

## Major Projects: below ground structural waterproofing risk assessment

### Introduction

This update provides guidance on the requirements associated with the design and construction of basements and other below ground structures. Principally, this concerns the process by which the risk of ground water penetration is appraised and addressed so that problems associated with penetration do not occur while consideration is also given to economic construction.

This process and rationale is primarily detailed within BS 8102 (2009) Code of Practice for protection of below ground structures against water from the ground (and other associated design guides). A risk assessment is to be provided prior to the submission of drawings to ensure that the site specific constraints are considered in the design proposals submitted.

The early involvement of a waterproofing designer is an important consideration because the waterproofing design typically has an influence on elements of the structural and/or architectural design. Early involvement allows the waterproofing to be duly considered in association with these other aspects and prevents situations where design fees are increased as a result of necessary redesign, or where waterproofing is compromised by working within the constraints of an ill-considered structure relative to achieving the required standard of environment.

### Applicable Functional Requirements to be regarded in the production of a below ground structural waterproofing design risk assessment

### Workmanship

- All workmanship must be within the tolerance requirements set out in the Premier Guarantee Technical Manual.
- All work is to be carried out by a technically competent person in a workmanlike manner.
- Concreting shall not take place during cold weather periods where the working temperature is below 2 degrees C or where ground conditions are frozen.
- Evidence of certification is required for any work completed by an approved installer.

### Materials

- All materials should be stored, installed and protected correctly in a manner that will not cause damage or deterioration of the product.
- All materials, products and building systems shall be appropriately tested and approved for their intended purpose.
- The structure shall, unless specifically agreed otherwise with the warranty provider, have a life of not less than 60 years. Individual components and assemblies, not integral to the structure, may have a lesser durability, but not in any circumstances less than 15 years.

### Design

- Foundation type and depth must be suitable to resist any movement including that due to the influence of nearby trees.

- Basements shall be appropriately designed to ensure that they adequately provide a suitable barrier against contaminants, ground gases and ground water.
- Design details of the basement waterproofing techniques must be provided prior to commencement onsite.
- The basement waterproofing design should be completed by a suitably qualified waterproofing specialist and have appropriate professional indemnity cover which covers their business activities, They must also have an understanding of hydrogeology and soil mechanics and hold a relevant professional qualification i.e. Certificated Surveyor in Structural Waterproofing (CSSW). The structural design must be coordinated with the waterproofing specialist to provide a site specific design.
- The CSSW qualified designer should provide a design philosophy which clearly sets out the desired grade of the environment to be achieved. The design philosophy should clearly set out how the specified design will provide the required environmental grade based on the specific hydrology and ground conditions of the site.

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## General guidance

For warranty purposes it is required that all below ground structures including partial, semi and full basement are be designed and constructed to a minimum of Grade 2 to BS 8102 (2009), with Grade 3 to BS8102 (2009) being necessary for habitable occupied spaces. An exception to this is a basement used solely for underground car parking, where a Grade 1 is accepted.

In order to meet the requirements of BS8102 the following must be considered:

- 1) It must be assumed that groundwater will be present at some time in the structure's life.
- 2) It must be assumed that defects will exist within the system.
- 3) The consequence of those defects must be considered.
- 4) If the consequence of those defects is unacceptable such as flooding then remedial work to the installed system must be feasible.

## The aim of the below ground structural waterproofing risk assessment

The risk assessment is to be produced in order to demonstrate the risks and then compare this to the proposed design. Assessment of a site must be based on the results of the site investigation and other site-specific factors. Seasonal variations in the water table must be accounted for unless long-term monitoring is undertaken. However, even where standing water levels are not noted during such pre-start site investigation, the drainage characteristics of the ground must receive particular attention.

Soils with low permeability represent a risk of waterlogging or encouraging a 'perched water table', where water stands temporarily or permanently within the ground against a structure, and arguably this affects more properties with basements versus the true water table level.

It could be assumed that, based upon a site investigation, the risk of water pressure ever occurring is low, BS 8102 advises that consideration is given to the effects of climate change and burst water mains and sewers, as well as stating that it should be assumed that there is risk of waterlogging "even where site examination indicated dry conditions".

In summary, the site investigation guides the design, but it should never be assumed that some degree of water pressure will not occur. We will require a specific design risk assessment of the geology, hydrology, services, water ways which will have an impact on the basement structure by causing the structure to be subjected to a head of water in the event of leaking services, rise in water table, etc.

## Provision of land drains

The purpose of a land drain is to relieve hydrostatic pressure from the structure walls to prevent water from bearing against the structure. The incorporation of maintainable land drains can be used under appropriate ground conditions. Scheduled maintenance of land drains is required.

The potential implications on the moisture content of the soil and the potential impact on adjacent structures must be considered in the design. Provision of a land drainage is not to be classed as one form of water protection e.g. when two forms are required AND that they must be connected to a reliable point of discharge.

A maintainable land drain must not to be positioned closer than a line of 45 degrees from under side of slab/blinding of with invert above upper surface of floor slab.

## What should a structural waterproofing report include?

The following guide is intended to support design teams as to what should be included in a below ground structural waterproofing risk assessment.

### **1) State the name of the CSSW waterproofing specialist who is taking full design responsibility for the structural waterproofing for the scheme.**

All design decisions made by others e.g. change of the structural design of the retaining wall, that might have an impact on the waterproofing design should be brought to the attention of the waterproofing specialist/designer and installing contractors. Final decisions and any recommendations should be approved by named the designer above.

Where relying on the use of waterproofing product manufacturer 'standard details', they typically disclaim design responsibility, so it is incumbent on the waterproofing design specialist to ensure that such details are correct and appropriate for the site and structure or offer suitable variation and it is the responsibility of the stated designer to ensure that the structural waterproofing design appropriate based on the site specific constraints encountered.

### **2) Drawings, reports and other information relied upon by the CSSW designer.**

### **3) Provide a narrative evaluation of hydrogeological ground conditions relating to the site.**

### **4) Provide a narrative risk assessment should be carried out which considers the long-term water pressures, the effects of surface water infiltration and the use of external drainage and cut-off walls.**

### **5) Confirmation of water table classification in accordance with BS 8102 Table 1 and confirmation of suitability against hydrogeological ground conditions identified.**

**6) Confirmation of waterproofing protection construction approach selected in accordance with BS 8102 Table 1.**

Note: One, or a combination, of the following types of waterproofing protection should be selected:

- a) Type A (barrier) protection;
- b) Type B (structurally integral) protection;
- c) Type C (drained) protection.

When making this selection, consideration should be given to:

- 1) The potential need for combined protection
- 2) The water table classification and required performance level
- 3) The requirement for continuity in the structural waterproofing protection.

Where a tanking product is proposed by the contractor and is outside of the waterproofing specialist design report, the waterproof specialist should endorse its use within their design remit.

**7) Confirmation of Waterproofing Protection approach selected in Accordance with BS 8102 Table 2, acknowledging the requirements of the technical manual will be achieved.**

**8) Provide a Narrative Risk Assessment evaluation confirming:**

- The effects of climate change;
- Burst water mains and sewers;
- Adjacent trees;
- Sulphates;
- Radon;
- Methane and other ground gases and contaminants;
- Overspill from guttering or edge draining balconies
- Where external drainage is proposed;
  - the effects of drawdown on adjacent structures;
  - the potential silting of drainage;
  - biofouling issues.

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

**9) Detail any Quality Control or Quality Assurance processes recommended for the scheme based on the construction approach.**

**10) Provide confirmation of any expected ongoing maintenance required relating to the system selection and identify who will be responsible for this (installer/client/end user etc.)**

Note: Details of maintenance, commissioning and handover pack proposed are critical to the long term success of any "Type C" system specified.

**11) Provide a Narrative Evaluation of how potential remedial work could be undertaken and the feasibility of any remedial work in the event of a defect occurring relevant to the construction approach specified.**

Note: Within BS 8102, waterproofing specialists are advised to consider the probability that systems may not be installed perfectly and that defects may occur as a result of this, or defects may be present in the supplied materials.

**12) A full set of tanking design drawings including product details and detailing connections / lapping particularly at ground level is to be provided.**

Please include details and specific products proposed for the scheme, not limited to but including:

- Any movement joint
- Any construction or day joint, including confirmation on maximum pour sizes for concrete.
- Pipe penetration through wall and floor or similar
- Fixings
- Provision of waterstops
- Wall to floor junction
- Wall to DPC at ground level showing how continuity of structural waterproofing is achieved.
- Detail of how transition between varying grades of structural waterproofing are achieved.

*Every care was taken to ensure the information in this article was correct at the time of publication. Guidance provided does not replace the reader's professional judgement and any construction project should comply with the relevant Building Regulations or applicable technical standards. For the most up to date Premier Guarantee technical guidance please refer to your Risk Management Surveyor and the latest version of the [Premier Guarantee technical manual](#).*

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