

TOWARDS ZERO CARBON CONCRETE



PENETRON
TOTAL CONCRETE PROTECTION

THE CONCRETE SOLUTION.

Concrete with the highest level of durability.

The world's most popular building material. Billions of cubic meters of concrete are poured or pre-cast every year. Concrete is used on almost every type of construction project around the world. The quality of the concrete is usually defined by its structure and strength. These characteristics have enabled the design of attractive structures that need to be durable and capable of withstanding extreme or aggressive environments.

Deterioration and costs. Unfortunately, concrete is an imperfect material; countless structures deteriorate severely and fail long before their design life expires. For building owners (and builders), the premature loss of concrete structures or the corresponding maintenance and repair can quickly reach prohibitive cost levels.

A delicate material. Concrete is essentially a hard, porous and absorbent material that can crack and allow water to easily penetrate through pores, micro-cracks and capillary tracts. The result is a wide range of problems that damage the concrete or the underlying reinforcing steel. This dramatically affects the durability and the lifespan of concrete.

Durability. Penetron products are formulated to react with key concrete components to produce an integral crystalline formation. PENETRON-treated concrete shows vastly improved chloride diffusion and sulphate resistance, permeability, drying shrinkage and freeze-thaw cycles, as well as self-healing capabilities. The service life of PENETRON-treated concrete is about three times that of conventional concrete.

Durability: Boguchany Dam, Russia

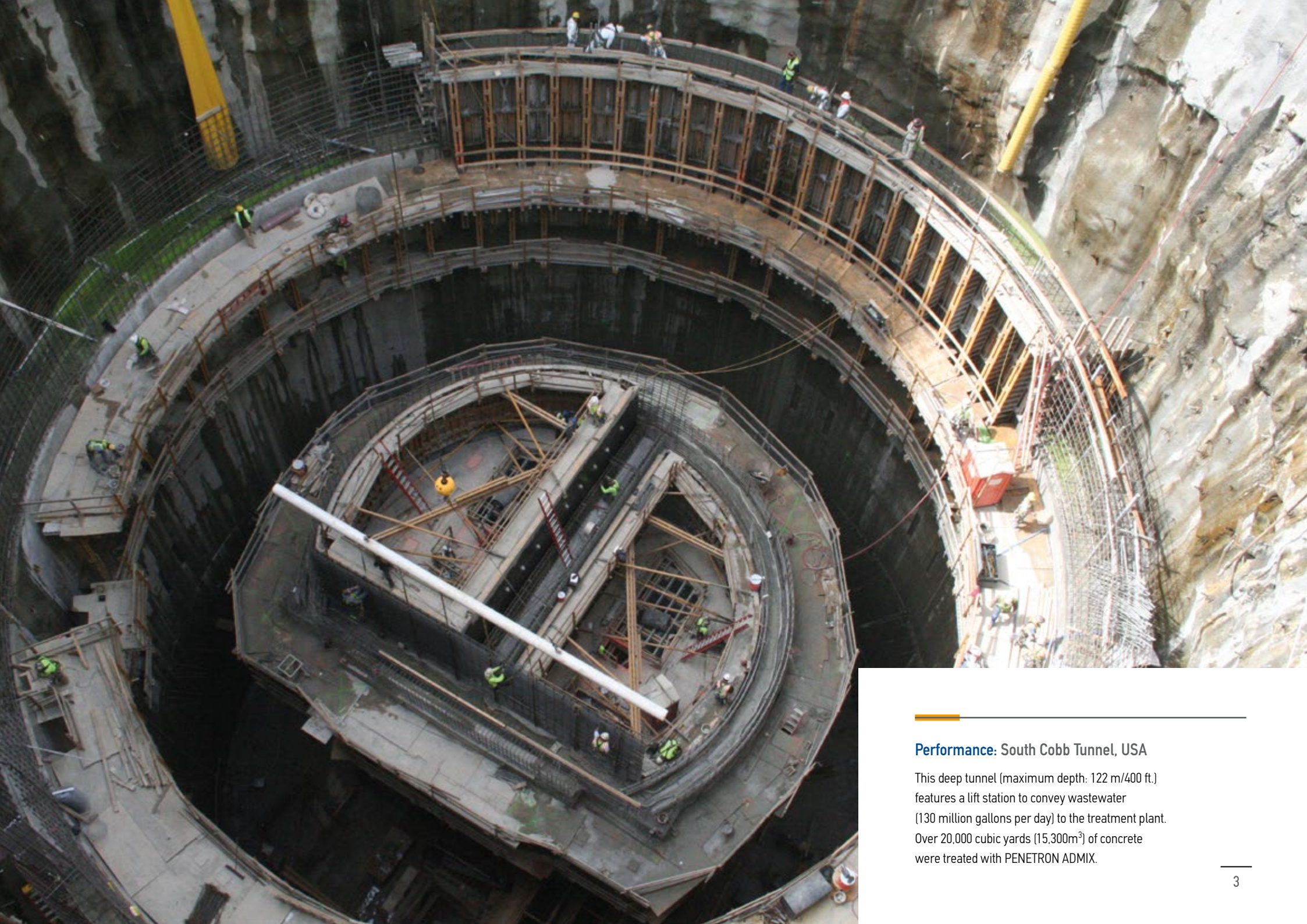
Currently the largest dam in Russia, deterioration of older concrete parts required repair and water-proofing to withstand high hydrostatic pressure. The Penetron System was successfully used on the concrete structures.



Reliability: Changi Airport, Terminal 3, Singapore

This newest showcase, Terminal 3 in Singapore, features innovative passenger facilities and modern architecture. PENETRON ADMIX was used through-out the concrete structures to provide a high level of durability and a long-lasting solution.





Performance: South Cobb Tunnel, USA

This deep tunnel (maximum depth: 122 m/400 ft.) features a lift station to convey wastewater (130 million gallons per day) to the treatment plant. Over 20,000 cubic yards (15,300m³) of concrete were treated with PENETRON ADMIX.





Image: MTA New York © 2013

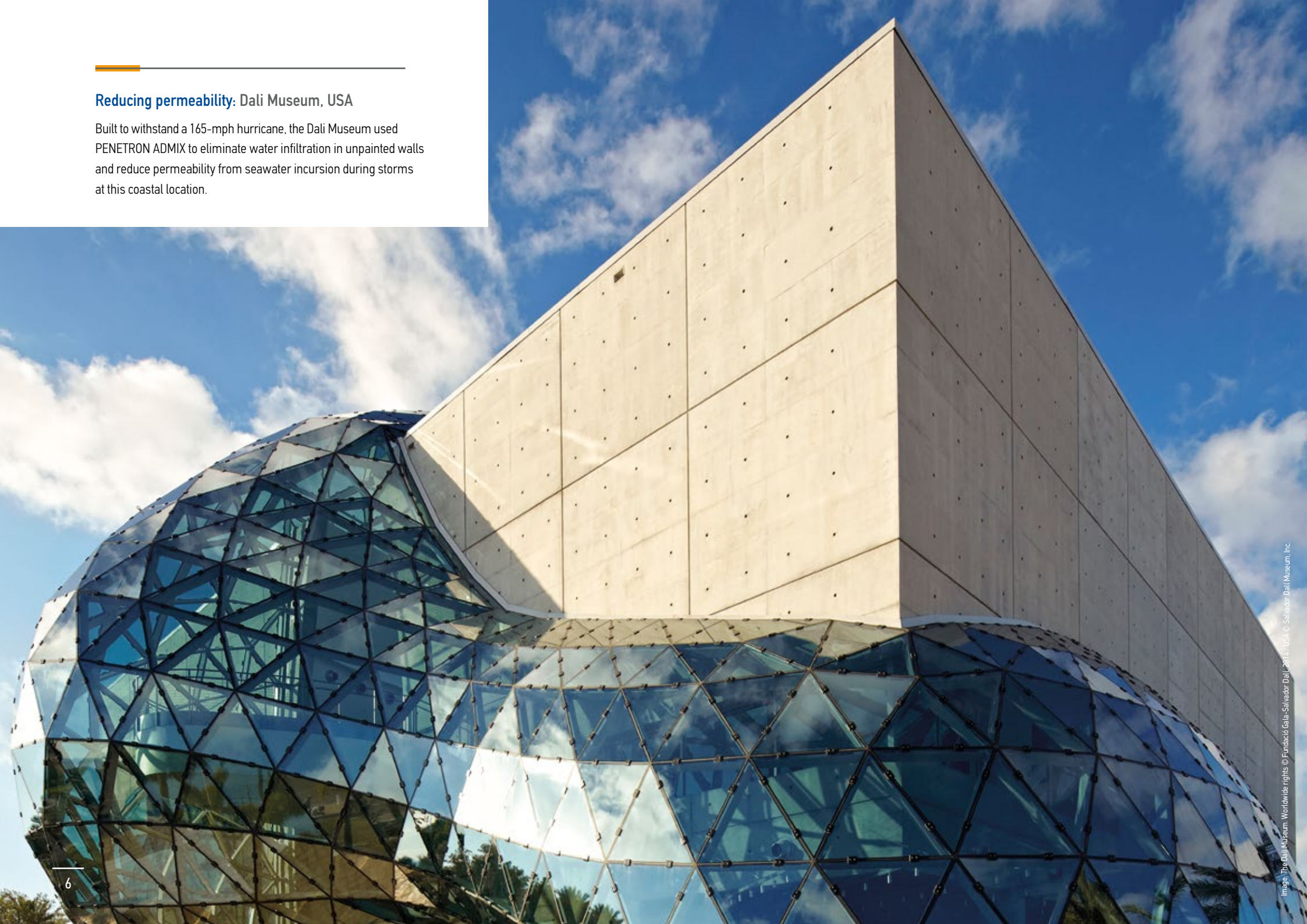
Staying on track: No matter how large the project

Even the largest civic projects benefit from Penetron technology to waterproof and enhance the durability of concrete structures. The integrated nature of a crystalline system also provides a scheduling advantage.



Reducing permeability: Dali Museum, USA

Built to withstand a 165-mph hurricane, the Dali Museum used PENETRON ADMIX to eliminate water infiltration in unpainted walls and reduce permeability from seawater incursion during storms at this coastal location.



Optimizing high performance

with a low-permeability concrete design.

Permeability exposes concrete. Concrete is naturally porous due to the nature of concrete placement, which allows the presence of cracks, voids and capillaries. This allows water and waterborne contaminants to enter the concrete, either by capillary absorption or under hydrostatic pressure. Such permeability exposes concrete to deterioration and premature failure.

An economical and environmentally friendly solution. By removing water from the concrete matrix, the life span and durability of concrete can be significantly increased. Adding a crystalline admixture to the concrete mix reduces permeability, increases density and promotes active self-healing. This is superior to traditional methods of producing low permeability concrete (manipulating the water-cement ratio and introducing passive pore blockers). A crystalline admixture is also more economical and environmentally friendly.

Durable concrete is better concrete. Reducing permeability in concrete keeps water and waterborne contaminants out of the concrete matrix. The American Concrete Institute (ACI), in their **Report on Chemical Admixtures for Concrete*, clearly spells out the advantages of a crystalline waterproofing solution as *"a superior product to reduce permeability in concrete under hydrostatic pressure (compared to hydrophobic pore blockers and colloidal silica) and thereby significantly increases the durability and lifetime of concrete structures."*

**Report on Chemical Admixtures for Concrete (ACI 212.3R-10), November 2010*



↑

Reducing permeability: Ferrari GES, Italy

With expansive below ground levels in the new center for Ferrari's Formula One team, PENETRON ADMIX was specified as the ideal waterproofing solution for a relatively high water table in order to resist the water pressure at the construction site.

Protecting concrete against...almost everything.

Preventing corrosion, freeze-thaw damage, scaling and other problems



Preventing problems to extend concrete life span. Using an integral waterproofing solution improves concrete durability and reduces permeability. This added protection also helps eliminate a number of potential issues that can seriously compromise and deteriorate the structure. The main reasons for concrete deterioration include:

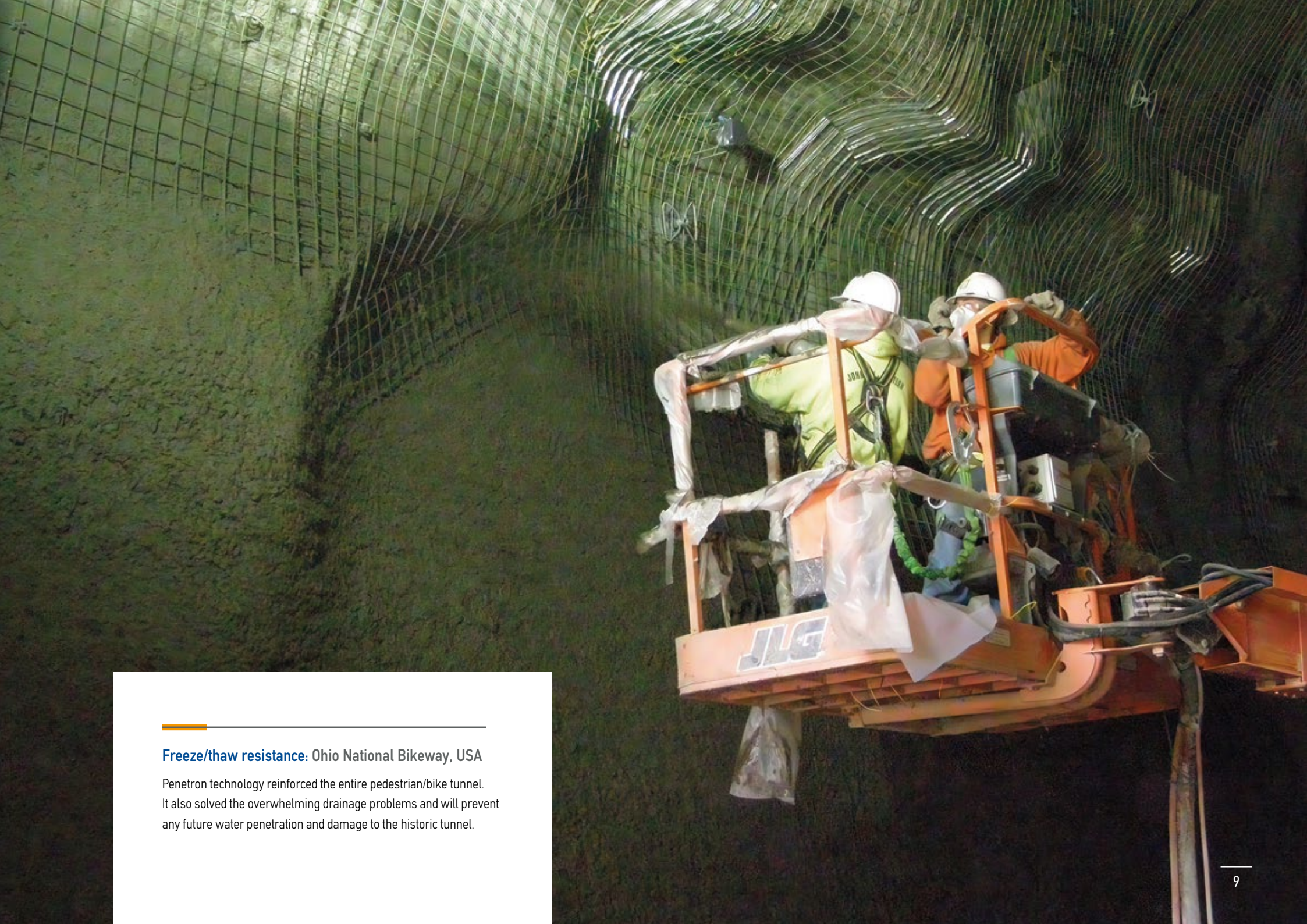
- Corrosion of the reinforcement steel due to water penetration
- Damage from repeated freeze-thaw cycles
- Alkali-silica reactions (ASR)
- Attacks by various aggressive chemicals, such as chlorides, sulfates and acids
- Damage from concrete scaling

Self-healing. The Penetron system provides concrete with the capacity to self-heal micro-cracks up to 0.5 mm throughout its service life. No further treatment or maintenance is required.

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Preventing corrosion: Heritage Wharf, Bermuda

This cruise ship pier in Bermuda needed critical repairs to worse-than-expected erosion damage. PENETRON ADMIX was used in the reinforced concrete marine wharf structures to protect the non-galvanized reinforcements.



Freeze/thaw resistance: Ohio National Bikeway, USA

Penetron technology reinforced the entire pedestrian/bike tunnel. It also solved the overwhelming drainage problems and will prevent any future water penetration and damage to the historic tunnel.

A crystalline solution to concrete problems.

The science behind Penetron technology

A micro solution for a macro problem. Because water and waterborne contaminants penetrate concrete mainly through capillary absorption and hydrostatic pressure, countering this problem demands a “molecular level” solution. Our Penetron crystalline waterproofing technology was developed and optimized over many years through careful micro engineering. The results speak for our success.



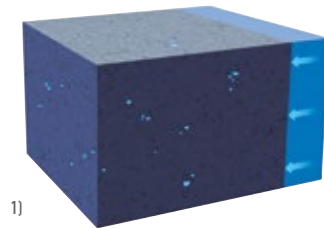
MAGNIFICATION 5000 X

THIS IS HOW PENETRON TECHNOLOGY WORKS:

- 1. The Penetron chemicals penetrate into the pores, micro-cracks and capillary tracts** of the concrete through osmosis, Brownian movement and dry particle reactions.
- 2. The Penetron active ingredients react with concrete minerals to form insoluble crystals,** which fill in cracks, pores and voids up to a width of 500 microns (0.5mm). This crystalline growth takes place deep inside the concrete structure relatively far from the point of application.
- 3. Water molecules (and harmful chemicals) can no longer pass through the concrete.** However, air can still pass, allowing the concrete to breathe. This avoids the build-up of vapor pressure.
- 4.** In the absence of further moisture, the Penetron components lie dormant. **Should moisture reoccur at any time, the sealing process resumes automatically** and advances deeper into the concrete.

Waterproofing Concrete

APPLIED TO A SURFACE →



1)

Typical concrete structure with moisture.



2)

PENETRON is applied to positive or negative side.



3)

The crystalline technology blocks moisture penetration.



1)

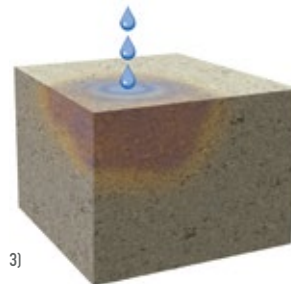
PENETRON ADMIX is added to the batch at the time of mixing.

ADDED TO A CONCRETE MIX →



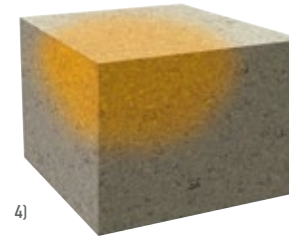
2)

The concrete sets and has integrated Penetron protection.



3)

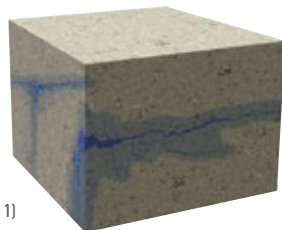
The crystalline technology is activated in the presence of moisture.



4)

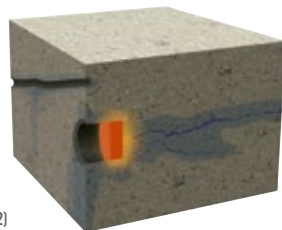
The concrete structure is protected against moisture penetration.

SEALING CRACKS AND HOLES →



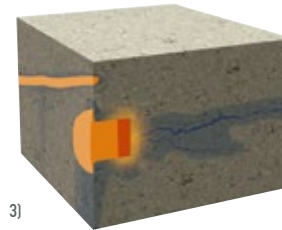
1)

The crack and hole are drilled out.



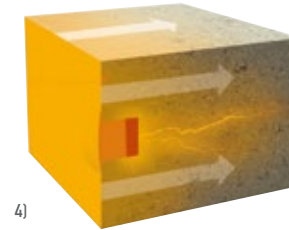
2)

PENEPLUG is applied into the hole for instant results.



3)

PENEKRETE MORTAR is used to seal the crack and remaining area of the hole.



4)

The crystalline technology blocks moisture penetration.

Constant vigilance means

constant improvement.

How our materials are tested and what the results mean for your project

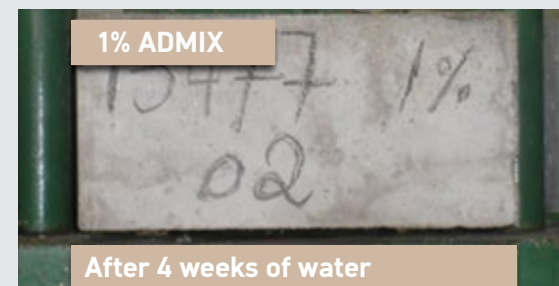
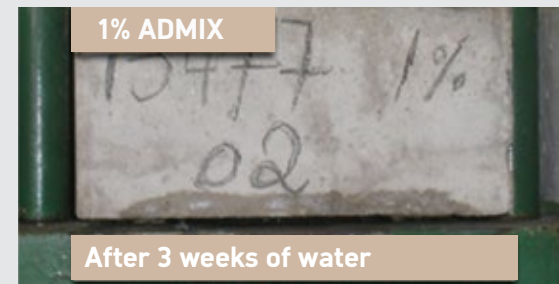
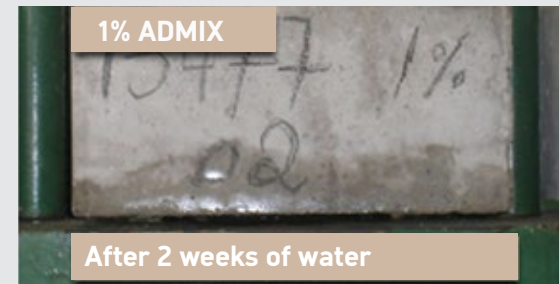
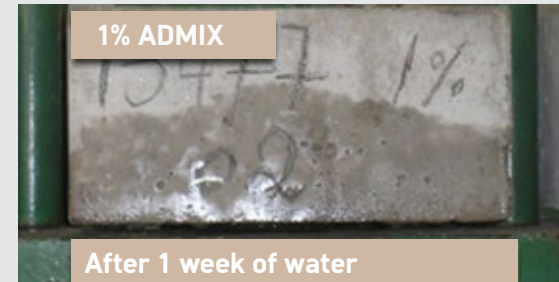
Permanent product development. All Penetron products undergo constant testing and critical evaluation—both on-site and in the lab—to ensure the consistency of results and enhanced performance. Only through constant efforts to improve can we ensure consistent and peerless quality and high performance—as well as to improve compliance with strict global production and testing standards.

Working with experts. Penetron formulations undergo continuous refinement by integrating the latest materials research from scientific testing labs and practical input from construction professionals in the field. Our products meet national and private standards—such as the NSF in the U.S.A., the CE/TÜV in Germany, the UK Board of Agrément and the NBR in Brazil—to meet all performance and environmental regulations.

Experts confirm the results. Penetron products are tested in a number of recognized international laboratories and certified to a wide range of international standards such as: DIN 1048, Nordtest, ASTM, CRD, etc.



► Testing Water Penetration Under Pressure
NBR 10.787/94
101.5 psi head pressure





- *“Rigorous and straightforward testing improves the breed: Penetron product development teams work closely with testing labs and concrete specialists to optimize the technology and permeability-reducing properties of our products.”*

Why choose Penetron?

It's more than just good waterproofing.

Our commitment can help keep your project on track

Focusing on the right things. Why do customers have the confidence that our solution is the most suitable for their project? It's a matter of providing expertise during the selection process, testing samples, responding to any questions that arise, ensuring on-time delivery of the product and project site visits to see first-hand that the concrete performs as expected. It's how we focus on the right things: listening and responding with honest explanations.

The Penetron advantage. This virtuous circle of dialogue and response is an important part of how we work. We provide end-to-end project support from the initial tender, through the construction phases to after-sales-service. But there are many other technical aspects that make a difference for your project. From the way we manufacture our products to how we package and deliver them to your site—performance at every stage is your advantage.

From the factory. . . Our production facilities strive for the right results with comprehensive manufacturing and tracking controls. The production line is equipped with state-of-the-art equipment and samples from each production batch are saved to ensure consistent quality control and rapid response in case any questions arise.

. . . to the construction site. We're scrupulous about on-time delivery with the right product, whether to a supplier, the end-user or the customer. By taking care of the details, we can ensure performance and quality are always right—and your project stays on track and on schedule.

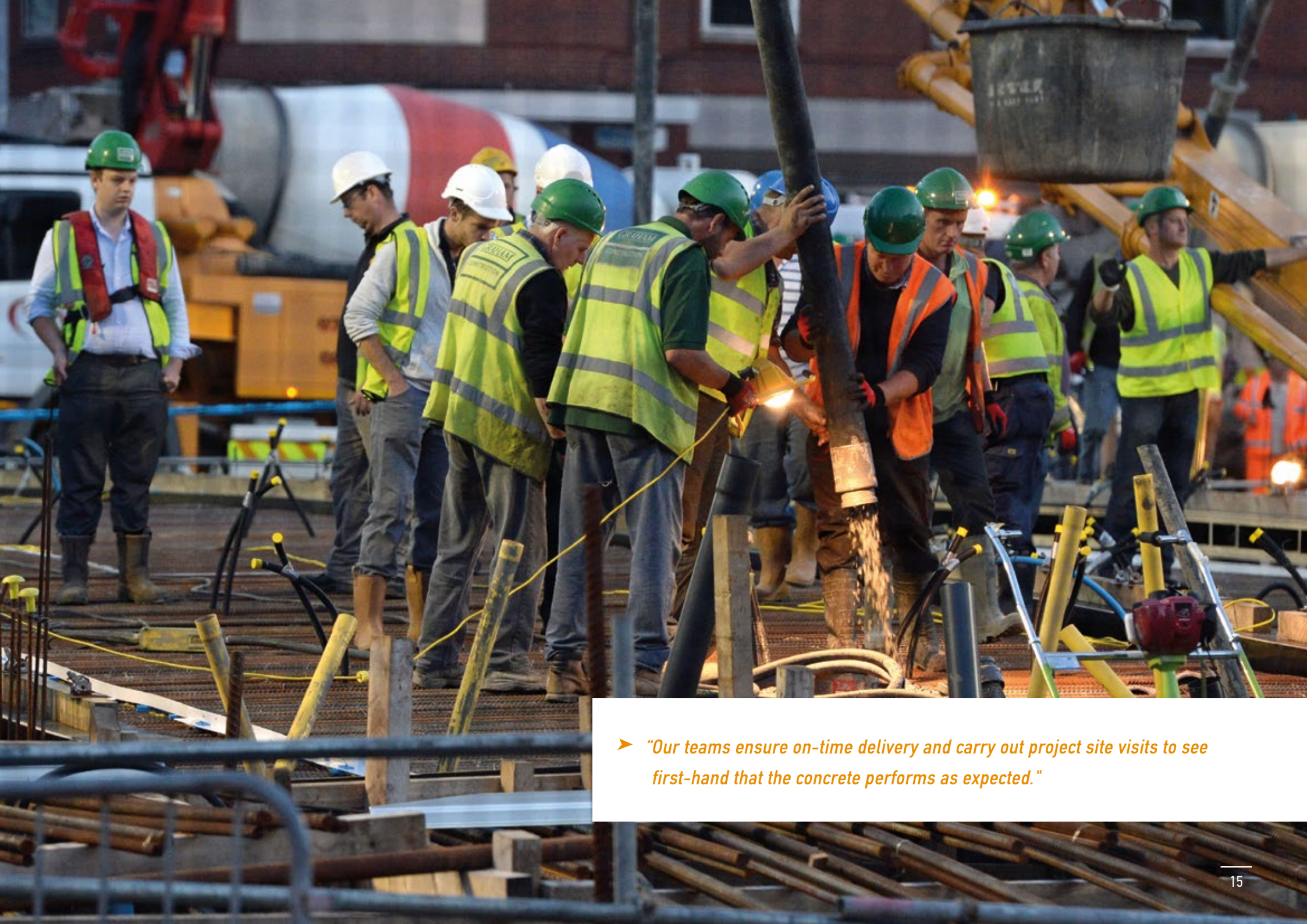


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Meeting deadlines: Corredor Duarte, Santo Domingo

This highway tunnel used a thinner (PENETRON-enhanced) shotcrete layer applied directly behind the tunnel boring machine to minimize deformation of the rock layers and accelerate construction.





- *"Our teams ensure on-time delivery and carry out project site visits to see first-hand that the concrete performs as expected."*

Every project is different.

Let's make them last.

A wide range of solutions ensures durable results

Not just a product, but a set of solutions. Penetron does not simply “provide world-class products.” We work with the client to develop solutions based on both the demands of a particular job site and our know-how and experience in concrete technology. Our world-class products are a result of years of experience, a global network of specialists and proven expertise in optimizing the mix and performance of concrete.

Many projects and a single goal. By combining the right products with the right application process, we can pinpoint the right solution with the best performance. Penetron helps concrete suppliers and contractors deliver the right mix for the special concrete types that fulfill the construction industry’s increasingly demanding performance requirements.

Name your project. Our solutions include a wide range of project types:

- **New concrete construction**—our PENETRON ADMIX crystalline admixture and PENEBAW sealing compound for construction joints combine for an industry-leading solution
- **Shotcrete**—for both wet-mix and dry-mix applications, PENETRON ADMIX is effective even under highly adverse conditions
- **Precast concrete**—use of Penetron technology ensures high-quality performance and durability in precast concrete elements
- **Existing concrete structures**—surface application of PENETRON ensures waterproofing and chemical protection, with PENESEAL PRO spray-on liquid sealer for hairline cracks
- **Concrete repair**—revitalizing damaged structures with PENECONCRETE MORTAR repair mortar and PENEPLUG cementitious compound stops active leaks, even under hydrostatic pressure
- **Floor hardening**—with our PENESEAL FH reactive penetrating sealer for concrete and masonry materials



Waterworld.

Over 70% of our planet is covered by ocean water. Durable concrete structures will play a key role as human activities increasingly move into aggressive marine environments. Penetron technology is an important part of the durability design of such structures.



Working to a budget is the way we work.

Cost-effective solutions from Penetron prevent cracks in your project budget

Looking at the bottom line. The premature loss of concrete structures or the resulting (and unexpected) maintenance and repair costs can easily reach prohibitive levels that exceed the original construction costs. Also, the global supply chain faces growing material shortages, increasing costs and a global trend towards regulations that specify more sustainable and efficient ("green") use of resources.

Consider the life cycle of a building. Current financing models for most projects cover the service life of a building and not the initial construction costs. This creates demand for structures with a long service life—and with enhanced durability concrete.

Solution for today and after work is done. Penetron engineers have developed successful solutions for an extremely wide range of projects that can help meet even the most stringent performance parameters—today and long after construction is completed.



Working to a budget: OCWA Eastern Reservoir, USA

PENETRON ADMIX was used in the ready-mix concrete to meet a tight project budget by saving man-hours, eliminating the need for membranes and coatings, and providing superior performance.



Securing a skyscraper: The Sail, Marina Bay, Singapore

As a 245m (800 ft.) tall condominium with over 1,000 luxury units, The Sail at Marina Bay is one of the tallest residential buildings in the world. Situated right on the water, The Sail used PENETRON ADMIX to treat the building's entire substructure.



Cost-effective solution: Cleveland Zoo, USA

A complex project, the African Elephant Crossing at the Metroparks Zoo used PENETRON ADMIX for the wading pool, swimming pool and waterfall as the most cost-effective solution.

The future of concrete is Green.

Ensuring reliability & sustainability

Working smarter. Long before it became a trend, Penetron crystalline technology represented a positive step towards sustainability, smarter use of resources and “greener” construction practices. While concrete does not immediately come to mind as a “green” product, eliminating liners and membranes, extending the life of concrete structures (and avoiding costly repairs) and offering non-toxic products (tested by environmental labs) all contribute to more sustainable construction projects.

The greener choice. Penetron technology is completely free of volatile organic compounds (VOC) and its non-toxic nature makes it compatible for potable water or food-containing applications. Being a green-label certified system, Penetron conforms to international green building standards.

Sustainable, yet cost-effective. All of our products adhere to the highest standards of environmental compliance and are continuously tested by recognized testing laboratories to ensure compliance with the latest standards, including EN, ASTM, DIN etc.

From the plant to the project. Our comprehensive quality assurance production processes and ISO 14001 certification underlines our efforts towards sustainability. This includes our careful selection of raw materials from local suppliers (whenever possible).



Sustainable construction: Calgary EEEL, Canada

With innovative, energy-saving and sustainable technologies, the EEEL won a LEED Platinum certificate. All below-grade concrete used PENETRON ADMIX to maximize durability and water resistance.





Being green: Gardens by the Bay, Singapore

These waterfront gardens are a horticultural attraction and showcase of sustainable energy technology—with severe waterproofing challenges. Penetron technology provided a “green” solution.

Our system is your system.

The products and performance behind the Penetron System

The Penetron System offers high quality products for a wide range of concrete durability applications. Our products undergo rigorous lab and field-tests and are all produced exclusively in our ISO 9001-certified production facility.

The complete Penetron System includes the following solutions:

CRYSTALLINE WATERPROOFING

Crystalline Durability with multiple activating chemicals for the most effective permanent concrete permeability-reducing system (PRAH) available.

PENETRON ADMIX®

A 3rd generation crystalline admixture added to new concrete during batching for complete integral waterproofing and concrete protection.



PENETRON ADMIX® SB

A Penetron innovation —our 3rd generation crystalline admixture features time-saving, pre-measured, soluble bags for easy application.



PENETRON®

Applied on the positive or negative side by brush or spray, below-grade and above-grade for waterproofing and chemical protection.



PENECRETE MORTAR™

A repair mortar to fill non-moving cracks, construction joints, form-tie holes, honey-combs and structurally damaged concrete.



PENEPLUG®

A fast setting crystalline-based, cementitious compound to stop active leaks, even under hydrostatic pressure.



PENETRON PLUS®

A dry-shake crystalline waterproofing formulation trowel-applied for horizontal surfaces and precast concrete.



PENETRON INJECT™

An advanced two-component injection grout for crystalline waterproofing and to quickly seal larger voids and cracks deep inside the concrete.



WATERSTOPS are swellable-type waterstops to treat non-moving construction joints or penetrations against water ingress, even under high hydrostatic pressure.

PENEBAR™ SW-45 RAPID

A sealing compound that expands rapidly when exposed to moisture, ideal for construction joint applications.



PENEBAR™ SW-55

Creates a physical barrier against water penetration through cast-in-place concrete joints that expand when exposed to moisture.



PENEBAR™ PRIMER

Stops water penetration by enhancing the bond between preformed sealants and concrete surfaces; easy to apply.



High quality products for a wide range of concrete durability applications.



LIQUID SEALERS

permanently protect, preserve and strengthen concrete—as waterproofing treatment (for exposed concrete e.g. roof slabs) and as a concrete floor hardener.



PENESEAL PRO®

A spray-on liquid sealer that forms a sub-surface barrier to seal hairline cracks and protect concrete against water penetration.



PENESEAL™ FH

A clear, reactive penetrating sealer that can permanently protect, preserve and strengthen concrete and masonry materials.

"We've talked a lot about performance and technology. But ever since I first waterproofed a cellar during a summer job, the priority — for me and the company — remains the same: We strive to provide the highest quality products together with a helpful support system to ensure the success of our customers' projects — anywhere in the world."

—Robert Revera, PRESIDENT



Jozef Van Beeck • DIRECTOR
International Sales & Marketing

Florian Klouda • DIRECTOR
International Account Coordination

Robert Revera
PRESIDENT & CEO

Christopher Chen • DIRECTOR
North America Sales & Marketing

"Total concrete protection."

Our Company

Founded in the late 1970s, Penetron developed cementitious waterproofing products and additives to create an optimal crystalline technology. The know-how and experience gained over the past 40 years has enabled Penetron to offer a broad range of concrete solutions for concrete protection, waterproofing, and the repair and sealing of concrete.

The Penetron System has been proven effective on countless major projects worldwide. The technical excellence of the products and our knowledgeable and dependable team of people have made the company the industry leader.

With offices in all key markets and production facilities around the world close to customer sites, Penetron offers products and technical support to every country in the world through a comprehensive network of distributors.



penetron.com

PHONE +1 631 941 9700

FAX +1 631 941 9777

EMAIL info@penetron.com



Chennai International Airport, India



Sheraton San Juan, Puerto Rico

Performance: Chennai International Airport, India

The modernization and upgrade of Chennai International demanded a high performance solution to cope with sudden monsoon weather. The Airports Authority of India (AAI) specified the use of Penetron technology.

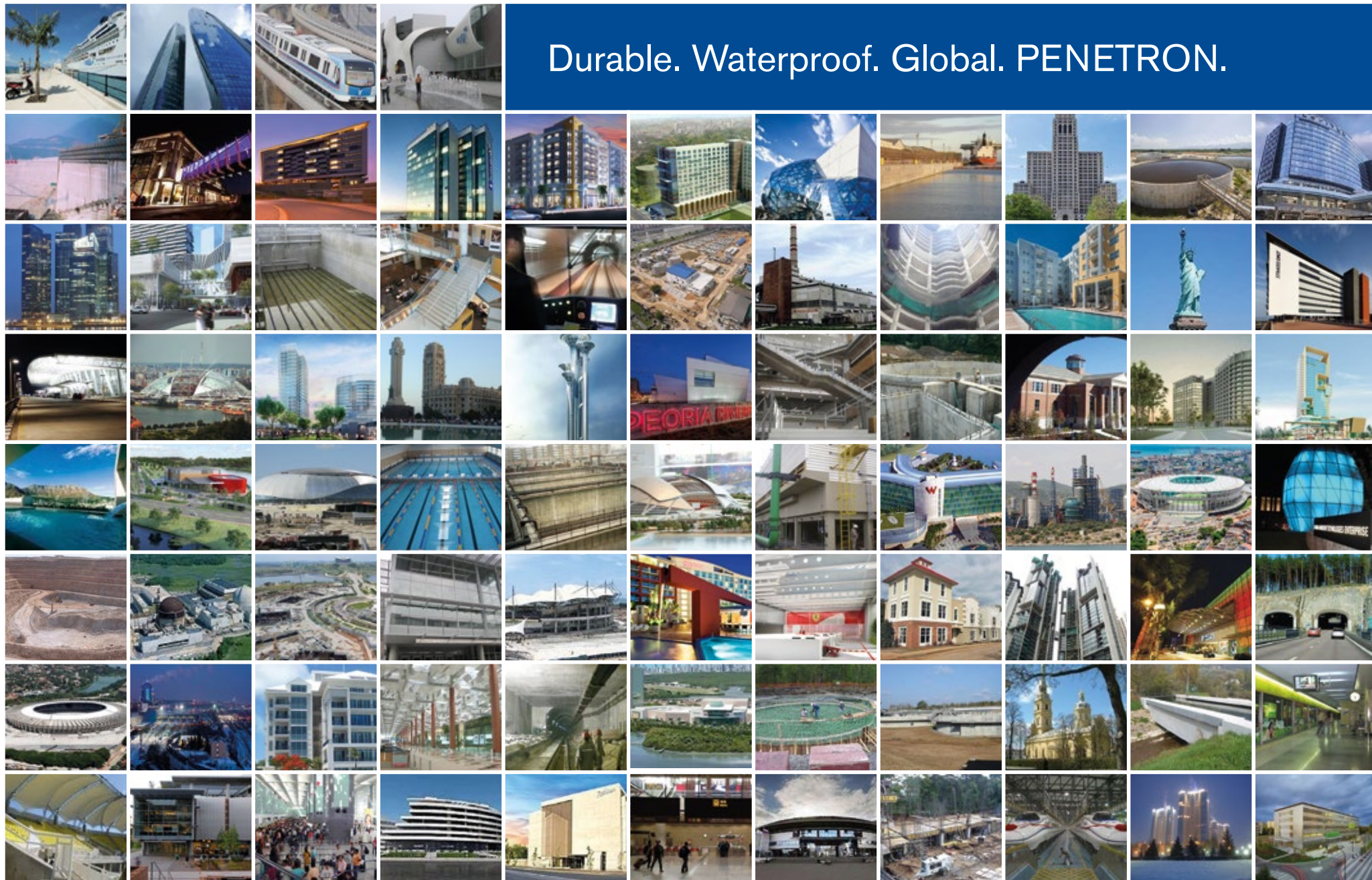
Working to a schedule: Sheraton San Juan, Puerto Rico

Meeting deadlines with a top-floor pool deck demanded a comprehensive concrete waterproofing solution for this 500-room hotel. PENETRON ADMIX was chosen to treat the pool and water cisterns to help reduce construction time.



Around the world with Penetron: Every image on these two pages represents a showcase project that relies on Penetron technology. These projects can be viewed at www.penetron.com/projects.

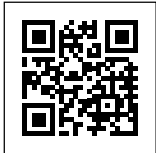
Durable. Waterproof. Global. PENETRON.





PENETRON INTERNATIONAL LTD

penetron.com | email: info@penetron.com
phone: +1 631 941 9700



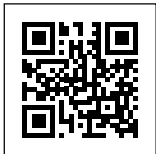
EUROPE SOUTH-EAST REGION

PENETRON HELLAS S.A.

G.E.MH. No: 07278001000

penetron.gr | email: info@penetron.gr

phone: +30 210 244 8250



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