

Best Practice Guidance

Type C Waterproofing Systems



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Best Practice Guidance - Type C Waterproofing Systems (BS8102: 2009)

1. Introduction

- 1.1. Appropriate Areas of Use
- 1.2. Basement site locations and forms
- 1.3. Combination Systems

2. Definitions

3. Principles of Design

- 3.1. BS8102: 2009
- 3.2. Design and Build Philosophy
- 3.3. Designer
- 3.4. Installer
- 3.5. Site Investigation
 - 3.5.1. Risk Assessment
 - 3.5.2. Water table
 - 3.5.3. Ground conditions
 - 3.5.4. Ground drainage
 - 3.5.5. Soil type and conditions
- 3.6. Sequence and timing of work
- 3.7. Considerations
 - 3.7.1. Site de-watering
 - 3.7.2. Ground gases
 - 3.7.3. Existing Structures
- 3.8. Structural stability

4. Products

- 4.1. Cavity Drainage membranes
- 4.2. Floor Drainage Channels
- 4.3. Ancillary products
 - 4.3.1. Pump Systems
 - 4.3.2. Battery Back-up systems
- 4.4. Product Selection

5. Cavity drainage membrane application, fitting and detailing etc.

- 5.1. Applications on Floors
- 5.2. Accommodating Services
- 5.3. Continuity with other systems and trades

6. Insulation in basements

7. Issues of 'free lime' in cavity drainage systems

8. Defects, repairs and maintenance

9. Service and maintenance of cavity drainage waterproofing systems

10. Standards and codes

11. Warranties, guarantees and insurance

12. Training / supervision

13. Bibliography

14. Acknowledgements

1. INTRODUCTION

This document has been produced to provide guidance on the design, adoption and use of Type C waterproofing in below ground structures.

Type C (drained) protection is defined by **BS8102: 2009 (Code of practice for protection of below ground structures against water from the ground)** as where the structure itself provides primary resistance against WATER penetration and incorporates a drained cavity within the basement structure. There is permanent reliance on this cavity to collect groundwater seepage through the structure and direct it to drains or a sump for removal by drainage or pumping.

The external basement wall must provide enough **PRIMARY** resistance to water ingress to ensure the cavity accepts only a controlled amount of water or dampness.

Type C systems do not provide a hydrostatic barrier but provide protection by means of water management.

Characteristics of the types of waterproofing protection.

Theoretically any structural waterproofing membrane designed to resist a hydrostatic head should not let any free water pass through it. However, in practice, consideration must always be given to what would happen as a result of any defect. The effects of water table conditions on the three basement types are discussed below. Where the site drains well enough to prevent the build-up of hydrostatic water pressure, all three forms of construction carry little risk of water penetration. The designer will need to be very sure that no risk of rising water is possible and it is much safer to always assume a full head of water pressure.

Type C construction relies on water being resisted by the structural elements and any water that penetrates the external shell of the structure being collected in a cavity formed between the external wall and an internal lining/wall. There is permanent reliance on this cavity to collect groundwater seepage and direct it to a suitable discharge point, e.g. drains or a sump for removal by gravity drainage or mechanical pumping. The amount of free water entering the cavity will depend on the size of the structure, on the volume of external water and its hydrostatic pressure, and on the resistance of the structure itself to water ingress.

Designers need to consider any risk associated with a constant supply of possibly contaminated water to the structure.

Such systems typically remove water via a mechanical sump pump system, or occasionally by gravity to low ground or drains externally where properties are formed into sloping sites. A third option is to use pumped back-flow protection devices where connection to drains is not safe. However, the need to control ground gases, e.g. radon, may not allow the use of gravity drainage. In all cases, consideration should be given to the point at which water discharges, understanding that the effectiveness of the system is reliant on removal of water, so an appraisal of this factor is required. Type C pumped systems should be engineered to cope with worst-case water ingress. If drainage capacity is exceeded, this may result in dampness or flooding. Type C systems are only designed to control and manage MINOR leakage and seepage into a structure.

Type C is not typically designed in new structures to be the primary form of waterproofing. The structure is built to be water resistant Type B, or is made to be water resistant by the application of Type A waterproofing. Type C is installed as the maintainable serviceable water management element to deal with water ingress in the event of a leak. If the new structure is leaking then defects should be rectified prior to the installation of the Type C system.

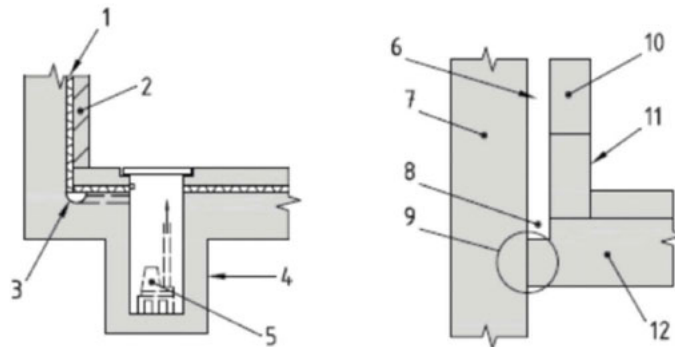
Where Type C is used in a remedial or flooding situation and where water ingress cannot be stopped the designer **MUST** provide a design to reduce the ingress as much as possible and calculate the maximum potential flow rate of water given all of the known factors. (Structure, hydrology, historic ingress) and design the drainage so the duty pumps and channel can manage the known volume of water. Back-up systems should have the same capacity as the duty pumps and both should have suitable battery or generator back-ups. Blockage of the cavity by silt or lime or other contaminants could result in flooding. The design of the system

should allow for clearing of silt should blockages occur in the system including discharging drains. This will require accessible drainage that includes access/inspection ports (see chapter on drainage below).

Where after careful consideration the preferred method is to discharge directly from a cavity drainage membrane to a discharge point, via perimeter channel, a risk assessment should be carried out. Collected water from cavity drainage membranes and channels should NEVER discharge directly into a combined sewer without correct approval and using appropriate non-return valves. Maintenance should be undertaken by a specialist, making assessment of the requirement to upgrade and replace pumps as necessary.

When combining systems in order to minimise the risks or negate the need for remedial measures, consideration should be given to the compatibility of the combined systems.

Type C = Drained protection - non-pressurised managed system using cavity drained membrane (CDM) directing water to drainage sump or gravity.



KEY

- | | |
|--|---|
| 1 Cavity drain membrane | 7 Reinforced concrete/steel pile or diaphragm wall |
| 2 Inner skin (render, dry lining or brick or masonry walling, depending on system) | 8 Drainage channel |
| 3 Maintainable drainage channel with pipe connection to suitable drainage point | 9 Waterstop at junction to follow wall profile |
| 4 Sump formed in situ or pre-formed | 10 Internal block wall |
| 5 Pump | 11 Access point(s) to drainage |
| 6 Cavity wall | 12 Floor slab with integral protection and/or added membrane (internal or external) |

1.1. Appropriate areas of use.

Although generally referred to when looking at designing basement waterproofing, Type C systems can be utilised for a number of earth-retained structures including:

- New build basements
- Basement refurbishment
- Semi basements and LGF areas
- Storage or plant rooms
- Any new Underground Structures
- Car parks
- Retaining walls
- Tunnels

1.2. Basement site locations and forms

There are many potential basement locations. Design forms and waterproofing methods will therefore depend on, for example, the prevailing terrain, soil conditions, water tables, proximity of adjacent buildings and the requirement of the end user. Typical locations and forms of basement construction are illustrated and summarised for three types of site: sloping, flat and infill.

Sloping sites

Sloping or elevated sites allow both full and semi-basements or split-level dwellings to be built, with cut-and-fill options. Since these sites can normally be effectively drained, properties would be at less risk from percolating groundwater and Type C systems may be used. However, the structure can pose a risk of 'damming' of water courses as the structure may also block the route of percolating water.

Flat sites

Flat sites provide the opportunity for basements wholly or partially below ground. Excavated material may be reused to landscape around basements partially below ground, giving the dwelling an elevated aspect.

Basements constructed on a flat site in low-lying areas with impermeable soils can be difficult to drain. Where there are problems with perched, fluctuating or permanently high water tables, substructures designed in water-resistant Type B and Type C combination systems would therefore be advisable. Any window fire exit must be above the highest anticipated water level. There is a greater risk of rising water to flat sites, and that water, as it rises, develops water pressure. The risk of water ingress to flat sites is much greater due to rising beds of water.

Additionally, while in the case of new construction waterproofing, the designer is providing the initial or first-stage measures of protection against groundwater, in existing structures it is often the case that designs are provided for the purpose of remedying failures in those initial measures, to address problems with systems of considerable age in older or historic property, or to facilitate change of use.

If options are limited by the confines of the structure, it is important to understand what that structure is, and equally, the nature of any installed waterproofing measures within it, which may further influence design.

Therefore, an analysis, through visual inspection, inspection of drawings (where available), and potentially intrusive investigation, i.e. trial hole formation, should be undertaken so that a thorough understanding of the structure and how it is constructed, is developed. The effects of any structural discontinuity as may typically occur in an existing structure must also be assessed.

Once the structure is understood, and objectives and instructions are defined, it is the role of the waterproofing designer to configure products and systems within that structure, all while considering the appropriate factors detailed within this guide, so that the objectives are successfully met and structures are protected in the long term.

1.3. Combination systems

Consideration should be given to the use of combined protection (i.e. Type A and Type B, Type A and Type C or Type B and Type C) where in a single system:

- the assessed risks are deemed to be high;
- the consequences of failure to achieve the required internal environment are too high; or
- additional vapour checks are necessary for a system where unacceptable water vapour transmission can occur. Although structures with Type B protection are designed to be water resistant, additional waterproofing systems may be applied internally or externally to control water vapour movement, where appropriate.

An in-situ "liner" wall designed to provide Type B protection can be cast inside an embedded retaining wall to provide combined protection. In some cases, a fully bonded barrier might also be provided between the two elements.

Although structures with Type C protection are designed to control and manage seepage into a structure, where this is unacceptably high the water resistance of the structure should be improved prior to the installation of the Type C protection, by the application of either Type A or Type B protection.

When combining types of protection, the compatibility of the different protection types should be assessed in

order to minimize the risks and negate the need for remedial measures.

It is also important that any waterproofing works are correctly detailed to maintain continuity with above ground works such as damp proof courses, damp proof membranes and cavity trays.

The design should ensure that waterproofing systems, materials and components are designed in accordance with the manufacturer's recommendations. Products used to create continuity are often loaded by the upper outer structure and should be tested to ensure they are capable of resisting imposed load.

2. DEFINITIONS

For the purpose of this document, the following definitions refer:

TYPE A (BARRIER PROTECTION)

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

TYPE B (STRUCTURALLY INTEGRAL PROTECTION)

Protection against water ingress which is provided by the structure.

TYPE C (DRAINED PROTECTION)

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

CAPILLARY MOISTURE

Capillary moisture means moisture held in the capillaries of a material, and which exerts no hydrostatic pressure on the structure.

CAVITY DRAINAGE MEMBRANE

Dimpled, 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. CDM may need to be installed during construction where an internal wall is built - for example.

CE MARK

The CE mark, or formerly EC mark, is a mandatory conformity marking for certain products sold within the European Economic Area (EEA) since 1985. The CE marking is also found on products sold outside the EEA that are manufactured in, or designed to be sold in, the EEA.

GEOCOMPOSITE DRAINAGE MEMBRANE

Geocomposite membrane materials consisting of a high flow rate drainage core coupled on one or both sides with filtering and/or impermeable elements to the other side.

HYDROSTATIC HEAD

Water pressure, expressed as an equivalent depth of water.

HYDROSTATIC PRESSURE

Water pressure exerted as a result of hydrostatic head. Pressure created by the volume of water.

INTERSTITIAL CONDENSATION

Interstitial condensation is condensation occurring to dewpoint surfaces that are WITHIN or between building elements, as opposed to the more common surface condensation.

MEMBRANE

A barrier that is impervious to water.

PLASTER

The term 'plaster' refers to any applied coat whose cementing action comes from either gypsum or cement/lime.

PRESSURE

Pressure is a force per unit area applied in a direction perpendicular to the surface of an object e.g. water pressure.

RENDER

The term 'render' refers to any applied coating commonly made up of a sand and cement mix only which can be used for coatings applied internally or externally. It may incorporate water-resisting admixtures, accelerators, plasticisers, or other approved additives.

SEEPAGE

Slow transmission of water through discrete pathways of a structure.

STRESS

Stress is the reaction within the elements of a structure subjected to and resisting applied loads and/or pressures.

TANKING

Application of an appropriate waterproofing barrier to the walls, the base slab and, where relevant, the roof 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.

VAPOUR CHECK

Any layer that is very vapour impermeable and so significantly reduces the passage of water vapour.

VAPOUR CONTROL LAYER

A vapour control layer is a strategically placed vapour check, used where control of water vapour is needed.

VAPOUR RESISTANCE

The ability to resist water vapour.

WATER

Water is H₂O in its liquid state.

WATERPROOF

A material or layer that is impervious to the passage of water.

WATERPROOFING

The application of a material that is impervious to water.

WATER RESISTANT

A material or layer with a high resistance to the passage of water.

WATER VAPOUR

Water in its gaseous phase.

3. PRINCIPLES OF DESIGN

3.1. BS8102: 2009

Code of Practice for the protection of below ground structures against water from the ground provides guidance on the methods which can be adopted to deal with and prevent the entry of water from the ground into a structure that is below ground level. It is widely referred to and used in basement waterproofing, making particular reference to:

- Adoption of a design team
- Water table classification
- Defects and remedial measures

Design should be in accordance with relevant building regulations and applicable statutory requirements.

All elements (including foundations, walls and floors) forming a below ground structure requiring waterproofing should be suitable for their intended purpose.

3.2. Design and Build Philosophy

As a general rule, design and construction should be kept as simple as possible. Consulting relevant waterproofing design specialists as early as possible and working through details sequentially will help to avoid unbuildable details on site.

All floors, ceilings and walls below external ground level including the junctions between them, should be designed to resist the passage of water and depending on habitable grade, moisture to the internal surface. The level of protection against water and moisture reaching the internal surfaces should be appropriate for the proposed use.

Habitable accommodation should be designed to “Grade 3” as described in BS8102: 2009 – that ‘no water penetration is acceptable and a dry environment will be provided if maintained by adequate ventilation’.

Plant rooms and storage should achieve Grade 2 as described in BS8102: 2009 as no water penetration is acceptable although damp is tolerated. However consideration should be given to the type of plant and stored items and their sensitivity to damp and any particular environmental controls required.

Car Parks can be grade 1 as described in BS8102: 2009 but consideration should be given to the present, intended and possible future use of the car park area. The finishes required and the expectations of the end user. Non-habitable areas such as parking areas can be designed to Grade 1 and are not normally required to achieve Grade 2 level. Storage or plant rooms where the internal finishes are not readily damaged by moisture should be designed to a minimum “Grade 2” as described in BS8102: 2009, as no water penetration is acceptable, although damp is tolerated.

Retaining walls used to form elements such as light wells ideally could be designed to provide “Grade 1” protection”, however the client should be made fully aware of the limit to this level and whether this is acceptable to the scheme.

3.3. Designer

Much of the failure associated with structural waterproofing is attributable to insufficient consideration of the relevant factors, leading to poor design. It is therefore advisable that where specifying waterproofing, these factors are examined rigorously, and that waterproofing specialists are consulted about a design at the earliest stage.

BS8102: 2009 defines:

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

- a) be suitably experienced;
- b) be capable of devising solutions that accommodate the various project constraints and needs;
- c) provide the design team with information and guidance that assists with and influences the design, installation and future maintenance of the waterproofed structure.

NOTE The waterproofing specialist could be the manufacturer or material supplier, provided that the manufacturer/supplier has the relevant expertise.

Waterproofing systems should be designed by a **Waterproofing Design Specialist** who can demonstrate that they have a suitable level of knowledge for designing waterproofing systems. Schemes offered by bodies such as the NHBC and LABC have requirements for suitably qualified persons to be involved in the design and installation of structural waterproofing systems. If a project involves such a scheme it should be determined if ANY qualifications are a requirement of any warranty application. In any case manufacturer's guidance and recommendations should be followed, unless any bespoke details have been confirmed with them and other relevant parties.

The Property Care Association (PCA) provides training for surveyors and designers of underground waterproofing systems. The Certificated Surveyor in Structural Waterproofing (CSSW) is a recognized industry qualification which requires an understanding of waterproof systems and the ability to comment on them. PCA has created a register of Waterproofing Design Specialists (WDS) who have shown further ability to provide design advice for structural waterproofing. The list of Waterproofing Design Specialists can be accessed – www.property-care.org/ProGuidance.RWDS.asp

3.4. Installer

Conditions of certification for waterproofing systems will usually require that they are installed 'under license' or by those trained by the supplier/manufacturer. ALL installations SHOULD be undertaken by suitably trained operatives. This could be by operatives holding a relevant qualification in the application of structural waterproofing, such as a relevant vocational qualification. Alternatively operatives trained and licensed by the supplier/manufacturer or PCA training could also provide a suitable demonstration of skill and knowledge.

The designer and installation company should be able to demonstrate experience in the implementation of similar waterproofing projects taking into account scale and complexity.

3.5. Site Investigation

An initial site investigation is important as its results will have a bearing not only on the waterproofing options considered, but also how the structure is designed. Although the findings of a site investigation can be seen as conclusive, consideration should be given that it is often a 'snap shot in time' and conditions on or around the site may change in the future.

It should be assumed that water will come to bear against the full height of the below ground structure at some stage in its life. Designing a system to offer full protection to full height, regardless of any water table classification, should ALWAYS be considered.

3.5.1. Risk Assessment

A risk assessment should be carried out which identifies any possible long-term water pressures, the effects of surface water percolation, use of external drainage and the effects of party wall impaction on neighbours. It should take into consideration the possible effects of climate change, defective water goods, nearby

trees, contaminants; and where external drainage is proposed, the effects dewatering may have on adjacent structures along with the potential for silting of drainage.

3.5.2. Water Table

High water tables present the greatest risk of failure to the waterproofing of a basement and it is therefore important to identify. A watercourse or water table that rises and falls and the potential for a perched water table must also be identified. How often and for how long the water table stays high are also important factors.

If the water table rises briefly – say, after heavy rain – and then immediately falls again, the risk of water penetration through external waterproofing and then through the structure is less than if the water table stays high for a much longer period. Consideration should also be given to the effect of possible planned developments adjacent or in close proximity to the site either under consideration or potentially possible in the future. Historic information on past flooding is valuable including any recording of rate of water ingress. Even if the water table is variable IT IS ADVISABLE TO DESIGN TO THE “HIGHEST LEVEL”.

More information on water tables and ground water can be found in the PCA document ‘What is groundwater?’

3.5.3. Ground Conditions

The design of the basement should take into account all current and likely future ground conditions.

A summary of common investigations relating to ground conditions along with some useful guidance is given in the table below:

Investigations	Guidance and information
<p>Desk study including reviewing</p> <ul style="list-style-type: none"> • groundwater and flooding issues • flood potential of the site • available groundwater data • SuD’s impact assessment • flood risk assessment • topography of the site • effects of adjacent surface finishes 	<p>www.environment-agency.gov.uk/homeandleisure/floods</p> <p>www.bgs.ac.uk/research/groundwater/datainfo/levels/home.html</p> <p>www.metoffice.gov.uk/climate/uk/stationdata</p> <p>TBIC - Guidance Documents (various) PCA - ‘What is Groundwater?’</p>
<p>Contaminated and aggressive ground</p>	<p>Testing required if there is the potential for chemically aggressive ground and/or groundwater</p>
<p>Seasonal water level change including risks of flash flooding and water logging</p>	<p>The report should consider likely fluctuations and short term flooding events that typically occur seasonally</p>
<p>Assessment of impact on the ground water flow where the construction is likely to have a “damming” effect</p>	<p>Interpretative report by a qualified engineer or hydrogeologists to include:</p> <ul style="list-style-type: none"> • assessment of the direction of groundwater flow, • “Damming” effects on the groundwater regime, • “Damming” effect of adjacent structures.

Contaminated Ground

It should be noted that whilst cavity drainage membranes may offer protection against the effects of Ground Gases, this will depend on the results of soil investigation in conjunction with above and section 3.5.5.

3.5.4. Ground Drainage

The topography of the land and the direction and movement of any groundwater should be determined as they will have a bearing on any proposals to provide drainage to reduce local groundwater pressures. If there are any drains or land drains, their positions and performance should be established. Any new construction proposals should not interrupt drains that still function unless measures are taken to redirect them or to intercept the water by a new drainage system. Flat ground does not dewater. On sloping ground the intercepted water courses should ALWAYS be directed around the obstructing structure to continue the drainage path downhill.

3.5.5. Soil Type and Conditions

The type of soil can greatly influence the volume of water reaching the basement wall. Free-draining soils not subject to variability in water tables generally present fewer problems than clays, which tend to be impermeable.

It is important, therefore, to determine the soil type and, in particular, its drainage characteristics. It should be noted that the soil around a basement may not be uniform and therefore care needs to be taken when assessing its overall characteristics. Such assessment is best left to specialists.

Some soils contain chemicals that may harm both the structure and the waterproofing system. Check the ground for materials that are detrimental, such as peat, sulphates, chlorides, VOCs and hydrocarbons and if needed, implement an external barrier to protect the structure from these potential harmful chemicals.

BS8102: 2009 advises the designer to take account of the presence of, or potential for ground gases when considering waterproofing. This is mentioned so that designers can take note of the perceived risks from ground gases and advise their clients accordingly. It should also be noted that high levels of ground gases can accumulate even where basements are protected by a waterproofing membrane (ground gas resistance), and this may lead to the installation of a ground gas management system where the risk assessment, particularly in existing structures, indicates that legislation might otherwise apply. See section 3.7.2 for more information.

3.6. Sequence and Timing of Work

It is fundamental that the waterproofing elements of a structure are communicated with all relevant parties throughout the construction process. For this reason the waterproof design should take into consideration the construction stages and timing between them to ensure the end result and function of any installed material is as expected. All parties should be aware of the waterproofing materials that are introduced at each stage to avoid problematic post installations, miss-installations or potentially leaving them out altogether. All waterproofing elements should be programmed into the construction programme and managed by the designer or suitably experienced specialist installer. Problems occur on large projects due to a lack of appreciation of the importance of waterproofing, site staff changes, inappropriate sequencing due to programme pressures, lack of preparation, piecemeal waterproofing and failure to test and record installed channels and bunds.

3.7. Considerations

3.7.1. Site De-Watering

If de-watering of a site is deemed necessary it should be done to a degree suitable for the proposed system with due consideration to existing surrounding structures to ensure any potential movement to the surrounding land as a result of de-watering does not have a detrimental effect. In any case specialist advice should be sought. Suggested further points of reading regarding dewatering are:

- CIRIA Document 515. Groundwater control – Design and Practice
- Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Edition (J. Patrick Powers, 2007)
- Groundwater Lowering in Construction: A Practical Guide (P.M. Cashman and Martin Preene, Ove Arup & Partners, UK, 2001)

3.7.2. Ground Gases

The likelihood of gases can be established from the underlying geological structure, and guidance for its control may be found in a number of documents and via official sources on the internet. BS8102: 2009 makes reference to maps of areas where basic or full protection against radon needs to be provided, that are contained in the Building Research Establishment (BRE) reports BR211, BR376, BR413 and the Health Protection Agency (HPA) documents:

- HPA-RPD-033, Indicative Atlas of Radon in England and Wales, 2007. ISBN 978-0-85951-608-2, available from HPA.
- HPA-RPD-051, Radon in Dwellings in Scotland: 2008 Review and Atlas. ISBN 978-0-85951-634-1, available from HPA.
- NRPB Documents, Vol 4, No.6, 1993, Radon affected areas: Scotland and Northern Ireland. ISBN 085951367X, available from HPA.

Attention is also drawn to the Building Regulations, and to further guidance on the characterisation and remediation of ground gases given in BS8485: 2015. Guidance on measures for large buildings is given in BRE guidance Radon protection for new large buildings. In view of health issues concerning radon, due vigilance should be observed regarding any revisions to these documents and other official sources.

Methane and other gases are likely to be linked to infill and made-up ground, particularly where large amounts of organic matter have been buried. Such sites can also present risks from acid wastes, mineral oil shales, and other fill materials. Some slags and other residues often contain toxic materials and some furnace ashes may be reactive. The Building Regulations give information on site preparation and resistance to moisture, and include guidance on ground contaminants.

PLEASE NOTE THE CONTROL OF GROUND GASES REQUIRES SPECIALIST ADVICE PRIOR TO SPECIFYING ANY FORM OF BARRIER.

3.7.3. Existing Structures.

Many of the considerations applicable to structural waterproofing design in new construction apply equally to the design of systems for existing structures, and this document serves equally well as a guide to review these necessary considerations for this purpose.

However, contrary to new-build scenarios, there are limitations inherent when working within the confines of an existing structure, in that there is typically a limited opportunity or scope to make structural alterations for the purpose of installing a given system.

The designer **MUST** provide initial or first-stage measures of protection against groundwater. It is often the case that designs are provided for the purpose of remedying failures to address problems with systems of considerable age in older or historic property, or to facilitate change of use.

Options may be limited by the confines of the structure, for example Tanking should not be applied to substrates which are not capable of absorbing potential loads applied by Hydrostatic Pressure. It is important to understand what that structure is, and equally, the nature of any installed waterproofing measures within it, which may further influence design.

Therefore, an analysis, through visual inspection, inspection of drawings (where available), and potentially intrusive investigation, i.e. trial hole formation, should be undertaken so that a thorough understanding of the structure and how it is constructed, is developed. The effects of any structural discontinuity as may typically occur in an existing structure must also be assessed.

Once the structure is understood, and objectives and instructions are defined, it is the role of the Waterproofing Design Specialist to configure products and systems within that structure, all while considering the appropriate factors detailed within this guide, so that the objectives are successfully met and structures are protected in the long term.

3.8. Structural Stability

Parts of the building constructed below ground level that form usable spaces should be designed by an Engineer. The existing substrate should be assessed by the Structural Engineer for suitability for the proposed system.

The design should consider all imposed loads including:

- ground movement
- lateral forces from ground water and retained ground
- buoyancy
- loading from other parts of the building

For further guidance refer to The Basement Information Centre Design guide.

4. SHEET PILED WALL CONSTRUCTION

4.1. Cavity drainage membranes

Cavity drainage membranes are high-density dimpled polymer sheets, placed against the structure. The dimples form permanent cavities between the structure and the internal shell. They are used internally to drain and control water ingress, and are not designed to sustain water pressure as specific barrier membranes.

Design considerations

- Installed following construction of the basement
- Installed during construction where an internal wall is built
- Defects may be rectified before completion
- Minimum preparation of substrate needed
- There is no hydrostatic pressure on the system: water entering the cavity is collected and drained/pumped away
- They are of consistent thickness and quality
- Flexible and able to adapt to minor settlement and shrinkage within the substrate
- Simple internal applications can overcome complicated designs, e.g. piles and ground beams
- With high or variable water tables, blockages or failure of drains/pumps may lead to flooding
- Where recycled materials are to be used, their durability should be checked with the manufacturer
- Planned maintenance is a requirement
- Assessment of the permeability of the wall is required in order to determine requirements for water collection and discharge

4.2. Floor Drainage Channels

A Floor Drainage Channel is a PVC drainage conduit (enclosed gutter) generally fitted around the perimeter of the floor at the vulnerable joints and in conjunction with cavity drainage membranes. Water entering the building through the walls is controlled behind the membrane and diverted down to the drainage channel at the base of the wall. The water enters the drainage channel through pre-drilled drainage holes to the rear of the channel and must then be diverted to a suitable drainage point, either gravity or a sump and mechanical pump system. Mid-floor flangeless spine channels may be added, to large or wide floors as additional drainage to link to the perimeter drainage. In a well-designed and maintainable floor drainage system the means of access to clean out and maintain the channel must be introduced at design stage. Ideally access points/jetting eyes should be installed at regular intervals to ensure accessibility to the system.

4.3. Ancillary Products

4.3.1. Pump Systems.

Basement waterproofing sump pump systems are typically provided as a packaged unit comprising a purpose-designed preformed sump liner or chamber with an integrated access cover over, which houses, as a minimum, dual (duty standby) automatic float switch operated pumps. The pumps activate and remove water when it reaches a set height within the liner. Pumps are always included at the lowest point within a structure, allowing collection of penetrating water by gravity, and then lifting this up to a suitable external discharge point which must be identified and appraised.

4.3.2. Battery Back-up Protection

Battery back-up pump systems are typically included to protect in the event of a power cut, with additional mechanical pumps being added to provide further redundancy or additional capacity as necessary. Such systems should include high level alarms to forewarn in the event of a problem, which may alert via local audible alarm or, where required, remote telemetric phone call. Backup pumps and alarms should in MOST situations be included, and always where there are consequences of failure. It should also be noted that:

- Type C systems require a maintenance schedule, as failure of mechanical pumps could result in flooding
- Where back up pumps are omitted the consequence and risk of a pump / power supply failure should be fully understood and formally agreed by all parties

Refer to PCA Guidance document on Pumps and Drainage

4.4. Product Selection

Given the wide range of waterproofing materials and certifications available it is clear there are many options when it comes to deciding upon a product or system for a given project. Historically and in most cases holding a CE approved accreditation through appropriate independent testing bodies has been sufficient. However with the changing requirements of Government, Europe and countries further afield, an assessment of the product for its given application should be carried out. Areas which may be important to the application and that need assessing could be:

- Product durability
- Expected life in service
- Resistance to aggressive environments (UV, contaminants, ground gases etc.)
- Waterproofing Ability

When selecting a product or system, it is also important to look at the supplier and/or manufacturer to confirm what support they offer. This could include:

- Design advice
- Range and type of products
- Site support
- Post-application support
- Product training (designers and applicators)

Reference MUST always be made to Manufacturers Product Recommendations for the application of these products.

CE marked products

As from 1st July 2013, construction products placed on the market in the UK and covered by a harmonised standard (hEN) or a European Technical Assessment (ETA) will have to be accompanied by a Declaration of Performance (DoP) and will need to have the CE marking.

The scope of harmonised standards is likely to increase over time and as such it would not be practical to list them in this document. It is however important that checks are made to ensure any products being used in works covered by a hEN include appropriately CE marked products, as failure to do so can lead to financial penalties and further legal complications further down the line (this applies to manufacturers, distributors, contractors and specifiers).

5. CAVITY DRAINAGE MEMBRANE APPLICATION, FITTING AND DETAILING

Preparation

When used in existing buildings, all plaster and any unsound render or screed is removed to expose the substrate. Remove any nails or sharp objects and clean with a stiff brush to remove loose material, laitance, salt residue, mould or adhesive. All timber and organic material **MUST** be removed. The surfaces must be sterilised with an appropriate biocide. Uneven substrates should be made good and level with a suitable repair material. They should be allowed to harden before the membrane is fixed. However the use of cement based materials **CAN** introduce lime into the system which will necessitate treatment. Check and remedy any unacceptable leaks in the concrete or masonry substrate using appropriate methods before the system is installed. If there are large or structural cracks present, seek the advice of a structural engineer.

Treatment of Free lime

Prior to installing the cavity drainage membrane on walls constructed of new concrete, the concrete surface should be treated to reduce the risk of leaching of free-lime or mineral salts, this can be done with a proprietary silicic acid compound crystallization slurry or epoxy coating.

Installation (General)

If the membrane is installed vertically it should always be used with the flanged edge positioned in front of and overlapping the previously installed membrane width – studs to the wall. If the membrane is installed horizontally, the position of the flange should be to the upper edge with the membrane installed to the higher level first if the wall is greater than the membrane width. Joints must be formed in accordance with the manufacturer's instruction.

Fixings are made through the studs into holes drilled through the membrane. Fixing plugs with seals are inserted into the holes and hammered flush with the membrane. Spacing and sealing of these fixings will depend on the product being applied, the application, the nature of the substrate and the type of finish to be achieved.

Soffits (Ceilings)

Cavity Drainage Membrane should not be applied to flat soffits. Soffits, to be covered, should always have a fall (as for vaulted cellar constructions) so water does not lie against the membrane or a joint. Refer to manufacturer or specialist waterproofing contractor for detailing. The membrane should be adequately fixed, to avoid the possibility of water ponding on top of the membrane. The wall membrane should be cut into the curve of the vault and fixed in accordance with the manufacturers' instructions.

Walls

Installation of the membrane is commenced at the top of the construction. The membrane may require initial fixing on the upper edge of a wall. Detailed instructions on the installation and jointing of wall membranes should be provided by the manufacturer. The membrane is fixed in accordance with the manufacturers' instructions, using the appropriate fixing and sealing materials. Power points, cables, light switches, pipes and any other services must be remounted in front of the membrane.

Dry Lining

Where timber battens are used ensure they are preservative treated, with cut ends adequately treated, and fixed into the fixing plug's internal fixing hole using the appropriate size screws.

An independent frame can be constructed in front of the system to accommodate wall finishes. This can be constructed in timber or a proprietary metal track system can be used. Gypsum plasterboard to BS EN 520: 2004, or similar dry lining boards covered by a current Agrément Certificate, are fixed to the battens or metal tracking with galvanized screws or nails, positioned a minimum of 12 mm from the edge of the board. Care should be taken to ensure that penetration of the plasterboard screws or nails is less than batten or tracking depth to avoid puncturing the membrane.

When a plaster finish is required, the membrane on walls may be substituted by appropriate plastering/rendering membrane, approved for use for below ground applications. This will be fixed, sealed, and finished in accordance with the manufacturers' instructions.

5.1. Applications on Floors

Preparation

Unsound or loose coatings such as screeds, laitance, salt residue, mould growth or adhesives must be removed. If mould or fungi is present, the floor and walls should be treated with an appropriate biocide (care should be taken to avoid contamination of watercourses when using biocides). Uneven substrates should be dubbed out with a suitable mortar, to achieve a flat finish. This must be allowed to harden before laying the membrane. Check and remedy, using appropriate methods, any unacceptable leaks in the concrete or masonry substrate before the system is installed.

New concrete floors should be laid LEVEL.

The surface irregularities should be within tolerances of the drainage method to be used. A general guidance is +/-5mm over any 10m direction is achievable, with the next 10m measured area being the same tolerance if the previous 10m had no deviation and up to +10 if the previous measure was -5mm and -10mm if the previous level was +10mm.

Carry out a flood test to check floor levels and to ensure that the drainage system works effectively.

Prior to installing the cavity drainage membrane on the floor, clean the horizontal substrate and remove all dust and debris. The surface of new or repaired concrete should be treated to reduce the risk of leaching of free-lime or mineral salts, e.g. this can be done with a proprietary silicic acid compound, epoxy coating or crystalline slurry. If a board covering is to be laid directly on the membrane, the concrete base must have a surface regularity with a maximum permissible departure appropriate to the cavity drainage membrane that is to be used.

Drainage

Floors should have a drainage outlet point. Perimeter drainage channels used in conjunction with wall and floor membranes ensure water will flow to the outlet or discharge point.

The outlet point will typically be a collection sump, which will then mechanically evacuate the water.

The need for drainage and the understanding of how drainage works is THE most important aspect of Type C waterproofing system. A common failure with Type C systems is due to poor drainage design and/or installation.

Refer to PCA Guidance document on Pumps and Drainage.

Installation

Before the floor membrane is laid all necessary perimeter drainage and access service points should be installed. The membrane is rolled out, with the dimples/studs facing downwards, over the floor. Consecutive membrane sections are laid so that the flange edges overlap. Where studded edges overlap, this should be by no less than is required by the manufacturer. All joints are then sealed with the appropriate materials in accordance with the manufacturers' instructions. The membrane is cut around pipes and services in the floor, and the gap sealed. Where appropriate, a patch of the membrane can be laid over the surface, and sealed to the main membrane. Alternatively, this can be detailed using pre-formed units. There should be no fixings through the horizontal floor membrane. Wall floor junctions and corners should be given special consideration and should be formed and sealed and finished in accordance with the manufacturers' instructions.

Floor Coverings

Before floor finishes are installed insulation boards can be laid over the membrane, (100% Closed Cell insulation MUST be used – see section 6 on insulation). Suitable tongue-and-groove floor board panels can be loose laid over the membrane to within 10 mm of the walls. The panels should be staggered and the joints sealed. To avoid unevenness in the finished floor, it is advisable to install floor panels so that the joints do not coincide with joints in the cavity drainage membrane. The membrane may be covered by concrete or screed generally at thicknesses over 50 mm. Proprietary screeds may also be considered, which can generally be laid at thicknesses less than 50mm. The use of these products with the membrane should be approved by the membrane manufacturer. Care should be taken to ensure the membrane is not displaced when placing the concrete or screed. Care should be taken with all screeds and bricklayers mortar that it does not enter the channel. Self-levelling screeds are very fluid and pose a real risk of blocking cavities and channels if not correctly detailed. All channels should be checked during and after screeding.

5.2. Accommodating Services

Services entering through a waterproofing system should be avoided where possible. Elements within the construction such as service ducts or light wells can allow for services to be brought in from above, therefore avoiding any compromising of the system.

Where services penetrating the system are unavoidable the design and detailing to seal such elements should ensure that they are watertight and durable and suitably situated to allow for such works to be carried out (having them too close together can be problematic for detailing). In all cases details that penetrate a waterproofing system should be detailed and installed in accordance with the relevant manufacturer's guidelines.

5.3. Continuity with other systems and trades

Careful detailing of connections to above ground elements (e.g. dpm's, dpc's) is important to ensure consistency for the overall structures performance. Where possible have a complete system from one source. Details can then be more easily confirmed as compatible.

As important as maintaining consistency between systems, communication and an appreciation of other trades are vital for a successful installation and end result. Regular meetings and communication sessions should be held to ensure that all parties involved at any one stage are aware of current or future works to ensure each can take place, be installed and ultimately function as intended.

6. INSULATION IN BASEMENTS

Insulation as a void former

Only high performance 100% Closed Cell insulation materials are recommended because of *negligible* moisture absorption and high compression resistance.

7. MOVEMENT JOINTS

The use of cavity drain systems, as a method of waterproofing, has become the commonest form of waterproofing system used in retrofit basements and increasingly is being fitted in new build basements.

In accordance with the Code of Practice BS8102: 2009, they need to be maintained. This has been helped significantly with the introduction of perimeter drainage channels and inspection ports, so as to make the drainage aspects maintainable and help to prevent blockages caused by the existence of free lime for example. In most new construction and retrofit basements (and also in refurbishment projects where the floor has been replaced), there is a high risk of free lime and /or mineral salts leaching from the concrete walls and floors. In retrofit this is particularly prevalent where "dry pack" is used at the top of the underpinning.

As free lime leaches from the new construction by groundwater ingress it deposits itself within the drainage cavity, (behind and underneath membranes) and particularly within the sump chamber and around the sump pumps. Thus potentially causes pump failure and therefore failure of the system.

Maintenance of cavity drain systems and discharge points is vitally important to the long term success of the system, with the recommended maintenance interval being 6 months.

The impact of free lime within the system will greatly increase the frequency of maintenance over the first 3 – 5 years, but especially within the first six months, reducing the interval to weeks in some instances, thus increasing both the costs of maintaining the system and also putting the system under undue risk. In order to minimise the risk of free lime impacting on the system, an “**anti-lime**” coating should be applied to the new concrete IN ALL CASES.

Long term benefits include significantly reducing the risks to the system and saving maintenance costs. For further detail refer to PCA documents on Free Lime and Dry Pack in Basements

The British Standard BS8102: 2009 says that the water management system should be “serviceable and maintainable”, however in reality the channel is very often forgotten and rarely serviced, for a variety of reasons:

- No knowledge of where the service points are.
- The internal dry lined walls are built out too far forward and obscure access to the service point(s).
- No water available to flush out the system.
- Concerns about damaging finishing’s (water damage).

The client should be given a site plan on completion, indicating the exact location of the service points and be made aware of the importance of the pump service and channel inspection. This should be a condition of guarantee.

Anti-Lime Solutions: preparatory Anti Lime Solutions are designed to remove carbonate deposits in groundwater bores, wells and pumps and are therefore particularly well suited for the removal of lime scale and other build up within cavity drain systems, sumps and pumps.

Benefits:

- Clears lime scale build up from cavity drain systems
- Fully biodegradable
- Ready to use
- Discharge into foul drains is acceptable

8. DEFECTS, REPAIRS AND MAINTENANCE

In order to ensure the long term integrity and effectiveness of the waterproofing system the property and the waterproofing system must be properly maintained. Waterproofing systems should be able to cope with water arising from leaking drains and domestic water pipes however, it is essential that all buildings are maintained to prevent water ingress and waterproofing systems are no exception. If the property and its drainage systems are not maintained then the underground structure may be subject to water ingress from sources that were not considered during the design of the waterproofing system.

It is important to ensure the client is aware of their responsibility to maintain the property. Special attention should be paid to:-

- Drainage channels
- Sumps and Pumps
- Drains and soakaways
- Rainwater goods,
- Gullies and culverts
- Excavated external window lights and stairwells
- Air bricks and ventilation systems

Cavity Drainage Systems

As cavity drainage systems rely on free drainage usually in association with sumps, perimeter drains and mechanical pumping devices it is essential that these elements are regularly maintained to ensure their long term effectiveness.

Immediately after the installation of a drainage system, the drainage channels and sumps MUST be cleared out and tested. Pumping devices must be checked, tested and properly commissioned. The drainage systems should then be inspected and serviced at regular intervals. It is recommended that service intervals should be no longer than annual. It is vitally important that the first service is within 3 months of the installation as it is within this period the system is most subject to Limescale. It is also possible that debris and site waste can find its way into the sump chamber during construction. This MUST be removed and the chamber cleaned at this first service.

In circumstances where pumps are running for long periods of time, or where the system is subject to silting or the depositing of free lime, service intervals may be far shorter. The design specialist has the responsibility for any guarantee issued on the system - that the waterproofing system is fit for purpose. They MUST instigate a MAINTENANCE REGIME for setting service intervals. Commonly this involves a service contract with a pump service engineer as most contractors do not service their own systems.

The servicing requirements for the waterproofing system should be clearly set out in the specification and/or contract and/or guarantee, supplied by the designer to the client. The client must be informed that any failure to adhere to the maintenance schedule may result in a failure of the waterproofing system.

It must be made clear to the client that any system failure that results from a deviation from a planned maintenance program will not be the responsibility of the installer and will not be covered by any guarantee that has been issued.

Condensation

Condensation is dampness generated from within a structure and will not be eliminated by the application of a structural waterproofing system. It is important to consider the likelihood and implications of condensation when the waterproof system is being designed. Waterproofing systems that conform to Grade 3 (BS8102: 2009) should usually include reference to heating and/or ventilation.

Condensation can usually be controlled by adequate air control such as increasing ventilation, dehumidifiers or a central air conditioning system. Increasing the internal temperature without improving ventilation can make matters worse. Interstitial condensation can be cured in the same way.

Minor condensation problems can often be cured by adjusting the heating patterns. Leaving the heating on permanently at a lower temperature will sometimes be sufficient. The most effective means of removing condensation risk is to reduce the volume of vapour held within the air and by doing so, the relative humidity. A humidistat controlled fan or dehumidifier should be installed to do this.

Further information on condensation can be found in the PCA Advisory Leaflet on Condensation.

System Failures

General water penetration and breaks in the system will need to be dealt with in accordance with the manufacturers recommendations.

9. SERVICE AND MAINTENANCE OF CAVITY DRAINAGE WATERPROOFING SYSTEMS

The need to service and maintain the drainage elements of a Type C Waterproofing system is paramount to its long term success. This is highlighted in BS8102, the PCA Code of Practice for Remedial Waterproofing of Structures below Ground and by the distributors of products and equipment used to create waterproof basements.

A schedule of maintenance should be agreed with the client in advance of commissioning. This schedule should then be adhered to throughout the life of the waterproofing system.

In some circumstances it may be necessary or desirable to amend the time and scope of the service visits. Any changes to the schedule of planned maintenance must be agreed with the client so that the service schedule is amended accordingly.

Trained, competent service engineers should be employed to maintain and service Type C waterproofing systems. The person undertaking the service should have a good knowledge of the waterproofing system and have access to details of the installed system. Copies of the original installation plans and specifications should be available for inspection.

The service engineer should be properly equipped so that service operations are carried out effectively.

Initially inspections should be undertaken to the channels, sump chambers and pumping units. Examinations should also be carried out to the discharge pipes and associated valves.

Any accumulation of silt, fines, or free lime should be noted before cleaning operations commence. The pump unit should be inspected to ensure that it is operating correctly before any flushing operations commence.

Drainage channels should be thoroughly flushed with water in order to remove any built up deposits. This is usually undertaken by using a hose or water jetting device at each of the channel inspection points.

In some circumstances it may be possible to flush the system by back filling the channels from the sump. This method of flushing should only be undertaken by an experienced service technician and great care taken to prevent the uncontrolled escape of water.

Flushing water will discharge into the sump so care should be taken to protect the sump pump from fouling on any materials that are washed from the channels into the sump during these operations. Care should be taken so that water from the cleaning process does not overwhelm the pumps.

The sump chamber should be inspected for damage and cleaned to remove any materials that may have accumulated.

Discharge pipe work should be inspected and cleaned. Special attention should be paid to areas where water may collect and stand within the pipes during periods when the pump is not in operation. This is particularly important when free lime is deposited as discharge pipes and non-return valves can become obstructed.

Maintenance of the pump unit will vary according to the type of pump configuration installed. Information relating to the servicing of individual pumps and configurations should be provided by the manufacturer.

Consideration should be given to the operation of the main and back up pumps and the condition of any batteries and switchgear should be established. Seals, washers and valves may require inspection and replacement.

The inspection and alteration of electrical circuits must be undertaken by a registered electrician.

Alarms and any back up switches that are fitted should be inspected and tested.

It should be remembered that the sump pump is a mechanical device and as such will fail eventually. It is therefore good practice to consider the service life of a pump and plan to replace the unit long before the pump fails.

It can be extremely difficult to estimate how long a pump might last so it is important to seek advice from the supplier of the pump when estimating service life.

Discharge points (the point where water collected by the waterproofing system and discharged to the outside) should be inspected and maintained as appropriate.

(If possible check to see that any lagging used to insulate the pipe is still in position. Replace as necessary)
Where a type C waterproofing system is partly reliant on external land drainage or dewatering outside the building, special attention should be paid to the condition and service requirements of these elements.

Service Intervals

Type C systems should be inspected and serviced at least annually but in some circumstances the period between services may be considerably shorter. Site conditions, design, materials, machinery used and the implications of any system failure will all play a part when deciding on the frequency and scope of service visits.

It is advisable to schedule the first service visit within three months of the system being commissioned. This will highlight any problems, allow for the removal of debris that may have been deposited in the drainage channels during the construction phase and allow the service engineer to assess the risk posed by free lime and silt that may be washed in-to the system.

Service intervals may be affected by the following factors:

- The volume of water being handled by the waterproofing system
- The prevalence of free lime
- The number of sumps and pumps associated with the system
- The deposition of silt, fines or other particulate matter into the system
- How hard the pumps are working (in some circumstances it may be advisable to install larger pumps)
- The implications of any failure in the drainage system
- The service life of the pump and batteries.

If uncertainty exists as to the frequency of service visits then it is always advisable to take a cautious approach. It is better to schedule more visits than may be necessary and prevent a failure rather than leave things too long and risk a flood. If it is decided that visits are occurring too often then the maintenance schedule can be amended (see note in service and maintenance section above).

Detailed advice on the frequency of servicing visits is available from manufacturers and suppliers of waterproofing products.

Liabilities

The need to service and maintain the drainage elements of Type C waterproofing systems is paramount for their long term success. It follows therefore that this should be communicated to the client by the supplier or installer of the waterproofing system. Where a system is installed for a builder or property developer then it is important to highlight the need for servicing by the future owners or controllers of the building.

The need for servicing a Type C waterproofing system should be made explicit when the system is proposed by the contractor or designer. This should be made in writing and can be within a report or as part of a tender submission. In some circumstances notification may be made under separate cover. Any notification should clearly state the need for servicing and maintenance and where appropriate highlight the implications if servicing is not carried out.

Contractors should clearly state the need to service and maintain the waterproofing system within any guarantees that may be issued.

Failure to notify the client of the need for servicing may result in a system failure. In some circumstances the consequences of this failure may be passed to the installer/ supplier.

In the event of a failure resulting from poor servicing then, subject to the circumstances it may be considered that the company or individual responsible for maintaining the drainage elements may share some liability for any failure.

If the client, or other persons responsible for the building, fails to instigate or implement a service plan recommended by the installer, designer or supplier, then it is less likely that any failure of the waterproofing system that results from a blockage of the drainage elements or the pumping system will be the responsibility of anyone other than the client or controller of the building.

10. STANDARDS AND CODES

The following standards, codes and specifications are directly relevant to structural waterproofing:

- BS8102: 2009 Code of practice for protection of below ground structures against water from the ground
- BS EN 1990: Basis of structural design
- BS EN 1997-1 Eurocode 7: Geotechnical design, part-1 General rules
- BS EN 1997-2 Eurocode 7: Geotechnical design Part 2 ground investigation and testing, BSI 2007
- BS 8002: Code of practice for earth retaining structures
- BS 5454 Recommendation for the storage and exhibition of archival documents BSI 2000
- Building Regulations

Other reference documents

- UKAS - The United Kingdom Accreditation Service is the sole national accreditation body recognised by government to assess, against internationally agreed standards, organisations that provide certification, testing and inspection and calibration services.
- The Basement Information Centre (TBIC): Basements: Waterproofing – General Guidance to BS8102: 2009 (Design Guide)
- TBIC - The Building Regulations 2010 – Basements for Dwellings – Guidance Document 2014
- BSWA: Waterproofing Existing Basements
- NHBC: Waterproofing of below ground structures (New Standard)
- ASUCplus: Guidelines on safe and efficient basement construction directly below or near to existing structures 2013.
- PCA – Code of Practice for Remedial Waterproofing of Structures below Ground
- PCA – Best Practice Guidance – Type A Waterproofing Systems
- PCA – Best Practice Guidance – Type B Waterproofing Systems
- PCA - Guidance for the Service and Maintenance of Drained Cavity Waterproofing systems (Type C)

11. WARRANTIES, GUARANTEES AND INSURANCE

Installer Guarantees

Typically these are where the contractor or installer guarantees their own workmanship for a period of years (normally up to 10 years for Structural Waterproofing).

An undertaking by the installation contractor guaranteeing both workmanship and performance of installation.

Insurance Backed Guarantees (IBG)

An Insurance Backed Guarantee (IBG) is a low cost, long term insurance policy (normally up to 10 years for Structural Waterproofing) which provides valuable protection for consumers when undertaking improvement projects. The principle of an Insurance Backed Guarantee is to honour the terms of the written guarantee, originally issued by the installing contractor, where that contractor has ceased to trade as defined within the policy document and is therefore unable to satisfy claims against that guarantee.

Latent Defect Insurance (For New Build, Renovation and Repair work)

Property owners, construction professionals and other building stakeholders will know that defects can become evident long after practical completion of building works. The rectification of these defects can be a costly undertaking and may result in expenditure which has not been budgeted, or otherwise provided for. For construction professionals, this naturally jeopardizes the availability of funding, time and manpower for future projects.

Latent Defect Insurance products take approaches to protecting stakeholder's investments in construction projects. The propensity for defects to occur is minimized from the outset, as technical audits are carried out prior to and during the build. In addition to indemnifying insured parties in respect of latent defects themselves, the insurance may also confer additional benefits in the event of a valid claim, such as meeting the costs of alternative accommodation, and the fees of architects or other professionals.

Manufacturer Warranties

These offer protection in the event of a product being proven not to have performed as intended in which result the manufacturer is often limited to re-supply of the material only. It is extremely unlikely that any ISO9001 compliant company will supply defective materials, hence why these types of warranty/guarantee are issued alongside the installer's commitment.

Other schemes

There are other schemes and companies who offer insurance products covering waterproofing in new-build projects. The National House Building Council (NHBC) Buildmark scheme provides 10 year warranty and insurance cover for newly-built and some new-build basement conversions in private homes. Premier Guarantee and LABC offer similar insurance products in the UK.

12. TRAINING/SUPERVISION

One of the most regular causations of failed waterproofing systems is defects in the installation. Conditions of certification for waterproofing systems will usually require that they are installed 'under license' of the supplier/manufacturer. In practice this does not always happen and it is not uncommon for waterproofing systems to be installed by operatives who have no relevant qualifications and/or no previous experience of installing waterproofing systems. This should not happen and in the main is the responsibility of the Main Contractor and/or Architect.

Type C waterproofing systems should be installed in accordance not only with the design, but also in accordance with manufacturers' specifications and by installers who can demonstrate relevant competence, experience and have been trained by the manufacturer or supplier of the waterproofing system. Installers should be made fully aware of the design and the manufacturer's recommendations for preparation and installation.

Qualities that should be sought after when selecting an installer include:

- Approval/accreditation by manufacturer
- Past experience in installing the subject product/system
- Quality Audit Systems
- Member of PCA or similar
- Product/system datasheets and guidance available onsite
- Offer "PI" (Professional Indemnity Insurance) covering relevant construction stage
- Financial ability to remedy any problems
- Relevant vocational qualifications
- Ability to interact with the rest of the design team, fulfilling the waterproofing design specialist role if not filled by others

The Property Care Association (PCA) provides training for surveyors and designers of below ground waterproofing systems. The Certificated Surveyor in Structural Waterproofing (CSSW) is a recognized industry qualification which requires an understanding of waterproof systems and the ability to comment on them.

Information about training courses and qualifications are available from the PCA website:

www.property-care.org

13. BIBLIOGRAPHY:

Reading Lists

The Basement Information Centre: Basements: Waterproofing - General guidance to BS8102: 2009 known as TBIC Waterproofing Design Guide (MPA – The Concrete Centre)

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HMSO - Party wall Act 1996

14. ACKNOWLEDGEMENTS:

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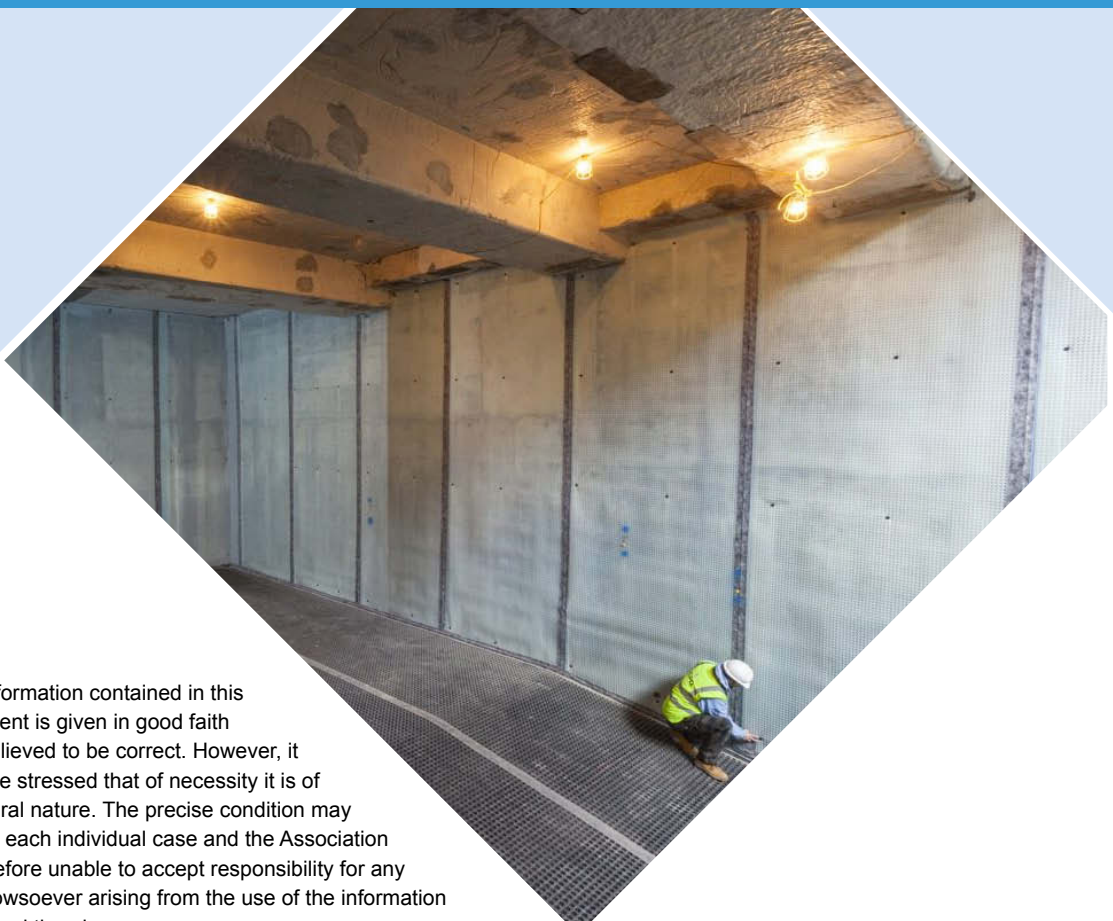
Mike Bromley – PCA

Refer via PCA website for Waterproofing related links

www.property-care.org/professionals/waterproofing/

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