

BS 8102:2022



BSI Standards Publication

Protection of below ground structures against water ingress — Code of practice

bsi.

AVA Documents
Document Sharing Hub

Publishing and copyright information

The BSI copyright notice displayed in this document indicates when the document was last issued.

© The British Standards Institution 2022

Published by BSI Standards Limited 2022

ISBN 978 0 539 15836 6

ICS 91.120.30

The following BSI references relate to the work on this document:

Committee reference B/526

Draft for comment 21/30428737 DC

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

Contents

	Page
Foreword	iii
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Design philosophy	4
4.1 General	4
4.2 Design team	5
4.3 Principal considerations	5
<i>Figure 1 — Design flowchart</i>	8
5 Site evaluation	9
5.1 General	9
5.2 Inspection and survey for existing structures	10
6 Water resisting design	12
6.1 Groundwater	12
6.2 Waterproofing protection	13
<i>Figure 2 — Schematic illustrations of Type A, Type B and Type C waterproofing protection – Type A (barrier) protection</i>	15
<i>Figure 3 — Schematic illustrations of Type A, Type B and Type C waterproofing protection – Type B (structurally integral) protection</i>	15
<i>Figure 4 — Schematic illustrations of Type A, Type B and Type C waterproofing protection – Type C (drained) protection</i>	16
<i>Table 1 — Use of different protection types based on water table classification</i>	17
<i>Table 2 — Waterproofing protection – Grades of performance for below ground spaces</i>	19
6.3 Exclusion of surface water	20
6.4 External sub-surface drainage	20
<i>Figure 5 — Sub-surface drainage positioning</i>	21
6.5 Buried decks below ground level	22
<i>Figure 6 — Typical details of a buried deck with drainage</i>	23
6.6 Ground gases	24
7 General construction issues	24
7.1 Site dewatering	24
7.2 Unexpected hazards	25
7.3 Structural elements	26
7.4 Continuity in construction	26
7.5 Protecting waterproofing	26
8 Type A (barrier) protection	27
8.1 Structural aspects	27
<i>Figure 7 — Effect of structure on applied waterproofing barrier</i>	28
<i>Figure 8 — Examples of pile to floor slab junction</i>	29
8.2 Waterproofing barrier materials	30
<i>Table 3 — Waterproofing barriers</i>	31
<i>Figure 9 — Effect of bonded or partially bonded barriers</i>	33
9 Type B (structurally integral) protection	36
9.1 General	36
9.2 Materials for structurally integral protection	36
9.3 Embedded retaining walls	39
10 Type C (drained) protection	41
10.1 Structural aspects	41

10.2	Cavity drain systems	41
	<i>Figure 10 — Example of a multi-level system</i>	44
	<i>Figure 11 — Example of a flood loop discharge</i>	46
10.3	Servicing and maintenance	47
11	Remedial measures	48
11.1	General	48
11.2	External grouting or injection	49
11.3	Repair with cementitious or polymeric systems	50
11.4	Replacement of locally defective material	50
11.5	Masonry structures	51
	Bibliography	52

Summary of pages

This document comprises a front cover, an inside front cover, pages I to IV, pages 1 to 53, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 March 2022. It was prepared by Technical Committee B/526, *Geotechnics*. A list of organizations represented on this committee can be obtained on request to its committee manager.

Supersession

This British Standard supersedes [BS 8102:2009](#), which is withdrawn.

Information about this document

This British Standard was originally published in 1990, superseding the earlier CP102 (1973). This is a full revision of the standard, and introduces the following principal changes:

- a) a number of recent developments are addressed, which are important when specifying, designing and constructing below ground structures, including:
 - 1) more deep construction in congested urban areas;
 - 2) an increase in the provision of residential basements;
 - 3) development and use of new materials for waterproofing;
- b) a more detailed assessment is provided of the risks inherent in below ground construction and how these might best be addressed.

It is noted that the figures used in this document are only representative of different installation methods, and are not to be translated directly into practice without first checking all the parameters specific to the installation.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

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

Users may substitute any of the recommendations in this British Standard with practices of equivalent or better outcome. 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 of this standard are presented in roman (i.e. upright) type. Its requirements 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.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient’s own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

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

1 Scope

This British Standard gives recommendations and provides guidance on methods of dealing with and preventing the entry of water from external sources into structures that are partly or wholly below ground.

It covers the use of:

- a) waterproofing barrier materials applied to the structure;
- b) structurally integral watertight construction; and
- c) drained cavity construction.

It refers to the evaluation of groundwater conditions and consideration of harmful ground gases, risk assessment and how to manage these risks in below ground structures.

This British Standard includes guidance on the drainage outside the structure and recognizes the risk of water entering a structure through openings.

NOTE 1 Structures that are partly or wholly below ground can include occupied rooms, tunnels, plantrooms, car parks, residential or commercial spaces, and service ducts. These structures can consist of any combination of solid masonry, concrete and steel as the primary ground retaining structures. This British Standard is relevant to structures below buildings or that are fully underground and covered by buried roofs, podium decks, or tunnel roofs.

Structures are generally characterized as “deep” if they have more than one storey below ground level, or “shallow” if they have only a single storey below ground. This British Standard is applicable to both.

NOTE 2 The principles for achieving waterproof underground spaces in this standard are relevant to most forms of underground space. However, it is recognized that deep tunnels, rock caverns, mines, pipelines and some water containment structures might follow design principles that are different to the approach set out in this British Standard. In these types of structures, the acceptable levels of water ingress can be very different to those defined in this standard.

NOTE 3 Standards and guidance for the protection of buildings against flooding by means of property level flood resistance and resilience measures are given in [BS 85500](#).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[BS 5930](#), *Code of practice for ground investigations*

BS 6100-3, *Building and civil engineering — Vocabulary — Part 3: Civil engineering — General*

BS 8000-2 (all sections), *Workmanship on building sites — Part 2: Code of practice for concrete work*

[BS 8204-1](#), *Screeds, bases and in situ floorings — Part 1: Concrete bases and cement sand levelling screeds to receive floorings — Code of practice*

BS EN 1504 (all parts), *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity*

BS EN 1542, *Products and systems for the protection and repair of concrete structures — Test methods — Measurement of bond strength by pull-off*

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

BS EN 1992 (all parts), *Eurocode 2 — Design of concrete structures*

BS EN 1992-3:2006, *Eurocode 2 — Design of concrete structures – Part 3: Liquid retaining and containment structures*

BS EN 1993 (all parts), *Eurocode 3 — Design of steel structures*

BS EN 1993-5, *Eurocode 3 — Design of steel structures — Part 5: Piling*

BS EN 1997 (all parts), *Eurocode 7 — Geotechnical design*

BS EN 1997-2, *Eurocode 7 — Geotechnical design — Ground investigation and testing*

BS EN 10210 (all parts), *Hot finished steel structural hollow sections*

BS EN 10219 (all parts), *Cold formed welded steel structural hollow sections*

BS EN 10248 (all parts), *Hot rolled sheet piling of non-alloy steels*

BS EN 10249 (all parts), *Cold formed sheet piling of non-alloy steels*

BS EN 12063, *Execution of special geotechnical work — Sheet pile walls*

BS EN 13670, *Execution of concrete structures*

DIN 1048, *Testing concrete*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in BS 6100-3 and the following apply.

3.1 buried deck

any roof structure which is at or below ground level

3.2 cavity drain membrane

cusped (also known as dimpled or studded), flexible, high-density polymer sheet, which can be placed against the internal face of a structure after construction and is designed to intercept water penetrating the structure and direct it to a drainage system

3.3 cut-off wall

embedded retaining wall (see [3.5](#)) designed to surround and seal off an area, to inhibit water inflow from the surrounding area

3.4 damp area

area which is slightly wet but no seepage (see [3.15](#))

3.5 embedded retaining wall

wall used to support the sides of an excavation, installed in advance and penetrating below the lowest level of the below ground construction

NOTE Within this British Standard, the principal forms considered constitute the primary permanent wall for the below ground construction, and are taken as diaphragm walls, contiguous or secant piles (which may be installed in different configurations) or steel sheet piles.

3.6 free lime

salt deposits caused by water moving over/through concrete and dissolving calcium hydroxide from the matrix

NOTE On contact with the atmosphere, calcium hydroxide reacts with carbon dioxide to form calcium carbonate, which is precipitated as a solid deposit when the water evaporates.

3.7 fully bonded

bonded, preventing water from tracking from a defect in the membrane to a crack/joint in the structure

NOTE This can provide enhanced protection where applied to a suitably impermeable structure because for ingress to occur, a defect in the membrane has to align with a pathway through the structure.

3.8 ground gas barrier

barrier between the structure and the ground intended to prevent or impede the ingress of radon, methane and other ground gases and contaminants

3.9 groundwater

water in the ground outside the structure from any source

3.10 hydraulic gradient

ratio of the hydrostatic pressure (expressed as head of water) to wall thickness

3.11 hydrostatic pressure

pressure exerted by depth of water

3.12 loading coat

layer of material designed to hold a Type A waterproofing material in place when resisting water pressure

3.13 perched water table

reservoir of water in the ground maintained permanently or temporarily above the standing water level in the ground below it, caused by the presence of an impervious soil or a stratum of low permeability

3.14 product information

manufacturers' data sheets, installation guides, accredited performance, test data and any regulatory compliance data

3.15 seepage

slow transmission of water through discrete pathways of a structure

NOTE This can also be known as weeping, as defined in ICE publication, *Specification for piling and embedded retaining walls* [1].

3.16 tanking

application of an appropriate waterproofing barrier to the walls, the base slab and, where relevant, the buried deck of a below ground structure, such that the entire envelope of the structure below ground is protected against water ingress

NOTE A cavity drain membrane is not considered to constitute tanking.

3.17 Type A (barrier) protection

protection against water ingress which is dependent on a separate barrier system applied to the structure

3.18 Type B (structurally integral) protection

protection against water ingress which is provided by the structure

3.19 Type C (drained) protection

protection against water ingress into usable spaces which is provided by the incorporation of an appropriate internal water management system

3.20 waterproof

impervious to free water

NOTE This can also be known as “watertight”.

3.21 waterproofing

application of waterproof/water resisting materials

3.22 waterproofing barrier

material that does not permit the transmission of free water, but might allow some water vapour permeability

3.23 waterproofing system

materials and methods used to protect a structure from water ingress, and which might also provide resistance to the diffusion of water vapour

3.24 water resistance

ability of a material to resist water penetration

3.25 water resisting admixture

admixture which reduces the capillary absorption of hardened concrete

NOTE Water resisting admixtures are often referred to as waterproofing admixtures by manufacturers.

3.26 waterstop

material designed to inhibit the transmission of water through joints in the structure

3.27 water vapour

water in its gaseous state

3.28 water vapour resistance

ability of a material to resist water vapour penetration

4 Design philosophy**4.1 General**

Strategies for dealing with all external sources of groundwater, surface/flood water, soil gases and contaminants should be determined from the very earliest stages of the planning and design processes for any project involving below ground structures.

For new structures, the structural design, overall weatherproofing design, waterproofing design and construction processes sequencing, and buildability of the structure should be reviewed together, as they generally interact.

In addition, during the design process and at all stages of the construction process, the designers, specialists, manufacturers and installing contractors should establish and maintain effective channels of communication.

NOTE Regular and clear communication coupled with good site supervision allows variations and amendments to the design to be planned and executed without compromising the performance of the waterproofed structure (see also 4.2 and Clause 7).

4.2 Design team

The advice of a geotechnical specialist should be sought on the geology and hydrogeology, the external drainage options and groundwater conditions (see Clause 5).

A waterproofing specialist should be appointed as part of the design team so that an integrated waterproofing solution is created. The waterproofing specialist should:

- a) be suitably qualified and experienced, commensurate with the type and size of the proposed project;
- b) be capable of devising solutions that accommodate the various project constraints and needs with an understanding of construction forms and sequencing; and
- c) provide the design team with information and guidance that assists with and influences the design, installation and future maintenance of the waterproofed structure.

If the RIBA stages are used, a waterproofing specialist should be appointed before the technical design stage at the latest.

Those responsible for the overall waterproofing design should be identified at the planning stage or as early as possible. All decisions made by others that might have an impact on the waterproofing design should be brought to the attention of the waterproofing specialist, design team and installing contractors. Final decisions and any recommendations should be approved by those taking overall responsibility for the design of the waterproofing.

Where waterproofing design responsibility is imparted as part of a contractual process, for example, as a Contractor's Designed Portion, the waterproofing specialist should be appointed as early as possible. Alternatively, a waterproofing specialist may develop an outline design, which is later adopted as part of a client's requirements and developed by a suitably experienced and qualified waterproofing specialist as a Contractor's Designed Portion.

4.3 Principal considerations

4.3.1 General

In order to develop a robust design for protecting a structure from entry of water from external sources, the following factors should be assessed:

- a) the likely highest level of the water table, the drainage characteristics of the soil and other site-specific properties (see Clause 5);
- b) the appropriate waterproofing measures (see Clause 6), i.e. Type A, B or C protection and, where necessary, external drainage based on:
 - 1) the results of the site evaluation, including the risk classification of the water table (see 6.2.4); and
 - 2) the intended use and finishes of the structure, with consideration given to any requirement for future flexibility of use. This should be undertaken in consultation with the client (see 6.2.4);

- c) the appropriate performance characteristics of the waterproofing system(s) selected (see [Clause 8](#), [Clause 9](#) and [Clause 10](#)); and
- d) the anticipated design service life of the building, and any required ongoing maintenance requirements.

NOTE 1 The general principle is to assess the risk of water reaching the structure during the anticipated design service life and then to select a form of construction and waterproofing system(s) capable of achieving the required internal environment.

NOTE 2 Mechanical heating and ventilation often play an important role in creating the internal environment and controlling condensation, particularly where higher grades are required. The design of such systems is a specialist activity, outside the scope of this British Standard.

A three-dimensional review of structure and waterproofing should be undertaken to assist in identifying any complex geometries, which are not readily identified from normal two-dimensional details.

Service entries are particularly vulnerable to water penetration. Where they cannot be avoided or are introduced post-construction or waterproofing, they should be carefully detailed, incorporating sealing of the adopted form(s) of waterproofing to minimize the risk of water ingress (see also [8.1.3](#)).

The practicality of terminations above ground level should be assessed at an early stage within the design to ensure full integrity of the waterproofing system, compatibility with superstructure construction and continuity with the damp and/or ground gas protection system.

NOTE 3 The three-dimensional review includes detailed information on the proposed waterproofing system (e.g. the effect that this has on wall base details, laps in membranes and waterstops). Examples of complex geometries are corner details and where the wall adjoins the base slab/foundation; the superstructure; differing floor levels; and windows below ground.

4.3.2 Defects and remedial measures

An ideal waterproofing solution would be defect-free. However, it should be taken into account that defects might occur in the waterproofing, which then, if subjected to water pressure, could result in the required internal environment not being achieved.

NOTE 1 These defects include the following:

- a) defects owing to design;
- b) defects owing to poor workmanship;
- c) inappropriate use of the materials being used and defects owing to the specific properties of the materials being used; and
- d) defects caused by follow-on trades and site operations.

NOTE 2 Reference to "defects" does not apply to normal designed flexural cracks or surface crazing in concrete elements but only to cracking, which might need to be locally sealed.

The construction methods, installation personnel, materials and protection thereof, used to realize the design, should be such that the defects in all of the above are avoided.

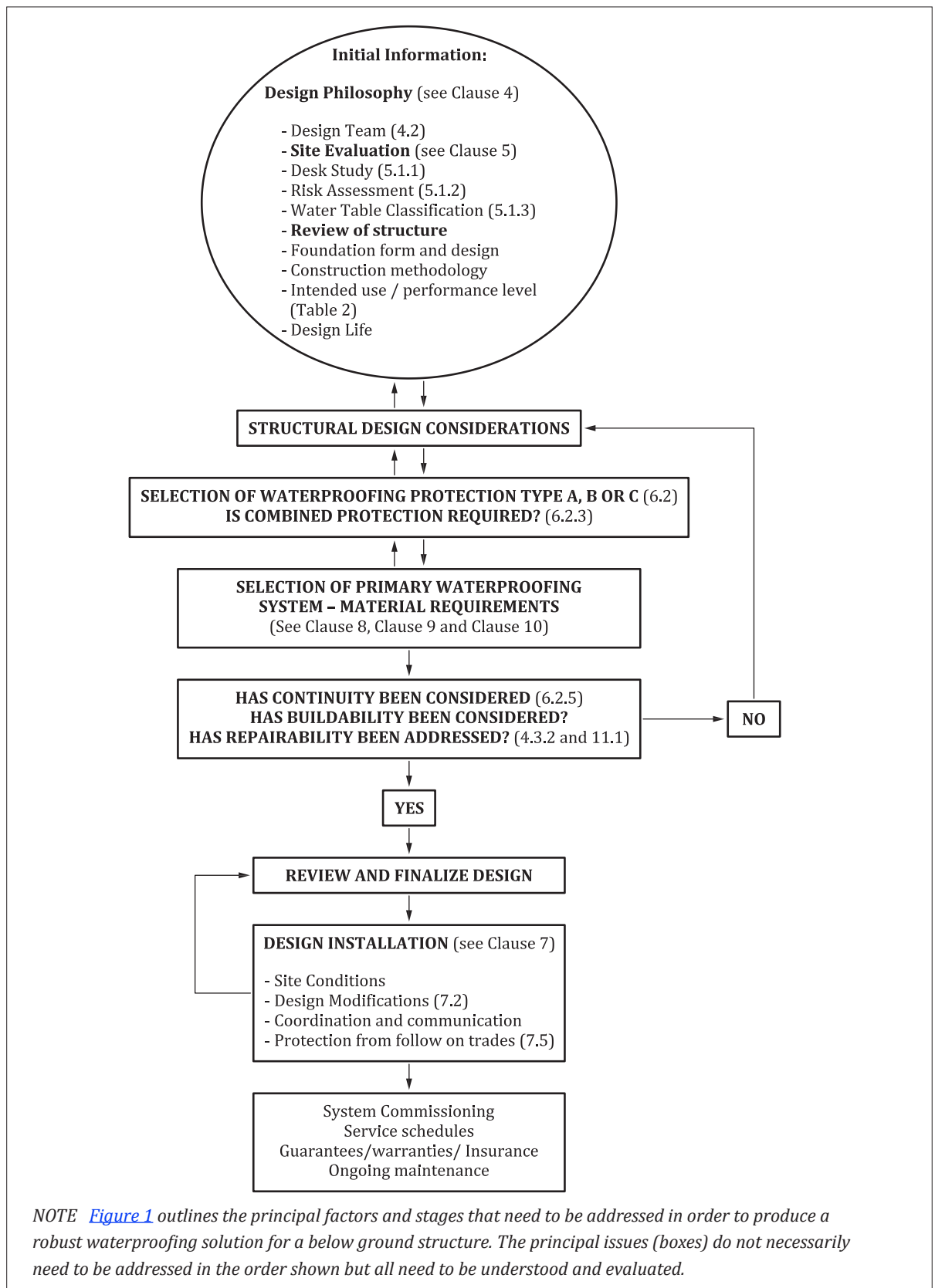
Materials should be used in accordance with the conditions and requirements set out in the relevant technical product information and in accordance with the manufacturer's recommendations by personnel trained in their use and application (see also [Clause 11](#)).

The potential for defects should be recognized and catered for in the design. Contingency planning for dealing with any localized defects or system failure that arise should be included as part of the overall waterproofing design for the structure (see also [Clause 11](#)).

In either case, the issue of repairability should be taken into account and the form and feasibility of remedial measures after completion of the project with finishes in place assessed.

[Figure 1](#) outlines the principal factors and stages that should be addressed in order to produce a robust waterproofing solution for a below ground structure. The principal issues (shown in boxes) do not necessarily need to be addressed in the order shown but all should be understood and evaluated.

NOTE 3 [Figure 1](#) demonstrates that some matters are interrelated and that a degree of iteration might result from a need to address buildability and repairability.

Figure 1 — Design flowchart

5 Site evaluation

COMMENTARY ON CLAUSE 5

Attention is drawn to the fact that many of the issues addressed in this Clause are also relevant to the design of the structure itself. For further guidance, see the relevant Eurocodes, e.g. BS EN 1992 (all parts) or BS EN 1997 (all parts).

5.1 General

5.1.1 Desk study

The design team should carry out a desk study in accordance with [BS 5930](#) and BS EN 1997-2 to:

- a) assess the geology and hydrogeology, including soil permeabilities, flood risk, radon, methane and other ground gases and contaminants (e.g. hydrocarbons, chlorides and acids);
- b) assess the topography of the surrounding ground in relation to the below ground structure;
- c) establish the likely highest level of the water table and the potential for the occurrence of a perched water table;
- d) establish the impact of flooding; and
- e) identify any missing ground and groundwater information, which should then be obtained by undertaking a site investigation in accordance with [BS 5930](#) and BS EN 1997 (all parts).

NOTE 1 Guidance on best practice in ground investigation, laboratory and field-testing for embedded retaining walls is given in CIRIA publication C760 [2].

NOTE 2 For guidance on good practice for assessment on impact of flooding, see [BS 8533](#).

The drainage characteristics from analysis of the soil should be determined in accordance with [BS 5930](#).

5.1.2 Risk assessment

NOTE 1 The principal risks with respect to water ingress into structures are the external environmental conditions.

A risk assessment should be carried out which determines the long-term water pressures, the effects of surface water infiltration and the use of external drainage and cut-off walls.

The risk assessment should also take into account:

- a) the potential effects of climate change, burst water mains, flooding, defects in underground sustainable urban drainage (SUD) systems and defective soakaways and sewers, adjacent trees, sulfates, radon, methane and other ground gases and contaminants; and
- b) where external drainage is proposed, the effects of drawdown on adjacent structures, the potential silting of drainage and biofouling issues.

Even when the site investigation indicates dry conditions, the risk of some waterlogging (see Note 2) in the future should be assumed.

NOTE 2 Even in a permeable subsoil, groundwater requires time to drain away and this can result in limited pressure periodically coming to bear against the structure.

5.1.3 Water table classification in relation to the structure

Where assessment of the water table is undertaken, this should be classed into the following three categories, which can then be used to determine the suitability of different types of waterproofing protection (see [6.1](#) and [6.2](#)).

- a) High – where the water table or perched water table is assessed to be permanently above the underside of the base slab.
- b) Low – where the water table or perched water table is assessed to be permanently below the underside of the base slab. This only applies to free-draining strata.
- c) Variable – where the water table fluctuates.

NOTE 1 In certain ground conditions, external drainage systems can be used to convert the “high” and “variable” water tables to the “low” condition (see also [6.4](#)) as part of waterproofing strategy.

NOTE 2 The type of structure can inherently raise the risk, e.g. block work construction below ground level, due to number of joints within these forms of construction.

Modular systems, such as twin wall and insulated concrete formwork (ICF) construction should be deemed inherently high risk. See [4.3.2](#) on defects and remedial viability.

5.2 Inspection and survey for existing structures

5.2.1 General

Following an assessment of the external risk (see [5.1.2](#)), and off-site desk study (review of historic information), a comprehensive survey should be undertaken of any existing waterproofing arrangements, which may include:

- a) the extents of retained earth – semi or full basement, stepped levels, multi-storey, etc.;
- b) internal mains drainage connections and presence or otherwise of non-return valves (surcharge risk);
- c) external mains drainage connections serving external wells adjoining the basement (surcharge risk);
- d) abutting structures and/or party properties;
- e) presence of podium decks/buried roofs/pavement lights – any areas projecting beyond the line of the external walls above ground;
- f) ancillary details such as damp-proof courses (DPCs) (see [6.2.5](#)) and cavity trays, including above ground wall construction and condition where decks over ground are present (see [Clause 6.5](#));
- g) existing ventilation measures and the influence of any condensation;
- h) finishes of external surfaces in relation to rate of surface water infiltration;
- i) rainwater goods condition including interface of down pipes and gullies;
- j) arrangement and condition of drainage systems serving the property (condition of drains, use of soakaways);
- k) presence, level and condition of land drain systems around basement, facility for maintenance and means of discharge;
- l) service penetrations detailing;
- m) continuity/discontinuity – presence of holes within a structure which might allow free ingress;
- n) presence of materials which can mask conditions present, such as damp-proof membranes (DPMs), insulation boards, impermeable finishes;

- o) potential for and influence of plumbing leaks (historic and active);
- p) present conditions in relation to patterns of dampness, for example extent and severity of efflorescent salts and/or water staining;
- q) condition and presence of organic structural components such as timber which might be influenced by waterproofing proposals;
- r) similarly, corrosion in steel structural members;
- s) evidence regarding history of issues and conditions if available through stakeholders; and
- t) presence of any ground gas protection measures.

It might be necessary to undertake intrusive works to establish detailing present, in which case, relevant justifications and proposals should be provided. The need for an asbestos survey in structures which pre-date 2000 should be taken into account.

The structure should also be examined in order to determine any potential movement that might occur between the walls and floor.

NOTE 1 The base slab of many older structures is likely to abut the external walls. This can give rise to movement between the walls and floor. Special flexible joint details might be required so that strains in the waterproofing materials are controlled within acceptable limits where bonded or surface-applied barrier materials are used in such situations. Similar details might also be required at other locations where structural movement can occur.

NOTE 2 Less movement would be expected in cases where the floor is set into the wall, although horizontal movement can occur unless the floor is reinforced, such as to achieve the necessary fixity.

NOTE 3 Existing waterproofing might have to be removed completely and replaced with an entirely new system, although in some instances it might be possible to apply a Type A barrier or a Type C drained cavity system directly. These systems can be considered where there is no existing waterproofing, but the suitability of barrier materials depends on the characteristics of the surface of the wall or floor, and any preparatory works that might be required.

5.2.2 External walls and floor

The structural permeability of walls and floors should be assessed in relation to the external risk (see [5.1.2](#)) and the intended use.

Variation in composition should be taken into account, for example:

- a) details, such as the use of comparatively permeable cavity masonry walls nominally below ground level, above a less permeable solid wall retaining structure;
- b) the presence of inner block leaf walls with cavities behind, with limited ability to absorb lateral loading applied by hydrostatic pressure, with scope for movement; and
- c) the presence of external drained voids and the efficacy of drainage details within these.

The form of floor structure, and particularly the interface with external and internal walls, should be taken into account.

Slabs abutting external walls could give rise to movement via floatation when subjected to hydrostatic pressure. Where practicable, waterproofing systems and details should be selected to accommodate this, or the floor structure designed and renewed to accommodate loadings.

Other factors that should be assessed include:

- 1) the strength of substrates and their ability to resist loading applied by hydrostatic pressure;
- 2) footing arrangements and the scope for conflict with perimeter drainage channels;
- 3) the requirement to remove any existing coatings and systems, to facilitate appropriate remedial measures; and

- 4) the presence, strength and efficacy of concealed drainage, such as drainage tiles, no fines concrete and historic floor channels.

The survey should include any constructions which abut the main structure, such as garden walls and arches under steps, as these are a potential source of moisture transfer.

5.2.3 Buildings of historic significance or protected by legislation

A pragmatic approach should be taken when dealing with buildings of historical or architectural significance. Efforts should be made to limit or prevent actions that could reduce the value of such buildings for future generations.

Maintaining exposed features can have implications on the environmental grade that can be achieved (see [Table 2](#)), and the implications of this upon the proposed usage should be discussed with the client [see [6.2.4](#), 1)].

Where buildings are recognized or listed by heritage bodies (e.g. Historic England, CADW, Historic Environment Scotland, DfC Historic Environment Division NI), listed building consent might be required before any works or disturbance to the buildings, fabrics or environments take place. The local conservation officer should be consulted at the design stage and before any works (including ground investigations or exposure work) begin.

NOTE 1 It might become a condition of any works that a record of conditions present is made and recorded at the inspection and survey phase. Similarly, conditions might be placed on the designer of the waterproofing system to ensure the impact on the building is fully or partly reversible.

An assessment of the building's drainage should always form part of any evaluation of the building before the final design and waterproofing measures are finalized.

All reasonable steps should be taken to ensure that drainage is optimized and that any existing drainage systems are functioning correctly. Drainage surveys and careful considerations of other factors, such as rainwater goods, gullies, ditches, culverts and watercourses, should form part of the site evaluation process.

NOTE 2 Addressing any drainage defects could reduce the rate of water into the ground and in doing so could assist with conservation of the existing structures above and below ground.

Extreme caution should be taken if dewatering is to be considered within or adjacent to any old building (see [Clause 7](#)). In addition, the use of waterproofing systems that could significantly increase the hydrostatic load on existing structures should be undertaken only after it is proved that this will not compromise the integrity of the building.

Where Type C waterproofing systems are considered, the location and impact of any water discharge points should be carefully assessed and mitigated.

6 Water resisting design

6.1 Groundwater

Waterproofing measures should be designed on the basis that during the life of the structure water might come against any part of the structure that is at or below ground level, or is earth-retaining. Waterproofing should therefore, whenever practicable, be taken above ground level by a minimum of 150 mm and/or be continuous around or over the top of the structure (see [6.2.5](#)), where the following are applicable:

- a) no detailed geological or hydrogeological assessment has been undertaken;
- b) the results of the soil investigations indicate this is necessary, or are inconclusive with respect to groundwater;