

By Hank Bruflodt

# MAXIMUM PERFORMANCE

## Avoiding slab moisture problems is crucial in healthcare

Inside any busy medical facility there is a myriad of different tasks taking place, yet all of them have one thing in common. They all are taking place on top of a floor covering material glued down to a concrete slab beneath it.

While that sounds insignificant, if that same floor covering fails to remain bonded, it will quickly become the most expensive post-construction nightmare short of an earthquake.

Floor covering material bond failures over concrete represent a multibillion dollar price tag to every kind of facility from homes to hospitals. Imaging having to shut down a busy facility, move patients out to another location, remove all objects in the room and then deal with the construction process needed to remedy and replace everything. The downtime costs, frustration levels and legal pursuits are historic. The only thing that is not well known about this problem is why it occurs so often.

All concrete slabs emit moisture in the form of water-vapor from the surface. If the volume of moisture exceeds the dissipation ability of the floor covering placed over it, moisture becomes entrapped between the slab and flooring.

In time, the volume of moisture and the chemistry of the substance will destroy the bond of the flooring, resulting in bubbles, seam splits, curling and other physical signs that ultimately result in trip hazards, breach of sterility, and aesthetic and performance loss.

Most people in medical building design and construction understand the devastating effect of unwanted moisture moving in through roofing, walls, windows and HVAC systems. In fact, unwanted moisture intrusion like this represents a substantial number of construction litigation cases. Great measures are taken to minimize the potential for roof and wall system moisture, but when it comes to the concrete slab the misunderstanding is actually amazing.

When a slab is poured on the ground, it is usually placed over a sand layer that is on top of a plastic sheet or over a sand-bed. This plastic sheet is commonly called a vapor barrier, is better termed a retarder. (You can never stop ALL moisture vapor from entering a building, only minimize its volume to where it's not a problem.) This measure is taken to reduce the long-term intrusion of moisture from the ground. Underslab vapor retarders however, have no effect on controlling the moisture that was inside the concrete during its construction that still has to escape.

The time it takes for a concrete slab to lose enough water-of-convenience to be acceptable to floor covering installations is usually considerably longer than the construction schedule. Building envelopes are supposed to be just that, but cannot become an envelope or internal environment until they are enclosed and the HVAC system is put into operation. It is then that many slabs begin to dry.

Those with experience in this realm already know that the floor covering material is one of the last things to be installed in a new facility and in most cases just a few days after the building has become an envelope, if even then. The acclimation of an interior creates an environmental effect on the building that draws moisture vapor out of concrete. How much moisture comes out of a given slab is governed by many variables, beginning with water/cement ratio, followed by surface profile, and ultimately drying time.

In most cases, buildings that are under fast track construction schedules are at risk for having all the right ingredients to create a floor bond problem. The American Concrete Institute long ago created a general rule on concrete slab drying. When it is 70 degrees or warmer with no more than 40 percent relative humidity nor more than a 15 mph wind, concrete slabs will dry at a rate of 1 inch

thickness per month. If the slab becomes rewetted anytime during the initial drying process, double that time.

The problem with moisture-related floor covering bond failures is discussed by every manufacturer of flooring products and is often a crowd-gathering subject when presented at seminars and monthly dinner meetings in the construction industry. The issue isn't whether or not there is natural moisture to a slab that can affect the bond of the floor down the road, the issue is really whose moisture it is.

Some years ago, the floor covering community governed by the World Floor Covering Association, banded together and published an industry position paper that is easily available at their website today. This paper summarizes very well the complexities involved in achieving floor/slab compatibility but also outlines the responsibilities they feel should be taken by all construction parties.

The owner drives the construction schedule in most cases, and needs to learn that concrete will dry on its own time, governed mainly by the environment. If the slab cannot achieve a moisture condition within compliance for flooring, the owner can elect to prolong the construction schedule or pay for additional costs needed to seal the slab from the surface to render it compliant for safe installation. Those are the only choices.

However, in most cases the awareness of this potential problem is not discovered until the last hour of construction when the floor covering is ready to be installed. The floor covering contractor who is diligent and cares about their own liability, will ensure moisture tests be conducted before laying a single tile on the ground. If the tests show everything is okay, they can proceed safely. If not, it becomes an interesting problem almost immediately.

In most cases, it becomes an emotional issue. The flooring contractor wants no liability for a failure and will ask



**1. A brand new floor (left side) installed over a properly sealed concrete slab. Patches are cement compound used to make the surface smooth.**

**2. Plastic sheets or vapor retarders under the slab are ineffective when the sand fill is first covered by rain water.**

**3. Half the floor is being treated while the other half is being used to transport patients in this Texas hospital.**

**4. Crewman install a concrete moisture sealer on a new slab at a Southern Californian high rise hospital building.**

**5. A floor failure with missing tiles in a Northern California hospital caused by concrete slab moisture.**

the general contractor to sign off on installation. The expectation is, the sign off will protect them legally from damages if they proceed to install anyway, even over a known problem condition. If the floor contractor refuses to install until the situation is fixed, it leads to delays and sometimes incompleteness damages placed on them.

The only way to address the problem is to be proactive in the specification process and to understand the time lines, the environmental conditions, and to have a plan to remediate the moisture condition prior to floor covering installation should test results come back high or unsafe. If the level is low, the allocated funds will not need to be spent. If they fail, meaning the slab needs to be sealed, then the money was already in the budget and the time was put into the schedule to fix the problem correctly.

Unfortunately, in most cases the general contractor is blamed for making a bad slab when they are the first to bring up the subject of high moisture test results at the last hour. The general contractor is forced to pay more money to render it compliant for flooring, even though the fault is best contributed to the age of the concrete, not the concrete itself.

Medical facilities cannot afford to shut down and move out because of the floor problem, and that should be the foremost thought on the minds of everyone in the construction process. If the issue is left to blame on the general contractor or flooring sub, it doesn't eliminate the risk or the experience of a failure, regardless of fault.

In every floor failure, the owner of the facility would confess that if they had known and understood the risk factor, they would have taken whatever precautions they could, rather than experience a costly failure and in some cases biological growth of bacteria and mold which can destroy a building. Hospital administrators are forced to lay off staff, move patients into other facilities and are at a loss to understand what happened, who

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is at fault and what to do next. The frustration levels are understandable, often unbearable.

So what to do? First, understand that the problem of floor moisture is one of nature, not necessarily some particular party's fault. Second, consider the construction schedules, concrete mix designs, placement specifications, building acclimation issues and floor covering sensitivities. If there clearly is risk involved, the owner needs to have the architect specify a treatment that is proven effective to solve the problem and then pay for it. The solution has to be viable, which is another complicated subject best saved for another time.

In many cases where a plan for remediation has not been thought of and budgeted beforehand, the owner forces the architect, general and subcontractor to absorb the cost. Their attitude is that they paid to have a building made, and that's that. But somewhere in the mix, because they are driving the construction schedule ultimately and not giving the concrete time to dry, they are forcing an unrealistic expectation.

Building owners, architects and contractors need to be on the same page when it comes to this rather misunderstood but all too common problem. That starts with admitting it exists, believe it or not. Too often one hears, "We have never had a moisture problem" only to discover that they just haven't heard about it, for it may take a year to occur, another year to figure out what happened, and yet another year to learn enough to

finally make it a legal pursuit.

The sociology of the problem is far more complicated than the physics. New slabs don't dry fast even with all the precautions taken to put vapor retarders under them. But who gets to pay for resolving the issue is an ongoing argument that occurs every day somewhere in our nation, as well as in other countries. This thing affects the homeowner to members of the Fortune 500. No one and no organization is immune.

Those who design, build and own medical facilities have a serious responsibility to the public whom depends on them to be functional. If the architect and owner agree to specify and install a remediation system then it should be done and its costs become just another part of the building. If they didn't plan for it in budgeting but discover the potential for a problem, then again the owner should pay for a solution or perhaps give the building an unrealistic year to dry out. But the moisture belongs to the owner, not the architect, general or floor subcontractor.

It's when nothing is done that the flooring contractor is put in to a Catch-22 situation and may be forced to install and risk the liability for a failure. Likewise for the general contractor, they get blamed for doing something wrong and look for the cheapest solution possible whether it's viable or not since they have to pay for it, leaving once again the owner to suffer the consequences of downtime.

There is no excuse for a floor failure, other than ignorance. The physics are not complicated, but the social issues have always been and that is why moisture related floor covering failures continue to occur. ■

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