PRAH
WATERPROOFING
Under Hydrostatic Conditions

The Future of Waterproofing.

E5 Nano Silica admixtures create waterproof concrete by reacting with calcium hydroxide to form more C-S-H, compacting the pore structure, reducing permeability, and improving overall durability and density.

E5® INTERNAL CURE + E5® LIQUID FLY ASH

Combine E5® Internal Cure® and E5® Liquid Fly Ash® for maximum waterproofing and moisture control under hydrostatic conditions.

Permeability Reducing Admixtures

E5® INTERNAL CURE

- Proprietary Nano Silica particles in suspension
- ASTM C 494 Type S admixture
- Precisely sized nanoparticles for optimal water control
- Self-curing, eliminating all other, less efficient curing methods
- Increased hydration for densified concrete matrix
- Harder, denser concrete surface

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E5® LIQUID FLY ASH

- Proprietary blend of Nano Silica particles in suspension
- Liquid SCM @ 8 oz/cwt
- Most efficient SCM for consuming calcium hydroxide
- Wider particle band
- Molecular particle packing for dense concrete
- Carbon reduction, replacing up to 10% of cement

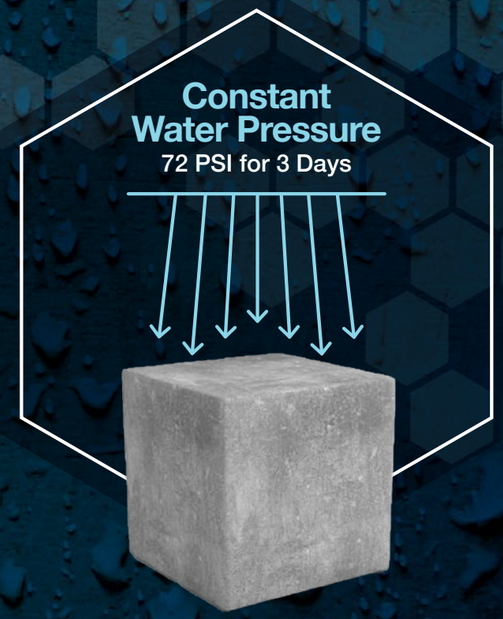
PRAH MUST BE ABLE TO PERFORM TWO FUNCTIONS:

1. Reduce concrete permeability by 50%-90% and resist water pressure
2. Self-seal cracks over the life of the concrete

ACI 212.3R-10 – Chapter 15

Permeability Test

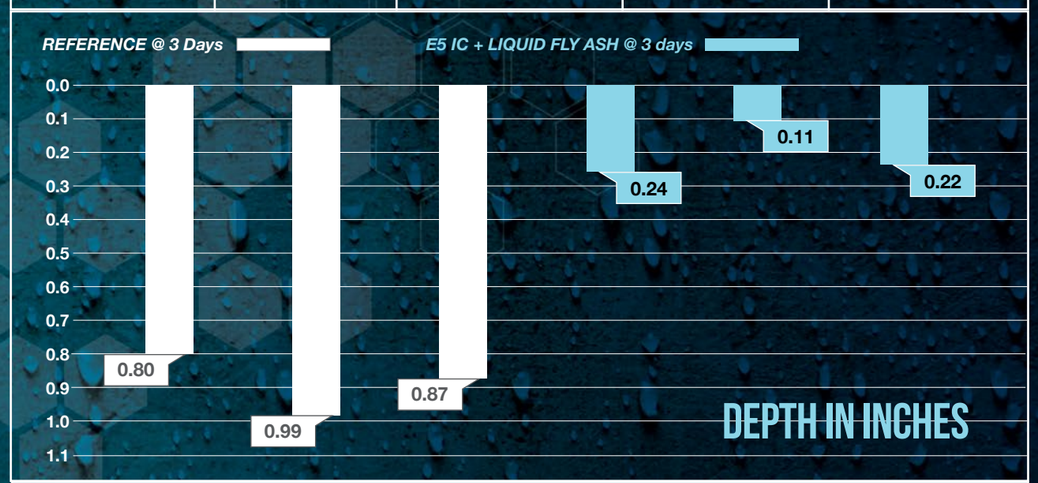
DIN 1048-5 / BS EN 12390-8



RED denotes the distance of ingress of water over 3 days from the top surface.

DIN 1048 Test Results

Mix ID	Sample	Maximum Depth of Penetration (in)	Average Depth of Penetration (in)	Difference From REF (%)
Reference	Depth, 1	0.80	0.89	
	Depth, 2	0.99		
	Depth, 3	0.87		
E5, 4 + LFA, 8	Depth, 1	0.24	0.19	79.55
	Depth, 2	0.11		
	Depth, 3	0.22		



Third Party Testing

Permeability Test

USACE CRD-C48

E5® Internal Cure® and E5® Liquid Fly Ash® colloidal silica admixtures were tested in accordance with the rigorous U.S. Army Corps of Engineers CRD-C48 water permeability standard. Both admixtures achieved exceptional results, demonstrating an average permeability coefficient of 6.13 × 10^{-13} cm/sec, significantly outperforming conventional concrete mixes.

These results confirm that E5® technology delivers superior densification and long-term durability by virtually eliminating water penetration under 200 psi pressure.

USACE CRD-C48 Test Results

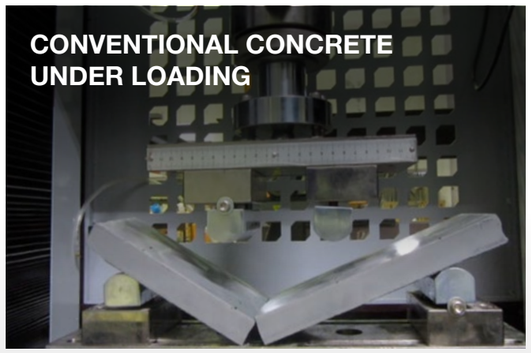
CRD-C48	E5 SAMPLE 1	E5 SAMPLE 2	E5 AVERAGE
Age at time of testing (days)	88	88	88
Diamter (in.)	6.00	6.00	6.00
Length (in.)	6.00	6.00	6.00
Flow Rate for last 5 days of testing (ft3/sec)	0.008	0.015	0.011
Water Permiability (ft3/sec)/ft2(ft head/ft)	4.20E-13	8.06E-13	6.13E-13
Total Change in Volume of water	5.14	6.55	5.85
Total Volume of Water Passed through specimen	0.0	0.0	0.0

SGS Tec Services

Research. Analysis. Development.

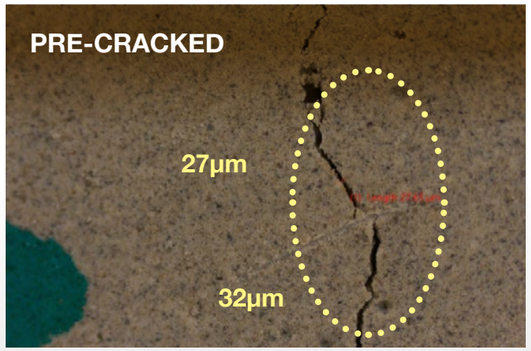
Luna Lu
Founding Director of Center for Intelligent Infrastructure
Purdue University and Professor of Civil Engineering
Alfred Noble Prize Winner 2022
Lyles School of Civil Engineering Purdue University

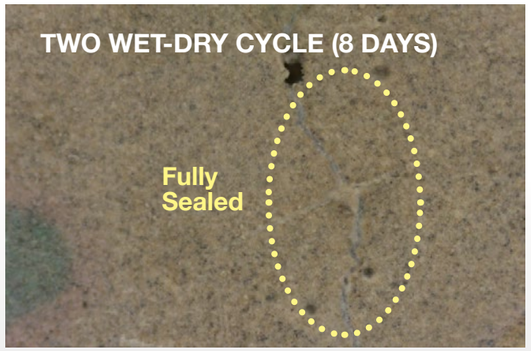
Self-Healing Concrete for Improved Pavement Durability



- Conventional concrete pavement suffers from freeze-thaw deterioration
- Self-healing cementitious composites (SHCC) with high-ductility can undergo substantial loading conditions, and then heal itself.

Microscopic Observation – 0.3% E5® Internal Cure® – SHCC





This research study was published in August 2022 and has been approved for journal publication following peer-review.

- Research shows, adding E5® Nano Silica to concrete helps fully seal cracks up 32µm in size.

Case Study: Block 20

Indianapolis, IN

With impressive DIN 1048 permeability reduction results and state-of-the-art research by Dr. Luna Lu at Purdue University proving the E5® technology self-heals and seals, E5® Nano Silica was the chosen solution to densify and cure the concrete for this 6-story structure in downtown Indianapolis. This building will serve the much-needed parking needs of this vibrant community for a very long time given the ensured longevity of this structure.

PROJECT HIGHLIGHTS

General Contractor: Meyer-Najem
Products Used: E5® Internal Cure® + E5® Liquid Fly Ash®

- $20M mixed-use parking garage, apartments and commercial building
- 4,000 psi concrete
- 50,000 sq.ft. below grade with 18 ft. high walls

Case Study: Beaver Creek Spillway

Georgia DOT

The Georgia DOT utilized E5® Internal Cure® and E5® Liquid Fly Ash® admixture system to achieve integral waterproofing of the spillway and dam structure, eliminating the need for post-applied surface chemicals. This approach provided a monolithic, internally cured concrete matrix with enhanced density and reduced permeability, resulting in superior long-term durability and resistance to hydrostatic pressure. By incorporating these admixtures directly into the mix, the team accelerated the construction schedule and avoided future maintenance associated with surface-applied systems. The result was a durable, watertight structure with improved performance, extended service life, and reduced lifecycle costs.

PROJECT HIGHLIGHTS

General Contractor: Heidelberg Materials
Products Used: E5® Internal Cure® + E5® Liquid Fly Ash®

- 1,200 cubic yards
- liquid nitrogen and ground granulated blast-furnace slag (GGBFS) were introduced to effectively manage heat of hydration
- optimized mix design maintained internal concrete temperatures below 70°F, preventing thermal cracking

Case Study: Deep Rock Tunnel Project

Fort Wayne, IN

As a significant public infrastructure effort aimed at protecting the city's rivers and preventing sewer overflows, the Fort Wayne's Tunnel Boring Machine drilled a five-mile sewer tunnel 200 feet underground. The tunnel helped manage combined sewer overflows, improving water quality and protecting the environment. The structure's concrete walls were treated with E5® Internal Cure® and E5® Liquid Fly Ash® admixture system to reduce permeability and moisture.

PROJECT HIGHLIGHTS

General Contractor: Lane
Products Used: E5® Internal Cure® + E5® Liquid Fly Ash®

- The tunnel depth is 200 to 250 feet below the groundsurface. It is a segmentally lined tunnel
- 90% reduction in combined sewer overflows discharging untreated water to the Fort Wayne rivers
- 5 miles of tunnel construction

Case Study: Wastewater Treatment Plant

Greenfield, IN

The Greenfield Wastewater Treatment Plant, serving approximately 4,700 metered customers with a flow capacity of 4 million gallons per day, is a key public infrastructure initiative dedicated to protecting the city's rivers and preventing sewer overflows. By improving water quality and safeguarding the environment, the plant plays a crucial role in our community's sustainability efforts. The facility has been treated with E5® Nano Silica, ensuring its durability and effectiveness by reducing permeability and moisture, thus enhancing its waterproofing capabilities.

PROJECT HIGHLIGHTS

General Contractor: Wilhelm Construction
Products Used: E5® Internal Cure® + E5® Liquid Fly Ash®

- Project value - $70M
- Doubles water processing capacity from 4 million to 8 million gallons per day

The Future of Waterproofing.

Transforming concrete from within.

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