

Code of practice for Demolition

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British Steel Industry	Institution of Civil Engineers*
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Department of the Environment (Transport and Road Research Laboratory)	Scottish Development Department*
	Timber Research and Development Association
	Trades Union Congress

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

Association of Metropolitan Authorities	National Federation of Master Steeplejacks and Lightning Conductor Engineers
Construction Health and Safety Group	National Joint Utilities Group
District Surveyors' Association	Royal Institution of Chartered Surveyors
Greater London Council	
National Federation of Demolition Contractors	

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Foreword

This revised code of practice has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee. It supersedes CP 94, which is hereby withdrawn.

Demolition is a skilled and sometimes dangerous operation and requires special procedures if it is to be carried out successfully; this code has been prepared with the object of formulating the discipline to which those procedures should conform. It is intended for the use of all those involved or engaged in demolition or in the preparation, supervision and execution of demolition contracts. In revising CP 94, which was first published in 1971, the Technical Committee has taken account of developments in techniques, plant and machinery and of new legislation. In particular, the clause dealing with prestressed structures has been considerably expanded.

The Health and Safety at Work etc. Act 1974 and the Construction (General Provisions) Regulations 1961 place duties upon employers regarding the training, competence and experience of employees to ensure their health and safety. It is recommended in the report of the Joint Advisory Committee on Safety and Health in the Construction Industries that priority be given to training in particular those who are in immediate control of demolition work. The importance of training supervisors, foremen and operatives in correct methods of demolition and safe working practices cannot be over-stressed and it is strongly recommended that full use be made of the training facilities available to the industry. Adequate and effective training is regarded as an essential factor in preventing accidents at demolition sites.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

This code of practice represents a standard of good practice and therefore takes the form of recommendations. Compliance with it does not confer immunity from relevant statutory and legal requirements.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 36, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard gives recommendations for various aspects of demolition work. It includes basic considerations and recommended methods of demolition of different types of structure, provides a basis for a logical approach to safe procedures and offers advice on safety precautions and statutory requirements. It is not a comprehensive guide to the law.

No specific recommendations are made concerning under-pinning or excavation works or shores and these should be carried out in accordance with the recommendations of CP 2004.

A list of relevant Health and Safety Executive publications is given in Appendix A.

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3 Definitions

For the purposes of this British Standard, the following definitions apply.

3.1

adjoining owner

the freeholder, owner, lessee, tenant or authorized occupier of an adjoining property

3.2

balling

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

3.3

blast mats

a protective covering of sufficient strength and weight and of fine enough mesh to contain flying debris during blasting operations

3.4 Buildings (see also Figure 1)

3.4.1

detached building on an isolated site

a building having a clear space on all sides of at least twice the maximum height of the section of building to be demolished

3.4.2

detached building on a confined site

a building having a clear space on all sides different from that defined in 3.4.1

3.4.3

attached building on an isolated site

a building attached on at least one side and having a clear space on all other sides of at least twice the maximum height of the section of building to be demolished

3.4.4

attached building on a confined site

a building attached on at least one side and having a clear space on all other sides different from that defined in 3.4.3

NOTE to 3.4 In this standard, "clear space" does not include any areas outside the boundaries of the site.

3.5

building owner

a person having the right to demolish or partly demolish a building, plant or other structure by virtue of legal ownership or other legal authority

3.6

chute

an enclosed shaft used to transfer debris from one level to another, set at an angle to prevent free-falling debris

3.7

cryogenics

the branch of engineering concerned with very low temperatures (usually taken to be below – 100 °C)

3.8

demolition ball

a cast steel weight with eyes and fixings, suspended from a lifting appliance and used to demolish a structure

3.9

demolition contractor

a person, company or organization carrying out the demolition

3.10

fan

a protective screen fixed to the face of a building to contain falling debris during demolition

3.11

felling

the deliberate collapse of a structure such that the debris falls in a pre-determined area

3.12

gas expansion burster

a steel cylinder containing a pressurized gas that expands with great force when energized by an electric current

3.13
grapple

a powered claw, mounted on a base machine for use in handling waste material

3.14
high balling

balling operations carried out on buildings or structures in excess of 30 m in height

3.15
hot work

the application of heat (including the use of tools that can produce an incendive spark) to plant, tanks or vessels that contain or have contained flammable substances

3.16
hydraulic burster

a steel cylinder fitted with a number of pistons or wedge arrangements that are forced out under hydraulic pressure

3.17
hydraulic cannon

a device mounted upon an excavator and used for splitting a mass by projecting a one-shot charge of water into a predrilled hole

3.18
jib derricking

angular movement of a crane jib in a vertical plane

3.19
machine-mounted impact hammer

a large breaker mounted on an excavator and powered either by hydraulics or by compressed air

3.20
pulling rope

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

3.21
purpose-built grab

a grab, suspended from an excavator or crane, specially designed and strengthened for use in demolition

3.22
pusher arm

a steel attachment fixed to an extended jib arm on mechanically operated mobile equipment

3.23
shear

a powered, scissor-action cutting tool, mounted on a base machine, for use in cutting metal

3.24
shoring

a system of temporary supports to prevent movement

3.25
slewing

rotary motion of a crane jib or load about a vertical axis

3.26
thermal reaction

a reaction producing heat, used to weaken structural steel members

3.27
thermic lance

a steel tube, sometimes packed with metal rods, through which oxygen is passed

4 Preliminary procedures

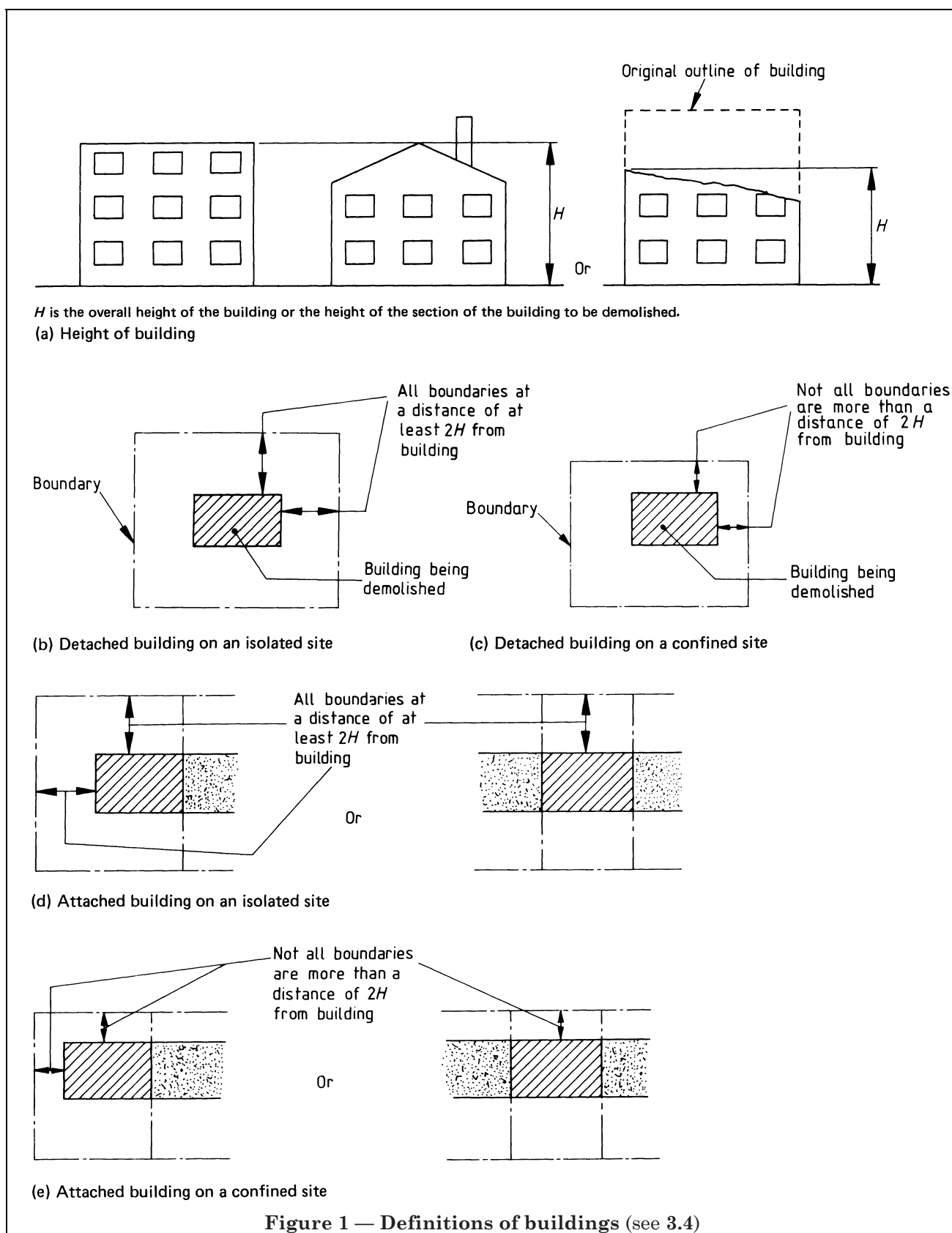
4.1 Survey

4.1.1 General. Before any works of demolition are started, a detailed survey and examination of the building or structure and its curtilage should be made, and recorded and kept available for inspection. Photographs should be taken where necessary. Special care should be taken when entering and surveying buildings affected by fire or blast damage.

All available plans of the building or buildings should be examined; where the nature of the construction is uncertain, a special site investigation should be carried out. Where there is doubt concerning the design of the structural arrangements, the opinion and advice of an engineer experienced in such work should be sought.

The relationship and condition of the adjoining property and other properties that may be affected by the demolition should also be considered, taking into account the existence of easements, wayleaves, party rights, boundary walls, etc.

The possible effect of ground or structural tremors caused by falling rubble may need to be considered when work is carried out in the vicinity of hospitals and other buildings containing equipment sensitive to shock and vibration. The possible modifying effects of the local ground structure and geological strata on the dispersion of such tremors should also be borne in mind.



When the building owner has information available about hazards likely to be encountered during the demolition process, he should make it available to the contractor when inviting tenders for the demolition work. Such information should take account of the possibility of drains, sewers or special services passing through or on his property.

If there are any benchmarks on the building to be demolished, the Ordinance Survey should be informed, in order that it may take appropriate action.

4.1.2 *Features of the structure*

4.1.2.1 General. During the survey, particular attention should be given to the nature of the construction of the building or structure, especially to those components or services detailed in 4.1.2.2 to 4.1.2.9. Also, the building or structure should be examined and, if necessary, tests be carried out, to determine its condition and whether constituent materials have deteriorated in strength, which could result in instability arising during particular demolition process. Structural elements hidden by cladding, suspended ceilings, etc. should be examined.

4.1.2.2 Roof and framed structures. The overall stability and the possible occurrence of unbalanced thrusts should be checked. All bracing members should be identified and protected to ensure that demolition is carried out in a sequence that maintains the stability and safety of the structure and adjacent works.

4.1.2.3 Walls. The plumb of all walls should be ascertained. It should be checked whether walls are loadbearing and whether party or cross walls are properly bonded into front and rear walls. The thickness and condition of walls and gables that are to remain in position should be noted, including walls to adjoining property, and, particularly, the reduction in thickness of walls at cupboards and fire-places, so that the extent of precautionary and final support requirement can be determined. The support bearings and seatings should also be inspected.

The possible effect on the remaining structures of the removal of buttressing walls should also be considered.

4.1.2.4 Cantilevered features. The nature of the support or tail-loading of any cantilevered construction such as balconies, heavy cornices or staircases should be ascertained.

4.1.2.5 Concrete structures. These should be examined for damage due to:

- a) use of different cements in the concrete of adjacent members, e.g. ordinary Portland cement against high alumina cement;

- b) structural deformations;
- c) differential cracks;
- d) incorrect seating on bearings;
- e) corrosion of reinforcement (chloride damage);
- f) alkali aggregate reaction (which occurs when silica combines with excessive proportions of alkali in some Portland cements to form an expanding gel capable of severely disrupting hardened concrete).

If it is proposed to take concrete cores for testing purposes, care should be exercised to avoid damaging any tendons in a prestressed structure.

4.1.2.6 Special buildings. Special buildings include precast concrete panel and framed structures, prestressed concrete structures, stressed skin structures (i.e. buildings that rely on the sheeting, cladding or decking to stiffen and restrain the structural framework) and slung structures (i.e. floors) that are in some way suspended from an umbrella-type framework supported from a concrete core.

There is at present very little experience in the demolition of these types of building and it is, therefore, essential to proceed with caution and to carry out a full investigation to determine the type of structural framework and the principal details before any demolition is commenced.

This may be done by:

- a) obtaining the necessary information from the engineers responsible for the original design of the framework and from the contractors responsible for the construction of the building;
- b) obtaining information from the Authority responsible for approving the design and details for the original building;
- c) carrying out a visual inspection of the building by a chartered engineer having a good general knowledge of structural frameworks, and where necessary carefully exposing parts of the structure to determine details of construction.

If prestressed members are identified then particular attention has to be given to establish the type of stressing used at the time of construction.

4.1.2.7 Basements, cellars, vaults and other voids.

Basements, cellars, vaults and other voids should be tested for flammable vapours if there is any suspicion of such vapours being present. They should be carefully examined and it should be determined whether they extend under public footpaths or beyond the curtilage of the site. The effect of the removal of the cross walls and the stabilizing load of the superstructure on old basement retaining walls should be considered. The effect of the retaining action of the basement walls on adjacent property should also be checked.

4.1.2.8 Wells and underground storage tanks. Before any physical inspection is made, precautions should be taken to guard against the effects of any residual contents. Wells and underground storage tanks should be tested for flammable vapours if there is any suspicion of such vapours being present. The positions, depths, sizes, construction, types of wells and contents of tanks should be determined. This particularly applies at chemical works, gas works and all premises where hazardous materials have been stored or used. Structures subjected to cryogenics (see 3.7) should be inspected carefully.

4.1.2.9 Dangerous structures. Local advice should be sought whenever possible to determine the type of construction, the cause of any damage and the reason for the structure being declared dangerous.

4.1.3 Mains and services. Some or all of the following mains and services, as appropriate, should be diverted, cut off, removed, or plugged before work commences, in order to make the site safe from foreseeable dangers:

- a) electricity (underground cables, overhead lines and former consumers' supply equipment);
- b) gas mains or similar piped supply;
- c) other fuel lines;
- d) water;
- e) hydraulic pressure mains;
- f) drainage;
- g) district heating mains;
- h) telecommunication cables;
- j) radio and television relay lines;
- k) other underground or overhead works, e.g. transport installations or road underpasses.

Suitable arrangements should be made in advance for this. The demolition contractor, when actually commencing demolition, should verify that the services, particularly gas and electricity mains, have been rendered safe.

Supply facilities for services that the contractor may require to carry out the works, e.g. electricity and water, should be the subject of a specific separate agreement between the demolition contractor and the appropriate undertaker.

4.1.4 Wastes and previous uses. During the survey a careful examination of the whole site, including basements, cellars, vaults and other voids and dumps of materials and rubbish, should be made to establish whether there are any drums containing flammable materials or toxic chemicals, gas cylinders, domestic aerosol sprays and similar items that could be hazardous if they were involved in a fire.

NOTE Advice concerning disposal of drums and cylinders etc. may be obtained by reference to the *Code for the Disposal of Cylinders* published by the British Compressed Gases Association, or to the Harwell Hazardous Materials Disposal Service.

Enquiries should be made concerning previous uses of the site in order to identify any associated dangers (e.g. from petrol tanks; gaseous material; flammable or explosive material; injurious chemicals; and radioactive contamination, sources or materials) and any notifiable waste. Special provisions should be made if such dangers or waste are present. The action to be taken depends upon the nature of the material and HM Inspector of Factories (Health and Safety Executive) or the Local Authority Petroleum Officer or Fire Officer should be consulted. Advice should be sought from the local Principal Inspector of Factories before any demolition or removal work is carried out on storage tanks that have contained any explosive or flammable materials.

Where radioactivity is suspected, if advice is not available within his own organization, the contractor should seek advice from a competent consultant or organization such as the National Radiological Protection Board. No attempt should be made to penetrate the containment of any suspect material.

Where radioactive contamination, sources or material are present, the requirements of the Ionizing Radiations (Sealed Sources) Regulations 1969, and/or the Ionizing Radiations (Unsealed Radioactive Substances) Regulations 1968, and/or the Radioactive Substances Act 1960 may be applicable. One of the requirements is notification of use and disuse under certain circumstances.

Enquiries should be made to ascertain whether asbestos has been installed, stored or used in the building to be demolished, and the necessary precautions detailed in the Asbestos Regulations 1969 should be followed.

4.2 Trees. Trees or other plants should not be removed or cut without instructions. Trees and other plants that are to be retained should be listed, numbered and a description recorded in the contract documents, and positioned on a drawing.

Trees to be retained should be protected from damage to branches and trunk by a suitable fence at least 1 m from the bole.

Fires should not be lit close to vegetation. A minimum distance of 3 m outside the furthest spread of foliage is preferable.

Trees to be retained should not be used to assist demolition operations on site in any way.

Heavy vehicles should be kept well clear of trees to avoid damage to branches, and to roots by compaction of the soil.

If excavation has to be carried out within the spread of foliage care should be taken to avoid damage to roots.

Comprehensive guidance on precautions to take when working in proximity to trees is given in BS 5837.

4.3 Materials. Any materials required for the demolition works should be in accordance with the appropriate British Standards or, in the absence of such standards, they should be the best of their respective kinds for the work required. Materials arising from the works should be removed as they accrue and not stored, disposed of or used again on the site, except with the approval of the building owner.

Any timber infested with lice, bugs, dry rot, woodworm or death watch beetle, or that is otherwise decayed, should be disposed of by burning on the site, wherever possible, and where police and Local Authority requirements permit; otherwise such timber should be removed by the demolition contractor and burnt on a site to be indicated or provided by him.

Any vehicles used for the purpose of removing infested material should be covered to avoid dropping such material and should be swept out and disinfected before being used for other purposes. Where necessary, the demolition contractor should take precautions to prevent the spreading of mud and debris on to the highway by vehicles. Care should be taken to ensure that vehicles leaving the site are securely loaded.

The responsibility of the demolition contractor in regard to clearing all refuse, debris etc. from the site and for the provision and use of the necessary tip should be emphasized. No refuse or waste should be allowed to enter public sewers and water courses. The means of disposal of explosive or flammable substances, toxic wastes, lead, asbestos, and radioactive substances should be in accordance with the appropriate regulations.

4.4 Scaffolding and shoring

4.4.1 Scaffolding

4.4.1.1 General. Any scaffolding required should be designed and erected in accordance with the recommendations given in BS 5973 and should be provided by a competent scaffolder.

Where scaffolding is required it should normally be an independent tied scaffold situated on the outside of the building or structure. The demolition contractor should arrange for the scaffolder to visit the site as necessary and make any adjustments required to the scaffolding as the work proceeds, to ensure its stability.

Care should be taken that the load of any debris collecting on a scaffold does not exceed the loading assumed for the design of the scaffold. Measures should be taken to prevent debris from being accidentally dislodged from the platform.

4.4.1.2 Progressive dismantling. Scaffolds that are to be dismantled progressively during the demolition of a building should not be left projecting above the residual height of the walls more than necessary. Stabilizing ties should be maintained, especially with sheeted scaffolds.

4.4.1.3 Compliance with the statutory regulations. Scaffolds when completed should be left in a condition suitable to perform the duty for which they were intended, and should comply with the requirements of the statutory regulations and with any Local Authority requirements.

Scaffolds should be inspected by the constructor before being taken into use. The user should inspect them weekly or at more frequent intervals if necessary to see that they remain in compliance with the statutory regulations and should sign the *Records of weekly inspections*¹⁾ to record his findings.

¹⁾ *Building operations and works of engineering construction. Records of weekly inspections, examinations and special tests, Form F 91 (Part 1), published by the Department of Employment under the Factories Act 1961.*

4.4.2 Shores and shoring. When required, shores and shoring should be designed and erected in accordance with the recommendations given in CP 2004. Shoring should be so designed and constructed that it is adequate for its purpose, and an experienced person should ensure that it is placed in position at the appropriate time. Provision should be made for the erection of adequate shoring before the existing lateral support is disturbed. The layout of the shores should be designed to enable any new building to be constructed with the least possible interference. The shoring should be checked for effectiveness as the demolition proceeds.

4.5 Access and road closures. Where the demolition works would be facilitated by a partial or total temporary street closure, the building owner should approach the appropriate Local Authorities as early as possible to obtain the necessary permission.

Where access to a site is across a footpath, the building owner should consult the Local Authority to obtain all necessary permissions. Regard should be had to the need to maintain convenient access to the adjacent properties.

4.6 Administrative aspects

4.6.1 Statutory requirements. As with other forms of building activity, demolition work is subject to the controlling influences of a large number of national and local legal requirements. Attention is therefore directed to these Acts, Byelaws, Regulations and other statutory requirements. Work should be carried out in accordance with, and the equipment in use should comply with, all the appropriate regulations. Amongst others, attention is drawn to those regulations, current at the time of publication of this standard, listed in Appendix B.

When a dangerous structure is dealt with by the Local Authority under statute, the demolition or remedial work is required to be to their satisfaction. Any demolition works in Great Britain that are expected to last more than six weeks have to be reported to HM Principal Inspector of Factories (Health and Safety Executive) before the work commences. Notice should also be given to HM Principal Inspector of Factories (Health and Safety Executive) 28 days before the removal of asbestos containing crocidolite.

The demolition contractor should ascertain from the Local Authority or other appropriate body what is required in respect of licences for hoardings, fencing, lighting, barricades, platforms, ramps, handrails, etc. and provide them accordingly. Where scaffolding or a crane jib will overlay adjoining airspace or property a licence is required. Any gantry extending over a public footpath should comply with the requirements of the Local Authority.

4.6.2 Supervision. The demolition contractor is required by law to appoint a competent person, experienced or trained in the type of operation being performed at that particular time, to supervise and control the work on site.

Where two or more demolition contractors take part in work on the same site each should appoint a competent person to supervise the work. To ensure the safety of the whole works these foremen should collaborate in the planning and execution of the work. This does not prevent the joint appointment of one person by two or more demolition contractors. It is in the interest of the building owner that he arrange for supervision and co-ordination of the work on site.

4.6.3 Sequence of demolition operations. Before the commencement of work on any particular phase a programme should be drawn up in which the proposed sequence and the method of operations is clearly indicated.

Where demolition is to be carried out in areas of severe exposure, careful consideration should be given to the possibility of sudden and severe climatic changes that might affect the work.

4.6.4 Contracts. It is recommended that a formal contract, in writing, be agreed between the parties concerned, e.g. the building owner and the demolition contractor. Professional advice should be taken in the preparation of tender and other contract documents. It is recommended that the contract contain a clause making clear the safeguarding of any items, including those of archaeological, historical or geological interest or value, and how these should be dealt with, and that the demolition contractor's position in regard to delays and interference with his completion be clarified.

Insurance policies for demolition work should provide cover for contractual liability.

5 Protective precautions

5.1 General. Demolition is a hazardous operation and, at all times, the methods, materials and equipment used should accord with the need to safeguard life and property. It is essential that precautions be taken both before and during actual demolition. For the purposes of this British Standard, such precautions may be categorized under the following three headings:

- a) those precautions that are specifically aimed at safeguarding personnel engaged on the site of the works;
- b) those precautions that are necessary for the safety and convenience of persons not connected with the demolition, including members of the public;
- c) those precautions that are necessary for the protection of property likely to be affected by the demolition works.

In addition to these general precautionary measures, there are various specific precautions associated with the particular method or methods of demolition being employed and the structure or structural element being demolished. These more specific measures are described in clauses 6 and 7. Attention is drawn to the recommendations given in BS 5228 concerning the control of noise on demolition sites.

5.2 Safety of personnel on site

5.2.1 Plant and equipment. Care should be taken to ensure that plant equipment is:

- a) of an appropriate type and standard having regard to the location and type of work involved,
- b) in the charge of a competent operator, and
- c) maintained in good working condition at all times.

The equipment should be fitted to machines of adequate power and stability for the use intended. The operator should be experienced in the use of the equipment and there should be a high standard of inspection and maintenance.

Where appropriate, plant and equipment should comply with the requirements of the relevant British Standards.

5.2.2 Protection of site personnel. During demolition work all operators should wear adequate protective clothing and, where appropriate, protective equipment such as safety helmets, goggles, ear defenders and respirators, complying with the requirements of the appropriate British Standard. Relevant standards include the following.

BS 679, *Filters for use during welding and similar industrial operations.*

BS 1397, *Specification for industrial safety belts, harnesses and safety lanyards.*

BS 1870, *Safety footwear.*

BS 2091, *Respirators for protection against harmful dust, gases and scheduled agricultural chemicals.*

BS 2092, *Industrial eye-protectors.*

BS 4555, *High efficiency dust respirators.*

BS 4558, *Positive pressure, powered dust respirators.*

BS 5240, *General purpose industrial safety helmets.*

High levels of noise can cause permanent hearing damage to workers. Attention is drawn to the Health and Safety Executive publication *Code of practice for reducing the exposure of employed persons to noise*, which contains advice on the levels of noise that are a serious hazard and the precautions that can be taken. When noisy machinery is used, ear defenders may be necessary.

For specific operations such as work on buildings where chemicals have been stored or used or where lead paint, asbestos, dust or fumes may be encountered, which may prejudice the health of persons using the site, special precautions should be taken regarding protective clothing, goggles and the use of suitable respirators. When the provision of protective equipment is a statutory requirement, it may be necessary to use equipment approved by HM Chief Inspector of Factories.

Projecting nails in timber should be removed or hammered flat; they should not be allowed to remain as a source of danger.

5.2.3 Precautions against uncontrolled collapse. The removal of certain parts of the building or structure during demolition can result in other parts becoming unsafe and it is necessary to pre-determine where temporary support will be needed. The advice of a competent engineer may be required. If the structure abuts other buildings, the abutting buildings should be given such lateral support or shoring (see 4.4.2) as is given by the structure to be demolished.

5.2.4 Other precautions

5.2.4.1 General. Every working place and approach and all openings dangerous to persons employed and others should be properly illuminated and protected.

Overloading of any part of the building by debris or materials should be avoided.