PENETRON NEWSLETTER

March 2024

As the industry struggles to comply with ambitious COP26 targets for Zero Carbon Concrete by 2050, we see many stakeholders looking to alternative Supplementary Cementitious Materials (SCMs) and reduced carbon-emitting ways of producing cement. While these efforts are worthwhile and can contribute to reducing the overall Carbon Footprint (CFP) of concrete, it is increasingly obvious the real solution will lie in combining various approaches to achieve maximum impact. Durability should be seen as a complementary approach to these measures, collectively contributing to a more sustainable concrete industry.

Increasing the service life (i.e. durability) of concrete to more than double its design life effectively reduces a building's CFP by more than half. With the right design and use of smart crystalline durability admixtures (like PENETRON ADMIX), designers today can build structures that last 150 years or more. The value of CFP reduction and the resulting savings this brings to public infrastructure projects becomes obvious to all.

Buildings can now be designed to be repurposed multiple times. By replacing facades and adding additions, the need to demolish and re-build is avoided; the core concrete structure can serve building owners for a 2nd, 3rd, … reincarnation. Yes, this will require a paradigm shift in building codes and new design ideas, but the benefits of substantial CFP reductions attainable through a

circular economy model in construction are worth the effort. In addition, the use of integral durability solutions will make high CFP membrane-type surface treatments – with their need for multiple repairs during the building's service life – redundant.

By emphasizing durability and adopting a holistic approach that combines various sustainability strategies, the concrete sector can make substantial progress toward achieving Zero Carbon Concrete goals. The benefits extend beyond immediate CFP reductions to long-term sustainability, resilience, and resource efficiency for our industry.

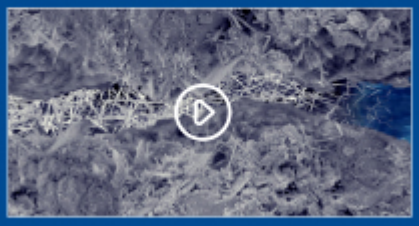
Download our "Towards Zero Carbon Concrete" brochure to learn more. Click here.

A lifecycle-assessment based on the enhanced durability features of PENETRON ADMIX-treated concrete was the core concern of a recent study undertaken by the Politecnico di Milano at Genoa Area Centrale Wastewater Treatment Plant. Read more about this study and other projects around the world that benefitted from Penetron solutions in our Penetron Worldwide section below.

With kind regards,

Jozef Van Beeck
Director, International Sales & Marketing

HOW PENETRON WORKS



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WITNESS PENETRON'S CRACK HEALING ABILITY

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PENETRON WORLDWIDE

Genoa Area Centrale Wastewater Treatment Plant (WWTP), Genoa, Italy
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Big 5 Global 2023
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Genoa Area Centrale Wastewater Treatment Plant (WWTP), Genoa, Italy

The Genoa Area Centrale wastewater treatment plant at the mouth of the Polcevera River was designed as a completely new project on the former grounds of Genoa's Ex Ilva steel mill. As part of a municipal development initiative by the City of Genoa, it inaugurates a redevelopment of the city's Cornigliano district. Completed in 2023, the facility is one of the largest sewage treatment plants in Italy and Europe.

The €60 million project was built by ICI.COOP SpA and is operated by Consorzio Integra, which consists of Veolia Water Technologies Italia and Suez Trattamento Acque.

Genoa's sewage system consists of numerous plants, distributed throughout the city's vicinity, of which many are ailing or obsolete. This affects the smooth management and distribution of wastewater and is only now being overcome with a general reorganization of the sewage system.

In addition to treating wastewater generated in the Val Polcevera basin, the Genoa Area Centrale WWTP also treats sludge from the city's entire sewage system (with a design pollutant load amounting to a 250,000-population equivalent (PE)). It replaces the existing Cornigliano WWTP as well as the Volpara sludge plant, which both had reached their maximum treatment capacities without the possibility to expand, and also treat sludge from the Sestri Ponente, Punta Vagno, and Darsena plants.

In view of the characteristics of the effluent and the surrounding marine environment, the C32/40 concrete mixes selected for the cast-in-place concrete structures of the PRE, MBR and BIO structures were designed and manufactured for use with exposure classes XC2, XA1, XS1.

The BIO tank compartment at Areale Centrale WWTP is organized in five parallel lines and consists of an activated sludge oxidation section with a total volume of about 20,000 m^3. The dimensions of the five compartments are: 35m x 8m and 18m x 8m with a height of 7.5m. The tanks are separated by a central structural joint in both the slab and the walls, effectively dividing the structure into two structurally independent bodies.

The load-bearing structure consists of:

- 70-cm-thick double-mesh reinforced slab
- cast in-situ peripheral and interior walls (making up the various tank compartments), 70 cm thick and 7.5 m high cast in a single pour

- cast in-situ canals
- roofing with prefabricated C.A.P. tiles and completion cast on site

Due to the complexity and strategic importance of the project, the use of Penetron crystalline technology for the BIO tank reservoir was specified at the design stage to ensure waterproof concrete, increased durability, and protection against chemical attacks, even without the use of any internal protective coating.

The Penetron solution, often referred to as the “Penetron White Tank System,” specified for Genoa's Area Centrale WWTP comprised of PENETRON ADMIX for the concrete slab, peripheral, and interior walls, as well as the overhead concrete canals (walls and slabs) and accessory products to seal the different construction joints. The Penetron White Tank System was chosen because the technology provides impermeable concrete and can be easily applied to different construction phases. Penetron guarantees integral waterproofing and concrete protection even when exposed to aggressive environments – and also seals construction and moving joints, significantly accelerating the construction schedule.

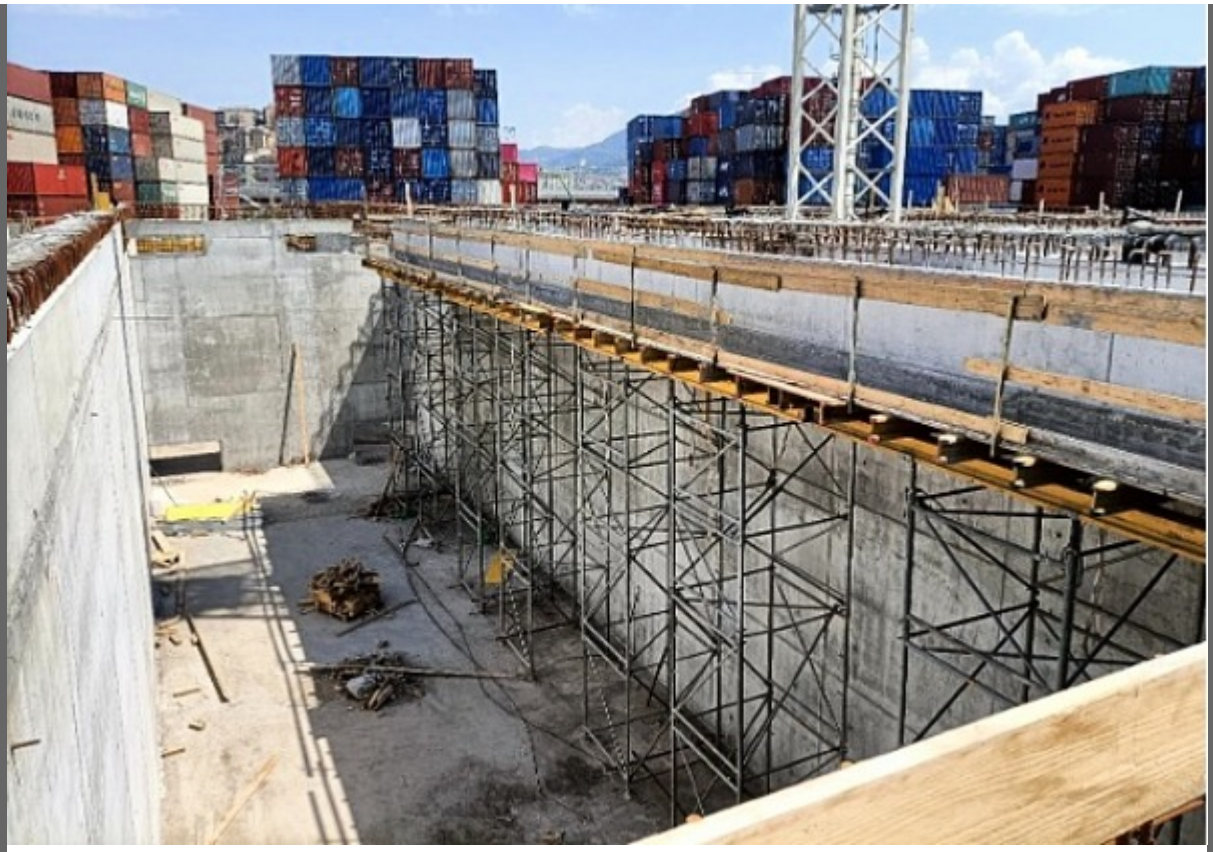
Lifecycle Assessment of the Genoa WWTP

The Genoa Area Centrale WWTP project served as a case study carried out by the Politecnico di Milano (POLIMI) under Prof. Liberato Ferrara, Professor of Construction Technology and the University of Ghent, Belgium.

The focus of the study was a lifecycle assessment of the new concrete structures by evaluating both durability and cost vs. benefits, and comparison of a control concrete sample and PENETRON ADMIX-treated concrete.

The tests performed under this study aimed to define chloride permeability and carbonation coefficients to identify mixes most suitable for the new environmental resistance EC2 and EN 206 standards.

The Politecnico di Milano study clearly shows that a service life of 100 years (required by NTC 2018 for infrastructure works of strategic importance like the Genoa Area Centrale WWTP project) can be achieved with PENETRON ADMIX-treated concrete, which significantly reduces the chloride diffusion coefficient – even in the cracked stage. The control concrete did not achieve the required service life under the same conditions.



World of Concrete India 2023

Penetron booth at World of Concrete India 2023.

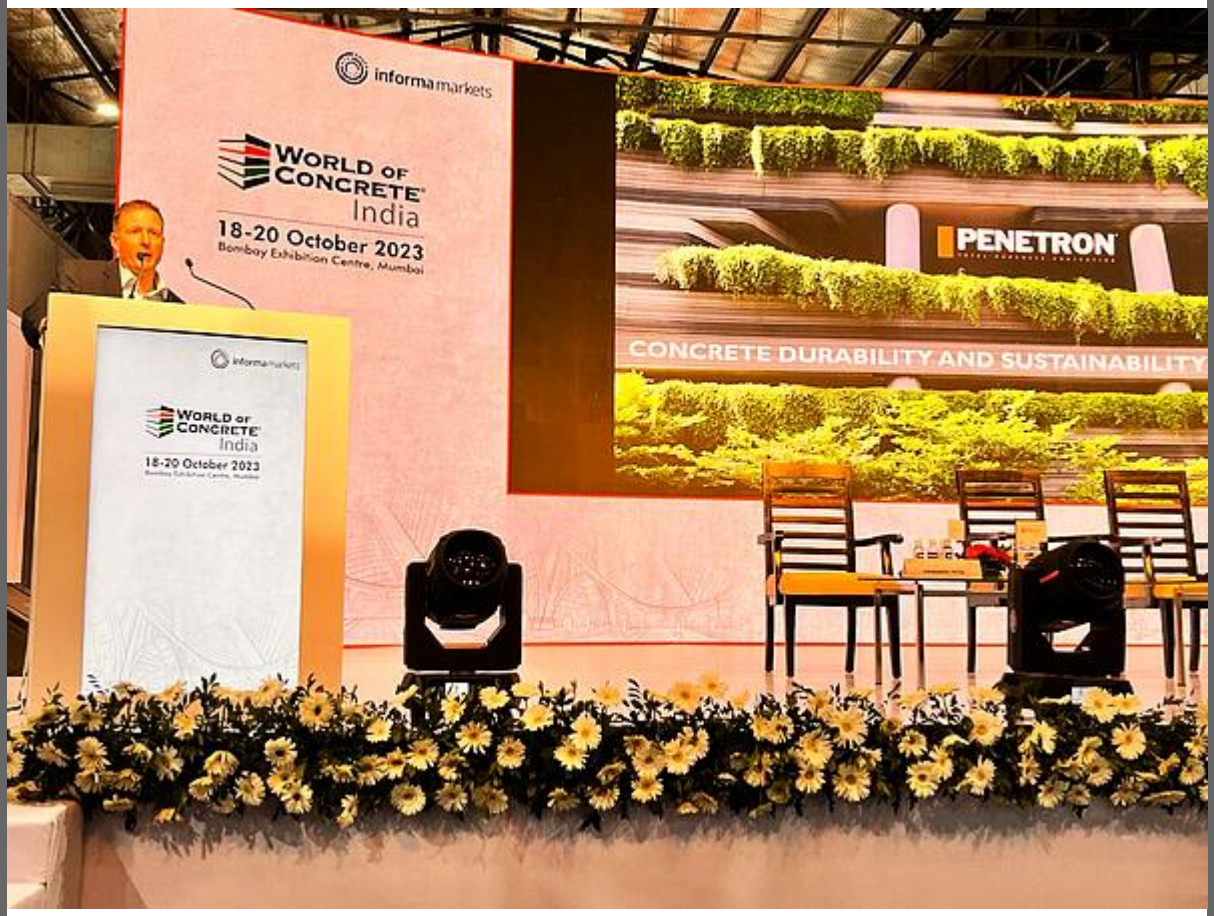
The annual World of Concrete India (October 16-18, 2023) showcases the latest trends and developments in the Indian concrete industry. Penetron, a market leader in India for concrete durability and waterproofing solutions, joined over 150 exhibitors at the Bombay Exhibition Centre to exhibit its wide range of innovative concrete protection solutions.

At the Penetron booth visitors interacted with commercial and technical teams from Penetron India to learn about the advantages of the Penetron crystalline product range and its various components. This close-up included detailed aspects of the application, areas of use, and the latest projects completed in India.

In 2023, the WOCI conference focused primarily on sustainability in the built environment with various panel discussions, including a presentation by Florian Klouda, Director, International Account Coordination of Penetron International, who spoke about the carbon footprint reduction potential of crystalline durability admixtures.

The event was the perfect opportunity for visitors to get an overview of some of the main stakeholders in the Indian concrete industry and their products and services. World of Concrete India remains an ideal platform for products and service providers to interact with key decision makers and clients in the fast-growing Indian construction market.

Penetron is proud to be part of World of Concrete India 2023 as a premium partner and looks forward to the 2024 show.



Florian Klouda, Director International Account Coordination speaking at WOC India 2023.

Big 5 Global 2023

The Penetron Middle East Team at Big 5 2023.

Held annually in Dubai, UAE, the Big 5 Global (December 4-7, 2023) is one of the biggest and most influential construction industry events in the Middle East, Africa, and South Asia. With over 2,000 exhibitors and 166 participating countries, more than 81,000 international attendees were able to see the full construction value chain, from inception to commissioning and management. Penetron is a long-time participant at Big 5 and represents the Penetron regional network, including Saudi Arabia, United Arab Emirates, Kuwait, Qatar, Bahrain and Oman in the Concrete Middle East section of the fair, welcoming visitors from over 40 countries.

Concurrently to Big 5 Global, Dubai hosted the world climate conference COP 28, where the American Concrete Institute (ACI) unveiled the new “Low-Carbon Concrete Code and Commentary” (ACI 323-24). The ACI also hosted several talks at Big 5 2023, including “Sustainability of Concrete with Crystalline Admixtures,” presented by Emilio Takagi, Technical Director, Penetron International.

Emilio Takagi, Technical Director, Penetron International presenting at ACI Talks during Big 5 2023.

Nuble Regional Hospital, Chillan, Chile

The Ñuble Regional Hospital is located in the city of Chillán, an administrative center and capital city of the Diguillín Province of Central Chile. With over 175,000 inhabitants, the city is also home to the Agricultural Department of the University of Concepción, a military base, and is a transportation hub for the Ñuble Region.

Constructed over a four-year period, the US$ 285 million project was the largest public investment in the Ñuble Region of Chile. The seven-story Regional Hospital of Ñuble features 128,000 m² (1.4 million ft²) of floor space for a 530-bed healthcare facility, which doubles the number of critical care beds available in the previous Herminda Martín Hospital. The new facility incorporates 14 wards, five comprehensive delivery rooms, and an Outpatient Care Center for Medical and Oncological specialties. A renovated ambulatory care center for medical and dental specialties was also completed. The hospital grounds comprise a public park, an underground parking garage, an auditorium, and outdoor amphitheater.

Initially, a pore-blocking additive was specified for the below-grade concrete structures of the hospital. However, this specification was considered insufficient by the project engineer due to the high groundwater levels prevalent in the Ñuble Region.

Due to its nature, hydrophobic pore blockers are typically solely considered for non-hydrostatic conditions. This is why PENETRON ADMIX was ultimately chosen to replace the initially specified product. PENETRON ADMIX, a permeability reducing admixture for hydrostatic conditions, effectively protects concrete against the ingress of water and water-borne contaminants even under high hydrostatic pressure. It also equips concrete with self-healing capabilities and is proven to enhance durability and service life of the structure.

Ready-Mix Concretes, the project's concrete supplier, delivered 3,300 m³ of PENETRON ADMIX-treated concrete for the foundation slabs for the entire hospital. Construction of the Regional Hospital of Ñuble was carried out by INSO.

Bintaro Xchange, Jakarta, Indonesia

Phase 2 is an exciting new addition to Bintaro Xchange Mall, which includes a retail section with over 85,000 ㎡ of floor space and a hotel complex under the Hilton Double Tree brand. Situated

on a 25 ha block in South Jakarta and designed by Lead 8 Architecture and Planning, the project took key design references from the well-known Javan rice terraces to create a multi-level landscaped environment.

A central park forms the heart of the development and provides space for recreation and entertainment opportunities.

The 6-story mall (including a 2-level basement) boasts a large variety of local and international brands as well as dining establishments. The main attraction of Bintaro Xchange is the BXSea Oceanarium, which is only the second of its kind in Indonesia.

The 4-star Double Tree Hotel features 184 guest rooms, 8 meeting rooms and a total of 1,162 ㎡ of event space. Other amenities include a gym, outdoor pool, parking facilities, and several restaurants.

A wide range of Penetron solutions were employed to ensure waterproofing and durability of the foundation at Bintaro Xchange. PENETRON ADMIX was added to approx. 25,000 m³ of concrete mix for the foundation slab (raft and retaining walls). PENETRON was applied to more than 10,000 ㎡ of the podium, roof garden slabs, swimming pool, and the sky bridge (connecting the two parts of the shopping mall). Over 10,000 m of PENEBAR SW swellable type waterstops were used to seal the construction joints and prevent leaks. This ensured a completely watertight envelope for the Bintaro Xchange Mall. PENESEAL FH provided enhanced protection for the Bintaro Xchange Mall parking decks. This unique floor-hardening product was applied to a total area of 30,000 ㎡. To waterproof the top parking deck, PENESEAL PRO was applied to a surface area of approx. 11,000 ㎡.

BXSea Oceanarium, Jakarta, Indonesia

BXSea, located inside Bintaro Xchange Mall, is the first aquarium tourist destination in the South Tangerang Area. It is a place for both entertainment and education to raise awareness in the community about aquatic biota and marine life.

Offering visitors a unique experience, the 7,354 m² facility showcases 140 species in 54 aquarium displays. The 44 fresh and seawater tanks and 10 terrariums hold a total volume of 4.5 million liters of water – the largest aquarium experience in Southeast Asia.

To ensure complete waterproofing of the tank structures at BXSea, PENETRON ADMIX was added to over 5,000 m³ of concrete supplied by SCG Jayamix. PENEBAR SW-45A ensured a permanent joint waterproofing solution to the full satisfaction of the client.

Clifford Residences, Mosman, Australia

Designed by Fortey & Grant Architecture & First Marque Designs, the renovated building situated at the tip of Curraghbeena Point only footsteps from the ferry wharf, retains its classic façade with subtle Art Deco references. The conversion of the previous 6 x 2-bedroom apartments on 3 levels into four whole floor luxury apartments also added an internal elevator linking each apartment to the stylish reception foyer, new balconies, high-level interior finish, and two underground floors, including a parking garage to enable vehicular access and basement areas.

Built right on the banks of Sydney Harbor and constantly exposed to seawater, the concrete foundation structures needed to be impermeable to both the hydrostatic pressure of the site's high groundwater levels and the marine environment.

After review during the planning phase of the project by engineers at John Romanous & Associates, PENETRON ADMIX, a crystalline waterproofing admixture, was specified to provide the Clifford Residences' concrete structures with long-term protection from the saltwater environment. Holcim, the concrete supplier, added the admixture to the concrete mix used for all below-grade structures, including the foundation slabs, retaining walls, elevator pits, and stormwater retention tanks. Exposed to wind, salt, and contaminates from the ocean, the building's concrete roof slab was also treated with PENETRON ADMIX.

Once added to the concrete mix, proprietary chemicals in Penetron's crystalline admixture react in a catalytic reaction with moisture to generate a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete. The resulting formation seals pores and microcracks, and becomes an integral part of the concrete matrix, making the concrete impermeable to high groundwater pressure and chloride ions in saltwater that can cause corrosion.

LD Celulose Paper Mill, Indianópolis, Brazil

A small industrial town of around 7,000 inhabitants, Indianópolis is located in the state of Minas Gerais in southeastern Brazil, about 450 km (280 miles) south of Brasilia, the country's capital city. Situated in the fertile farming region of the Triângulo Mineiro, the region features coffee, banana, and rubber plantations, as well as cattle ranches.

One of the town's key industries is the LD Celulose paper mill, a joint venture between Lenzing, an Austrian company and the world's largest producer of cellulose fiber, and Dexco, a Brazilian company and the largest wood panel producer in Latin America. The new Indianópolis dissolving pulp mill, with an annual capacity of 500,000 tons, is one of the largest and most energy-efficient mills in the world.

The dissolving pulp produced in Indianópolis is a key raw material for the manufacture of Lenzing's wood-based textile and specialty fibers. Cellulose fiber is also used in a wide range of products, including viscose, fibers, clothing, footwear, hygiene and beauty products, tires, medicine capsules, foods (yogurts and ice cream), and LCD screens.

The project architect required a robust concrete waterproofing solution due to the constant exposure to liquids, moisture, and chemical attack typical for this type of manufacturing and wastewater treatment plants. Before construction of the new mill began, Penetron Brazil was approached about a concrete waterproofing and protection solution to protect the facility's planned water storage tanks and dedicated wastewater treatment plant. After reviewing the performance parameters of Penetron's crystalline products on numerous previous projects in Brazil and beyond, the architect specified PENETRON ADMIX, a crystalline waterproofing admixture, for all concrete water storage tanks and the wastewater treatment plant's effluent treatment tanks.

PENEBAR SW, swellable waterstop strips which create a physical barrier against water penetration through cast-in-place concrete joints, permanently sealed the new concrete joints of both the water storage tanks and the wastewater treatment plant.

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