Curing and Sealing

September 10, 2019
National Concrete Consortium
Kalispell, Montana
BILL JOHN TK PRODUCTS

CURING OR SEALING

- What's the difference?
- Why should we do either? What's the big deal?
- How do we cure or seal?
- What are the best ways?

CURING

(ACI-308-81)

AMERICAN CONCRETE INSTITUTE

- Curing is the maintaining of a satisfactory moisture content and temperature in concrete during its early stages so that desired properties may develop

Curing Concrete

"Holding Water in the Concrete"

Will:

- Increase concrete strength
- Increase concrete abrasion resistance
- Lessen the chance of concrete scaling
- Lessen the chance of surface dusting
- Lessen the chance of concrete cracking

Good curing is the final step in giving your customer the quality concrete job you intended

AET PROJECT NO: 20-21650 **DATE:** AUGUST 19, 2019

INTRODUCTION

This report presents the results of laboratory work performed by our firm on one concrete core sample submitted by David Wirth of American Engineering Testing, Inc. (AET) on behalf of John Schaffler of Aggregate Industries, Inc. on July 18, 2019. We understand the concrete core was procured from a residential driveway located at 9209 Loch Lomond Boulevard in Brooklyn Park, Minnesota by a representative of AET. The concrete was reportedly placed on October 3, 2018. The scope of our work was limited to performing petrographic analysis on the sample to document the general overall condition of the concrete and to determine cause(s) of surface deterioration.

CONCLUSIONS

Based on our observations and testing, we believe:

1. Scaling of the concrete was due to cyclic freeze-thaw action on a saturated, poorly durable surface paste produced by inadequate curing. At least 50% of the top surface was shallowly scaled away to 2 mm (1/16") depth. Carbonation depth proceeded to 7 mm (1/4") from the intact, broom-finished, top surface; much deeper than would be expected for concrete of this age and is evidence of the lack of curing. Carbonation in well-cured concrete, of moderate water to cementitious materials ratio (w/cm), typically progresses at a rate of approximately 1 mm (1/32") per year. Scaling has occurred within the carbonated paste and we expect scaling to continue within this weaker paste if exposed to cycles of freezing and thawing when saturated.

2. The concrete was air entrained and contained a fairly well distributed air void system that was consistent with current American Concrete Institute (ACI) recommendations for freeze-thaw resistance. The core contained numerous, fine, spherical, air voids and exhibited 10.5% total air content, a specific value of 1270 in^2/in^3, and a spacing factor of 0.001". A reduced amount of spherical, entrained-sized, air voids was observed within the top 3 mm (1/8") of the core, indicating over manipulation of the top surface of the concrete during finishing. The reduction of air voids at the top surface further lessened the freeze-thaw resistance in the top 3 mm (1/8") of the concrete sample.

METHODS OF CURING
Best to worst

- Water
- Membranes
- Sheet Goods
- Hay, Straw, Insulated Blankets
- Damp soil
- Air/Sun Shine


HomeWrap
HomeWrap
HomeWrap
HomeWrap

ASTM C-171 Poly curing

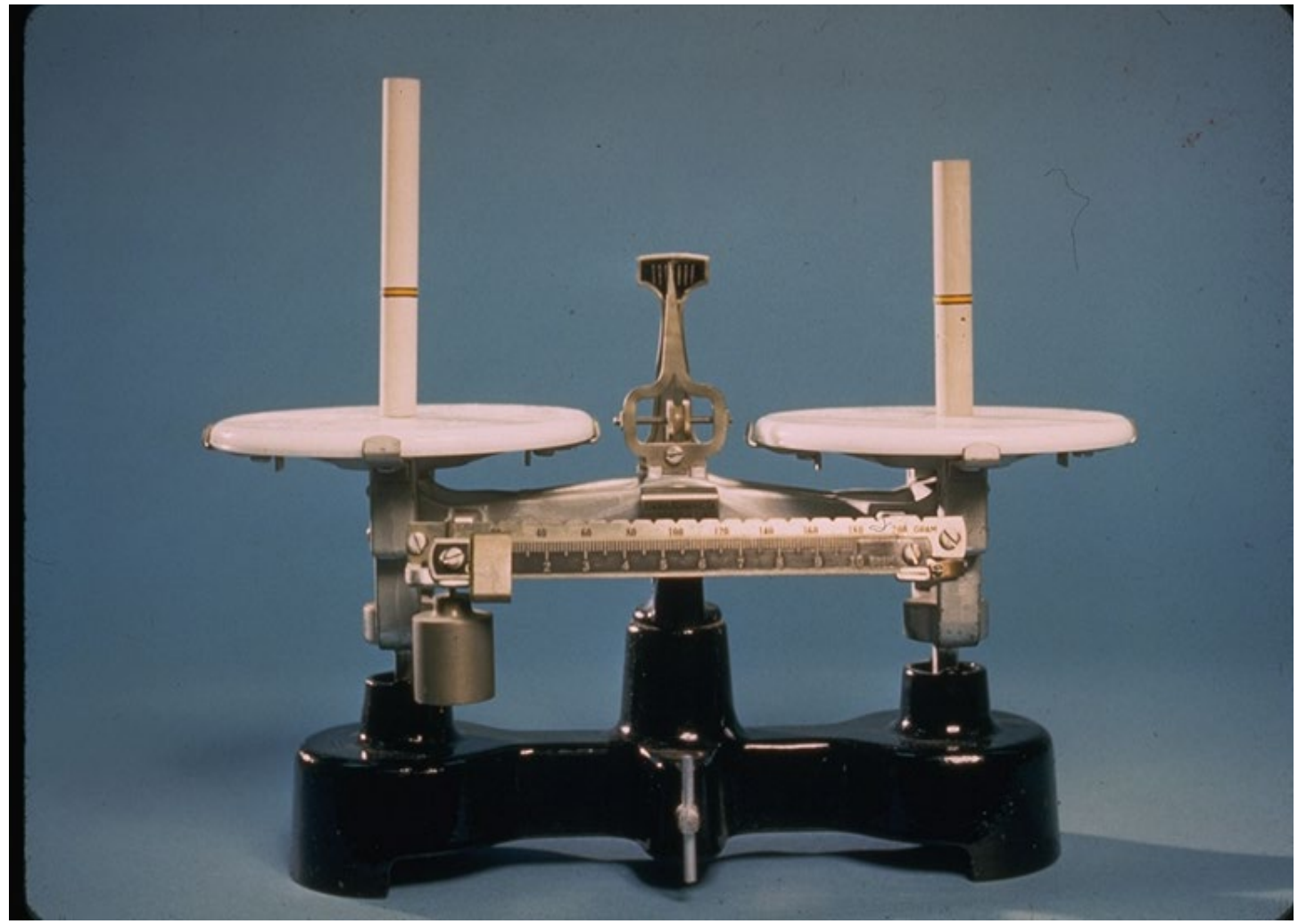
Hydration of Cement

Portland Cement Association

- The hydration of portland cement is the chemical reaction between grains of cement and water to form the hydration product, cement gel; and cement gel can be laid down only in water-filled space.

Cement hydration

Water/Cement Ratio



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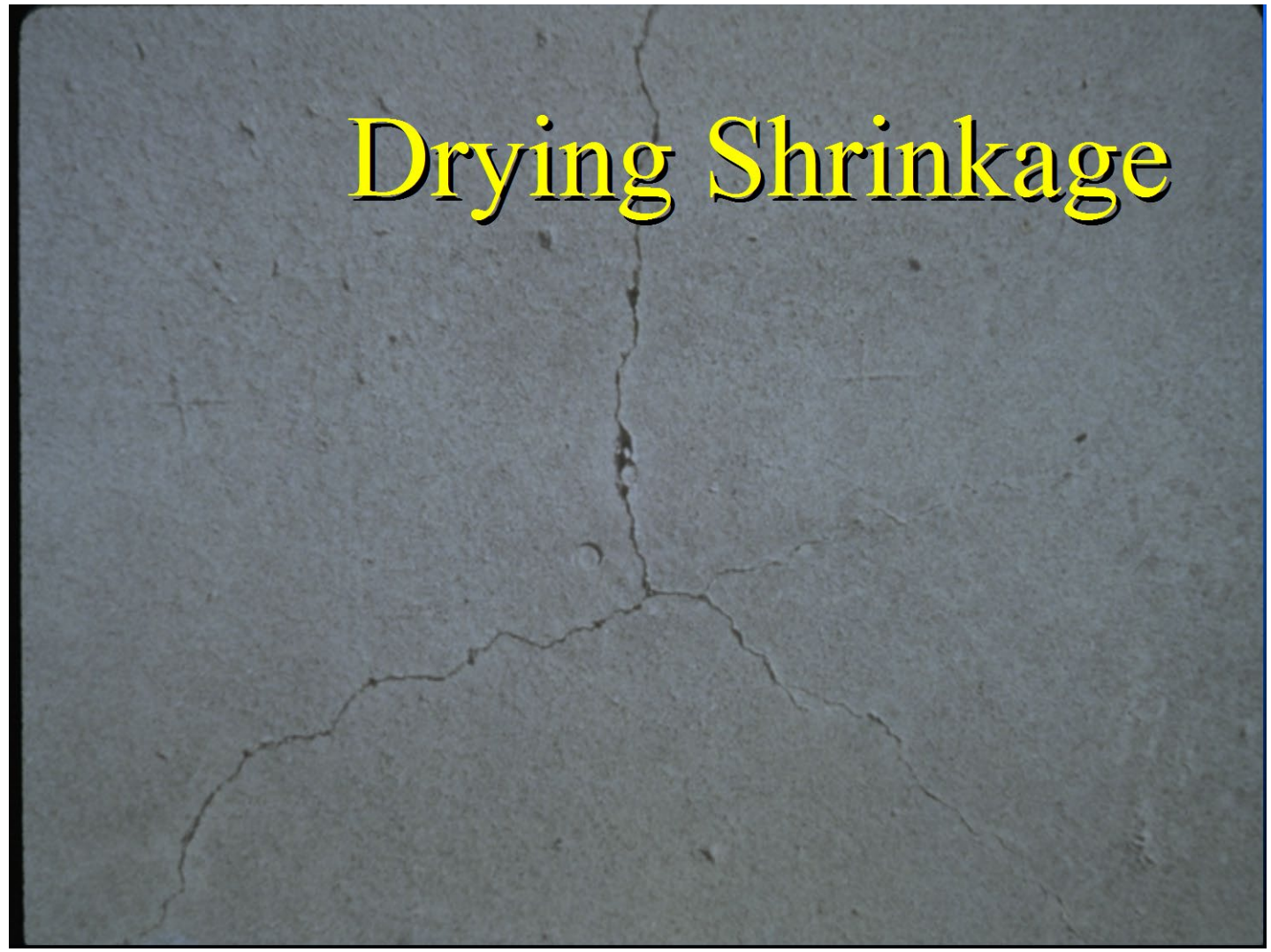
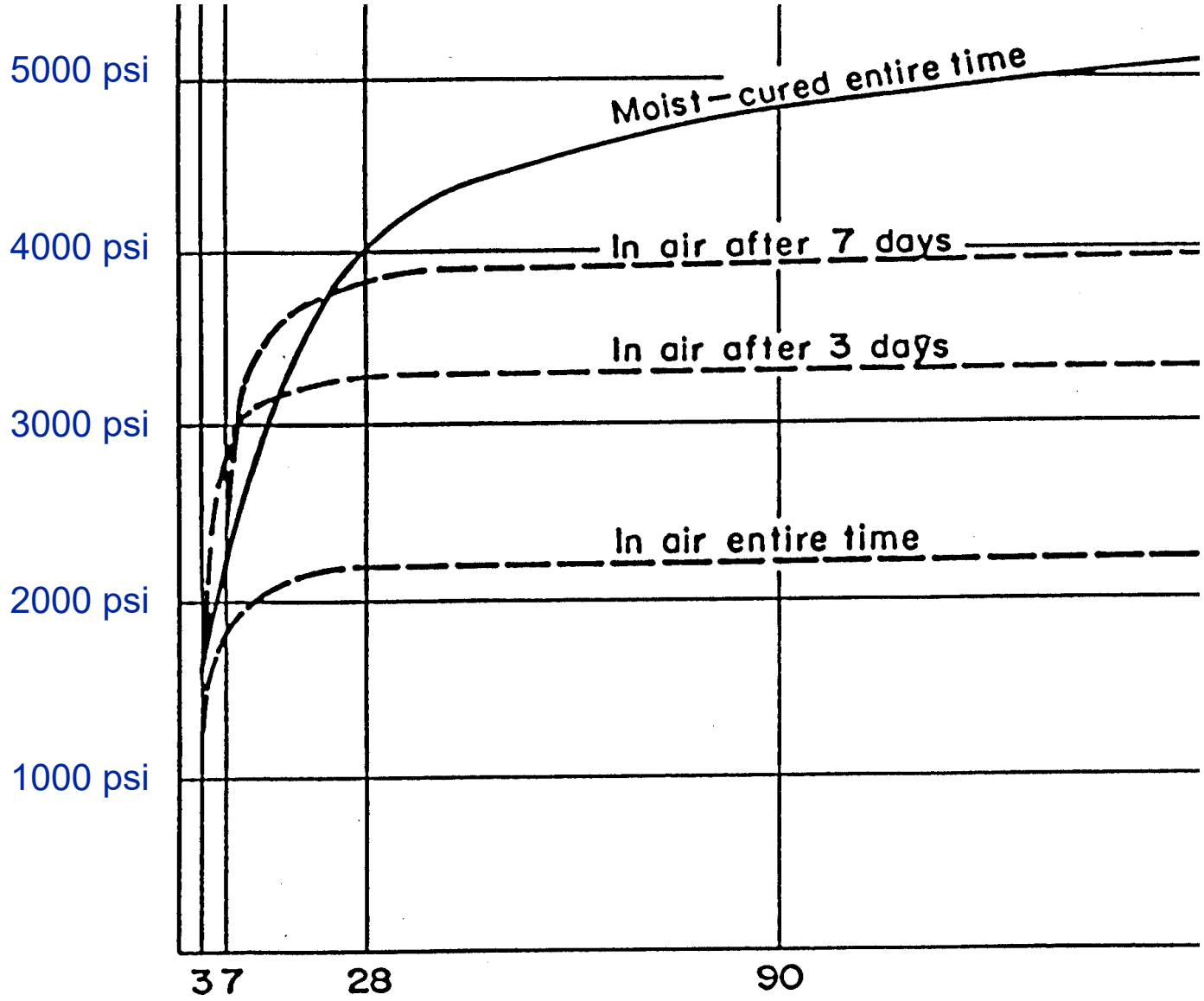

Drying Shrinkage

Scaling

Crazing

- **Concrete strength with moisture present for curing**
- according to the Portland Cement Association



Strength gain at different temperatures

according to Portland Cement Assoc.

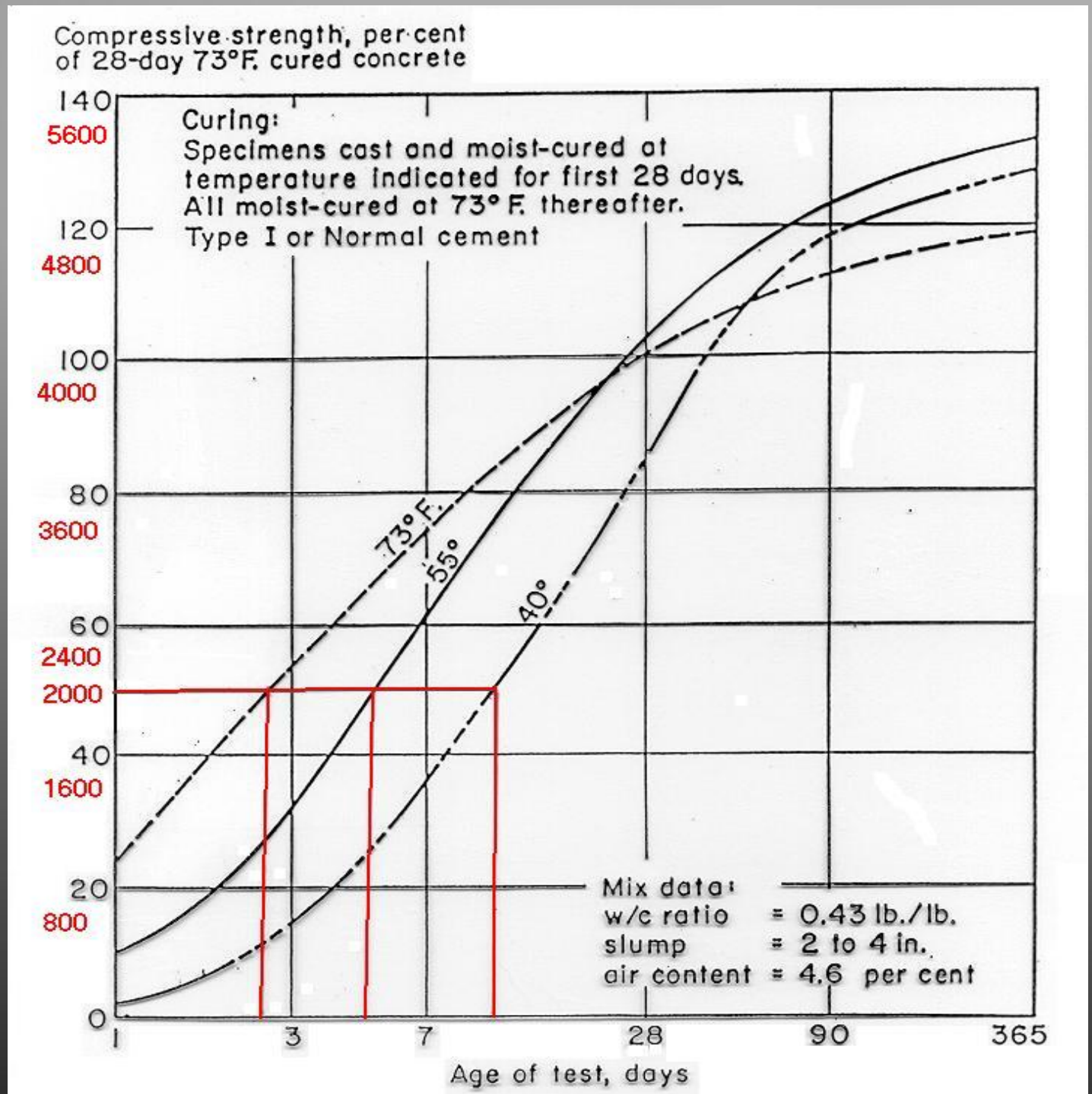


Fig. 64. Effect of low temperatures on concrete compressive strength at various ages.

ASTM STANDARDS for Curing Materials

AMERICAN SOCIETY FOR TESTING AND MATERIALS

C-171 SHEET MATERIALS FOR CURING CONCRETE

C-309 SPECIFICATION

-Must be membrane forming

-No solids requirement

-Water retention at 200 square feet per gallon

-Loss of water not more than 0.55kg/m^2 of surface in 72 hours

C-1315 SPECIFICATION

-Must be membrane forming

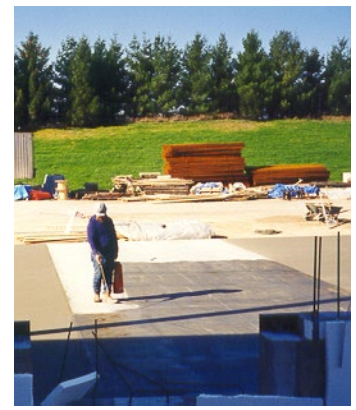
-25% solids requirement

-Water retention at 300 square feet per gallon

-Loss of water not more than 0.40kg/m^2 of surface in 72 hours

Curing, and Curing and Sealing Compounds

All Products Meet Federal EPA's VOC Requirements



Solvent based - ASTM C-1315

Styrene Acrylic resin

Methacrylate Acrylic resin

Chlorinated rubber resin

Water based - ASTM C-309

Acrylic resin

Poly Alpha-methylstyrene

Dissipating resin (Hydrocarbon Resin)

Wax

Picture of floor after cure & seal applied

Floor partially cured out

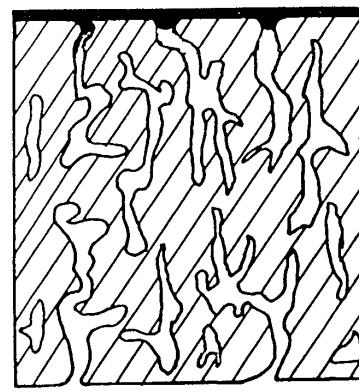
Floor totally cured out

Rese
al

Reseal your concrete before winter

to protect it from deicing salts that drip off your car. The Curing and Sealing Compound used by your contractor when applied to newly poured concrete forms a film on the surface to hold the hydration water in for proper curing. When you drive on this film it gets perforated and allows deicing chemicals to enter the concrete. Resealing when the concrete is cured out and dry will allow the cure & seal to penetrate the concrete and seal it from within.

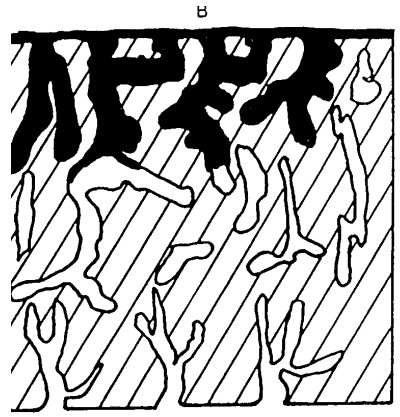
Side view of concrete with Curing and Sealing Compound applied as soon as the concrete is finished.



Coat of curing and sealing compound

Water in the pours and capillaries

You need to recoat the concrete with a Curing and Sealing Compound after the concrete is cured out (It usually takes at least 28 days or more). At this time the concrete is dry so the cure & seal can penetrate into the pours.



Resealing will melt the cure & seal applied by the contractor and allow it to penetrate into pores and capillaries that are open and dry.

It is important that the concrete has been washed before sealer is applied, so no dust or dirt is on the surface and that it is dry for proper penetration.

It is recommended to reseal every 3 years after the initial sealing.

ually concrete scaling comes from water getting into the capillaries and freezing. By reseal[illegible]can get sealer into the capillaries, so water can not get in.

SUPERIOR SNOW AND ICE MELT

SWI

Scotwood Industries, Inc.

MIRACLE MELT™

A CALCIUM CHLORIDE &
MAGNESIUM CHLORIDE BLEND

MELTING POWER -15°F

MELTS SNOW & ICE AT -15°F

SUPERIOR MELTING POWER

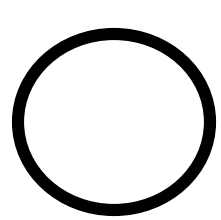
NET WT. 50 lb (22.68 kg)

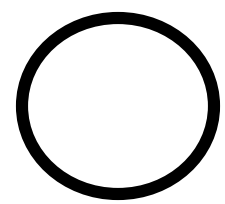
Aggregate Pop

SEALING OPTIONS

- Solvent Base Cure and Seal
- Water Base Cure and Seal
- Linseed Oil
- Silane or Siloxane (Water Repellents)
- Silicates, Siliconates and Fluorides (Hardeners and Densifiers)
- Epoxy
- Urethane
- Polyaspartic

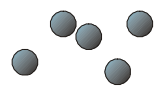
Resin

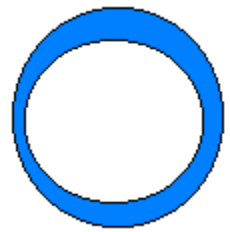




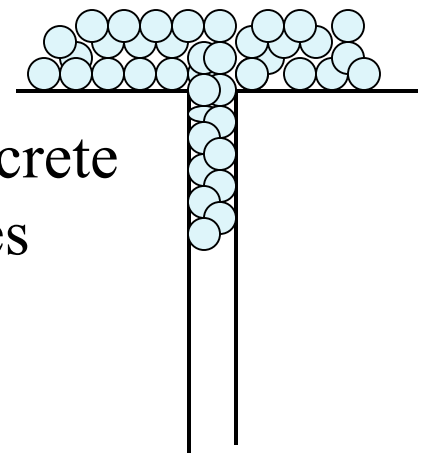
Resin

Resin
Dissolved

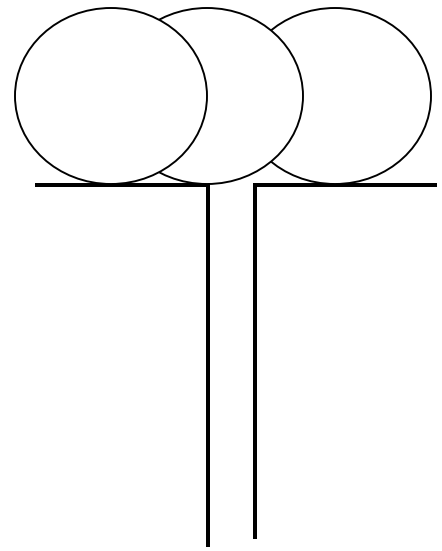




Resin soften
on the exterior
by co-solvent



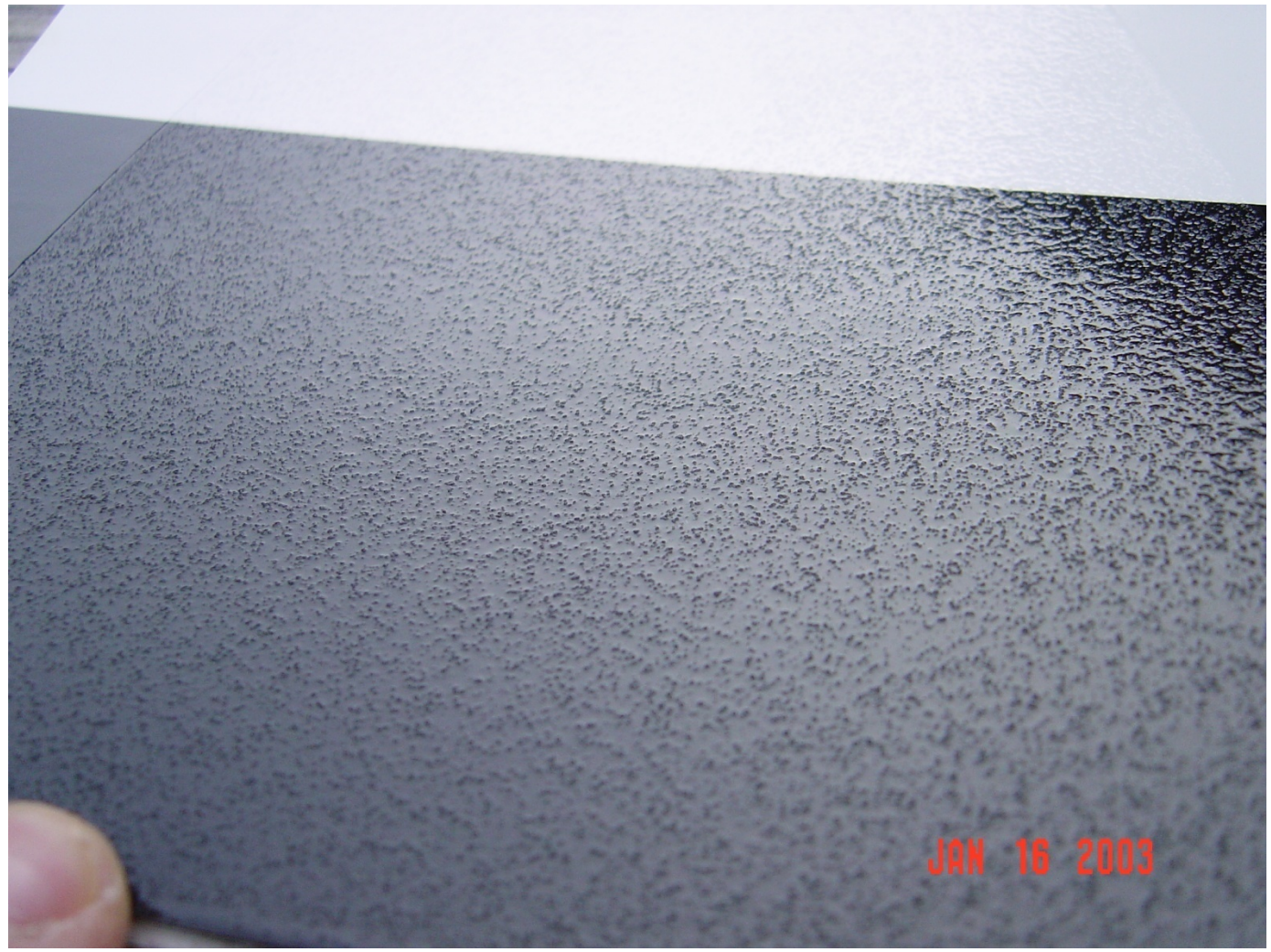
Concrete
Pores



Solvent Based Cure & Seal

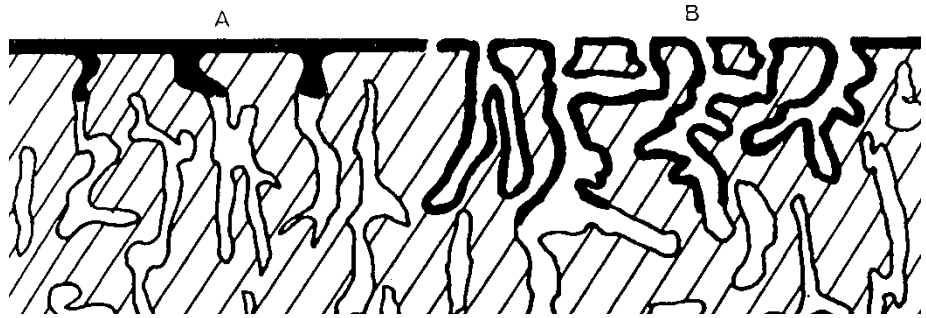
Solvent Based Cure & Seal with a matt finish

Solvent Based Cure & Seal with a non-slip aggregate added

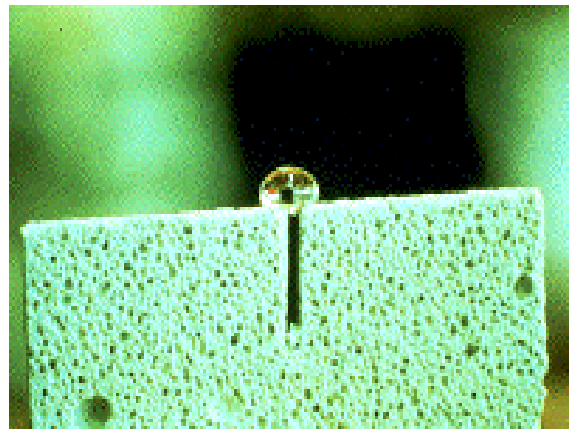


Water Repellents

Membrane Sealer Silanes and Siloxanes



Silanes and Siloxanes seal by lining the pores and capillaries and making them hydrophobic.



- breathable
- non-darkening and non-glossy unlike membrane sealers
- can be over coated by a membrane coating for double protection

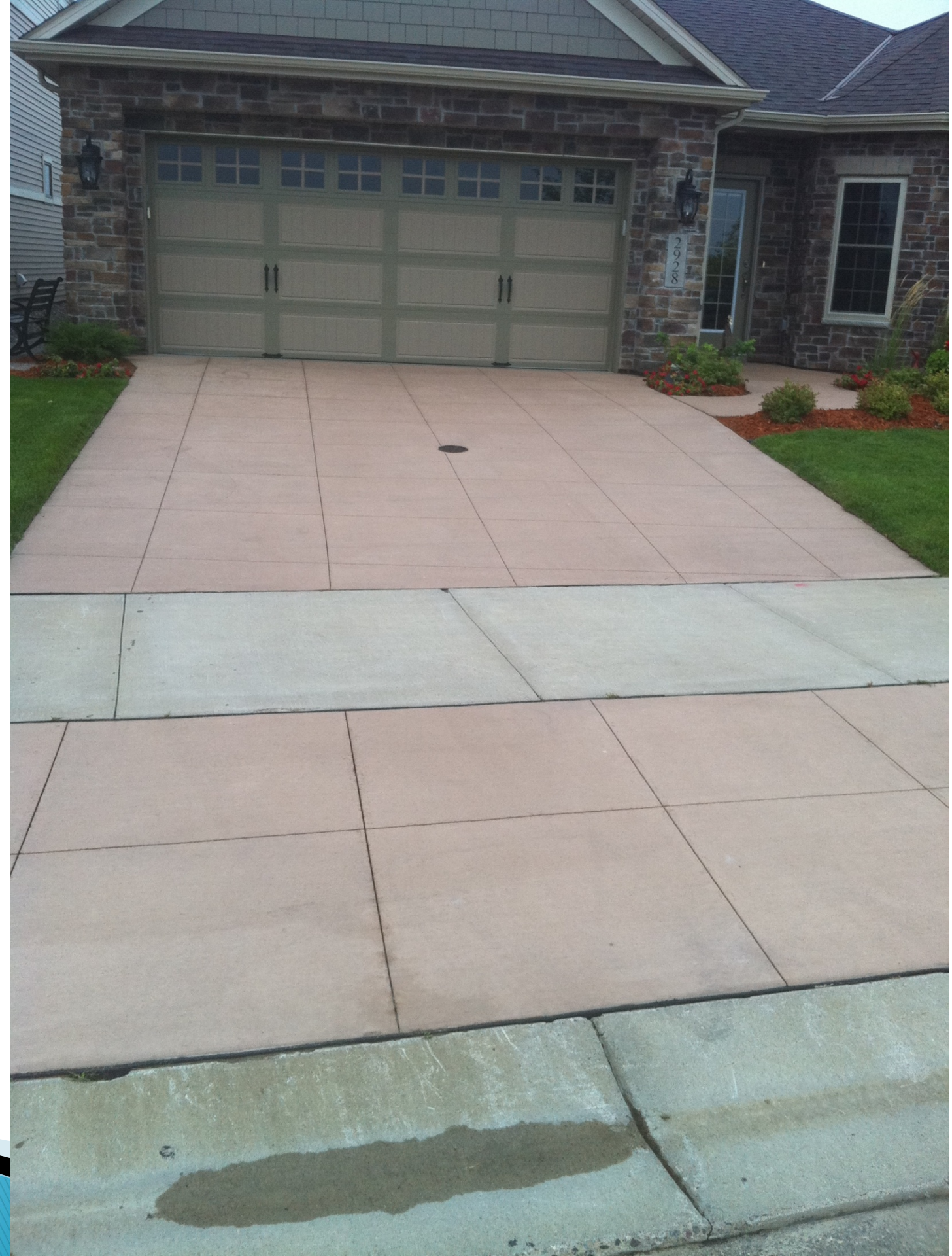
Siloxane

Responses of the Laboratory Phase

Factorial Points	Curing	Sealer	Deicer Exposure	Scaling Rating
1	4 weeks	8% siloxane	$CaCl_2$	0
2	4 weeks	40 % silane	$CaCl_2$	0
3	4 weeks	None	None	1
4	4 weeks	None	$CaCl_2$	3.5
5	2 weeks	8% siloxane	$CaCl_2$	2
6	2 weeks	40 % silane	$CaCl_2$	3
7	2 weeks	None	$CaCl_2$	4.5
8	2 weeks	None	None	1
9	3 weeks	8% siloxane	$CaCl_2$	1.5
10	3 weeks	40 % silane	$CaCl_2$	2

0-5 Rating

Siloxane Penetration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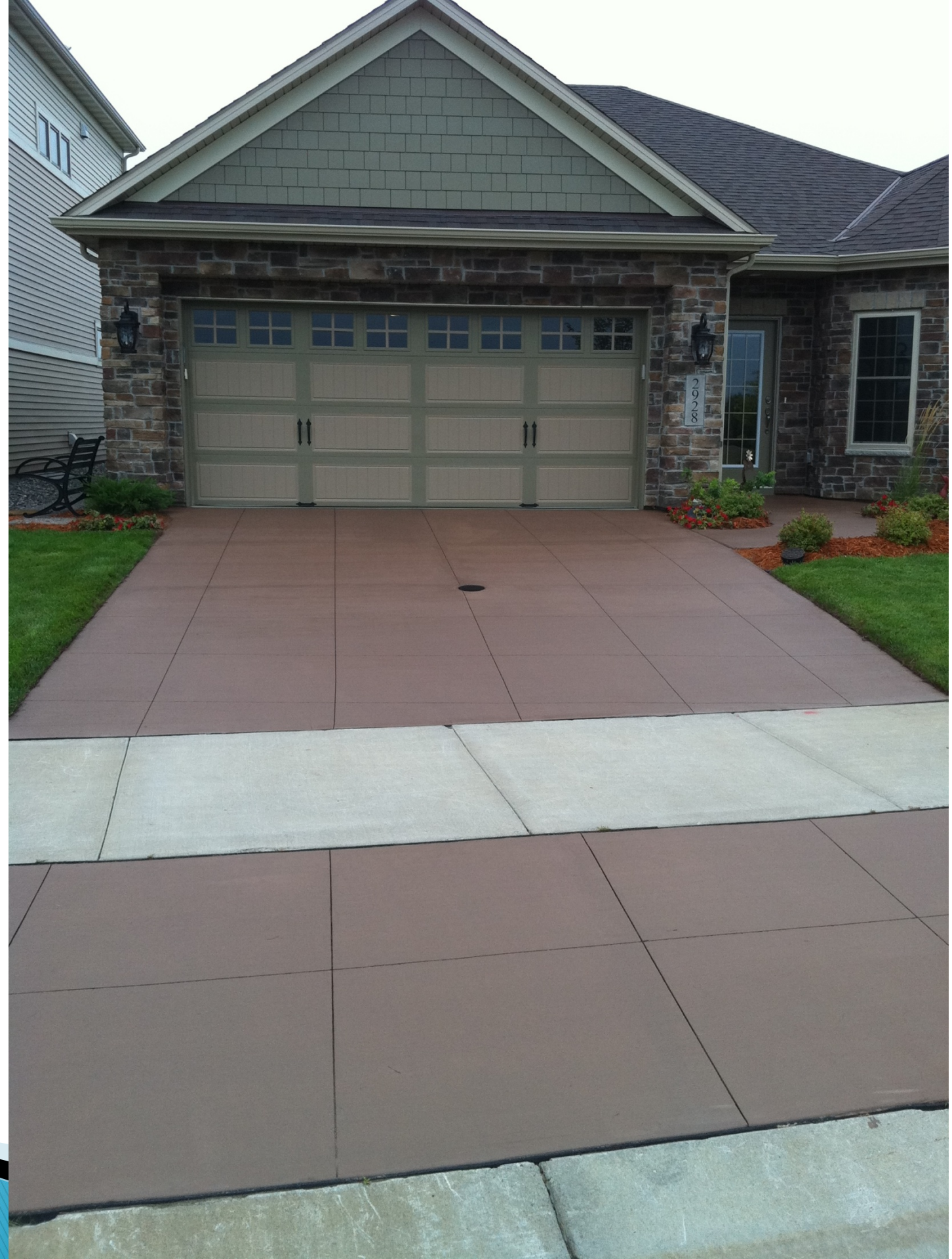
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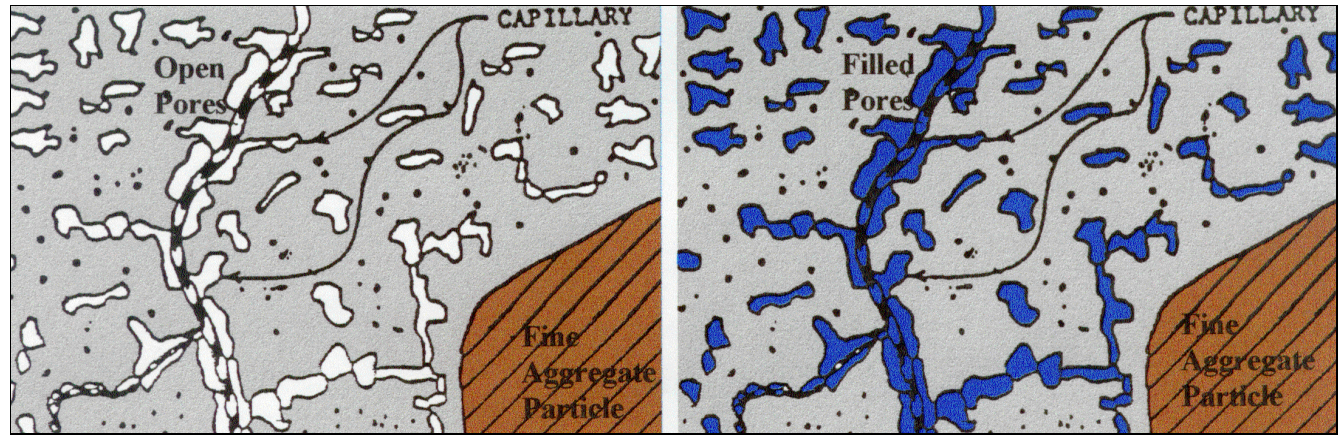
Chemical Hardeners

- Magnesium Fluoride Concrete Hardener
- Silicate Hardener and Densifier

Microscopic view of concrete before and after treatment with Silicate

Concrete fully cured has open capillaries and pores.

Silicate fills these capillaries and pores to make the concrete less imperious to water, and many chemicals.



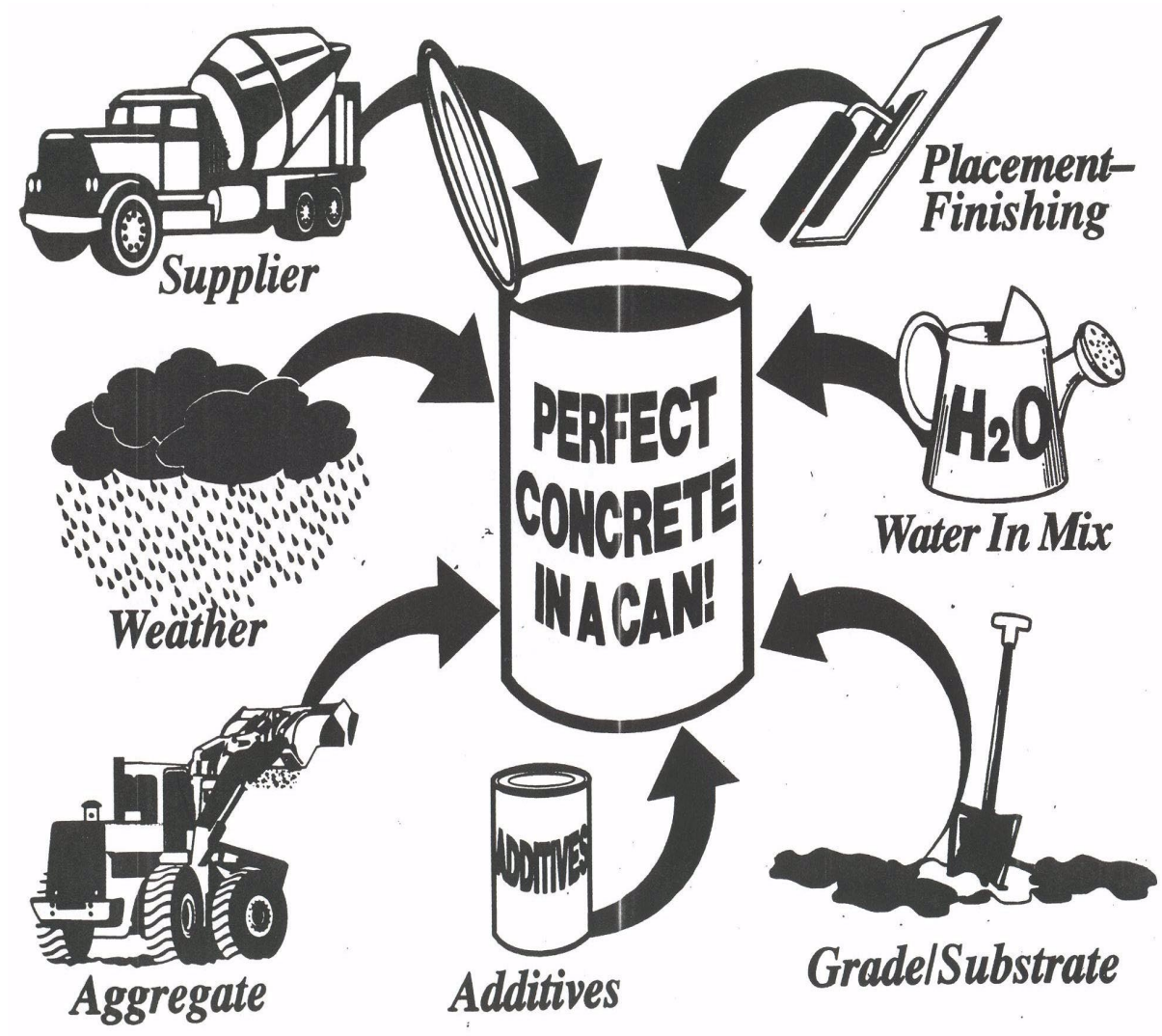
Floor sealed with Silicate Hardener and Densifier

Under Hot/ Dry/ Windy/ Low Humidity Conditions

- Use **Evaporation Retardant**
- Slows water evaporation by 80%.
- Works by putting a molecular film around the water molecule to keep it from evaporating.
- Fresh concrete has a total of 6.33 oz. of water/sq.ft. in the top 1/2 inch of 4” slump concrete.

Mortar Flaking

Mortar Flaking


Supplier
Placement–
Finishing
PERFECT
CONCRETE
IN A CAN!
H2O
Water In Mix
Weather
ADDITIVES
Aggregate
Additives
Grade/Substrate

QUESTIONS ?

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