StarLog™

An ongoing series of bulletins that address floorcovering issues

Published by StarNet Commercial Flooring Cooperative.

Volume VII
Issue 2

In this Issue...

StarNet is a Member of...

AIA

American Subcontractors Association, Inc.

ASID

BOMA International

Carpet Cushion Council

CRI

IFMA

IIDA International Interior Design Association Corporate Member

WFCA Success By Association

The "Cure" for Concrete Moisture and pH Ills

Moisture-related floor covering failures are responsible for over $1 billion annually in damages. The problems range from cupping, buckling, blistering and adhesive failure to discoloration and mold growth. These issues can occur soon after the installation, and in some cases, years down the road. This *StarLog* provides information about concrete, moisture and pH problems and solutions.

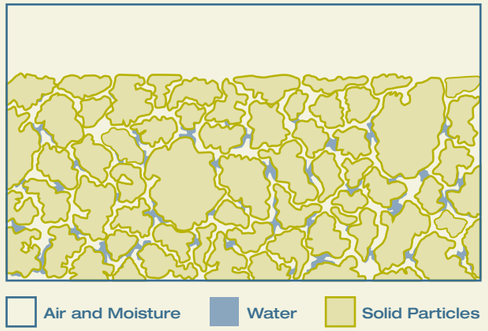
An Old Problem With New Challenges

There's no mystery about why moisture-related failures happen. Concrete is porous by its very nature. The greater the porosity, the greater the potential for moisture vapor to move at a volume intolerable to the floor covering. Concrete slabs that have a high moisture emission rate and/or too high a pH level have never provided the right sub-floor foundation for a successful floor covering installation. Major culprits for excess moisture vapor include too much water in the concrete mix, too little curing and/or drying time, rainfall from incomplete roofing systems, lack of HVAC climate control and poor landscaping that fails to drain water away from building foundations. Another culprit is buffing the concrete smooth to eliminate potential

Moisture-related floor covering failures—a $1 billion dollar problem.

Continued on page 2.

StarNet® The flooring project experts.



Slab porosity and permeability

"telescoping" imperfections on the floor covering. This practice inhibits drying time even more because it seals the concrete's pores. A related problem — too much alkali — destroys the bond between the adhesive and floor covering. High alkalinity results when too much moisture moves through the slab. Today's fast track construction schedules, in combination with new technologies in adhesives and floor covering products can exacerbate the problem.

Prevention

The best prevention is educating all parties on a project about the downside of installing the floor covering on concrete that's simply too wet. The pluses of waiting until concrete conditions are acceptable far outweigh the minuses, especially when you think about the cost of floor failures and the ensuing liability, the effect on indoor air quality and health, and the added costs of downtime for corrective action and floor replacement. However, construction schedules drive many projects, and waiting until the concrete is dry enough may not be an option. In this situation, a remediation budget needs to be included up front, and all parties including the building owner should sign a waiver of liability releasing the installer from responsibility if the floor fails from moisture. The floor covering installer should not be liable for moisture-related flooring failures that are beyond his control.

Independent Testing

Historically, floor covering installers were accountable for the testing and the satisfactory installation of floor covering over concrete. The more recent and accepted school of thought is that the responsibility for moisture testing rests with the general contractor (GC) or with the concrete subcontractor (CS) who specified and poured the concrete. The CS in particular is responsible for the slab's behavior and condition prior to receiving a floor covering. That said, neither the GC, CS nor the floor covering installer should conduct moisture vapor testing themselves. Independent professionals have the best equipment to conduct moisture emission and pH tests, and the best training for obtaining accurate and quantifiable results. Their autonomy assures no allegiance and no stake in the outcome. GCs, CSs and flooring installers not only have a vested interest in test results, they simply don't have the expertise to determine if the slab is ready for the floor covering.

The use of independent testing companies is endorsed by all major construction industry organizations. The World Floor Covering Association, the floorcovering industry's largest advocacy organization, not only recommends that testing be performed by qualified independent agencies, it further recommends that architects, building owners and GCs move such testing away from Division 9 (finishes) specifications and place them with other construction related test requirements. Another construction body, the Inter-Industry Working Group on Concrete Floor Issues, comprised of representatives from the construction trades, flooring manufacturers, specification bodies and technical societies, collaborated on the topic of concrete and moisture in an effort to reduce the number of callbacks, claims and litigation. Their final report also endorses the practice of hiring an independent testing agent to conduct floor moisture testing, with the use of trained and certified testing personnel. Your StarNet Member contractor will be happy to recommend a certified independent testing company to consult on your project.

Independent professionals have the best equipment to conduct moisture emission and pH tests and the best training for obtaining accurate and quantifiable results.

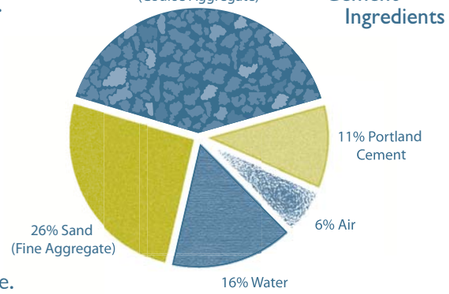
The use of independent testing companies is endorsed by all major construction industry organizations.

Another important recommendation that both the WFCA and the IIWG-CF agree on is that the cost for tests and potential moisture remediation be included in the initial planning process and budget, and be paid for by the building owner. These important points of business are the most professional way to avoid after-the-fact budget and accountability issues.

Test Methods

No single test should determine if a concrete slab is ready for floor covering. A combination of tests is the smarter choice. Test timing is as important as the method because moisture emissions change as a result of natural and man–made forces. Ideally, tests should be conducted on the slab after the building and finish materials have been acclimated to final operating conditions. HVAC systems (heating and air conditioning) in particular, have an effect on moisture in the concrete. Typically, a benchmark reading should be taken one week after HVAC systems are turned on. If moisture readings are low, you can proceed with installing the floor covering. If moisture readings are high, it's a good idea to review the options which include waiting and testing again at a later date, and/or discussing the moisture remediation measures that were included in the initial planning and budgeting. Keep in mind that floor covering manufacturers may stipulate which test, or combination of tests, should be conducted for warranty protection.

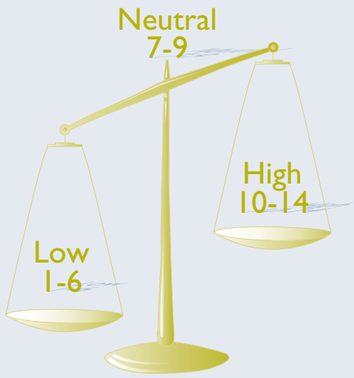
No single test should determine if a concrete slab is ready for floor covering. A combination of tests is the smarter choice.



There are well over a dozen tests and test methods available. Here are the most common, along with sage advice.

1. Calcium Chloride Test ASTM F1869

Pros: This test has been the standard for testing concrete moisture vapor emissions for approximately 50 years and is endorsed by most floor covering manufacturers. It is considered the best and first test to use to measure moisture emission levels in concrete. The results are expressed as pounds of moisture emitted from 1,000 square feet of concrete in 24 hours. It is the only test that accurately measures how much moisture is moving through the concrete.



The pH Scale

Cons: It's not foolproof. An accurate reading relies on proper site preparation, which may include mechanically removing sealers, bonds or other coatings that may have been applied to the concrete during the drying/curing process. In other words, the concrete pores must be open. This test also involves a required waiting period, plus the correct number of tests performed based on square footage. Another "con" is that this test measures vapor emissions at the time of testing, which can change as the building environment changes. Finally, it measures moisture vapor emissions only from the top one inch of the slab and is not an indicator of moisture deep in the slab.

2. Relative Humidity Probe ASTM F2170:

Pros: Relative humidity (RH) probes are less sensitive to fluctuations in ambient air humidity and temperature above the slab than calcium chloride testing. This test is thought to be an accurate way of predicting what will happen to the slab in the future by some industry experts, and some floor covering manufacturers are now recommending this test be included in specifications.

Cons: The test involves drilling holes to 40% of the slab thickness to measure moisture inside the slab. It does not measure moisture moving through the slab.

3. Relative Humidity "Hood" Method ASTM F2420:

Pros: Like the ASTM F 2170 method, this test measures RH, but on the surface instead of inside a hole in the concrete. This method measures the amount of free water in the concrete without the need for drilling. It is similar to the Calcium Chloride Test but not as sensitive to atmospheric conditions, according to manufacturers of the test.

Cons: New for the US, although used in Europe for quite a number of years, it does not have the proven track record or experience yet to be a sole source for determining whether or not a slab is ready.

4. Moisture Meters:

Pros: These meters may be helpful as part of a multi-test system for measuring the dryness of gypsum underlayments and for identifying concrete locations that are wetter than others.

Cons: Although easy to use, these meters were originally developed to test wood, not concrete. They are a snapshot in time that gives no indication of the long-term moisture conditions. **NO** resilient flooring or adhesive manufacturers will accept this method exclusively for installing their product over concrete.

5. The "Senses" Method

Pros: None!

Cons: Never trust anyone who says, "it looks dry," "it feels dry," or "it smells dry." It's impossible to make a decision based on looks, touch or smell.

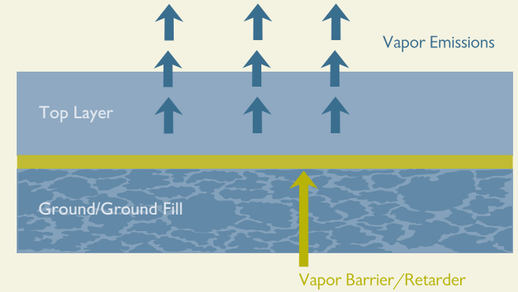
6. The Plastic Sheet Test

Pros: None!

Cons: Concrete dries from the top down, so even if the underside of the sheet looks and feels dry, the slab may still by drying throughout the bulk of its thickness.

Possible Solutions When Floors Must Be Installed Over A Slab With A High Moisture Emission Rate

- Consider using a floor covering that can withstand a higher moisture emission rate, like tile instead of sheet, or carpet instead of resilient.
- As risky as it seems, it may cost less to replace only a few failed sections of floor covering than to lose revenue from postponing an opening date. But, be aware that over time, if the moisture problem is not corrected, the cost for repeatedly replacing failed flooring may become significant.
- Balance the pros and cons of installing a cheaper floor compared to the costs of remediation with a more expensive floor covering. Look at the needs of the space aesthetically and functionally, and run some cost scenarios with different types of floors.
- Use a topical moisture or pH suppression system. These are surface-applied treatments intended to mitigate a high moisture condition within the slab either before or after a problem develops. Treatments range from single coat applications to multi-stage systems that combine two or more materials. Proper preparation of the concrete, e.g. the removal of sealers, is critical to the success of any suppression system.
- Moisture that originates below the slab may contribute to high moisture levels in concrete. Vapor barriers/retarders installed beneath the slab can be effective in blocking moisture from migrating upward to the concrete.



Vapor Retarder

As new technologies and test methods evolve, the scientific community may develop better and more accurate ways to test moisture emission levels. Additional remediation methods will most likely be introduced by the construction trades. Manufacturers of floor coverings and installation systems will introduce new constructions and compositions, too. Your local StarNet Member contractor will be happy to keep you informed about any updates.

Finding an Independent Testing Company

Testing, inspection and consulting companies are located throughout the country. Many of these offer lab and field test services for a range of disciplines including geotechnical engineering, environmental sciences, microbiology and analytical chemistry. Others specialize in construction materials testing and evaluation, while a few actually specialize in concrete testing for the floor covering industry. The most important criteria for selecting a testing service includes confirmation that the company conducts their tests according to ASTM and other recognized standards, and that their technicians are thoroughly trained and/or certified.

There is no one "parent" organization that lists these companies, but there are multiple national and state sources you can use to locate a qualified professional. Here are just a few:

- **ACIL (American Council of Independent Laboratories), www.acil.org**

  ACIL members are organized by the type of testing services they provide. Click on "Construction Materials Engineering and Testing" for an alphabetical listing. Many members have links to their websites on this page.

- **ACI (American Concrete Institute), www.concrete.org/certification/cert_search.asp**

  This landing page has drop-down and selection boxes where you can enter certification category and location. Select "concrete field testing technician" and "concrete lab testing technician" to see who employs the most qualified personnel.

- **ASTM (American Society for Testing and Materials), www.astm.org/cgi-bin/SoftCart.exe/CONSULTANTS/index.html?L+mystore+ddzj1857+1185905711**

  This landing page has drop-down and selection boxes in which you can enter a category for scientific and technical consultants. Click on "construction" and then on "concrete."

- **The ASCC (American Society of Concrete Contractors), www.ascconline.org/home.asp**

  The "contact us" option may be able to direct you to independent testing service in your locale.

- In some parts of the country, such as the southeast, concrete and moisture issues are a larger problem than in the drier desert states. In those states, look for specialists that have national plus state-specific qualifications such as Florida's CTQP (Construction Training Qualification Program).

Quick Facts

1. If a floor covering starts exhibiting signs of moisture-related failure, the problem is probably one or more of the following:
   - The concrete has a higher moisture emission rate than the floor covering can tolerate.
   - The floor covering was installed before the concrete had cured and/or dried.
   - Moisture testing wasn't conducted at all, or wasn't conducted correctly.
   - The moisture testing didn't indicate future concrete slab behavior.
   - A high moisture emission rate led to a high pH level in the concrete, compromising the adhesive bond.
2. The responsibility for concrete moisture testing rests with the GC, but the cost should be borne by the building owner.
3. Curing and drying are not the same. A concrete slab cures in 28 days. The drying time is in addition to curing, ideally, one month for each inch of slab thickness.
4. Alkalinity is measured by pH from 1-14. The ideal pH for installing a floor covering is 7-9. High alkalinity (high pH) combined with moisture will destroy flooring adhesive bonds. pH test materials are part of the ASTM F 1869 Calcium Chloride kit.
5. You can download free WFCA White Papers about concrete and moisture testing. "Position Statement on Moisture Emission Testing" and "Moisture Emission Testing—Responsibility and Qualifications for Testing" are available at wfca-pro.org. The "Summary Report" by the IIWG-CF is available at www.concrete.org/general/floors.htm
6. The maximum acceptable moisture emission level (as tested by the Calcium Chloride Test) differs from floor type to floor type, and the manufacturer. Most commercial floors have an acceptable rate of 3 pounds for resilient sheet, 5 pounds for resilient tile, and 5 – 7 pounds for carpet and hardwood, per 1,000 square feet per 24 hours.

The StarLog™ Library

StarLog reports on subjects that impact commercial flooring products, installations, maintenance and reclamation. Past issues are available in pdf format at www.starnetflooring.com. Click on "Technical Library".

Volume 1 Issue 1
Shading, Pile Reversal & Pooling
- What are Shading & Pile Reversal?
- Pooling/Watermarking
- What Causes Pooling?
- Preventing Pooling

Volume 1 Issue 2
Coming Unglued
- Bond Failure Symptoms & Solutions
- Causes of Bond Failure
- Moisture & Alkali
- Other Concrete Problems

Volume 1 issue 3
Carpet Air Quality: The debate, the myths, the facts.
- Can Carpet Actually Improve Indoor Air Quality?
- 5 Easy Steps for Choosing Better Carpet

Volume 1 Issue 4
Carpeting Without a Professional, A Review of the Costs and Complications
- Underlying Costs Uncovered

See our first report about concrete emissions...

Volume 1 Issue 5
Understanding Concrete Moisture and Vapor Emission Problems
- The High Price of H_2O
- Moisture and Vapor Sources
- Minimizing Concrete Moisture Problems
- Who's Responsible
- Tackling Moisture and Vapor Emission Problems

Volume 1 Issue 6
What you Should Know about "Green" Floorcovering
- Confused about "Green?"
- You're Not Alone
- Defining Green Floorcovering
- Advice from Carpet's Green Guru

Volume 2 Issue 1
The Growing Popularity of Specialty Floor Coverings
- One Size Does Not Fit All
- Why Use Specialty Floors?
- Costs Considerations
- Tips on Selection and Specification

Volume 2 Issue 2
It's What You Don't See that Makes the Difference: The Importance of Floor Patches and Levelers
- Smooth Move –
- Selecting the Right Patch and/or Leveler
- Penny Wise Patch Foolish

Volume 2 issue 3
Purchasing Carpet Direct: An Update on the Costs and Complications
- Hidden Costs and Added Hassles
- Experience Counts

Volume 2 Issue 4
Ceramic Tile
- Cool-to-the Touch, it's One of the Hottest Floors for Commercial Installations

Volume 4 Issue 1
Annual StarNet Design Awards
- A Starstruck Evening for StarNet Commercial Flooring Cooperative and the Winners of the Fourth Annual Design Competition

Volume 4 Issue 2
Up with Lift Systems! The Downside of Traditional Moving Methods
- Fast, Hassle-Free Office Renovations
- Need Help on Your Next Renovation

Volume 4 Issue 3
Commercial Wood and Laminate Floors Growing in Popularity
- What's New in: Hardwood, Cork, Bamboo and Laminate
- Changes for the Better
- Across the Board

Volume 4 issue 4
Safety Underfoot Advances in Flooring Safety
- Carpet – Safe and Sound
- Rubber Flooring & Stairwell Systems
- Partnering with a StarNet Flooring Dealer to Reach Your Safer Building Goals

Volume 4 Issue 5
The Perfect Match: Carpet Built on the Right Foundation
- Patterned Carpet
- Why Upgrade Carpet Backings?
- Backing Basics – What You Should Know
- Specify Branded Backings

Volume 4 Issue 6
Appearances Do Matter
- Maximize Life Cycle and Warranty Protection
- Good Design and Planning = Easier Maintenance
- Caring for Carpets
- Carpet Cleaning Professionals

Volume 5 Issue 1
Anticipating the Unexpected...
- Anticipating the Unexpected to Keep Flooring Projects on Schedule and on Budget
- Collective Strength Builds Better Business
- Total Job Guarantee

Volume 5 Issue 2
Hassle-Free Flooring Renovations in Retail and Library Environments
- Retail LIFTMAN
- Library LIFTMAN

Volume 5 Issue 2
The High Cost of Buying Low
- Stick to What You are Good At
- Carpet is Not a Commodity
- Our Thoughts on Lowest Price and Reverse Auctions

Volume 6 Issue 1
Flooring in the LEED
- LEED Categories and Credits that Apply to Flooring
- NRDC Tips for Controlling Costs on LEED Projects

Volume 6 Issue 2
Patterned Carpets: Finding the Best Match for Your Project
- Patterned Carpet Trends
- Experience Counts
- Big & Small, We Work with Them All
- You Get What You Pay For

Volume 7 Issue 1
A Glossary of Terms Commonly Used in the Flooring Industry

StarNet® The flooring project experts.

To locate a StarNet Professional near you call or visit us online at **www.starnetflooring.com**
1-800-787-6381

Member StarNet Commercial Flooring Cooperative

One in a series of bulletins from your Commercial Floorcovering Professionals at:

StarNet Commercial Flooring Cooperative
20 Homestead Road
Darien, CT 06820
(800) 787-6381
Fax: (203) 353-9521
www.starnetflooring.com