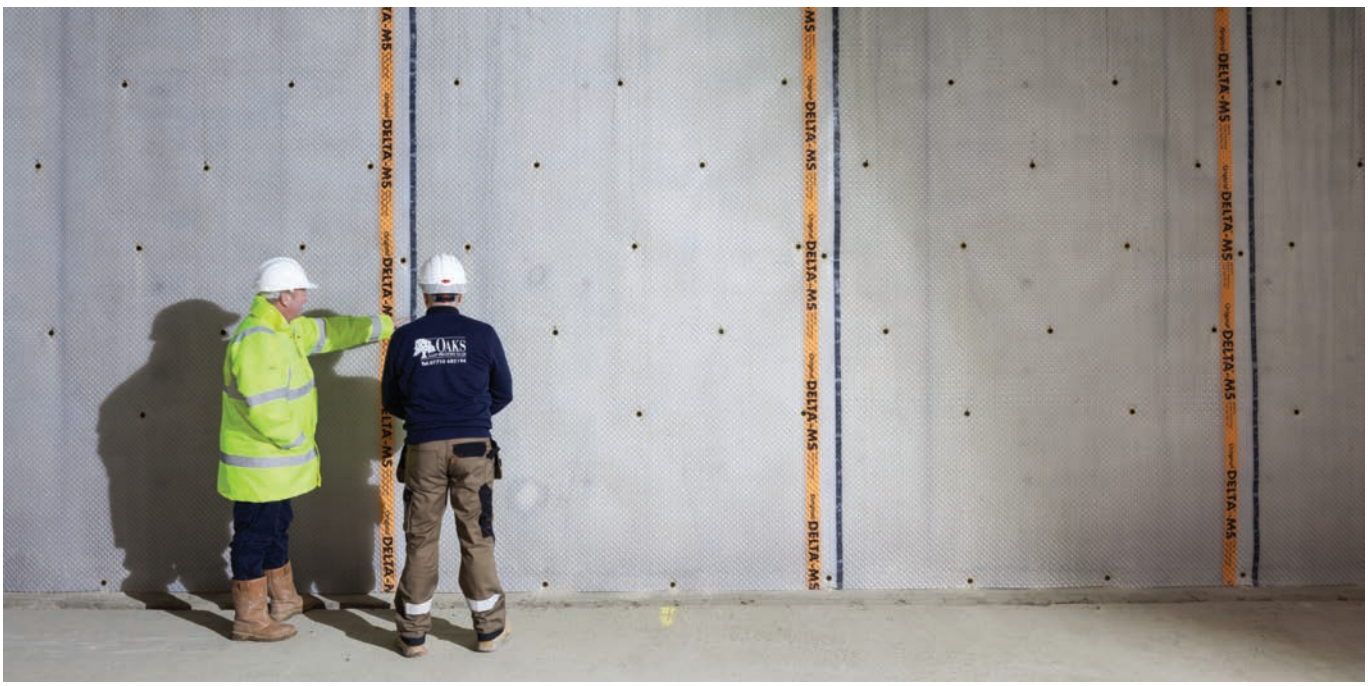
Watertight concepts

Christopher Burbridge from Delta Membranes looks at the importance of concrete in below ground waterproofing, and the key factors for achieving a robust specification



The restrictions Covid-19 will inflict on the construction industry, and how the pandemic might influence how we work in the future, is very much an unknown. Of huge reassurance is that the industry is well versed in dealing with difficult times, and adapting to change. We often think of the word "change" as being a negative, however, it can help us to develop a more resilient approach and assist with our capacity for growth and learning.

One material which has definitely seen a lot of coverage during the pandemic has been concrete. With many plants closing during lockdown, concrete supplies were choked off, with limited options and increased lead times. Construction projects rely heavily on quarry products, and this will have impacted on projects in various ways ranging from delays to sourcing new supplies.

The strong industry demand for concrete, due to its many important attributes such as in structural waterproofing, will continue in importance, as specifiers look to ensure life-cycle oriented design and reliable, durable and robust waterproofing solutions.

Structural waterproofing

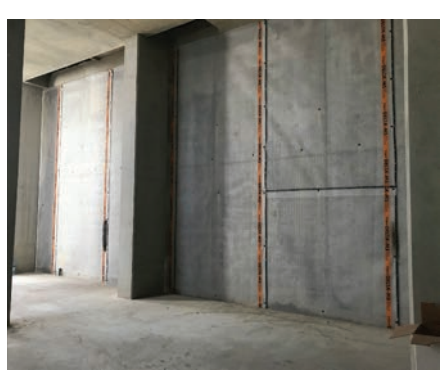
In terms of types of structural waterproofing, concrete is classed as a Type B, integral protection system. British Standard BS 8102:2009, which all waterproofing systems should adhere to, defines three types of systems.

Type A (Barrier) Protection

Also historically referred to as 'Tanking,' this provides protection against groundwater ingress by applying a waterproof material to the internal or external walls and floor slab of a basement or underground structure, forming a barrier between the structure and any groundwater. Historically, methods for Type A systems included internal, external and sandwich.

Type B (Structurally Integral) Protection

This is protection against water ingress provided by the structure itself. Type B



The devil is in the detail – all waterproofing elements must be considered at the construction design stage to be durable and effective

Protection relies heavily on the design and materials incorporated into the external shell of the structure.

Design, materials, as well as the quality of the workmanship, contribute to the success of Type B Systems. The pattern of any seepage encountered is often associated with poor joints, cracks or other 'discontinuities' such as service penetrations.

Type C (Drained) Protection

Provided by an internal water management system, Type C Protection allows moisture or running water to penetrate through the external wall or floor of the structure and to travel behind the membrane in a controlled drainage system. Type C systems collect and manage water ingress by diverting it into a designated safe point of disposal (such as a sump pump/package pump station).

Waterproofing systems for below ground structures have stringent requirements regarding durability, exposure and stress conditions. Today, the service life of modern reinforced concrete and glass curtain wall buildings is required to be 60 years or more, and in conventionally built structures (masonry and wood) up to 120 years is expected. The lack of water-tightness in a structure can severely reduce the service life however.

Water ingress over time will result in a physical attack and deterioration of the concrete and embedded steel.

While concrete is classed as impermeable, the water tightness of a Type B construction system is reliant upon the design and construction of the basement as an integral shell. Designing and constructing a concrete structure to be watertight requires good crack width control, waterstops/waterbars in joints, design considerations to service penetrations, and the use of suitable concrete such as a reinforced or waterproof variety, with admixtures included. Concrete which incorporates a range of admixtures has improved resistance to water ingress.

To establish a waterproof structure when using concrete, it's essential to follow good concrete practices. The importance of ensuring concrete is fully compacted and cured should be fundamental. If compaction is not appropriately carried out various problems may arise, such as honeycomb, loss of strength and increased risk of cracks. Poor compaction of concrete can also lead to water entry via capillaries and pores.

The compaction process expels trapped air from freshly placed concrete, and packs the aggregate particles increasing the density of concrete. Adequate compaction is essential in maintaining the structural integrity of a structure, especially in basement slabs. It increases the concrete's ultimate strength, as well as durability and resistance to water ingress, while minimising shrinkage and the chances of cracking while enhancing the bond between concrete and reinforcement.

Project failure can happen to any project, and there are an infinite number of potential reasons. In most cases, failure is controllable. There are many common pitfalls when it comes to designing a robust waterproofing system. Products do not fail; when failures occur, it is due to the design and build philosophy not being correct. The devil is in the detail – all waterproofing elements must be considered at the construction design stage to be durable and effective.

Expect your structural waterproofing designers to advise on what tests they would expect to see for your scheme, such as geotechnical and soil testing. Waterproofing design approaches should encompass the entire project, with consideration to technical challenges – which can arise from soil conditions, water tables, groundwater conditions and environmental changes – whilst anticipating any defects such as improperly cured concrete, inadequately designed foundations, or poor workmanship.

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