PENETRON NEWSLETTER

June 2023

Dear reader,

When it comes to concrete protection and waterproofing, Penetron is a leading and globally trusted solution provider. For over 40 years Penetron has assisted engineers, architects, contractors and developers in providing customized solutions to increase the service life of their projects and reduce maintenance costs.

The reliability and effectiveness of our product systems has been proven in independent testing and most importantly, where it matters most: on the job site. The Penetron performance complies with countless international standards and certifications and hence is trusted by leading designers worldwide.

In this edition of the Penetron Durability Update, we are focusing on how Penetron, a crystalline slurry coating can be used to protect steel reinforcement from corrosion and how it can be used in repair situations to restore and protect carbonated concrete structures.

We also would like to take some time to remind our readers of the numerous international certifications of our product ranges including globally recognized British Board of Agrément (BBA) certificate, before we dive into an overview of some of the recently completed Penetron projects all around the world.

With kind regards,

Florian Klouda
Director, International Account Coordination
PENETRON INTERNATIONAL LTD.

PENETRON - The world's first crystalline rebar corrosion protection coating

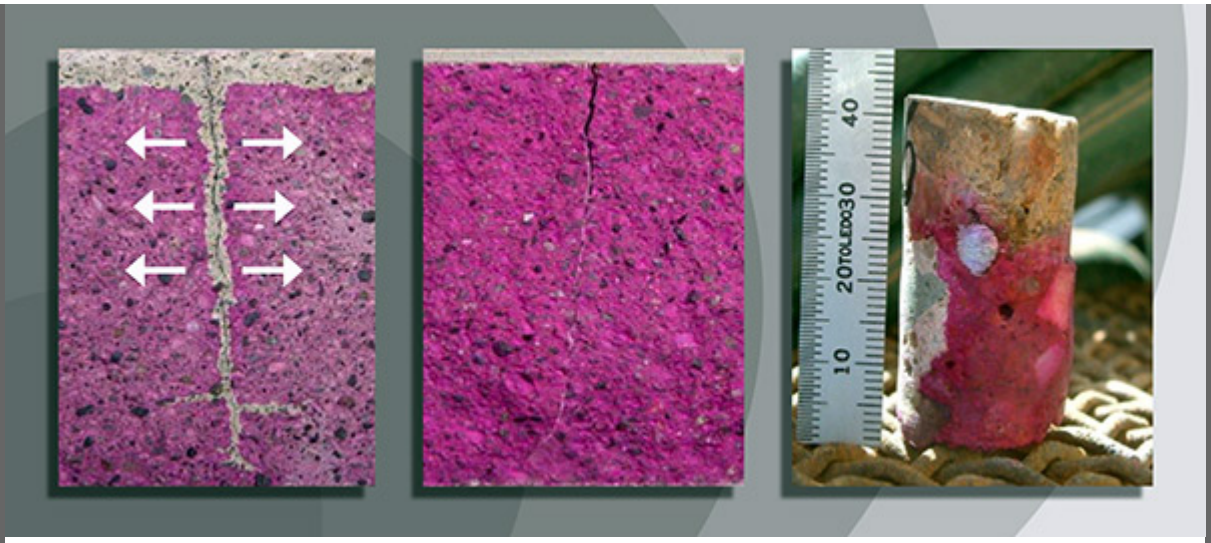
European Standard EN 1504-7 specifies the requirements for the identification and performance (including durability aspects) of products and systems for active and barrier coatings for protection of existing uncoated steel reinforcement and embedded steel in concrete structures under repair.

Penetron contains high-quality Portland cement and acts as an active coating for steel protection. It has been tested in accordance with EN 15183:2007 and EN ISO 6988:1998 standards and proven to effectively protect both exposed and embedded steel from the onset of corrosion.

This makes Penetron the world's first crystalline coating conforming to EN 1504-7.

In addition to completely waterproofing existing concrete structures, Penetron can now also confidently be specified as a solution for the corrosion protection of reinforcement steel on new and existing projects or during repairs – enhancing the durability and service life of your assets.

PENETRON slurry – the effective repair solution for carbonated concrete structures



Carbonation of concrete is the result of a chemical reaction between carbon dioxide in the air and calcium hydroxide as well as hydrated calcium silicate in the concrete to form calcium carbonates. Over time carbonation reduces the pH, which ultimately leads to corrosion of concrete and loss of mechanical strength.

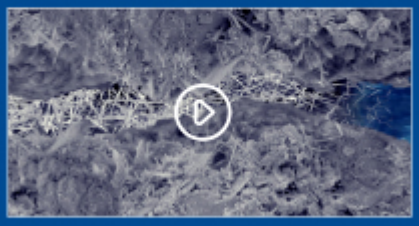
PENETRON, a highly alkaline, crystalline coating provides a high resistance against carbonation. It can be used effectively to protect new concrete as well as for the repair of existing concrete structures.

Recent tests show a significantly higher carbonation resistance of PENETRON-treated concrete compared to a SN EN 206-1 designed concrete mix for exposure classes XC4 and XC3.

With a 69% lower carbonation coefficient, the lower-quality, PENETRON-treated concrete provides an effective, long-lasting one-product solution for the repair of carbonated concrete structures and rehabilitation of corroded reinforcement steel. Not only does Penetron significantly slow down the speed of carbonation – even in more porous concrete structures – it also reduces the potential of incompatibility problems of other multi-product repair solutions as well as the need for reapplication and significantly reduces cost of repairs.

Click here for the full article.

HOW PENETRON WORKS



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WITNESS PENETRON'S CRACK HEALING ABILITY

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PENETRON WORLDWIDE

- Penetron products are British Board of Agrément (BBA)-certified
- World Tunnel Congress 2023, Athens Greece
- Baytak Construction Exhibition, Kuwait
- Project Qatar 2023, Doha, Qatar
- Penetron International Training 2023, Athens, Greece

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The Integration Bridge, Foz do Iguacu, Brazil

Dragon Ocean Do Son Resort, Hai Phong, Vietnam

Wahda Bank Building, Benghazi, Libya

Albion In the Gulch Residences, Nashville, USA

Campbelltown Hospital, Campbelltown, Australia

Al Arab Hospital, Jeddah, Saudi Arabia

Old Doha Port, Doha, Qatar

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Penetron products are British Board of Agrément (BBA)-certified

The British Board of Agrément (BBA) is a UK-based, globally trusted certification body in the construction industry that helps clients create accountability and mitigate risk. BBA certifies construction products and systems and provides inspection services to support designers and installers. Services provided by the BBA include extensive research, auditing, inspection, testing and certification.

Hence, asking for a British Board of Agrément certification helps customers to make informed decisions and can provide confidence in the quality, safety, and performance of the products they are purchasing. Further it helps to ensure regulatory compliance, reduce risk, provide independent assessment and access to valuable information.

Penetron offers BBA certification for a wide range of products that have undergone rigorous independent testing and assessment to ensure end-users of the trusted Penetron-quality that has been protecting concrete structures worldwide for more than 40 years.

World Tunnel Congress 2023, Athens Greece

The World Tunnel Congress (WTC) is the premier annual event of the International Tunnelling Association (ITA-AITES) and considered the top attended tunnelling conference in the world with the participation of more than 2000 professionals.

In 2023 the event was hosted by the Greek Tunnelling Society from May 12-18, 2023, at the international conference center Megaron in Athens. This years' theme "Expanding Underground" explored multiple advantages and solutions that underground space can provide including the use of smart technology to change investigation, design, construction and operation methods and strategies.

All presented papers were assessed by a scientific committee of more than 150 highly skilled professionals and academics from all around the world to ensure a high scientific level prior to publication on an open access portal.

WTC 2023 also featured a large exhibition space for more than 120 exhibitors including major international firms involved in the tunnelling industry.

Penetron International Ltd., a world-leading manufacturer of crystalline, self-healing waterproofing and protection solutions for underground concrete structures, was proud to support the WTC 2023 as gold sponsor in coordination with our Greek subsidiary Penetron Hellas SA.

At the Penetron booth, visitors got a first-hand overview of how Penetron solutions provide unique benefits to tunnels and other underground structures by increasing concrete durability and service life. Penetron has been used on critical underground infrastructure around the world including metro systems in Delhi (India), Santiago (Chile), Rio de Janeiro and Sao Paulo (Brazil), Guangzhou (China), Botniabanan Railway (Sweden), Sydney West Connex (Australia), Zara Expo Tunnel Milan (Italy), Corredor Duarte Tunnel (Dominican Republic) and many more.

Robert Revera, President & CEO of The Penetron Group with Theodor Mentzikofakis, Managing Director & Partner of Penetron Hellas SA, Enricomaria Gastaldo Brac, CEO & Partner, Penetron Italia and team members of Penetron Hellas and Penetron International Ltd. at the Penetron booth during WTC 2023.

Baytak Construction Exhibition, Kuwait

Penetron Kuwait exhibited during the Baytak Construction Exhibition, which was held from May 22 – 27, 2023 at the Kuwait International Fair Grounds (Halls 5 & 6) in Mishref, Kuwait.

More than 135 local and international exhibitors from all over the construction sector showcased their products and services to provide a unique experience for potential buyers, contractors, engineers, architects, interior and exterior designers, developers, and construction professionals.

Penetron Kuwait provided a comprehensive overview of its portfolio including local project references and approvals and welcomed both existing as well as potential customers to introduce its latest products and solutions in concrete waterproofing and protection.

“The Baytak Construction Exhibition provided an excellent platform bringing together suppliers and project owners, allowing us to interact with our large base of satisfied customers and more importantly assist in making new connections to expand our business here in Kuwait.” says Mostafa Sheikh Sulaiman, President of Penetron Kuwait.

Penetron booth at Baytak Construction Exhibition 2023, Kuwait.

Project Qatar 2023, Doha, Qatar

Qatar's largest construction fair took place from May 29 to June 1, 2023, at the Doha Exhibition & Convention Center (DECC).

With more than 240 exhibitors from over 20 countries, the exhibition strives to attract key influencers and industry leaders looking for up-to-date technology and state-of-the-art equipment available on the market. As in previous years the event was targeting architects & interior designers, civil engineers, construction material & equipment purchasing managers, project managers, wholesalers and distributors, government officials, investors, manufacturers, property developers and specifiers.

The exhibition was divided into several product zones including the:

- Smart District (Qatar's Smart Cities – Transforming the future)
- Properties District (Local and International Real Estate Opportunities)
- FM District (Operating and Maintaining Safely and Efficiently all Built Projects in Qatar)
- Home Mart District (Household Appliances)
- Heavy Max (The Region's Dedicated Heavy Machinery Exhibition)
- Wholesale Market & Auction (Selling Construction Products with Exclusive Prices)

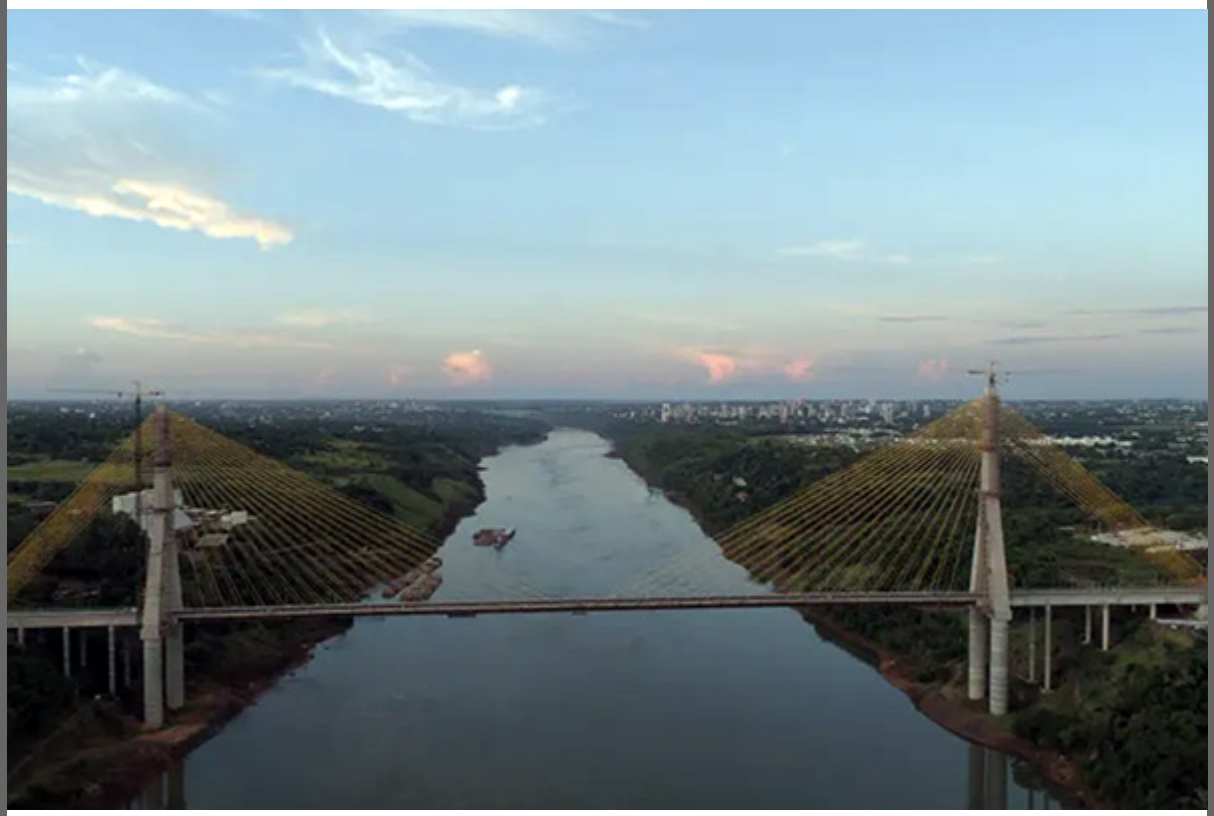
Penetron welcomed visitors at stand H69 to present the latest in concrete protection using the crystalline Penetron range of products that enables self-healing concrete, which effectively increases durability and service life of new structures and can also be used extensively in the repair and rehabilitation of existing concrete.

Penetron International Training 2023, Athens, Greece

In March, Penetron International hosted another training session for members and supporters of its international network. Attendees from 13 different countries gathered in the Penetron Training facility in Athens, Greece for a comprehensive, 3-day training session on various Penetron product ranges. The program included presentations on different topics around the specific Penetron solutions as well as the demonstration of multiple concrete protection and waterproofing products as well as repair solutions and liquid sealants.

The training provided a deep insight into the various Penetron product ranges, their benefits and specific application scenarios to assist designers as well as applicators in problem-solving of a wide variety of potential issues on potentially occurring on their projects.

The Integration Bridge, Foz do Iguacu, Brazil



The Integration Bridge is the second major traffic connection between Brazil and Paraguay, spanning the Paraná River, between the towns of Presidente Franco (Paraguay) and Foz do Iguacu (Brazil). The new bridge provides a much-needed boost in capacity for cargo transport, easing the bottleneck of the Friendship Bridge, first commissioned in 1965, which has hampered traffic for years. Access to the Integration Bridge will remain limited until May 2025 due to ongoing infrastructure work that will enhance access to the new bridge.

The R$463 million (US$84 million) construction project was carried out by a consortium, Construbase-Cidade-Paulitec, and also includes work on connector roads on the Brazilian side and compensation for residents who were displaced due to the bridge location. The Integration Bridge is 760 m (2,500 feet) long with a free span of 470 m (1,550 feet) – the longest in Latin America. The bridge accommodates two single 3.6 m-wide lanes, a 3 m-wide shoulder, and a 1.7 m-wide sidewalk. The final bridge height is about 174 m (575 feet).

For the project engineers at Construbase-Cidade-Paulitec, protecting the underlying concrete structure of the bridge deck from deterioration, especially corrosion of steel, was a priority. Penetron Brazil was asked to provide a durable concrete waterproofing solution to secure a longer bridge service life – and reduce downstream maintenance and repair costs.

After review by Construbase-Cidade-Paulitec, the Penetron System was specified. PENETRON, a topical crystalline waterproofing material, was applied to all the joints of the consolidation plates of the bridge deck. PENETRON ADMIX, a crystalline waterproofing admixture, was used in the underlying concrete plates, and PENESEAL PRO, a spray-on liquid sealer, was sprayed over the entire bridge deck as a final coating.

The Penetron System was also chosen because it has been proven to perform in similar highway and bridge construction projects around the world. According to Claudio Neves Ourives, Managing Partner and CEO of Penetron Brasil. “The final results for the Integration Bridge project exceeded the builder’s expectations!”

Dragon Ocean Do Son Resort, Hai Phong, Vietnam

The 3rd largest city in Vietnam and that country’s busiest seaport that serves Hanoi and the Red River Delta region, Hai Phong is a major economic and industrial center. Blessed with historic colonial-era architecture at its center, this city of around 2.1 million inhabitants is the cultural and technological center of Vietnam’s Northern Coast region.

Located in the Do Son district (adjacent to the Do Son peninsula) of Hai Phong, about 22 km (14 miles) south of the city center, the Dragon Ocean Do Son Resort covers an area of 480 hectares (1,190 acres) of reclaimed land. The project is the largest coastal urban development in northern Vietnam and the largest eco-tourism development in the Hai Phong region.

A town square with fountains forms the center of this mixed-use development, which integrates a business district (with offices and state-of-the-art conference and seminar centers), a commercial center (with supermarkets, retail stores, restaurants, cafes, and cinemas), and a 5-star Wyndham Hotel with 303 rooms and 42 villas. Amenities include: a 27-hole golf course, an artificial lake, a water amusement park with freshwater & saltwater swimming pools, and playgrounds.

Due to the location of the Dragon Ocean Do Son Resort on reclaimed land right on the ocean shore, high groundwater levels at the construction site needed to be addressed. Penetron Vietnam was approached by the general contractor Hoa Binh to provide a robust and durable concrete waterproofing solution.

PENETRON ADMIX was ultimately specified to treat almost 18,000 m^3 (24,000 yds3) of concrete for the below-grade concrete structures of the foundation slabs, retaining walls, and underground water storage tanks used by the hotel, retail stores, and offices – as well as the town square fountains.

Wahda Bank Building, Benghazi, Libya

Formed in 1970 through a merger of five North African banks (African Arab Bank, Bank of North Africa, Al-Kafela Bank, Al-Nahda Bank, and Commercial Bank), Wahda Bank is a Libyan banking

and financial services institution with 76 branch offices across the country. The bank's main offices are located on Gamal Abdal Nasser Street in Benghazi, which is in close proximity to the Mediterranean Sea.

The new Wahda Bank Building comprises five above-ground floors housing the offices with the ground floor customer areas, and a below-grade basement floor. Notably, the natural ground level of the construction site was only 1 m (3 feet) above sea level. This contributed to the extensive deterioration of the foundation of the previous building because of the saturated environment and chemical attacks (sulfates, chlorides, and other harmful elements in the groundwater and soil) – and hastened the decision to construct a new building.

As a result of the harsh coastal conditions, the project engineers required an effective waterproofing solution to prevent any chloride ion penetration and resulting corrosion of the reinforced concrete structures of the new Wahda Bank Building.

Initially, the engineers at Assarh Engineering specified a waterproofing membrane system to protect the below-grade structures from the corrosive environment. However, Penetron North Africa showed the engineers how an integral waterproofing solution based on PENETRON ADMIX, a crystalline concrete waterproofing admixture, would provide less permeable concrete with increased durability and resistance to chloride ion penetration, as well as speed up the construction schedule and reduce labor costs.

After the consultation with Penetron North Africa, Assarh Engineering and Golden Gate Contracting, the project's general contractor, revised the project specifications and replaced the waterproofing membrane system with PENETRON ADMIX-treated concrete. El Reehab Concrete, the concrete ready-mix supplier, delivered the PENETRON ADMIX-treated concrete for the raft foundation slab and retaining walls. PENEBAR SW-45A was used to permanently seal the construction joints.

Compared to conventional waterproofing membrane systems, the Penetron solution turned out to be substantially more economical for the Wahda Bank.

works with Penetron Admix-treated concrete at Wahda Bank Building in Libya.

Albion In the Gulch Residences, Nashville, USA

The $140 million project was designed by Hartshorne Plunkard Architecture, a Chicago-based architecture, planning, and interior design firm. With two 20-story residential towers of curved edges, the Albion in the Gulch development features 415 residential units, offered in studio, 1, 2, & 3-bedroom layouts, as well as 2-bedroom townhome units. Fifteen townhomes are on the 4th floor between each tower and five are on the 20th floor of the east tower.

The 4th floor splits the building into two towers and features an outdoor plaza with a large terrace, golf putting green, BBQ stations, and indoor/outdoor fitness center. The 20th floor of the west tower will have an outdoor deck with a pool and tiki bar. Further amenities include a comedy club/karaoke venue, coffee shop, indoor dog run, spa, golf putting greens and simulation room, and 10,000 ft2 (910 m²) dedicated to co-working space.

Nashville Ready-Mix added PENETRON ADMIX SB during batching to all concrete used for the foundation slabs, the below-grade retaining walls that protect the basement structures, and elevator pits. PENEBAR SW waterstop strips were also used in the new concrete elements to permanently seal all construction joints.

Campbelltown Hospital, Campbelltown, Australia

A picturesque town of about 175,000 inhabitants, Campbelltown has a historic center and is adjacent to the Australian Botanic Garden Mount Annan, the country's largest botanical garden, and Dharawal National Park. The city is located on the outskirts of the Sydney metropolitan area in New South Wales, about 55 km (34 miles) southwest of the Sydney central business district.

Together with the Camden Hospital, the newly expanded Campbelltown Hospital has served the southwest suburban communities of Sydney (NSW), Australia since 1977. Since then, the facility has undergone numerous expansions and upgrades. The second and final phase of construction, a A$632 million (US$447.65 million) hospital redevelopment project, added a new 12-floor clinical services building. This facility doubles the hospital’s ICU bed capacity, increases the number of maternity beds, and expands mental health services. A multi-story car parking garage with seven levels and over 800 spaces was also added as part of the project.

Due to the high groundwater level at the construction site in Campbelltown, Penetron Australia collaborated with the project’s general contractor to provide an effective concrete mix design with a very low permeability. This effectively converts the concrete into a waterproofing element with built-in self-healing capabilities for any microcracks that may emerge. As a result, PENETRON ADMIX was specified to waterproof all below-grade concrete structures, exposed terraces, roof slabs, and hospital helipad. PENEBAR SW swellable waterstops were also applied to permanently seal all construction joints.

Al Arab Hospital, Jeddah, Saudi Arabia

This brand new, state-of-the-art hospital will be the latest addition for the Al Arab Medical Group.

The 27-storey tower will house a wide range of medical facilities including a 24/7 emergency department, inpatient and outpatient services, the latest technology operating theaters, intensive care unit, a natal intensive care unit, diagnostic imaging, pharmacy and a rehabilitation center.

The close proximity to the Red Sea and Obhur Creek presented a notable challenge for the project engineers of the main contractor Zawaya Construction. An effective solution to waterproof and protect the 1.6m-thick basement raft was required.

Penetron Middle East worked closely with Zawaya Construction and ultimately Penetron Admix was specified to ensure the impermeability and durability of the slab. Penetron Admix is a convenient solution as it is added directly to new concrete at the time of batching. This not only reduces the construction time but provides effective concrete protection against the ingress of seawater even under high hydrostatic pressure. Penetron Admix has been proven to reduce penetration of a wide variety of chemical such as chlorides to prevent corrosion of the steel reinforcement and extend the service life of treated concrete.

At Al Arab Hospital, Penetron Admix was added by using soluble bags that are mixed into the concrete of the ready-mix drum of approx. 11,000m³ of raft concrete.

Old Doha Port, Doha, Qatar

The comprehensive redevelopment of Doha's port took four years to transform a previous combined marina/cargo port into the Old Doha Port, a new tourist destination and marina for yachts and cruise ships. The project comprised the renovation and new construction of over 50 cafés and restaurants, >100 shops and businesses, many with marine activities and water sports, 150 hotel apartments, and a 30-room hotel.

Due to its strategic location next to the Corniche in the center of Doha, it became one of the main centers for fan events during the 2022 FIFA World Cup and since then remained a popular

nightlife destination.

During the planning phase of the Old Doha Port project, it was evident that the quayside concrete marine structures and the extended sea wall of the new port terminal would require a durable waterproofing solution for the concrete piers, walls and slabs exposed to seawater – and chloride penetration, a major cause of concrete deterioration. DAR, the project's technical consultant, asked Penetron to provide a durable waterproofing solution after reviewing a range of different waterproofing products including polyurea coatings, which proved to be unsuitable or too costly.

Ultimately, PENETRON, a crystalline topical material, was specified for the new marine structures and seawall. Applied as a slurry on prepared concrete surfaces, it creates a waterproof barrier to any further chloride ion penetration to prevent the onset of corrosion of the embedded steel.

In total 7,100m² of seawall were treated with PENETRON against water and chloride ion ingress.