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Concrete Moisture Control Admixture Technical Bulletin

Concrete is chemistry. Properly proportioning the materials that make up finished concrete is critically important to the final result. As concrete chemistry science has evolved, the appreciation of requirements necessary to achieve an outstanding outcome has been refined. There are a number of moisture control or Type S admixtures on the market, that when incorporated into a design mix, will result in a variety of final properties for that concrete pour. In most instances those final properties include compromises. Cracking, curling, floor flatness and floor levelness considerations are some of the challenges inherent to concrete chemistry. Presently, many concrete moisture control admixtures are struggling with those challenges, and unfortunately, so are their customer's projects.

Concrete Curling

Concrete curling is a challenge for concrete slabs and, later, the placement of resilient flooring systems. Curling occurs when volumetric changes result in "differential moisture loss from [the] concrete slab to the surrounding environment. This distortion can lead to conflicts with respect to installation of some floor coverings in the months after concrete placement." ACI 302.1R-15. **Curling Concrete Costs Cash**. The remediation of curled concrete will result in schedule delays, as well as additional expense to grind, level, or outright replace the slab. Presently, moisture control admixture systems appear to remove water too quickly from the slab during the curing and hydration process and can result in curling. It is happening frequently and various environmental factors (humidity, temperature, acclimation, etc.), not totally understood in this context, may be contributing. Regardless of contributing environmental factors, the costs are real, and unfortunately, a consistent compromise associated with application of these admixture systems. Further refinement of moisture control admixture formulations, testing and installation processes must happen before they will be considered a reliable concrete moisture control option.

Cracking and Compressive Strength

Concrete slabs crack. Owners do not like this unavoidable fact; however, cracking in a slab should be expected. Modest visible cracking, zero to three percent of the surface area, is normal for most slabs and in most instances is simply a cosmetic matter. ACI 302.1R-15. Expansion and control joints are intended to manage concrete slab cracking in a specific manner along a grid spacing specified as part of the project planning and concrete installation process. Concrete cracking that evades expansion/control joints can be a significant issue, and when a slab has major cracking, it can pose structural concerns, as well as creating a host of problems that may persist for years or decades for the subsequent resilient floor covering system. In most cases, cracking occurs because slab water is lost during the early curing and hydration phase, resulting in shrinkage which manifests itself in the form of cracks. As noted, admixtures that are not properly formulated, or Type S admixtures that specify removal of water to achieve an ASTM C494 certification or to achieve higher PSI numbers, can contribute to significant slab cracking. The slab hydrates rapidly, resulting in a very brittle, high-PSI slab that shatters, leaving the owner and contractors with an unsatisfactory mess.

The remediation requirements for a shattered slab in preparation for installing resilient flooring include chasing all cracks so they can be filled with a semi-rigid polyurea joint filler, potentially in conjunction with a two-component resin moisture control system installation to remediate slab moisture conditions. Before the joint filler is installed, all cracks must be routed out with a diamond blade grinder/saw and then thoroughly cleaned and vacuumed. This is a labor-intensive and time-consuming process. Even after remediation, the cracking may cause

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issues years later as the slab and cracks widens/shrinks/settles causing joints to pop, causing the cracks to telegraph through the resilient flooring system.

Fig. 1. Moisture control admixture incorporated into the concrete mix design that doubled (3000 PSI to 6600 PSI) the project-specified PSI at 28 days, resulting in major cracking throughout the entire concrete slab that required substantial remediation.

Moisture Testing

In theory, moisture control admixtures ***should*** reduce the moisture levels in the concrete slab to acceptable levels for flooring placement in compliance with flooring manufacturer requirements. However, what commonly occurs in the marketplace are wild promises about placing flooring within days of placing the concrete slab, with disregard for industry standards and common field moisture tests utilized to verify the slab moisture condition. OBEX has remediated existing admixture-treated slabs that have failed to comply with project and flooring manufacturer requirements, namely Relative Humidity (RH) testing reflecting results above 90% RH. Failed moisture tests should NOT result in a letter assuring product performance radically outside the product's own specified performance standards. Presently there are manufacturers making big claims about the efficacy of their concrete moisture control admixtures, but when the tests are coming back, they are NOT achieving the promised/advertised Moisture Vapor Emission Rate (MVER) or the Relative Humidity standards. When customers note the discrepancy or shortfall in performance, the company is quick to put pen to paper with a "get

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out of jail free" letter indicating warranted protection despite not delivering on their Technical Data Sheet (TDS) performance criteria. What's the point of the TDS criteria? Why specify any at all – why not just provide a letter with each installation? Taking on additional liability and forgoing industry standards is a questionable business model for combating egregious outlier measurements for what is purported to be a scientifically-advanced product.

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OBEX has invested considerably in exploring, developing, and testing concrete admixture moisture control systems. Creteshield® UltraMix is a Type S ASTM C494 Admixture that was tested with no water removed during the C494 certification, achieving an 11 percent compressive strength increase at 28 days, a 60 percent increase in resistance to abrasion as well as increased resistance to chemical attack and a modest reduction in concrete Relative Humidity levels in comparison to an untreated control slab. Reduced internal Relative Humidity levels allow for faster floor placements and reduce the likelihood of needing to encapsulate the slab with an ASTM F3010 system prior to flooring placement.

Some moisture control admixtures do work, but can also result in undesirable consequences in addition to being more expensive than other moisture control options. Take note before you make your final concrete moisture control decision and understand the very real potential consequences of that choice in advance – especially when it comes to concrete moisture control admixtures. The promise of a lifetime warranty will not overcome the incremental costs, or potential concrete rip and replacement costs, if the owner does not accept the curled and/or cracked slab, in preparing a concrete slab to receive resilient flooring.