

Royal Mills Riverpoint Apartments

West Warwick, United States (2010)

**Winner of the 2010 New England
ICRI Project of the Year!**

BACKGROUND

Built in 1890, Royal Mills near Providence, Rhode Island, once operated one of the world's busiest hydro-powered cotton mills. In 2004, the mill was purchased with the plan to convert the building into trendy apartments. However, a major fire, 120 years of harsh wet weather, heavy industrial use and neglect from 10 years of vacancy had taken its toll. Royal Mills would need considerable restoration and waterproofing. The mill's location on the banks of the river made excavation and external waterproofing challenging.

New England Dry Concrete was brought in to assess the site, they found severe water intrusion including wet stone and brick inside occupied apartments, poor conditions in many sub-grade units and no insulation or weather stop from the outside, allowing the weather to migrate right through the walls.

SOLUTION

Along with extensive cosmetic work, significant waterproofing was needed to bring the space to habitable levels. New England Dry Concrete used Kryton's line of products because it allowed the company to waterproof from the inside out, leaving the building's beautiful stone exterior intact. As the site sits along a canal and waterfall, the resistance to hydrostatic pressure that the Kryton line of products offered was a very important benefit.

OWNER:

Struever Bros. Eccles & Rouse

ENGINEER:

PCI Consultants

REPAIR CONTRACTOR:

New England Dry Concrete

DISTRIBUTOR:

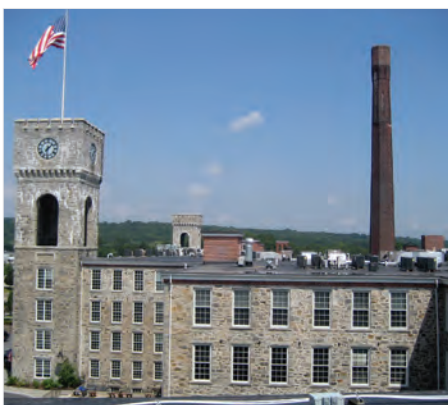
New England Dry Concrete

PRODUCTS:

Learn more at kryton.com
 Krystol Internal Membrane™ (KIM®)
 Krystol® Crack Repair System
 Krystol T1®/T2®
 Hydrostop™ Sealer
 Krystol Bari-Cote™
 Krystol Plug™



The riverfront location made external waterproofing challenging.



Royal Mills is now the heart of a new, hip community.

Royal Mills Riverpoint Apartments

West Warwick, United States (2010)

SOLUTION

The extensive waterproofing repair work included:

- 1,000 linear feet of cracks sealed with the Krystol® Crack Repair System
- Krystol T1®/T2® applied to interior walls to waterproof below the river level
- 250,000 sq. ft. of Hydrostop™ Sealer (Hydropel™ Sealer) was used to seal the original stone exterior and reduce water absorption
- To reduce permeability Krystol® technology was added to the mortar used to repair the historic stone veneer
- Several slabs were poured using the Krystol Internal Membrane™ (KIM®) admixture to provide a permanent waterproofing solution and eliminate the need for external liners
- Over 1500 window sills and lintels were repaired with Krystol Bari-Cote™ and Krystol Plug™
- Several concrete and rubble elevator pits were repaired using KIM®

Sustainability was important to the developer, much of the original flooring was refinished and 50% of all construction debris from the historic site was reused in signage and other public areas.

Developer benefits of using Kryton's Krystol® System:

- Permanent dry concrete, stone and brick
- Zero VOCs (Volatile Organic Compounds)
- No tar or petroleum based materials
- Restored original aesthetics on interior and exterior
- Greatly decreased jobsite waste
- Cost effective solution
- Provided single source system warranted from manufacturer

New England Dry Concrete was selected as the recipient of the 2010 New England ICRI Project of the Year for this project.

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 Krystol Bari-Cote™
 Krystol Plug™



Marina Bay Sands demonstrated the efficiency of construction with crystalline admixtures.

The cutting edge of concrete waterproofing

This article looks at the latest findings of the American Concrete Institute (ACI) and the implications for waterproof concrete construction.

Kevin Yuers, Kryton International, Vancouver, Canada

Though the benefits of integral crystalline waterproofing in concrete structures are well-documented, some North American builders have been slower to adopt it than their international counterparts. The traditional choice, namely external membrane waterproofing, meets existing North American building codes and appears on the surface to be more cost-effective. However, integral crystalline waterproofing has experienced a surge in popularity since the ACI published its report on permeability-reducing admixtures for concrete, ACI 212.3R-10⁽¹⁾. The report goes a step further than endorsing integral crystalline waterproofing: it separates the chemical

admixture into two categories.

The report provided much-needed classification for permeability-reducing admixtures by replacing outdated and unclear terminology such as 'waterproof' and 'damp-proof' with PRAH (permeability-reducing admixture - hydrostatic conditions) and PRAN (permeability-reducing admixture - non-hydrostatic conditions). The new classifications revealed that not all admixtures are created equally: only those designated as PRAH are suited to watertight construction. While the clarification was welcome, it has resulted in some concrete manufacturers claiming that their product is PRAH when in fact it only meets PRAN standards.

Case study: Sekolah Sukan Sabah

The Government of Malaysia takes its Olympic programme very seriously and would settle for no less than PRAH Standards when it built Sekolah Sukan Sabah, the latest of its modern integrated academic and sports schools designed to produce the nation's Olympic contenders. The concrete used to create the Olympic-sized swimming and diving pools needed to withstand hydrostatic pressure, chlorine and heavy usage. The complex houses facilities for every sport imaginable.

The owners of the project wanted to be sure the building solution they selected would withstand the demands of heavy usage, the humid tropical climate and proximity to the sea. With several solutions providers vying for the project, the owners needed demonstrable proof that their waterproofing system would be reliable.

Kryton had recently finished work on the neighbouring Marina Bay Sands project in Singapore, an immense resort complex built on reclaimed land surrounded by seawater, the deepest point being 25m below grade. The engineer behind the project could attest to the effectiveness of the PRAH Standard integral crystalline waterproofing of the concrete: even if cracks should form in the future, the incoming moisture reacts with the concrete admixture to produce more crystals and preserve the watertight seal.

The Marina Bay Sands project also demonstrated the efficiency of construction with

crystalline admixtures, which allowed the formidable project to be completed to the highest safety standards on a tight timeline. Over 60,000m³ of concrete were waterproofed in the Marina Bay Sands project; and 1100m³ in the Sekolah Sukan Sabah project.

After construction, the design engineer performed tests and reported that the PRAH admixture used, Krystol Internal Membrane (KIM), performed exactly as the data sheets indicated it would.

Case study: Royal Mills

Where waterproofing is carefully considered in new concrete construction, restoration projects require a different kind of finesse.

The Royal Mills Riverpoint Apartments project on Rhode Island was a reclaimed 19th Century cotton mill whose structure had been weakened by a century of industrial use, neglect, a fire and exposure to river water. In order to preserve the character of the building's original façade, the structure needed to be waterproofed from the inside out. In addition to repairing existing cracks and leaks with a crystalline crack repair system, KIM was mixed into several slabs of concrete used to strengthen the structure and to repair rubble and elevator pits.

Thanks to the extensive waterproofing and restoration, the developer was able to reclaim several units that had previously been deemed uninhabitable.

New England Dry Concrete, Kryton's East Coast distributor, was awarded the 2010 New England International Concrete Repair Institute (ICRI) Project of the Year for its work on Royal Mills.

Ensuring PRAH standard

Although traditional membrane waterproofing is still a common practice and may be appropriate for certain projects, the widespread adaptation of crystalline integral waterproofing has resulted in a higher concrete construction standard to which many developers adhere.

The further classification of crystalline waterproofing admixtures by ACI 212.3R-10 demonstrates a clear, singular choice for a watertight building solution – one that contains permeability-reducing admixture for hydrostatic conditions. As a result, waterproofing costs are lower, reliability and quality control are increased and weeks are shaved from the construction schedule.

Ensuring your waterproof building solution meets PRAH standards involves a little effort, but the legwork will prove worthwhile for years to come. One step is to request case studies as points of reference, which any reputable distributor will be happy to provide. Another involves simply asking your building solutions provider to show you the proof in the form of a permeability test. ■



Above: Sekolah Sukan Sabah sports school in Malaysia.



Above: Royal Mills Riverpoint Apartments.



Reference:

1. AMERICAN CONCRETE INSTITUTE, ACI 212.3R-10. Report on Chemical Admixtures for Concrete. ACI, Farmington Hills, Michigan, USA, 2010.

Above: Marina Bay Sands.

Royal Mills: The Past Reborn

By Jillian Worker

Bringing a derelict building back to life may be more sustainable than erecting a new building, but it is no easy task. Royal Mills, on the banks of the Pawtuxet River in Rhode Island, was built in 1890 and quickly became one of the world's busiest hydro-powered cotton mills, serving as the signature cotton mill for the Fruit of the Loom clothing company. More than 100 years after its heyday, the mill stood vacant and deserted. A major fire in 1919, more than a century of harsh wet weather, union strikes, political staging, misplaced cigarettes, and neglect from 10 years of vacancy had taken its toll.

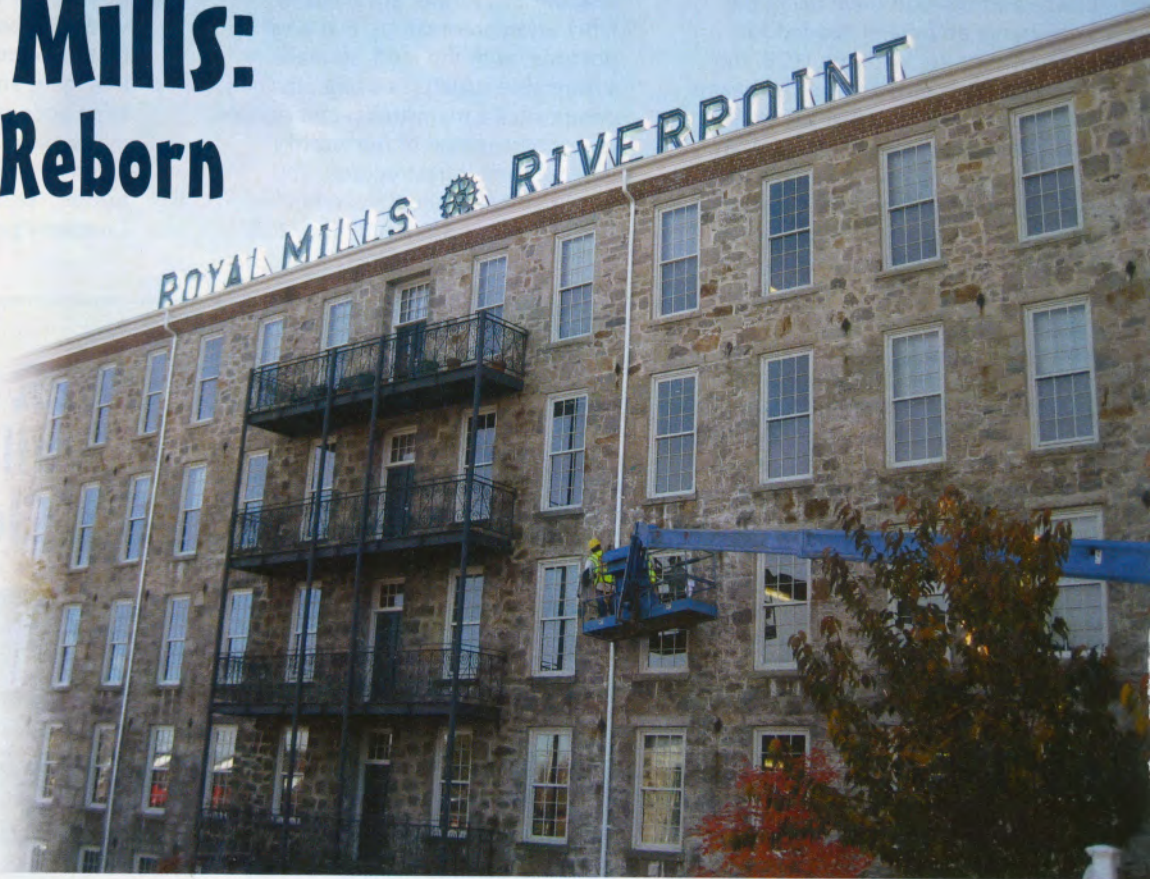
BUILDING REVIVAL

Developer Struever Bros. Eccles & Rouse purchased the mill in 2004 and had big plans for the refurbishment of Royal Mills. Over the next 5 years, they worked to renew and revitalize the vacant old mill and develop the building into trendy one- and two-bedroom and loft-style apartments. Their plans also involved Royal Mills having public and retail spaces on the ground level and a revived riverfront with public walking paths. Due to its close proximity to Providence, Rhode Island, and its gorgeous location, the developer was convinced Royal Mills could be one of the most unique and inspiring live and work leasing spaces in America.

In order to make their dream into a reality, a lot of work would need to be done first. The building required extensive renovation, restoration, and waterproofing, and the team tasked with this job was committed to doing it sustainably.

SUSTAINABLE CHOICE

In an effort to make an environmentally sustainable choice, the developer invited New England Dry Concrete, a local distributor of integral crystalline waterproofing products, to



conduct an extensive study assessing the various conditions that plagued the restoration. The company found severe water intrusion, including wet stone and brick inside some apartments, as well as poor conditions in many below grade suites. They learned 15 percent of the suites had water damage due to leaks in the foundation, windows, or walls. Repairs would have to be done to the interior and exterior mortar work and the mill's floor slabs required replacement. Without adequate waterproofing repair work, the developer was looking at potentially hundreds of thousands of dollars in lost revenue over the coming years as water damage left damp suites empty and unrentable.

WATERPROOFING SOLUTION

The mill's location on the banks of the river made excavation and external waterproofing impossible. As a result, the development team decided to use integral crystalline waterproofing. Not only did the decision to go with Kryton's integral waterproofing mean it would eliminate volatile organic compounds typically associated with traditional membrane application, it also made sure there'd be no tar or petroleum-based materials—making the waterproofing process that much more green.

By using integral waterproofing, the team also guaranteed the longevity of their waterproofing job. Over time, unique

FOR MORE
INFORMATION

Kryton takes the risk out of concrete waterproofing. Be Sure. Be Kryton. For more information, call 800.267.8280 or visit www.kryton.com.

chemicals react with concrete and water to form millions of microscopic crystals. The crystals grow and fill the capillaries, pores, and cracks in concrete. If moisture enters the structure in future years, the crystals reactivate and grow, continuing to block water flow. This continuous waterproofing ability keeps structures dry over the long term.

The team decided to use Kryton International Inc.'s Krystol Internal Membrane (KIM) during the replacement construction of the structure's floor slabs and elevator pits. It also used Krystol T1—a cementitious brush-applied treatment—on the interior walls that were located below the river level. Two of Kryton's other products, waterproofing grout Krystol Bari-Cote and rapid-setting hydraulic cement Krystol Plug, were used to waterproof more than 1,500 window sills and lintels. Finally, 250,000 square feet of Hydrostop was used to seal the original stone exterior. Hydrostop is a polymer state-of-the-art water repellent sealer that maintains the original appearance of a structure. For the historic Royal Mills building, this was a key benefit. The waterproofing work took more than 6 months to complete.

REUSING MATERIALS

Throughout the extensive renovation project, a key building element was reusing, adapting, and recycling as much building material as possible. In the end, the building team was able to salvage 500,000 square feet of historical brick, mortar, stone, and steel. In addition to the reuse and refinishing of all the original wood floors of the mill, roughly 50 percent of the construction debris wound up being salvaged and reincorporated into Royal Mill's environment,

either as building signage, railings, way-finding, public seating, pathways, and other common areas.

The efforts to reuse old mill materials weren't limited to the outside. The developer also incorporated the old cotton mill's machinery in the interior, giving it new life as furniture or structural railings and even art installations. Meanwhile, the team refurbished the old dam (originally built in 1861) with a new megawatt, hydro-powered turbine strong enough to power the common areas.

The project was finished ahead of schedule in mid-2009 and came in on budget. When it was finished, a desolate and decrepit memory of the 19th century building had been transformed into luxury living of the 21st century. Finished with granite kitchen counter tops, maple cabinetry and vanities, porcelain bath floor tiles, and cultured marble vanity tops, the new suites were as steeped in elegance as they were in heritage. The soaring ceilings, exposed brick and wood beams, hardwood floors, and in-home washers and dryers completed the elegant interiors, all without losing any of Royal Mills' historical charm. From the large oversized windows in all the suites, new residents could look out over the forest, the Pawtuxet River, or the surrounding town of West Warwick.

Most importantly, Royal Mills had been transformed from a derelict building into a historical monument to the past. After years of work, it is now listed on the U.S. National Historic Register and was recently named the 2010 New England International Concrete Repair Institute Project of the Year. Today it stands as an elegant, historic, and dry development blending old stone walls with modern luxury. ■

ROYAL MILLS RIVER POINT APARTMENT REHABILITATION

BY KEVIN YUERS

The unique and historic Royal Mills apartment complex in Rhode Island was originally built in 1890 as a hydropowered cotton mill and operated as one of the world's busiest mills for over 30 years until it was partially destroyed by fire in 1919. After cotton production was moved from the site, Royal Mills housed numerous manufacturing operations until its official closure in 1993.

The abandoned site was purchased in 2003, and the massive conversion project began. The derelict buildings were converted into 250 trendy loft-style apartments, public spaces, retail spaces, and a completely revived riverfront, including a public walking path. The former dam on site was also renovated and is now used to produce green energy in the form of hydroelectric power.

ASSESSMENT NECESSARY

Royal Mills' location on the river, years of harsh weather abuse, heavy industrial use, fire, and years of neglect presented a big challenge for the developer. The developer invited a local cementitious waterproofing firm and distributor of integral crystalline waterproofing products to conduct an extensive repair study assessing the various

conditions that plagued the complex. The waterproofing firm was then retained to perform remediation work to bring the facility to a higher rentable condition and restore the complex to its former glory.

The firm's assessment found severe water intrusion—including wet stone and brick inside occupied apartments—poor conditions in many subgrade units, and no insulation or weather-stop from the outside, allowing the weather to migrate right through the walls from the outside.

When the waterproofing firm was brought on the project, nearly 15% of the apartments had signs of internal moisture. Some had mold growing, and it didn't look like they would be able to be brought up to living standards.

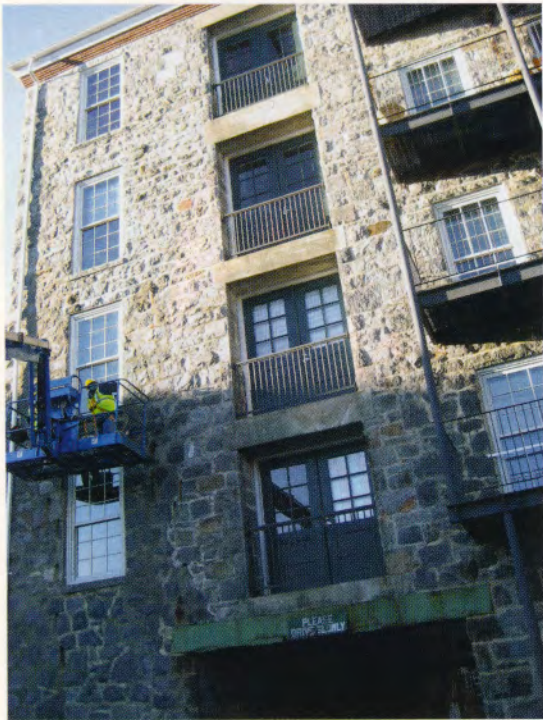
WATERPROOFING WORK

Along with extensive cosmetic work, significant waterproofing work was needed to bring the space to habitable levels. The waterproofing firm used a line of integral crystalline waterproofing products for the job. The products were selected because they allowed the company to waterproof from the inside out, leaving the building's beautiful stone exterior intact. The waterproofing products selected for the repair and waterproofing work also feature self-sealing abilities; the crystalline technology reacts with incoming water to self-seal the cracks that inevitably develop in concrete, protecting the structure against water and contaminants that can weaken or destroy the concrete. Because the site sits along a canal and waterfall, the resistance to hydrostatic pressure that the waterproofing products offered was a very important benefit.

Sustainability was also important to the developer; much of the original flooring was refinished, and 50% of all construction debris from the historic site was reused in signage and other public areas. The crystalline waterproofing products used at Royal Mills are environmentally friendly because they are added directly to the concrete mixture. There is no need for old-fashioned petroleum-based external membranes, and the concrete waterproofing admixture contains no volatile organic compounds and has no affect on air quality. Not using traditional external membranes also greatly decreased the job-site waste.



Royal Mills survived many years of harsh weather and industrial use



Nearly 2400 sills and lintels were repaired



Extensive stone veneer repair work was completed



The riverfront location and waterfall posed a waterproofing challenge



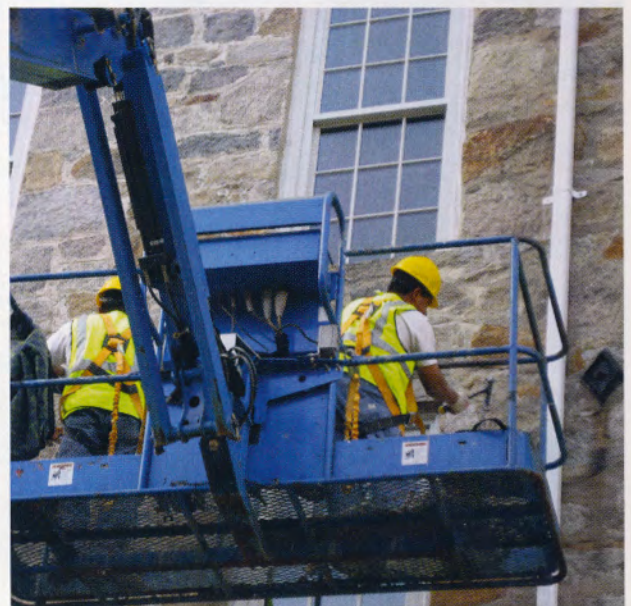
Crack repair was needed in elevator pits



Extensive waterproofing and repair work was needed to revive the old mill



Extensive rubble elevator wall crack repair allowed the facility to pass inspection from authorities



Historic reproduction of veneer stone—much with crystalline mortar



Canal dam head section received extensive reconstruction to stave off canal head pressure from lower apartment units



The waterproofing project was finished ahead of schedule and on budget

The extensive waterproofing repair work included:

- 1000 linear ft (305 linear m) of sealed cracks;
- Cementitious concrete waterproofing slurry applied to interior walls to waterproof below the river level;
- 250,000 ft² (23,225 m²) of water-repellent sealer used to seal the original stone exterior and reduce water absorption;
- A crystalline admixture added to the mortar used to repair the historic stone veneer to reduce permeability;

- Several slabs poured using the same crystalline admixture to provide a permanent waterproofing solution and eliminate the need for an external membrane;
- Extensive windowsill and lintel repair with a variety of crystalline material;
- Several concrete and rubble elevator pit repairs; and
- Mold remediation to the areas that required it.

Because of the extensive waterproofing and repair work, the developer was able to use a number of additional units that were once deemed unsuitable for living.

The project was finished ahead of schedule and on budget, and the owners and investors can now rest assured that their investment will be much improved.

Royal Mills was added to the national historic registrar in 2004.

Royal Mills River Point Apartments

OWNER

Struever Brothers Eccles & Rouse
Baltimore, MD

PROJECT DESIGNER

New England Dry Concrete
Danbury, CT

REPAIR CONTRACTOR

New England Dry Concrete
Danbury, CT

MATERIAL SUPPLIER

Kryton International, Inc.
Vancouver, BC, Canada

PROJECT ENGINEER FOR MT & T BANK
PCI Consultants



Kevin Yuers is a lifelong veteran of the construction industry, having spent many years running his own contracting company before joining Kryton International, Inc. in 1994. Today, Yuers is responsible for Product Development and Technical Services at Kryton. He spends most of his time providing customers with real-world solutions to their challenges throughout Kryton's worldwide network. Yuers writes a weekly blog offering advice and comments on all things concrete-related, with a focus on waterproofing, restoration, and repair. Read it at www.waterproofconcrete.com.

From Hydro-powered Cotton Mill to Dry Homes, with Kryton



Built in 1890, Royal Mills near Providence, Rhode Island, USA, once operated one of the world's busiest hydro-powered cotton mills, including production for "Fruit of the Loom." In 2004, the mill was purchased with the plan to convert the building into vibrant one- and two-bedroom and loft-style apartments. However, a major fire, 120 years of harsh wet weather, heavy industrial use and neglect from 10 years of vacancy had taken its toll. Royal Mills would need considerable restoration and waterproofing – about 15 percent of the suites had water damage due to leaks in the foundation, windows or walls. The mill's location on the banks of the river made excavation and external waterproofing impossible.

The developer agreed that **Kryton International's** range of crystalline waterproofing products would be the best solution. Kryton's products were selected because they allowed the building to be waterproofed from the inside out, leaving the building's beautiful stone exterior intact.

Kryton supplied its Krystol Internal Membrane™ (KIM®), the original integral crystalline concrete waterproofing admixture, to add to the concrete mix used for replacement construction for the floor slabs. To reduce permeability on the interior walls, Krystol Internal Membrane (KIM) was also added to the mortar.

Krytol Internal Membrane is a proprietary admixture, which reacts with cement and water to form millions of needle-shaped crystals. These crystals grow and fill the capillary pores and micro-cracks in the concrete. Although not a replacement for proper external curing, KIM will act as an internal curing agent to help reduce shrinkage and cracking. As time passes and water tries to enter, any new moisture causes the crystals to reactivate and grow until they block the incoming water – ensuring continuous waterproofing over many years.

Kryton's Krystol Crack Repair System™, which provides both physical and chemical waterproofing barriers, was used on more than 1,000 linear feet of cracks found in the structure. And over the entire exterior of the building – some 250,000 square feet – workers applied Kryton's Hydrostop, a reactive state-of-the-art water repellent sealer that would not alter the appearance of the mill's exterior stone walls. Kryton's Bari-Cote, a waterproofing grout, and Krystol Plug, a rapid-setting hydraulic cement, were also used to waterproof around the windows.

The waterproofing work alone took more than six months, and construction and renovation were completed by mid-2009. Now the building takes its rightful place in the US National Historic Register of buildings, providing elegant and dry homes to 250 families. ■

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