

BS 6187:2011



BSI Standards Publication

Code of practice for full and partial demolition

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 December 2011. It was prepared by BSI Panel B/513/-/9, under the authority of Technical Committee B/513, *Construction equipment and plant and site safety*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

BS 6187:2011 supersedes BS 6187:2000, which is withdrawn.

Information about this document

This standard has been revised to reflect advances in technology and equipment in the demolition industry, and to give recommendations on the following principal areas.

- a) Project development and management, site assessments, risk assessments, decommissioning procedures, environmental provisions and facade retention.
- b) Deconstruction techniques, including activities for reuse and recycling.
- c) Exclusion zones and safe working spaces, including their design and application.

Recommendations for methods of, and techniques for, demolition and partial demolition, including for structural refurbishment, have been retained, with consideration of specific types of structure, but the text has been significantly updated to reflect current and developing good practices. By being less prescriptive, this edition also allows for innovative techniques and methods to be employed.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

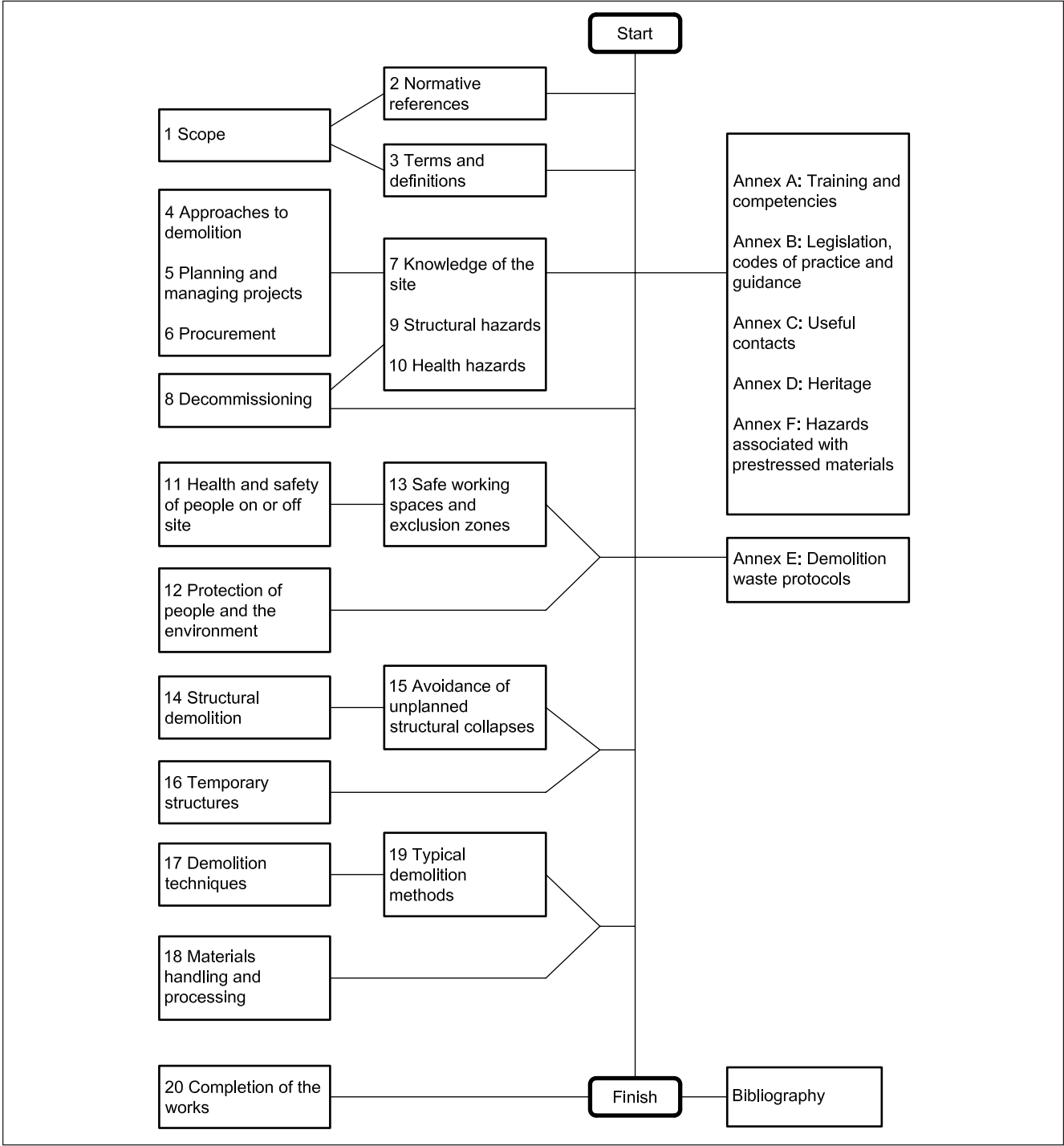
This code of practice concerns the process of demolition, including demolition as part of structural refurbishment, from initial considerations, through planning and design to the execution stages (see Figure 1).

The word “demolition” is often misconstrued to mean “large scale” or to involve the complete removal of a structure or building. However, the removal of a single element or the part removal of a structure or building also constitutes demolition. This standard is therefore intended to be applicable to those involved with all demolition activities, however large or small, including those undertaking partial demolition, which might be for structural refurbishment projects. Trade contractors unfamiliar with the vagaries of demolition activities required for structural refurbishment are advised to seek the advice of a competent practitioner. It is important to note that this standard does not cover all aspects of structural refurbishment; rather it is applicable only to those activities involving partial demolition.

Route maps have been included at the beginning of most clauses. These are not intended to be process flowcharts, but to guide the user through the information in the text. This is particularly in respect of the hierarchy and interdependence of use of the clauses and subclauses, which might not always be obvious because of the complexity of the demolition processes and the wide coverage of this document. Such projects, from inception to completion, include numerous activities, many of which are iterative and which require revisiting. For example, as the project moves through the tender process to contract acceptance and on to site operations, planned methods of work will be developed and augmented further at each stage.

This code of practice has been written on the understanding that the execution of its provisions is entrusted to appropriately qualified and competent people and organizations. Competence is about being able to do the work safely, without endangering others, and meeting the legal health and safety requirements. Clients and procurers of demolition works have a key role and have to take reasonable steps to ensure that those appointed or engaged by them are competent for what they are expected to do. Similarly, those accepting such appointments ought only to do so if they are competent to undertake the demolition or partial demolition activity.

Figure 1 Outline route map



1 Scope

This British Standard gives good practice recommendations for the demolition (both full and partial) of facilities, including buildings and structures. This standard is therefore applicable to demolition activities undertaken as part of structural refurbishment. It also covers decommissioning.

In particular, the standard gives recommendations for:

- a) the proper and effective management of demolition processes, including those forming part of structural refurbishment;
- b) maintaining structural stability, including through the provision of temporary structural support, where necessary;
- c) managing deliberate structural collapse;
- d) identifying and establishing responsibilities during all phases of the demolition processes;
- e) acquiring a knowledge of the site, including its former uses;
- f) managing environmental issues;
- g) managing health and safety hazards;
- h) carrying out risk assessments and planning the work accordingly;
- i) establishing and managing procedures effectively;
- j) determining and managing safe exclusion zones.

The standard takes into account safety, health and issues that affect the protection of the environment.

For the purposes of this standard, demolition activities include, for example, activities that might be known as dismantling, disassembling, demounting, partial demolition, removal, decommissioning, deconstruction and soft stripping, and structural refurbishment, including renovation, rehabilitation, rebuilding, remodelling, reconstruction, redevelopment, restoration, renewal, replanting, development, enlargement, extending, augmenting, conservation, modifications, alterations, structural alterations, upgrading and reroofing.

This standard is not applicable to all structural refurbishment activities; only those involving partial demolition.

It is essential that those carrying out demolition activities possess the necessary levels of competence. Clients or procurers of demolition works need to ensure that all contractors, designers and other team members that they propose to engage or appoint are competent to comply with the health and safety requirements necessary to undertake demolition activities. Annex A gives guidance on the training and competence required for the activities covered by this standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5228-1, *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*

BS 5228-2, *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*

BS 5607:1998, *Code of practice for safe use of explosives in the construction industry*

BS 5837, *Trees in relation to construction – Recommendations*

BS 5930:1999+A2:2010, *Code of practice for site investigations*

BS 5975, *Code of practice for temporary works procedures and the permissible stress design of falsework*

BS 6100, *Building and civil engineering – Vocabulary*

BS 6164, *Code of practice for health and safety in tunnelling in the construction industry*

BS 7121-1, *Code of practice for safe use of cranes – Part 1: General*

BS 7121-2, *Code of practice for safe use of cranes – Part 2: Inspection, testing and examination*

BS 7121-3, *Code of practice for safe use of cranes – Part 3: Mobile cranes*

BS 7121-4, *Code of practice for safe use of cranes – Part 4: Lorry loaders*

BS 7121-5, *Code of practice for safe use of cranes – Part 5: Tower cranes*

BS 10175, *Investigation of potentially contaminated sites – Code of practice*

BS EN 1991-1-6, *Eurocode 1 – Actions on structures – Part 1-6: General actions – Actions during execution*

BS EN 12811-1, *Temporary works equipment – Part 1: Scaffolds – Performance requirements and general design*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 6100 and the following apply.

3.1 adjoining owners

freeholders, owners, lessees, tenants and/or occupiers of a property adjoining the site of work

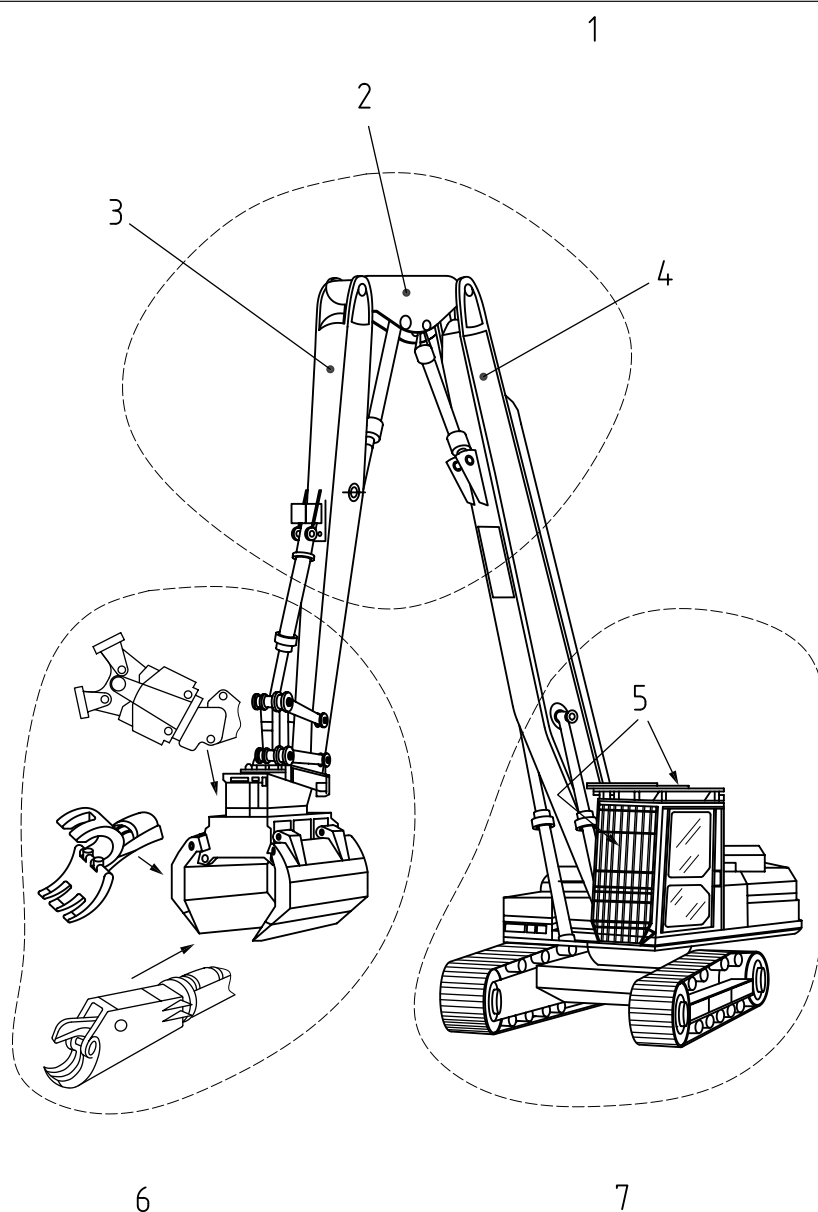
NOTE The term “adjoining owners” has a specific meaning under the Party Wall etc. Act 1996 [1].

3.2 attachment

assembly of components forming the working tool that can be mounted onto the base machine or (optional) equipment for specific use

NOTE See Figure 2.

Figure 2 Base machine, equipment and attachments

**Key**

- | | | | |
|---|--------------------|---|--|
| 1 | Equipment | 5 | Protective cage over and in front of operative's cabin (and to the sides if appropriate) |
| 2 | Optional extension | 6 | Examples of optional attachments |
| 3 | Dipper arm | 7 | Base machine |
| 4 | Boom | | |

NOTE 1 This is an example. The equipment and attachments can differ.

NOTE 2 The protective cage needs to provide a falling object protection structure (FOPS) and a falling object guard screen (FOGS). It might also provide a roll-over protective structure (ROPS).

3.3 base machine

machine without equipment and attachment that includes the mountings necessary to secure equipment, as required

NOTE For example, operator protective structures for demolition. See Figure 2.

3.4 building owner

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

NOTE The term "building owner" has a specific meaning under the Party Wall etc. Act 1996 [1].

3.5 client

initiator of the works for demolition or partial demolition for structural refurbishment

NOTE 1 The client is usually the structure owner, but could also be, for example, a main contractor.

NOTE 2 The term "client" can have a particular meaning in contractual relationships and has a specific meaning under the Construction (Design and Management) Regulations 2007 (CDM Regulations 2007) [2] (see 5.3.1 and 7.2.1).

3.6 cold cutting

method of cutting that generates no incendiary sparks and little or no heat

3.7 competent person

person with sufficient knowledge of the specific tasks to be undertaken and the risks which the work will entail, and with sufficient training, experience and ability to enable them to carry out their duties in relation to the project, to recognize their limitations, and to take appropriate action to prevent harm to those carrying out or affected by the work

(CDM Regulations 2007 [2], modified)

NOTE See Annex A.

3.8 complex structure

structure with unusual or complicated load paths and/or internal forces, which might not be obvious, that requires the planning of safe modes of failure during demolition activities following appropriate structural assessments and analysis

3.9 contaminated site

site which harbours residual health hazards resulting from the presence of physical, biological, ionizing or chemical entities

3.10 decommissioning

process whereby an area is brought from its fully operational status to one where all live or charged systems are rendered dead or inert and reduced to the lowest possible hazard level

NOTE 1 See also 3.23.

NOTE 2 Decommissioning includes decontamination, where appropriate. Some industries, e.g. the nuclear industry, have specific meanings for this term which include dismantling. In practice different hazard levels will apply. For the purposes of this British Standard, decommissioning does not include demolition or dismantling.

3.11 deliberate collapse

controlled removal or weakening of key structural members causing collapse in a planned way of the whole or part of the building or structure being demolished or partially demolished

3.12 deliberate removal

controlled removal of selected members of the structure by dismantling or deconstruction

3.13 equipment

set of components mounted onto the base machine to fulfil the primary design function when an attachment is fitted

NOTE See Figure 2 and 3.24.

3.14 exclusion zone

designated three-dimensional space from which all persons, including the public, are excluded during demolition activities

NOTE 1 One exemption is where an operator in a protected position is authorized to be within the zone to effect a particular demolition activity, such as initiating explosives.

NOTE 2 In certain circumstances, key personnel may remain within the zone for a specific task provided they are adequately protected.

3.15 facade retention

method of maintaining the stability of the outer wall of a building or structure in its original position during and following nearby demolition activities using auxiliary or temporary structures

NOTE See also 3.33.

3.16 fan

temporary platform at height used solely to contain any debris or other materials unintentionally dropped in the demolition process and prevent this from being a danger to persons or property below

NOTE 1 A fan is usually formed in scaffolding projecting from a building or structure at an inclined angle. See also 3.17.

NOTE 2 Fans are not intended to be used for access, storage of materials, accumulation of demolition debris or as working platforms.

3.17 gantry

designed temporary structure providing a covered way that protects people from unplanned falls of materials and/or a structure that protrudes from the building facade to facilitate the removal of debris and materials

3.18 hand-held equipment

powered portable equipment or manual tools held in and operated by hand

3.19 high-pressure water jetting

cutting, removal or cleaning of material using high-pressure water

3.20 hot cutting

method of cutting where heat is applied (e.g. by flame) or is generated

NOTE With this method there is potential for producing incendiary sparks.

3.21 materials recycling

action of reprocessing materials which have previously been processed for inclusion in a product

NOTE For example, concrete and bricks recovered through a reprocessing activity can be crushed, screened and sold as an aggregate.

3.22 mobile demolition machine

self-propelled machine made, or adapted for use, for demolition activities, which comprises a base machine (3.3), equipment (3.13), optional equipment (3.24) and attachments (3.2), as appropriate

NOTE See Figure 2.

3.23 mothballing

process of decommissioning and then preserving buildings, plant or structures in such a way that they can be readily brought back into service if required

NOTE See also 3.10.

3.24 optional equipment

optional items of equipment mounted onto the base machine to increase, for example, capacity, flexibility, comfort and/or safety

NOTE See Figure 2 and 3.13.

3.25 permit to work procedure

procedure which sets out the agreed work to be undertaken on identified equipment, or in an identified area, and the precautions to be taken and to be managed as part of a safe system of work

NOTE This is an additional level of management control provided specifically to ensure that risks arising during high-hazard activities are appropriately controlled. See 11.7.

3.26 prestressing

process whereby compressive stresses are built into the parent material by, for example, tensioning wires or bars to give added strength prior to working loads being imposed

3.27 prestressed elements**3.27.1 post-tensioned prestressed element**

structural element in which the wires or bars are, for example, tensioned after the material to be compressed (e.g. concrete) is in place and has reached a suitable strength

3.27.2 pretensioned prestressed element

structural element in which the wires or bars are tensioned prior to the placing of the material to be compressed (e.g. before concrete is poured) and then released after the material has reached a suitable strength

3.28 pretreatment

process of changing the physical, chemical or biological properties of material to facilitate its handling, recovery and disposal

NOTE Pretreatment can include sorting and segregation, provided this involves an element of recycling. All wastes are required to be pretreated prior to disposal.

3.29 pre-weakening

deliberate weakening of part of a structure as part of an efficient controlled design collapse mechanism to be effected a short time afterwards, while ensuring sufficient residual stability until deliberate collapse is initiated

NOTE See also 3.36.

3.30 product reuse

repeated use of products taken from buildings or infrastructure, in their original form, for the same or a similar application

3.31 progressive demolition

controlled removal of parts of a structure whilst maintaining the stability of the remainder as demolition activities progress through the facility

3.32 recovery

operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy

(Waste Framework Directive [3])

3.33 shoring (including propping)

system of auxiliary supports which provide a load path to maintain stability during temporary states of the structure

NOTE See also 3.15.

3.34 site waste management plan (SWMP)

systematic identification of expected and actual waste arisings together with an appraisal and implementation of management options in line with environmental legislation and the principles of the waste hierarchy

NOTE 1 There are financial threshold values above which the Site Waste Management Plans Regulations 2008 [4] require an SWMP to be prepared.

NOTE 2 There are statutory variations in some parts of the UK. There is guidance particular to different areas.

3.35 structural refurbishment

alteration to an existing retained building or structure that involves removal or modification of structural elements or members, which might or might not cause instability

NOTE This includes removal or addition of structural elements, dismantling and partial demolition of the existing structure.

3.36 weakening

deliberate removal of parts of a structure that can reduce its ability to resist loadings, including imposed loadings and its own self weight

NOTE Weakening may be undertaken to create openings (e.g. in walls and floors) for removal of materials, for example, but excludes deliberate structural pre-weakening (see 3.29).

3.37 waste

substance or object which the holder discards or intends to discard or is required to discard

(Waste Framework Directive [3])

NOTE Any material no longer required by the original owner and, in the case of demolition, any material that leaves the site boundary, is legally classified as “controlled waste” and is subject to the provisions of the Environmental Protection Act 1990 [5]. Under case law [*R (Save Britain’s Heritage) v. SSCLG 2010*], any material no longer required by the original owner is classified as waste, regardless of whether it is sent for recycling or recovery, whether it has a commercial value and an end market, and whether or not it poses an environmental threat. This is important because demolition materials left on site for a period of time might need a permit to remain on site until a market is found. As a general rule, further use needs to be a certainty, not a possibility.

4 Approaches to demolition

4.1 Options assessment

Demolition, including demolition as part of structural refurbishment, may be just one option considered in a broader assessment, especially within an asset management context. A base assessment, e.g. options assessment, should therefore be carried out to ascertain the most appropriate options.

4.2 Assessment of approaches

On the basis of the results of the options assessment, one, or a combination of, the following approaches should be selected.

- Complete demolition with potential reuse of site (possibly by others).
- Complete demolition and rebuild.
- Partial demolition and building some new replacement facilities.
- Structural refurbishment (see Table 1).
- Structural refurbishment whilst not in use.
- Structural refurbishment whilst in use.

NOTE See also CIRIA C621 Good practice guidance for refurbishing occupied buildings [6] and also CIRIA C638 Climate change risks in building - an introduction [7].

Table 1 Determining the significance of demolition activities on structural stability

	Effect on fabric of facility	Effect on integrity of structure	Examples	Competence required
Structural refurbishment	Non-invasive		Shop fittings such as counters	
		Non-structural	Non load-bearing walls	Ability to assess whether this is so; a structural engineer might be required
	Invasive	Structural	Load-bearing walls	Structural engineer

4.3 Intervention principles

The extent and effect of any particular planned process or physical intervention should be assessed. A decision should be taken about which activities would be most appropriate.

When considering the activities and the possible methods to be adopted, the various hazards and thus potential risks should be assessed, for example, where materials are to be removed and where structural instability might be possible, whether planned or unplanned. The amount of materials to be removed is not necessarily the key criterion as the effect of their removal should be considered together with the proposed methods of removal, including the structural instability that could be caused. The need for auxiliary (or temporary) or permanent works to provide interim (or replacement permanent) support should be assessed and, if necessary, planned. The design should ensure that the structure is taken down in a planned and controlled manner, thus avoiding any unplanned structural instability or collapse.

4.4 Selection of the approach

When selecting an approach to demolition activities, a number of factors should be taken into account, including the following.

- a) The information given in relevant guidance documents.
- b) Health, safety and environmental requirements.
- c) The needs of the client, the users and the workforce.
- d) The type, age, condition, use and business activity (if appropriate) of the facility and local conditions and constraints (e.g. access, existing services, party walls).
- e) The need to avoid disruption to business continuity, the community and nearby structures.
- f) Legislative requirements (see 5.1.3).
- g) Party wall constraints.
- h) Cost and commercial benefits:
 - 1) cost of work; and
 - 2) existing and new revenue.

4.5 Choosing the methodology

To ensure a successful outcome, the decision about which of the following methodologies to adopt should take account of such factors as sustainability, waste strategies, client issues, risk management issues, e.g. increased risk of accident or injury, the potential for statutory nuisance, prohibition and prosecution, and insurance issues.

- a) Hand working (manually).
- b) Mechanical working (machine use).
- c) A combination of hand working and mechanical working.

EXAMPLE

A building contains a large amount of “soft strip” material. If the building is detached and there is adequate space around the structure, the decision may be taken to manually strip out all of the material to assist in a clean reduction of the remaining structure. However, if the same building is located in a heavily populated or dense area, such as a city or town centre, the best option might be to reduce the structure with all materials *in situ* and transport this elsewhere for segregation and processing.

4.6 Demolition activities in structural refurbishment

4.6.1 General

Because demolition activities as part of structural refurbishment can alter the load-bearing parts of the structure, the following issues should be assessed.

- a) The load-bearing requirements and the necessary temporary support system.
- b) The potential for unplanned collapse of structure (e.g. often due to lack of understanding of traditional building construction).
- c) Fire safety (e.g. fire loading, means of escape, protection).
- d) All services, including electricity and gas (e.g. isolation and disconnection of services, especially where properties either remain in occupation or are the subject of phased handover, leading to work being carried out with live services).
- e) Health issues [e.g. noise and vibration, the presence of asbestos, lead, silica, polychlorinated biphenyls (PCBs) or zoonoses carriers, the need to provide welfare facilities].
- f) Client issues (e.g. raising awareness, wide variation of client experience, provision of relevant information).

Competent advisors should be involved early in the process. When gathering information, the design team should identify and understand the concerns and needs of:

- 1) the client;
- 2) the occupier of the building (who might not be the client, but could be living in the building while the work is done);
- 3) the contractor; and
- 4) any third parties (e.g. members of the public, adjoining owners, emergency services, environmental matters).

The team should also identify the need during the project for emergency procedures in the event, for example, of fire, power loss and security incidents.

NOTE See also CIRIA C579 Retention of masonry facades - best practice guide [8] and C589 Retention of masonry facades - best practice site handbook [9].

4.6.2 Extent and effects of demolition activities in structural refurbishment

The degree to which demolition in structural refurbishment might be invasive and affect the structure should be assessed both before and during the work (see Table 1). This assessment should be undertaken for each element of work and then encompassed into the demolition plan.

4.6.3 Types of work involving partial structural demolition and structural supports

The type of instability created in a structure should be assessed before and after such work as the following is carried out.

- a) Removal of floors.
- b) Removal of walls.
- c) Chimney breast/stack removal.
- d) Alterations to traditional building structures.
- e) Forming new openings.

- f) Excavation/removal of foundations, etc., for basement construction under existing buildings and garden areas.
- g) Loft conversions.
- h) Facade retention.
- i) Cutting back floors to upgrade insulation/create mezzanine/two storey height areas in the building interior.
- j) Extensions.
- k) Construction of additional floors at roof level of existing buildings.
- l) Conversion of office buildings into residential/hotel accommodation.
- m) Structural refurbishment, such as:
 - 1) modernization, e.g. upgrading a facility where the same use is to be retained;
 - 2) change of use, including subdivision; and
 - 3) significant rebuild, e.g. undertaking major structural works but reusing the existing foundations and retaining the facade.

NOTE 1 Activities not generally described as structural refurbishment include maintenance jobs, such as painting, gutter cleaning and window cleaning.

NOTE 2 Table 2 gives examples of possible changes of use arising from structural refurbishment activities as a guide for broader risks, establishing the management criteria of the demolition work and the competencies required, particularly where there could still be occupation of the facility.

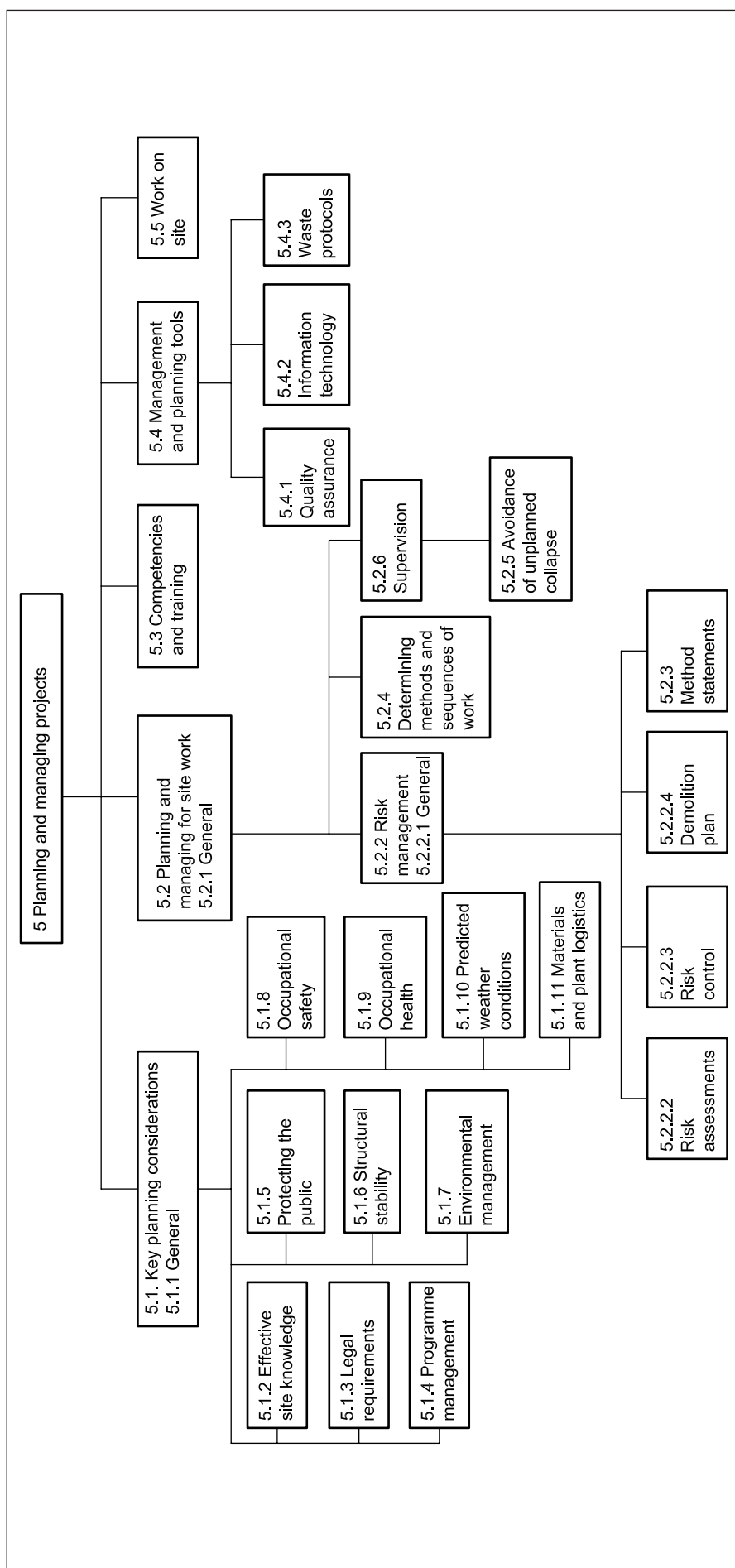
Table 2 Types of structural refurbishment

Category	Existing use	Possible change of use	Issues	Building type and occupancy (BS EN 1991-1-7: 2006, Table A.1 ^{A)}
Commercial	Office premises, car parking	Residential use, health or educational facilities	Structural alterations, new service ducts, asbestos	2A, 2B, 3
Industrial	Factory buildings, mills, warehousing and storage	Residential use, offices, restaurants and other entertainment	Proximity to other buildings, hazardous substances	2A, 2B, 3
Residential	Detached, semi-detached, terraced houses, flats	Residential, retail, offices, work space, catering	Requirement to carry out works while building/parts thereof in use	1, 2A, 2B, 3
Health	Hospitals, doctors' surgeries, other health facilities	—	Prevention of infectious diseases	2A, 2B, 3
Education	Schools, universities	Community facilities	Requirement to carry out works while building/parts thereof in use	2A, 2B, 3
Retail	Shops, shopping malls, warehousing	Residential, workshops	Structural alterations, new service ducts, asbestos	2A, 2B
Infrastruc- ture	Bridges, power stations, waste water treatment works	Art gallery, residential, new technology	Structural alterations, new service ducts, asbestos	3

NOTE Attention is drawn to the Building Regulations [10, 11, 12].

^{A)} The classifications in this column relate to design requirements to ensure the ability of buildings to sustain localized damage without a disproportionate level of collapse.

Figure 3 Route map for Clause 5



5 Planning and managing projects (see Figure 3)

5.1 Key planning considerations

5.1.1 General

The issues in 5.1.2 to 5.1.11 should be addressed, as appropriate, when planning demolition projects. Sufficient lead-in time should be allocated for completion of these activities.

NOTE The key considerations listed in the following subclauses are relevant at many stages of work, from scheme concept and development, through tender development, tendering procedure and contract awarding procedures to contract management and work on site.

5.1.2 Effective site knowledge (see Clauses 7 and 8)

An assessment and survey of the site should be planned to identify the following, as far as possible.

- a) The extent of decommissioning.
- b) Details of the isolation or removal of services and details of temporary supplies.
- c) Knowledge and history of the structure, including form, materials of construction, structural interactions and location.
- d) Isolation and protection measures for adjacent structures.
- e) Hazardous materials.
- f) Previous uses of the site.

5.1.3 Complying with legal requirements (see Clause 11 and Clause 12)

5.1.3.1 Legislation

Arrangements should be put in place to ensure compliance with legislation in a number of different related fields, including the following.

- a) Waste management.
- b) Reuse and recycling.
- c) Control and minimization of nuisances to the site's neighbours, including:
 - 1) dust;
 - 2) noise;
 - 3) vibration;
 - 4) smoke; and
 - 5) traffic movements and management.
- d) Air overpressure.
- e) Environmental protection, including prevention of pollution.
- f) Occupational health and safety.
- g) Planning (including listed buildings and party wall constraints).
- h) Building regulations.
- i) Highways and roads.

NOTE A list of relevant legislation and official guidance is given in Annex B. Legislation can vary nationally or under local authorities. Information and advice can be obtained from regulating authorities, such as the Health and Safety Executive (HSE), the Environment Agency and local authorities. Further advice can be sought from the relevant professional bodies and industry associations. See Annex C.

5.1.3.2 Permissions, consents and licenses

5.1.3.2.1 General

Early consideration should be given as to whether any permissions, consents or permits/licences are required for the works and whether any special measures need to be put in place, particularly for works on dangerous structures or special (e.g. nuclear) sites and for works which could:

- a) affect a public or private road or highway, e.g. works which necessitate:
 - 1) the partial or total closure of the road or highway;
 - 2) the erection of temporary structures (e.g. scaffolds, fans, screens, hoardings and supports) on or over the road or highway;
 - 3) the use of plant or equipment on or over the road or highway; and
 - 4) the storage of site vehicles on the road or highway;
- b) affect features outside the curtilage of the site (e.g. footway lights, vaults and other voids under a highway);
- c) affect access routes, for example, to:
 - 1) an adjoining property; or
 - 2) utilities;
- d) involve scaffolding or a crane jib passing over an adjoining property; or
- e) involve the burning of waste in the open on site.

NOTE 1 Discussions might need to be undertaken with a number of parties, including regulating authorities (e.g. the local authority or Highways Agency), utilities providers, public transport operators, property owners or emergency services. All demolition activity in England and Wales requires planning permission.

NOTE 2 Special measures might include, for example, the provision of temporary diversions for both pedestrian and vehicular traffic in the event of a road closure.

5.1.3.2.2 Heritage site activities

The relevant local planning authority (LPA) should be consulted in good time for advice as to:

- a) whether consent is required for:
 - 1) demolition or partial demolition of a building or other structure that is a designated heritage asset ¹⁾ or is otherwise considered to have heritage significance meriting consideration in planning decisions; and
 - 2) work involving disturbance of the ground (such as removal of soil, foundations or buried services) in an area that is considered to be of archaeological significance;

¹⁾ The consent is generally incorporated in the necessary planning permission for the development. In the case of a building or other structure that is listed, a Listed Building Consent is also required; in the case of a building or other structure in a conservation area, a Conservation Area Consent is also required. Applications for planning permission, Listed Building Consent and Conservation Area Consent are usually published by the LPA for public consultation, comments from which are taken into account by the LPA in making its decision.

- b) what information will be required in any application; and
- c) whether the LPA intends to:
 - 1) place restrictions on the work, such as prohibiting alteration or demolition of certain parts of the structure, or require the use of non-contemporary materials or techniques, all of which could have cost and time implications; or
 - 2) require consultation with specialist bodies, which could again have a significant influence on project timing.

Consents should be applied for and obtained before demolition activities commence.

The timetable for applications and consents should also be established with the LPA, and taken into account in the programme for work on site.

NOTE Annex D gives details of the common sorts of Conditions that might be applied to a consent relating to heritage matters.

5.1.3.2.3 Other activities

The following activities should be carried out, where appropriate.

- a) Obtaining permissions from, and liaison with, for example, the police, roads and highways and local authorities, utilities, rail and waterways companies, and others as necessary.
- b) Prior agreement with the local environmental health departments about environmental noise.
- c) Application to the local authorities for licensing of crusher or screening plant.
- d) Possible permission from the local authorities and environmental regulator for on-site burning of waste materials.
- e) Prior consents or other agreements with the relevant regulator for the disposal of ground water or waste water and other fluid discharges.
- f) Waste management, including waste disposal.

NOTE 1 Attention is drawn to the Environmental Protection (Duty of Care) Regulations 1991 [13] and Waste Management – The Duty of Care – A Code of Practice [14], and the Landfill Regulations [15].

- g) Allocating site waste management plan responsibilities and requirements.

NOTE 2 Attention is drawn to the Site Waste Management Plan Regulations 2008 [4].

5.1.4 Programme management (see Clause 6)

A detailed programme and timetable of events, as appropriate, should be prepared, detailing the following.

- a) The scheme, sequence and method of proposed demolition.
- b) The plant required and its usage.
- c) Traffic management, the plan for controlling traffic to, from and within the site (see HS(G) 144 [16]).
- d) The management of arisings, including likely types and amounts, removal and temporary storage on site, and options for reuse, recycling, recovery, disposal, etc., where appropriate.
- e) Contingency arrangements, e.g. for partial collapses or misfires when explosives are used.

- f) The agreed start and completion dates.
- g) Any limitations, e.g. tidal, nightworks, seasonal.

5.1.5 Protecting the public (see Clauses 11, 12 and 13)

Arrangements for protecting members of the public should include the following.

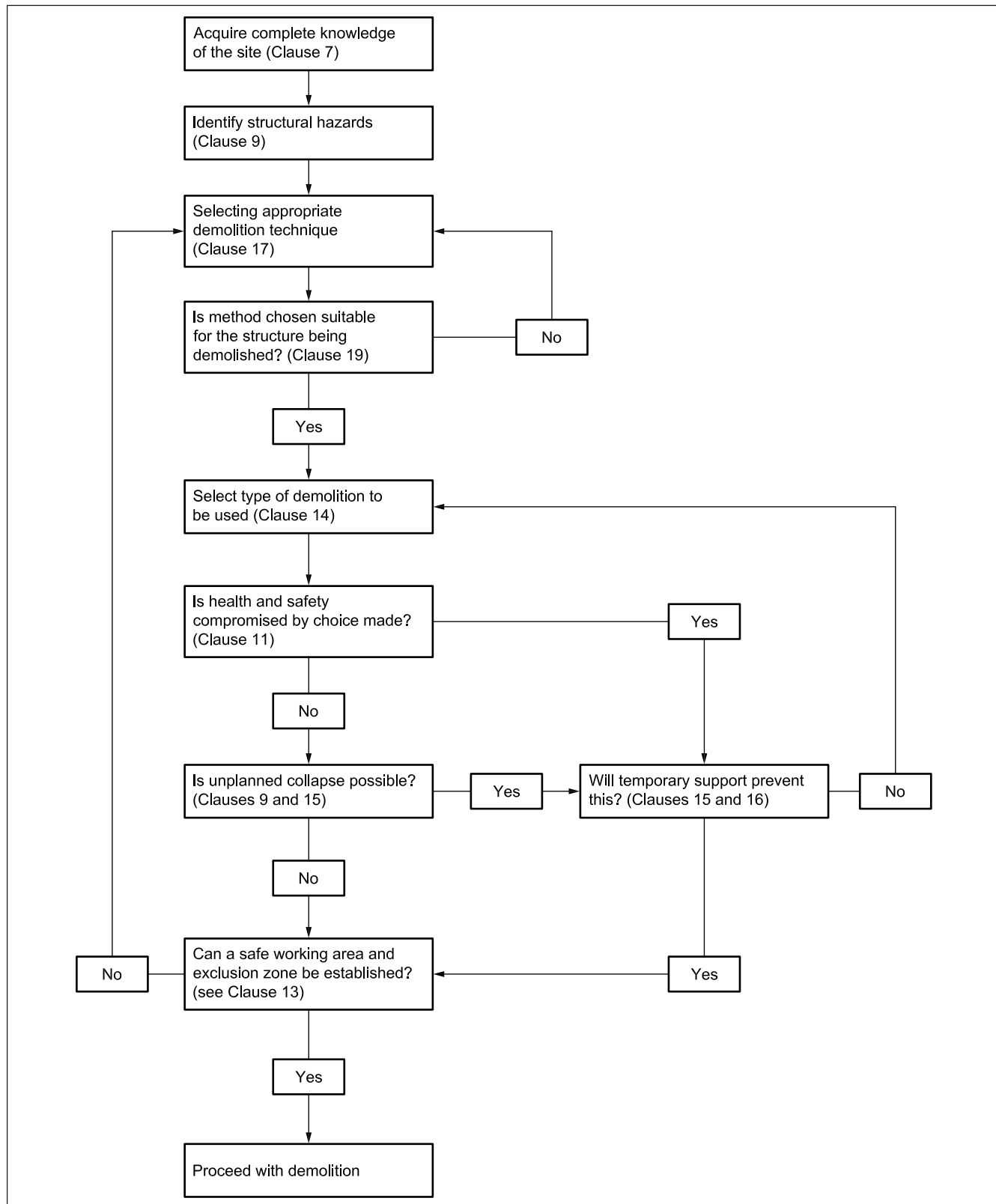
- a) Site security, including the provision of, for example, suitable fencing and/or barriers.
- b) The control of spectators and/or site visitors.
- c) Exclusion zones outside the site boundaries during critical aspects of the work, when appropriate.
- d) Containment of demolition materials.

5.1.6 Structural stability (see Figure 4 and Clauses 9, 14, 15 and 16)

The process for maintaining structural stability should be in accordance with Figure 4, taking the following into consideration.

- a) Avoidance of unplanned, including premature, collapses and maintenance of residual structural stability.
- b) Details of any pre-weakening and knowledge of the remaining structural stability designed by a competent engineer, including the sequence of the operation.
- c) Details of any auxiliary or temporary works to provide support designed by a competent engineer, taking into account adjacent structures.
- d) Previous collapse history relating to the form of the structure, e.g. large panel precast concrete construction (see 19.2.3) and lift-slab concrete structures (see Forensic Engineering ICE Conference proceedings).

Figure 4 Flowchart for maintaining structural stability



5.1.7 Environmental management (see 5.4.3 and Clause 12)

The need for the following should be assessed during the planning process.

- Control of noise at the site boundaries.
- Control of dust emissions.

- c) Waste management, including reduction, reuse and recycling.
- d) Minimization of materials haulage.
- e) Bunding arrangements for storage and dispensing of fuel oils.
- f) Wheel washing plant and road-cleaning arrangements, where required.
- g) Skip or truck sheeting arrangements.
- h) Arrangements for dealing with hazardous materials, e.g. flammable materials, gases, hazardous liquids and asbestos.
- i) Anticipated values of air overpressure and ground vibration.
- j) Areas of conservation, including flora and fauna.
- k) Minimizing landfill.
- l) Carbon consumption/agenda.

Clients and contractors should consider waste minimization and recycling in accordance with the waste hierarchy during the planning stages, and implement systems to prevent downstream breaches in environmental legislation, such as the duty of care, and illegal deposit of waste.

Priority should be given to minimization before construction, for example, through designs, layout and other decisions, with preference given to on-site reuse and recycling, followed by off-site reuse and recycling, recovery and disposal.

NOTE 1 European and national waste strategies and plans refer to the waste hierarchy.

NOTE 2 Waste protocols, such as the ICE Demolition Protocol [17] and the WRAP Quality Protocol for the Production of Aggregates from Inert Waste [18] (see Annex E), describe what is meant by the waste hierarchy in the context of demolition. The principles of the waste hierarchy are embedded in the Site Waste Management Plans Regulations [4] and Code of Practice [19], and other good practice guidance [20].

NOTE 3 All waste is required to be pretreated prior to landfill disposal.

NOTE 4 The Site Waste Management Plan Regulations 2008 [4] provide a formal framework to help contractors both comply with waste management law and incorporate resource efficiency into construction processes. While the regulations currently only apply in England for projects greater than a certain financial threshold, the site waste management plan approach provides a useful methodology which can help contractors achieve best practice for any size project. Contractors involved with smaller projects may prefer to use the Site Waste Management Plans Code of Practice 2004 [19] as a guide.

It is the responsibility of the client to ensure a SWMP is written before construction work commences, and during construction and afterwards the responsibility passes to the principal contractors.

NOTE 5 Further advice is available from www.envirowise.gov.uk/construction and www.wrap.org.uk/business/construction.html

The amount of space available on site for processing materials should be identified, e.g. where on-site processing is impractical, it might be more productive to send the waste to a materials recycling facility (MRF, also known as a "transfer station").

NOTE 6 Many of these waste disposal facilities are ideally placed to handle a large variety and volume of mixed materials direct from the demolition site. Because of the large volume of waste accepted at these facilities, separation of all types and grades of waste material makes for a cost-effective process and produces a high rate of resource efficiency, whilst reducing to an absolute minimum any waste destined for landfill. Although there is invariably a gate charge to dispose of the waste, the contractor generally saves that which would be payable through the landfill tax scheme.

During planning, advice should be obtained from local enforcement authorities as to what will be allowed for the burning of materials, both by open fire or incineration, as these activities are subject to local and national restrictions.

NOTE 7 The control of the burning of materials on site is generally subject to Section 80 (Nuisance provisions) of the Environmental Protection Act 1990 [5] and the Clean Air Act 1993 [21]. Burning waste in the open on a demolition site might require an environmental permit (England and Wales) or a waste management licence (Northern Ireland and Scotland) or registered exemption.

NOTE 8 Subject to certain exemptions, all companies undertaking demolition have to register with their local authority or waste regulatory authority for a certificate of registration before they undertake the work (see 5.3 and Annex A).

5.1.8 Occupational safety of the workforce (see Clauses 11, 13 and 16)

Measures for the following should be put in place.

- a) Obtaining details of personnel access and working platforms, including the procedure for their maintenance and subsequent removal as the structure is reduced.
- b) Establishing appropriate working spaces and exclusion zones.
- c) Protecting the workforce, including reference to any permit to work procedures.
- d) Providing effective communications, including warning signs and signals.

5.1.9 Occupational health of the workforce (see Clauses 10 and 11)

Processes for the following should be put in place.

- a) Hazard recognition, risk assessments and control measures for:
 - 1) substances potentially hazardous to health, e.g. from heavy metals or other toxic substances, including when working with materials which can be reused or recycled; and
 - 2) exposures to harmful substances such as asbestos and radioactivity.
- b) Assessments and control measures for noise on sites.
- c) Identification of deleterious atmospheres, such as oxygen deficiency in confined spaces.
- d) Hazard recognition and risk assessments for the need for, and the provision of, appropriate personal protective equipment (PPE).
- e) Appropriate welfare arrangements, including for when the work involves exposure to contaminated materials or dirty work.
- f) Health monitoring of all staff.

5.1.10 Predicted weather conditions

Arrangements should be made where appropriate for liaison with, for example, the Meteorological Office to obtain forecasts of sudden and severe weather changes, such as strong winds, lightning, snow and heavy rain, and indications of how these can affect the planned works and programme.

5.1.11 Materials and plant logistics

As materials and plant will be incoming and outgoing, the logistics for delivery, storage and movement, for example, should be planned effectively. The need for temporary, auxiliary and permanent items should be assessed, taking account of the need to manage the waste streams from the site.

NOTE This might be particularly relevant for phased operations and where partial demolition is being undertaken on premises that are still occupied.

5.2 Planning and managing for site work

5.2.1 General

Demolition works should be planned in such a way that it is undertaken using systems of work that take into consideration safety, health, the environment, and efficiency.

All those involved from concept through tender to contract execution should ensure effective planning and communication, and the provision of sufficient time to allow the execution of a successful and efficient project.

The timescales required for the acquisition of any licences or permits should be allowed for in the programming of works.

After the contract has been awarded, and before work commences, the contractor should determine the proposed safe sequence of operations on the basis of an assessment of the comparative risks, related specifically to the site and conditions. This sequence should be used to assess and expand the construction phase plan (CPP) for the tender and proposed programme of works. The expanded plan for the tender should form the basis of the CCP (demolition plan) for the demolition. SWMPs may also be considered.

The methods of work should allow for demolition activities and site clearance as stipulated by the contract, taking account of any constraints imposed by the client.

Adequate time should be allowed for setting up the site prior to work commencing and for executing the works.

5.2.2 Risk management

5.2.2.1 General

Tenderers/contractors should look for the hazards in the project, including how and where the work could be done and the equipment and materials used.

When planning methods and sequences of work, a suitable and sufficient risk assessment should be carried out in accordance with 5.2.2.2 and recorded. This should include selecting methods, materials and equipment to remove or minimize risk from work.

5.2.2.2 Risk assessment

The following principles of risk assessment should be followed when determining methods and sequences of work.

- a) Identify the hazards associated with the proposed work.
- b) Consider who might be harmed and how, including workers, site visitors, members of the public and anyone affected by the work.
- c) Evaluate the risks and identify the precautions required by, for example, comparison with good practice and categorization of risk level (likelihood and severity).

- d) Record the findings and implement the control measures for the residual risks.
- e) Review the risk assessment and update if necessary.

The risk assessment should take into account any constraints that the client has identified, but the contractor should be given the freedom to determine the proposed methods of demolition.

The risk assessment should identify the risks associated with the work and enable the contractor to select appropriate demolition solutions that remove or reduce the risks before the work commences.

The contractor should then select the most suitable methods of demolition which include measures to properly control any remaining risks (see 5.2.2.3).

5.2.2.3 Risk control

The steps required for effective risk control are simple. First, a determination should be made as to whether the hazard can be eliminated altogether. If not, consideration should be given to the control measures required to reduce harm, e.g. equipment, systems of work and sequencing. If the risk is unacceptable, alternative control measures should be applied till the risk is acceptably low.

The following principles should be applied to the control of risk.

- a) If possible, avoid the risk completely by using safer alternative methods or materials.
- b) Address risks at source, rather than using superficial control measures that result in a high or unnecessary residual risk remaining in place.
- c) Wherever possible, adapt the work to the individual, particularly in the choice of work equipment and methods of work, as this makes the work less monotonous, improves concentration and reduces the temptation to improvise equipment and methods.
- d) Take advantage of technological progress, which often offers opportunities for safer and more efficient working methods.
- e) Incorporate the protective and preventive measures into a coherent plan to reduce progressively those risks which cannot altogether be avoided, taking into account working conditions, organizational factors, the working environment and social factors.

5.2.2.4 Demolition plan

All demolition, and partial demolition, activities should be planned and carried out such as to remove or reduce the risks to people to as low as reasonably practicable. The arrangements for carrying out such demolition, or partial demolition, should be recorded in writing before the demolition work begins, with a level of detail proportionate to the risks involved. For projects notifiable under the CDM Regulations 2007 [2], the demolition plan should form part of the CCP prepared by the principal contractor. On individual projects, the demolition plan should be the focus for ensuring adequate cooperation, coordination and planning between all members of the project team.

Adequate pre-construction information should be provided by the client to allow the contractor to identify the hazards and risks associated with the proposed work.

5.2.3 Method statements

5.2.3.1 General

Method statements should address the particular needs of the site and detail the planned sequences and methods of demolition works. The proposed working methods should be assessed to determine whether a number of method statements are required, particularly where the operations are phased.

Method statements should be prepared in such a way that they enable supervisors and managers to ensure that persons on site are made aware of how the work is to be carried out, including the sequence of operations, the plant and types of equipment to be used and the precautions to be taken, as appropriate.

NOTE Methods such as "tool box" talks are recommended to help in disseminating the information, especially for those carrying out the work.

Method statements should be regarded as live documents and modified as required to cater for planned changes in systems of work. Any modifications should be made in accordance with 5.2.2 and 5.2.4.

5.2.3.2 Format

Each method statement should be succinct and should form a single document, including site plans, annotated diagrams and a detailed programme for the work, to clearly communicate to those carrying out the work on site what is required. A logical order should be followed. It should be easy to understand, and agreed by and known to all levels of management and supervision. Repetitive tasks may be covered by standard sheets, but critical activities should be specified in full.

NOTE The use of photographic sequences has been found to be effective.

Each method statement should be clearly marked with the date of preparation and any revision number or letter, so that the latest edition can be readily identified.

5.2.4 Determining methods and sequences of work

The chosen methods of work should be determined in accordance with 5.2.1 and 5.2.2 and detailed in each method statement (see 5.2.3).

When proposed methods of work need to be altered because of changed and/or unforeseen circumstances, the cycle of determining methods and sequences of work should be repeated, commencing at 5.2.1.

New methods should not be applied on site unless agreed by all concerned. They should then be included in a revised method statement that should then be promulgated before implementation.

Operatives about to carry out work should be informed of the methodology and be required to give an acknowledgement of understanding of the safe system of work.

5.2.5 Avoidance of unplanned collapse: surveys

Inspection surveys and assessments should be undertaken before work is carried out. The chosen methods of work should be such that demolition activities can be carried out in such a way that the unplanned collapse of any part is avoided by maintaining the structural stability of the remaining parts at all times. The methods of work should therefore emphasise the importance of planning surveys, including those of the structure, being undertaken before any work is carried out. The types of surveys required should be explicit and the reasons given if they relate, for example, to features which might not be immediately apparent. Such surveys may be intrusive to ensure an adequate survey of the structure is undertaken. The surveys should permit structural assessments to form a fundamental basis for maintaining adequate structural stability at all times, so the terminology and requirements should be clear to avoid any misunderstandings.

CAUTION: The term “structural survey” can cause confusion as its meaning can differ, for example, when the term is used by estate agents where the survey is for different purposes, such as valuation.

NOTE 1 See also Clause 7, which includes advice about types of surveys, inspections and assessments.

NOTE 2 Unplanned collapse can result from instability caused by, for example, the interruption of load paths or from overloading individual elements.

NOTE 3 The IStructE guide, Appraisal of existing structures [22], gives advice.

A detailed structural assessment should identify any weak elements, supports or connections, and allow for the overall stability throughout demolition to avoid danger from unplanned collapse, including neighbouring properties. The findings should be recorded within the risk assessment (see 5.2.2.2).

When methods of work require modification, the structural assessment should be revisited and, if necessary, revised.

5.2.6 Supervision

Managers and supervisors should ensure that the planned method of work arising from any assessment is monitored for its correct implementation during the demolition processes, and that the actual conditions found on site, e.g. concerning the type and strength of the structure, confirm the assumptions made in any survey of the structure, the risk assessment and the planned method of work.

NOTE 1 Those undertaking demolition activities are required by health and safety legislation to employ a competent person to supervise and control the work on site.

Where two or more of those undertaking demolition activities take part in work on the same site, each should appoint persons to supervise the work. To ensure the safety of the whole works these persons should collaborate in the planning and execution of the work.

NOTE 2 See 5.5.

Those undertaking demolition activities should maintain competent supervisory staff on site throughout the working day. The extent of supervision and management should be appropriate to the complexity and extent of the work to be undertaken. Supervisory staff should have direct access to higher management at all times.

5.3 Competencies and training

5.3.1 Competencies

All demolition and structural alteration activities should be carefully planned and carried out by competent practitioners and organizations. People making appointments should take reasonable steps to ensure that those appointed are competent for what they are expected to do. Likewise, those accepting such appointments should only do so if they are competent to undertake the particular activity. Clients and procurers of demolition works have a key role and should ensure that all contractors, designers and other team members that they propose to appoint have either the competence to carry out the work themselves or have engaged the services of an individual or organization with these competencies.

NOTE 1 See Annex A for further details on competence and training.

NOTE 2 The CDM Regulations 2007 [2] place responsibilities on the client and other persons involved with construction activities, including demolition works, to ensure that competent persons are employed on the project.

5.3.2 Training

Management should ensure that the necessary levels of competence exist and are developed by appropriate training as required. This should include industry-recognized training schemes intended to ensure that managers, supervisors and operatives in the demolition industry are competent at the level of experience that they claim and that they have received suitable training in, for example, health and safety and waste management.

NOTE Bodies providing industry recognized demolition training schemes are listed in Annex C.

5.4 Management and planning tools

5.4.1 Quality assurance (QA)

As part of rigorous project management, consideration should be given to using QA systems to help compliance with environmental, health, safety and legal requirements.

NOTE Users of this code of practice are advised to consider the desirability of quality system assessment and registration against the appropriate standard in the BS EN ISO 9000 and BS EN 14000 series by an accredited third-party certification body.

5.4.2 Information technology (IT), including knowledge-based systems

Computer-based IT should be used, where appropriate, to record, access, search, update and retrieve information about the demolition process.

The potential for the use of innovative technology, including IT systems, should be explored, for example:

- a) virtual reality;
- b) knowledge-based and expert systems;
- c) robotics;
- d) sensing and recording devices including lasers;
- e) three-dimensional modelling;
- f) project management and project control systems; and
- g) the internet, e.g. SMARTWaste and BREMAP, hosted by BRE which offers a

SWMP tool and a database for recovering and exchanging construction and demolition materials (see Annex C for useful website addresses).

NOTE The Data Protection Act 1998 [23] is applicable to the storage of personal information.

5.4.3 Waste protocols

The client team should engage in early discussions to secure the highest value recovery of products and materials by implementing an appropriate waste protocol at an early stage of a project where removal of materials is being considered as an option. A number of such protocols are available and should be considered, and the client may require the use of a protocol that is more suitable for a particular application. The client should therefore ask for a waste protocol to be taken into account.

NOTE More background on, and examples of, such protocols are given in Annex E.

5.5 Work on site

Where more than one contractor is working on the same site, one party should have the authority to coordinate and manage all the activities on the site. If the project is notifiable under the CDM Regulations 2007 [2], such authority should be vested in the principal contractor. Particular attention should be paid to such issues as the following.

- a) Fire, including process and general fire precautions.
- b) Waste management.
- c) Electrical distribution.
- d) Transport on site.
- e) Deliveries to the site.
- f) The proximity of different contractors' operations and allowance of clear routes to and from each area of operations
- g) Exclusion zones.
- h) Auxiliary or temporary works.

6 Procurement

6.1 Professional advice

The client should be aware of any direct responsibilities under their duty of care and receive professional advice as appropriate.

All demolition activities should be planned, designed and undertaken following agreement of a formal written contract. This should be entered into and signed by both the client (or their legal representatives) and the contractor undertaking demolition activities. Standard forms of contract, which can be obtained from various sources, e.g. professional bodies and industry associations (see Annex C), should be used.

Subcontracting the whole or part of the works should only be permitted with the prior written consent of the building owner. Where such consent is granted, the terms of the contract should be the same as those between the building owner and those undertaking demolition activities.

6.2 Scheme for demolition and contract documents

A proposed scheme for demolition, and associated contract documents, should include, as appropriate, the following.

- a) The location and site of the works.
 - b) All relevant site surveys (see Clause 7).
 - c) Plans showing the position, ownership and nature of boundary walls, fences, hedges and trees, and the location of buildings, structures or subterranean features that are to be the subject of the works or that are to be preserved.
 - d) Plans obtained from utility companies showing the alignment, position and depth of all their cables, pipes, ducts, tunnels, apparatus and equipment, together with any special requirements to safeguard and maintain, where necessary, their installation and service.
 - e) Written confirmation from each of the utility companies providing services on the site, e.g. water, gas, electricity, telecommunications, that they have disconnected their supply.
 - f) Highways authorities and/or police requirements regarding the position of points of access to and egress from the site and the periods of the day when such access/egress will be permitted.
 - g) Local requirements relating to the provision of hoardings, gantries, walkways, fans, scaffolding, working arrangements and notices prior to commencement of work by those undertaking demolition activities.
 - h) Insurance provisions to indemnify the building owner and cover employers' public and third party liabilities to a specified level appropriate to the scheme and sufficient to cover any specified risks arising as part of the works.
 - i) The action to be taken by those undertaking demolition activities to protect specified features of heritage or geological importance during the works and, if unknown at the commencement of works, provisions as to the notification of such items and costs arising from the need to preserve them.
 - j) The appointment and duties of the person supervising the demolition activities for the building owner.
 - k) A contract appropriate to the scheme, including provisions setting out the roles of the parties, the agreed works, the method of dealing with any delay in the progress of the works, completion of the works by the building owner if the contractor is unable to complete the works at the required time, payment provisions, insolvency of either the building owner or contractor, and other appropriate conditions.
- NOTE 1 The Scheme for Construction Contracts (England and Wales) 1996 [24] affects procedures for demolition contracts. It is automatically applicable to all contracts signed after the scheme that brings the Housing Grants Construction and Regeneration Act 1996 [25] into effect. See also similar schemes for Scotland and Northern Ireland.*
- l) The date, where known, for commencement of the works and the date, or time allowed, for the completion of the works.
 - m) Any party wall agreements and schedules of condition, including photographic materials and a list of adjoining owners' names and addresses, together with those of their agents, agreed between the building owner and adjoining owners/occupiers.

- n) Indication of any known prescriptive rights of support, rights of way which have been acquired, easements, covenants or licenses and other property rights.

NOTE 2 Such rights can include rights of support provided by part(s) of the building owner's building to an adjoining building.

- o) The specification of the works should be clear and unambiguous, provide the contractor with the building owner's requirements and a list of all documents, plans and notices, and include information obtained by the building owner necessary for incorporation in the contract.
- p) Specific constraints imposed on working methods, including arrangements in respect of hazardous materials.
- q) The decommissioning report for the site.
- r) The demolition plan (see 5.2.2.4).
- s) The health and safety file (for previous work when available).
- t) The SWMP.

NOTE 3 The provision for SWMP may be passed on through the tender process: clients are increasingly producing high-level waste management strategies with outline SWMPs which form part of the tender.

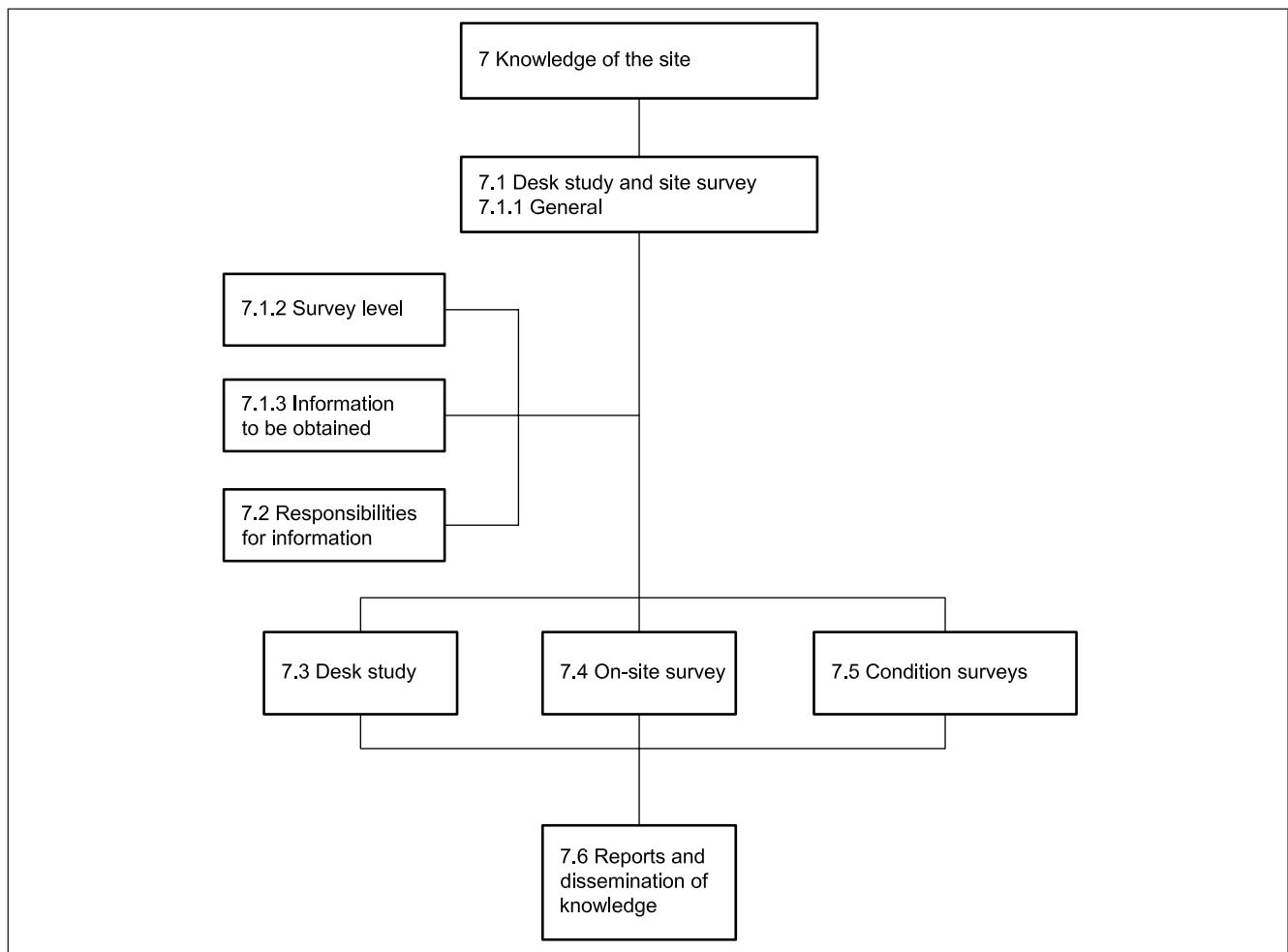
NOTE 4 For larger projects, the SWMP may be a key environmental mitigation measure, or may even be passed on as a planning Condition.

6.3 Tender procedure and administration

Tendering for demolition works, separately or as part of a larger contract, should follow the procedures used in good construction industry practice. Professional advice should be sought to assist the building owner in the preparation of tender documentation and the selection of contractors to undertake the work.

7 Knowledge of the site (see Figure 5)

Figure 5 Route map for Clause 7



7.1 Desk study and site survey

7.1.1 General

The following should be undertaken to obtain a clear understanding of the site's state and condition.

- a) An initial desk study (see 7.3).
- b) An on-site survey (see 7.4).

NOTE 1 This understanding is fundamental to the completion of a successful project in terms of the environment, efficiency and health and safety, including physical and health hazards. The information is needed initially for the tender stage.

NOTE 2 In this context "the site" includes everything above, at or below ground level, within the area under consideration.

Off-site features that can affect work on site should also be determined and the condition of adjoining premises surveyed, where necessary (see 7.5).

The assessments/surveys might need to be repeated when work starts on site as more information is revealed as demolition proceeds. Any additional information should be incorporated into the risk assessment process and reviewed to establish whether the methods of work need to be amended.

CAUTION: Buildings should be considered on their own merits since geographical variations in structural approach often occur between apparently similar buildings. Additionally, the original structure might have been subject to structural alteration in the past and might not be as initially expected.

7.1.2 Survey level

The appropriate level of survey should be identified and undertaken prior to work commencing (see Table 3).

Table 3 Types of survey and levels and information that might be revealed by surveys

Type of survey	Examples of levels and information that might be revealed
Structural	Desktop; visual; intrusive
Utilities	Desktop; intrusive
Asbestos	Refurbishment and demolition survey
Topographical	Dimensional; services information; environmental information; vegetation (inc. tree preservation order information); hazard identification; party wall issues; neighbouring properties; rights of way
Geotechnical	Existing foundations; desk study; trial pits, boreholes; interpretative reports on ground conditions; contaminated land surveys
Services on site	Desk study (incoming services and distribution on site); intrusive (confirmation of accuracy of desk study)
Environmental	Watercourses; contaminated land; pest infestations; dry rot

NOTE See also CIRIA C653 Reuse of foundations [26].

7.1.3 Information to be obtained by desk study/on-site survey

7.1.3.1 Industry processes and materials

The desk study/on-site survey should identify any industrial processes that have taken place on the site, and their associated materials, particularly hazardous residues, including the following.

- Materials forming, and within, the fabric of the building(s) and other structures.
- Raw materials.
- End-products.
- By-products or wastes.
- Materials from neighbouring sites.
- Organic deposits.

A systematic approach should be used including a pre-demolition audit.

7.1.3.2 Built environment

The desk study/on-site survey should gather information about aspects of the built environment that could pose a risk to health and safety, including the following.

- Physical features, either natural or built, such as buried tanks or waste materials.
- Form, type, elements and other features of the building(s) and other structures.
- Design and load paths, including stability features, of the building(s) and other structures.

- d) Construction materials and strengths of constituent materials.
- e) Any peculiarities of, or modifications to, the building(s) and other structures.
- f) Other potential physical hazards, e.g. from plant, machinery and equipment.
- g) Claddings and coverings that could be a health risk, e.g. asbestos lagging or sheeting.
- h) Health risks from the building fabric, e.g. treated timber.
- i) Previous collapse history relating to the form of the structure, e.g. large panel precast concrete construction (see 19.2.3) or lift-slab concrete structures.

The types of hazard associated with materials in the built environment, which can be toxic, carcinogenic, pathogenic, sensitizing, corrosive or irritant, should be identified, for example:

- 1) radioactive materials;
- 2) fibres which can be harmful, such as asbestos and man-made mineral fibres; and
- 3) chemicals which can be harmful, such as polychlorinated biphenyls (PCBs).

7.2 Responsibilities for acquiring and providing information

NOTE The responsibilities for providing information are addressed by criminal, civil and common law and professional liabilities.

7.2.1 Client

The client should:

- a) initiate the desk study and on-site site survey so that a detailed site report can be produced (see 7.6), providing drawings and sketches for information that incorporate any alterations that have occurred;
- b) arrange a pre-demolition audit to identify the types and amounts of waste that are likely to be produced and how they are to be managed, and feed this information into the SWMP, where one is required;

NOTE 1 The client has ultimate responsibility, but the principal contractor assumes responsibility for producing and implementing the SWMP.

- c) arrange for a decommissioning report (see 8.1.3) to be prepared which, amongst other things, identifies specific areas of concern relevant to future demolition work;
- d) engage professional advisers, where appropriate, and provide full and accurate information to enable them to carry out relevant surveys which aid in the preparation of the tender documentation;

NOTE 2 The appointment of a professional adviser does not ultimately relieve the client of their responsibilities.

- e) make available the decommissioning report and results of surveys at the tender stage to assist in the provision of a tender that covers the cost of dealing with the identified issues;
- f) appoint the principal contractor and provide full and accurate information before work commences; and
- g) respond to requests from the professional advisers or principal contractor for further information.

NOTE 3 Attention is drawn to the CDM Regulations 2007 [2].

7.2.2 CDM coordinator

On projects notifiable under the CDM Regulations 2007 [2], the CDM coordinator should ensure that:

- a) the required information about the site and proposed work is collected in the principal contractor's construction phase plan, which should incorporate the demolition plan (see 5.2.2.4);
- b) during the execution of the work, any additional relevant information is collected and incorporated into the health and safety file (see 20.2) to be given to the client on completion of the project.

NOTE The CDM Regulations [2] require a CDM coordinator to be appointed on notifiable projects. CDM coordinators have statutory duties that include ensuring that the relevant information regarding the site is passed over to contractors, in a timely manner, in order for them to formulate the safe methodology, method statements, risk assessments and demolition plans prior to works commencing.

7.2.3 Professional advisers

NOTE Professional advice may be drawn from a number of disciplines which could include independent consulting engineers, surveyors, environmentalists and CDM coordinators. Equally, the information needed by the client and/or client team may be drawn from within the organization.

Professional advisers should ensure that initial and/or additional information that could affect the planned site activities is given in a timely manner, and is effective, relevant and accurate.

They should be receptive to requests from contractors for further information, particularly if the planned works include demolition activities where such information is critical to the planned and safe execution of the work.

7.2.4 Contractors

Contractors should:

- a) ensure they have all the information necessary to undertake the work in a safe and efficient manner;
- b) confirm receipt of all such information provided by the client, requesting any additional information that is required; and
- c) verify the information received before it is used in the preparation of proposed methods of work and the development of the demolition plan and the SWMP, where the latter is appropriate.

NOTE If the SWMP applies directly to the demolition contractor as principal contractor, they are required to name the person producing the SWMP. If the demolition team is subcontracted, responsibility lies with the principal contractor.

7.3 Desk study

7.3.1 General

The desk study should identify:

- a) all former uses of the site, including its buildings, taking account of:
 - 1) any manufacturing processes and materials that are likely to have been present; and

NOTE 1 Where adequate information or detail cannot be obtained for a specific site, a more general review of processes and practices appropriate to the industry can be made to give an indication of potential hazards. For a given industry, the processes and materials are often similar regardless of geographical location.

- 2) any hazards, including gases or chemical contaminants and the possible locations of hazards from gas or chemicals, with a schedule containing a preliminary assessment of the nature of the hazard at each location and suggestions for suitable means of dealing with it;

NOTE 2 Any contamination is likely to be concentrated in particular areas of a site. The investigations can become complex when many changes of use have occurred during the site's history of occupation.

- b) structural features, such as:
 - 1) below-ground structures, e.g. basements, cellars, tanks and vaults with no structures on top, and their proximity to the boundaries of the site; and
 - 2) above-ground structures, including those with basements, etc., and those at or near the boundaries of the site;
- c) topographical features, such as trees and water courses which can require protection (see **12.3.12** and **12.4**), or otherwise affect the planning of the work;
- d) ground conditions, including the water table, the potential for flooding (see also **11.9**), ground types, and the presence of sink holes, mineshafts and shallow workings;
- e) access routes that have been established to, from and around the site;
- f) the location and type of services, both above and below ground, as these can pose a hazard or require protection, isolation or diversion, including details of relevant contacts;
- g) the presence of neighbours whose premises or equipment:
 - 1) might be sensitive to the works, e.g. impact vibration, noise, dust or electronic transmissions; or
 - 2) might impact upon the works, e.g. by producing radio transmissions that could affect the use of electric detonators;
- h) expected waste arisings and options for waste management (see **12.3.2**), including special or hazardous wastes [see also item a)2)].

NOTE 3 If subcontractors are undertaking the work, information needs to be obtained from the main contractor regarding SWMP requirements. Ideally, the main contractor will work in partnership with key subcontractors (such as the demolition contractor) to agree achievable SWMP objectives, particularly in relation to reuse and recycling options.

7.3.2 Types and sources of information

The following types of information should be considered during the desk study.

- a) Graphical, such as drawings and historical maps.
- b) Pictorial, such as photographs, engravings and paintings.
- c) Textual, such as trade directories and special interest books.
- d) Verbal, such as personal recollections.

Information may be obtained from the following sources during the desk study.

- 1) County, national and industry-based archives and records offices, local history societies, libraries and museums.
- 2) Local government departments, such as planning and building control, and central government organizations, such as the Health and Safety Executive (HSE), the Environment Agency (EA) and the Scottish Environment Protection Agency (SEPA).

3) Internet and data warehouses.

Archive material should be used cautiously as conditions might have changed since the archive was prepared or the original information might have been inaccurate. Any modifications that have taken place on site since the creation of the archive should be taken into account.

7.3.3 Out-of-service decommissioning report

The existence of a decommissioning report should be ascertained during the desk study. The date, status and extent of decommissioning on the site should be established, including whether:

- a) it is out of service for re-fitting, repair or structural refurbishment;
- b) it is out of service for mothballing;
- c) it has been out of service for some time prior to demolition so that there might, for example, be health and safety hazards that were not present at the time of decommissioning; and
- d) it is to be taken out of service immediately prior to demolition activities.

NOTE Decommissioning reports are usually prepared when a facility or site is taken out of service. A decommissioning report is an essential part of the desk study; however, its value depends on its age and accuracy. See Clause 8 for further information on decommissioning procedures and reports.

CAUTION: The decommissioning (and hence the report) might not have been intended for demolition purposes as there might have been plans to bring the facility back into service at a later date after being mothballed.

7.4 On-site survey

7.4.1 General

The on-site survey should augment the knowledge gained during the desk study and enable a more accurate understanding of:

- a) past features;
- b) present features; and
- c) the existing condition of the site.

The survey should identify health hazards (see Clause 10) and measures to address these (see Clauses 11, 12 and 13).

Existing information, including drawings, should be used during the survey. Once its accuracy has been confirmed, the information should be used as a basis for extending knowledge of the site by, for example, taking account of any differences such as alterations or modifications that have taken place. Records should then be updated with the current knowledge and their status should be confirmed. During partial demolition, the information should be updated as work progresses to ensure that the altered condition of the structure is accurately recorded.

CAUTION: The term “structural survey” is to be avoided since misunderstandings can arise between clients and professional advisors about what is actually included and/or excluded, and the degree of intrusive investigation (see Table 4).

Table 4 Examples of types and purposes of building and structure investigation

Type	Use	Qualifications, including limitations	Notes
a) Evaluation	May be taken as an assessment, appraisal, estimate or valuation of the structure for the purpose of tendering for the work or as a final costing to update any changes in the procurement process, intended methodology and/or disposal costs.	An evaluation is not to be interpreted as, or used in place of, a survey report for structural stability purposes. Generally, the scope of an evaluation inspection, and any measurements taken, is restricted to what is necessary to establish aspects and factors material to value.	The person undertaking the evaluation might need more detailed advice on condition before completing the evaluation.
b) Structural inspection	Can be undertaken for a variety of reasons, such as: 1) an investigation of the facility, such as its construction method, materials and condition of the building or structure; 2) preparing a schedule of condition to record the condition of the building at that particular time, supported as necessary by photographs, sketches and drawings; and 3) as part of an elemental and/or specialist investigation, including other specialist advice obtained relating to specific issues, as appropriate.	The survey of a building or a structure generally includes the structure detail, fabric, finishes and grounds. The extent of the survey is subject to specific agreement between the professional and the client. Such a survey includes a measured survey, sometimes referred to as a dimensional survey, which involves taking measurements of a building and/or its site in order to prepare accurate drawings to scale or for comparing with existing drawings. It may include taking levels. The purpose for which the drawings will be required, their scale, detail and acceptable tolerances need to be agreed between the parties beforehand.	The survey report should include reference to visible defects and guidance, as appropriate, on relevant aspects, such as maintenance and remedial measures. An elemental or specialist investigation is carried out where concern exists over specific parts of, or defects in, a premises. The exposure and testing of services are not usually covered (see 5.1.2).
c) Structural examination	Can be undertaken for a variety of reasons, such as a more detailed look at a building or structure.	Would need to be undertaken by those with more specialized competencies.	Clarification would be required on what was to be included, as well as any exclusions.
d) Structural assessment	Can be undertaken for a variety of reasons, such as: 1) an investigation and assessment of the construction and condition of a building or structure to establish residual strength; 2) an investigation and assessment, as in 1), for various states of loading (see BS EN 1991-1-6).	The scope of this type of investigation is specific to each individual job and, if necessary, the brief may be altered as findings on site dictate. A schedule of dilapidations identifies the need for repairs to premises, perhaps in relation to obligations under the terms of a lease. Tends to use information from a), b) and c).	Examples of this specialist work are the detailed study of movement, cracking, bulging, bowing, timber decay and corrosion.

7.4.2 Survey methodology

When planning the on-site survey, the desk study should be taken only as an indication of what is present, as other substances and conditions can occur in practice.

Methods of measuring and recording information can vary, but those used should be appropriate to the circumstances to minimize the risk of harm to any individuals undertaking such measurements and recordings, e.g. for lone-working (see 11.12).

NOTE Clauses 11 and 13 give advice on personal safety.

The on-site survey should be undertaken in accordance with BS 5930:1999+A2:2010 as a progressive, information-gathering process. It should be carried out in such a manner that it does not compromise the safety of the structure, and should include, where appropriate:

- observation;
- close inspection;
- dimensional measurement;
- removal of, for example, panels and cladding to locate hazardous materials, including asbestos;
- identification of materials, e.g. residues; and
- sampling of the key features to assess potential hazards (see Table 5).

Table 5 Key features to be sampled for potential hazards

Key feature	Potential hazards
Atmospheres	Breathable quality and explosive potential
Residues of chemicals	Toxicity and detrimental vapours
Organic deposits and growths	Pathogens
Water/moisture contents and residues	Toxicity, pathogens and materials strengths
Ground water	Assessment of migrated or deposited contaminants
Materials used in the construction	Chemicals and fibres
Structural materials and connections	Type, condition and thus residual strength
Materials changed during maintenance/structural refurbishment	Potential entrapment of hazardous material/weaker construction
Insulating materials	Chemicals and fibres, ozone-depleting substances
Paints and other preservatives	Lead and other chemicals

Where there is a possibility that toxic materials are present, for example asbestos, a specific survey detailing the extent and identifying the type of the materials should be carried out.

7.5 Condition surveys of adjoining premises and for delapidation

A condition survey(s) of adjoining premises and associated street furniture should be prepared, when appropriate, to help avoid or resolve any dispute that arises about alleged property damage (see also 9.3.2).

7.6 Reports and dissemination of knowledge

Reports should be produced detailing the findings of:

- the desk study, including decommissioning and expected waste arisings;

- b) the on-site survey, covering the current state of the site and buildings, including true decommissioning status and structural and health hazards; and
- c) any condition surveys of adjoining premises [see also 6.2m) and 7.5].

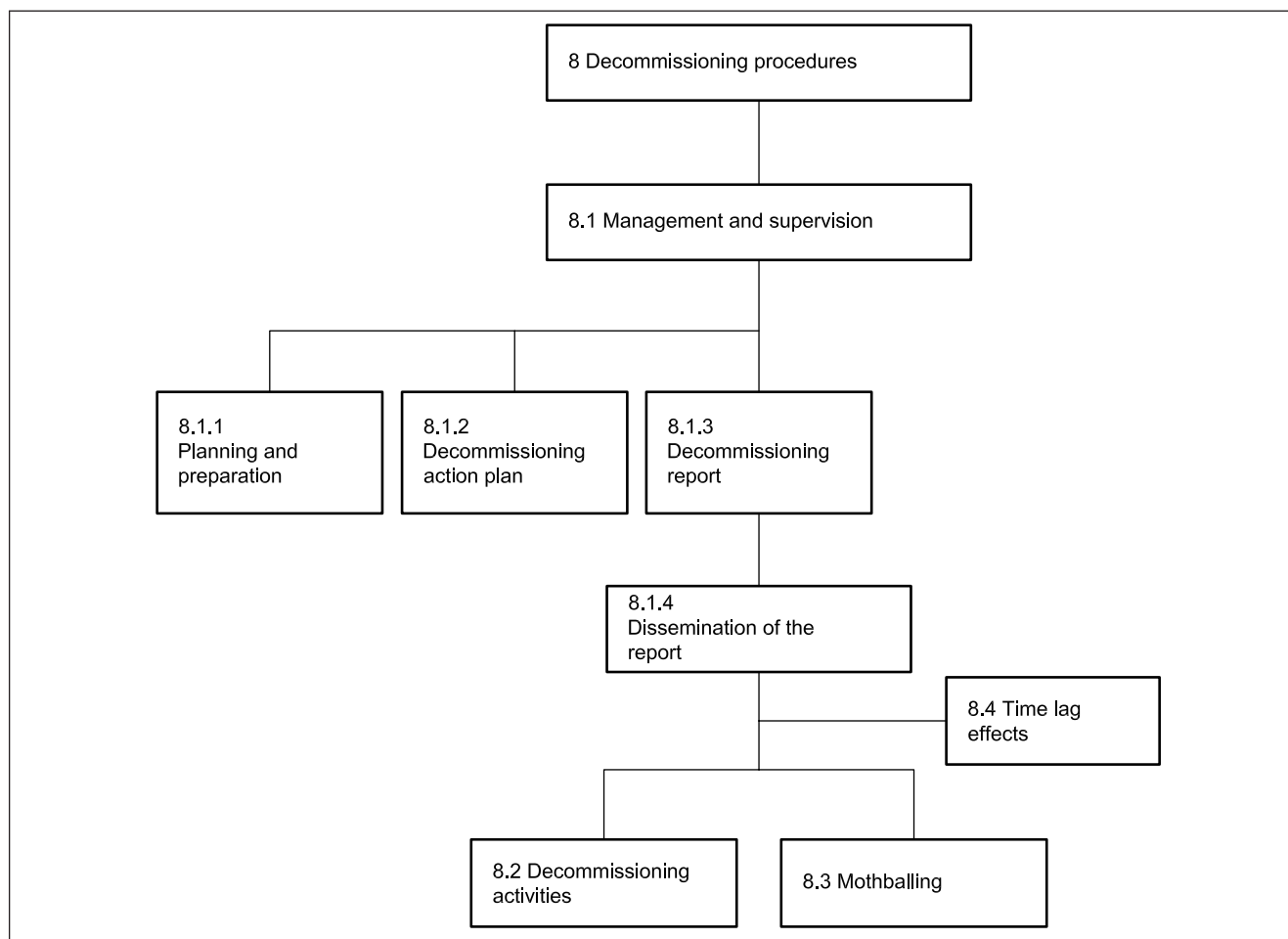
NOTE Full decommissioning ought to have been achieved prior to the commencement of any demolition. However, where the site is not fully decommissioned, the measures needed to achieve full decommissioning have to be included in a supplementary decommissioning action plan (see 8.1.2).

A site report should then be prepared which combines these outputs. The site report should be regarded as a “live” document and should be updated whenever more information becomes available as the project progresses. It should be used throughout the project, from the procurement process into the works stage.

The site report should be made available to all parties involved in the work as part of the dissemination of information for the site.

8 Decommissioning procedures (see Figure 6)

Figure 6 Route map for Clause 8



8.1 Management and supervision

8.1.1 Planning and preparation

Prior to the demolition or partial demolition of any buildings, structures or industrial plant, a planned decommissioning procedure should be carried out by the client or body responsible for the facility. The objective of this procedure should be to bring the building, structure or industrial plant from its fully-operational status to one where all “live” or charged systems are rendered “dead” or reduced to the lowest hazard level.

If there is a delay (see **8.4**) between decommissioning for demolition and the demolition itself, or if there is a change of plan such that a mothballed facility is to be demolished rather than brought back into service, the recommendations of **7.3.3** and **7.6** should be followed.

Planning and preparation should include the elimination of any hazards arising from the process that was carried out prior to closure of the facility. All hazardous materials should be identified and recorded in the decommissioning action plan (see **8.1.2**).

Where hazards remain, for whatever reason, these should be made evident on site.

NOTE Further information can be found in Decommissioning, mothballing and revamping, published by the Institution of Chemical Engineers [27].

Wastes should be considered together with the planned removal of such wastes with the waste hierarchy in mind.

8.1.2 Decommissioning action plan

A decommissioning action plan should be prepared by the client as an aid to the effective management of decommissioning. The plan should identify key target dates, including termination of services, and activities to be achieved for decommissioning.

8.1.3 Decommissioning report

The client should ensure that the decommissioning procedure is fully and accurately documented in a comprehensive report that shows exactly what activities have been carried out in accordance with 8.2 to reduce the inherent hazards. The decommissioning report should clearly state the extent of decommissioning and include details of possible health, safety or environmental implications during the course of demolition.

The report should also provide a general description of the nature of the plant or building, its age, the various processes that are likely to have been carried out, and details of any major changes like replanting or structural alterations.

Comprehensive drawings and plans, particularly those showing underground services and underground chambers or plant rooms, should be included.

8.1.4 Dissemination of the report (see also 7.6)

On completion of the decommissioning report, the client or body responsible for the premises should arrange for the report to be made available to those undertaking pre-contract site surveys and/or contaminated land/building investigations. The report should be made available to the CDM coordinator for inclusion in the pre-tender information to tenderers.

8.2 Decommissioning activities

Decommissioning should involve a number of activities that, where appropriate, take into account any earlier decommissioning work that was not completed [for example, because of mothballing (see 8.3)]. Where relevant, decommissioning activities should include identification of, and action in respect of, for example:

- a) isolation, earthing, spiking and cutting of high-voltage cables at points outside the demolition area, with a physical cut being made at point of entry to the main distribution box and all tails exiting the box;
- b) isolation of low and medium voltage cables not rendered "dead" by the actions in item a);
- c) disconnection of cables crossing the demolition area from buildings that are not to be demolished;
- d) disconnection and separation of emergency/standby direct current (d.c.) battery systems;
- e) removal of bulk process or other chemicals, including battery acids and oils;
- f) draining and purging of all process chemicals from pipework and vessels such that the plant is chemically inert;
- g) draining, purging and venting to atmosphere of vessels and systems that have contained flammable or noxious gases, ensuring that fluids cannot accumulate;
- h) draining of all substantial heads of water;

- i) isolation of water and gas supplies at points outside the demolition area, or removal of a section of the pipework and the fitting of blanks or plugs;
- j) controlled release of stored energy in strong springs or suspended counterweights;
- k) removal or elimination of substances that can give rise to biological, chemical, explosive, fire or radiological hazards; and
- l) removal of asbestos (however present) or, if not removed, preparation of an "asbestos register".

Hazards related to, for example, the following industries should be taken into account during decommissioning.

- 1) Chemical.
- 2) Power.
- 3) Offshore.
- 4) Nuclear.
- 5) Manufacturing industries.
- 6) Mineral extraction.
- 7) Food processing.
- 8) Health care.
- 9) Munitions.

8.3 Mothballing

Mothballing should be planned and executed in the same way as decommissioning, ensuring that every operation is undertaken with due regard for health, safety and the environment, and is recorded.

The choice of method of mothballing should be informed by the following.

- a) The probability of recommissioning ever being required.
- b) The extent of operation after recommissioning.
- c) The length of period of preservation.
- d) The current state of the plant.

When planning the demolition of a previously mothballed facility, the decommissioning procedure should be reactivated and consideration given to the effect of the time lag (see 8.4).

8.4 Time lag effects

The following effects of time lag between taking a facility or part of a facility out of service and its demolition or partial demolition should be taken into account.

- a) Deleterious atmospheres.
- b) Ingress and egress of fluids.
- c) The chemical action of contained substances.
- d) The deterioration of structures and containment vessels.
- e) Reduced stability, e.g. weakening of foundations and support members.
- f) Impact damage.
- g) Reduced strength of any support intended to be temporary, e.g. scaffolding.

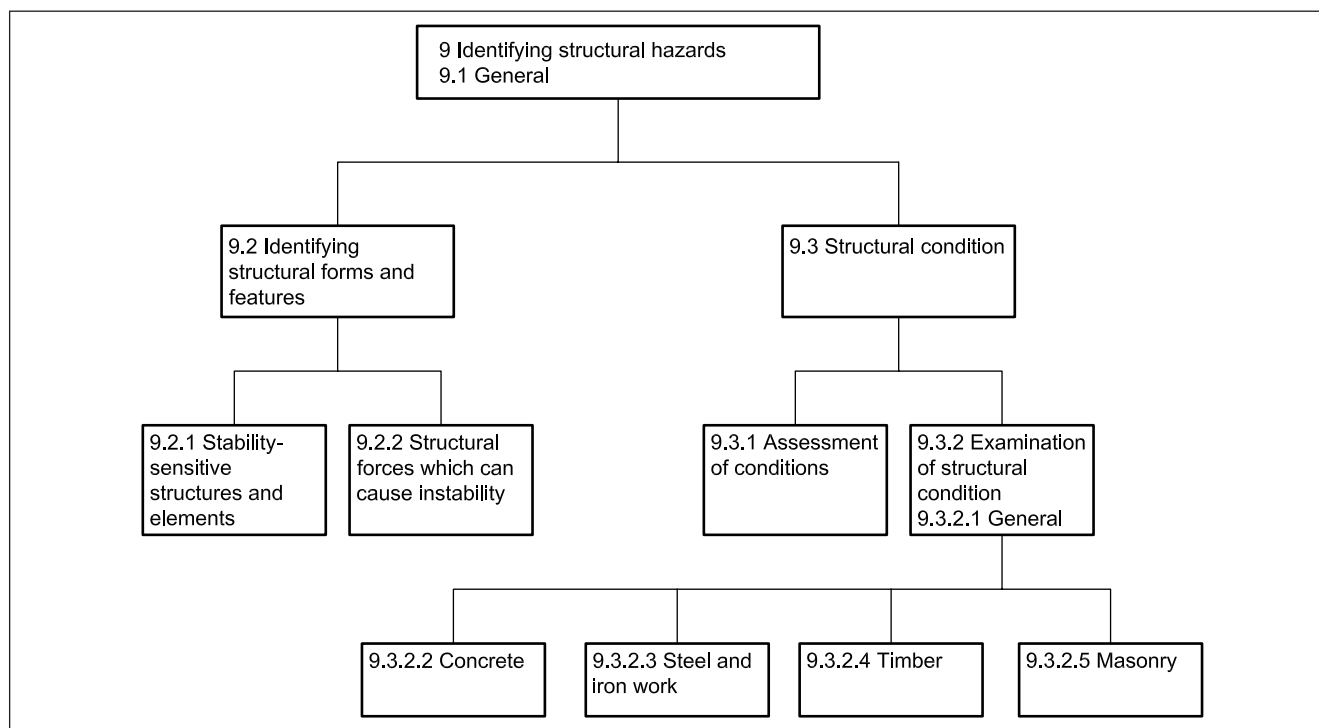
- h) Deliberate removal of parts of the facility for other uses elsewhere (cannibalizing).

The extent of the effects can vary and the following aspects should be considered together with the length of time involved.

- 1) The environment in which the facility is located.
- 2) The extent of any earlier decommissioning (either full or partial).
- 3) Whether mothballed or not.
- 4) The effects of weather.
- 5) Variations in water table.
- 6) Possible vandalism.
- 7) Effects of "organic invasion".
- 8) Effects of "biological invasion".
- 9) Fire damage.

9 Identifying structural hazards (see Figure 7)

Figure 7 Route map for Clause 9



9.1 General

Structural form and features should be identified in order to reduce the risk of unplanned collapse of any parts of structures during the demolition activities. This should involve assessment of local stability of parts of the structure and the global stability of the structure as a whole. This information should be used to help avoid unplanned collapses (see Clause 15). To achieve this, however, the ways in which all loads are transmitted to the ground, i.e. the load paths, should be identified. The behaviour of the structure and its elements under the action of those loads will vary and should be understood. Structures that are designed with load paths which might not be immediately obvious from an initial inspection should be identified, e.g. when they are covered by cladding or suspended ceilings, or where they have been altered during their lifetime, e.g. for a change of use, extension of the premises or provision of additional services.

9.2 Identification of structural form and features

9.2.1 Stability-sensitive structures and elements

Structural features should be identified which are stability-sensitive, and/or where structural problems are known to occur and can lead to particular problems in demolition. Expert engineering advice may be called upon to confirm the type of structure present. In particular, problems that arise due to the following should be identified.

- a) Inherent form, elements and features, including those that rely on interdependence for stability of structures and buildings, including any modifications.
- b) Intrinsically weak features of structures and buildings, including any modifications.