.

Fix the tops of the fence sections together, using bolts or fencing wire.

Tools you need: Spanner, wire cutters.

Materials you need: Bolts, fencing wire.

Step 7 - Install the gate

Install the gate section like you did the fence sections.

Tools you need: Spanner, fencing wire, wire cutters.

Materials you need: Gate section, bolts, fencing wire, concrete feet.

Step 8 - Complete the fence

Keep installing fence sections as you have done so far.

If the fence joins an existing wall or fence, wire the last fence section to the existing structure, to support the fence and stop people sneaking around the side.

Fit the chain and padlock to the gate.

Tools you need: Spanner, fencing wire, wire cutters.

Materials you need: Bolts, fencing wire, chain, padlock.

Building a simple frame and installing dust blankets

Step 1 - Measure up for the frame

Measure the height and width of the space for the frame.

Decide the height and width of the frame. It must be big enough to almost fill the space - there should be a small gap around the sides and top. Otherwise, you will not be able to move it into position when it is built and tuck the dust blanket over the top of it.

Tools you need: Ruler, pencil, paper.

Step 2 - Calculate measurements

Calculate the height of the studs (the height of the frame minus the thickness of the top and bottom plates).

Calculate the best cuts out of the lengths of timber. You might have to join two shorter pieces of timber together to make one stud or plate.

Tools and materials you need: Ruler, pencil, paper, calculator, timber for frame.

Step 3 - Make the frame

Cut all the studs and the top and bottom plate to the correct lengths.

Nail the plates and studs together to make the frame.

Tools and materials you need: Saw (hand or power), hammer and nails or nail gun, timber.

Step 4 - Make the legs

Cut two lengths of timber for the base legs. Nail them to the top of the bottom plate (If you nailed them to the bottom of the bottom plate, there would be a gap where dust could get through).

Cut and nail four small chocks to the ends of each leg, to make them the same height as the bottom plate.

Attach braces to the frame and legs.

Tools and materials you need: Saw (hand or power), hammer and nails or nail gun, timber.

Step 5 - Clean up

Pick up any timber off cuts and put them in the waste bin.

Disconnect power tools and put all tools away in the correct place.

Sweep or vacuum up any sawdust.

Tools you need: Broom, shovel, vacuum cleaner.

Step 6 - Install dust blankets on the floor

Choose a dust blanket that's the right size for the area. Too small is no good, because areas will be unprotected. Too big and you might trip over it, or get things caught in it.

Use more than one dust blanket for odd shaped areas. Overlap blankets to make sure areas to be protected are well covered.

Materials you need: Dust blankets.

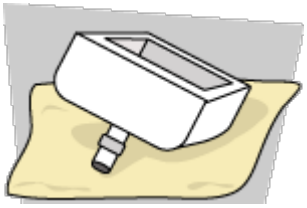
Step 7 - Hang the dust blanket on the frame

Put the frame into position.

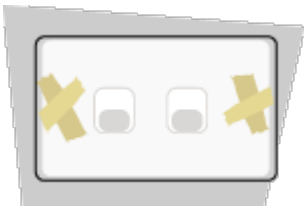
Hang the dust blanket so that one end touches the floor. The opposite end goes up over the frame (between the ceiling and the frame, in the small gap you left at the top).

Cleaning up after demolition

Packing away re-usable items and unused materials



Fittings which can be re-used must be kept clean and scratch free. Before removing them, take thick blankets and put them close to where you will work.



Use cardboard boxes for the electrical fittings, and packing tape to secure very small items (like screws and face plates for switches and sockets).

Pick up any unused materials, like timber or packing materials. Store them in a covered area such as a garage till they can be removed from the site.

Cleaning up

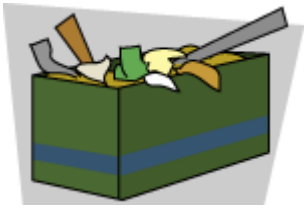
Clean up and waste disposal should be done throughout the demolition process. Pick up any rubbish, like paper, timber offcuts, old nails or used packing tape. Put in the waste bin.

After each stage of the demolition process, put away tools that are not being used. Tools are expensive and usually made to last. They shouldn't be left lying around. Pick up all the tools and clean them if necessary. Put any tools (like spanners) away in their holders. Store tools in a clean, dry place.

Sweep or vacuum the work area.

Tools you may need: Broom, shovel, vacuum cleaner.

Disposing of waste



Waste, rubble and debris should be removed as it is created.

Recyclable materials should be stored separately from waste materials.

Safe work practices should be used when handling hazardous materials. These should be disposed of at an approved hazardous waste site. Personal protective equipment that is contaminated by hazardous materials should be disposed of in the same way.

APPENDIX A – DEFINITIONS

Asbestos	The asbestiform varieties of mineral silicates belonging to the serpentine or amphibole groups of rock forming minerals including actinolite asbestos, grunerite (or amosite) asbestos (brown), anthophyllite asbestos, chrysotile asbestos (white), crocidolite asbestos (blue), and tremolite asbestos.
Asbestos containing material (ACM)	Any material or thing that contains asbestos.
Bearer	The primary horizontal support members for a formwork deck that are placed on top of formwork frames. Bearers are usually constructed from timber but are sometimes constructed from metal, such as in the case of some modular formwork systems.
Brace	A member, usually a diagonal, which resists lateral loads and/or movements of a structure.
Chute	An inclined or vertical trough or tube through which articles are passed from a higher to a lower level.
Competent person	A person who has acquired through training, qualification or experience the knowledge and skills to carry out the task Note: for certain activities, specific additional competencies are required – refer to Chapter 1 of the WHS Regulations.
Dead load	A permanent inert load on a building or other structure due to the weight of its structural members and the fixed loads they carry, which impose definite stresses and strains upon the structure.
Debris	Material created by demolition work that is larger than rubble.

Demolition contractor	The person conducting a business or undertaking that has management and control of the demolition work.
Demolition drop zone	Zone for the disposal of demolition rubble and debris, which is clear of obstruction and isolated from workers and other persons at the workplace, to allow objects to fall freely.
Earthmoving machinery	Operator controlled plant used to excavate, load, transport, compact or spread earth, overburden, rubble, spoil, aggregate or similar material, but does not include a tractor or industrial lift truck.
Essential services	Services that supply: (a) gas, water, sewerage, telecommunications, electricity and similar services, and (b) chemicals, fuel and refrigerant in pipes or lines.
Exclusion zone	An area from which all persons are excluded during demolition work.
Footing	The construction that transfers the weight of the structure to the foundation.
Foundation	The ground upon which the footings of a building are constructed.
Framework	A structure constructed of metal, concrete, timber, brick or other rigid materials.
Lagging	Insulated covering for services (for example, hot water pipes).
Live load	A moving load or a load of variable force acting upon a structure, in addition to its own weight.

Load bearing wall	A wall which provides structural support, including for the floor and/or roof in a building, its own weight, live loads, dead loads and lateral forces of arches, vaults and wind.
Main	Street reticulation service provided by the supply authority, for example, gas, water and sewerage
Masonry	Brick, concrete, stone, artificial stone or terra cotta laid in mortar.
Partition wall	An interior non-load bearing wall that divides a building into rooms.
Pier	A column or post supporting a superstructure such as floor bearers, verandas, beams etc.
Purlins	a) in simple roof construction, longitudinal roof timbers giving intermediate support for rafters, supported at intervals longitudinally by struts b) in some roofs of trussed construction, the purlins provide direct support for the roof covering, they bear on the principal rafters of each truss and span between trusses, and c) in roofs of trussed construction employing common rafters, purlins span between trusses supporting the lighter common rafters at requisite intervals.
Rafter (common)	In roof construction, a timber framing member providing the principal support for the roofing material.
Reinforcing steel	Steel bars of various sizes and shapes used in concrete construction for giving added strength.

Roof truss	A truss providing structural support for a roof.
Rubble	Rough broken stones or brick used for filling.
Shoring	Temporary supports used to maintain stability and prevent movement typically to: a) prevent the collapse of an excavation, and b) support an existing structure, especially where they may be weakened by the removal of adjoining buildings.
Stability	A determination of the ability of a structure to withstand overturning, sliding, buckling, or collapsing.
Underground essential services	Essential services that use pipes, cables other associated plant located underground.
Underground essential services information	In relation to proposed demolition work, means the following information relating to underground essential services that may be affected by the excavation: (a) the essential services that may be affected (b) the location, including the depth, of any pipes, cables or other plant associated with the affected essential services, and (c) any conditions on the proposed excavation work.
Underpinning	The construction of new footings and walling under the footings of an existing structure which have failed or may fail.
Vault	An arched structure of masonry usually forming a ceiling or roof.

Ventilation	The process of changing or circulating the air in a space by either natural or artificial means.

APPENDIX B – DEMOLITION PLAN

Given the specialist nature of demolition work, a demolition plan might be prepared to collate the key information relevant to the work into a single document, including some information relevant to work health and safety. A demolition plan should not duplicate a WHS management plan or SWMS but may reference them.

A demolition plan might include:

- the location of the site on which the structure to be demolished stands
- the overall height of the structure above ground level and the least distance from the structure to each site boundary
- the type of building (occupancy class), its structural support system and the principal materials of its construction
- the proposed methods of demolition including the number and types of major items of plant
- the proposed methods for handling and disposing of demolished materials and, in particular, of hazardous materials
- the proposed methods of controlling and maintaining access and egress to workplace
- the proposed sequence of carrying out the demolition works and an estimate of the time (in days) it is likely to take to complete all of each of the stages of the work
- the proposed hoardings, scaffolding and fencing and of any overhead sidewalk protection
- any other plans, illustrations, written documents, or specialist reports as may be necessary to support the proposed methods of work or protective structures
- traffic management arrangements, which includes managing vehicles and mobile plant hazards in relation to operation at the workplace and interaction with the public.
- the location and condition of the following:
    - Underground essential services including:
        - electricity
        - drainage and sewerage
        - gas
        - water
        - communications cables (for example, telephone, radio and television relay lines)
        - hydraulic pressure mains
        - liquid fuel lines
        - lubrication systems
        - process lines (chemical, acid)
    - Above ground essential services
    - Hazardous materials, including asbestos
    - Underground structures such as a basement, cellars, or storage tanks
- any confined spaces where work will be undertaken

- the general condition of structures on adjoining properties, particularly where these are close to or on the boundaries of the demolition workplace
- the effect demolition may have on people working in adjoining properties or seeking access to and egress from those properties, and
- the emergency arrangements, which should include equipment for the rescue of injured persons.

APPENDIX C – ENGINEERING INVESTIGATION CONSIDERATIONS

Some of the issues to be considered when undertaking an engineering investigation include:

- obtaining the as-built details of the component members (if available)
- identifying the type of structural system involved
- conducting a search for engineering details specifying size, type and configuration of reinforcement and the strength of materials (if available) and the located documents referenced
- assessing the current load-carrying capacity of the structure, taking into account:
    - the strength requirements of the relevant structural technical standards current at the time of construction and the strength and loading requirements of those now current
    - degradation of the original properties of the materials used due to time, weathering, wear, or other deleterious causes, and
    - the capacity of the structure as a whole and individual members to sustain superimposed loads without:
        - premature collapse of any member; or
        - deforming to an extent which will lead to static instability of the member itself or to connected members.
- verifying the composition or quality of structural components, if necessary, using methods such as:
    - core drilling
    - electronic reinforcement location, and
    - exposure of reinforcement
- assessing any loss of structural strength resulting from any destructive investigation methods used
- identification and location of floor penetrations to facilitate construction or structural irregularities
- assessing whether the proposed methods and sequence of demolition can be executed without causing unpremeditated collapse of the whole or part of the structure, and
- identifying any other details of the structure regarding strength, construction or contents which will influence the selection of demolition methods/procedures.