Moisture Problems with Concrete Slabs

By Peter Craig

Moisture-related floor covering and coating problems have in recent years become among the most common and costly issues being faced by design professionals, contractors, manufacturers, installers, and building owners. Each year, such problems account for hundreds of millions of dollars in unanticipated expenses to correct problems and resolve disputes.

Here are some commonly asked questions on this issue.

Q Why does it seem that moisture-related flooring problems are more common today than in the past?

A Moisture-related problems with flooring materials installed over concrete slabs are not new and have been around since the earliest days of flooring installations. However, the magnitude and frequency of such issues does appear to be more prevalent today.

There are a number of reasons why moisture-related flooring problems are so common today. First, we live in a fast-track world where construction schedules often do not provide sufficient time for concrete to dry naturally to a level acceptable for the installation of flooring or coating materials.

Second, it is all too common for below-slab moisture protection to either be omitted from the building design or for the materials used to provide a less than adequate protection, be installed improperly, or compromised during construction.

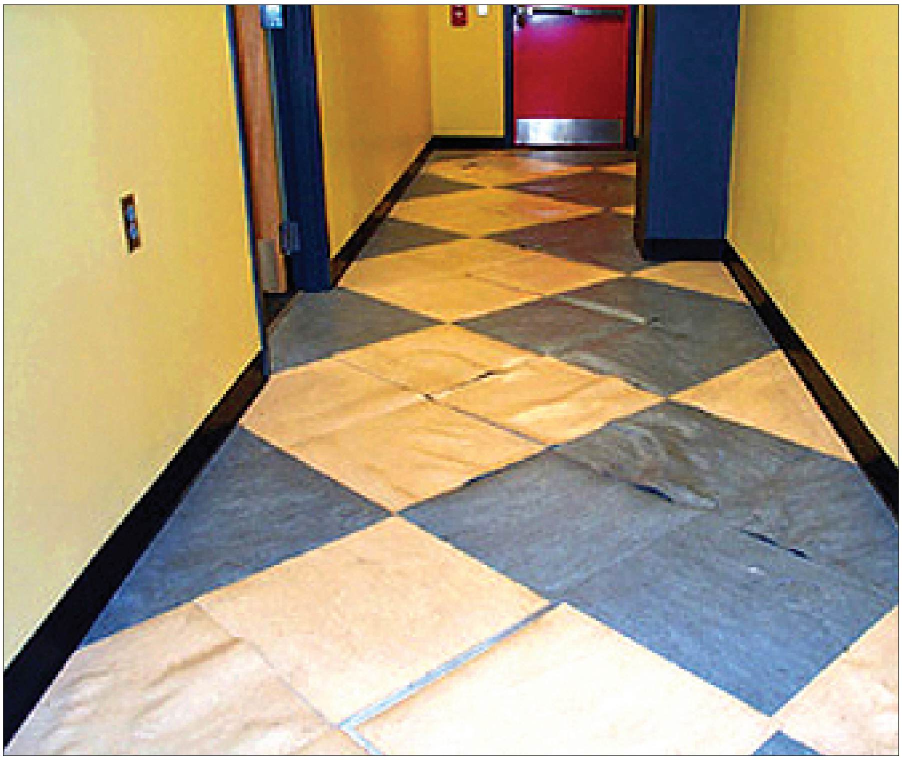
There are several other factors, such as the change from solvent-based to water-based adhesive formulations and the widespread use of curing and bond-breaking compounds.

Q Where does the moisture come from?

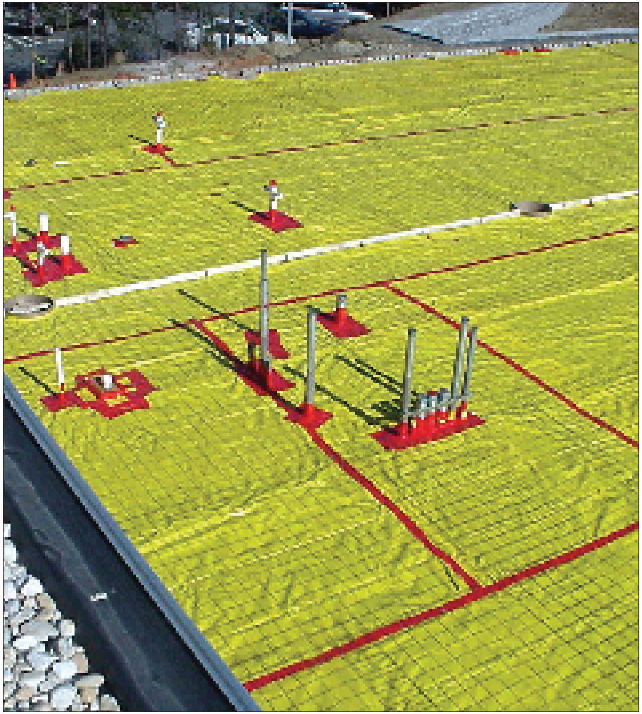
A The first moisture that is a challenge to any new flooring installation is free water within the concrete itself. Free water, or water of convenience, is that water above what is absolutely necessary to hydrate the cement particles and brings a concrete mixture to a workable consistency for placement. Free water does not combine chemically in the hydration process and is present within the concrete paste, aggregate particles, or within capillaries or pores of the concrete.

The second source is moisture rising from below the slab. If an effective, low-permeance vapor retarder material is not installed directly in contact with the underside of the slab, the concrete will be exposed to a perpetual source of moisture rising from below. Without an effective vapor retarder below the slab, the flooring material becomes the stopping point for rising moisture, setting the stage for problems to develop.

Q We are designing a facility in the Southwest where the water table is hundreds of feet below grade. Do we really need a vapor retarder beneath the slab?



Moisture-related problems with flooring material installed over concrete slabs seem to be increasing.



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A low-permeance vapor retarder will prevent concrete from being exposed to moisture rising from below.

A Yes. Regardless of where a project is being constructed, effective below-slab moisture protection is an absolute necessity for any slab that is to receive a moisture-sensitive floor covering or coating. It does not matter if the water table is 10 feet or 510 feet down. Once the building is constructed, the structure itself will inhibit evaporation of moisture from the ground.

Regardless of the depth of the water table, once the slab is placed and covered with a low-permeance flooring material or coating, moisture beneath the slab will increase over time and most often reach close to 100% relative humidity.

In addition, to comply with published flooring industry guidelines, using a vapor retarder beneath floor coverings is mandatory. To omit or remove a vapor retarder from the design or construction process places those responsible for such action at risk of being cited for non-compliance with industry standards, should a moisture-related flooring problem develop.

Q How can we determine if it is safe to proceed with our flooring installation over a concrete slab?

A Several field tests will be required to establish if the moisture level within the concrete is low enough for the flooring installation to proceed safely. Historically, the calcium chloride, moisture vapor emission rate (MVER) test (ASTM F 1869) has been the most commonly used and referenced method of testing the slab moisture level.

However in recent years, much has been learned about what the MVER test does and does not measure. The calcium chloride MVER test has been shown to measure moisture present in the near surface region or top 3/4 inches of the slab only. The test does not tell one anything about how much moisture is present deeper within the concrete.

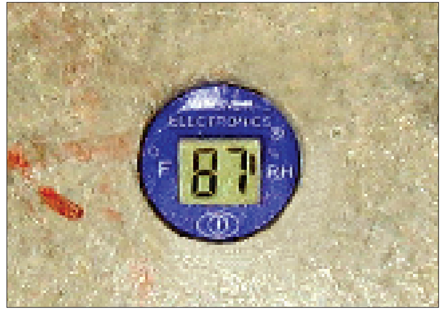
While it is helpful to know the level of moisture near the slab surface, it is as, if not more important to know how much moisture is present deeper within the concrete that will rise and increase the moisture level at the slab surface once the flooring is installed.

To measure moisture deeper within the concrete, relative humidity sleeves are installed into holes drilled into the hardened slab. Measurements are then taken with a sensor placed into the sleeve after a minimum exposure period of 72 hours. Testing the internal relative humidity within a concrete slab has been done in Europe for many years and is done now in this country and covered by ASTM F 2170.

Using these two tests together can give those responsible for making the decision about moisture-related suitability of the slab a much better picture than one would have with MVER test results alone.

However, it should be noted that without an effective, low-permeance vapor retarder directly beneath the concrete, the results of either test are subject to significant increases over time. An effective vapor retarder installed directly beneath the slab is an absolute necessity to keep slab moisture levels within safe limits, once they are reached.

Q Moisture testing can become expensive when non-passing results make it necessary to repeat the entire process until a passing level is reached.



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A small battery-powered relative humidity sensor installed into the hardened concrete will monitor the drying progress of the slab.

Is there any way to manage testing costs and still gain meaningful information as to the drying progress of the slabs?

A Yes. Today two new approaches are available that can allow members of the project team to continually monitor the drying progress of the slab before conducting a full battery of moisture tests, as required by the flooring manufacturer and/or ASTM F 710.

The first new approach is a self-contained, small battery-powered sensor unit that is installed into the hardened concrete once the area is closed in and watertight. The unit does not protrude above the concrete surface. And when activated, it will provide both a temperature and relative humidity reading within the slab. The unit will shut itself off after several alternating displays of the data.

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Project team members can monitor the drying progress of a slab with a sleeve and sensor that are placed into the hardened concrete after the area is closed and watertight. Data is transferred wirelessly to a central unit and can be accessed in real time over a Web site.

Another new approach is remote monitoring of the drying progress. A sleeve and sensor are placed into the hardened concrete when the area is closed in and watertight. The sensor is connected to a logging unit capable of transferring data wirelessly to a central unit connected to a phone line. As desired, the data can be accessed in real time over a Web site from any location.

Both of these approaches can help the project team monitor the drying progress of the slabs and avoid the cost of conducting MVER or internal relative humidity tests until the monitoring levels suggest that the slabs are dry enough to pass the tests.

Q What if we do not have time for the concrete to dry naturally?

A With effective moisture protection beneath the slabs, accelerated slab drying techniques can be used or a number of topical moisture and pH suppression systems can be applied.

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