J+J FLOORING GROUP
A DIVISION OF ENGINEERED FLOORS

Moisture in Concrete and the Impact on Flooring Systems

Water is an essential ingredient in concrete, but uncontrolled excessive moisture can create a whole host of problems with concrete floor slabs.

Concrete slabs are the most common flooring base used in a range of buildings including residential and commercial. Like the majority of building materials, concrete constantly interacts with the conditions around it - temperature, humidity and other factors all have an impact on the moisture levels in concrete.[1]

Water is an essential ingredient in concrete, but uncontrolled excessive moisture can create a host of problems involving concrete floor slabs. Moisture related problems in flooring are more prevalent today then they used to be. Factors such as these listed below are responsible for moisture problems: [2]

- Fast track construction
- Omission of moisture protection
- Inadequate materials being used
- Moisture protection being installed improperly

Moisture in a concrete slab comes from two sources: free water (otherwise known as water of convenience) is the water above what is necessary to hydrate the cement particles and brings a concrete mixture to a workable consistency. The second source of moisture in a concrete slab is the result of moisture rising from below the slab. Moisture vapor that comes up from beneath a concrete slab usually results from failing to install a low-permanence vapor retarder directly below the slab. Not using a barrier to stop the moisture sets the stage for problems.[3]

Moisture Implications on Flooring

Excessive moisture from floor slabs after installation can cause floor covering system failures such as: [4]

- Debonding of coatings
- High pH attack on floor finishes
- Microbial growth
- Release of adhesive
- Flooring expansion

These failures can mean significant, expensive damage to a flooring system. Hundreds of millions of dollars are spent annually in North America to correct such problems.[5] If moisture issues are identified before the floor covering is installed, corrective measures are much simpler and less expensive than after the flooring is in place.

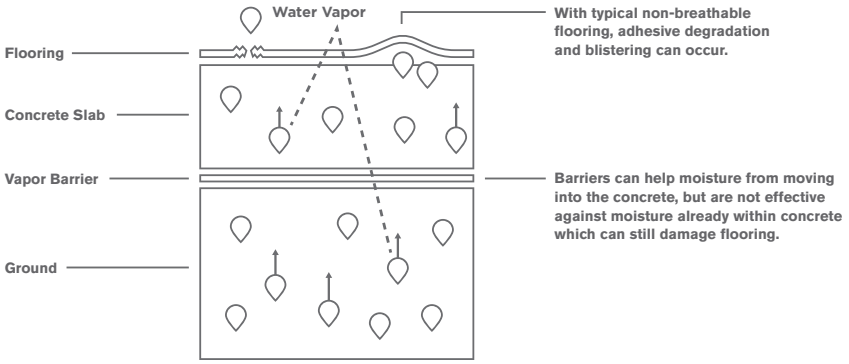

Table 1. **Maximum Value of Relative Humidity in Concrete**

Max. % RH	Cover Material
75%–85%	Rubber
80%–85%	Broadloom Carpet with Synthetic Latex Backing
90%	Luxury Vinyl Tile and Plank Modular Carpet with Thermoplastic Backing Sheet Vinyl
100%	Kinetex with PreFix

Several approaches are being promoted to mitigate moisture-related influences for new and remodel projects before the flooring is installed.

Moisture Testing

Substrate surfaces must be tested for moisture emission prior to starting the installation. There are two industry standards for measuring moisture vapor emissions in concrete: Relative Humidity testing (ASTM F-2170) and Calcium Chloride Testing (ASTM F-1869)[6]

Relative Humidity is the ratio of the amount of water vapor in the air at a specific temperature to the maximum amount that the air could hold at that temperature, expressed as a percentage.[7]

The Relative Humidity Test (ASTM F-2170) measures the percentage of moisture within the concrete by holes that are drilled into the concrete slab. Probes are inserted into the holes that report the Relative Humidity. The ASTM F-2170 standard requires that the holes be drilled at 40% of the depth of the concrete to achieve accurate results.[8] Regarding acceptable Relative Humidity probe testing results are by product (see chart).[9] The maximum acceptable pH is 9.0.

Calcium Chloride is a white deliquescent compound, used as a drying agent, refrigerant, preservative.[10] The Calcium Chloride Test (ASTM F1869) determines moisture vapor rate (or MVER) from a concrete slab. Calcium chloride testing involves sealing a small dish of calcium chloride on a clean section of concrete under a plastic dome. The salt absorbs moisture in that environment and the weight gain after three days is used to calculate the MVER.[11]

Most manufacturers and flooring installation contractors recommend Relative Humidity (RH) probe moisture testing, as the results are more accurate, reliable and consistent.

Solutions for Moisture in Concrete

If high moisture emission is discovered, then proper precautions should be taken to prevent flooring system failures.

I. Mitigation - Several approaches are being promoted to mitigate moisture-related influences for new and remodel projects before the flooring is installed. Topical applications used for moisture mitigation include the following:[12]

a. Reactive penetrants – reduce moisture and soluble alkali transfer from the slab by reducing the surface porosity of the concrete and by chemically combining with hydroxides within the cement paste.

b. Moisture retarding coatings - slows moisture emission from the slab and help isolate the applied flooring material from the pH - raising effects of soluble alkalis in the concrete.

c. Modified cementitious overlays – epoxy-based or epoxy-modified coating overlays used to form a separation layer between the base concrete and the applied flooring system. Acts as an isolation barrier to keep solutions of alkaline salts within the concrete from reaching the adhesive.

d. Dispersive membranes (modular use only) – uses a fiber mat membrane to provide a diffusion path beneath flooring materials. The membrane can be adhered directly to the prepared concrete surface or applied over certain coatings.

II. Selecting a floor covering with higher tolerance

There are floor covering options, such as Kinetex with PreFix, that will perform in elevated RH slabs up to 100%. The breathable nature of these flooring products allow moisture to pass through the backing rather than trap it underneath.

For more information regarding J+J Flooring Group products and concrete testing, please contact our Customer Relations Department at 800.241.4586.

Notes

[1] Spangler, Jason. "6 Outside Sources for Concrete Moisture." Retrieved from http://www.wagnermeters.com/6-outside-sources-moisture.php; accessed July 29, 2013.

[2] Craig, Peter. " Problem Clinic: Moisture Problems with Concrete Slabs." *Concrete Surfaces.* Hanley Wood, LLC, March 2007. Web. August 13, 2013.

[3] Craig, Peter. " Problem Clinic: Moisture Problems with Concrete Slabs." *Concrete Surfaces.* Hanley Wood, LLC, March 2007. Web. August 13, 2013.

[4] Kanare, Howard. " Why Are We Still Having Problems with Moisture and Concrete Floor Slabs." *Concrete Construction.* Hanley Wood, LLC, November 15, 2007. Web. July, 29, 2013.

[5] http://en.wikipedia.org/wiki/Epoxy_Moisture_Control_System_%28Flooring%29

[6] http://en.wikipedia.org/wiki/Epoxy_Moisture_Control_System_%28Flooring%29

[7] http://www.thefreedictionary.com/relative+humidity

[8] Smith, Ron. " Performing Correct and Accurate RH Testing in Concrete Slabs." *Floor Covering Installer.* BNP Media, Oct/Nov 2009. Web. July 28,2013.

[9] Kanare, Howard. "Concrete Floors & Moisture." Portland Cement Assn, 2008. Chapter 6.

[10] http://www.thefreedictionary.com/calcium+chloride

[11] Spangler, Jason, "A Quick Course in Concrete and Moisture." Retrieved from http://www.wagnermeters.com/concrete_basics.php; accessed July 29, 2013.

[12] Craig, Peter. " Moisture Mitigation for Concrete Slabs." *Concrete Repair Bulletin.* International Assoc of Concrete Repair Specialist, Jan/Feb 2006. Web. July 27, 2013.