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# Lightweight Concrete Finishing Concern - Defining A Better Way To Specify

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Several years ago, a colleague from another contractor experienced a floor failure, where the adhered flooring to the concrete top surface separated from the concrete slab throughout the floor. The floor was in use at the time of failure, which affected the owner's operations. The concrete was lightweight, with an air content of 7 percent and a hard-troweled surface, all within specifications. The investigation determined that air bubbles had aligned just below the top surface of the concrete and, after a few weeks of use, failed and caused the floor to debond. Learning from that event, our quality department checklist now reviews this scenario before construction.

**Exploring the Details Can Lead To Enhanced Specifications**

Knowing how specific concrete curing and finishing practices benefit or negatively impact the flooring installation process allows us to improve overall performance while saving the project time and money. Being proactive in identifying specific issues and taking into account all the materials to be installed and in what sequence requires thinking beyond the current moment of construction. We must understand the next step of construction installation and how each component will interact with the next component in the sequence. For example, how will curing and finishing concrete affect the flooring installation? It's important to look beyond the team's focus on performing the task at hand and consider the consequences of each installation step.

As we continued the specification review during the meeting, we noticed that the concrete specifications call for a floor flatness of 35 (FF35). While FF35 is typical for flooring applications, to achieve an FF35, the floor must be hard-troweled, which creates a weak surface in lightweight concrete with air entrainment of over 3 percent and is unsuitable for any floor installation.

It is easy to overlook the finishing needs and flatness requirements with this sequence of specified materials and understand the consequences of the installation techniques required to achieve what is specified for installation. If we had finished the concrete as specified, with an FF35, we likely would create a path for floor failure.

**Offering Additional Insights**

We seldom see the consequences of how one trade affects another with regard to concrete finishing and floor installation. As a result, it is critical that this be one of the items reviewed during our quality pre-installation meetings.

Through our quality program, associated processes, and coordination meetings, we have developed several strategies to address these concerns with the designer and installer. We now recommend the following changes to the specifications, which help to avoid the potential for a multi-million-dollar flooring disaster:

1. Use normal-weight concrete if the structure and building fire design allow.

Floor-finishing techniques are often overlooked in regard to the type of concrete being used, and different types of concrete will be negatively affected when the wrong finishing method is applied.

Concrete curing should be job specific and dependent on the following sequence of work. Installing chemical curing compounds can have a negative effect on floor leveling or floor-finish installation, which needs to be evaluated and reviewed before the curing technique is used on-site.

Recently, I conducted a quality department pre-installation meeting for interior concrete slabs of a steel and concrete mid-rise medical office building in downtown Chicago. We discussed the mix design for the lightweight concrete slabs, reviewing each component and comparing the mix design to the job specifications. During the discussion, it was identified that the concrete had an air entrainment of 4-7 percent, typical of an exterior concrete slab, but not interior. It was determined that 4-7 percent air entrainment is typically required for lightweight concrete to meet the specified concrete weight of 90-115 PCF compared to normal weight concrete, which is 140-150 PCF. As noted in ACI 302, a guide to floor and slab construction published by American Concrete Institute, air-entrained concrete over 3 percent should not be overly troweled or hard troweled; otherwise, the air bubbles that are created during the air entrainment process will tend to line up just below the surface of the concrete and make a weak plane that could easily debond from the concrete surface as previously described.

2. If lightweight concrete is required (as noted in #1), reduce the floor flatness (FF) specifications to FF20, which could be achieved with a lighter finishing technique that will not create a weak top surface. The remainder of the flatness that is required for the flooring would be made up of a thin engineered floor topping.

3. If lightweight concrete is required (as noted in #1), reduce the allowed air content in the concrete slab mix design. A concrete design of a 3 percent air content maximum will increase the overall weight of the concrete to about 2 PSF (pounds per square foot) for a 6" slab and maintain a 114 PCF (pounds per cubic foot) design rather than 110 PCF.

Collaborating with the designers, structural engineers, and concrete suppliers, we can change how the industry specifies lightweight concrete slabs to better interact with the down-line trades. Going through the entire construction process, including discussing the next step of construction with the stakeholders, will educate and provide a better set of job-specific specifications that work for the initial to final installations.

Putting together the down-line scenario and catching issues such as these before they become concerns is critical to a successful project. Having a quality program in place with an experienced team that can review the work before it commences benefits the project and all companies involved.