A Guide to Structural Waterproofing

Part One

Waterproofing Protection For Below Ground Structures

gcp applied technologies

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Table of Contents

GCP Around the World

- 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

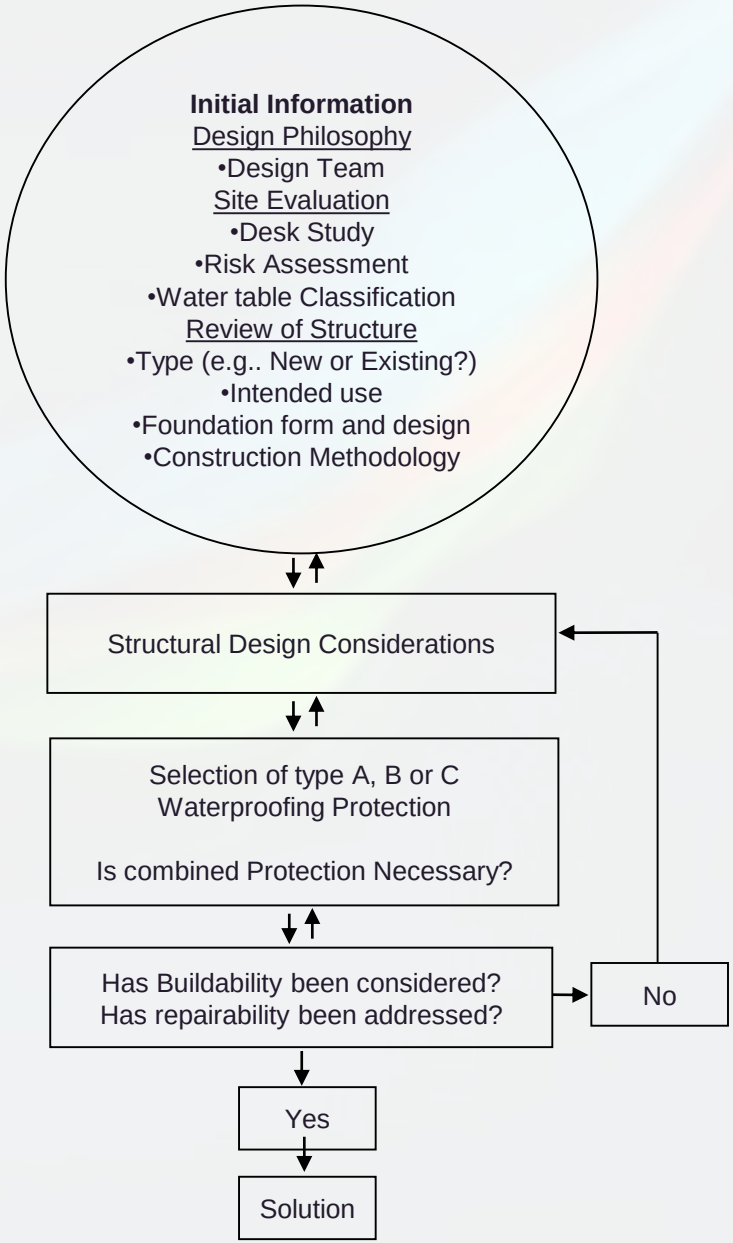
Waterproofing Strategy

- Design Flow Chart
- Design Team
- Clients Requirements
- Desk Study
- Risk Assessment
- Consequences of Failure

Design Flow Chart

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 Team

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

The waterproofing specialist should:

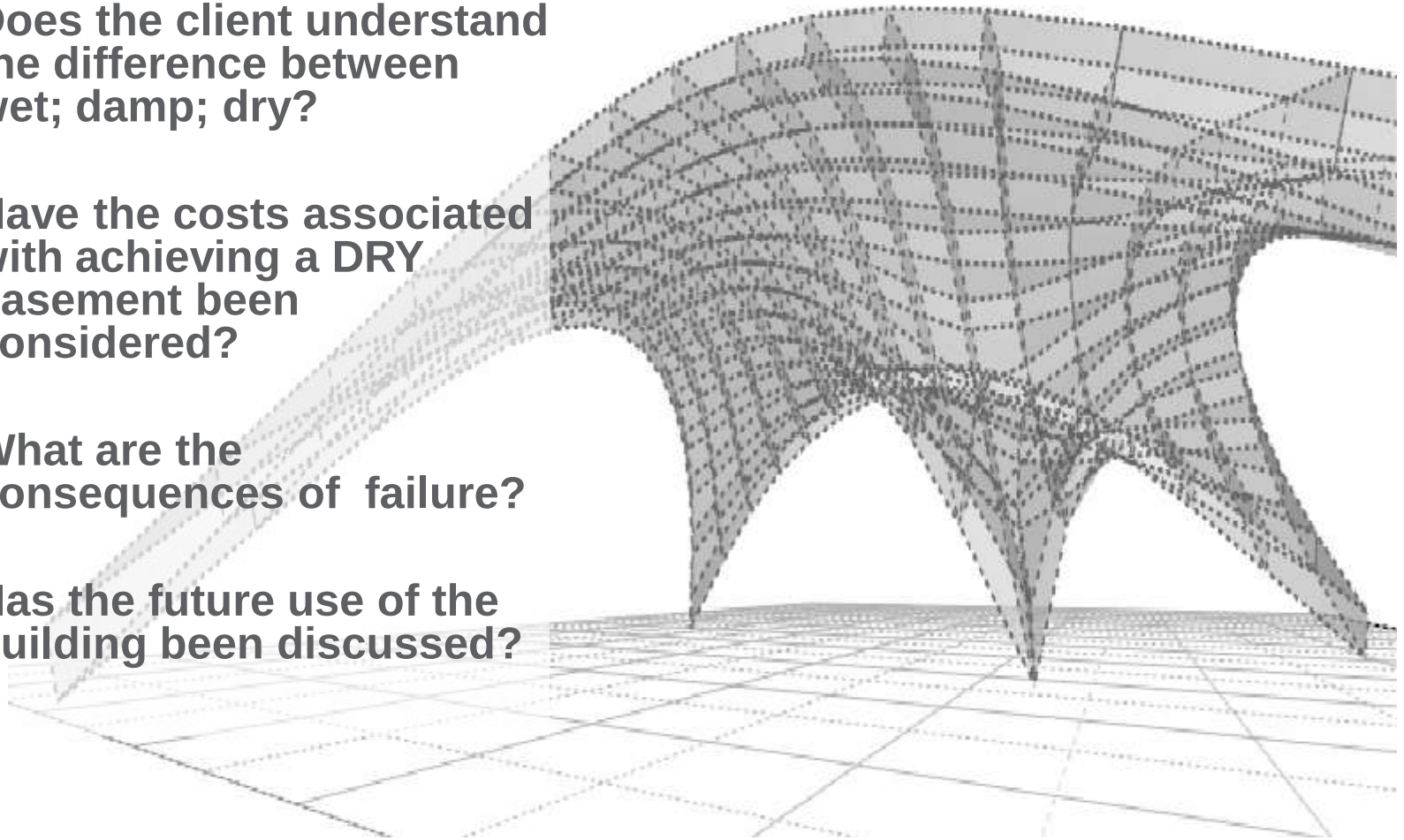
- Be suitably experienced;
- Be capable of devising solutions that accommodate various projects constraints and needs;
- Provide the design team with information and guidance that assists with and influences the design, installation and future maintenance of the waterproofed structure

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

BS8102:2009 clause 4.2

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?**



Site Evaluation - Desk Study

- Hydrostatic head, water table and perched water table
- Local topography, soil type, contaminates, gas
- Missing information obtained by physical site investigation

BS8102:2009 5.1.1

- Historical information

Site Evaluation – Risk Assessment

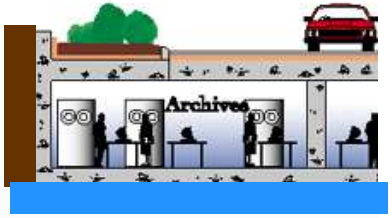
- Long term water pressures
- Affects of surface water infiltration
- Use of external drainage
- Effects of climate change, burst water mains sewers.
- Effects of drainage on existing neighbouring structures
- Effects of gas or contaminates

BS8102:2009 5.1.2

BS8102:2009 Water Table Classification

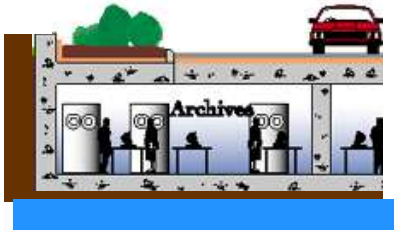
High

Permanently above underside of the base slab



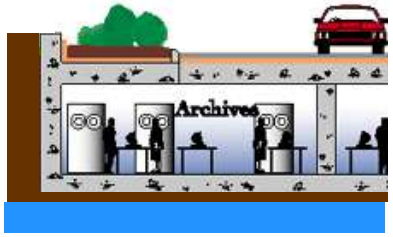
Variable

Where the water table fluctuates



Low

Permanently below underside of the base slab in free draining strata.



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 grade1

Dry

Grade 3 Habitable

Ventilated residential and commercial areas incl. offices, restaurants; leisure centres

Protection Types

A

Barrier

Physical Barrier

- Fully Bonded Membranes, Loose Laid Geosynthetic Clay Liners
- Cementitious Renders, Liquid Waterproofing Systems

B

Structural Integral

Protection by Design

- Admixtures, Controlled Crack Width Design
- Sheet Pilling (may need further protection)

C

Drained Protection

Cavity Drain

- Preformed Cavity formers
- Designed Open Cavity

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 (ICE) REDUCING THE RISK OF LEAKING SUBSTRUCTURE A CLIENTS GUIDE

Typical Type A Solutions

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

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Typical Type A Solutions

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?

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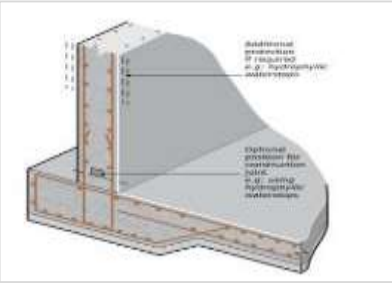
Typical Type B Solutions

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

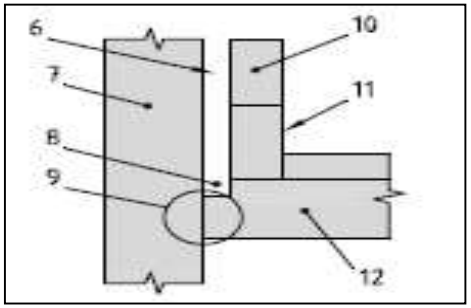
- Additional protection may be needed
- Relies on workmanship
- Can be used as part of a redundant post injection system.

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.

Quality Waterproofing Demands Teamwork

- 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

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Systems Summary

Basement Grades - BS8102

Grade 1 - Wet

Grade 2 - Damp

Grade 3 – Dry

Protection Types

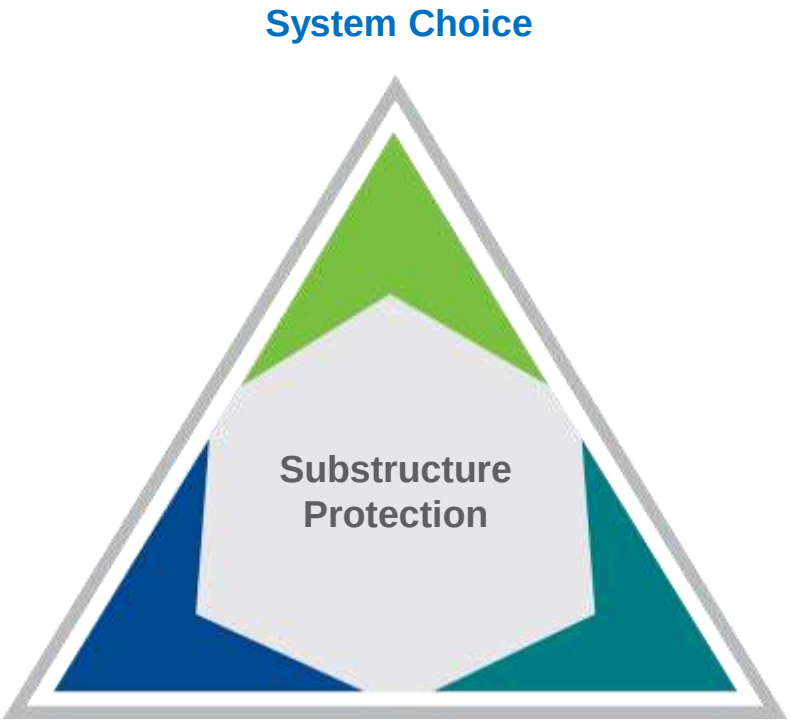
Type A – Barrier

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**

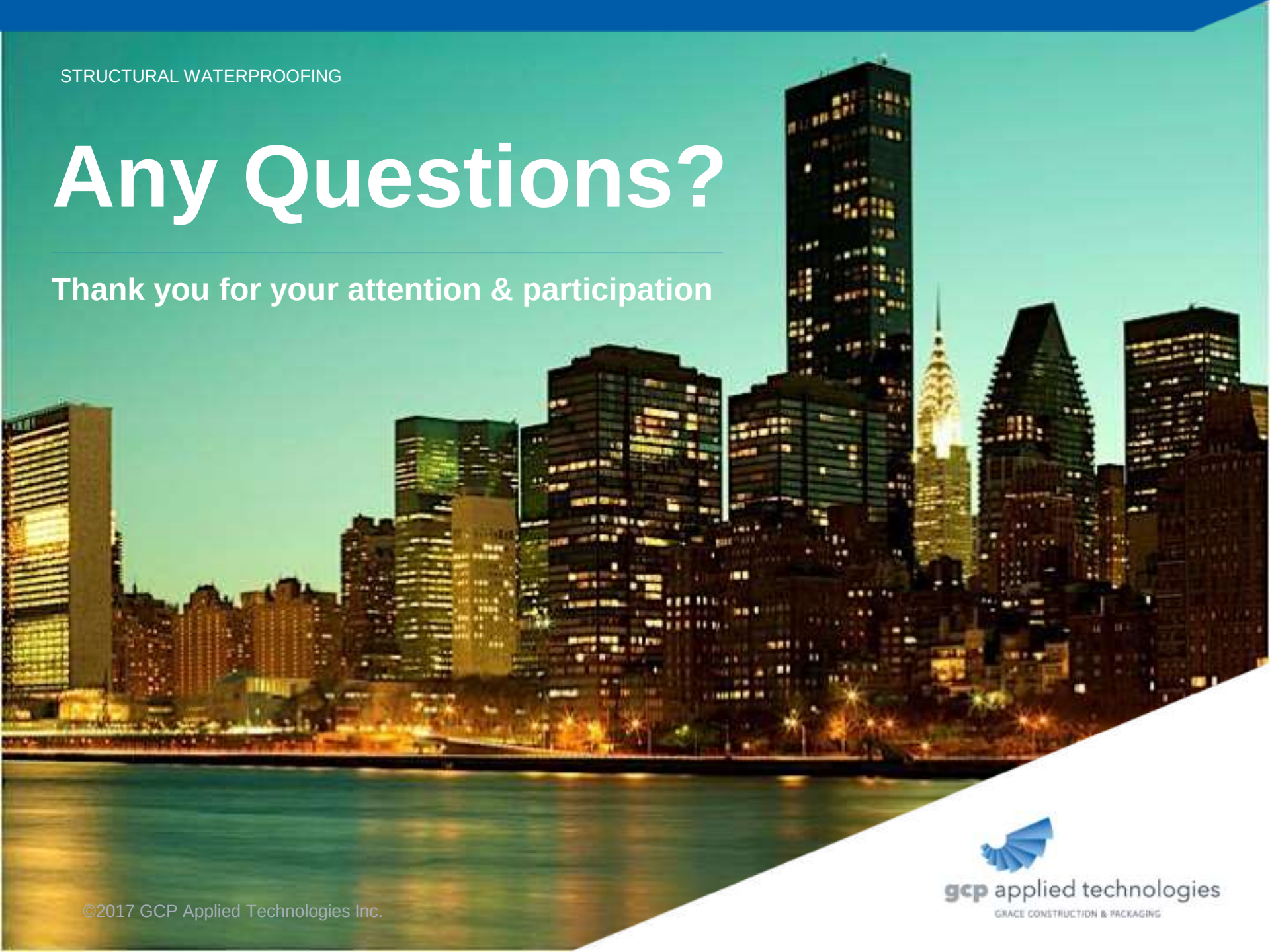
Summary



Successful Waterproofing Protection For Below Ground Structures relies on these three elements.

Any Questions?

Thank you for your attention & participation



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