

Surface Defects in Exterior Concrete Flatwork

Problem: Scaling, mortar flaking, plastic shrinkage cracks, etc.

References:

- NRMCA CIP Concrete in Practice Series,
<https://my.nrmca.org/Main/ItemDetail?iProductCode=2PCIPS&CATEGORY=ENG>
- ACI Durable Concrete ACI 318-19 & 319.25 Building Code for Structural Concrete, ACI 302 Guide to Concrete Slab and Floor Construction, ACI 330 Commercial Concrete Parking Lots, ACI 301 Spec. for Concrete Construction
- CPG Tools for Success: Deicer Damage Protection

Tools at our disposal: to adjust the concrete and make it easier to place and finish, as well as improve long term durability and avoid surface defects.

Mix Design & Admixtures (Ready-Mix Producer)

- Water reducers
- Accelerators
- Fibers
- Viscosity modifying admixtures
- Internal curing and/or Internal sealers (admixtures)
- Water/cementitious ratio, $\leq .45$ w/c ratio, 4500 psi, (per ACI 318)

Water Demand (Engineer/Specifier/Producer)

- Industry standard ACI 318 and ACI 302 for W/C guidance
- Discuss best options with Concrete Producer and Contractor

Finishing (Contractor)

- Reduced bleed water in concrete; surface wants to dry out before the middle & bottom of the concrete is set up. This can lead to plastic shrinkage cracks, or finishing before the concrete is ready, sealing the surface leading to potential scaling.
- Do not overwork the surface, prefer low-contact finishing equipment
- Do not work water or evaporation retarders into the surface
- Do not use steel trowels/pans/fresnos, they knock out air in the surface, & seal the surface, leading to potential scaling. Consider new polymer trowels as an alternative.
- Finishing aids:
 - Can improve slip/workability
 - Are not the same as evaporation retarders

Curing (Contractor)

- Curing is a critical step in the process that cannot be overlooked
- Begin ASAP after finishing completed, ensure proper coverage
- Assigning curing-specific field staff, clean sprayers/equipment, for proper application coverage

Sealing (Contractor/Owner)

- More important than ever, seal concrete
- Educate owners on sealing responsibility in the future
- Internal (admixture) added at the ready-mix plant
- External topical application, after 28 days (not at same time as curing)
 - Film sealers — surface visible
 - Penetrating sealers — subsurface, moisture-repelling

Surface Finish Management (Contractor/Owner)

- Adjust expectations, rough broom finish vs light broom finish

Deicer Management (Owner)

- **Avoid salt, especially the 1st winter** — use sand
- **Avoid harsh deicers:**

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- Magnesium, Potassium, Ammonium
 - Super salts (blends)
- **Alternatives to Deicers:**
 - Sand (broom off after weather event)
 - Radiant heat
- **If deicers are used:**
 - Avoid over-application, remove excess after weather event
 - Education on post-weather event cleanup
 - Magnesium/super salts = more surface damage

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