

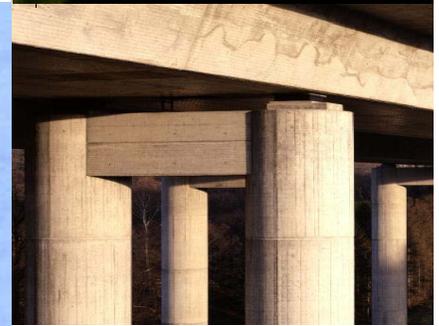


## Hycrete Concrete Testing Summary



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[www.hycrete.com](http://www.hycrete.com)



### WATERPROOFING AND HYDROPHOBIC PROPERTIES

**Unparalleled** Hycrete concrete achieves the highest waterproofing performance ratings of waterproof concrete mix designs.



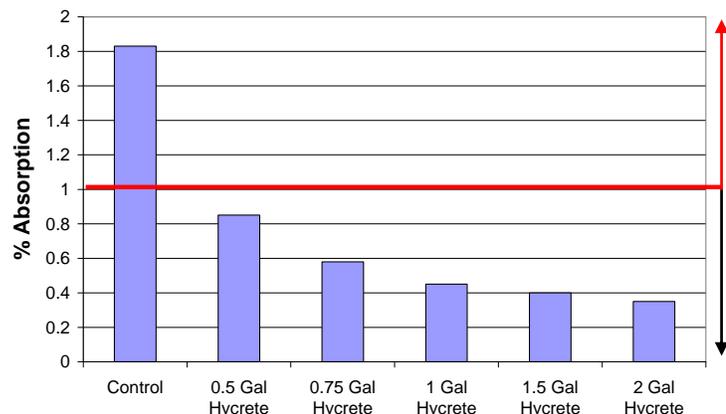
### Absorption Testing (BSI 1881- 122)

**Excellent** This test is used as the benchmark for hydrophobic concrete. Low w/c concrete typically tests in the 2%-4% absorption range with BSI 1881-122 testing. Hydrophobic concrete is specified at less than 1% absorption. Hycrete performs at the 0.4% to 0.9% range.

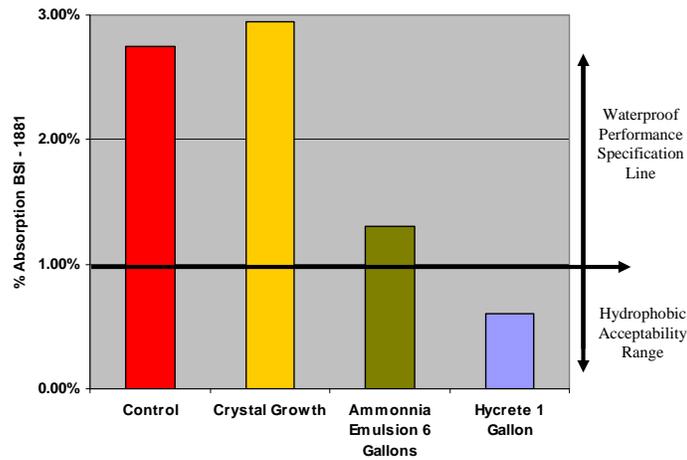
South Carolina  
Independent  
Lab Testing:  
40/60 Structural Mix  
0.40 W/C - 611 Type I-II Cement  
Polycarboxylate Superplasticizer



BSI 1881 Absorption Testing



### Independent Shotcrete Absorption Testing

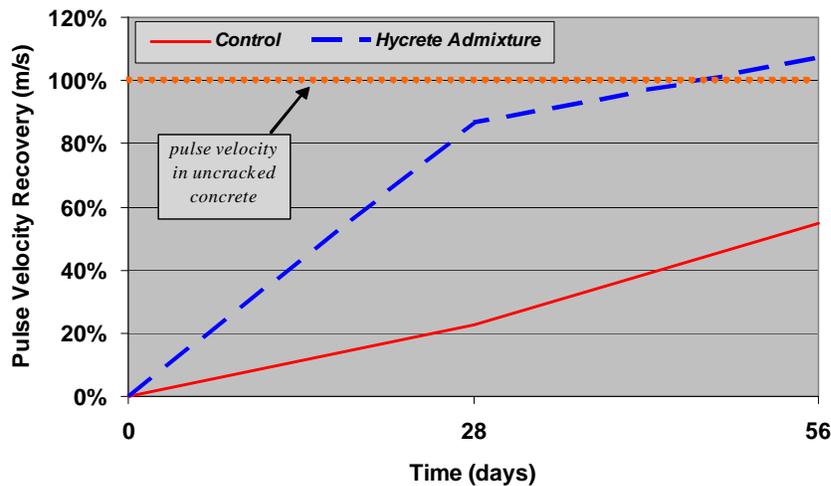


### Autogenous Self-Healing of Cracks with Hycrete Admixture

Hycrete Admixture has been tested under numerous scenarios in cracked concrete. In a test conducted by Material Service Life, LLC, a Portable Ultrasonic Non-destructive Digital Indicating Tester (PUNDIT device) was used to record pulse velocity through concrete. Sound waves travel faster in uncracked concrete than they do in cracked concrete. The study deliberately cracked the concrete and measured pulse velocity. As cracks heal, velocity of pulses will rise towards the velocity measured in uncracked concrete. As shown in the figure below, Hycrete Admixture, at 1 gallon per cubic yard, fosters faster and 100% complete healing compared to the untreated control sample.

Source: Materials Service Life, LLC

### Pulse Velocity Recovery (%) of Cracked Concrete With Time (Days)



**Hydrostatic Pressure Resistance ASTM D 5385**

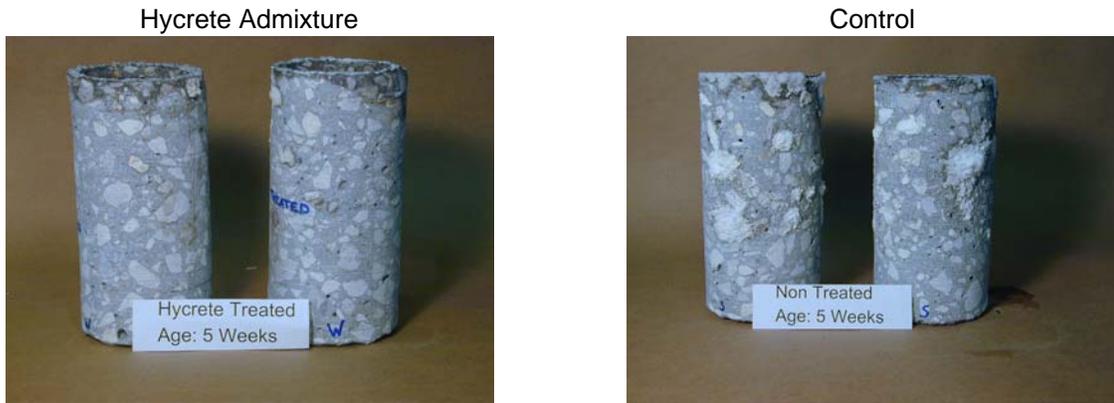
	<u>PSI</u>	<u>HEAD OF WATER PRESSURE</u>
<b>Hycrete 1 Gallon per CY</b>	<b>100</b>	<b>231 Feet Resistance</b>

Labs, Chicago, IL: Nelson Testing 40/60 Structural Mix .40 W/C 565 lbs. Cementitious 24% Type F Flyash Water Reducer

**Reduced Chloride Transmission**

Cups made of concrete with Hycrete Admixture and a control. NaCl solution was poured into the cups for a 5 week period. As seen, salt leaching was observed in the control and not in the Hycrete admixed sample.

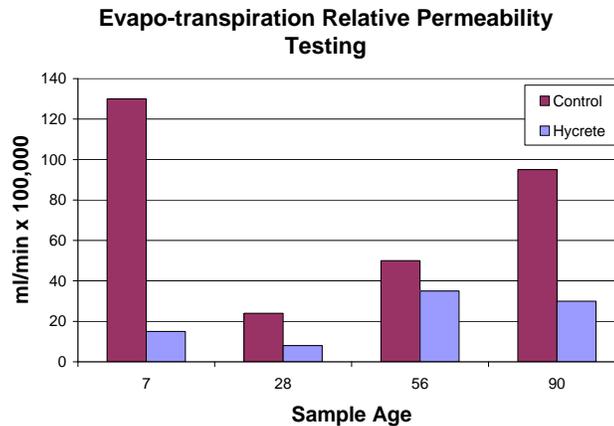
Source: Kansas DOT



**Evapo-transpiration Relative Permeability Testing:**

**Performance** Hycrete demonstrated a 68% vapor transpiration reduction compared with the control at 90 days. Resistance to capillary flow of water through the concretes was measured using the Kansas evapo-transpiration test, in which a desiccant on one side of a one-inch-thick sample draws water from the other side.

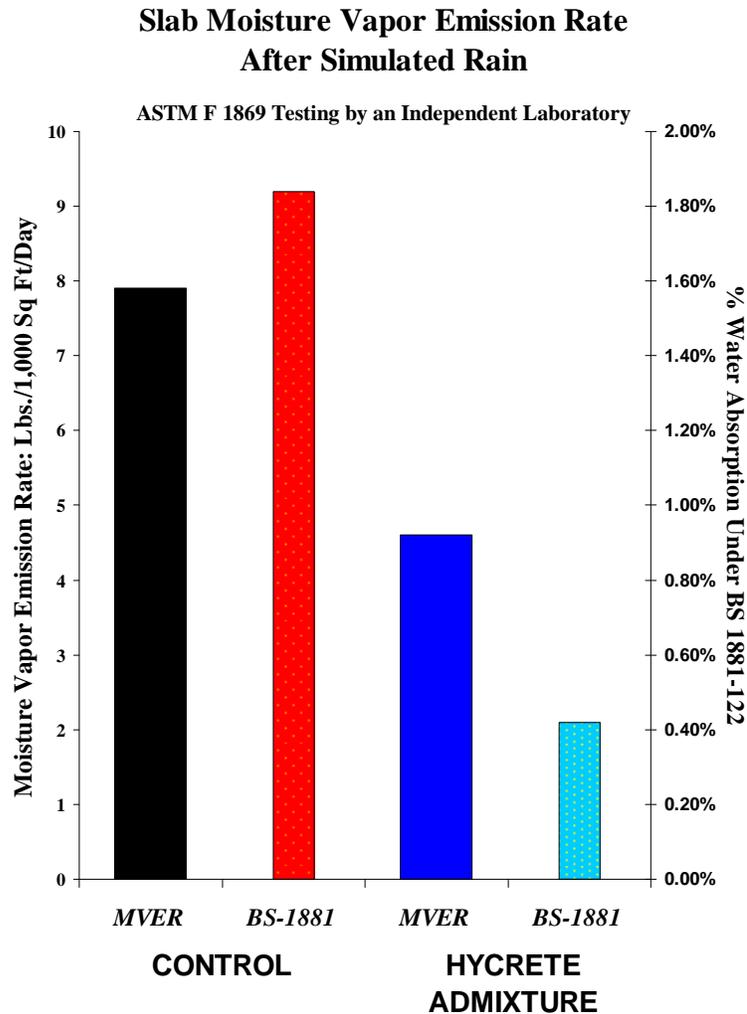
Kansas Department Of Transportation: .42 w/c 600 lbs. cement Hycrete 2 Gallons per CY



## Rewetting of Slabs Using Hycrete Admixture/Moisture Vapor Emission Reduction

Three inch concrete slabs were cast with 1 gallon per cubic yard of Hycrete Admixture. Slabs were dried to a near zero moisture vapor emission state at 100C for 3 days, followed by 1 day cooling. Slabs were immersed in water for 15 minutes. This simulates an intense, 15 minute rain shower. The slabs were allowed to surface dry at 50% RH overnight (15 hours). Moisture vapor emission was measured by ASTM F 1869, which measures moisture vapor emitted over a 3 day period and absorbed by a desiccant. Results clearly show that Hycrete Admixture-enabled concretes absorbed less water (shown on the graphic as results from the British Standard Absorption Test BSI 1881) and emit less water vapor upon rewetting.

Source: CTL Group, Skokie, IL; w/c = 0.39; 700 pounds cementitious; 15% Fly Ash



# CORROSION PROTECTION

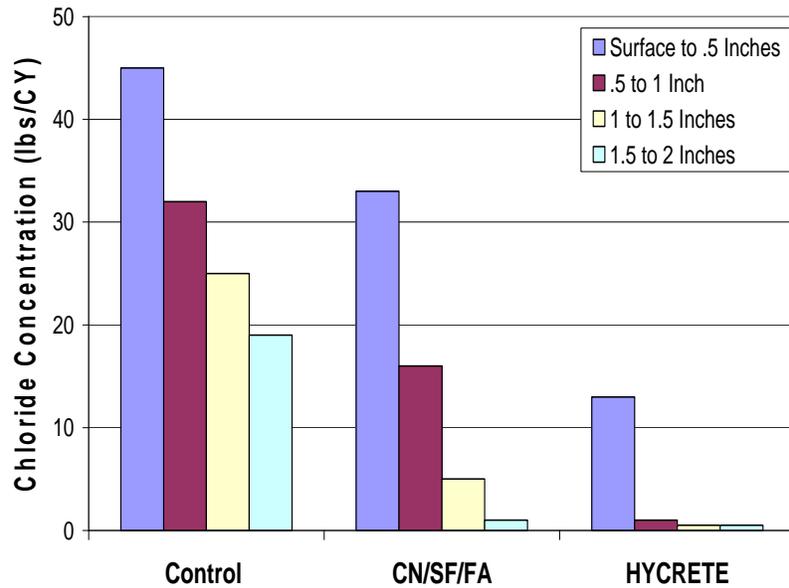
## Chloride Diffusion Reduction

**Excellent -** Outperforms Silica Fume HPC mixes.

**Independent Testing Lab mixes: w/c 0.40, Admixture: CN (3 gal/cy), Silica Fume (6%), Fly Ash (15%), Hycrete (2 gpy) Double-ASTM G-109 blocks, Salt Ponding Regime 12 weeks of 4 day ponding, then 12 weeks of continuous ponding.**



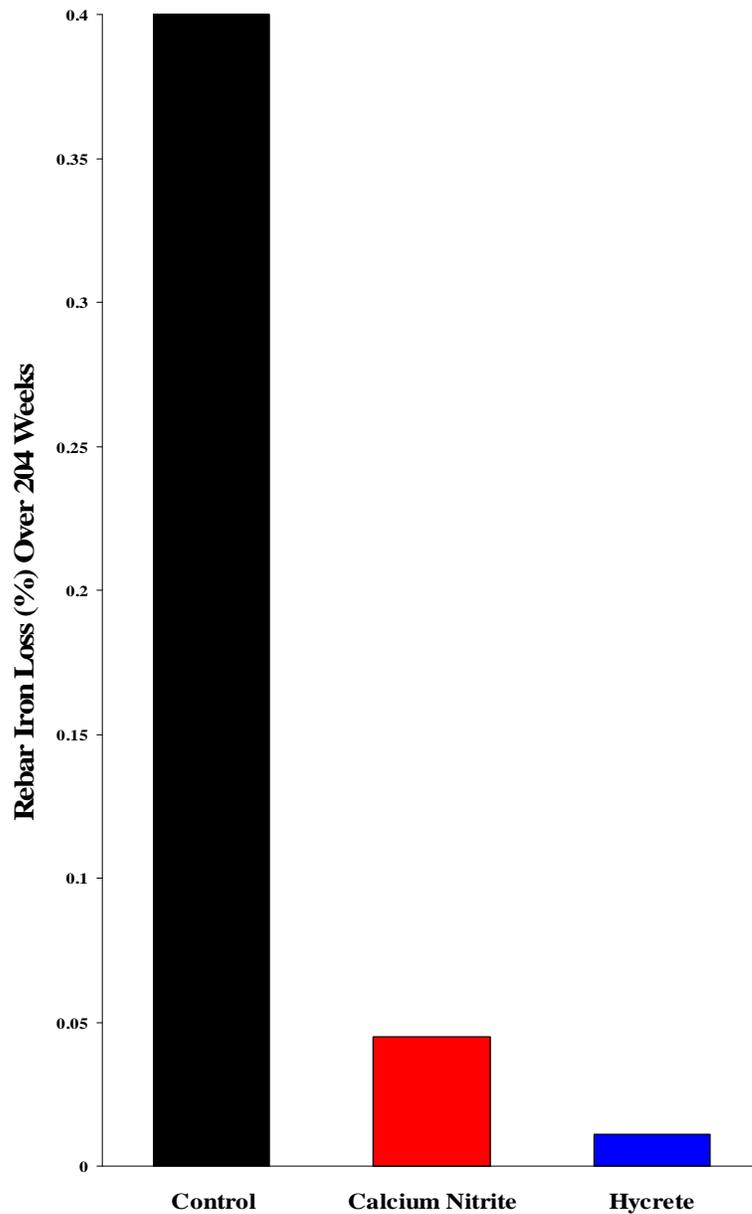
**Chloride Diffusion Comparison between  
CN/SF/FA Combination and Hycrete Concrete**



## High Endurance

Accelerated chloride ion in water ponding cycled with specimen drying. Cycles of 4 days wet plus 3 days dry were maintained over a 4-year period. Samples with Hycrete Admixture remain waterproofed and corrosion inhibited after long term harsh condition accelerated testing. Effectiveness and presence of Hycrete Admixture over time is assessed by measuring iron lost by steel reinforcement bars embedded in the ponded concrete samples as well as measuring chlorides (or lack thereof) at various depths of the concrete.

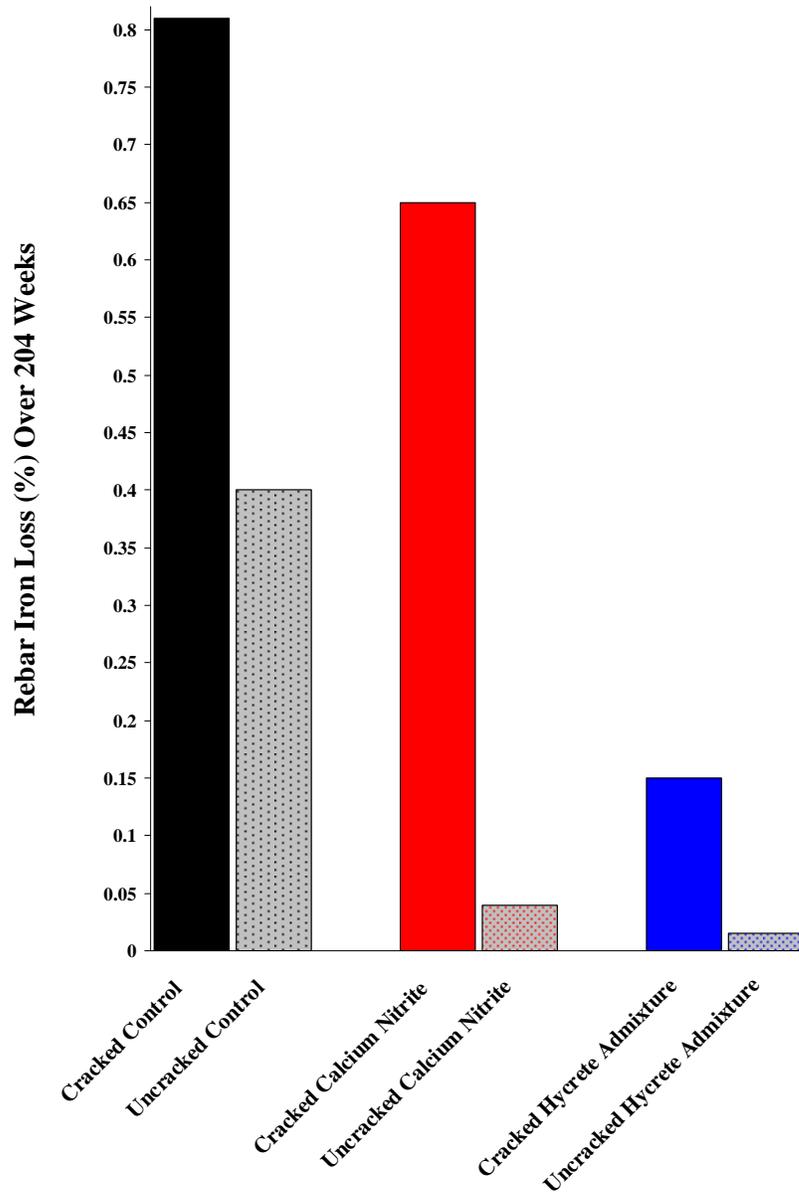
Source: Independent Testing Lab



## Corrosion Protection of Hycrete Admixture in Cracked Concrete

Hycrete Admixture has been the focus of a number of government commissioned corrosion inhibition studies. In one such study, 204 weeks of cycled ponding and drying in sodium chloride solution were evaluated for corrosion by macrocell measurements leading to a calculation of iron lost. Both uncracked and cracked specimens were evaluated, and a number of competitive corrosion inhibitors were studied. The results indicate that corrosion is accelerated by cracking and that Hycrete Admixture is able to inhibit corrosion compared to the controls and to calcium nitrite treated specimens in both uncracked and cracked concretes.

Source: *Independent Testing Lab*



### Example of Corrosion Inhibition from Hycrete Admixture:

**Performance** Hycrete Admixture and rebar in NaCl solution of pH 13 for 28 days illustrated below.

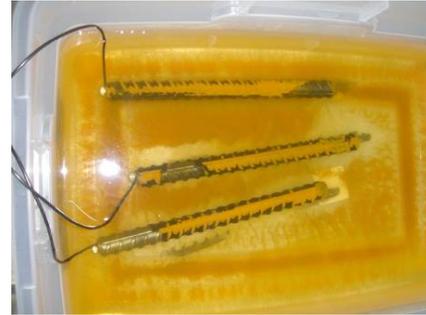
Source: *Materials Service Life, LLC*

Rebar in 6% Hycrete Admixture  
and NaCl Solution



No Damage Measured

Rebar in NaCl Solution



0.11% Steel Loss

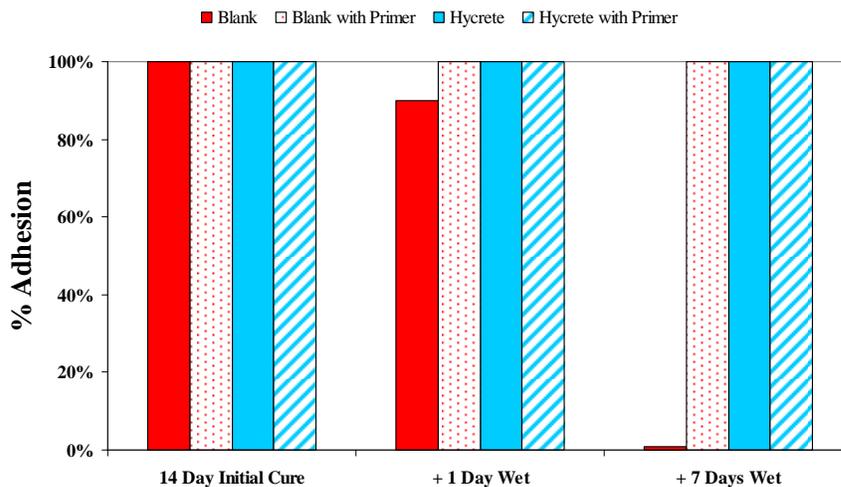
## COMPLIMENTARY BENEFITS

### Adhesive Adhesion to Concrete Treated with Hycrete Admixture

Concrete treated with 1 gallon per cubic yard Hycrete Admixture was compared to identically prepared blank concrete for adhesion bond of silicone sealants by GE Silicones. Data shows that Hycrete Admixture does not affect the bond of sealant to concrete and in fact significantly improves the bond when exposure to water occurs. The data indicates that Hycrete Admixture used in this capacity can allow the sealant primer step to be eliminated. (Note: Other sealants were tested with similar results.)

Source: *GE Silicones Construction Laboratory, Waterford, NY 2006.*

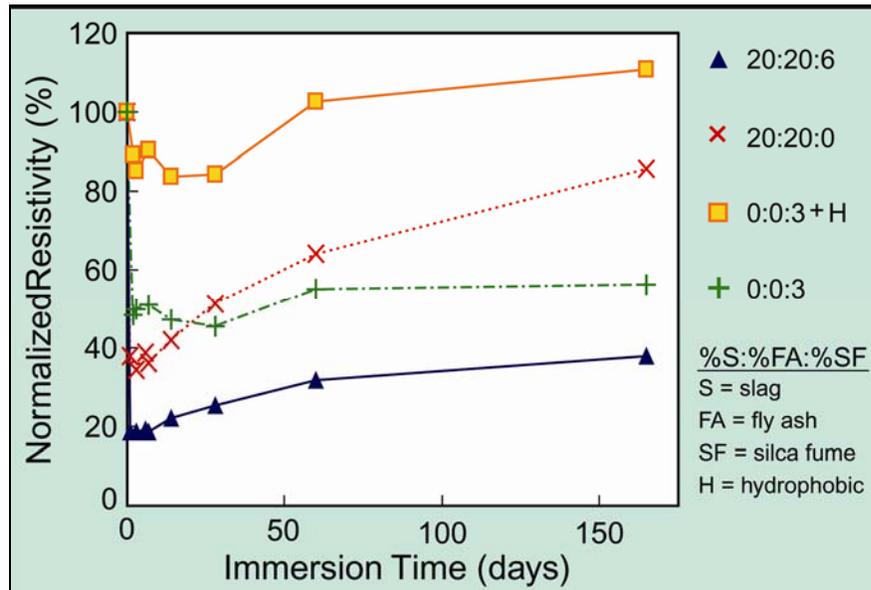
Silicone Adhesion to Hycrete Admixture Treated Concrete



## Resistivity of Concrete Treated with Hycrete Admixture

Hycrete treated concrete was measured with the intent of maximizing resistivity to prevent the transmission of stray current from an electric trolley line from corroding underground piping. Hycrete Admixture at 1 gallon per cubic yard (designated "H" here) was shown to resist the decrease in resistivity shown by alternative concretes when exposed to water, which is critical to controlling stray currents in environments where rain occurs.

Source: Figure reproduced with permission and gratitude to John S. Tinnea & Associates and NACE International from Burke, et. al., **Materials Performance**, September 2007, pp. 2-8. © NACE International 2007.



## GENERAL CONCRETE PROPERTIES

### Plastic Concrete Properties

Workability  
& Cohesion:

Excellent

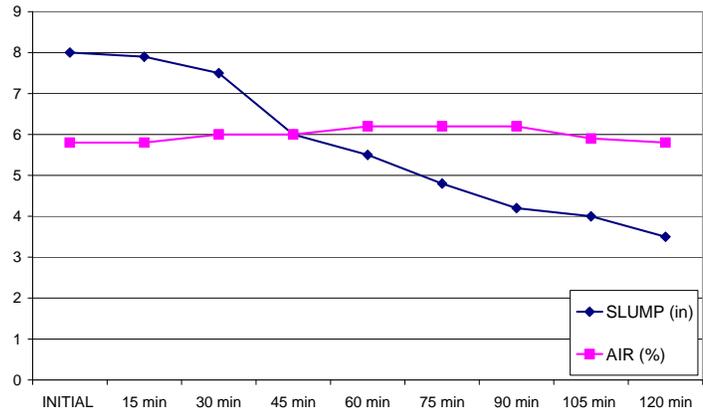


**Slump Retention:** Excellent

**Air Content:** Highly Stable

Pacific NW Independent Lab Testing:  
 40/60 Structural Mix  
 .42 W/C- 590 Lbs  
 Cementitious 20% Class F Flyash  
 Polycarboxylate Superplasticizer

**Slump and Air Retention**



**Setting Time:** Set Neutral

New Jersey DOT  
 Field Data

Set Time, Initial, hrs  
 Set Time, Final, hrs

(Typically + / - 30 minutes of control)

Control	Hycrete
4:59	4:39
6:05	5:47

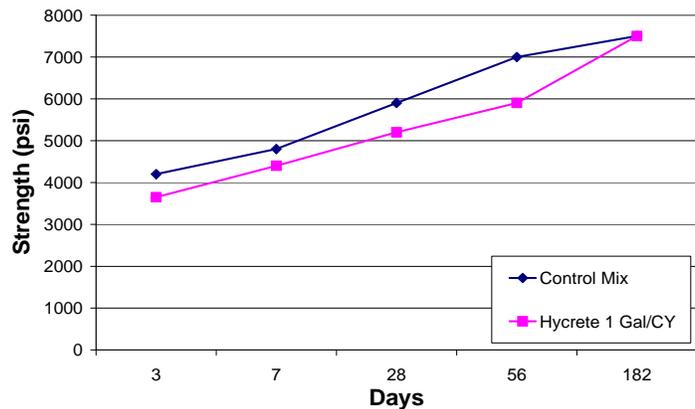
## Hardened Concrete Properties

### Compressive Strength:

**Performance** Hycrete treated concrete mixes meet ACI strength guidelines requirements for structural concrete.

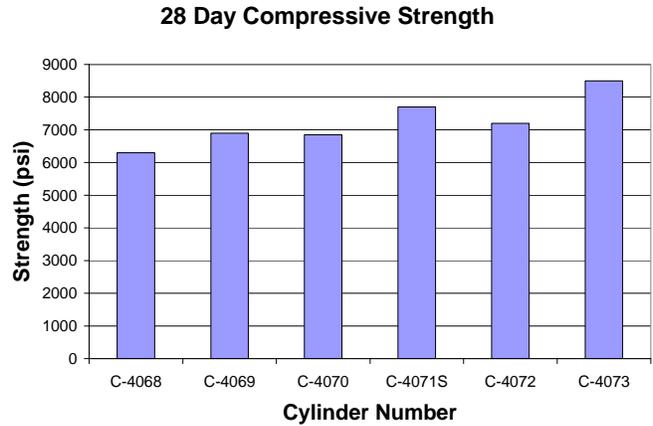
Kansas  
 Independent  
 Lab Testing:  
 40/60 Structural Mix  
 0.40 W/C - 600 lbs  
 Type I - II OPC

**Hycrete Relative Strength Gain Comparison**



**Production Strengths:**

Meritage Project: Seattle, WA 0.40 wc, 655 cementitious, 1 gpy Hycrete



**Freeze Thaw Durability ASTM C666:**

**Passes**

Hycrete treated concrete is air entrainable and meets the vigorous demands placed on concretes used in severe winter weather conditions. (300 + cycles with durability readings of 90+)

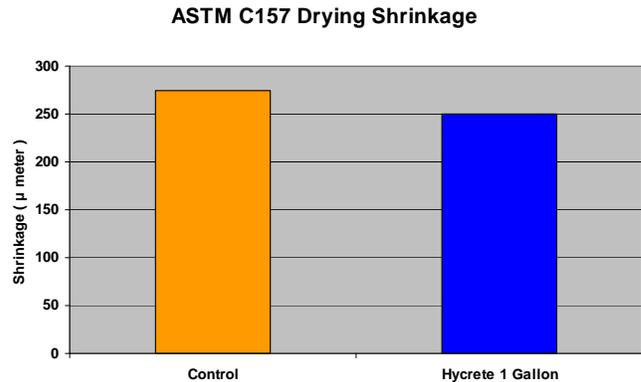
**Independent Lab Testing**



**Drying shrinkage ASTM C157:**

Shrinkage of concrete is dependent upon numerous factors. Hycrete Admixtures, in limited testing, has generally been shrink neutral.

Nelson Testing  
Labs, Chicago, IL:  
40/60 Structural Mix  
.40 W/C 565 lbs.  
Cementitious  
24% Type F Flyash  
Water Reducer



## Shotcrete Performance

**Rebound:** Excellent  
**Odor:** Neutral  
**Consolidation:** Excellent  
**Stand up:** Excellent  
**Set Time:** Neutral  
**Absorption:** Superior

Northern California  
Independent Lab Testing:  
70/30 Shotcrete Mix  
780 lbs Cementitious - 25% Slag  
.38 W/C Water Reducer and  
Polycarboxylate Superplasticizer



## Hycrete Concrete Testing Summary

For more information or any questions, please contact your Hycrete representative.

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