

**PENETRON**<sup>®</sup>  
TOTAL CONCRETE PROTECTION



# Topical Applications

Getting the most out of  
existing concrete structures

# Topical application solutions from Penetron



## **Heydar Aliyev Center, Baku, Azerbaijan**

Designed by Zaha Hadid, this building complex houses conference and gallery halls, offices, restaurants and a museum. PENETRON and PENECRETE MORTAR were used to enhance the impermeability of the concrete in the basement.

## **Vantage Norwest, Bella Vista, Australia**

The five-floor commercial building with an innovative, sustainable design and three levels of parking employed PENETRON PLUS and PENETRON ADMIX to treat the retention tank, stairs, planter boxes, ground slab, sunshades, roof slab, roof shaft and slab, tunnel room and generator roof.

## **Expo Axis Walkway (Expo 2010), Shanghai, China**

The Expo Axis Walkway, the largest single structure of the Expo 2010 (1 km long, 100 m wide with two underground and two above-ground levels), connected the major exhibition areas. PENETRON was applied as a dry-shake to protect the entire bottom concrete slab against the high groundwater.



## Getting the most out of your concrete

Penetron topical crystalline products provide durability and repair & maintenance solutions for a wide range of existing concrete structures:

- Comprehensive protection for all newly poured and existing structures
- Repair leaking cracks, damp spots, honey-combs, construction joints, structural cracks and otherwise structurally damaged concrete
- Concrete slabs showing wear-and-tear from road salts and other forms of deterioration
- Negative-side repair of leaks in tunnels when conventional waterproofing methods fail

The effectiveness and reliability of the Penetron System have been demonstrated across a wide spectrum of applications, including, but not limited to, wastewater treatment plants, parking garages, nuclear reactors, chemical storage facilities, mass transit tunnels, basements and other underground structures.

Penetron crystalline materials can be applied to both fresh and existing concrete structures – for protection, repair and renovation – to eliminate cracks, voids and fissures. Non-toxic, with no volatile organic compounds (VOCs), our products adhere to the highest standards of environmental and ecological compliance.



### Advantages of Penetron topical products:

- Provides concrete with a self-healing capability
- Easy to apply; labor-cost effective
- Reduces chloride penetration and carbonation
- Can be applied to moist or “green” concrete
- Can be applied from either the positive or negative side
- Seals hairline and shrinkage cracks up to 0.5 mm (1/51”) wide
- Waterproofing and chemical-resistance are intact even if the surface is damaged
- Completely effective against high hydrostatic pressure
- Not a coating or a membrane: PENETRON becomes an integral part of the concrete
- More effective overall and less costly than membranes or clay panel systems
- Increases concrete’s compressive strength
- Resists chemical attack and protects from freeze/thaw cycles, aggressive subsoil waters, sea water, carbonates, chlorides, sulfates and nitrates
- Protects embedded steel (reinforcing steel and wire mesh)
- Inorganic – contains no polymers
- Non-toxic – approved for potable water applications (NSF-61)

# The Penetron System: for durable concrete structures

## The best for concrete repair & maintenance

Penetron crystalline products consist of various active, proprietary chemical formulations. They are applied to the surface of newly-poured and existing concrete structures. Mixed with water and applied with a brush, trowel or spray gun, they protect and waterproof above-grade or below-grade structures – even under high hydrostatic pressures.

Penetron develops and manufactures high quality products for a wide range of concrete repair and maintenance applications, including:

- Wastewater treatment plants & water storage (dams & reservoirs)
- Marine structures
- Commercial/residential building foundations & retaining walls
- Sports stadiums
- Bridges, tunnels & transportation infrastructure



### 2014 Winter Olympics, Sochi, Russia

The largest single infrastructure project in Russian history. Construction projects included a harbor, train stations, power plants, an Olympic village, alpine and cross-country ski complexes, an ice skating and hockey palace and a wastewater treatment plant. Penetron technology was used to ensure durability and waterproofing in a large number of buildings and structures that were part of the 2014 Winter Olympics.





## The Penetron System of topical application products:

### **PENETRON**

Applied in slurry form, PENETRON is used for waterproofing and chemical protection for above and below-grade structures.

### **PENECRETE MORTAR**

Ideal for filling cracks and covers at joints and to fill form tie holes, honeycombed (spalled) areas and routed-out cracks. PENECRETE MORTAR can be used as a stand-alone repair mortar or in combination with PENETRON.

### **PENETRON PLUS**

A dry-shake powder formulation used for horizontal surfaces and precast concrete, PENETRON PLUS is designed for an easy trowel-in application.

### **PENEPLUG**

A rapid-setting compound, PENEPLUG stops even severe active leaks under high hydrostatic pressure.

### **PENETRON INJECT**

Used to fill and seal deeply embedded voids, cracks and fissures, PENETRON INJECT stabilizes hollow spots in repaired concrete.

### **For new concrete:**

For new concrete solutions, please refer to our PENETRON ADMIX and PENEBAR SW brochures



### **Tropicana City Mall, Petaling Jaya, Malaysia**

This 12-story office tower, with four retail and three basement levels, stood abandoned for ten years. PENECRETE MORTAR, PENETRON and PENEPLUG successfully restored and waterproofed the heavily leaking below-grade concrete basement structure.



# The science behind Penetron topical applications

## How does it work?

Penetron crystalline products consist of various active, proprietary chemical formulations.

The active ingredients in Penetron products react with the moisture and by-products of cement hydration to create a catalytic reaction. The chemical reaction generates non-soluble crystalline formations throughout the pores and capillary tracts of the concrete, which will permanently seal micro-cracks, pores and capillaries against the penetration of water and liquids from any direction. The concrete will be protected from deterioration, even under harsh environmental conditions.

### A micro solution for a macro problem

Keeping water out of the concrete prevents deterioration, thereby increasing concrete durability and service life. Because water and waterborne contaminants penetrate concrete mainly through capillary absorption and hydrostatic pressure, countering this problem demands a “molecular level” solution. Penetron crystalline waterproofing technology was developed and optimized over many years through careful micro engineering. The results speak for our success.



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 (0.5 mm). (Magnification 5,000x)

## This is how Penetron technology works:

1

The Penetron chemicals penetrate into the cracks, 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 (0.5 mm). This crystalline growth takes place deep inside the concrete structure 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 into the concrete.



Self-healing concrete

# A crystalline solution to concrete problems

## Basic application methods

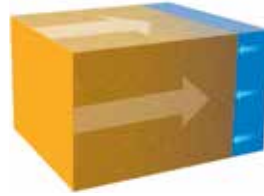
### Applied to a surface



1) Typical concrete structure with moisture.



2) PENETRON is applied to positive or negative side. The PENETRON chemicals penetrate deeply into the concrete.



3) The crystalline technology continuously and permanently blocks moisture penetration and pushes water out of the concrete.

### Sealing leaking cracks and holes



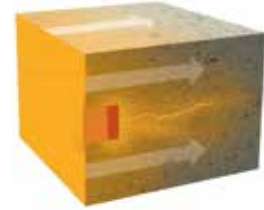
1) The area to be repaired is opened up.



2) PENEPLUG is applied into the hole to stop the active water flow.

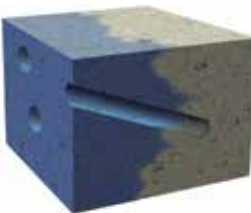


3) PENECRETE MORTAR is used to seal the crack and remaining area of the hole.

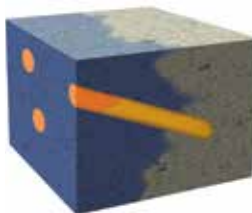


4) Two layers of PENETRON are applied. The crystalline technology permanently blocks moisture penetration.

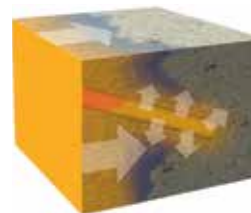
### Filling cavities/cavity-fill method



1) Drill holes up to 3/4" through the wall at an angle of 40-80°.



2) Fill cavities with PENETRON slurry and seal with PENECRETE MORTAR.



3) Coat the surface of the wall with PENETRON. Crystals will penetrate from the inside and outside of the wall.



4) As the crystalline technology spreads, it continuously and permanently blocks moisture penetration.



## PENETRON

Recommended for all above and below-grade concrete structures, PENETRON is a surface-applied, integral crystalline waterproofing material used to prevent penetration of water and waterborne chemicals, even under high hydrostatic pressure.



Mixed only with water, PENETRON can be applied by brush or spray to either the positive or the negative sides of the concrete. In the presence of moisture, it penetrates deeply into the structure. The ensuing chemical reaction fills micro-cracks, pores and capillaries with an insoluble and permanent network of crystals.

### Wide range of applications

PENETRON protects concrete against seawater, wastewater, intrusive ground water and many aggressive chemical solutions. PENETRON is approved for use in contact with potable water, making it suitable for water storage tanks, reservoirs, water treatment plants, etc.

Typical areas of application are:

- Basement retaining walls
- Parking structures
- Concrete slabs (floor/roof/balcony, etc.)
- Tunnels and subway systems
- Foundations
- Water retaining structures
- Underground vaults
- Swimming pools
- Sewage and water treatment plants
- Channels
- Reservoirs
- Bridges, dams and roads



**CPMC Tissue Manufacturing Plant, South Santiago, Chile**  
Numerous repairs were needed on the concrete structures of the CPMC Tissue Manufacturing Plant. PENETRON and PENECRETE MORTAR were used to repair cracks and leaks; 6,000 m<sup>2</sup> (64,600 ft<sup>2</sup>) of concrete surface were treated with PENETRON.

### Packaging

PENETRON is available in:

- 22.7 kg (50 lb) bag
- 25 kg (55 lb) pail



# Used in combination with PENETRON



## PENEKRETE MORTAR

Used for filling structural cracks and covers at joints and to fill form tie holes, spalled or honeycombed areas and routed-out cracks, PENEKRETE MORTAR is a cementitious, ready-mixed repair and sealing mortar. In combination with PENETRON, PENEKRETE MORTAR is recommended for a wide range of concrete repairs and upgrades.



Applied to moist concrete, PENEKRETE MORTAR fills structural cracks and can be skim-coated or feather-edged. The active chemicals in PENEKRETE MORTAR react with moisture and the by-products of cement hydration to waterproof damaged concrete surfaces. Depending on ambient temperature and environmental conditions, PENEKRETE MORTAR permanently blocks capillaries and cracks and seals the concrete after only a few days.

### Packaging

PENEKRETE MORTAR is available in:

- 22.7 kg (50 lb) bag
- 25 kg (55 lb) pail



#### **Brookville Water Treatment Plant, Brookville, PA, USA**

This advanced water treatment facility treats 1.5 million gallons of water daily and complies with increasingly stringent water quality standards. PENETRON crystalline material, PENEKRETE MORTAR and PENEPLUG were used for the sedimentation channels and the main concrete structures.

#### **Alemão Oswaldo Cruz Hospital, Sao Paulo, Brazil**

A LEED-certified project, this hospital features five underground levels and 19 above-ground floors. A combination of PENETRON, PENEKRETE MORTAR and PENEPLUG was used to help seal the underground concrete walls and construction joints.



# Stops active leaks even under high hydrostatic pressure



## PENEPLUG

A rapid-setting, cementitious crystalline waterstop, PENEPLUG is designed to stop active water leaks and moisture ingress, even under high hydrostatic pressure. Commonly used as a waterproof plugging mortar, it seals leaking joints, form tie holes, and cracks in concrete, masonry, earthenware and stone.



PENEPLUG sets in approximately 30–60 seconds after mixing and can even be used underwater. It contains no volatile organic compounds and is safe for use both outdoors and in confined indoor spaces.

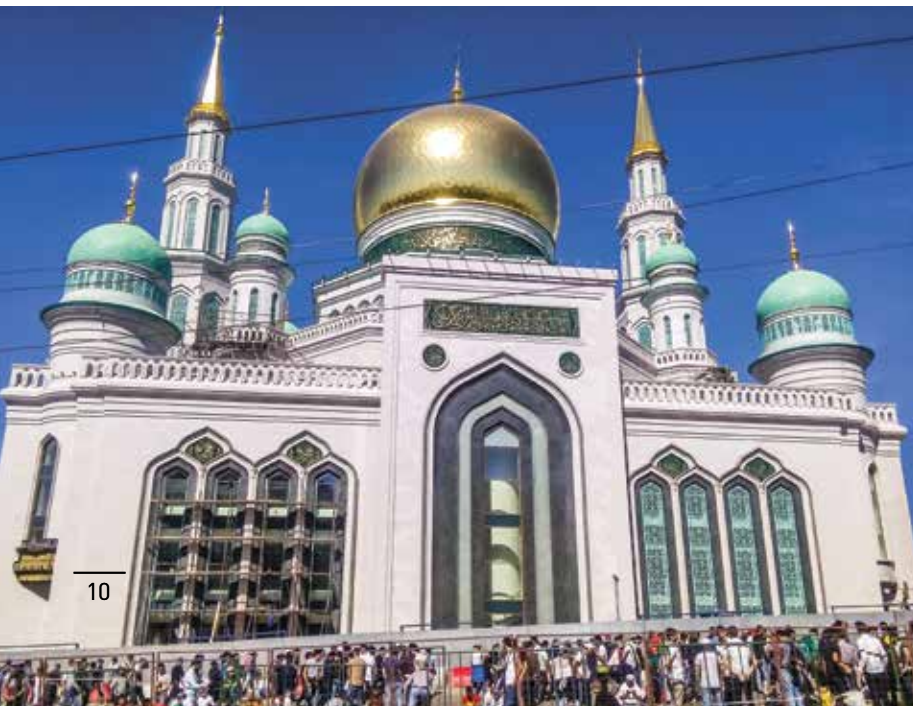
### Packaging

PENEPLUG is available in:

- 18 kg (40 lb) bag
- 25 kg (55 lb) pail

#### Moscow Cathedral Mosque, Moscow, Russia

Built in 1904 to serve a large Muslim community and surviving the Soviet era, the basement renovation revealed widespread water damage. The entire Penetron System of products was applied in the basement and to the outside walls of the mosque, including PENETRON, PENETRON ADMIX and PENEPLUG.



#### Flisvos Marina, Athens, Greece

Renovation and repair of this luxury yacht facility included filling visible cracks with PENECEMTE MORTAR, using PENETRON GROUT to fill surface cavities and applying a layer of PENETRON across the surface as a waterproof barrier to prevent any further chloride penetration.

# Advanced injection grout to seal deep voids, cracks and fissures



## PENETRON INJECT

Highly effective, two-component, crystalline injection grout to fill and seal cracks and fissures, and fill hollow spots and voids. The extremely fine particle size of its ingredients (for a very low, water-like viscosity) allows PENETRON INJECT to penetrate into micro-fine, hairline cracks in concrete or rock fissures and seal them.



The integral crystalline waterproofing technology forms an insoluble structure to further aid in sealing cracks and fissures, as well as larger voids deeper inside the concrete. This adds stability and strength to repaired areas in concrete and rock and restores structural integrity. It also provides corrosion protection for embedded steel and anchors in concrete.

Its stable and low heat of reaction allows for controlled injection to completely fill larger voids. PENETRON INJECT contains no organic or combustible solvents or other harmful ingredients (such as amines, which can cause serious skin irritation) unlike other organic-based injection materials. It is non-toxic and contains no volatile organic compounds (VOCs).

### Wargaming Headquarters, Nicosia, Cyprus

The headquarters of this international game developer and leader in online action games is 75 m (246 ft) tall and topped by a large, disc-shaped solar array. The builder applied Penetron products – including PENETRON INJECT – to ensure impermeability of the concrete basement when the original system did not meet expectations.



## Packaging

PENETRON INJECT is available in:

- Powder (Part A): 25 kg (55 lb) pail
- Liquid (Part B): 2 l (2.1 qt) jug

### Grand Hyatt Hotel, Rio de Janeiro, Brazil

Located in an area of luxury condominiums, large office complexes and seaside hotels along beautiful beaches, the hotel's basement lies under the water table. PENEBAR SW-55 was used in the construction joints of the hydrostatic slab; PENEPLUG was used to seal all leaks at the foundation anchor points.



# For dry-shake applications on horizontal surfaces



## PENETRON PLUS

Specially formulated for dry-shake applications on newly poured concrete slabs or precast segments, PENETRON PLUS provides enhanced impact and abrasion resistance. Completely non-toxic and highly resistant to aggressive chemicals, PENETRON PLUS can seal hairline cracks up to 0.5 mm (1/51"). The dry-shake application method reduces the risk of scaling, dusting, flaking and delamination commonly associated with coating applications to horizontal slabs.



Once applied, PENETRON PLUS penetrates quickly into the setting concrete. As an integral part of the concrete surface, PENETRON PLUS eliminates problems normally associated with coatings (e.g. scaling, dusting, flaking and delamination). With moisture from the fresh slab, crystal growth takes place rapidly to ensure a permanent seal against water penetration.

Packaged as a dry powder compound, PENETRON PLUS is recommended for:

- Sewage and water treatment plants
- Traffic bearing surfaces
- Warehouse floors
- Foundation slabs
- Below-grade structures
- Parking structures

### Packaging

PENETRON PLUS is available in:

- 18 kg (40 lb) bag
- 25 kg (55 lb) pail



#### **El Quimbo Hydroelectric Plant,**

**Potrerrillos, Gigante, Huila, Colombia**

Located on Colombia's main river, the Rio Magdalena, this facility features two sizeable dams and a 400MW power station. The cracks in the spillway were successfully and quickly treated with the Penetron System.

## We test what we sell

The superlative performance of Penetron topical materials is a result of constant testing and evaluation: We utilize both on-site and lab evaluations to ensure the optimal product for your project.



All Penetron products are manufactured and tested in our own production facilities located around the world. They meet all main manufacturing and environmental compliance certifications, including (but not limited to) ISO 9001, ISO 14001, NSF 61, DWI, Singapore Green Label, CE mark, GB-18445.

### Effective construction choice

Recognized as the leading concrete waterproofing and durability solution, Penetron crystalline products provide maximum concrete durability and eliminate the need for traditional waterproofing systems, such as membranes and non-crystalline coatings.

### Optimize the service life of the structure

PENETRON-treated structures generally have greatly reduced further maintenance and repair costs and out-live untreated structures. Penetron crystalline materials have no negative effect on concrete strength or other concrete performance requirements.



#### Rucatayo Hydroelectric Power Plant, Puyehue, Chile

This 315 GWh hydroelectric plant developed extensive leaks while new. The Penetron team carried out on-site repairs with PENEPLUG to stop active leaks. PENECRETE MORTAR was used to seal construction joints and tie holes and a final layer of PENETRON was applied to permanently waterproof the concrete structure.

# Ideal for vertical and horizontal concrete surfaces

## How to apply PENETRON for optimal results

Penetron topical materials can be applied to vertical and horizontal concrete surfaces, new and existing structures, construction joints and irregular surfaces – even under high hydrostatic pressure. In general, do not apply topical materials at temperatures below 4°C (39°F).



### Surface preparation

- All surfaces must be structurally sound and clean (no dirt, cement laitance, curing compounds, paints, coatings, etc.).
- Grind-off any paint or coatings to provide an open-capillary structure.
- Smooth surfaces should be water or sand blasted (300 bar or more).
- Construction joints and cracks larger than 0.5 mm (1/51") should be routed out to a U-shaped configuration, approximately 19 mm (3/4") wide and a minimum of 19 mm (3/4") deep.
- Remove any honeycomb areas.
- Moisten surface to a dull dampness.

### Mixing

Mechanically mix with water to a creamy consistency (like thick oil). Mix only as much as can be used within 20 minutes and stir frequently. If the mixture starts to set, do not add more water, simply stir to restore workability. More water can be added for spray application or slurry consistency.

### PENETRON

### PENECRETE MORTAR

Add water until a medium stiff, trowelable consistency is reached. The mix should be pliable enough to be troweled into cracks with some pressure. Add only a small amount of water to form tie holes; mix consistency should be that of "dry earth." Mix only enough material to use within 20 minutes.

### PENEPLUG

Add only a little water and mix quickly, about 15 seconds. The mix should have a dry pack ("dry earth") consistency and hold shape when squeezed in your hand. Setting occurs in about 30 seconds. In cold weather, use lukewarm water. In higher temperatures, use cold water.

### PENETRON INJECT

Mix Part B (liquid) with water, slowly add Part A (powder) and mix for two minutes for a smooth, homogeneous, lump-free mix. Pour mixture into the funnel of the injection pump; it is ready for use. Slightly agitate every 10 – 15 minutes if not used immediately.

# Application of topical materials

## PENETRON

- **For slurry:** apply 1–2 coats to damp concrete with masonry brush or power spray. Apply 2<sup>nd</sup> coat once the 1<sup>st</sup> coat is dry to the touch.
- **For dry powder on horizontal surfaces:** distribute powder and trowel into the freshly placed concrete once initial set begins.
- **For construction joints:** apply as a slurry or dry powder prior to placing the overlying concrete slab.
- **Post-treatment:** Keep treated area damp and covered with polyethylene sheeting or damp burlap for five days and out of direct sun, wind and frost.

## PENECRETE MORTAR

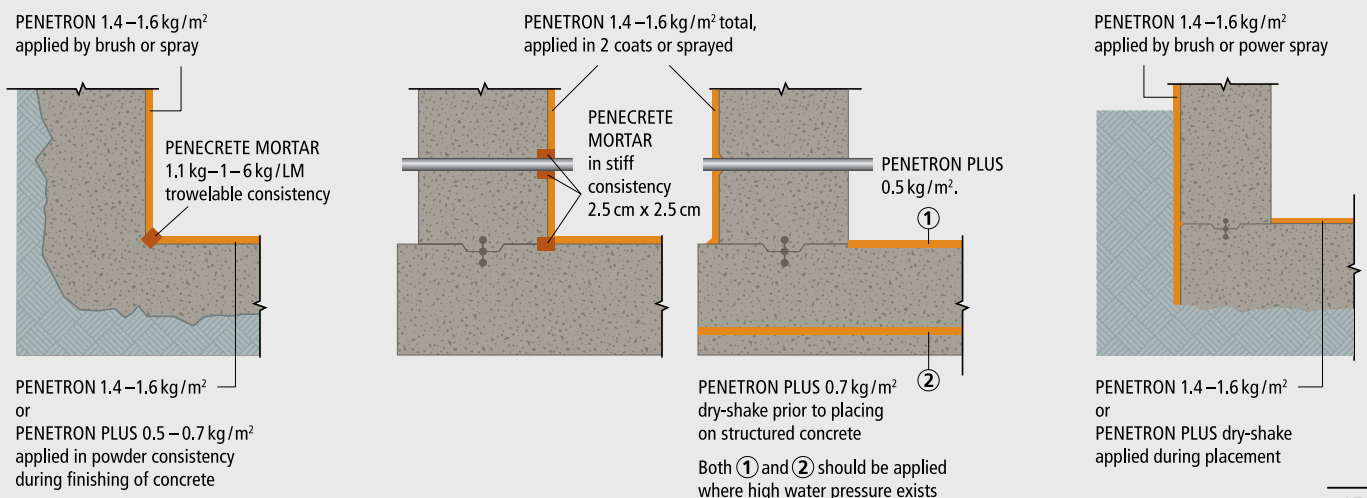
- Prime the surface with a slurry coat of PENETRON and fill cracks flush with PENECRETE MORTAR.
- Once set (approximately 1–2 hours), apply more PENETRON as a surface treatment.
- Not for use in expansion joints or other joints designed for movement.

## PENETRON PLUS

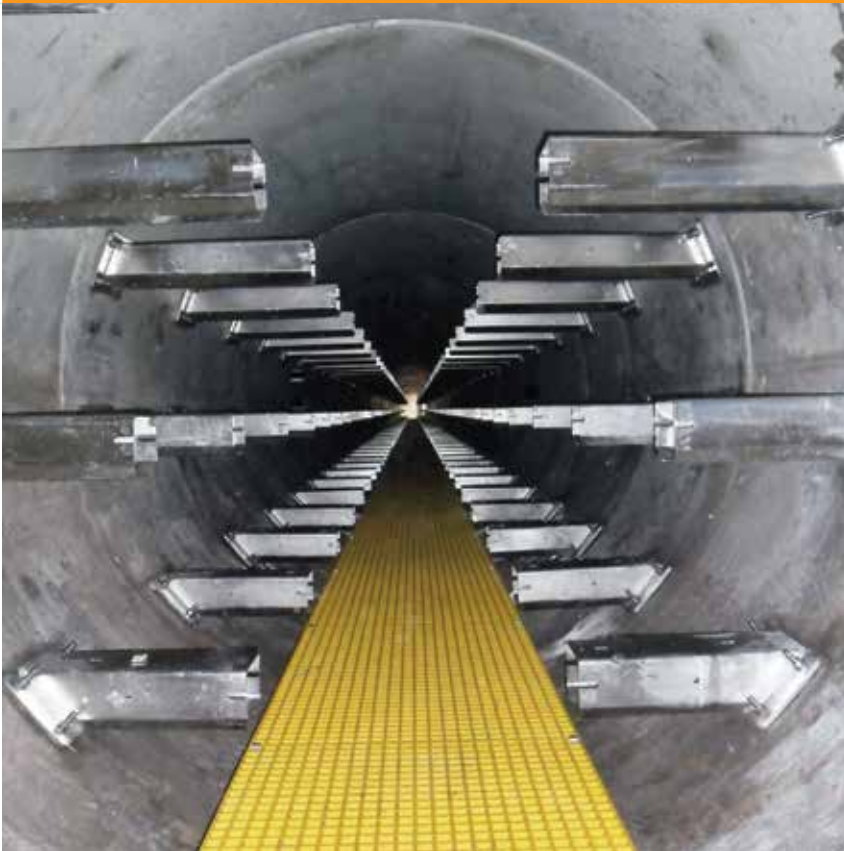
- Apply after fresh concrete is leveled and can be walked on (with only small indentations), and free of bleed water.
- Float open the surface and, within one hour of finishing, apply half of the dry-shake material by hand or mechanical spreader.
- When the dry-shake material absorbs moisture from the base slab, power float to the surface. Apply remaining dry-shake material.
- When concrete has hardened, power trowel to the required finish.
- Use moist curing procedures (water spray, wet burlap or plastic covers) for at least 48 hours.

## PENEPLUG

- Form PENEPLUG into a wedge plug and force into the leak immediately.
- Work the plug into the leak and apply as much pressure as possible, hold firmly in place for about 30 seconds or until set.
- After the leak stops, prime with PENETRON, fill any voids with PENECECRETE MORTAR.
- Apply a final coat of PENETRON to the repaired area.



# Penetron Topical Crystalline Products



## **Burrows Road Tunnel,**

Sydney, New South Wales, Australia

Dug in completely saturated (and contaminated) soil, construction of the watertight 87 m (285 ft) long and 2.8 m (9 ft) diameter tunnel demanded a comprehensive and immediate waterproofing solution. As part of the overall Penetron program, the form tie holes were filled and sealed with PENEPLUG and PENECRETE MORTAR.

## Total Concrete Protection

Penetron topically-applied crystalline products have been proven effective in countless projects worldwide. The performance and reliability of our crystalline products have firmly established the company as the industry leader.

With locations in all key markets, including facilities in Asia, Europe, North America, Middle East and South America, Penetron develops and manufactures high quality products for a wide range of applications. Penetron products and technical support are available through a comprehensive network of distributors.



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