Code of Practice

For Remedial Waterproofing of Structures below Ground

September 2008
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DEFINITIONS

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

Figure 6 of BS 8102 describes defines 3 different construction types:-

Type A
(Barrier protection). Constructed from concrete or masonry, offering only limited protection against the ingress of water by the nature of its design. Protection is therefore primarily dependent on a barrier system applied to the structure, combined with serviceable land drainage where appropriate.

Type B
(Structurally integral protection). Designed and constructed in reinforced or pre-stressed concrete either to BS 8110 (to minimize water penetration) or to BS 8007 (to prevent water penetration) dependent on the chosen grade of basement use.

Type C
(Drained protection). Constructed from structural concrete (including diaphragm walls) or masonry to minimise the ingress of water. Any moisture that does find its way into the basement is channeled, collected and discharged within the cavity created through the addition of an inner skin to both walls and floor.

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

CAVITY DRAIN MEMBRANE
Cavity drain membranes are dimpled, flexible, high-density polyethylene (HDPE) or polypropylene sheets, which can be placed against the internal face of the structure after construction and used to control infiltrating water.

HYDROSTATIC PRESSURE
Hydrostatic pressure means pressure created by water.

INTERSTITIAL CONDENSATION
Interstitial condensation is condensation occurring WITHIN the system, as opposed to the more common surface condensation.

MEMBRANE
A thin piece of material that covers an opening.

PRESSURE
Pressure is a load which is spread across an area, e.g. hydrostatic pressure.

RENDER
The term ‘render’ refers to any applied coat which is made up of a sand; cement mix only, and can be used for coatings applied internally or externally. It may incorporate accelerators, plasticisers, or other approved additives.

STRESS
Stress is the pressure that builds up within the elements of a structure to resist applied loads and/or pressures.

TANKING
The term ‘tanking’ refers to a pressure resisting waterproofing system that is applied internally or externally to a structure, which will prevent any lateral penetration of liquid, either by capillary action, or by hydrostatic pressure. It’s most common usage is in cellars and basements, where it should provide a complete, waterproof envelope.

VAPOUR CHECK
Any layer which reduces the passage of water vapour, resulting in a build up of humidity immediately behind it is known as a vapour check.

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.

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

WATERPROOFING
The application of a materiel 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.
1. THE OBJECTIVES AND PRACTICE OF POST CONSTRUCTION STRUCTURAL WATERPROOFING.

The objective of structural underground waterproofing is to achieve effective control of water or water vapour caused by penetration and to reduce the likelihood of further deterioration of the building fabric or finishes in below ground spaces.

1.1 General Consideration

The PCA code of practice is aimed at providing guidance for contractors, surveyors and other specialists involved in the planning and provision of usable spaces in structures that are below ground.

It is essential for the success of any project that includes underground structures that strategies for excluding groundwater are considered from the very earliest stages of the planning process.

The designer of the underground waterproofing system must first consider the client’s requirements. They must then provide a design solution that can be installed successfully and will deliver the performance characteristics specified by the client. To achieve this, the designer must give consideration to the structure and the prevailing soil and ground conditions.

In all circumstances the specialist should be adequately trained and competent to design and/or install the waterproofing system. Projects will vary in size and complexity and the specialist must be able to provide design, engineering and practical solutions commensurate with the project.

PCA provides training for surveyors and designers of underground waterproofing systems. The recognized industry qualification is Certificated Surveyor in Structural Waterproofing (CSSW). Information about training courses and qualification are available from the Property Care Association.

It is important that during the design process and at all stages of the construction process that the designer, specialists and the operators installing the waterproofing systems establish robust channels of communication. Regular and clear communication coupled with good site supervision will allow variations and amendments to the design to be planned and executed without compromising the waterproofing system.

The implications of design or construction variations may not always be immediately apparent. Deviations from the design must be drawn to the attention of the designer. When considering the design of a waterproofing system it is important that consideration be given to the form and feasibility of remedial work should the system fail for any reason.

The designer of the waterproofing system should also consider the implications of any future failure if the system and how any defects can be repaired in the future.

2. STANDARDS

2.1 Product Certification

Waterproofing material should usually hold a current British Board of Agrément Certificate or accreditation through appropriate independent testing.

2.2 Codes

The following codes specifications are directly relevant to structural waterproofing:

- BS8102: 1990 Protection of structures against water from the ground.
- TBIC - The building regulations 2000 - Approved Document, basements for dwellings + addendums.
- BCA: Basement Waterproofing Design Guide.
- BCA: Basement Waterproofing Site Guide.
- BSWA: Waterproofing Existing Basements.

3. PRODUCTS

PCA members are generally asked to supply waterproofing solutions to existing basements. These on the whole relate to the supply of type A and or type C methods waterproofing (as defined in BS8102). This code is therefore limited and reflects services provided by the majority of PCA members.

Although there are several generic types of waterproof systems available such as sheet membranes, liquid applied bitumen’s, mastic asphalt and injected polymers in the remedial industry there are two main types which are in common use:-

- Cementitious systems.
- Cavity drain membranes.

3.1 Cementitious Systems

Cementitious systems fall into two main categories:-

- Multi coat renders.
- Cementitious coatings.
3.1 Multi-Coat Renders
These are multi-coat cementitious renders and screeds, modified with chemical additives. The modified mortar is applied by conventional rendering or screeding techniques in several layers. The number of render layers and final thickness are dependent on the conditions likely to be experienced and are specified by the relevant material manufacture. They are used for waterproofing basements or water retaining structures by internal tanking.

3.1.2 Cementitious Coatings
These are, pre-mixed cementitious compounds comprising cement, graded aggregates and chemical additives. They are supplied in powder form to be mixed with water and or polymers on site and applied as a slurry by brush, trowel or spray, to form a coating that is usually between 2mm to 6mm thick. They can be applied direct to sound substrates or they can be applied to a render coat previously applied to the substrate. They can be further modified to improve adhesion elasticity and flexibility. They are used for waterproofing basements or water retaining structures by internal or external tanking.

3.2 Cavity Drainage Membranes
These are vacuum formed high density polyethylene or polypropylene sheet materials with moulded domes for application to below ground, on internal wall ceilings and floors. They are supplied in roll form and are secured to walls using proprietary fixings. The fixed wall and ceiling membranes are used to support dry lining or may be plastered, whilst the floor membranes may be screeded or overlaid with wooden flooring.

Cavity drainage membranes constitute a water management system and not tanking. It is essential that the system is free draining at all times as the buildup of hydrostatic pressure will result a failure of the waterproofing system. Cavity drainage membranes must be used in conjunction with serviceable, drainage channels and/or pumping systems.

4. SURVEYING
When surveying a property for a waterproofing system the following procedures should be regarded as a minimum:

| Establish the intended usage of the area and type of finish required. |
| Establish the type and condition of the existing structure. |
| Assess the ground conditions relating to water table, permeability and aggressive contaminants. |
| Select the appropriate generic system. |
| Prepare a detailed specification. |

4.1 Intended Usage of Area
BS8102, Table 1, defines performance levels in the form of Grade 1 to 4, and relates these to the use to which the basement is to be subjected. For anything other than a grade 1 environment, water penetration is not acceptable, therefore when designing a system to grade 2, 3 or 4 the surveyor should always initially specify work on a worst case scenario basis. This means that a system which will resist assumed ground water levels as defined in BS810, should be advised and specified.

If the client requests a reduced specification (for example, a partial system or CDM without adequate drainage) the implications of this must be fully explained and understood by the client. The limitations of a partial or incomplete system should be clearly stated in the report and where a quotation is provided for such works it is advisable to also include an alternative quotation for a specification that complies with BS8102, thus giving the client the ultimate choice.

4.2 Type and Condition of the Structure
The surveyor should determine the type, condition & finishes of existing walls, floors and ceilings and note any flat soffits. The survey may need to be invasive, possibly including trial holes, to establish this detail, particularly in the case of solid floors. Consideration must be given to whether the existing structure will require any upgrading prior to installation of the waterproofing system, the services of a structural engineer may be required at this stage.

Any item, fixture or feature that could impede a continuous or full system must be identified and considered (e.g. door/window frames, staircases, floor timbers, partition walls, services etc).

All timbers which could be vulnerable to moisture and therefore fungal decay should be noted. These should be replaced with an alternative material or isolated from the damp masonry.

Any previous waterproofing ‘treatments’ should be noted.

Type B structures may also be encountered where typically leaks through cracks, construction joints and defective concrete manifest themselves. (Specialist concrete repairs are generally outside the scope of this COP although installation of a Type C system may be considered as a solution).

If a type A or B structure is lined with a proprietary cavity drain system, it automatically becomes a Type C structure.

4.3 Ground Conditions
It is important to establish whether or not there are any ground conditions which could adversely affect the structure after application of the waterproofing, such as:-
• High water tables/changing ground conditions which could put the substrate into tension or cause induced stresses in the structure.
• Aggressive contaminants such as nitrates, sulphates, acids etc. which could affect the integrity of the structure over a period of time.
• It is important to determine the likely maximum water level and/or flow rate to enable the drainage to be suitably designed.

In practice, potential water levels, may not be immediately apparent at the time of the survey. The surveyor should make enquiries about the flooding history of the basement and of the local area generally. Flood zone information is available at: www.environment-agency.gov.uk/floodline

The surveyor should also consider external factors such as, rainwater goods, adjacent water courses, wet ground, local topography, adjacent buildings, roads, pavements, coal chutes etc.

Attention should be paid to any existing external drainage. The surveyor should note the effects of the external drainage on the proposed waterproofing system.

It will sometimes be prudent to recommend that the client commissions a complete soil survey so that this can be considered by the designer of the waterproofing system.

In all cases water table levels stated in BS8102 and referred to in 4.1 should be assumed and the system designed accordingly unless specifically requested otherwise by the client, as previously stated.

4.4 Selecting a Generic System
In remedial situations most jobs require the application of waterproofing systems to be internal. For this type of work, cementitious coatings, multi-coat renders, epoxy coatings or cavity drain membranes with integrated drainage channels are most common.

In most circumstances any one of the above systems can be applied equally effectively. However, the following points should be considered before finally selecting a system.

Cementitious systems require little or no on-going maintenance, can hold back a significant head of water and are not dependent on mechanical parts and an electricity supply. However, when water pressure comes to bear, the substrate will come into tension and bending.

The substrate must be strong enough to accept this stress. Non-structural floors and half brick walls are not suited to the application of a cementitious system due to their inability to withstand bending stress.

Cementitious systems may not be suitable where they are likely to be subject to heavy vibration or substantial seasonal movement i.e. below roads, railway lines etc.

If there is any doubt about the ability of a structure to absorb the changing stresses caused by waterproofing, the guidance of a structural engineer should be sought.

Cementitious systems are versatile in that they can be applied relatively easily to convoluted shapes and to flat soffits. Their success however depends on the bond achieved between the material and the substrate. To achieve a good bond considerable surface preparation may be needed. In this case health & safety considerations in relation to noise, hand arm vibration and dust nuisance should be taken into consideration.

Cavity drainage systems will not usually put the substrate into tension, but they will need to be adequately drained by using drainage channels that are connected to either natural drainage or pumping points. Cavity drainage systems cannot withstand any hydrostatic pressure. Mechanical equipment such as pumps will require routine maintenance and the system will fail if there is a breakdown of the power supply and water comes to bear against the drainage membrane. All drainage channels that form part of the system should also be subject to regular routine maintenance in order to ensure the free flow of water to drainage points.

Cavity drainage systems are relatively quick to install but may not be suitable for application to convoluted shapes and flat soffits.

Substrates will usually require minimal preparation and drying time, finishes can be applied quickly allowing early decoration.

Thermal insulation can be incorporated in a cavity drain system; the potential for interstitial condensation must however be considered.

The formulation of channels into structural or reinforced floor slabs may have unforeseen consequences. It is therefore important to consider the structural implications of this action.

4.5 Contents of a waterproofing report and specification
In order that the specialist surveyor can properly
discharge his obligations to his client we recommend that any submission supplied by a specialist following a request for specialist advice by a client, should contain the following minimum levels of information.

The report should when appropriate include reference to the following:

- Confirmation of clients instruction
- Limitations/restrictions of survey
- Clients required use of the basement and therefore the design grade required (i.e. 1, 2, 3 or 4 as defined in BS8102)
- A description of existing basement construction
- If known, the soil/ground type and permeability
- Defects/moisture sources that require rectification in conjunction with waterproofing works
- Proposed generic waterproofing method(s) e.g. Cementitious Multi coat render, Cementitious Slurry, CDM etc
- Suitability of existing structure to accept proposed system and any up grading works required e.g. a new floor slab etc. NB For type A internally applied systems the floor slab should be designed by a structural engineer
- How existing staircases will be isolated from the walls and floor, or incorporated into the waterproofing system
- Reference to condensation control/ ventilation/ dehumidification.
- Reference to long term guarantee if applicable
- Detailed Specification for chosen method.

In all situations where waterproofing treatments are recommended the specialist should include the following advice:

- The extent of the waterproofing must be clearly described/ indicated. If a full waterproofing system is not being specified then the reasons for this should be stated and the risks arising from a partial system explained. It should be made clear that the limitations of a partial system are at the client’s own risk. Where a partial system is being offered it is advisable to offer a full system as an alternative so it is the client who makes the choice.
- Preparation works including removal of existing finishes, joinery items, services etc.
- Advice on fixing to/through the system
- Drawings showing areas to be waterproofed and other relevant details

Where a CDM system is specified advice should include the following information:

- Position and type of internal drainage including facility for cleaning/inspecting
- Position, size, number and type of pumps – the designed extraction capability of the pumps should be stated
- Pump outlet arrangements
- Pump wiring arrangements
- Membrane type & stud size for walls/floors/ceilings as applicable
- Joint sealing detail if applicable
- Finishes
- Pump/drainage servicing requirements and/or agreement.

Where a Cementitious multi coat render system is recommended the report should include reference to:

- Preparation method for masonry and other surfaces as appropriate
- Specific provisions for fixings where required
- Product type and application method/process
- Floor/wall joint details
- Curing requirements.

5.  APPLICATION METHODS

Specifications from manufacturers vary, and it is strongly recommended that applicators liaise closely with a manufacturer to establish exactly how their system should be applied.

There are certain areas, however, common to all systems, which need to be highlighted.

5.1  Cementitious Coatings and Multi-Coat Renders

5.1.1  Preparation

Any timbers embedded in the substrate must be removed.

The substrate which is to receive the system must be well keyed to achieve a good bond and sound to prevent de-bonding. Any old renders, coatings or general contamination must be removed by suitable means such as grit blasting, high pressure water jetting, scabbling, or other suitable means. Care needs to be taken if wire brushing is used as it can leave the surface soft and dusty. Bush hammering tends to compact the surface and can result in the system pulling away, taking the surface with it.

Soft mortar joints should be raked out, and any unsound and defective areas cut out and made good. Open joints should not be re pointed but the
mortar should be pushed into the open joints when applying subsequent renders.

Excessive suction should be controlled prior to applying renders by saturating with water, or applying a suitable bonding agent as a primer or slurry.

Unless the substrate is reasonably flat and true, a render levelling coat should be applied prior to application of the waterproofing system.

**Note:** Structures built out of soft stone or random materials frequently present a problem. If the soundness of the surface is in doubt, consideration can be given to applying a stainless steel lathing, provided the water table is not high, or likely to be high. If water tables are high then an internal structural lining built out of block, designed by a structural engineer, could be considered or the structure will not take render.

### 5.1.2 Curing

After applying the system to the manufacturer's specification, care must be taken to ensure that the renders/coatings do not dry out too quickly. Curing must be carried out strictly in accordance with the manufacturer's specification.

Under no circumstances must the system be force dried in any way.

Care must be taken to ensure that spatter coats do not dry out prior to applying the next coat. These coatings should provide a good mechanical key for the following coat. If allowed to dry out, they can become weak and powdery, and actually act as a release plane for the next coat.

### 5.1.3 Fixings

Where possible, nothing should be allowed to penetrate the tanking after application. Where fixings are required the advice of the manufacturer should be sought prior to applying the system.

Power points, cables, light switches, pipes and any other services must be remounted in front of the waterproofing layer.

Angle beads should not be used within the system itself. If they are incorporated into the finishing coat, they should be of stainless steel or plastic.

### 5.1.4 Special Problems

Very fine hairline cracking frequently occurs at points where stress concentration occur, such as wall/floor junctions, retaining wall/partition wall junctions, where differing materials abut, etc.

Where these occur, the manufacturer of the system should have a specification to deal with the problem. The solutions usually involve either fillets to distribute the stress, or flexible membranes.

Bonding agents can be used to cope with situations where there is either insufficient suction for bonding, or so much suction that the hydrating water is removed. When the latter occurs, debonding and cracking is almost certain to occur.

Nitrates and sulphates cause deterioration of the waterproofing system over a relatively short period of time. The use of sulphate resisting cement in the renders is recommended, unless special additives are supplied by the manufacturer. Where this is the case, follow the manufacturer's instructions.

### 5.1.5 In Depth Crystallisation Slurries

These are specifically designed for the waterproofing of concrete structures. They comprise of a blend of cement, fine aggregates and active chemicals. The active chemicals react with water and un-hydrated cement in concrete to form insoluble crystalline complexes which block capillaries and pores within the concrete.

Before waterproofing materials are applied it is essential that surface laitance and any surface contamination be removed from the concrete. Concrete should be prepared using high pressure washing or grit blasting to give a clean open surface.

Application and curing is to be in accordance with manufacturers instructions. Applied to the surface by either brush or spray.

These materials can also be used as an “anti-lime” coating for cavity drain systems. Refer to manufacturers for guidance on this application.

### 5.2 Cavity Drainage Membranes

#### 5.2.1 Application on Walls and Ceilings

##### 5.2.1.1 Preparation

When used in existing buildings, any unsound plaster, 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.

Uneven substrates should be dubbed out or made good with a suitable render. They should be allowed to harden before the membrane is fixed.

Check and remedy using appropriate methods, any unacceptable leaks in the concrete or masonry substrate before the system is installed.

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.

5.2.1.2 Installation

General

The membrane should always be used with the flanged edge positioned in front of and overlapping the previously installed 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, are inserted into the holes and tapped 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.

5.2.1.3 Ceilings

Ceilings to be covered should always have a fall (as for vaulted cellar constructions) so water does not lie against the membrane or a joint. Special attention must be given to jointing and providing adequate overlaps in these situations.

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 ceiling, fixed in front of the ceiling membrane, and the gap sealed in accordance with the manufacturers' instructions.

5.2.1.4 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, prior to final fixings along batten runs. The lower sheet is always positioned in front of the upper sheet. Detailed instruction on the installation and jointing of wall membranes should be provided by the manufacturer.

The installation is conducted over windows and later the membrane is cut away to expose them, and the gaps sealed. For doors and some obstructions, the membrane is installed up to the perimeter and the gaps are sealed. 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.

5.2.1.5 Dry Lining

Preservative-treated timber battens of minimum dimensions 25 mm by 38 mm are fixed into the plug's internal fixing hole using the appropriate size screws. If required, approved mastic can be injected into the fixing holes to reduce the risk of water penetration

Alternatively, 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 a meshed membrane, approved for use for below ground applications. This will be fixed, sealed, and finished in accordance with the manufacturers' instructions.

5.2.2 Applications on Floors

5.2.2.1 Preparation

Unsound or loose coatings such as screeds, laitance, salt residues, mould growth or adhesives must be removed. If mould is present, the floor should be treated with fungicidal wash, (care should be to avoid contamination of watercourses when using fungicides). 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.

When a new concrete floor is being laid, it must be laid in accordance with BS 8204-1: 2003.

Prior to installing the cavity drainage membrane on the floor, clean the horizontal substrate and remove all dust and debris. The surface of the 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 or epoxy coating.

Carry out a flood test to ensure that any falls in the floor slab drain to drainage exits and pump sump stations, and that the drainage system works effectively.

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 to that is to be used.
5.2.2.2 Installation

Before the floor membrane is laid all necessary perimeter drainage and access service points should be installed see 5.2.2.4.

The membrane is rolled out, with the domes 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.

5.2.2.3 Floor Coverings

Before floor finishes are installed insulation boards can be laid over the membrane, (seek manufacturer’s guidance).

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 50 mm. 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.

5.2.2.4 Drainage

Floors should have a drainage outlet point. The floors must be “dead level” or have a fall towards the outlet point or drainage channel.

Perimeter drainage channels used in conjunction with wall and floor membranes to 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.

6. MAINTAINANCE

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 his responsibility to maintain the property. Special attention should be paid to:-

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

6.1 Cementitious Systems

Cementitious waterproofing systems usually require little maintenance; however, it is important to note that these systems rely on the integrity of the applied membrane to hold back water. Any action that may perforate, puncture or damage the waterproofing system should be prevented.

In the event that a cementitious waterproofing system is perforated a specialist must be employed to instigate repairs. This advice should be communicated to the client by the specialist in the contact or specification.

6.2 Cavity Drain 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 drainage channels and sumps should 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.

In circumstances where pumps are running for
long periods of time, or where the system is subject to settling or the deposition of free lime, service intervals may be far shorter. The specialist that has the responsibility for any guarantee issued or providing assurance that the waterproofing system is fit for purpose must be responsible for setting these service intervals.

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.

6.3 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 grades 3 & 4 (BS8102) should usually include reference to heating and/or ventilation. (see 7.1.1)

7. PROBLEM SOLVING

The following is a summary of some common faults and their possible solutions.

7.1 Assessing the Cause

Dampness on the surface of a waterproofing system will invariably be as a result of one of the following:

- Internal plumbing leaks
- Surface condensation
- Interstitial condensation
- Permeability of the waterproofing system

A break in the waterproofing system, such as cracking

A failure or blocking of cavities, drains or pumps in a cavity drainage system

Cracking and de-bonding of a waterproofing system can have many causes, of which the following are the most common:

- Insufficient key on the substrate
- Dirt, dust, paint or other contamination on the substrate surface
- Substrate too weak to accept the renders
- Incorrect render mixes
- Insufficient curing
- Excessive or insufficient suction
- Chemical/ salt attack (sulphate, nitrate, etc)

7.1.1 Internal Plumbing Leak

When internal plumbing defects occur these can manifest themselves in many ways depending on the location and severity of the leak. It is important that the surveyor investigating dampness in the building is aware of the location of water and central heating pipes before investigations begin.

When plumbing leaks are detected these should be repaired and the extent of the water damage must be properly quantified. Any making good to the wall and floor finishes should be undertaken by the waterproofing contractor to ensure that this dose not compromise the waterproofing system.

7.1.2 Surface Condensation

If the surface is damp, but immediately behind the surface it is dry, then the dampness is almost certainly surface condensation.

The use of a diagnostic hygrometer and surface thermometer can be used to check if condensation is occurring at the time of the inspection. If not, a ‘condensation telltale’ can be left on the surface. It can be electronically interrogated at a later stage to see if condensation has occurred.

If there is still doubt, a check for salts will help. The presence of chlorides and/or nitrates would probably indicate that there is lateral penetration of ground water. (Beware, however of contamination from other sources, such as salt from water softeners, salts that are introduced in building materials or nitrates from damaged drains etc).

7.1.3 Interstitial Condensation

Much more difficult to verify, interstitial condensation can be checked with a diagnostic hygrometer and deep probe thermometer.

Interstitial condensation is most frequently associated with the application of a vapour check to the surface of the tanking system. If this is the case, then the vapour check needs to be removed and the system allowed to dry out before further assessment can be done. If the surface does not
dry out, check the system for the presence of hygroscopic salts which could have passed through the waterproofing system by diffusion.

7.1.4 Permeability of the System
If the waterproofing system has had renders and plasters applied over it, it will be necessary to remove these layers prior to assessing where water is permeating through the system.

If condensation is ruled out and the damp patches seem to follow an ill defined pattern, then it is likely that there is some water penetration through the system itself.

7.1.5 A break in the waterproofing system
If the waterproofing system has had renders and plasters applied over it, it will be necessary to remove these layers prior to assessing where there is a break in the system.

If the dampness emanates from a distinct point, or points, then a pinprick hole is likely. If it seems to be over a large area, but follows a line, then cracking is likely.

7.1.6 Failure of Drains and Pumps
Blockage of cavities and drains, or a failure of pumps can result in uncontrolled water building up within a cavity drainage system. Water or dampness will come through as a result. It is essential that some form of access for water jetting and/or maintenance is planned and built into the system.

7.1.7 Cracking and de-bonding of Renders
Where renders crack and de-bond, it will be necessary to remove a section of the render to examine the substrate/render interface and, if necessary, to send the render for analysis for contaminating salts.

Usually, when de-bonding render is removed the cause of the de-bond is obvious from a visual inspection, e.g. dust or paint on the substrate, or incorrectly gauged render mixes.

7.2 Effecting a Cure
Having diagnosed the likely cause of continued dampness, the following remedies may be considered.

7.2.1 Condensation
Surface condensation can usually be cured 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 provided any vapour checks present have been removed. If it is found that hygroscopic salts have diffused through the tanking and are causing a problem, consideration must be given to replacing the damaged system.

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.

Further information on condensation can be found in the PCA Technical Information Leaflet DP3.

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

7.2.3 Cavity Drainage Systems
Regular maintenance of all channels, gullies, sumps and pumps must be undertaken to ensure that water can not build up behind the membrane.

7.2.4 Cracking & De-bonding
All cementitious systems are prone to shrinkage, so cracking and de-bonding is something that will invariably occur to some degree.

It is difficult to be specific about when remedial work becomes necessary, although consideration should be given to removing and re-applying affected areas in the following circumstances:-

1. When moisture penetrates the crack.
2. If the cracks are excessively unsightly.
3. If the render starts coming away from the substrate.

7.3 Tests for Conformity
It is not normally considered necessary to test pre-mixed materials for conformity to manufacturer’s specifications while they are being built in, as any testing necessary is usually done before arriving on-site. However, there may be occasions where the testing is considered necessary for a precautionary reason, or if there is a failure of the system during the construction phase.

Where mixes are made up on site, or where a material is used as an additive for a specified mix, conformity tests might be required by the client as routine, or if there are failures.

7.3.1 Proprietary Materials
Where testing of a proprietary material is required, this is best done through the manufacturer. The formulae for pre-mixed materials are usually a closely guarded secret, and will not be readily disclosed. Any testing done by an independent laboratory will be of dubious benefit if the formula for the material is not known.
7.3.2 **Mixes Batched on Site**
If the mix is a render, the conformity that would normally be required would be testing that the aggregate: cement and water: cement ratios are correct, and that the correct sands have been used. There are several independent testing laboratories who undertake this work.

If there are special additives used in the mix, the testing can be done either by the manufacturer, (if they offer this service) or by an independent laboratory, with the manufacturer's co-operation.

7.4 **Tests for Contamination**
Where it is thought that problems are caused by contaminating salts, either mixed into the materials or which have accumulated over a period of time, then an independent laboratory will provide the necessary testing facilities.

Simple salt analysis kits for on-site testing of the common salts such as chlorides and nitrates are available, and can be very beneficial. However, they will not provide information on sulphates, acids, oils, etc. This information will need fairly specialised equipment, and is usually only found in an established laboratory.

7.5 **Use of Moisture Meters**
Moisture meters in a basement situation should be used with great caution. Due to environmental conditions, a small degree of dampness will usually be present in basements and show on a moisture meter. The meter should be used for a comparative readings, and then only by an experienced person.

Where hygroscopic salts are suspected, the wall should first be checked. If salts are present, do not use a moisture meter but investigate the cause of the salt that is present.

Under no circumstances should a wall be tested for moisture in depth. Results will be meaningless as there will usually be significant dampness immediately behind a tanking system.

Further information on the use of moisture meters can be found in PCA Technical information Leaflet DP1.

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