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An Introduction to Concrete Floors

History, Terminology, Failures and Prevention

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I have often said, "bad concrete has been very good to me." As a technical specialist in the commercial resilient flooring industry, concrete issues are an almost daily topic of discussion for me, and my clients come to me for answers.

Not being from the concrete industry, I have had to learn a great deal about this issue—I have attended a number of seminars and served on committees with some of best minds in the flooring and concrete industries. As a result, I have developed more of an understanding of concrete, although I feel like it's just the tip of the iceberg. The more I know the more I realize I need to learn.

Concrete moisture related failures are at near epidemic proportions today. That may seem like a dramatic statement but, the fact is, there is so much misunderstanding about this issue that mistakes continue to be made every day and assumptions are made which lead to these mistakes.

An understanding of concrete and the issues related to flooring installed over concrete can go a long way to understanding what goes wrong and why.

I am grateful to Lew Migliore and the staff of *Commercial Flooring Report* for the opportunity to share some of what I have learned, and I hope this basic introduction to concrete floors and testing will help you offer advice about prevention and correction of concrete moisture problems.

History

According to Howard Kanare of Construction Technology Laboratories (CTL), "Perhaps the oldest known concrete floor slab was discovered in 1985 in the Middle East at Yiftah El in Southern Galilee. The 1,900-sq.-ft. slab is part of a settlement that was dated to 7,000 B.C. Laid on compacted, sandy clay, the travertine-like lime concrete is 1- to 3-in. in thickness and contains 0.4-in. diameter aggregate, with a ground and polished surface. A sample of this concrete yielded 5,800 psi compressive strength!"

That's a far cry from the 3,000 to 4,000 psi concrete that is in common use today. Kanare's Book, "Concrete Floors and Moisture" was published in January by the Portland Cement Association, and is recommended reading for a detailed understanding of concrete issues.

Terminology

I have often heard people talk about "the cement floor" that they are going to put a floor covering on top of, or use the word cement in other ways, such as cement sidewalk, foundation or even cement mixer. These terms are used incorrectly.

Cement is one of the ingredients in concrete—the gray powder in the mix. Concrete is defined as a strong, hard material made by mixing a cementing material (commonly Portland cement) and a mineral aggregate (such as washed sand and gravel or broken rock) with sufficient water to cause the cement to set and bind the entire mass. So, you can say that concrete is made of cement, sand, rocks and water, in addition to other additives that are sometimes a part of the mix.

Kenneth C. Hoover, in his article, "The Roman Empire Fell – Its Concrete Endures" (Concrete International, Nov. 2004) put it very well, saying, "The word concrete derives from the Latin verb concrescere, 'to grow together,' 'to congeal' or 'to harden.'"

He explains, "Those of us dedicated to correcting the general confusion between the terms cement and concrete might be surprised to learn that our word cement is a mistranslation of the Latin word caementum, which means 'crushed stone.' As a consequence, more than 2,000 years later, semantic confusion reigns: concrete specialists say that a cement truck is a bulk transport tanker; the general public thinks a cement truck is a transit mixer, but a true Latin scholar will know that a cement truck is really a dump truck full of crushed stone."

Curing

So, once a new concrete floor slab is placed, what happens? The concrete begins to cure.

Curing is the chemical reaction by which the cement paste (formed by cement powder and water) chemically bonds with the sand and the aggregate to make concrete. The cement paste is the binding agent that holds all the ingredients together.

Initially, the reaction needs the presence of water, so curing is facilitated by not allowing water to escape. In the old days this was achieved by spreading burlap on the floor and keeping it wet for up to seven days, a process known as a 7-day wet cure. You may still see this today in some highway work, where soaker hoses or sprinklers are used to keep the burlap wet, which keeps the concrete wet for the initial cure.

After the initial cure, the concrete mix has used most of the water it needs, so the burlap is removed. The curing continues from there, and the term "28-day cure" refers to the approximate time it takes for standard mix, 4-in. thick concrete to fully cure. However, after 28 days, the concrete is not dry, and would never be ready for floor covering.

Drying

A common mistake is assuming cured means the concrete is ready for floor coverings. Cured is not dry!

The industry standard, ASTM F710, describes the process: New concrete slabs shall be properly cured and dried before installation of resilient flooring. Drying time before slabs are ready for moisture testing will vary depending on atmospheric conditions and mix design. A 4-in. thick

slab, allowed to dry from only one side, batched at a water-cement ratio of 0.45, typically requires approximately 90 to 120 days to achieve a moisture vapor emission rate (MVER) of 3-lb./1,000-ft.^{2} per 24 hours (the resilient flooring industry standard MVER).

This standard describes a standard mix, under ideal conditions of 70 degrees Fahrenheit and 50% relative humidity. Standard mix comes directly out of the truck and is placed on ground floor or below ground floor slabs. Lightweight concrete is the pumpable variety that is pumped up to the upper floors. We'll talk more about this difference later.

As I noted earlier, initially, the water in concrete needs to be kept in so the initial cure can occur. The traditional curing method of using wet burlap has been largely replaced by sprayed on film-forming curing compounds, which seal the surface and allow construction to begin on top of the new slab a day or two after it is placed.

However, these compounds actually keep the concrete damp for much longer than necessary, and often are not compatible with floor covering adhesives. Even so-called dissipating compounds usually remain on the surface much longer than necessary.

Concrete floors to receive resilient flooring shall be free of sealers, coatings, finishes, dirt, film-forming curing compounds, or other substances which may affect the rate of moisture dissipation from the concrete or the adhesion of resilient flooring to the concrete[2]. Curing compounds should be removed soon after the concrete is placed.

A better option is a cover cure, where the concrete is covered with waterproof paper or plastic sheeting for several days to hold in the water needed for the initial cure. Once the cover is removed, the concrete can immediately begin to dry. This faster variation on the burlap method can result in much faster drying than curing compounds, yet still allows the construction team to work on top of the new concrete slab.

The follwoing are some examples of those false assumptions and misplaced blame.

It's bad concrete. If the concrete contractor follows the specification and the concrete is batched and placed correctly, then he's done his job, so a moisture problem is rarely his fault. That's assuming the specification is written correctly. Exceptions are when the driver of the truck adds more water to keep the concrete mix "alive" on a hot day, or when the plastic sheet vapor retarder beneath a slab on grade is compromised or broken or not used at all.

Today's fast-track construction practices are most often to blame because the buildings are completed before the slab has had a chance to dry sufficiently.

Frequently, flooring is installed before the climate control system is operational, which can lead to problems when the excess water vapor in the concrete is drawn upward through the slab surface by the dry conditioned air.

Another factor is the use of curing compounds that don't allow concrete to dry quick enough instead of a method like the cover cure method.

It's bad adhesive. It is very rare for an adhesive to be defective, so unless the glue is attacked by moisture and the elevated pH levels that come with it, it is rarely the cause.

Are some floor coverings more prone to failure than others? Are floor coverings and adhesives more sensitive today than in years gone by? Well, I'm not going to walk into the mine field of an adhesive discussion.

Today's water-based adhesives compared to the solvent-based products of the past have excellent strength and workability, but there is a lot of disagreement about whether they are more moisture sensitive. The fact is, if the concrete is dry they work very well.

As far as flooring products, there are some excellent high performance ones available today that were not even around a few decades ago. Products such as vinyl backed carpet, rubber sheet flooring, vinyl backed sheet vinyl and large format resilient tiles all have excellent performance and visual characteristics.

However, they are often impervious to moisture so they may be more sensitive than action back polypropylene backed carpet, felt backed vinyl and 12X12-in. vinyl composition tile, which are generally not as good a quality. As in any decision, there are compromises to be made and the person specifying the job needs to look at the big picture by taking all these factors into consideration.

Concrete cures in 28 days so its ready for a floor. As I stated earlier, 28 day cure does not mean the concrete is dry enough for floor covering. Curing and drying are two different things.

In one particular laboratory study, a standard mix concrete slab at ideal conditions (70 degrees Fahrenheit, 50% relative humidity) took 46 days to dry to a 3-lb. vapor emission reading. At lower temperatures or higher humidity, the concrete will take much longer than that.

Another point to consider is, even if the slab dries completely, all bets are off if it gets re-wetted. Rain, broken pipes, floods and water damage can set the drying clock back almost to the beginning. So, rather than asking how old the slab is, it's more important to know when the building was enclosed, if there is a vapor retarder, and if there was any water on the floor at any time.

Moisture is only a problem on the ground floor. Many moisture-related problems occur in slabs on or below grade because ground water vapor passes thorough concrete and softens the adhesive.

Every concrete floor slab on or below grade to receive resilient flooring should have a moisture retarder (often improperly called a vapor barrier) installed below the slab.[1] The vapor retarder is often left out in the interest of saving time and money, and its absence may make the concrete easier to finish. But, the use of

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such a moisture vapor retarder, provided its integrity has not been compromised, reduces the potential severity of moisture vapor penetration.[3]

It is very important to ask the question about a vapor retarder for on or below grade slabs. If there is none, then there are no guarantees for the flooring or adhesive.

What about upstairs? Don't make the mistake of assuming that everything from the second floor up will be problem free. Some of the worst moisture failures occur above grade because things such as "lightweight concrete," floors containing lightweight aggregate or excess water, and those that are allowed to dry from only one side, such as concrete on metal deck construction, may need a much longer drying time.[3]

In the same laboratory study mentioned earlier, a lightweight mix concrete took 168 days to dry. Rather than the old days, when standard concrete was hoisted to the upper floors by a crane, today's lightweight concrete is pumped to the other floors, saving plenty of time and money. However, in order to make the concrete pumpable, more water is used, so it takes much longer to dry.

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While it is true that on or below grade slabs are a concern because the concrete is in contact with the ground, concrete on the upper floors is in no way immune to moisture problems.

We don't have to worry about moisture problems in the desert. Those of you doing business in dry climates like the Southwest might assume that you don't have to worry about a moisture problem because you're in the desert. Tell that to the thousands of building owners in the Southwest who have had moisture-related failures.

In reality, they have as many or more problems than the rest of the nation. This is because vapor retarders are left out of the buildings, even though there is often a high water table in a desert climate, or extra water is added to keep the mix alive in the desert heat, and so on.

Don't assume that because you are in a dry climate you are immune to moisture-related failures.

The slab is 30 years old, so don't worry about it. Adaptive re-use is a leading cause of moisture failures. Warehouses are changed to shops or offices, garages are switched to living space, basements are converted, etc.

One of the worst moisture problems I've ever seen was in a 30-year-old warehouse building that was converted to a furniture store. Because the slab was not designed to be covered, there was no vapor retarder in place beneath the concrete.

For 30 years, ground water vapor moved through that slab unnoticed—until the floor was covered with sheet vinyl and the adhesive turned to mush. Don't assume that an older concrete slab is immune to moisture problems.

By the same token, don't assume that if a floor is installed now with no problems that you don't have to worry about moisture if you cover or replace that floor. It may not have bothered the old floor but you can't assume anything about the new one. Test the slab no matter what.

It was the maintenance guy's fault. Another common scapegoat is the floor care technician. I have been on many jobs where the person with the mop gets blamed. But unless the floor is flooded and left wet for long periods, there is usually not enough water in the cleaning process to cause an adhesive to turn to mush.

If you pull up a tile and the glue is effected around the edges, maybe. But, mushy adhesive in the center of a tile? No way is it from the floor care team. This is especially true in most of the large installations where an automatic scrubbing machine is used. Scrubbers suck the water up within seconds after the floor is wet.

The floor care technician is an easy target when it comes to moisture related problems but is rarely to blame.

Rather than blame flooring products, adhesives, concrete contractors, or floor care technicians, what really needs to be looked at is construction practices. The two biggest causes of moisture related failures are fast-track construction and adaptive re-use of older buildings.

In truth, concrete hasn't changed that much over the years. While the flooring and adhesives products have changed some, they both work extremely well when the concrete is dry.

We all need to work and help those in the specification community to learn about and understand the causes of these problems, write better specifications and change their practices.

Finally, as professional floor coverers, we need to be sure the concrete floor is properly tested, and to JUST SAY NO to installing over concrete we know is not ready. Often, the best way to avoid concrete moisture related failures is a four letter word, "wait," followed by, "let it dry."

When and where should a concrete floor be tested? Everywhere and always! As we have seen so far, even older concrete can have moisture problems, and concrete slabs above grade can be as much of a problem as the ground floor.

My rule is test if it's old or new, even if there is an existing floor down that looks in good shape. Test on grade, above grade, or below—from the penthouse to the basement. If it's concrete, test it!

There are a variety of testing methods testing. Here are five of my favorites—some of which work and some of which do not.

The senses test

Many is the time I have heard someone say something like, "I have been in this business for umpteen years and I have never had a moisture related failure." With this attitude, if there is any testing of the concrete at all, the test method for moisture is usually done by using the sense of sight, the sense of touch or the sense of smell, or all three.

The methodology is something along the lines of, "It looks dry, it feels dry," or "It smells dry." Unfortunately, these methods have not been proven any more accurate than flipping a coin to decide if the floor is ready.

You cannot see, feel or smell moisture vapor coming out of a concrete slab, so more accurate methods of testing are necessary.

The plastic sheet test

For many years, this was a widely used moisture test method—an old-time test where you tape a sheet of

plastic to the floor or leave a heavy rubber- or vinyl-backed mat on the floor for a day or two and then come back to see if the concrete looks damp. If it is damp, don't do the job and make some time to do further testing.

It has always been assumed that if the slab is dry after this test you are probably good to go. However, science has proved this assumption wrong. I saw the laboratory test in person, where a calcium chloride test was coming in at 13-lbs. and the plastic sheet test showed completely dry.

You can imagine my surprise upon seeing the results of the two tests compared against one another.

Therefore, it is safe to say this is an inaccurate method, and should come off your list of "approved" moisture testing methods.

Moisture meters

I often hear from flooring contractors or installers that use moisture meters to decide whether to install a new floor.

There are plenty of easy-to-use electronic meters on the market that are valuable for various purposes, but one of those is not to make a "go" or "no go" decision on installing a floor.

Meters are valuable as a "spot" test for surface moisture—at that spot in the slab, at that point in time—and could be a way of deciding if further testing is needed.

Gypsum underlayment manufacturers also recommend meters as a way of determining if their product is dry enough to install floor coverings.

Check with the gypsum maker to learn what meter it wants you to use and what results are acceptable.

Another use for meters is when a floor has failed. If you think there is a moisture problem, the meter will confirm that there might be one and is a visible way of showing the problem to the building owner or contractor. Then, you can recommend further testing by an accepted method.

Just remember, that moisture meter testing on concrete is not a way to decide go or no go for a floor covering installation.

There are two testing methods that are accepted by the floor covering industry: Relative Humidity and Calcium Chloride.

Relative humidity testing

The Internal Relative Humidity test has been used in Europe for over 20 years and is now gaining some popularity in North America. It is known here as ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.

With this method, holes are drilled to 40% of the slab thickness—usually 2- to 3-in. The hole is vacuumed clean and a plastic sleeve is inserted. After three days, a relative humidity probe is used to determine the percentage of relative humidity at the bottom of the hole.

Usually a reading of 75% to 80% is acceptable. Check with the floor covering manufacturer to see what its limits are.

One nice thing about this test, it is easily repeated. After testing, cover the sleeve, then come back a week or two later, reinsert the probe, wait for it to reach a steady reading, and write down the results. If it's still too high, cap the sleeve and come back again later.

The only time you have to wait three days is on the first test after the initial drilling is done.

This test is thought of as being the best way to the future as far as moisture rising to the surface of the concrete. This is truly the latest technology for moisture testing and is very quickly being recognized by flooring manufacturers throughout the world.

Calcium Chloride test

This 40-year-old test method, recognized by virtually every carpet and resilient manufacturer, was originally published in the 1950s by the Rubber Manufacturer's Association (RMA) and is now known as ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate (MVER) of Concrete Subfloor Using Anhydrous Calcium Chloride.

F1869 uses a manufactured kit consisting of a plastic dome and a dish of calcium chloride crystals that are a bit larger than Kosher salt. The dish is weighed and then sealed under the dome for 60 to 72 hours.

Because salt naturally absorbs water vapor, it gains weight during the test and the weight gain is calculated to determine the MVER, which is expressed in pounds of water vapor per one thousand square feet per 24 hours (lbs./1,000 ft.^{2}/24h), or just pounds.

Most of today's resilient flooring and carpet needs a maximum MVER of 3- or 5-lbs. depending on the product. Check with the manufacturer for its limits.

One of the most common errors made doing a calcium chloride test is not doing the first two steps: cleaning and waiting. Twenty-four hours before putting the kits down, a 20-in. square of the concrete needs to be clean, even if it is brand new.

The best way to do this is with a light grinding—wire brushing or scraping is not enough to remove curing compound, sealer or adhesive residue. After the 24-hour waiting period, the kit is placed.

F1869 measures the MVER from the top 1-in. or so of the concrete. It is a good test for surface moisture, but it does not measure deep down moisture the way the F2170 test does.

I'm often asked whether the F2170 test or the F1869 test should be used and I recommend both. The reason is, if the results from the F2170 test are low and the F1869 test is high, that may mean the slab is dry, but the surface became wet because of a flood or other source of moisture. In this case, it's not too hard to dry out the surface using fans or heat or dehumidifiers.

However, if the results are opposite, that tells us the slab is drying from the top down, but there is still a lot of moisture inside waiting to come up. In this case, it may take a lot longer for the slab to dry out, or some other measures may have to be taken to get it ready for the new flooring.

Many people use a combination of these last three tests to determine if the concrete is ready for a floor covering installation, and these methods are also used to troubleshoot a floor that has failed because of moisture.

Regardless of which test method is used, it is imperative that the test protocol be followed to the letter. Spend the money and get the actual test method documents from ASTM (www.astm.org)—and follow them.

Don't take shortcuts like forgetting the "cleaning and waiting" required for the F1869 test.

The most common mistake with all of these tests is doing them when the building is not climate controlled. The concrete needs to be tested in the condition it will be in when the floor is in use.

For example, test results from a building without the air conditioning on will be much lower than they will when the system is turned on because the air above the slab will be so much dryer, and the moisture will be drawn upward. If the building is not ready, don't bother with the test.

Another mistake is not doing enough tests. Three tests are required for the first 1,000 square feet and then one test per 1,000 after that. So, a 5,000-sq.-ft. job should have seven tests and a 500 square foot job should have three.

Doing just one or two tests does

not provide enough information. If you do the test and someone knowledgeable is able to determine it was not done correctly, the results are invalid and you may be liable for the failure that occurs. So, again, follow the test method to the letter!

So, you did your due diligence, tested the concrete under the right conditions and you got results that are above the flooring manufacturer's allowable limits. Now what? I am asked all the time what to do in this situation and, the bad news is. it's not always as easy as putting some kind of magic juice, as I call it, on the surface and then installing the floor. To decide what to do, you have to ask a number of questions first.

If this is a new concrete slab, one of the best ways to solve a moisture problem is to wait. Of course that is a four letter word that the general contractor probably won't want to hear, but the fact is, if you can open up the pores of the concrete by abrading the surface, get the air moving with fans, lower the humidity by turning on the air conditioning or cranking up the heat, the drying time of a concrete slab can be accelerated.

The closer you can get the environment to about 70 degrees Fahrenheit and 40% to 50% relative humidity, the better. Some companies even make equipment that will dry-out the inside of a building.

This equipment was designed to repair flood damage, but can also be used to dry out a floor. If there is time to do this, it is the best way, because you are not going to rely on a coating or some other layer on the floor.

Dealing With Older Slabs

In the case of an older slab, the source of the moisture is usually not the concrete itself. Moisture may be coming from the ground and through the concrete if there is no vapor retarder beneath the slab. This can happen anywhere—regardless of whether the building is in a damp climate or in the desert.

Other common sources of moisture are landscaping, parking lots, sprinklers or downspouts on the outside of the building that allow rainwater to gather at the base of the foundation and soak into the slab. Broken pipes inside or beneath the slab, or in an attached building next door, or flooding on top of the slab can also be sources of concrete moisture related failures.

For above grade slabs, a leaking pipe in the wall, or the boiler room or unheated parking garage below the slab can be possible sources of moisture intrusion. If sources such as these can be identified and corrected, then the moisture problem may be eliminated, which means all that needs to be done is to dry out the slab and install a new floor.

But, if waiting is not an option, and something needs to be done, how do you correct a moisture problem so a floor can be installed? Again, questions need to be answered to determine the course of action.

Testing Methods

The first thing is to have a complete testing protocol done using ASTM F1869 Calcium Chloride tests and ASTM F2170 Internal Relative Humidity tests. This information will serve as the benchmark for the condition of the concrete. In addition, pH testing is important, as the combination of moisture and alkalinity can have a very negative affect on floor covering adhesives.

As far as moisture readings, high levels on the F1869 test combined with low F2170 results would indicate the moisture is at the surface, so in this case, it may be relatively easy to dry the slab.

If the opposite is true, there is moisture down inside the slab that will certainly move upward after the floor is installed, and that has to be dealt with.

Another important consideration for on or below grade slabs is whether there is a vapor retarder present beneath the slab. If there isn't then moisture vapor is going to continue to move upward for the life of the floor.

The next step that needs to be done in the process is to look at what type of floor covering material is to be installed and what the product's maximum moisture readings are as established by the manufacturer.

Most of the companies are still using the F1869 Calcium Chloride test as an industry benchmark, although it seems the F2170 limit of 75% is starting to work its way into more and more specifications.

For manufacturers the F1869 limits will usually be noted as 3-lb./100-sql.-ft./24 hours for products that are more moisture sensitive. Examples are heat-welded sheet vinyl, rubber flooring, cork, carpet and carpet tile other than action back, most solid vinyl tile and so on.

Other more moisture tolerant products such as Vinyl Composition Tile, some felt backed sheet vinyl, action backed carpet and some others will have a higher limit of 5-lbs. on the F1869 Calcium Chloride test.

No Established Standards

There are no hard and fast rules, so check with the manufacturer to be sure. Do this by making a phone call to the technical department. Don't rely on published guidelines as, nowadays, these are subject to change with so much research going on.

Once all the data is gathered, the selection process for a surface-applied vapor reduction system can begin. I use the term, surface-applied vapor reduction system, although there is no official saying for the growing industry of products that are applied to concrete to block or limit moisture emission from the slab.

More than once, I have heard the term, snake oil used, and I often jokingly call the category magic juice. By saying that, I don't mean to disparage the hard working scientists who are trying to come up with these systems which will hopefully solve and prevent many of the moisture related issues in our industry.

My terminology is more a result of the frustration I feel when a client or a friend in the industry calls me for advice on how to fix a problem because of confusing terms such as moisture control system, moisture barrier and sealer, moisture emission and alkalinity control, sealer-primer, concrete sealer and many other names manufacturers use for these types of products.

I was recently invited to serve on a subcommittee of the International Concrete Repair Institute (ICRI). The name of this committee is, Moisture Related Issues With Concrete Surface Finishes, and I hope the members will be able to draft some industry standards to make the products, and the process, less confusing.

All these vapor reduction products and claims about what they will and won't do to solve your problem come with a variety of price ranges as well, so the product needs to be matched with the job site and the flooring to be installed. For example, if the floor covering has an F1869 moisture limit of 5-lbs., and the readings are 8-lbs. or less, a lower cost product may do the job.

However, a more complex and expensive system may need to be used if there are higher F1869 readings, or concern over moisture inside the slab because of high F2170 readings, or concern for water vapor intrusion from the ground because of the lack of a vapor retarder beneath the slab.

Whose Vapor Reduction Product To Use?

When making these decisions, look at the reputation of the manufacturer, track record, warranty and insurance coverage to be sure you will be covered down the road if the product fails.

Once you narrow it down to one or two systems, call the vapor reduction manufacturer directly in order to get its direct involvement and advice.

A good manufacturer will say no if its product is not right for your job. If it is the right product, a person from the company will visit the site and stay with you through the process to help make sure the product is properly applied.

Some manufacturers have taken control of the process to the point they are insisting that certified applicators who have been factory trained be the one to apply the product.

There are two other points that need to be considered. First, is to make sure the flooring manufacturer is on board as far as the plan of action.

Also, some reduction systems require the use of a specific adhesive, so you need to be sure you are using the right kind of glue for the floor covering to be installed.

Check First

Other systems are sold as compatible with all types of flooring adhesives, but you still need to check to be sure this is true or do a test area and see for yourself.

Often, the vapor reduction system is designed to be covered with an underlayment or patching compound, so there is rarely a compatibility issue in such a case. However, to be sure, make certain the channels of communication are open.

The other point that needs to be considered is, that before you start applying any of these systems, the concrete has to be cleaned, which usually means bead blasting. That is the only way these types of products can penetrate into the concrete and firmly adhere to the surface.

I don't have much trust for products being sold that can just be painted on without plenty of preparation.

All of this is obviously a great deal of work and expense—especially if these corrective measures have to be taken after a floor is installed. This just once again underscores the importance of testing.

If you know about moisture issues before the floor is installed, it is far easier to fix them than it is after the floor is installed.

More work needs to be done to get The Floor Covering Industry White Paper Position Statement on Moisture Emission out to the world.

The following statement comes from the White Paper and is one of the most important elements in it that needs to get out: "…it is unreasonable to expect a general contractor, concrete contractor or a flooring installer to have sufficient expertise to anticipate and ask the proper questions for evaluation of potential concrete/flooring problems.

"Another complicating factor is that each has a vested interest on the testing and/or performance outcome of the installation.

"Flooring contractors should be made aware of test results, as all flooring manufacturers have placed upward tolerable limits of moisture vapor emission for the installation of their products; most have also recognized that adhesives will cure within a moderate range of pH.

"However, flooring contractors' expertise should, by requirement, be limited to flooring materials and their installation. Changes in construction materials and practices should not lead to a mandatory indepth expertise of all the disciplines [just] mentioned above.

"It is therefore our recommendation that concrete moisture vapor emission testing be performed by qualified independent agencies."

Testing Companies

Today, more and more independent agencies are doing these types of moisture testing.

In fact, I recently started working with a company that is doing this kind of testing all over the country and it has been nice to see how many flooring people, not to mention people outside the industry, are appreciative of having an independent source of testing for this.

In addition, I have been lucky enough to work with the Institute of Inspection, Cleaning and Restoration Certification (IICRC), which recently did a great deal of work to develop training and certification programs for inspectors of substrates as well as resilient flooring.

I've also been fortunate to work with the American Society of Testing Materials (ASTM), which has developed the industry standard test methods and practices for concrete under resilient flooring and continues to do so as new information is learned.

So, what I'm getting at is, help is on the way.

Footnotes

1. ASTM F141 Standard Terminology as it is related to Resilient Floor Coverings.

2. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

3. ASTM F710-05 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

Additional reading

- *ASTM Standards are available from ASTM International at www.astm.org or (610) 832-9500;*
- *Floor Covering Industry White Paper Position Statement on Moisture Emission Testing available from the World Floor Covering Association at www.wfca.org, and*
- *I also recommend Concrete Floors & Moisture, by Howard Kanare, available from the Portland Cement Association at www.cement.org/bookstore.*

About the Author

A fourth generation floor covering specialist, Christopher Capobianco's background includes retailer, architectural sales representative, technical support manager, consultant, writer, educator and activist.

His company, Flooring Answers, provides training, on-site support, technical writing and other resources for companies that don't have personnel to handle important technical projects.

He has written for several industry magazines such as Floor Covering News, plus his current columns in National Floor Trends and Floor Covering Installer, and has spoken and conducted training at conventions and industry events such as Surfaces.

Capobianco volunteers his time as Chairman of the FCICA (The Floor Covering Installation Contractors Association); The executive committee of ASTM Committee F.06 on Resilient Flooring; Chair of the Resilient Floor Inspector committee of the IICRC (Institute of Inspection, Cleaning and Restoration Certification), and as newsletter editor and board member for LIFCA (Long Island Floor Covering Association). For more information, visit www. FlooringAnswers.com. ■