

PACA's Initiative to Reduce Scaling and Durability Issues through Revised Specifications, Education and Certification

NESMEA - 2025
Harrisburg, PA.

Northeast PA. Spring 2017





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Reducing Scaling of Concrete Surfaces

A STIC Initiative

State Transportation Innovation Council
Construction and Materials TAG

1. Finisher certification:

ACI Flat Work Finisher or

NRMCA exterior concrete finisher

2. A Training Module for Construction Insp.

Almost exclusively on: Hand finished exterior concrete



Scaling - usually occurs after the 1st winter
There are other issues in warmer parts of the country



SCALING

A GREAT QUOTE:

This is NOT a finisher problem

This is NOT a producer problem

This is NOT a specifier problem

This IS an Industry Problem







ASR / Durability / Strength

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POZZOLANS (SCM'S)

We all know that Concrete with an average amount of pozzolans ALWAYS has the potential to be stronger, more durable, with less work to finish

- *They help reduce bleed water (a bit)**
 - *They push back and extend the window of finishability**
 - *They more likely to have the top dry out and have improper finishing**
 - *Needs to be finished correctly!**
 - *Use surface evaporation retarder!**
- MUST BE CURED-----**

Type 1L (PLC)

Variable set times; 1 hour faster to 2 hours slower

Some reduction in bleed water

Potential for plastic shrinkage cracking

Top surface crusting (craze cracking to follow)

Difficulty in timing the finish

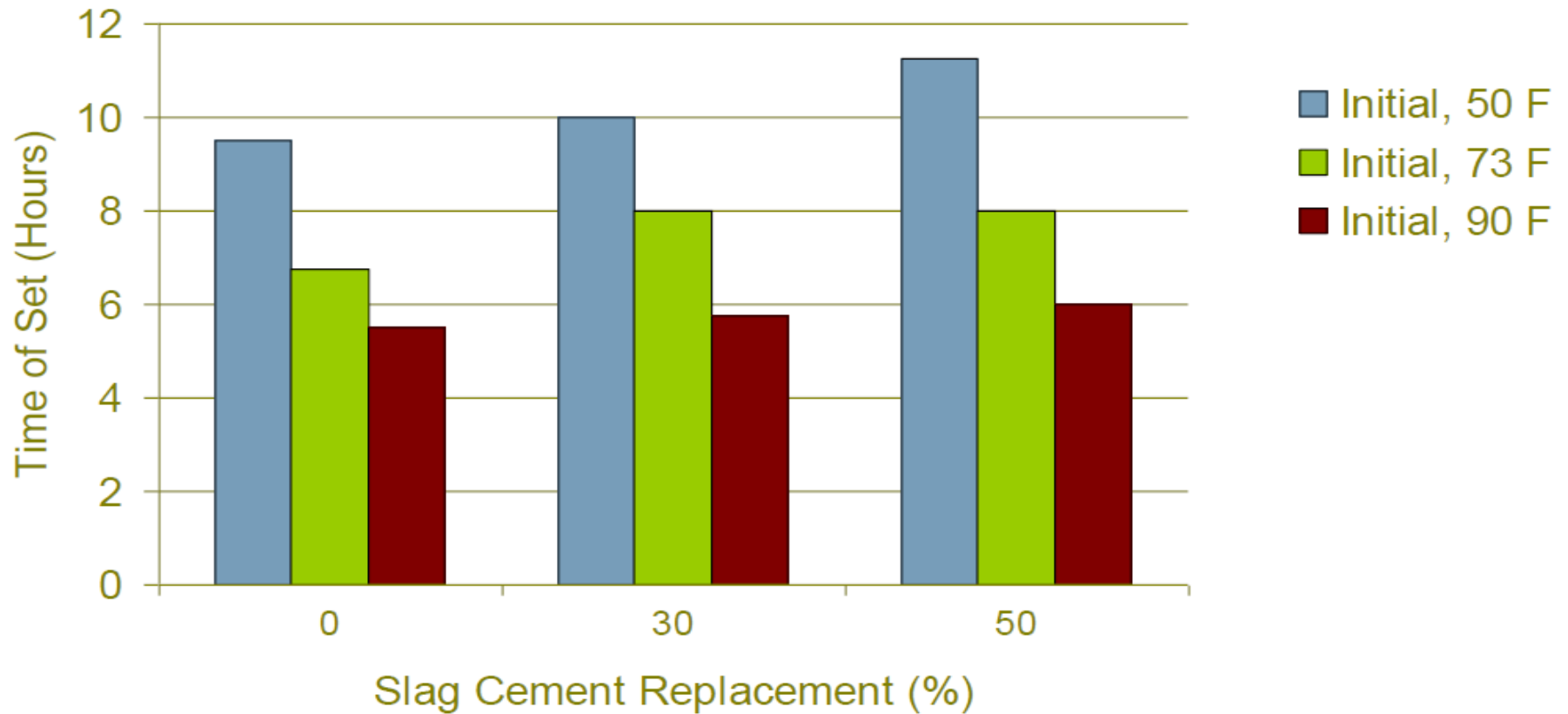
Slight reduction in PSI (early ages)

Always recommend a mock-up – trial slab

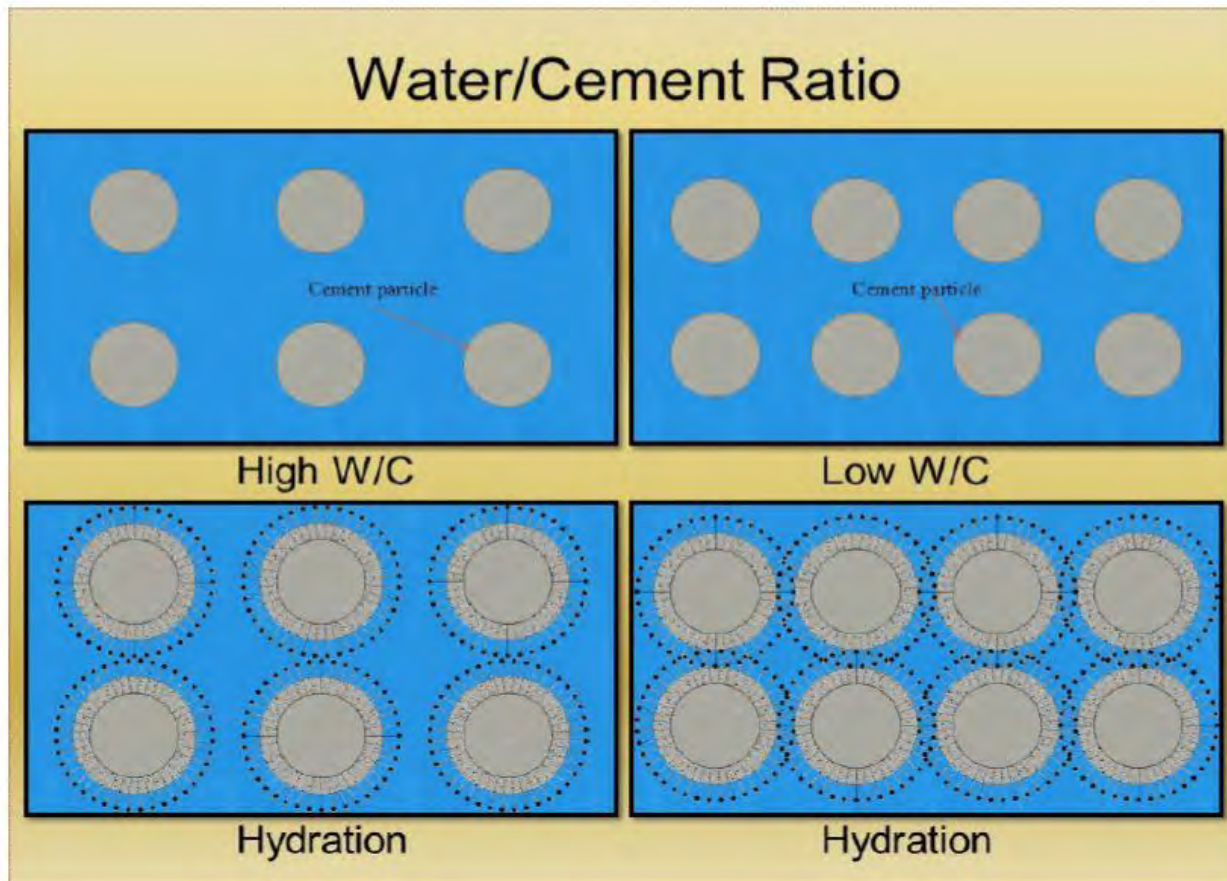
Especially for larger square footage

Not always in the bid

Time of Set Characteristics



As water is added we move the cement particles apart



Ok – How not to get a durable surface!



How we handle snow/ice currently

DE-ICING Chemicals

- Increases cycles of Freeze/Thaw
- Keeps concrete saturated with water
- Can chemically react with concrete causing it to deteriorate
- Use of Magnesium Chloride (Brine)



**Safe for Pets??.....definitely not for your concrete!
NO SUCH THING AS SAFE SALT!**





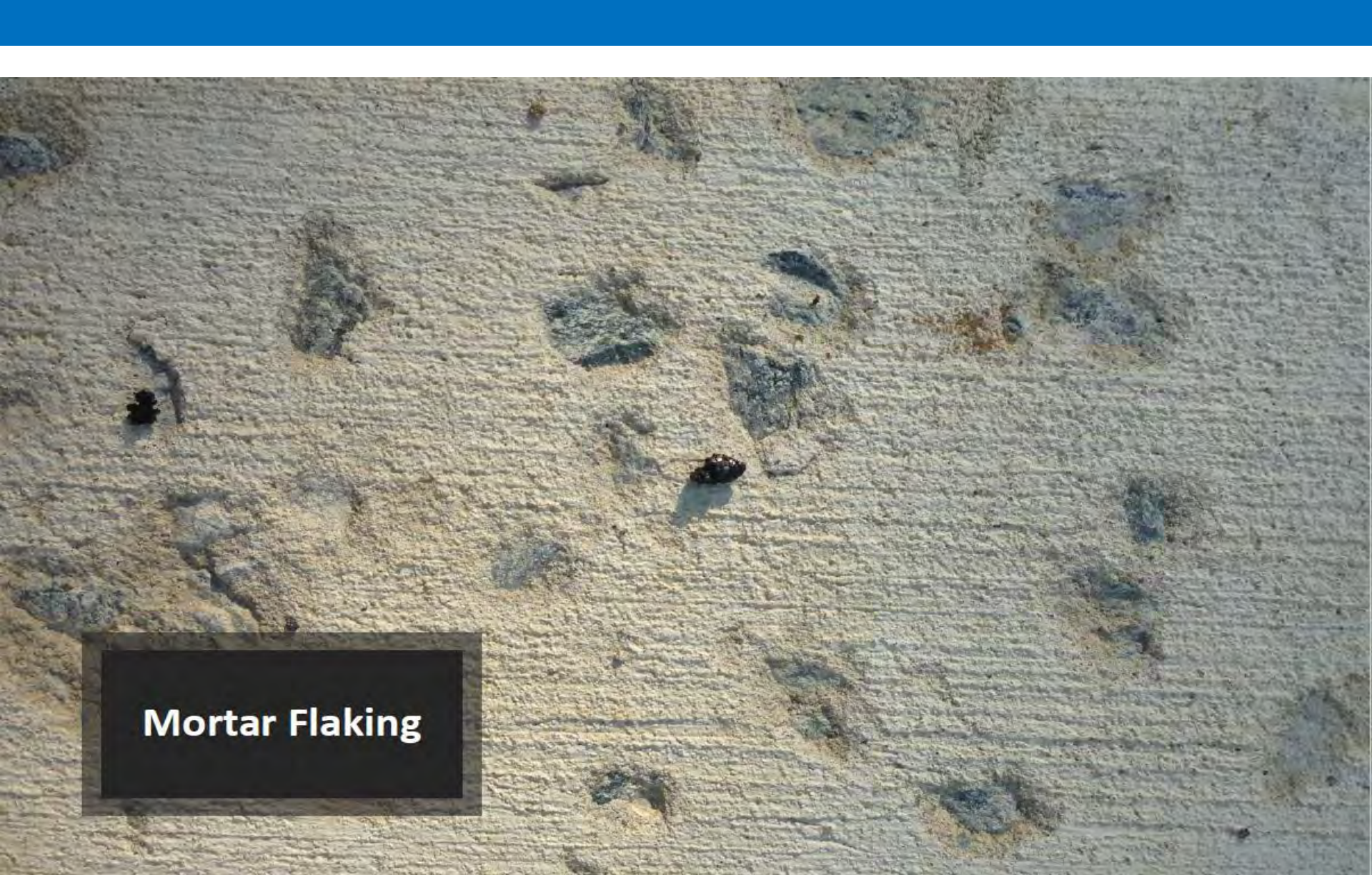
Types of Surface Deterioration

There are different types of surface deterioration that are referred to as scaling. It is important to be able to identify what type of deterioration is occurring to figure out what caused the problem.



The image shows a close-up of a concrete surface with several 'pop outs' or aggregate fragments. Two pens are placed next to the fragments for scale: a blue pen is positioned horizontally above a large, irregularly shaped aggregate fragment, and a silver pen is positioned vertically to the left of another large fragment. The aggregate fragments are light-colored, possibly white or light grey, and appear to be embedded in a darker, greyish concrete matrix. The background is a textured, grey concrete surface.

Pop Outs



Mortar Flaking



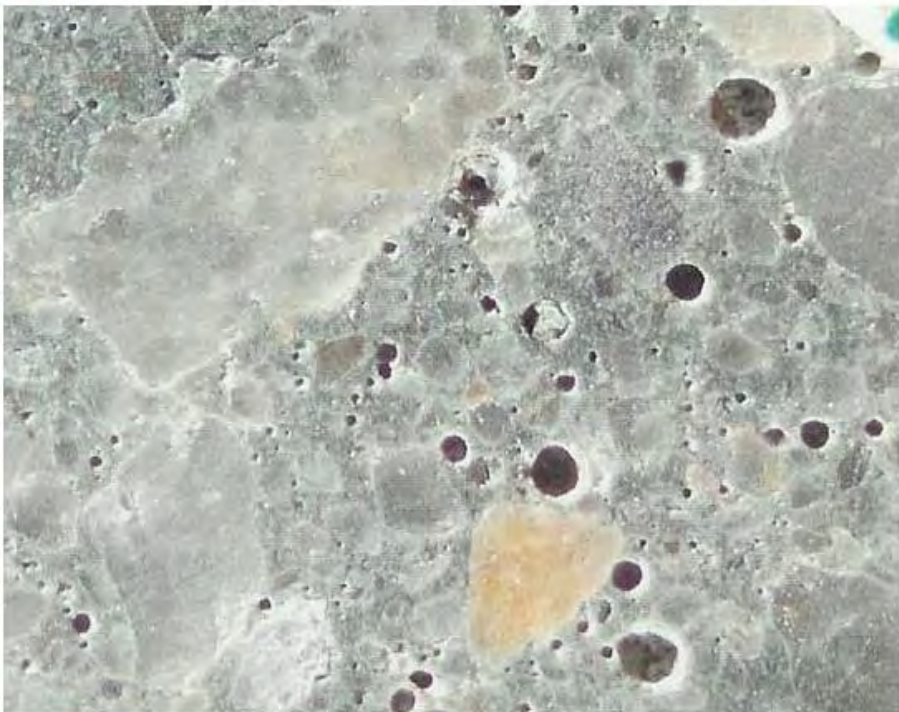
Caused by:

- De-icing chemicals / freeze thaw action
- Poor mixture design
- Lack of air in the concrete
- Poor finishing
- Poor curing

Ordering Concrete

Concrete Property	Requirement
Minimum Strength	4000 psi
Coarse Aggregate Size	No. 57
Max Water/Cementitious Ratio	0.45
Air Content	5-8%
Max Slump (Normal Water Reducer)	5-6 inches
Max Slump (HRWR)	8 inches
Concrete Temperature	50-95 °F
Slag Cement	25-50%*
Fly Ash	15-25%*

*Slag cement and fly ash used as a % by weight of total cementitious. Always use lower end of range in cold weather (or straight cement) unless otherwise required by specification.





Cold Weather Mixtures

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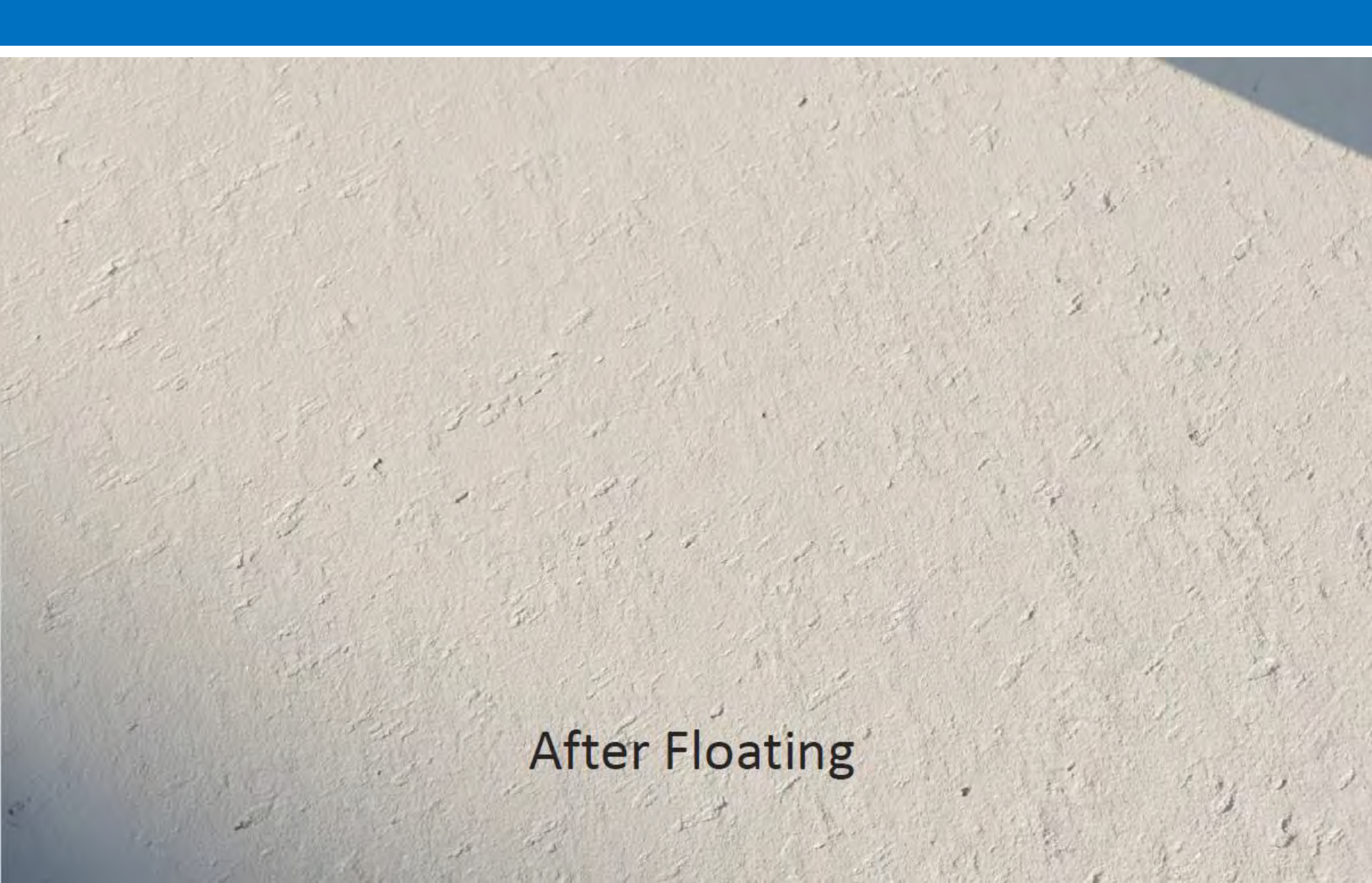


vs. COOL WEATHER Mixtures

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After Floating

So what do we do or don't do?

Failure of the surface to gain adequate strength due to:

- *Surface drying out (Hydration stops)*

While we are finishing – *Surface Evaporation Retarder*

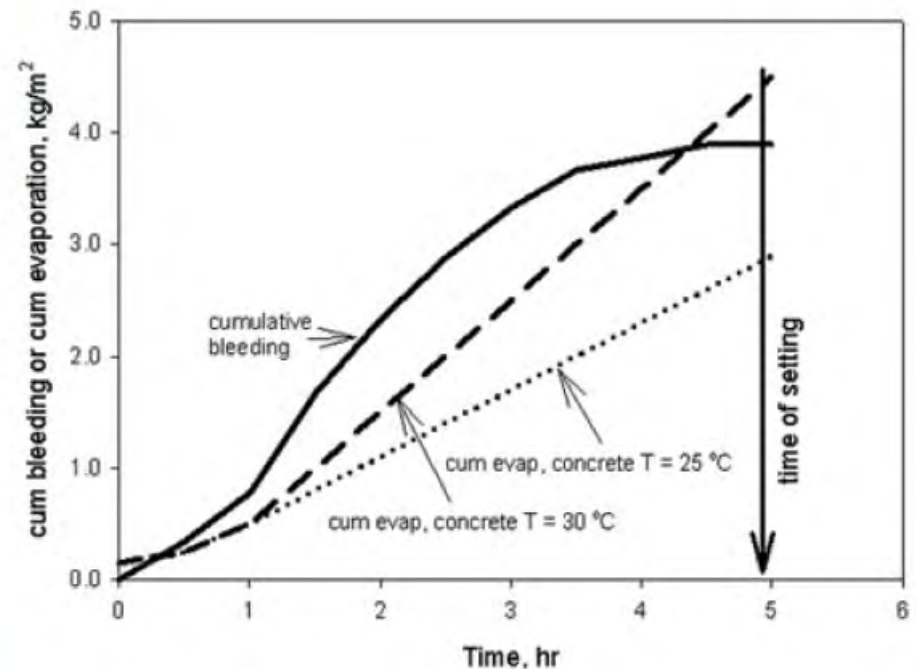


Surface Evaporation Retarder

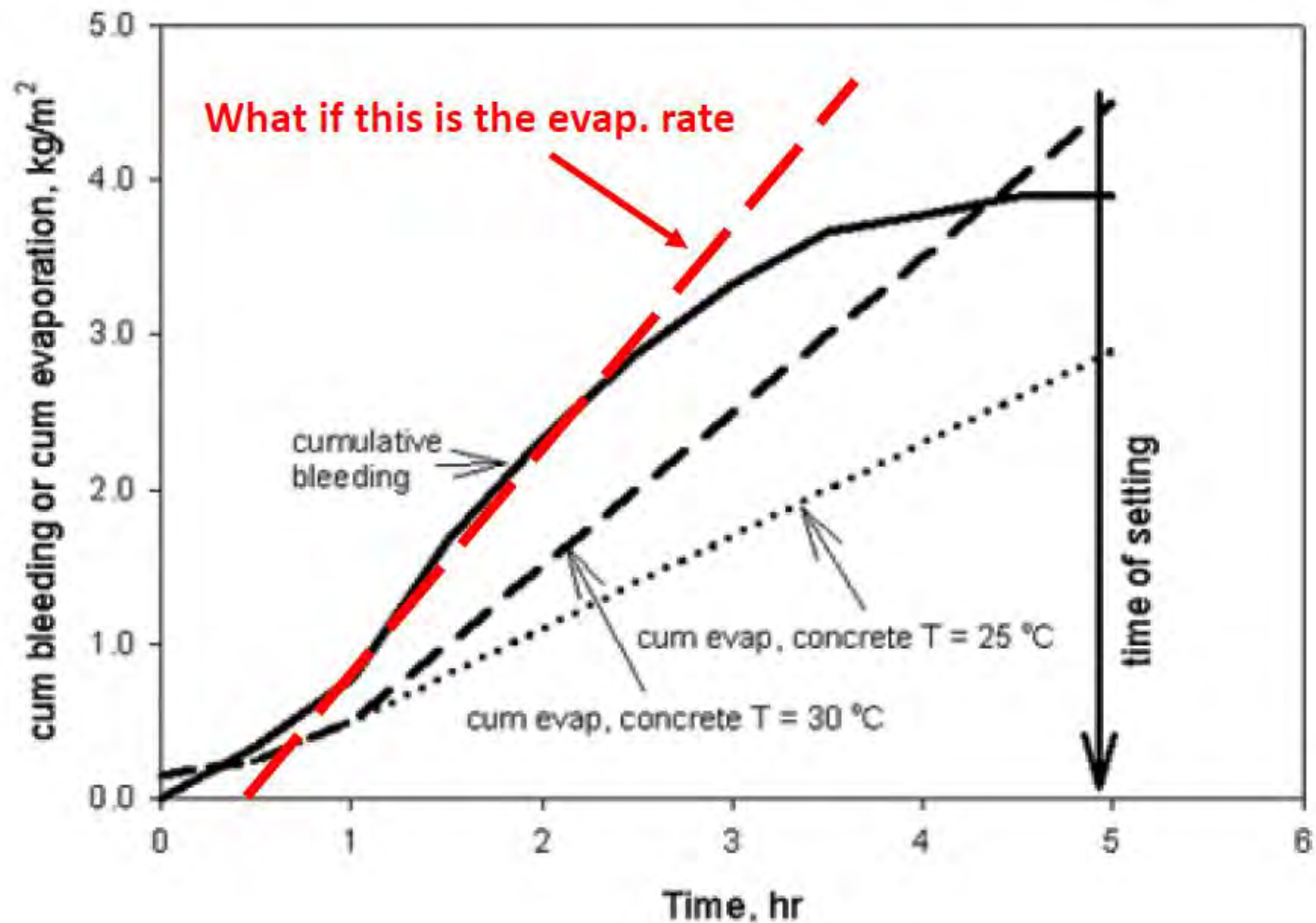




Bleed water – Seen or Unseen



Unseen Bleed Water





Rest

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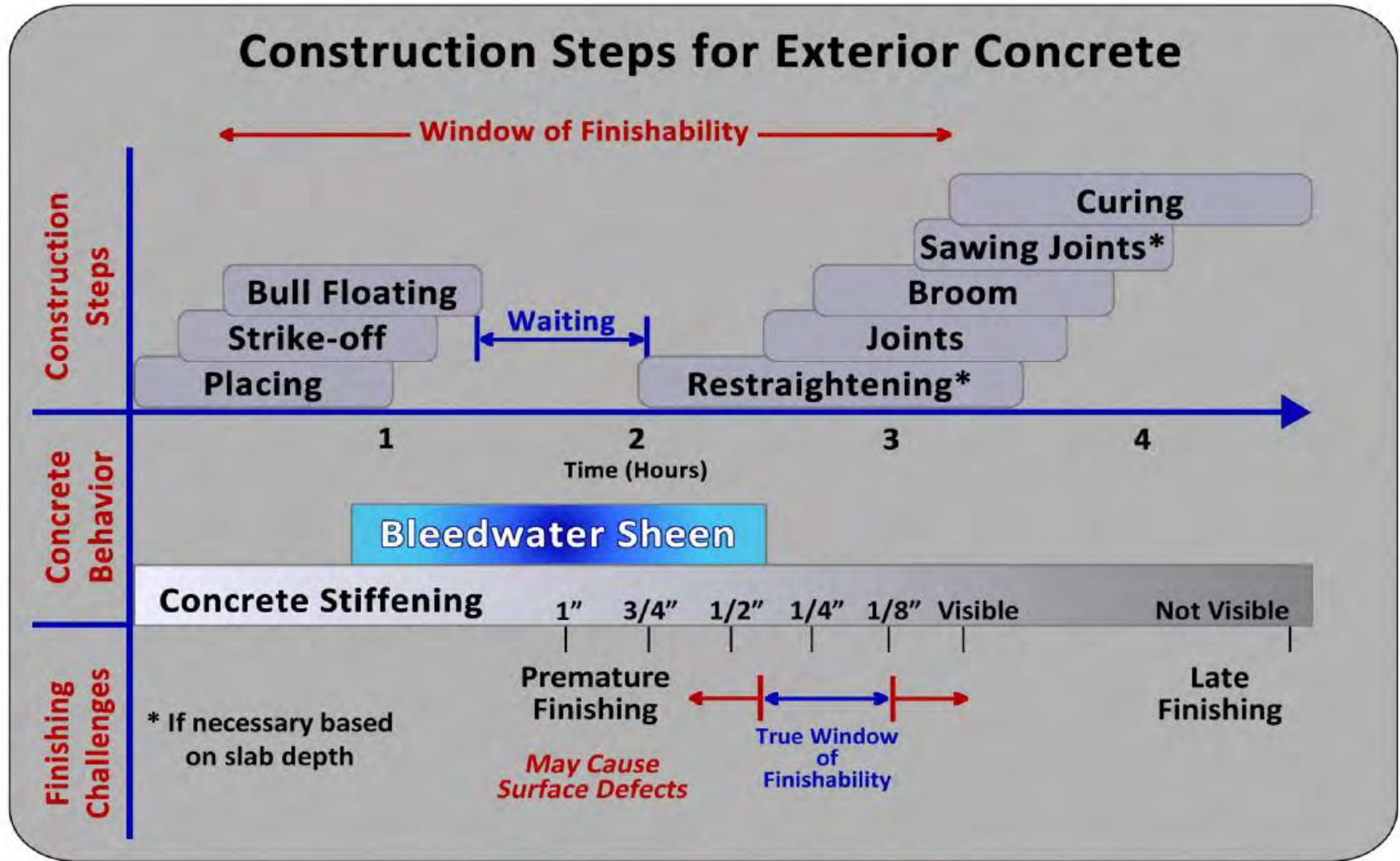
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Thursday Nov 5, 2020

Temp Dew Pt Rel Humidity

8:54 AM	50 F	50 F	100 %	CALM	0 mph	0 mph	Fog
9:06 AM		51 F	100 %	CALM	0 mph	0 mph	Fog
9:17 AM	52 F	51 F	97 %	S	3 mph	0 mph	Mostly Cloudy
9:37 AM	52 F	51 F	97 %	S	5 mph	0 mph	Mostly Cloudy
9:44 AM	53 F	52 F	96 %	S	5 mph	0 mph	Mostly Cloudy
9:54 AM	54 F	51 F	90 %	SW	5 mph	0 mph	Mostly Cloudy
10:54 AM	63 F	48 F	58 %	SW	10 mph	0 mph	Partly Cloudy
11:54 AM	65 F	46 F	50 %	WSW	8 mph	0 mph	Partly Cloudy
12:54 PM	68 F	43 F	40 %	SW	14 mph	0 mph	Partly Cloudy
1:54 PM	68 F	43 F	40 %	SW	13 mph	0 mph	Partly Cloudy

Window of Finishability





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Definitely AVOID over-working/finishing the surface on stamped concrete, again it will drive the air out, thus causing scaling



Finishing Bleed Water into the Surface of the
Concrete Will Cause the Concrete to Scale

Less is more!

- “The best defense against scaling of air-entrained exterior concrete slabs is minimal finishing”

ACI Craftsman Workbook CP10



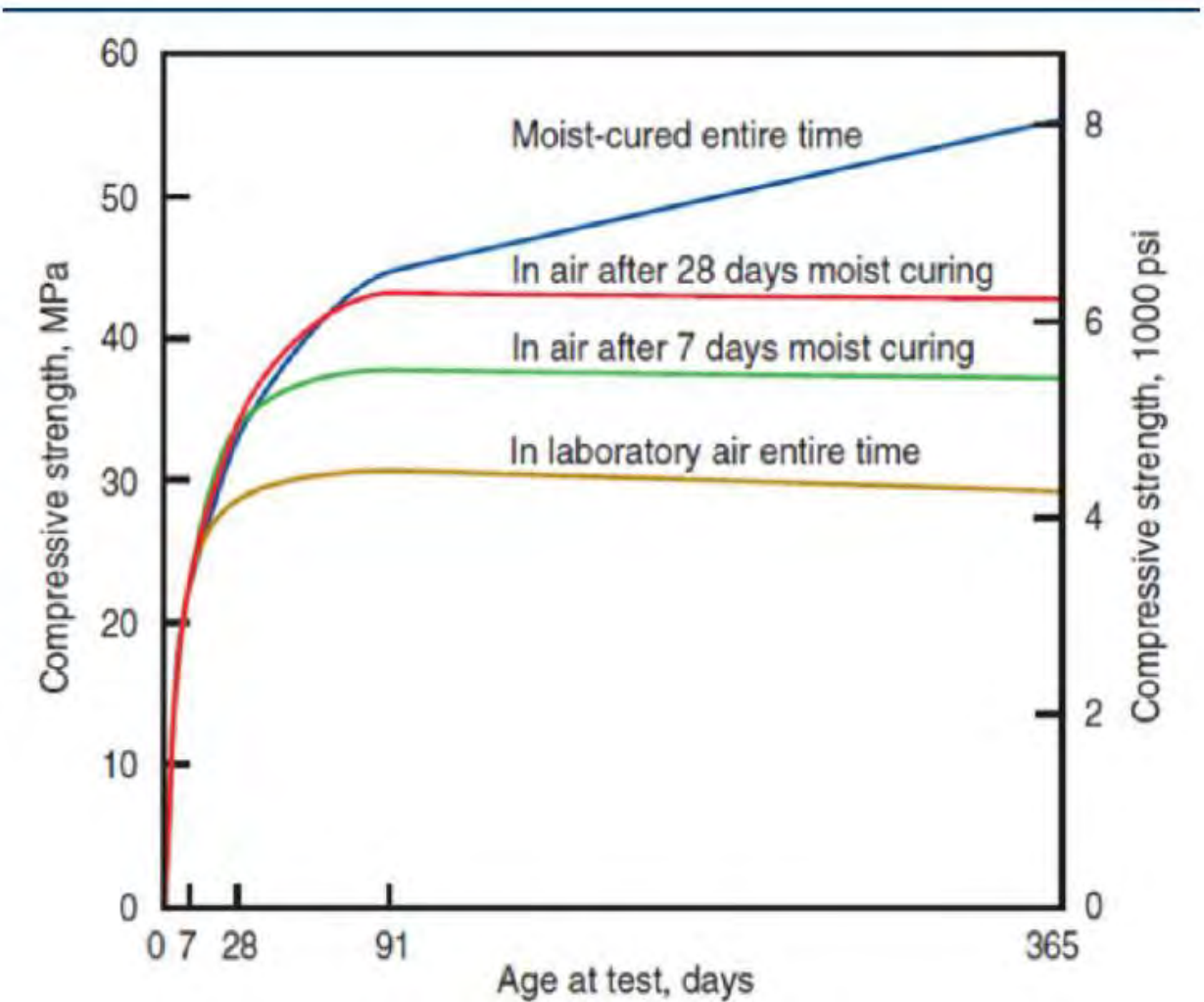
Curing

- Curing compound should be placed immediately after brooming
- If water curing is used, it should be started as soon as the water will not mar the surface

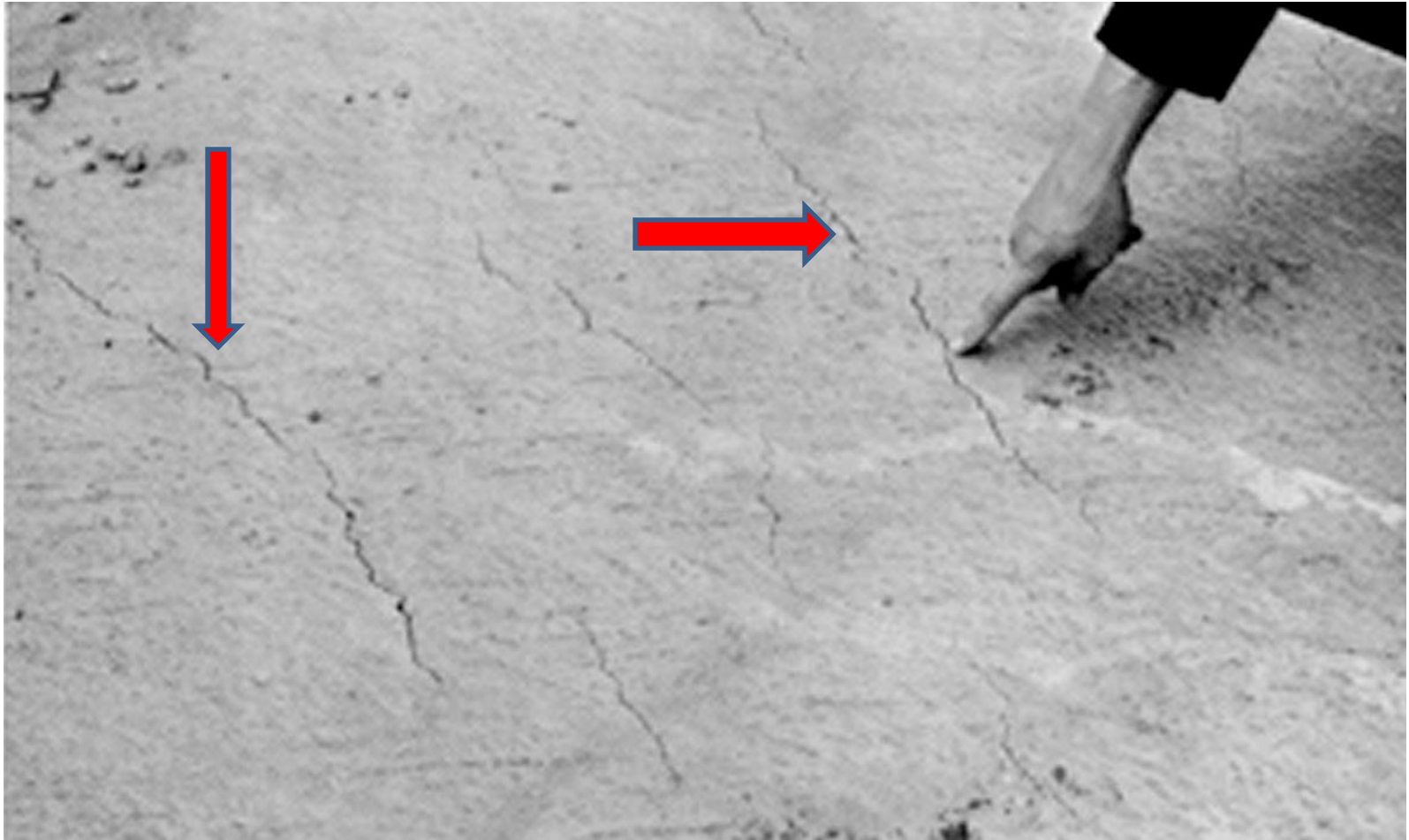
Have you ever heard this question?

***How long is it going to
take that concrete to cure?***

Not Curing Concrete -or getting half of what you paid for



Plastic Shrinkage Cracks





Cure Immediately

- Followed by:
- Additional Curing
- Added Curing
- Continued Curing
- And when you are done
 - More Curing

ASTM C309
Curing Compound



Membrane (spray on)Curing



IMPROPER CURING WILL CAUSE THE CONCRETE TO SCALE



- From MnDOT Specs – “Apply homogeneously to provide a uniform solid coverage on all exposed concrete surfaces (equal to a white sheet of typing paper when using pigmented curing compound).”



Wet Curing - The “old school” way



Picture of Dry Shrinkage Cracks





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DURABILITY CRACKING

**Better known
as
“D-Cracking”**



7 Deadly Sins of Concrete:

- *Poor mix design**
- *Low or High Entrained Air**
- *Adding excessive water on site**
- *"Blessing" the surface**
- *"Wet" finishing the bleed water in**
- *Finishing with steel trowels (Ext.)**
- *Poor or non-existent curing**



THE VERY LAST STEP SEALING IT



What have we(Industry/PennDot accomplished since;

*Section 676 of the Spec. 408 was changed for Sidewalks

*Section 704 addresses all of the other Sections related to concrete for certified finishers.

*Additionally, the majority of industry has now been certified in either the ACI or NRMCA finishing class

PACA holding NRMCA classes for finishers AND specifiers EDUCATION, EDUCATION, EDUCATION



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It's now HAPPY HOUR!!