


Concrete Pavement Surface Defects

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Overview

- Definitions
- Causes
- Prevention



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The Problem

- Not new...
- Various forms

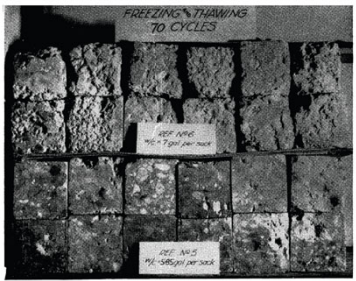



Fig. 3. The durability of concrete exposed to freezing and thawing is affected by the quality of the paste. Specimens in lower part of photograph, made with 6.50 gal. of mixing water per sack of cement, were more resistant than those in upper part, made with 7 gal. Same aggregate was used in all specimens.

PCA 1960
Figure 1. Excerpt from 1950 edition of *Design and Control of Concrete Mixtures*

The Problem

- Popouts
 - Inverted pyramids
 - Cracked aggregate
 - Progresses with deeper aggregates over time



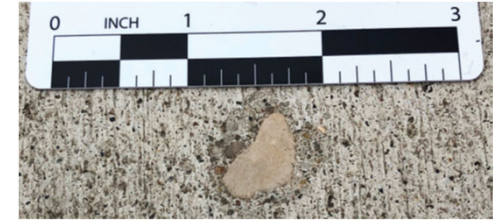
Popouts

- Causes
 - Porous aggregate
- Prevention
 - Don't use it
- Repair
 - Enjoy



Mortar Flaking

- Causes
 - Smooth aggregate
 - Over worked
 - Worked late
 - Poor curing
- Prevention
 - Workmanship
- Repair
 - Enjoy



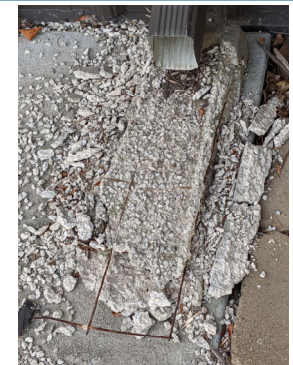
The Problem

- Freeze thaw
 - Loss of paste
 - Progressive with time
 - Worse in wet zones



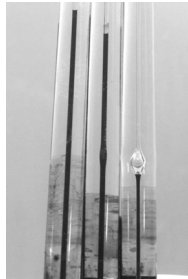
Freeze Thaw

- Causes
 - Saturated freezing
 - Insufficient air



Freeze Thaw

- Prevention
 - Limit SCM dose (~25% fly ash, 50% slag cement)
 - Sufficient air
 - Harder to saturate bubbles
 - Have to be close enough
 - w/cm
- Repair
 - Protect
 - Replace



The Problem

- Flakes
 - Surface peels off
 - Sound material below
 - Often around the aggregate



Flaking

- Causes are debated...
 - Salt crystallization
 - Soft surface
 - Soft below surface
 - Overworked surface
 - System chemistry
 - Osmosis
 - Glue spalling
 - Cryogenic suction

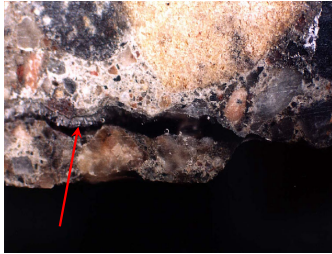


Salt Crystallization



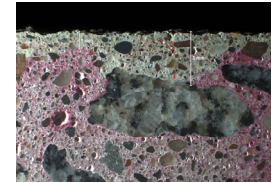
Salt Crystallization

- Salts expand when they precipitate
 - Not necessarily cold weather



Soft Surface

- Water added to the concrete
 - At the truck - "add 10!"
 - Blessing
- Inadequate curing
 - Hydration stopped early



Moulzolf

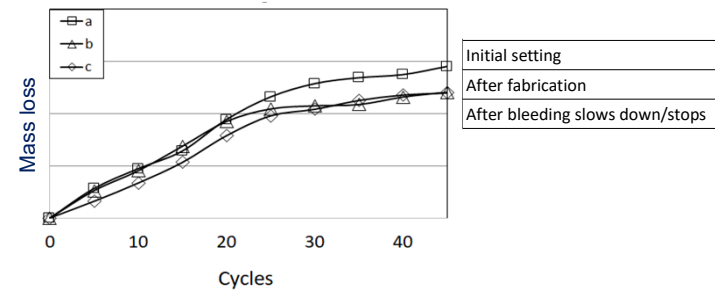
Soft Below the Surface

- Finished before bleeding ended
 - Bleed water trapped
- Over finished
- "Crusting"



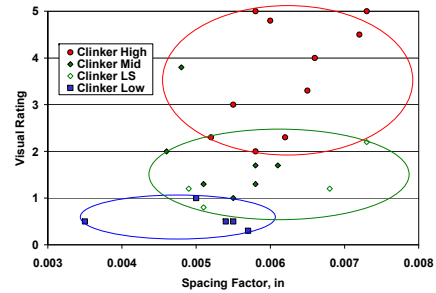
Poole

Effect of finishing



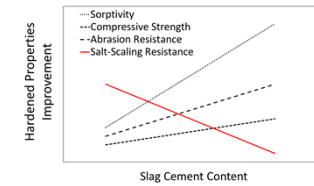
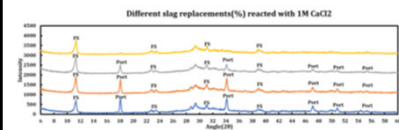
System Chemistry

- Cement alkali and C_3A content
- SCM
 - Type
 - Dosage



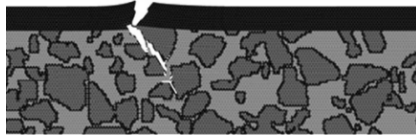
Slag Cement

- Improves all mechanical properties
- Yet scaling tests are worse
- Increases AFm phases in the concrete
 - Which convert to Friedel's salt with chloride salts
 - Unstable in acidic environments



Cold

- Osmosis
 - Pressures from salt gradients
- Glue spalling
 - Ice shrinks while bonded to the surface
- Cryogenic suction
 - Water moves toward ice



Test methods

- Air void system – ASTM C 457
 - Very aggressive
- Scaling - BNQ
 - Similar to ASTM C 672 except
 - Finishing is early & with a wooden ruler
 - Curing is longer
 - Presoaked in solution before cycling



Prevention

- Finishing
 - No added water
 - After bleeding ends
 - Minimum work



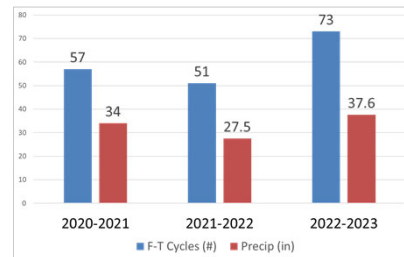
Repair

- Depends on causes
 - Do nothing
 - See if damage progresses
 - Grind
 - Restores ride
 - Reduces thickness
 - Sealants
 - May slow further distress



But Wait

- Cements are changing
 - Set times move
 - Bleeding moves
 - Strength gain rate moves
- The weather is also a factor



Moulzolf

But Wait

- More change is coming
- Means finishing practices must also move
- We need better tools to indicate when the slab is ready



Keven


Closing

- It's always been hard
- We have to pay attention
- Define expectations
- It is possible to do good things



Cavalline

Closing



"Moving Advancements Into Practice"
MAP Brief Summer 2023
Download this document at <https://www.nccconcrete.org/education/education-library>

Revisiting Concrete Sealing

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PROJECT TITLE
 Revisiting Concrete Sealing

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Introduction

The ability of concrete to resist water and chloride ion penetration is a key factor in its long-term durability. The use of sealers to protect concrete surfaces is a common practice, but the use of "high-solids" sealers to protect concrete surfaces is a relatively new development. This article discusses the benefits and challenges of using high-solids sealers on concrete surfaces, and provides recommendations for their use.

As a result of high-solids sealers, the use of sealers on concrete surfaces has become more common. This is due to the fact that high-solids sealers provide a more durable and longer-lasting protection for concrete surfaces. However, the use of high-solids sealers also presents some challenges, such as the need for proper application and the potential for surface damage if not applied correctly.

Many of the problems appear to be related to the application of the sealers, rather than the sealers themselves. Proper application is key to the success of any sealer. This includes proper surface preparation, the use of the correct application method, and the use of the correct amount of sealer. If these steps are not followed, the sealer may not perform as intended, and the concrete surface may be damaged.

It is important to note that the use of high-solids sealers is not a substitute for proper concrete maintenance. Regular cleaning and repair of damaged areas are still necessary to ensure the long-term durability of concrete surfaces.

Directly after the preparation of a concrete surface, the use of sealers offers many benefits. The sealers provide a protective barrier that helps to prevent water and chloride ions from penetrating the concrete. This helps to reduce the risk of scaling, delamination, and other forms of surface damage. Additionally, sealers can help to improve the appearance of the concrete surface, making it look smoother and more uniform in color.

However, the use of sealers also presents some challenges. One of the most common problems is the need for proper application. If the sealer is not applied correctly, it may not perform as intended, and the concrete surface may be damaged. Additionally, the use of sealers can be expensive, and the cost may increase over time as the sealer wears away and needs to be reapplied.

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