Concrete Polishing Council

of the American Society of Concrete Contractors

Position Statement #8

Portland Limestone Cement and Its Effect on Polished Concrete

Over the past few years, there has been a notable trend toward replacing the production of Type I/II and II/V cements with the production of cement containing a higher proportion of interground limestone. While Type I/II and II/V cements must adhere to ASTM C150/C150M, the newer cements, termed Type IL cement or portland limestone cement (PLC), must adhere to ASTM C595/C595M. The latter exhibits greater variability from source to source. This variability can lead to significant challenges such as altered initial setting characteristics, variations in compressive strength gain rates, and changes in bleed rates and timing, among others.

These challenges may pose difficulties for the placing and finishing crew, including issues such as extended or shortened initial and final setting times, trapped bleed water promoting delaminations, and, in some cases, significant segregation resulting in excessive limestone fines surfacing and creating a whitish haze. The latter issue is particularly problematic in slabs intended for polishing.

It's important to recognize that any material change necessitates a learning curve for the ready mixed producer, concrete placing and finishing crew, and polished concrete contractor alike. While this doesn't imply that all slabs incorporating Type IL cement cannot be effectively placed, finished, and polished, it does necessitate adjustments to concrete mixture designs, placing and finishing techniques, and polishing methods. These adjustments can present challenges for all parties involved, including the owner, architect/engineer, cement manufacturer, ready mixed producer, general contractor, concrete placing and finishing contractor, and polished concrete contractor.

Some of the possible challenges associated with concrete made with PLC may include:

- Potential for slower strength gain, which can extend the wait periods for slab hardness to develop;
- Increased water demand, depending on factors such as Blaine fineness and particle size distribution;
- Increased slab porosity;
- Increased fine aggregate (sand) rollout leading to pinholes from differential setting characteristics, necessitating grout coating. This can incur additional time and expense;
- Reduced coverage rate for densifying chemicals due to reduced calcium hydroxide and calcium silicate hydrate (C-S-H) formation in the original concrete; and
- Reduced availability of calcium hydroxide for densifier reaction in the formation of additional C-S-H near the slab surface.

These conditions can significantly impact project schedules and the time frame within which the slab can be polished. Historically, with ordinary portland cement (OPC) and a well-graded mixture design combined with appropriate finishing techniques and curing considerations, a polished concrete contractor could typically commence polishing before the recommended 28-day curing time frame. Mixtures containing PLC may require additional time to achieve acceptable slab hardness, potentially up to 45 days or more, depending on various factors including concrete mixture design, ambient temperatures, placing and finishing techniques, and curing methods.

ACI 310.1-20, "Specification for Polished Concrete Slab Finishes," Section 3.1.4.1, specifies that Mohs hardness measured on the slab surface should be greater than 4 to withstand the grinding process and be considered a sustainable surface. This requirement is fundamental to ensure that the slab surface has attained sufficient hardness for grinding operations to commence. In some instances, additional repairs may be necessary due to slab damage during the curing period, particularly with slabs containing PLC cement, which can be more susceptible to damage due to the softer nature of limestone particles compared to cement clinker particles (refer to CPC Position Statement #6, "Surface Repairs Prior to Polishing Concrete").

If the slab does not achieve Mohs hardness greater than 4.5, additional densifier treatments may be required to accelerate the development of surface hardness. It is essential to note that this additional cost should not fall solely on the polishing contractor. A softer slab surface typically results in lower 60° gloss and Distinctness of Image (DOI) levels than a harder slab (refer to the CPC Polished Concrete Appearance Chart). Therefore, it's advisable to construct a jobsite mockup panel to establish reasonable expectations and demonstrate the final appearance of the slab. The engineer of record (EOR) or the architect of record (AOR) responsible for the specification must have realistic expectations regarding potential adjustments if the slab fails to meet the required minimums for polished concrete slabs.

The CPC contractor will collaborate with the owner, design team, and general contractor to ensure a successful project outcome and address any issues arising from mixture designs featuring low-embodied-carbon concrete.

If you have questions, contact the CPC Technical Hotline at +1.888.483.5288 or cpchotline@ascconline.org.

This position statement from the Concrete Polishing Council of the American Society of Concrete Contractors is presented for reader interest by the editors. The opinions expressed are not necessarily those of the American Concrete Institute. Reader comment is invited.