Durable Structures For Tomorrow

Where Should the Waterproofing Live?

Kevin Lin · Kryton International Inc.

WHAT YOU'LL LEAVE WITH

01 Compare surface vs. integral.

02 Judge it on three criteria.

03 Specify by performance.

04 Deliver it as a team.

WHERE WE'RE HEADED

→ **What's changing** the stakes below grade

→ **Where the barrier lives** the core question

→ **The proof** independent evidence

→ **Delivery** specifying it, as a team

SECTION 01

The Ground Is Changing

Below-grade work is getting harder — and the cost of getting it wrong is rising.

REGULATORY SHIFT

You can't pump your way dry.

A growing list of BC municipalities now restrict permanent dewatering — Richmond, North and West Vancouver, Coquitlam, with more to come.

THE NEW BASELINE

Higher. Deeper. Tighter. Harder.

Taller towers, deeper foundations, blindside walls, sites we used to avoid.

HIGHER COST OF FAILURE

And failure costs more.

Mobile crews you can't assume into the workmanship. Service lives now measured in decades.

SECTION 02

Where Should Waterproofing Live?

Not whether a membrane works — but where the barrier sits, and what it costs over time.

THE LANDSCAPE

External, or internal.

EXTERNAL

Applied to the outside

- Sheet & bentonite membranes
- Fluid-applied membranes
- Pre-applied / blindside

INTERNAL

Part of the structure

- Crystalline admixtures
- Densifiers & pore-blockers
- Negative-side coatings

One keeps water off the structure. **The other makes the structure the barrier.**

THE CONVENTIONAL APPROACH

A membrane works when everything goes right.

Surface prep, environment, trained trades, the right product for the conditions — every one, every square foot, every day of the pour.

THE DECIDING FACTOR

When it fails, you can't reach it.

It's buried behind backfill. The leak travels. You end up repairing the concrete anyway.

Delaminated under the membrane. Leaking at a cold joint. Both already past the barrier.

REFRAMING THE CHOICE

Where does the barrier live?

SURFACE

- On the outer face
- Detailed at every penetration
- Buried — unreachable

→

INTEGRAL

- Inside the concrete
- Watertight through the mass
- Reachable from inside

Not membrane vs. crystalline. Where the barrier lives decides whether the concrete stays dry for its service life.

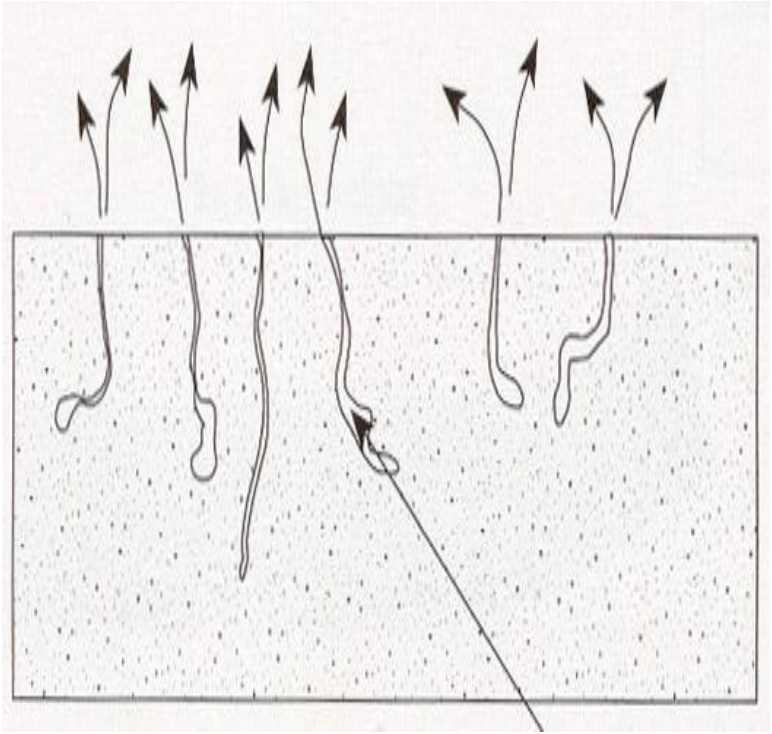
SECTION 03

Making the Concrete the Barrier

Concrete isn't watertight by nature. Here's how you change that.

HOW WATER GETS IN

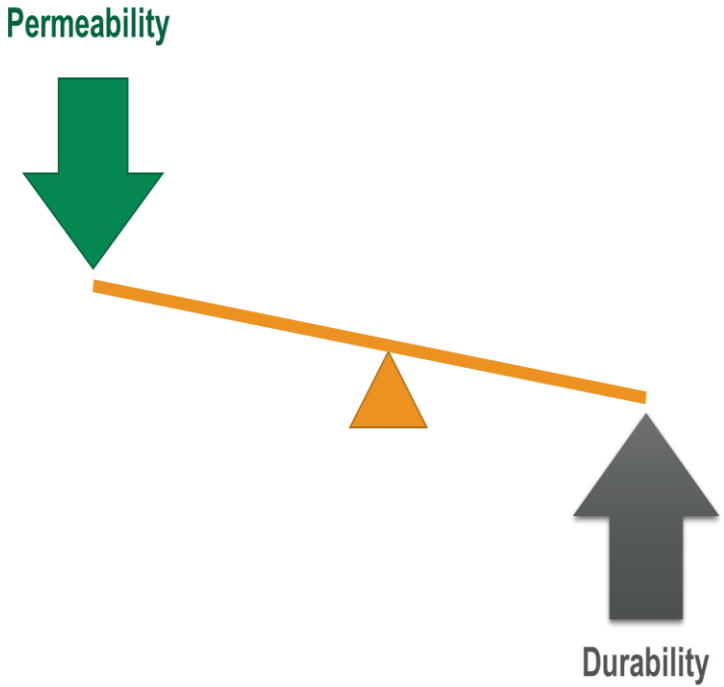
Concrete leaks by nature.



Mix water leaves; an interconnected capillary network remains.

THE CENTRAL RELATIONSHIP

Less permeable. More durable.



Permeability and durability move in opposite directions.

THE SHIFT

Can the concrete be the barrier?

Yes — put the waterproofing inside it, not around it.

ACI 350 - Code Requirements for Environmental Engineering Concrete Structures

- *“Usually, it is more economical and dependable to resist liquid permeation through the use of quality concrete, proper design of joint details, and adequate reinforcement rather than by means of an impervious protective barrier or coating.”*

Can Concrete Be Waterproof?

PRA's
Permeability Reducing Admixtures

PRAN
Permeability Reducing Admixture for Non-Hydrostatic Conditions

PRAH
Permeability Reducing Admixture for Hydrostatic Conditions

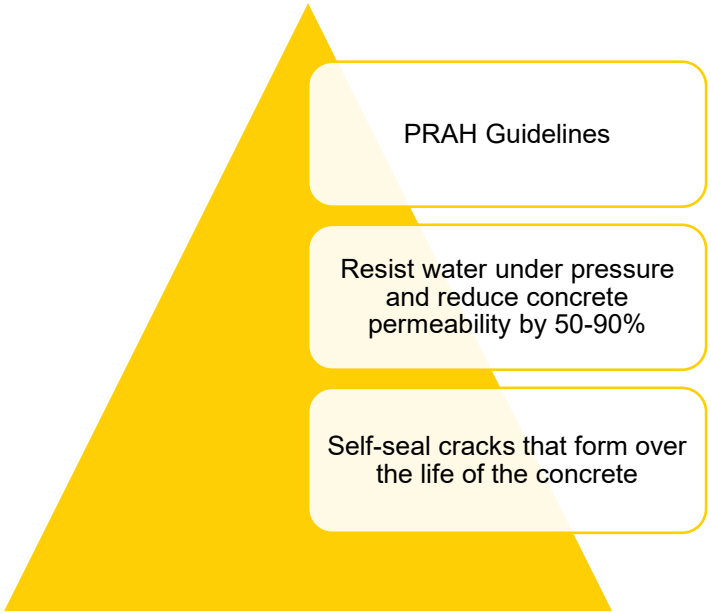
Damp proofing

Waterproofing

UNREACTIVE
HYDROPHOBIC ADMIXTURES
DENSIFIERS PORE BLOCKERS

REACTIVE
CRYSTALLINE ADMIXTURES

ACI 212.3R-10 – CHAPTER 15



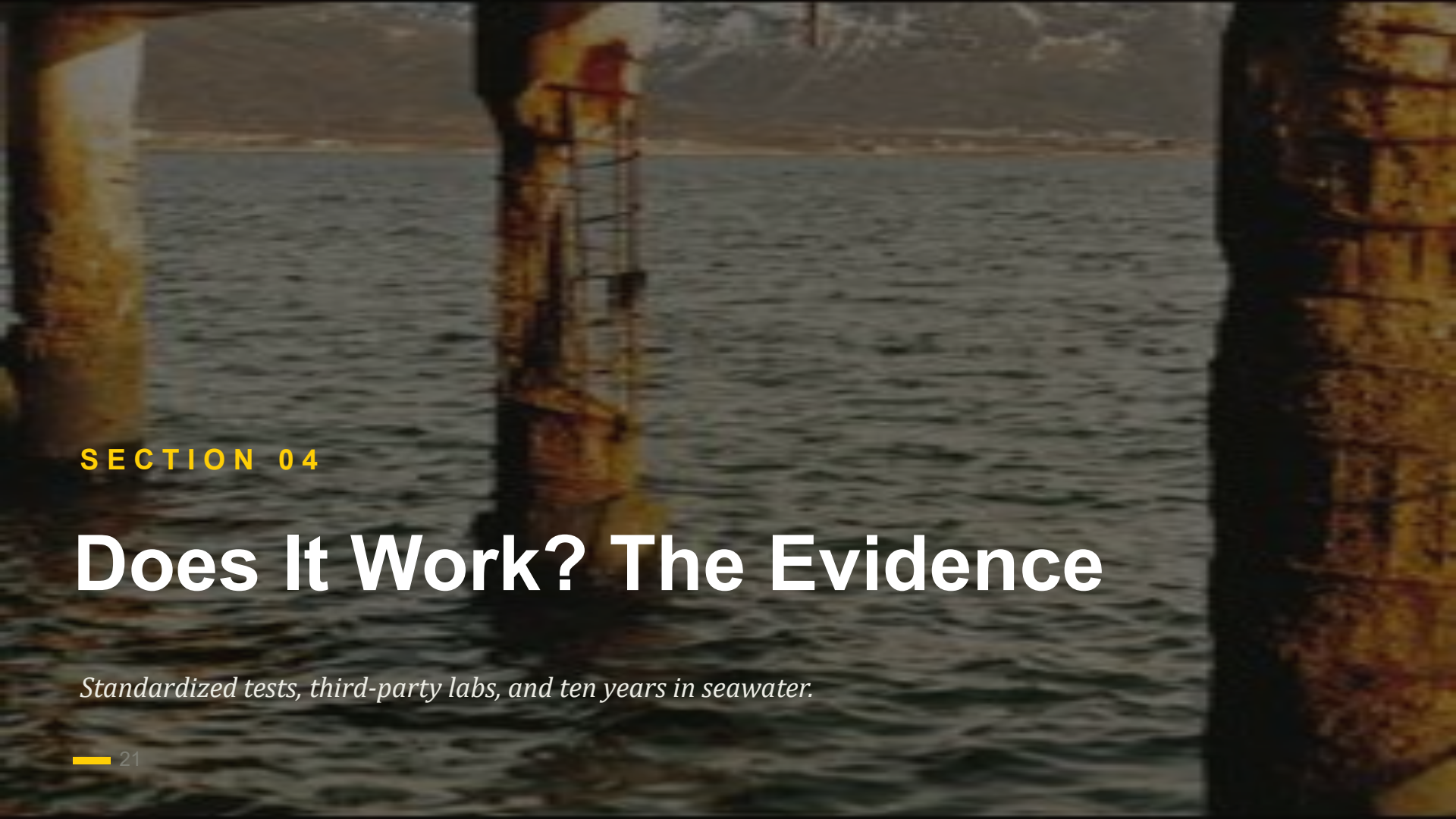
ACI 212.3R-10 - Chapter 15

ONLY CRYSTALLINE ADMIXTURES CAN ACHIEVE BOTH OF THESE GOALS

KIM – Krystol Internal Membrane

- Reduce permeability
- Self-sealing
- Environmentally friendly
- Protects reinforcing steel
- Reduces shrinkages and cracking
- Permanent solution

KRYTON
SMART CONCRETE®



SECTION 04

Does It Work? The Evidence

Standardized tests, third-party labs, and ten years in seawater.

WHAT WATERTIGHTNESS TAKES

1 **Cut permeability.**

2 **Seal the cracks.**

3 **Reduce cracking.**

Get all three and the concrete is the waterproofing.

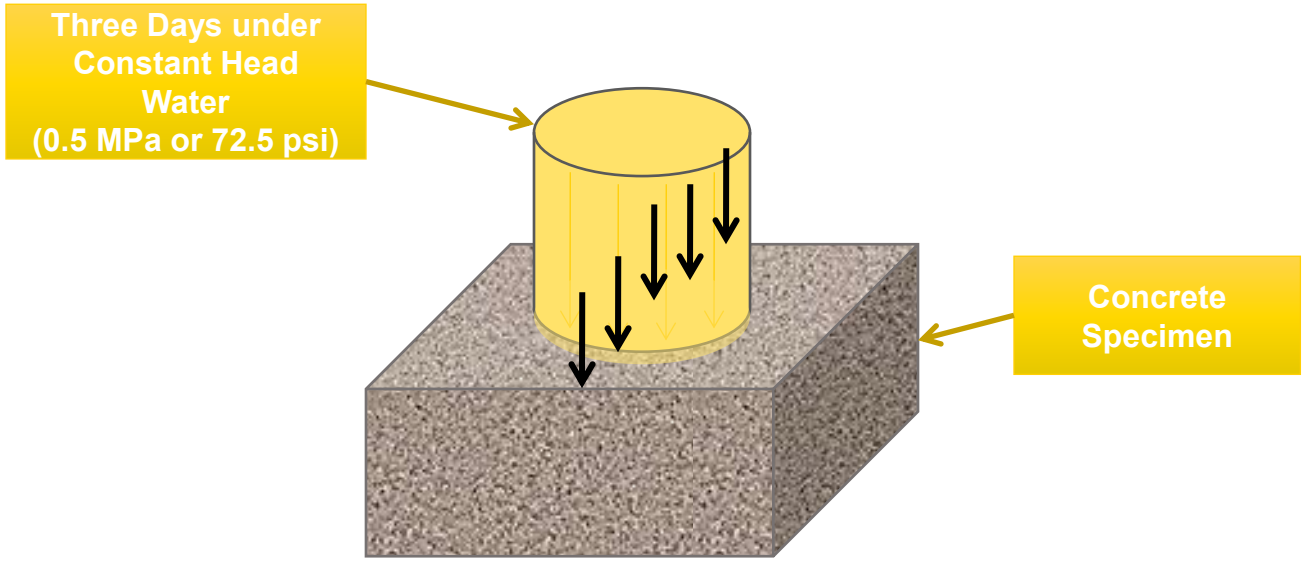
KEY 1 · PERMEABILITY

Tested under pressure.

DIN 1048 · target 50–90% less permeable.

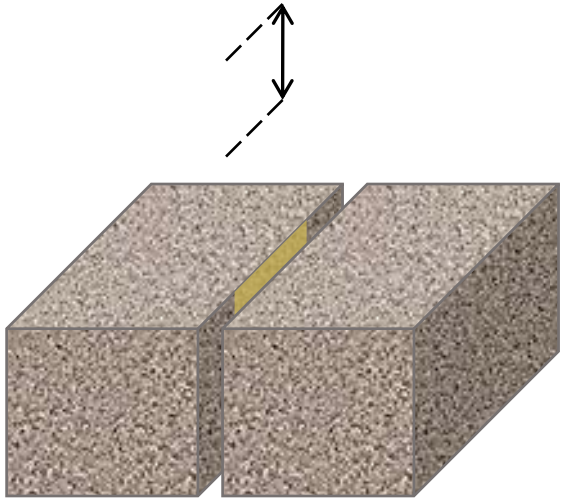
STANDARDIZED TEST

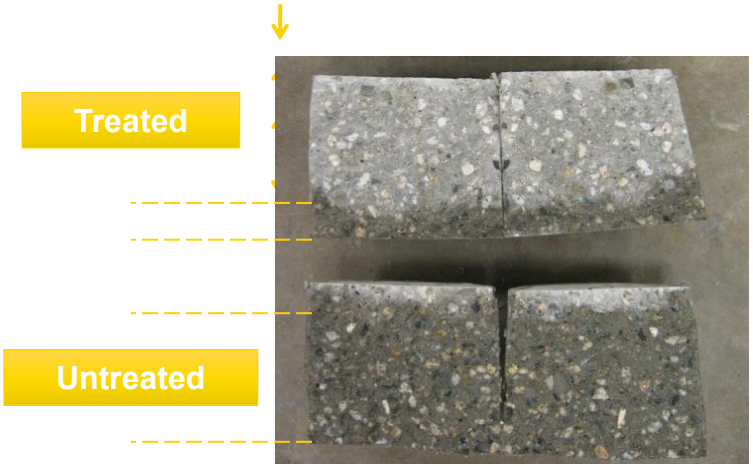
DIN 1048-5 Permeability Test Method



Permeability Test Method

DIN 1048-5 Permeability Test Method





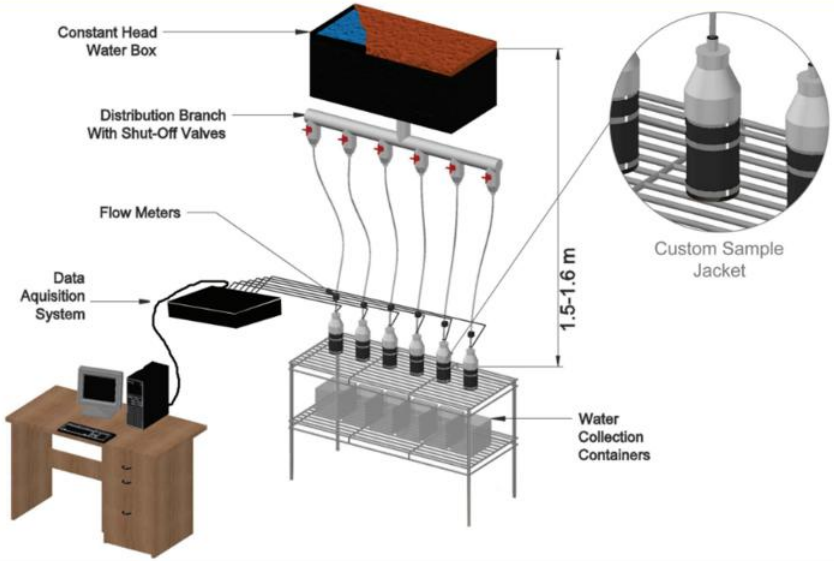
Permeability Test Method

Permeability – Test Method

PRAH PRAN Control (untreated)

Test Results

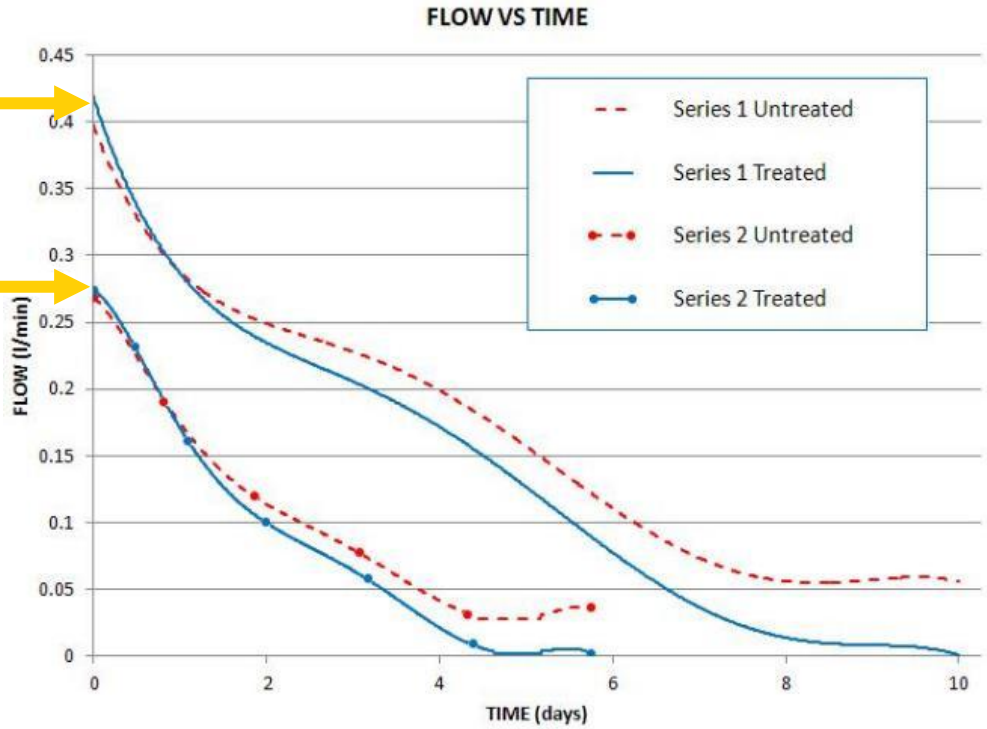
The BC Institute of Technology's test method (US Patent 9,038,477) measures self-sealing performance.



Performance — Self-Sealing

Water Flow = 6.34 gal/hr
Crack size = 0.7 mm

Water Flow = 4.27 gal/hr
Crack size = 0.6 mm



POTENTIAL TO SELF-SEAL

WITH THE RIGHT CRYSTALLINE ADMIXTURE AT THE RIGHT DOSAGE

Same joint, ten years apart — still dry, no membrane involved.

INDEPENDENT TESTING

No salt water? Freeze-thaw.

CONTROL

KIM CRYSTALLINE

After 100 cycles: the control scales and loses mass; the crystalline stays intact.

3rd party testing; British Columbia Institute of Technology (#428)

Reducing the size and number of cracks in concrete is enormously beneficial to waterproofing performance

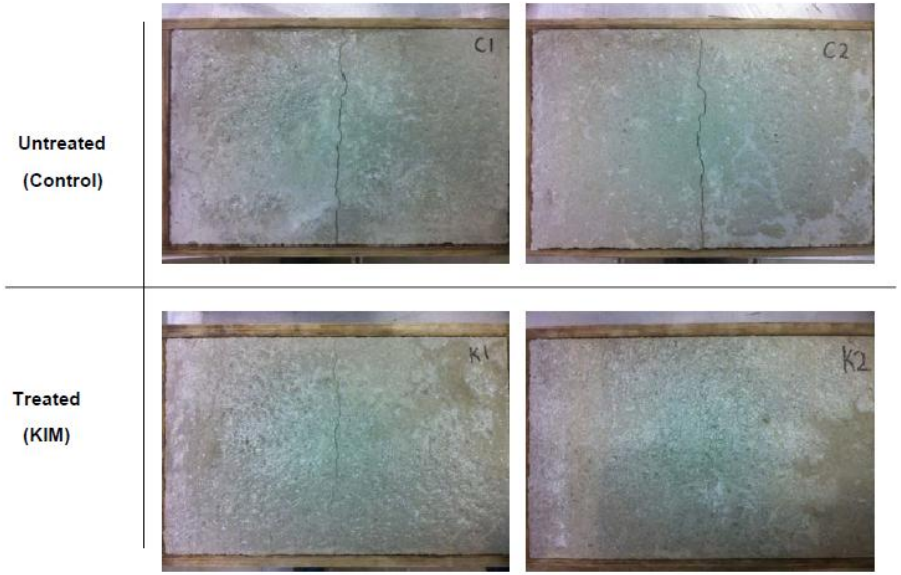


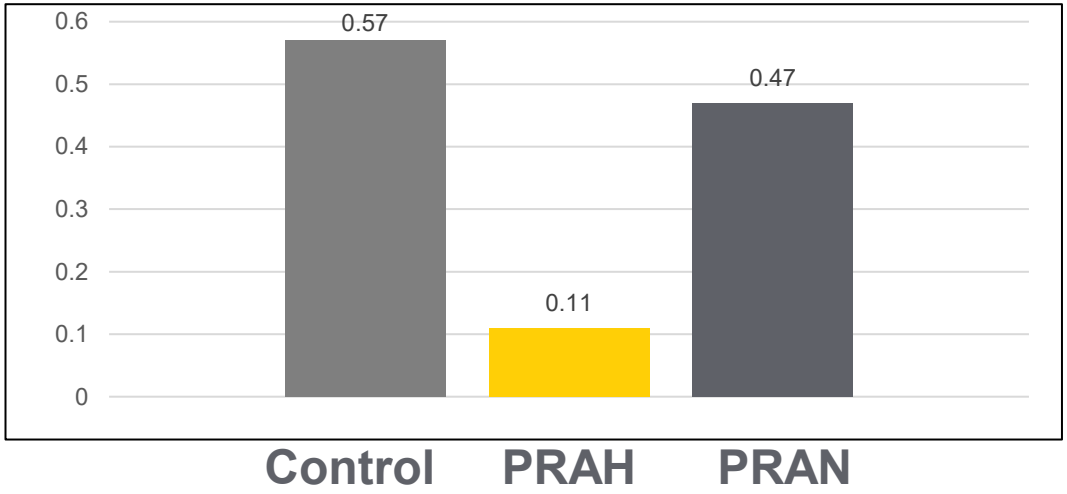
Figure 1. Crack widths of Un-treated (C1 & C2) and Treated (K1 & K2).

BCIT- Shrinkage Crack Reduction

BCIT Performance Testing- Shrinkage Crack Reduction

COMPARISON OF AVERAGE CRACK WIDTH (MM) – STD CURING CONDITIONS

- PRAH admixture reduces average crack size caused by plastic shrinkage in fresh concrete much better than PRAN
- This minimizes water entering the structure from Day 1



3rd party testing; British Columbia Institute of Technology (#440)

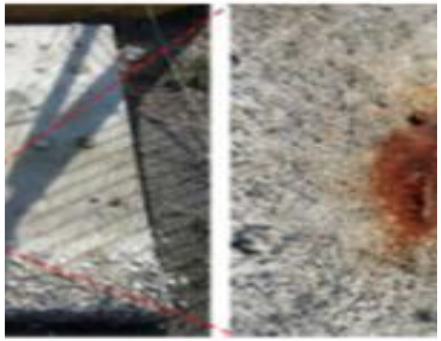
INDEPENDENT CORROSION STUDY

The University of Hawaii evaluated the performance of corrosion-inhibiting admixtures in a marine environment.

Reinforced concrete panels were exposed to a tidal zone, and their resistance to corrosion was evaluated over 10 years.

This was funded by the Hawaii Department of Transportation (HDOT).

The crystalline admixture performed well over a 10-year period and was recommended by the University of Hawaii to reduce corrosion in marine environments.



CONTROL

CRYSTALLINE

"The panel using 2% Kryton KIM performed well during the field exposure, with low half-cell readings and no visible signs of corrosion after 10 years exposure."

OTHER ADMIXTURES

"Exhibited inconsistent to poor results."

Data from the University of Hawaii (#425)

ONLY ONE PERFORMED WELL .

"CONSIDER INCLUDING CRYSTALLINE AT 2% BY WEIGHT OF CEMENT"

SECTION 05

How do we compare?

Working isn't the same as better. Judge it by the criteria that decide service life.

THE DECISION CRITERIA

Three questions decide the service life.

01

Can you reach it to repair it?

If you can't, the concrete carries the failure for the rest of its life.

02

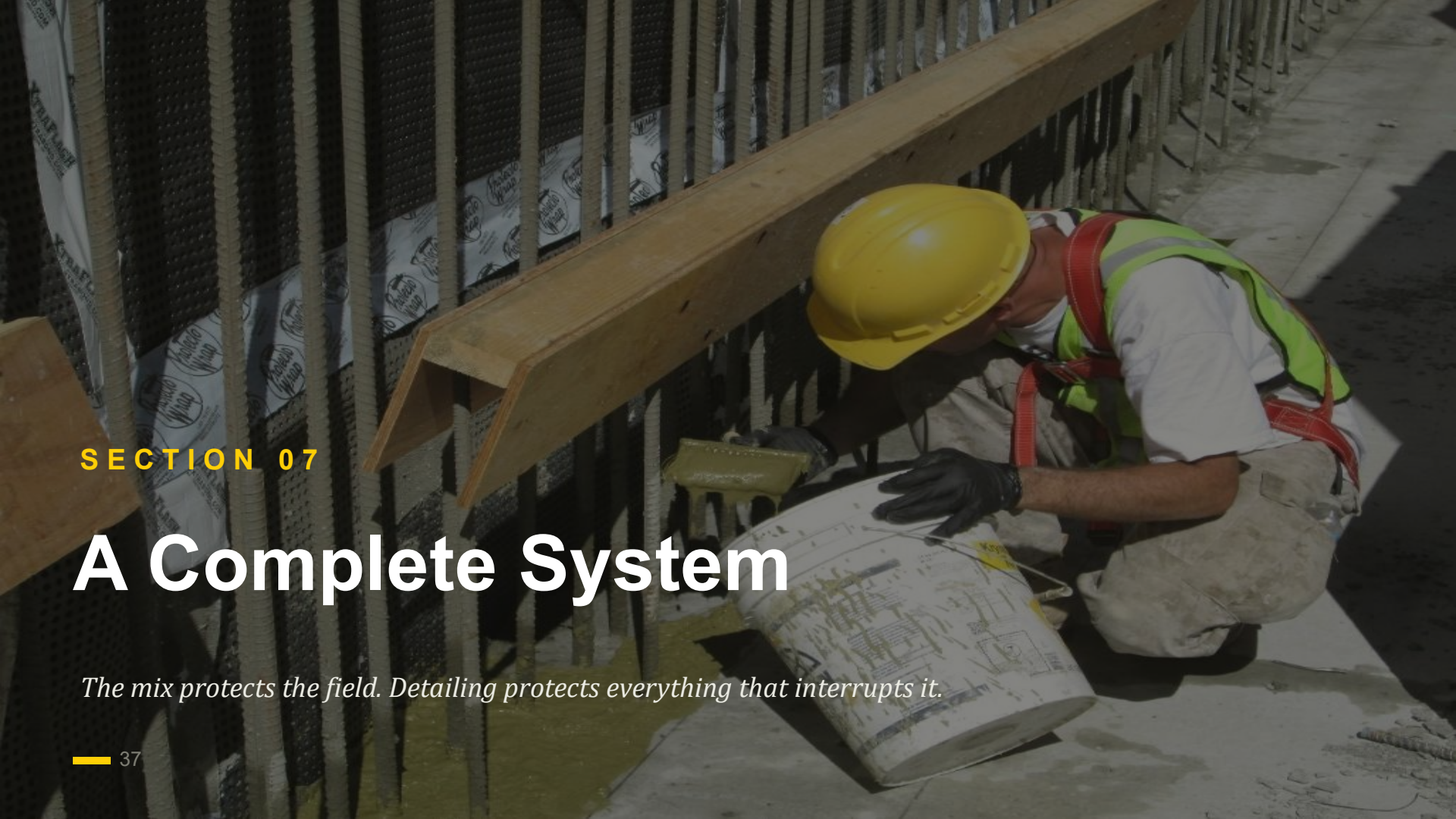
How reliable/easy is the system to detail?

Every pile cap, tie-back, and grounding rod is a place a surface layer can fail.

03

What happens to the barrier over the life of the structure?

Cracks are where deterioration begins — and where water goes first.

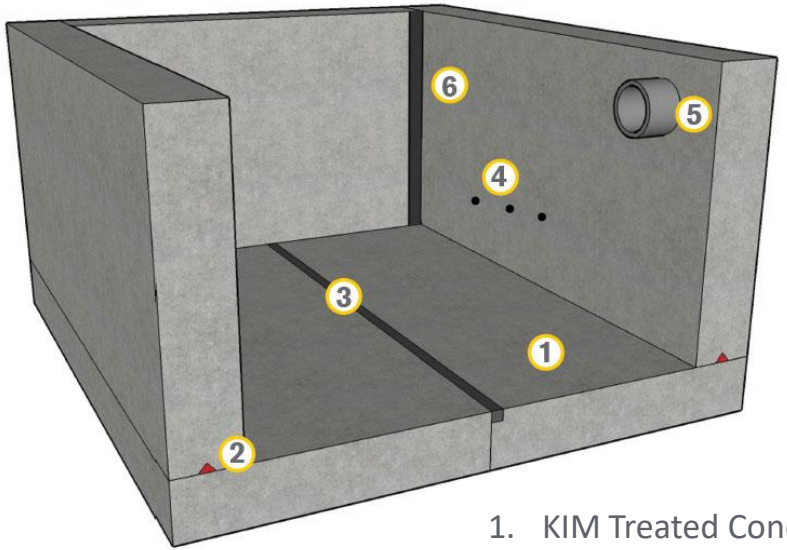


SECTION 07

A Complete System

The mix protects the field. Detailing protects everything that interrupts it.

Below-Grade Waterproofing System



1. KIM Treated Concrete
2. Wall-to-slab joint
3. Slab-to-slab joint
4. Tie holes
5. Pipe penetration
6. Wall-to-wall joint

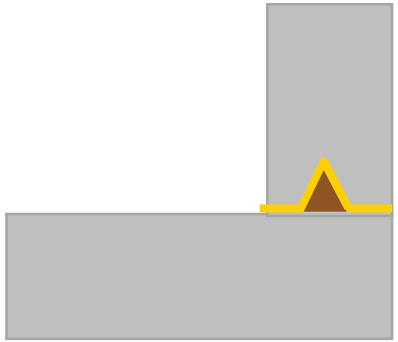
Krystol Waterstop System

Waterproofing protection for:

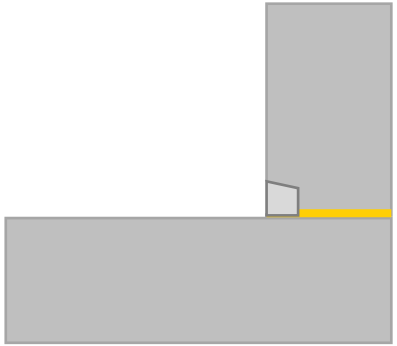
- Construction Joints
- Pipe Penetrations
- Tie Holes
- Control Joints

When a Permanent, Long-Term Hydrostatic Waterproofing Solution Is Needed

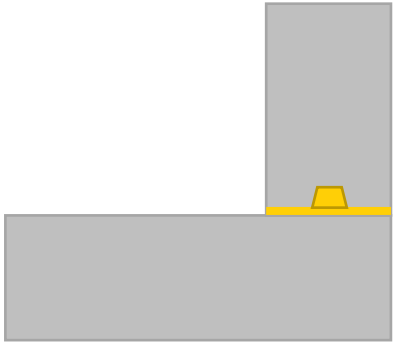
Internal Grout Method



External Grout Method



Internal Swelling Method

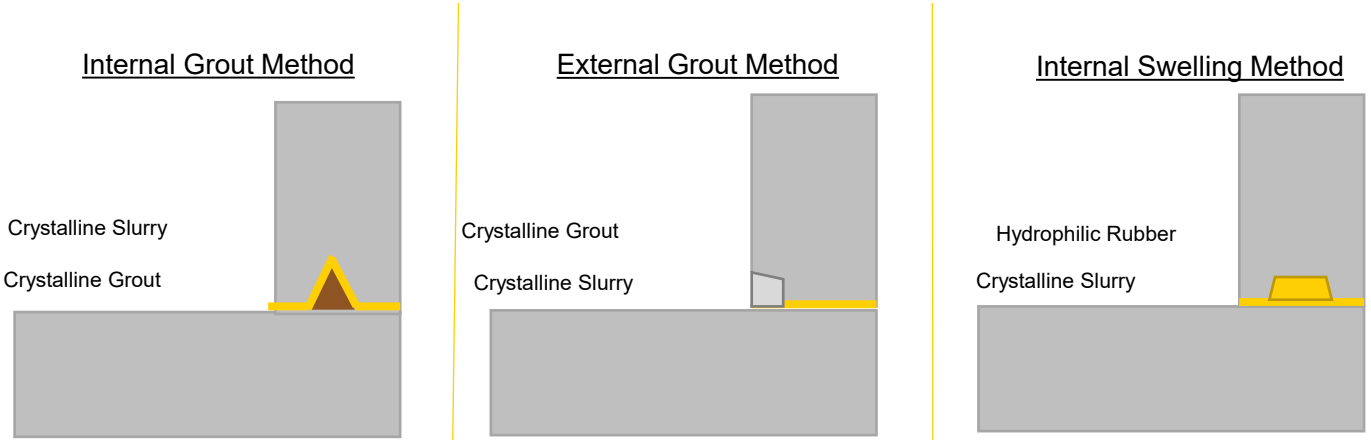


Supports Crystalline Waterproofing

Construction Joints — Double Protection

Construction Joints – Double Protection

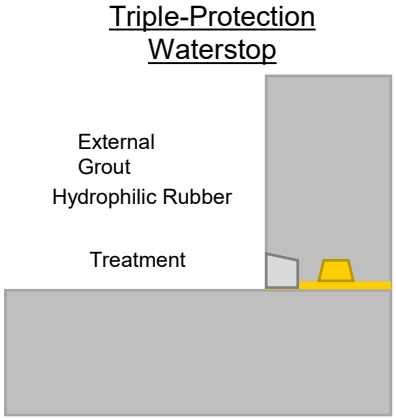
When a permanent, long term, hydrostatic waterproofing solution is needed.



Supports crystalline waterproofing

KRYTON
SMART CONCRETE™

When a Permanent, Long-Term Hydrostatic Waterproofing Solution Is Needed



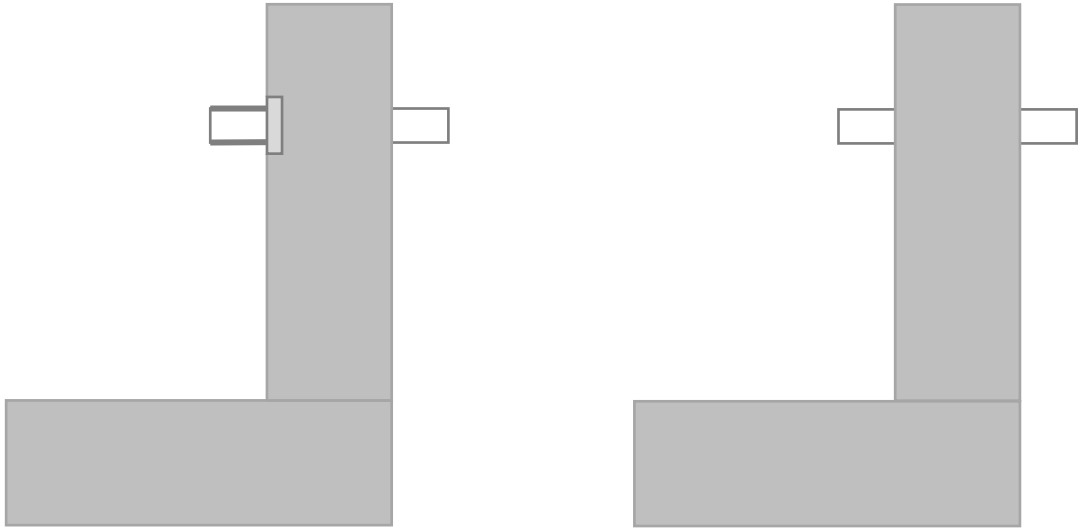
Supports Crystalline Waterproofing

Construction Joints — Triple Protection

Installation of Crystalline Slurry

Installation of Crystallline Grout Keyway

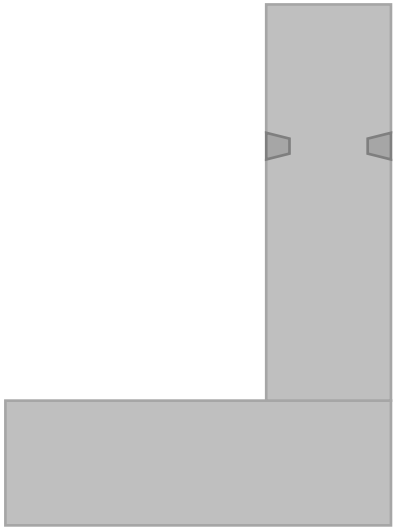
Crystalline Grout Installed



Compatible with Crystalline Waterproofing

Pipe Penetrations

Pipe Penetration

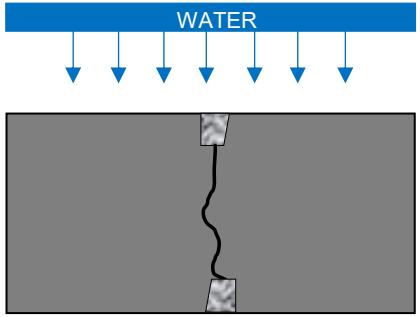


Compatible with Crystalline Waterproofing

Tie Holes

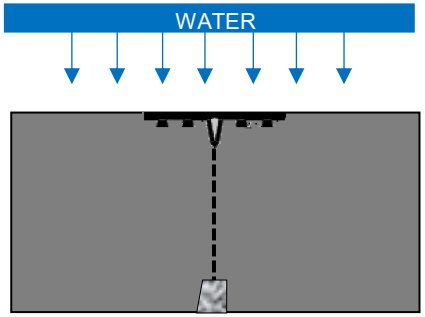
IMPORTANT REMINDER — Leveling .

Grout



If the back side of the wall is exposed, keyways can be created and filled with grout before backfilling.

Crack Inducing Waterstop



When there's no access to the back side of the wall, align Crack Inducing Waterstop and keyway. Fill keyway with grout.

CRACK-INDUCING CONTROL JOINTS

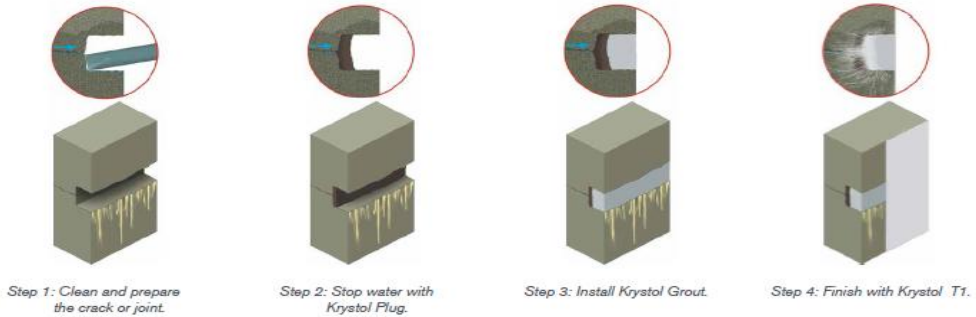
ACCESSIBLE VS BLINDSIDE APPLICATIONS

Planned Control Joints

Unplanned Control Joints .

100% EFFECTIVE LEAK REPAIR SYSTEM

- Works under any jobsite condition
- Is designed for maximum waterproofing protection with minimal hassle
- Has an easy step-by-step installation
- Eliminates stress and costly callbacks



Step 1: Clean and prepare the crack or joint.

Step 2: Stop water with Krystol Plug.

Step 3: Install Krystol Grout.

Step 4: Finish with Krystol T1.

Leak Repair System

PREEMPTIVE REPAIR

ACCESS **WILL BE DIFFICULT LATER**

SECTION 08

A Team Sport, In Practice

Quality assurance is what turns a shared responsibility into a controlled one.

A SHARED RESPONSIBILITY

From one trade to the whole team.

Put the barrier in the concrete and everyone who touches it owns the result — the way airtightness became everyone's job.

LEVERS FOR MAXIMUM SUCCESS

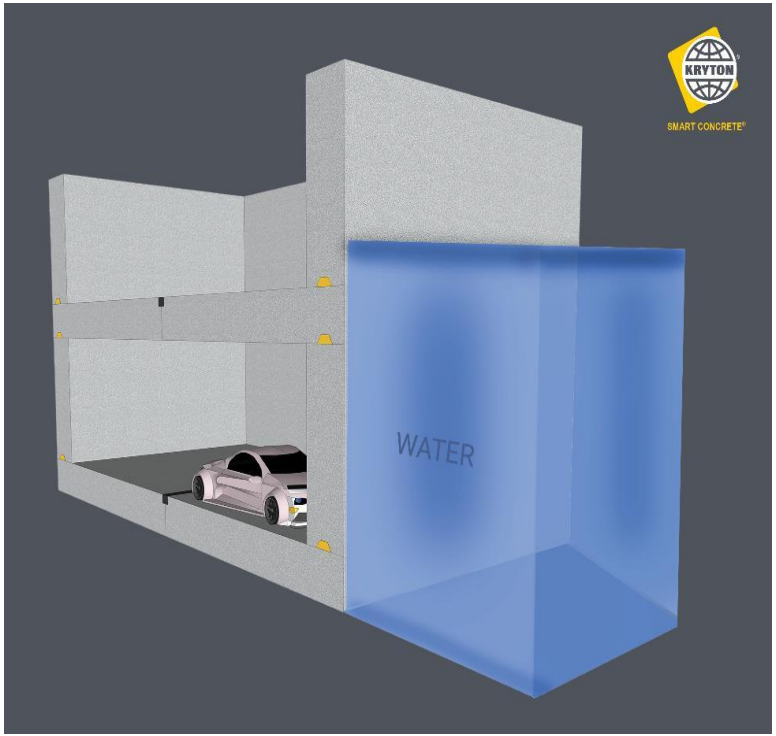
Quality assurance, end to end

1. Pre-construction
2. Pre-pour
3. During placement
4. Post-placement
5. Site support
6. Maintenance

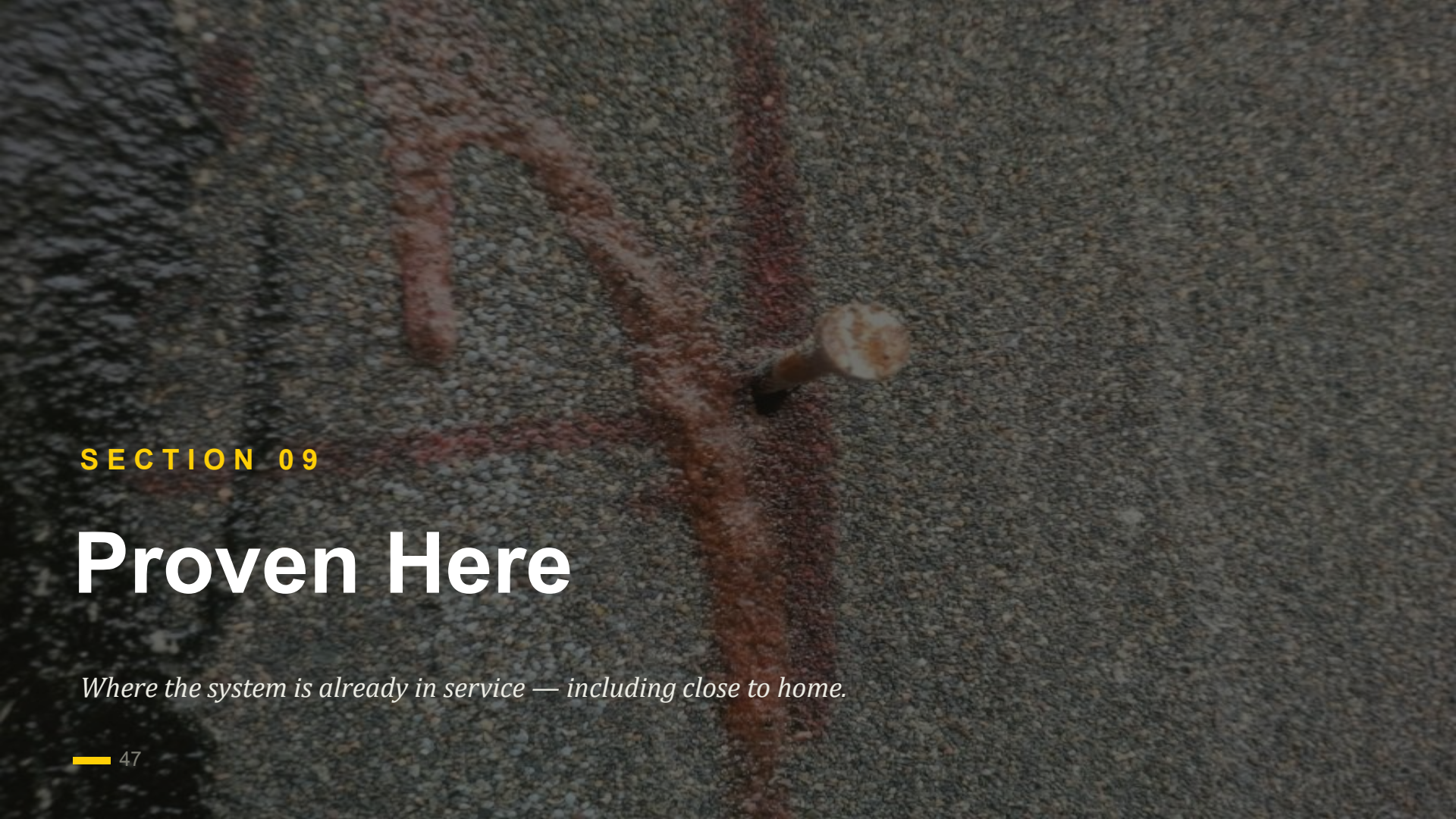
BUILDING ASSEMBLIES

Drainage becomes a choice.

No membrane to drain around. Concrete can sit against the water.



Integral concrete in direct contact with hydrostatic water — no drainage cavity.



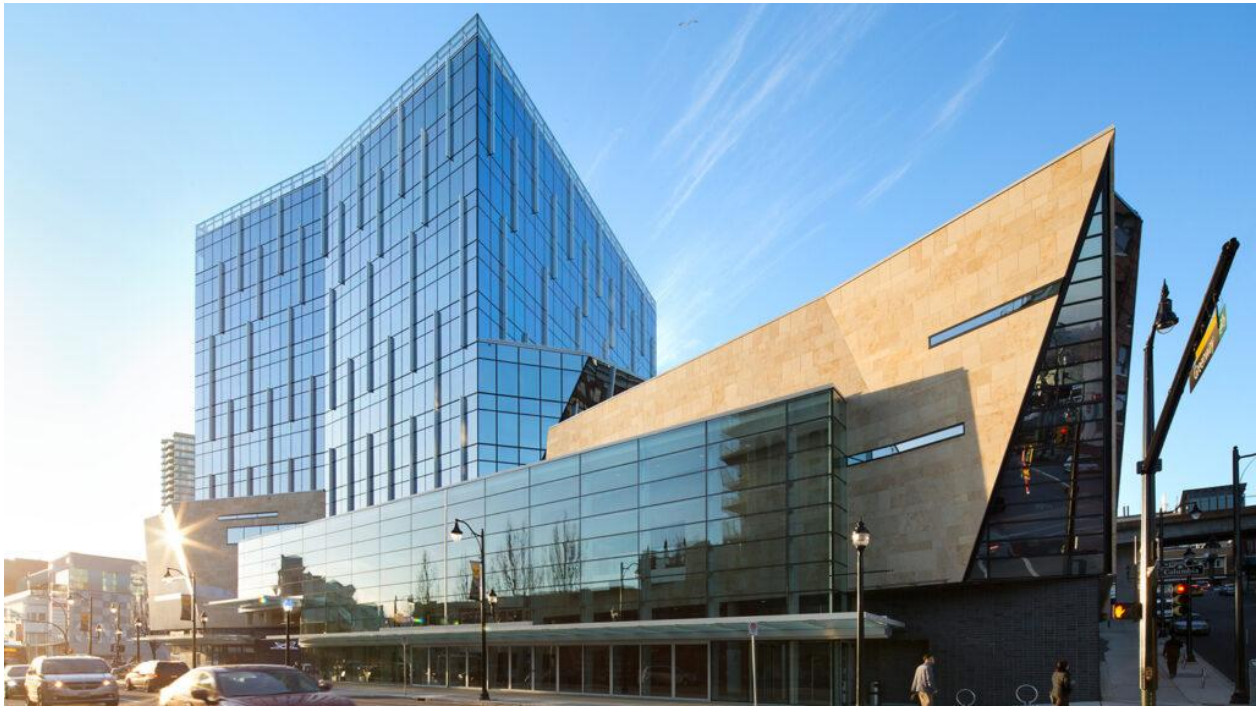
SECTION 09

Proven Here

Where the system is already in service — including close to home.

Project Map


Shaw Tower Parkade
Downtown
Olympic Cauldron
Downtown
Telus Garden
Downtown
Jameson House
Downtown
60 West Cordova Street
Downtown
North Vancouver
1
2
3
4
5
6
Downtown
7
8
Vancouver
9
10
12
11
YVR - Vancouver International Airport
16
15
14
13
Richmond
Seylynn Village – Beacon Tower
North Vancouver
The Arc
Downtown
700 West 8th
Vancouver
Mount Pleasant Sub-Station
Vancouver
The Independent at Main
Vancouver
BC Children's and BC Women's Hospital
Vancouver
YVR-Airport Tunnel
Richmond
YVR-Airport Aquarium
Richmond
YVR-Pier D Expansion
Richmond
VanDusen Botanical Garden Visitor Centre
Vancouver
River District
Vancouver



New Westminister - Anvil Centre

UBC Kelowna: No Membrane No Problem

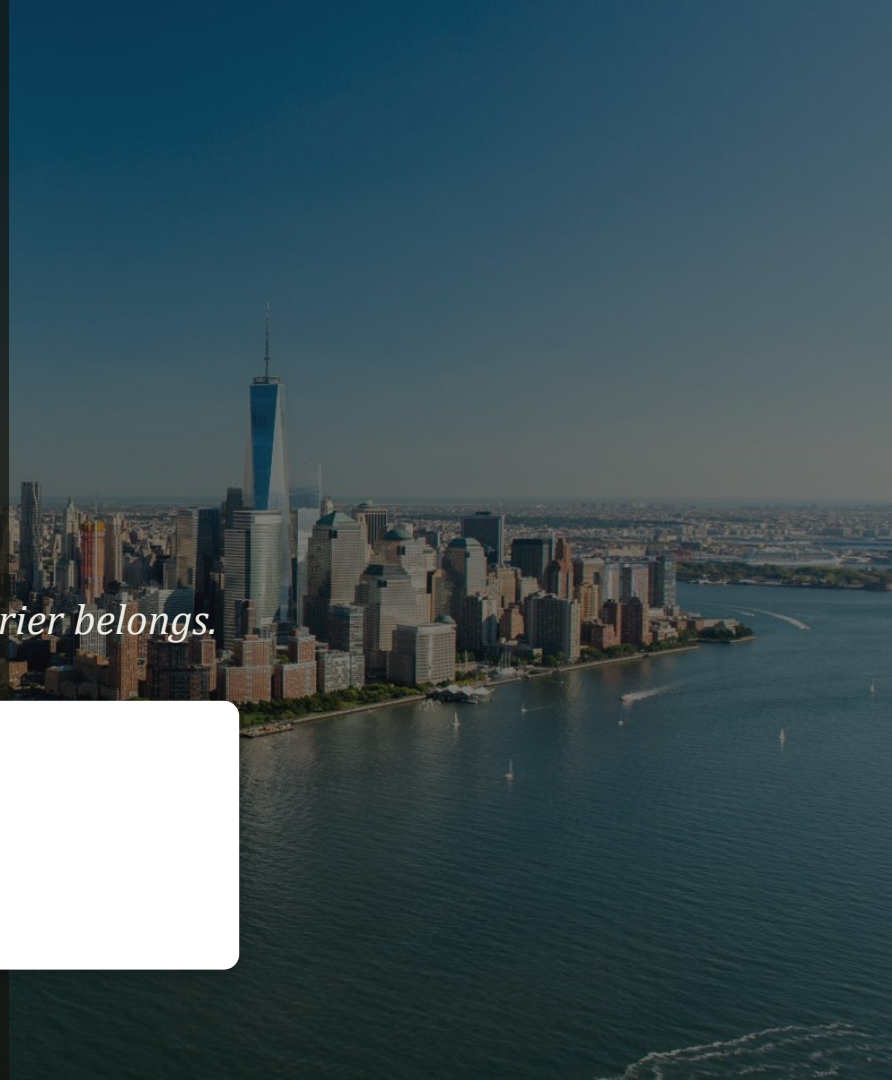
IN SUMMARY

1. Where the barrier lives.
2. Conditions are getting harder.
3. The evidence is independent.
4. Specify by performance.
5. It's a team sport.

KRYTON
SMART CONCRETE®

Thank You

Round Table Discussion— let's decide where the barrier belongs.



Kevin Lin

Territory Manager — British Columbia · Kryton International Inc.

klin@kryton.com

604-220-8287