



Nano Silica Hydrogels for Rejuvenating Deteriorated Concrete

Jon S. Belkowitz, PhD, PE

Chief Technical Officer

Intelligent Concrete, LLC

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What is a Hydrogel?

Hydrogels can be defined as materials formed by a porous three-dimensional network prepared from crosslinked natural or synthetic hydrophilic polymers that hold large quantities of water or biological fluids in their structure without dissolving.

What are the raw materials for Hydrogels?

- **Natural forms** – Collagen, Starches, Bacterial Cellulose
- **Synthetic Forms** – Polyvinyl Alcohol, Poly Acrylic Acid, **Colloidal Silica**



0.50 inches



Problem

America's infrastructure is falling apart. The American Society of Civil Engineers has given U.S. infrastructure a grade of C-



Problem

Failure is not an option.



Concrete is the most widely used building material on the planet.

600K

The U.S. alone has more than 600,000 concrete bridges

\$48B

The US concrete industry is over \$48B annually

\$8.3B

Every year, \$8.3B is spent maintaining concrete infrastructure

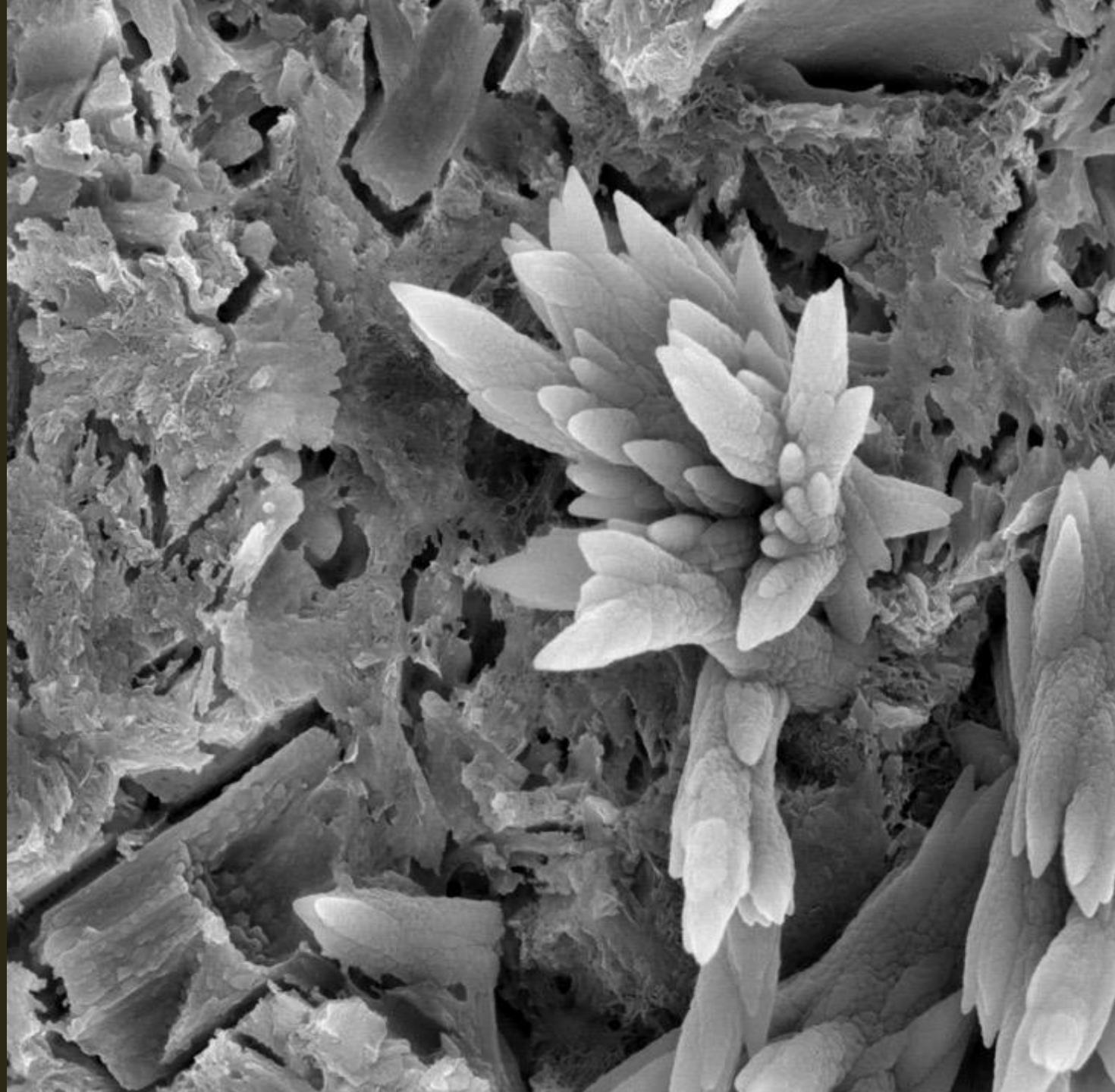
The **good news** is that there is a solution to our concrete infrastructure problem.

Problem

The root cause of the decay is in **concrete's molecular structure.**

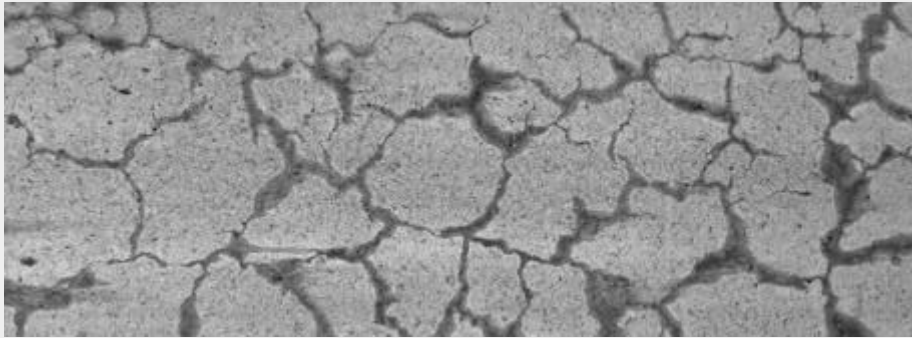
Concrete is essentially a hard sponge. Over time, water seeps into its pores and evaporates, forming cracks.

Deteriorated concrete is at the root of America's infrastructure challenges.



Problem

Over time, water and contaminants cause the **slow breakdown** of concrete.



Chemical attack leads to the steady breakdown of concrete as it absorbs moisture.



Concrete placed in marine environments, including key bridges, are especially susceptible to breakdown from seawater and tidal wear.

Problem

How water and contaminants break down concrete over time.

1. Concrete pores are dry and open to the elements.

2. Concrete pores fill with water + contaminants and evaporates.

3. Over time, this leads to cracks and eventual structure failure.



Solution

Nano Silica Hydrogels **penetrate and heal** deteriorated concrete.

1.

The solution is sprayed onto the exterior of concrete and seeps into the pores

2.

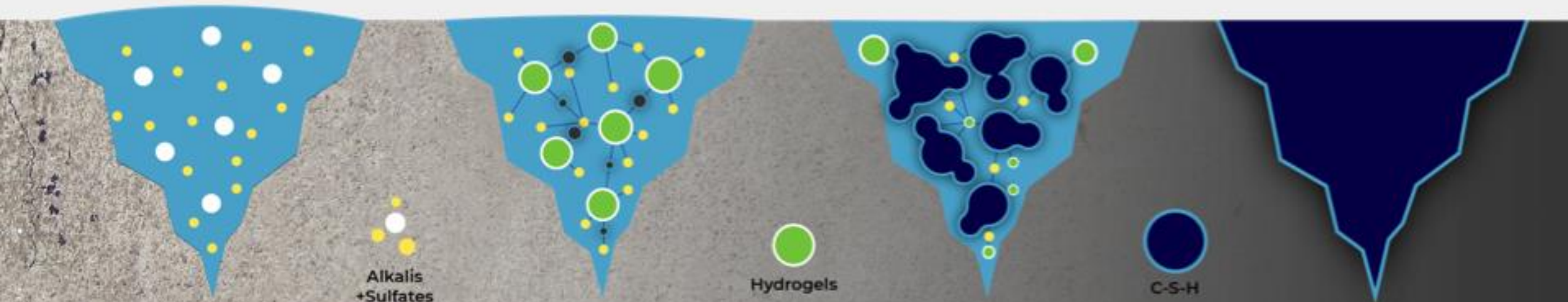
A hydrogel solution interacts with the alkalis, sulfates, and other chemicals naturally present in concrete pores

3.

The suspended components react to create C-S-H, the compound that gives concrete its strength

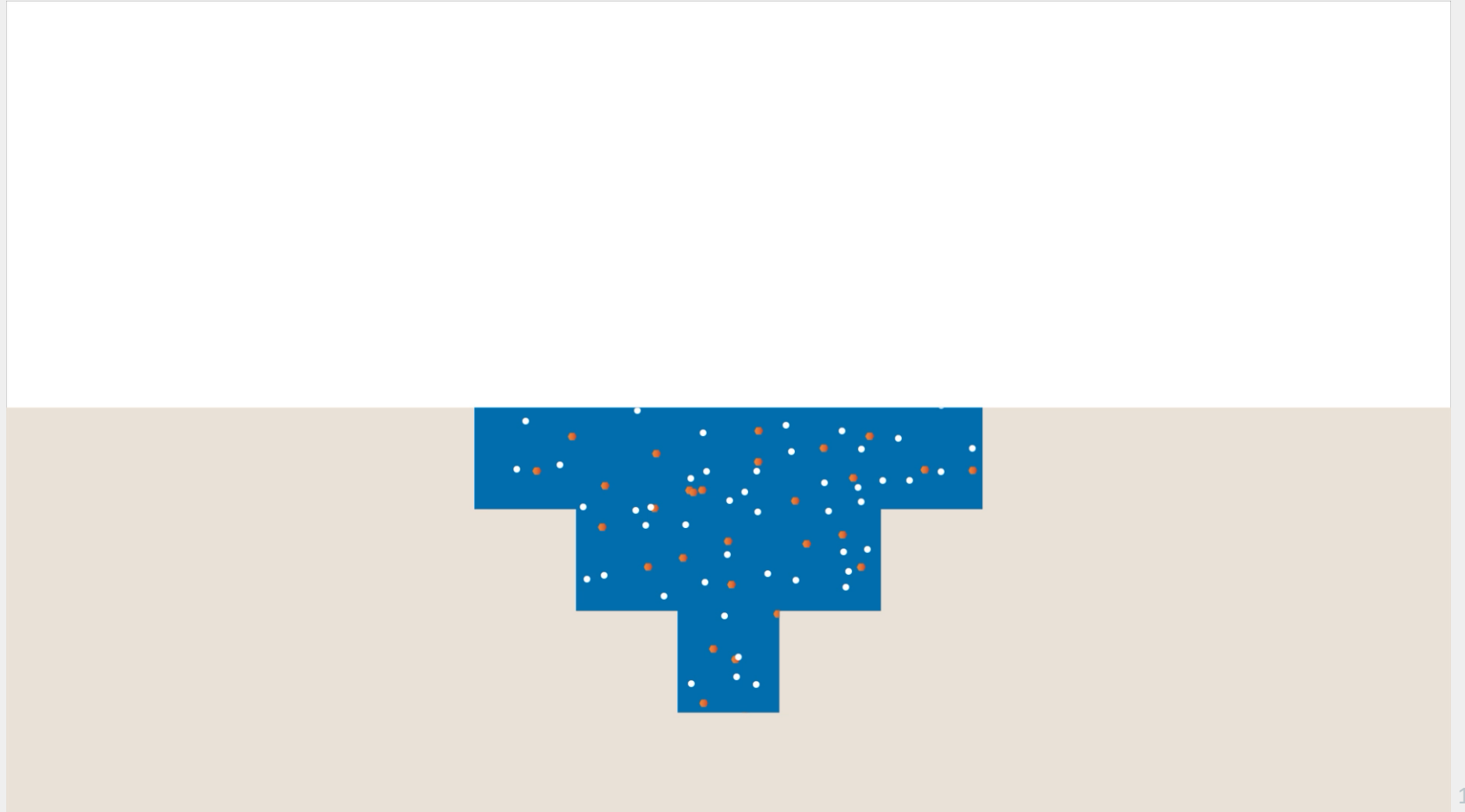
4.

The hydrogels complete their transformation into C-S-H, healing the cracks and sealing the pore



Problem

How does the technology **rejuvenate damaged concrete.**



Solution

The average design life of a bridge is **50 years.**

Early tests suggest that HYDROGELS can extend the life of a bridge by 15 to 25 years, even if they're near the end of their design life.

This increases the usable life (and value) of concrete pavements and infrastructure by 30-50%.





**Case Study – The Kruse
Tunnel in Ft Wayne, IN.
Concrete repair with Nano
Silica Hydrogels.**

Kruse Tunnel_{Ft Wayne, IN}

Case Study

- **Concrete Cracks**
 - Kruse Tunnel
 - Concrete Tunnel set for demolition
- **Measure the impact and capacity of the EDYSTON Hydrogel Technology to rejuvenate cracked concrete.**
- **The significance of this phenomenon was elucidated by the employment of a modified version of ASTM C 1585, Concrete Wicking.**



How To

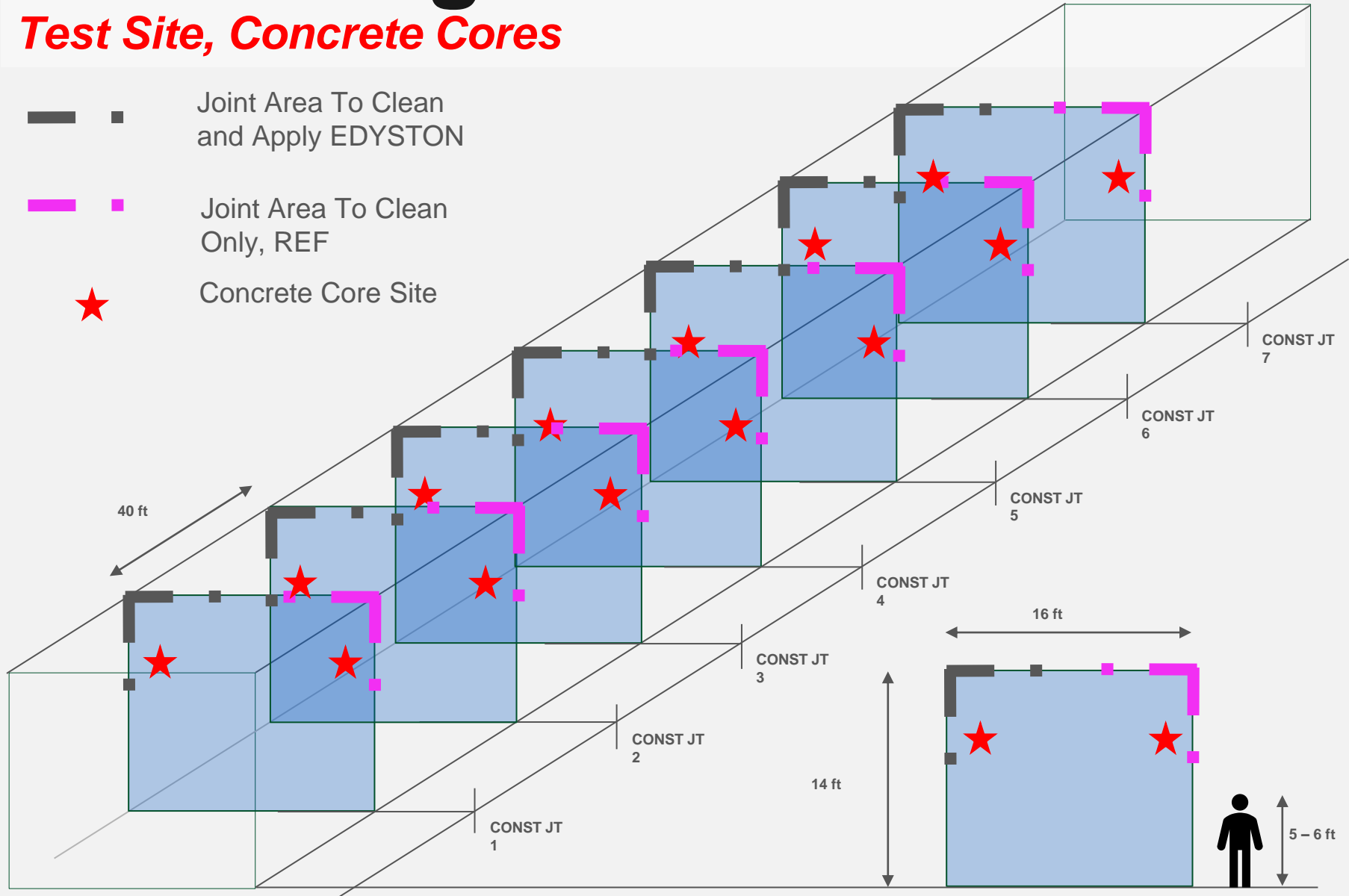
Prep and Application

1. **Power wash (3000–3500 psi) to remove salt and weak concrete.**
2. **Allow the surface to dry (SSD).**
3. **Apply Hydrogel Technology**
 - **(125 sq ft Per Gallon Max)**



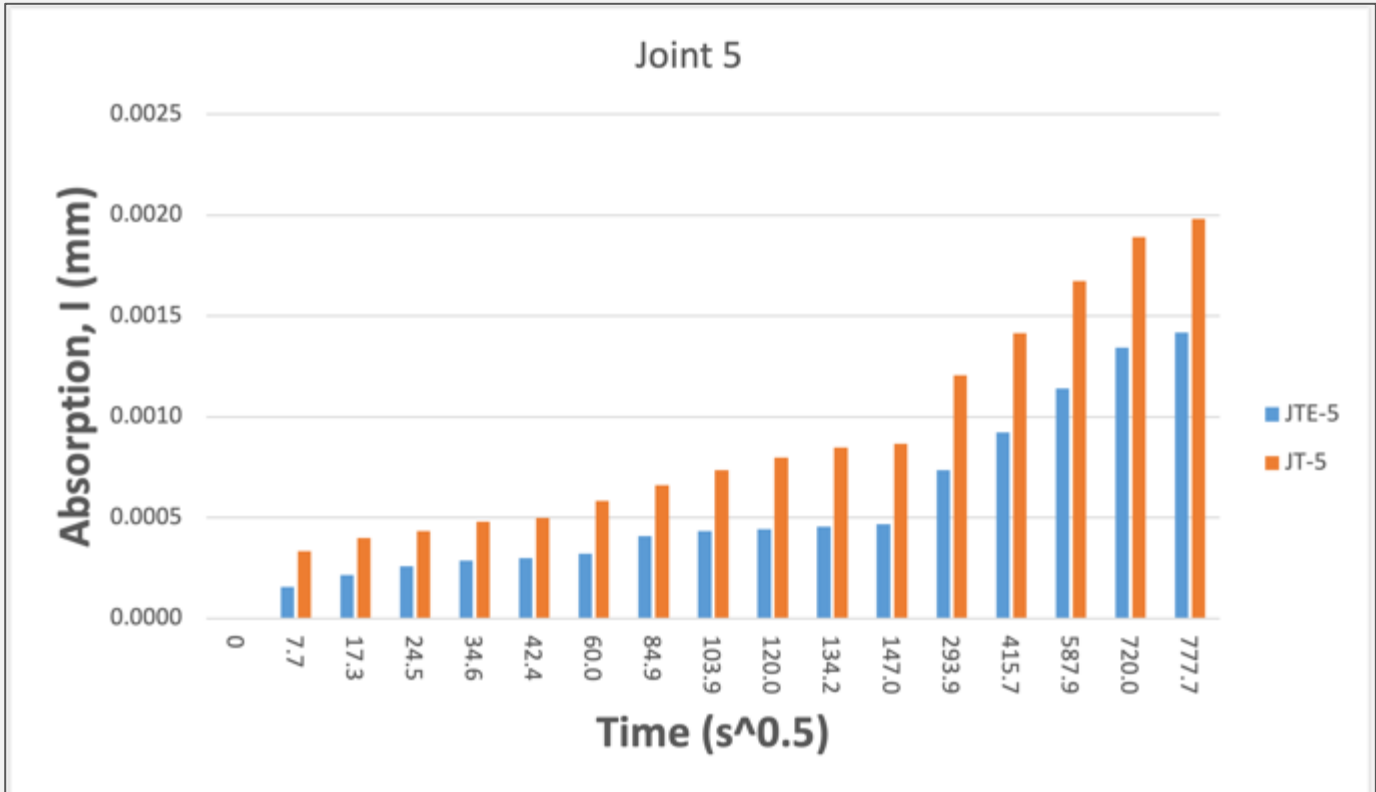
Evaluating Perf.

Test Site, Concrete Cores



Results, 5-7 AFTER 4 MONTHS

Level of Deterioration		3
EDYSTON TYPE / ORDER	DENSYGEL / DURYGEL	
DOSAGE (sq ft per gal)	250 / 250	



Results, AFTER 4 MONTHS



**REFERENCE
CONCRETE**



**HYDROGEL
TECHNOLOGY**





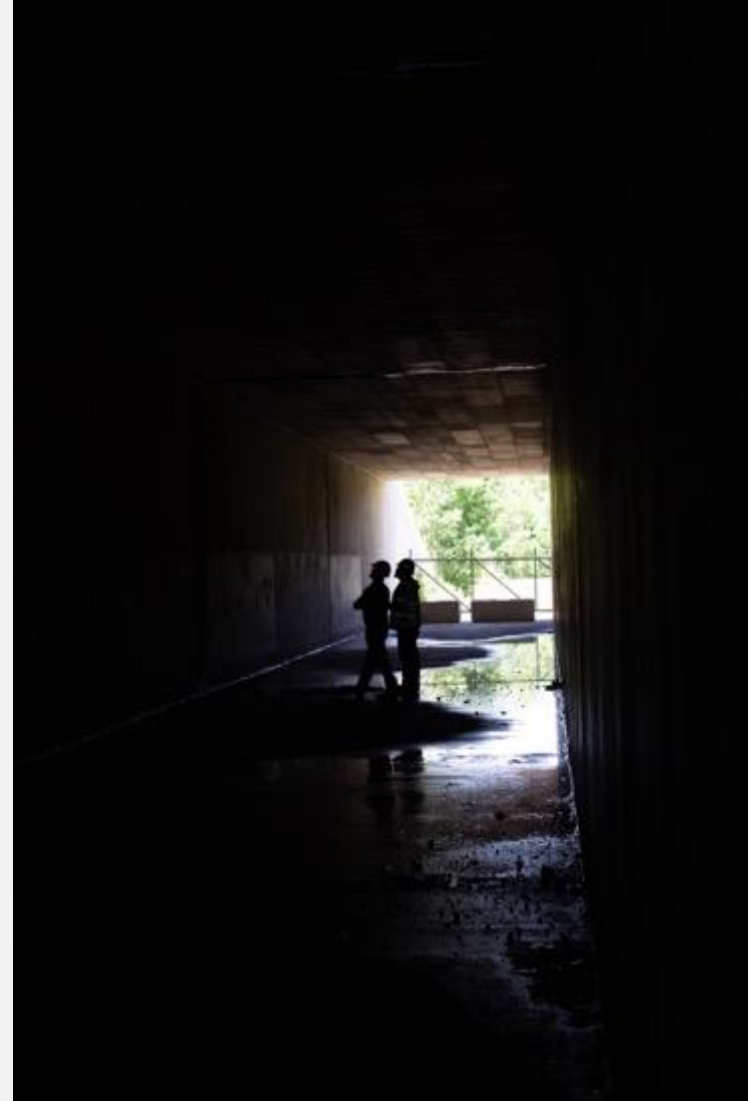
**THE IMPACT OF
CONCRETE DAMAGE**

**THE IMPACT OF
HYDROGEL
TECHNOLOGY**

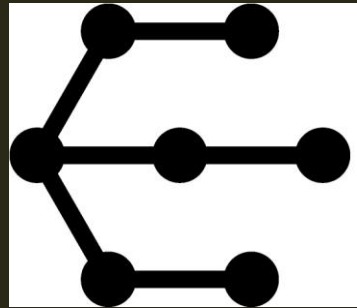
Summary

Recap of Presentation

- **Define a Hydrogel**
 - **Why do we care about Hydrogels**
- **How Can We Use Hydrogels**
 - **A Short Review on Corrosion**
 - **How do Hydrogels Impact the deteriorated Concrete**
- **Reviewing a Case Study**
- **The Next Steps**



Acknowledgements



EDYSTON



Thank you!

Jon S. Belkowitz, PhD, PE
mobile: 719.367.8092