A Guide to Structural Waterproofing

Part One
Waterproofing Protection For Below Ground Structures
• Grace Construction Products, a brand you know and trust has a new name: GCP Applied Technologies.
• Customers in more than 110 countries
• Operations on six continents
• Approximately 2,850 employees with $1.4bn net sales (2015)
BS8102:2009: Code of Practice for Protection of Below Ground Structures against Water from the Ground

- BS8102 gives recommendations and provides guidance of methods of dealing with and preventing the entry of water from surrounding ground into a structure below ground level.

Institution of Civil Engineers (ICE): Reducing the Risk of Leaking Substructure a Clients Guide

- An ICE client guide explaining substructure waterproofing issues and the risks associated with waterproofing
Waterproofing Strategy

- Design Flow Chart
- Design Team
- Clients Requirements
- Desk Study
- Risk Assessment
- Consequences of Failure
Assess the risks from external environment, then adopt a waterproofing strategy capable of achieving client’s requirements

- Early inclusion of waterproofing specialist
- Clear understanding of clients requirements and expectations
- Develop strategy and select waterproofing system as part of overall robust solution

**Design Flow Chart**

**Initial Information**
- Design Philosophy
  - Design Team
  - Site Evaluation
  - Desk Study
  - Risk Assessment
- Water table Classification
- Review of Structure
  - Type (e.g., New or Existing?)
  - Intended use
  - Foundation form and design
  - Construction Methodology

**Structural Design Considerations**

**Selection of type A, B or C Waterproofing Protection**

Is combined Protection Necessary?

- Has Buildability been considered?
- Has repairability been addressed?

- Yes
- No

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

The waterproofing specialist should:

- Be suitably experienced;
- Be capable of devising solutions that accommodate various projects constraints and needs;
- 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.
Clients Requirements

• Does the client understand the difference between wet; damp; dry?

• Have the costs associated with achieving a DRY basement been considered?

• What are the consequences of failure?

• Has the future use of the building been discussed?
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Site Evaluation - Desk Study

• Hydrostatic head, water table and perched water table

• Local topography, soil type, contaminants, gas

• Missing information obtained by physical site investigation

BS8102:2009 5.1.1

• Historical information
• Long term water pressures

• Affects of surface water infiltration

• Use of external drainage

• Effects of climate change, burst water mains sewers.

• Effects of drainage on existing neighbouring structures

• Effects of gas or contaminants
For variable or non free draining strata the classification is considered as high.
Potential Water Ingress

- Ingress may occur from more sources than just groundwater.
Consequences of Failure

- Disputes costs, legal fees
- Private or public property damage liability
- Endangerment of building operative or public from damage to electrical equipment
- Damage to archives, stored goods or plant
- Loss of rent
- Reduction in value of property
- Damage to reputation of landlord/developer
- Facility, business disruption
- Lack of access/utility of basement areas
- Costs of remedial work and operational delays
Waterproofing System Selection

- BS 8102:2009 Basement Grades
- BS 8102:2009 Protection Types
- Water Migration
- Guidance on Combined Systems
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Basement Grades - BS 8102: 2009

Wet

Grade 1 Basic Utility
Car parking; plant rooms (excluding electrical equipment); workshops

Damp

Grade 2 Better Utility
Plant Rooms and Workshops requiring drier environment than grade 1

Dry

Grade 3 Habitable
Ventilated residential and commercial areas incl. offices, restaurants; leisure centres
Apart from managing the risks, it is important to understand the waterproofing options available; each method will have cost and space implications for the basement scheme.
### Pre-Applied Bonded Membranes
- Applied prior to placing of structural concrete
- Full and intimate bond
- Eliminates water migration vertically & horizontally
- Suitable for alkaline soil conditions
- Unaffected by wet dry cycling

### Bonded Sheet Membranes
- Full & intimate bond vertically
- Eliminates water migration vertically
- Some can be suitable as gas protection
- Some can be used in alkaline soil conditions

### Cementitious Coatings
- Designed for negative water pressure
- Eliminates water migration vertically
- Good as solution to complex details
- Ideal as remedial solution
Water Migration
**Mastic Asphalt**
- Must be applied in three coats
- Dated technology that requires heat
- Can become brittle with age

**Mechanical Key Membranes**
- Mechanical key to concrete
- Does not resist water migration

**Bentonite Carpets**
- Mechanical key to concrete
- Does not resist water migration
- Not suitable for alkaline ground
- Wet/dry cycling?
**Structural Design**
- Controlled crack width
- Additional protection may be needed
- Can be cost prohibitive due to steel content

**Concrete Design with Admixture**
- Requires proper curing of the in-situ concrete.
- No requirement for vapour barrier
- QSRMC/BSI accredited ready-mix supplier.
- Should be considered as part of a system that includes water stops

**Sheet Piled wall**
- Additional protection may be needed
- Relies on workmanship
- Can be used as part of a redundant post injection system.
Typical Type C Solutions

**Drained Cavity**

- Installed internally after construction of basement.
- No hydrostatic pressure on sheets designed more minor seepage.

**Open Cavity Design**

- Installed after basement construction
- Does not prevent vapour transmission
Use of Combined Protection Systems Reduces Risk

- Consider combining multiple systems of waterproofing where:
  - Assessed external risks are high
  - Consequences of failure to achieve desired internal environment are high.
Detailing - Adopt a Simple Approach

- Involve the waterproofing specialist for advice
- Ensure continuity with above ground DPC/building envelope.
- Consider buildability and order of works.
Potential risks identified in the waterproofing strategy should be understood by the whole team.

Changes to sequence of works will have a major impact on waterproofing integrity.

Ensure the contractor has the prerequisite experience to install the chosen system.
Basement Grades - BS8102
Grade 1 - Wet
Grade 2 - Damp
Grade 3 – Dry

Protection Types
Type A – Barrier
Type B – Structural Integral
Type C – Drained Cavity

- Look for Materials that limit water migration.
- Consider combined systems where the risks & consequences of failure are high
Successful Waterproofing Protection For Below Ground Structures relies on these three elements.

System Choice

Substructure Protection

Design

Workmanship
Any Questions?

Thank you for your attention & participation
THE BRAND YOU KNOW AND TRUST HAS A NEW NAME

For additional information, please visit www.gcpat.com or contact: preprufe@gcpat.com

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