

WHITE PAPER

The Fundamentals of Below-Grade Waterproofing Systems: Enhancing Durability and Sustainability

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SMART CONCRETE®



Executive Summary

Concrete, known for its strength and versatility, is a fundamental material in the construction industry. However, its vulnerability to environmental factors like water infiltration necessitates advanced waterproofing and durability measures to ensure the long-term safety, performance, and sustainability of structures. This guide explores these critical aspects, focusing on modern solutions that enhance concrete's resilience against environmental challenges, reduce maintenance costs, and contribute to more sustainable construction practices.

Key Considerations for Below-Grade Waterproofing

1. Concrete's Dual Role with Water

- Concrete's porous nature and its tendency to crack under stress make it vulnerable to water damage.
- Effective waterproofing ensures the serviceability and health of structures while extending their lifespan.

2. Types of Waterproofing Systems

- Type A: Barrier protection using external membranes or coatings.
- Type B: Integral waterproofing with admixtures like PRAH for hydrostatic conditions.
- Type C: Internal cavity drainage systems for water management.

3. Standards and Best Practices

- Adherence to BS 8102 and ACI 212 ensures performance and longevity.
- Early integration of waterproofing strategies in the design phase is critical.

4. Innovative Solutions

- Kryton's crystalline technology offers self-sealing properties, reducing permeability and mitigating shrinkage-induced cracks.
- A complete system approach ensures compatibility and maximizes performance.

Case Study: Boeing Center

The Boeing Center in the United States showcases the durability of Kryton's crystalline waterproofing technology. For over 40 years, this system has provided effective protection against water ingress, demonstrating its value in demanding conditions. Such success stories highlight the importance of investing in robust, long-lasting waterproofing solutions.





Table of Contents

1. Introduction

- Purpose of the Whitepaper
- Importance of Below-Grade Waterproofing

2. Understanding Concrete Permeability

- The Dual Role of Water in Concrete
- Porosity, Cracking, and Pathways for Water Ingress
- The Impact of Water on Durability

3. Types of Waterproofing Systems

- Overview of Type A, B, and C Systems
- Key Standards and Guidelines (e.g., BS 8102, ACI 212)
- Comparison of System Strengths and Weaknesses

4. Key Considerations for Below-Grade Applications

- Hydrostatic Pressure and Soil Conditions
- Drainage Systems and Repairability
- Factors Influencing System Selection

5. Innovative Waterproofing Solutions

- Permeability-Reducing Admixtures (PRAN vs. PRAH)
- Benefits of Kryton's Crystalline Technology
- Three Layers of Defense: Impermeability, Crack Resistance, Self-Sealing

6. Case Studies

- Boeing Center: 40+ Years of Durability
- Other Success Stories Highlighting Kryton Products
- Lessons Learned from Real-World Applications

7. Sustainability and Long-Term Durability

- Service Life Cost vs. Initial Investment
- Reducing Environmental Impact with Reliable Waterproofing

8. Recommendations and Best Practices

- Early Integration in Design
- Training and Technical Support
- Ensuring Execution Quality

9. Conclusion

- Summary of Key Takeaways
- Kryton's Commitment to Innovation and Support

10. References and Further Reading

- Standards, Guidelines, and Industry Research
- Links to Kryton Resources and Technical Documentation



1. Water in Concrete: Friend or Foe?

Concrete, due to its unique properties, is one of the most common construction materials. However, it's not without limitations. Despite the belief that concrete is waterproof by nature, as stated in ACI 212, concrete is a porous and even permeable material. Concrete is inherently a porous material, containing microscopic voids and capillaries within its structure. Moreover, it's prone to cracking at various stages of its life cycle due to factors such as shrinkage, thermal changes, and loading stresses. When these pores and cracks interconnect, they create pathways through the concrete matrix, transforming it from merely porous to permeable. This permeability allows water to pass through the concrete, potentially compromising its structural integrity and durability.

These characteristics make concrete vulnerable to water, which plays a complex dual role in its lifecycle. Initially, water is essential for concrete, being crucial in the mixing and curing processes that make it stronger and more durable. However, once concrete

has hardened, water can become its worst enemy. In fact, water is considered the biggest culprit for concrete destruction, surpassing even the damage caused by war and natural disasters.

Water can damage concrete structures in various ways. Water penetration can lead to leakage and dampness, compromising structural integrity. It also creates an environment conducive to mold growth, resulting in health concerns. Furthermore, water initiates deterioration mechanisms such as corrosion, ultimately impacting the structure's service life and durability.

Given concrete's vulnerability to water and the potential for extensive damage, having reliable protection and safeguards against water intrusion is vital. Proper waterproofing measures are essential to ensure the serviceability, health, and durability of concrete structures.

2. Waterproofing for Durability - A Step Toward Sustainability

When evaluating the importance of structural waterproofing, it is essential to consider the consequences of neglecting it. Without proper waterproofing, structures are vulnerable to water ingress, leading to costly maintenance and repairs. More critically, the absence of effective waterproofing can significantly impact the durability and longevity of the structure.

Proper waterproofing plays a crucial role in both durability and sustainability by protecting the structure from moisture-related damage, thereby extending its lifespan. By reducing the need for frequent repairs and conserving resources, effective waterproofing contributes to a more sustainable built environment.

"Probably the most effective way of making concrete more sustainable is to increase its effective service life."

Sustainability of Concrete, Aitcen and Mindess, Spon Press, 2011



3. Below and Above Grade Waterproofing

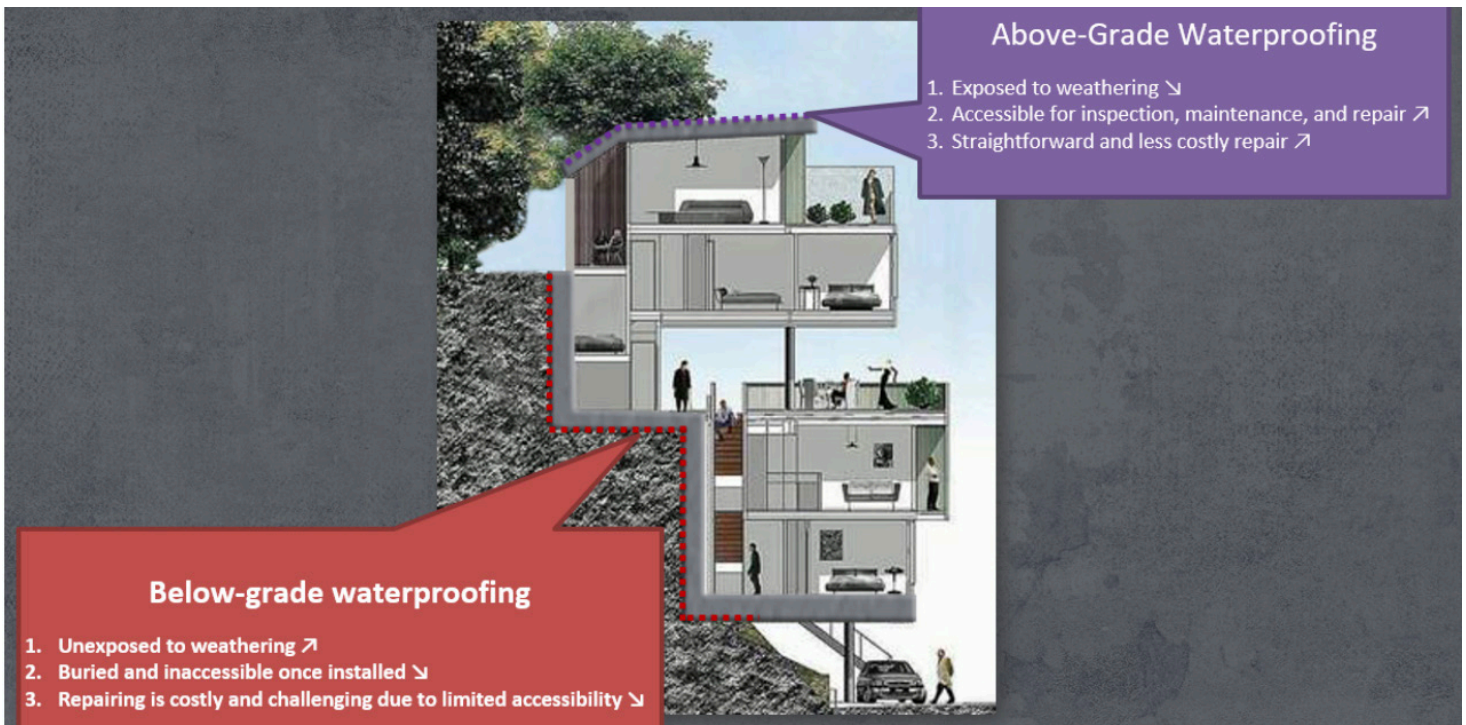
Structures waterproofing can be broadly categorized into two main types: above-grade and below-grade waterproofing, each serving distinct purposes in safeguarding buildings against moisture intrusion.

Above-grade waterproofing focuses on protecting the visible parts of a structure exposed to environmental elements. This includes exterior walls, roofs, balconies, and other surfaces that come into direct contact with rain, snow, and atmospheric moisture. The primary goal of above-grade waterproofing is to create a barrier that prevents water from penetrating the building envelope. Common methods include the application of water-resistant coatings, installation of proper flashing systems, and the use of water-repellent materials in construction. Above-grade waterproofing also plays a crucial role in preventing issues like efflorescence, paint peeling, and mold growth, which can occur when moisture seeps into the building's exterior.

Below-grade waterproofing, on the other hand, deals with the parts of a structure that are underground or in direct contact with soil. This includes foundations, basements, and underground parking facilities. Below-grade waterproofing is particularly critical due to several factors. Firstly, it protects against hydrostatic pressure,

which occurs when groundwater exerts force against the structure. Secondly, it prevents soil moisture and chemicals from penetrating the concrete, which can lead to deterioration over time. Most importantly, the inaccessibility of below-grade areas after construction makes initial installation quality paramount. Unlike above-grade systems that can be more easily maintained or repaired, failures in below-grade waterproofing often necessitate costly excavations and extensive remediation work.

Overall, the significance of below-grade waterproofing cannot be overstated. A properly waterproofed foundation is essential for maintaining the structural integrity of the entire building. It prevents water ingress that can lead to mold growth, compromised indoor air quality, and even structural instability. Moreover, effective below-grade waterproofing contributes to energy efficiency by maintaining a dry, insulated environment in basement areas. While both above-grade and below-grade waterproofing are essential, below-grade waterproofing requires particular attention due to its long-term impact and the significant challenges associated with post-construction repairs. Investing in high-quality below-grade waterproofing solutions is not just a protective measure; it's a crucial step in ensuring the longevity, safety, and value of any structure.





4. Overview of Waterproofing Solutions

Waterproofing methods are classified based on how they protect concrete from water intrusion, either through physical barriers, chemical treatments, or a combination of both. Each system has its unique approach, but the goal remains the same: to safeguard the integrity of the structure. A critical part of this process involves selecting the right products in accordance with industry standards. Among the most recognized guidelines is BS 8102, which categorizes the main waterproofing types (A, B, and C) and assesses their performance based on key factors such as risk assessment and hydrostatic pressure levels. This standard provides a comprehensive framework for understanding how various systems prevent water ingress into structures. Each system offers a different approach to waterproofing, as outlined below:

Type A waterproofing, often called "barrier protection," involves the application of an external membrane or coating that serves as a physical barrier to prevent water from entering the structure. This method is widely used in situations where the building components themselves are not inherently waterproof and where high risks of water ingress exist. The success of Type A waterproofing relies heavily on the integrity and continuous application of the membrane, making careful installation essential for long-term performance.

Type B waterproofing, integrates waterproofing directly into the structure by using watertight concrete or additives that enhance the water resistance of the materials. In this type, the structure itself acts as the primary defense against water ingress, eliminating the need for additional external barriers. The success of Type B waterproofing relies on implementing a solution that is carefully tailored to the project's specific requirements and environmental conditions. This involves designing an optimal concrete mix, selecting the appropriate materials, and adhering to best construction practices to ensure long-term durability and watertight performance.

In Type B waterproofing, various additives can be employed to enhance water resistance. ACI 212, Chapter 15 further defines these additives as permeability-reducing admixtures (PRAs) and categorizes them into two types based on their specific applications:

PRAN (Permeability-Reducing Admixtures for Nonhydrostatic Conditions): These admixtures are intended for use in concrete exposed to nonhydrostatic conditions, where damp-proofing is required rather than full waterproofing. PRANs are suitable for environments where water pressure is minimal, but moisture resistance is still necessary.

PRAH (Permeability-Reducing Admixtures for Hydrostatic Conditions): These admixtures are designed for use in situations where the concrete is exposed to hydrostatic pressure, making them true waterproofing solutions. PRAHs provide a more robust barrier to water ingress, suitable for environments where the structure is under continuous water pressure.

Type C waterproofing utilizes internal cavity drainage systems that allow water to penetrate the outer structure but manage it by channeling the water to drainage points, such as sumps, for removal. While effective in specific situations, Type C is not as common as Type A and B systems, especially in environments that require more proactive waterproofing measures.



5. Below-Grade Waterproofing: Making the Right Choice

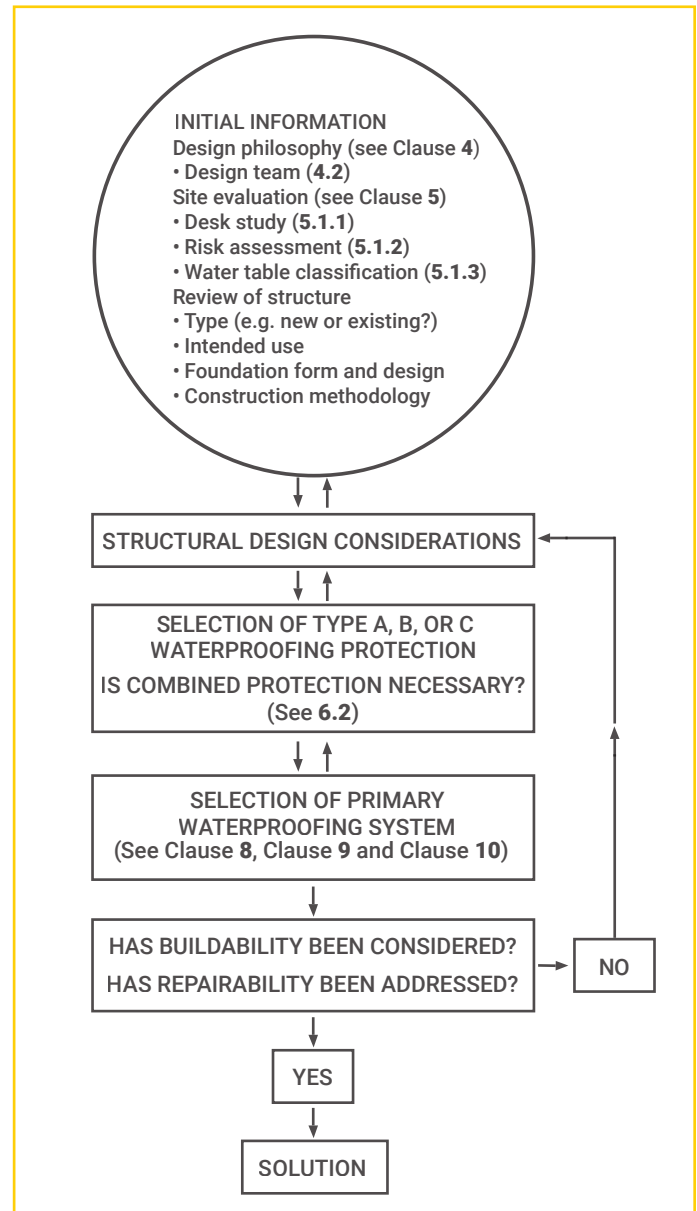
Selecting the appropriate waterproofing system for below-grade structures is essential to ensure long-term durability and performance. Key considerations include the structure’s expected service life, hydrostatic pressure levels, and drainage systems. Additional factors, such as fluctuations in the water table, soil permeability, and the presence of aggressive chemicals or contaminants, must also be evaluated. These factors, among others, form the foundation for choosing a waterproofing solution that aligns with the specific challenges of the project. Given the complexity and variability of these factors, adhering to established guidelines and standards is essential; they provide a framework that ensures the selected products meet rigorous performance criteria, ultimately minimizing the risk of failure and safeguarding the structure’s integrity and longevity against water intrusion.

To effectively implement these considerations, it is vital to incorporate waterproofing strategies early in the planning and design phases. According to Section 3 of **BS 8102**, regardless of the waterproofing system type, it is imperative to consider these strategies from the earliest stages of planning and design to effectively mitigate the risk of water ingress and ensure the long-term performance of below-grade structures.

Another critical aspect emphasized in BS 8102 is the consideration of reparability, as highlighted in the design flowchart within the standard. One of the key decision points in this flowchart is whether the system’s reparability has been adequately addressed; if not, the design must be revised accordingly. This is particularly crucial for below-grade waterproofing systems, given their inaccessibility once installed. Ensuring that reparability is factored into the initial design not only supports long-term durability but also minimizes future maintenance challenges and potential failure risks.

BS 8102 also includes a detailed table that categorizes the different waterproofing types (Type A, B, and C) and clarifies the appropriate methods based on the risk factors associated with varying water table levels. This table serves as a valuable guide by summarizing which waterproofing approach is most suitable for each risk level, ensuring that the selected system provides effective protection against potential water ingress based on site-specific conditions.

British Standard - Design flowchart



COMMENTARY ON FIGURE 1

Figure 1 outlines the principal factors and stages that need to be addressed in order to produce a robust waterproofing solution for a below ground structure.

It demonstrates that some matters are interrelated and that a degree of iteration might result from a need to address buildability and reparability. The principal issues (boxes) do not necessarily need to be addressed in the order shown but all need to be understood and evaluated.



Risk associated with water table	Water table classification (see notes)	Type A (Barrier)	Type B (Structurally Integral)		Type C (Drained)
			Piled Wall	Reinforced Concrete wall to Eurocode wall	
Low	Low	Acceptable	Acceptable	Acceptable	Acceptable
	Variable	Acceptable if 'variable' classification is due to surface water: seek manufacturer's advice	Acceptable where: a) the piled wall is directly accessible for repair and maintenance from inside the structure or b) the piled wall is combined with a fully bonded waterproofing membrane or c) the piled wall is faced internally with a concrete wall to Eurocode 2	Acceptable	Acceptable
High	High	Acceptable where: a) an appropriate cementitious multi-coat render or cementitious coating is used or b) the wall is of concrete to Eurocode 2		Acceptable	Acceptable

However, while the table suggests that all three types of waterproofing can be considered for any water level and risk factor, it should not be taken as a definitive solution. The table primarily highlights the potential applicability of each system but does not address the detailed factors necessary for designing a robust waterproofing strategy. For an effective selection, it is crucial to consider the pros and cons of each type, recognize the performance variability among products within the same category, and tailor the final solution based on the project's unique conditions and limitations. Therefore, at this stage, it is essential to delve deeper into the specifics of each waterproofing method to make a fully informed decision. Reliable guidelines and standards remain the most valuable resources to guide this process and ensure that the chosen solution meets the required performance expectations.

When selecting a waterproofing system for below-grade structures, it is crucial to consider the application aspects of Type A and Type B systems, as they significantly impact project timelines, and performance. Type A Waterproofing consists of barriers applied directly to existing concrete surfaces. This method often requires additional time for application and necessitates the involvement of skilled teams and dedicated applicators who are well-versed in the proper use of the products. The expertise of the application team is vital, as installation and potential inconsistencies in execution can be a major factor affecting product performance. Notably, standards such as ASTM D7832 emphasize that due to the variability in installation conditions, it is difficult to draw an exact correlation between the results of laboratory tests on waterproofing membranes and their performance in real-world applications.

The significance of proper installation becomes even more apparent when examining the main factors that cause defects in

construction. BS 8102 emphasizes that an ideal waterproofing system should be defect-free; however, in reality, various factors can lead to defects, with poor workmanship and improper product

1.4 - It is not possible to establish a precise correlation between laboratory tests on waterproofing membranes and performance attributes after installation due to variations in chemicals in the soil, design, material, and installation.

use identified as key contributors according to this standard. In contrast, Type B Waterproofing is typically integrated into the concrete mix itself, making it less dependent on application techniques and reducing the potential for human error. This approach streamlines the construction process, potentially leading to shorter project timelines and improved overall performance, as it eliminates the need for additional surface treatments.

Another critical consideration, as outlined in ASTM D7832, is the requirement for below-grade waterproofing systems to maintain their integrity throughout the entire lifespan of the structure. However, due to the inherent limitations of traditional membranes, which are prone to property changes over time as a result of aging, this requirement often cannot be fully met—especially in modern buildings designed for extended service lives. As a result, there is a growing need for advanced, resilient waterproofing solutions that can withstand the long-term demands of durability and performance.



Designation: D7832/D7832M – 14

Standard Guide for
Performance Attributes of Waterproofing Membranes
Applied to Below-Grade Walls / Vertical Surfaces (Enclosing
Interior Spaces)¹

Considering the limitations of Type A systems, such as aging and potential loss of effectiveness over time, as well as the increasing need for more flexible and robust solutions in complex designs, Type B waterproofing systems have been introduced as a reliable alternative. Although Type B systems have been available for over half a century, their adoption remains relatively new in some markets. As mentioned in the previous section, these integral systems enhance the concrete's properties, transforming it into a watertight barrier. When the designer evaluates the project's needs and decides to implement a Type B integral waterproofing solution, here are specific factors that must be taken into account.

One of the critical considerations in selecting the appropriate Permeability-Reducing Admixture (PRA), as outlined in ACI 212, Chapter 15, is recognizing that PRA encompasses a broad category of materials with significant variations in performance and effectiveness. Consequently, not all PRAs will achieve the same results. Therefore, it is essential to carefully evaluate each product and choose a PRA that meets the distinct needs and exposure conditions of the structure, rather than assuming that all products within this category will perform consistently. To be more specific, ACI 212, in Section 15.2, categorizes Permeability-Reducing Admixtures (PRAs) into five main groups.

15.2—Materials

Permeability-reducing admixtures (PRAs) typically include, but are not limited to, the following categories:

- a) Hydrophobic water repellants
- b) Polymer products
- c) Finely divided solids
- d) Hydrophobic pore blockers
- e) Crystalline products

These materials are used alone or in combination to give varying ranges of performance.

4.1 - A Waterproofing membrane should maintain its water-tight integrity for the life of the building in a continuously or intermittently moist environment and may be subject to continuous or intermittent hydrostatic pressure. It should resist chemicals that can har the membrane and root growth.

Among these, crystalline products are considered one of the most effective options for structures exposed to hydrostatic pressure, categorizing them as Permeability-Reducing Admixtures for Hydrostatic conditions (PRAH). However, it's important to note that not all products marketed as 'crystalline' necessarily qualify as effective PRAH. ACI 212, Chapter 15 outlines specific criteria for PRAH, including a demonstrated improvement in permeability of over 50% and self-sealing capabilities. Therefore, a thorough evaluation is required to ensure the selected product meets these performance benchmarks, can effectively withstand hydrostatic conditions, and, most importantly, has a proven track record of successful implementation in projects exposed to hydrostatic pressure.



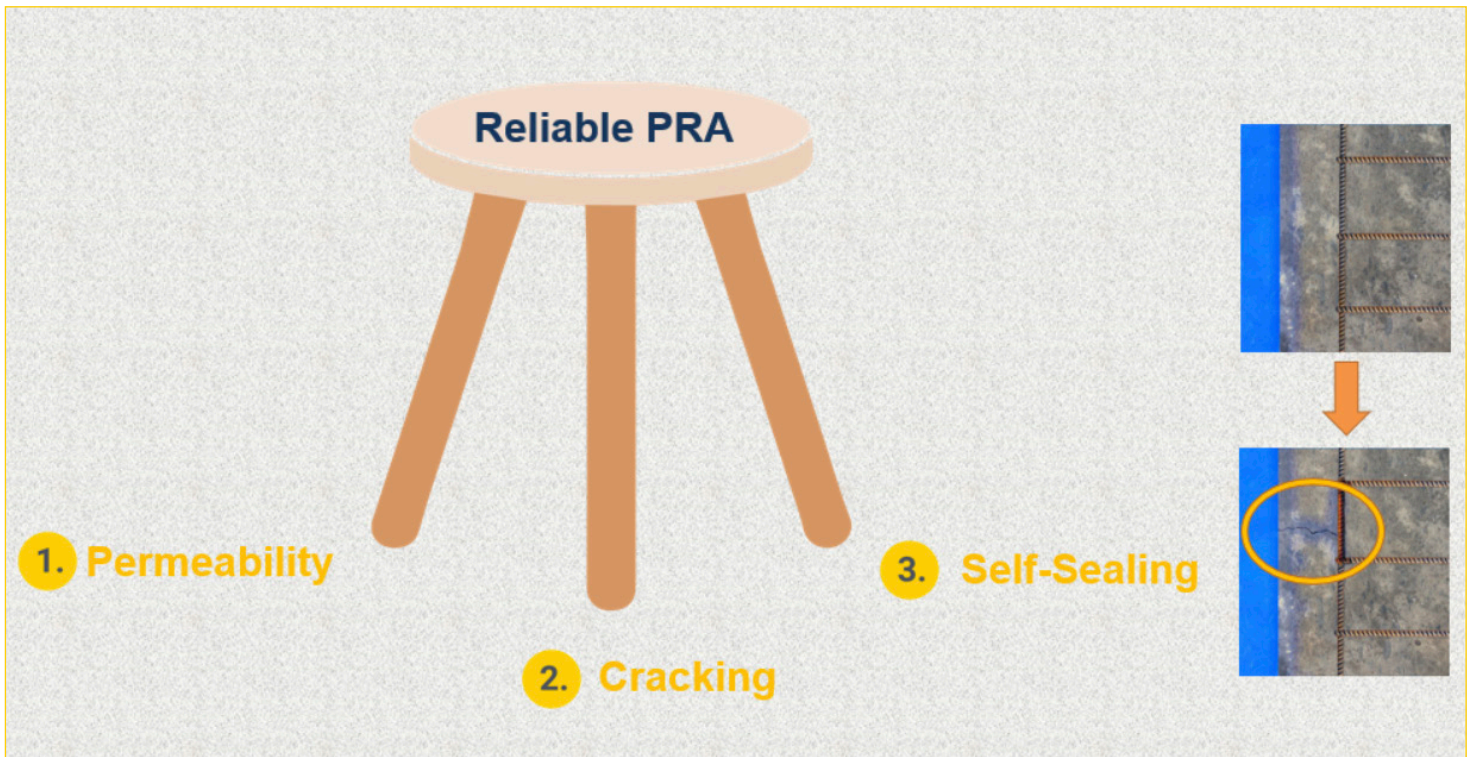


Another critical consideration when selecting a suitable waterproofing admixture is that improving concrete's resistance to water penetration is necessary, but not sufficient on its own to ensure long-term durability and reliable protection of the structure. This is because concrete, despite its density, is inherently prone to cracking over its service life. Even in high-quality, low-permeability concrete, cracks create direct and easy pathways for water and aggressive chemicals to enter, which can significantly compromise both the serviceability and durability of the structure. Hence, to achieve reliable waterproofing, three essential layers of defense are needed, similar to the stability provided by the three legs of a stool. The first line of defense is reducing the permeability of the concrete to prevent initial water ingress. The second is minimizing the concrete's tendency to crack, which acts as an additional safeguard against pathways forming. Finally, the third layer is ensuring that, if cracks do form, the concrete possesses self-sealing capabilities to automatically block these potential points of entry.

This is where Kryton's crystalline technology stands out. Kryton's crystalline technology not only falls under the crystalline category but also meets the performance requirements outlined in ACI 212, Chapter 15 for PRAH admixtures.

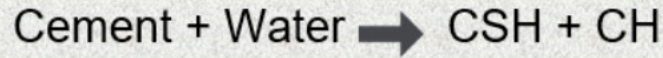
This is achieved through its hydrophilic catalytic action, which chemically reacts with water and unhydrated cement particles to form insoluble, needle-shaped crystals that penetrate and fill capillary pores and micro-cracks within the concrete matrix. By blocking these pathways, Kryton's technology effectively prevents water and waterborne contaminants from penetrating the concrete, providing permanent and reliable waterproofing protection.

Kryton's unique admixture technology, with its advanced chemistry, provides a reliable waterproofing solution that fully meets the three key requirements of an ideal waterproofing system. It not only enhances the impermeability of concrete, but also reduces shrinkage and shrinkage-induced cracking, thus reinforcing the second layer of defense. Moreover, Kryton's self-sealing properties provide the third and final line of defense, ensuring that any micro-cracks that develop over time are effectively sealed. This robust, three-layer approach has been validated through extensive laboratory testing and has been proven effective in real-world projects, such as the Boeing Center in the United States, where Kryton's technology has provided durable waterproofing protection for over 40 years.

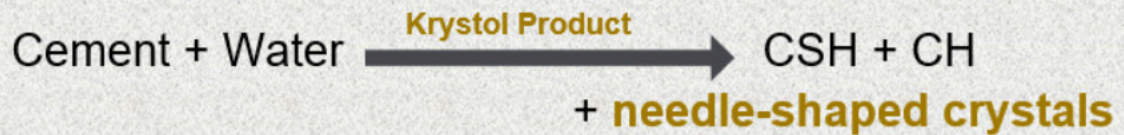


The principles are similar to the Hydration of concrete.

- Untreated concrete



- Treated concrete



*CSH = Calcium Silicate Hydrate *CH = Calcium Hydroxide

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In addition to meeting the requirements outlined in ACI 212 for PRAH, Kryton's products also comply with various other standards, including the compatibility requirements set by BS 8102. This standard specifies that when using a waterproofing admixture, the product 'should be used in conjunction with other waterproofing components supplied by the same manufacturer' to ensure compatibility and system integrity. Kryton addresses this by offering a full range of complementary solutions designed to work seamlessly with our KIM (Krystol Internal Membrane) waterproofing admixture. These include joint sealing solutions, crack repair systems, surface coatings, pipe penetration treatments, tie-hole repair products, and more. By providing a complete and compatible waterproofing system, Kryton ensures that the entire structure is effectively protected against water ingress, offering a holistic and reliable solution for even the most challenging environments.

Overall, selecting the appropriate waterproofing solution requires careful consideration of multiple factors, including the specific project needs and the advantages and disadvantages of each system. ACI 350 offers valuable guidance, emphasizing an integral system approach rather than reliance solely on external waterproofing methods. It states, 'it is usually more economical and dependable to resist liquid permeation through the use of quality concrete, proper design of joint details, and adequate reinforcement, rather than by means of an impervious protective barrier or coating.' This highlights the necessity of integrating quality concrete practices with well-designed joints and reinforcement alongside waterproofing solutions to achieve a robust and durable structure.

Code Requirements for Environmental Engineering Concrete Structures (ACI 350-20) and Commentary (ACI 350R-20)

Usually it is more economical and dependable to resist liquid or gas permeation through the use of quality concrete, proper design of joint details, and adequate reinforcement, rather than by means of an impervious protective barrier or coating.



Up to this point, we have primarily focused on the technical aspects involved in selecting below-grade waterproofing solutions. However, before we conclude this section, it is important to consider another key factor that influences the selection process: cost. While a project's budget certainly influences the selection of construction products, it is crucial to ensure that cost-saving measures do not compromise the quality and safety of critical structural elements. Sacrificing these factors can result in long-term problems that significantly outweigh any initial savings. This principle is emphasized in the Whole Building Design Guide (WBDG), which highlights that below-grade waterproofing systems are not only difficult to access but also cannot be easily replaced once installed. Consequently,

these systems must be designed and built to match the overall service life of the structure.

When evaluating below-grade waterproofing options, it's essential to consider the service life cost rather than focusing solely on the initial investment. While a lower initial cost may seem advantageous, it often leads to higher maintenance and repair expenses over the structure's lifespan. Therefore, selecting a solution that prioritizes durability and long-term performance will ultimately prove more cost-effective and reliable, ensuring the system meets the intended service life of the building.

Durability of design and materials is mandatory with below grade enclosure systems. Unlike some other building components that might be designed to be replaced several times within the overall building service life, below grade systems need to be built to approximate overall service life. Below grade systems are often inaccessible for repairs and extremely costly if repairs or modifications are necessary. For below grade enclosure systems design and materials must not focus on the first initial cost but consider the life cycle costs of various design options, especially costs to repair or replace systems that are buried.



4. Overview of Waterproofing Solutions

Selecting the appropriate waterproofing solution is a fundamental step in safeguarding the durability and longevity of a structure. Yet, it is crucial to understand that choosing the right product alone cannot ensure success. Without considering other critical factors, even the best product may fall short of expectations.

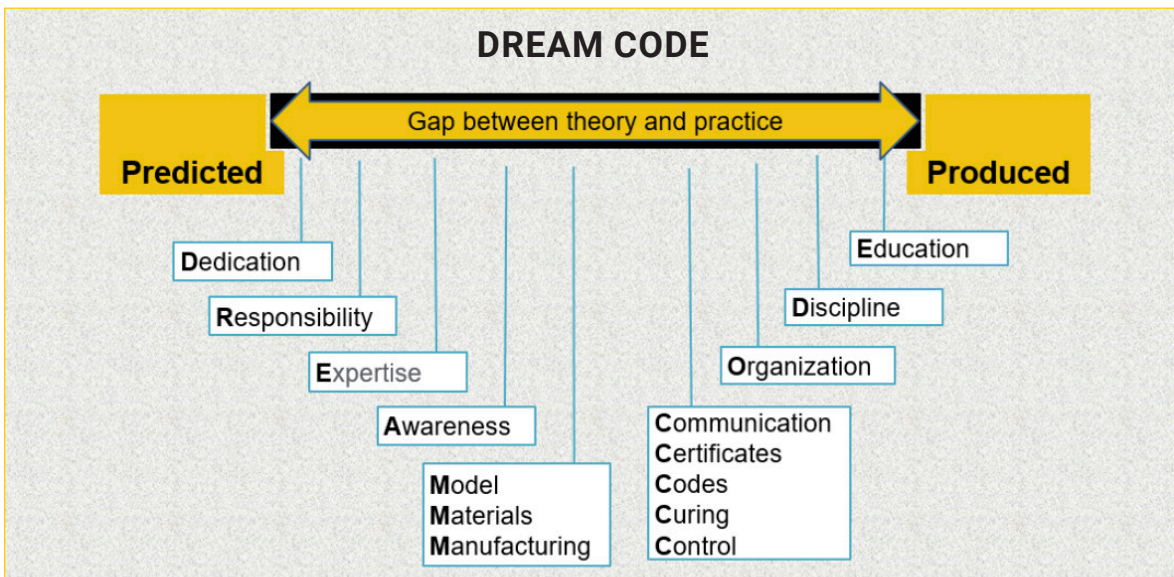
One of the key challenges in both constructions is the inevitable gap between our initial expectations and the final outcome. This phenomenon is not limited to construction but can be observed

across various scenarios, from manufacturing processes to common tasks in daily life. Consider a simple example: baking a cake. Even if you have a perfect recipe and purchase all the required ingredients, the final result may still differ from what you anticipated. Why? Baking requires more than just having a recipe and the right ingredients. You must also account for precise measurements, proper mixing techniques, baking time, and temperature control. If any of these factors are overlooked, the final result may not meet your expectations, even with the best ingredients.



Similarly, in construction, selecting the right materials and designing the ideal mix are crucial, but they alone do not guarantee success. The gap between theoretical predictions and actual production results needs to be carefully managed. In concrete construction, for instance, variables such as placement techniques, curing conditions, workmanship, and unforeseen site challenges can significantly impact the final performance. Furthermore, construction projects often involve multiple stakeholders—from designers and engineers to contractors and suppliers—making effective communication critical. Clear, consistent communication helps ensure that everyone involved is aligned on expectations and execution, reducing the risk of errors and ensuring that the initial design and product selection are fully realized through best practices and rigorous quality control.

The concept of "DREAM Code," introduced by K. Van Breugel, refers to a framework that highlights the key factors contributing to the gap between prediction and production in construction projects. This framework encompasses a variety of elements related to project planning, execution, and maintenance, which collectively influence the outcome of any construction endeavor. By addressing these factors—such as design accuracy, resource management, execution quality, and the ability to anticipate and mitigate site challenges—the DREAM Code aims to bridge the divide between anticipated results and actual performance. In doing so, it helps ensure that the original design intent is achieved, while also minimizing the risks associated with unforeseen complications that often arise in real-world construction projects.





7. Sealing the Deal: Key Takeaways

Waterproofing is vital for ensuring the longevity and durability of concrete structures, but it becomes even more critical in below-grade applications due to the unique challenge of inaccessibility. Below are key considerations for designing and executing an effective below-grade waterproofing system:

- **Early Design Integration:** Waterproofing should be addressed from the initial design phase to avoid costly issues during construction and long-term service life. Starting early ensures that solutions are fully integrated into the structure's design.
 - **Understand the Waterproofing Options:** Familiarize yourself with both external (Type A) and integral (Type B) waterproofing systems, along with their respective advantages and limitations. External systems provide barrier protection, while integral systems enhance the concrete's inherent resistance to water.
 - **Follow Established Standards:** When selecting between external and integral methods, adhere to recognized standards like ACI 212. These standards often recommend integral solutions, especially in below-grade applications where access is limited, and long-term durability is critical.
 - **Not All Integral Systems Are Equal:** Ensure the selected system fits the specific needs of your project. For structures exposed to hydrostatic pressure, choose PRAH (Permeability-Reducing Admixture for Hydrostatic Conditions). Evaluate these products based on adherence to ACI 212, Chapter 15, and review their performance history.
 - **Thorough Product Evaluation:** Recognize that not all products within the same PRAH category perform equally. It's essential to select a proven product with a track record of success, supported by performance data and industry recommendations.
 - **Execution is Just as Important as Product Selection:** Choosing the right waterproofing product is critical, but it is equally important to ensure proper execution. Poor workmanship, incorrect placement, or subpar curing can compromise even the best materials.
 - **Training and Technical Support:** Ensure all stakeholders are well-trained, and provide clear technical guidance to prevent mistakes during installation. Ongoing support and quality control can make the difference between success and failure.
- **Long-Term Durability and Sustainability:** By selecting the right system and executing it properly, you not only extend the life-span of the structure but also contribute to its sustainability by minimizing the need for repairs and maintenance.
 - **Integral Waterproofing Offers Long-Term Reliability:** Catalyst-based integral systems with hydrophilic properties have demonstrated superior, lasting performance in both lab and field conditions. These systems are more dependable than external membranes and other integral solutions that degrade or are consumed during chemical reactions.

Kryton's catalyst-based integral waterproofing systems with hydrophilic properties meet all the requirements outlined in this document, providing superior long-term durability and performance in even the most challenging conditions. These advanced systems offer reliable, self-sustaining protection without degradation over time or depletion during chemical reactions. In addition to our innovative products, we are committed to supporting your project with comprehensive documentation, training, and technical services, all critical to ensuring correct application and implementation. From design to execution, Kryton's solutions are engineered to deliver lasting performance, safeguarding the integrity and sustainability of your structures.

Contact us today to learn more about how our solutions can protect your next project from the challenges of water ingress and ensure long-term sustainability.

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Conclusion

Below-grade waterproofing is a critical component in modern construction, with far-reaching implications for durability, sustainability, and cost-efficiency. Key benefits include:

- **Enhanced Longevity:** Proper waterproofing prevents water ingress, reducing structural wear and prolonging the building's service life.
- **Reduced Maintenance Costs:** A robust waterproofing system minimizes the need for repairs, saving time and resources over the structure's lifespan.
- **Improved Structural Integrity:** By safeguarding against hydrostatic pressure and contaminants, waterproofing ensures stability and resilience.
- **Sustainability:** Durable waterproofing systems decrease material consumption and waste over time, contributing to environmentally responsible construction practices.
- **Comprehensive Protection:** Advanced technologies, such as Kryton's crystalline systems, provide self-sealing capabilities and multi-layered defense against water penetration.
- **Design Flexibility:** Early integration into planning allows for tailored solutions that meet the specific challenges of any construction project.

Investing in high-quality below-grade waterproofing is not just a technical decision but a strategic one, securing the safety, efficiency, and value of infrastructure for generations to come.