WWW.CONCRETE DEFENSE.COM

PRODUCTS, INC.

918 N. UNION STREET
APPLETON, WI 54911
(920) 739-8685
1-800-221-638
FAX (920) 739-8704

EPOXY & FIBERGLASS FLOORING, SEAMLESS FIBERGLASS WALL SYSTEMS, SEALERS, HIGH PERFORMANCE COATING SYSTEMS, AND INDUSTRIAL CLEANERS

INDUSTRIAL FLOORING TECHNOLOGY SERIES
#1 MOISTURE VAPOR TRANSMISSION

Perhaps no single topic has aroused more interest and argument than moisture vapor transmissions through concrete. Since 1992 we have tested concrete floors and specified products with this in mind. I believe this is the single greatest reason for industrial floor failure- after poor or no preparation- and it's NOT a complicated subject.

WHAT IS IT.

It's water as a gas. Humidity is moisture vapor. It is NOT liquid water. Puddles on the surface or ponds under the concrete are not moisture vapor. It is not hydrostatic pressure, which is water pressure from the outside like against a dam wall.

WHERE DOES IT COME FROM

Two sources: water put into the concrete at the time the concrete is mixed that wants to come out, or water vapor coming from under and through the concrete.

WATER IN THE CONCRETE

Water is put in the cement/stone/sand mixture to allow the cement to hydrate and get hard and water over this necessary amount is put in to make the concrete flow easily during pouring. The more water the "soupier" the mix and the more that has to come off for the concrete to be "dry" enough to top. The included graph is very useful. On the left side "4" is a good number to focus on. The units are lbs of moisture vapor per 24 hours per 1000sqft of surface. If the rate is 4 or under most generally the surface can be coated and most other types of flooring and adhesives will work also. On the bottom is Days and the various graph lines are different water/cement ratios in the concrete blend. The lower graph is 0.4 water/cement. So a 4 inch thick slab poured at a 0.4 water/cement, curing at 73F in 50% relative humidity with no sealer will get to 4 in 28 days. This is the often used 28 day rule. If the water/cement ratio is higher, if the temperature is cooler, if the slab is thicker, if the relative humidity over the slab is higher, if there is a sealer on the concrete, it will take longer for the concrete to get to 4. Simple.

WATER VAPOR COMING THROUGH THE CONCRETE

If the slab is old or you have waited past when you think the concrete should have dried and the MVT level is still high, you have moisture vapor coming through the concrete from underneath. We test Every job we do in case this is happening.

WHY WOULD VAPOR MOISTURE COME THROUGH THE CONCRETE?

There are three usual reasons:

1. If chlorides are used in the concrete blend the Cl ion VERY much attracts the water molecule and loads up the slab with a LOT of additional moisture. This comes out easily and is continually replaced from below. Chloride levels of 20-50 PPM (parts per million) might be expected from area water. If a core test for chlorides measures 1500 PPM we KNOW chlorides have been added.
2. If the water/cement ratio is high the moisture that comes up and out initially leaves trails in the concrete – capillaries- that makes it easier for future moisture vapor to come through.
3. The relative humidity in the room over the slab is very low and draws moisture up and out of the slab. One Piggly Wiggly store in southern WI lost floor tiles every January. I ran a test and the MVT level was 8.25. The relative humidity in the store was 2% also. Below zero F air was brought in from outside at perhaps 50% RH, heated to 65F, which dropped the RH to near zero. Tiles popped off. A humidifier solved the problem.

HOW DO YOU TEST THE MVT- MOISTURE VAPOR TRANSMISSION- LEVEL

We use the calcium chloride dome test. A weighed amount of calcium chloride, in a petri dish is placed on the concrete, sealed under a plastic dome for 60-72 hr in 60F - 85F temperatures. Using a formula with the time and weight gain of the material gives us the MVT level. This test is a very well accepted ASTM test for MVT.

There are testing methods using drilled probes that measure humidity in the concrete, conductivity of the concrete methods, and radio wave methods. The problem with the other methods is that they haven't been successfully correlated with each other or the dome test, so a reading of one method does not translate to any other method. We stick with the dome test. Data from hundreds of tests from 1992 onward gives us confidence that this tells us when we can coat the concrete. Taping a piece of plastic to the floor and then looking at it is not acceptable nor legally defensible.

WHAT DO YOU DO IF THE MVT LEVEL IS HIGH?

NEW CONCRETE.

1. Wait awhile. As a rule of thumb figure 0.75-1.0 point drop a week in a dry, well ventilated area.
2. If you cannot wait there are several companies that will dry out the area faster. Munters and Lincoln contractors have this equipment.
3. Take off the cure and seal. This helps drying.
4. use a moisture vapor barrier epoxy primer. This works up to 10 or so but does add significant costs.
5. use a product called DRYCRETE, ideally when the concrete is first poured to save money and eliminate the problem at the start- to plug up the capillaries and encapsulate the water in the concrete.

OLDER CONCRETE OR NEW CONCRETE THAT REFUSES TO DRY SUFFICIENTLY.

1. Use a breathable silicate sealer. These are usually a penetrating silicate type material or reactive silicate material such as our FLORIDYNE. These "seal" the concrete and can give it a shine especially if polished. Colors are not possible unless the concrete is already colored or is stained.
2. Use a breathable coating. As a rule 1-2 mil of material will diminish the MVT by 1 point and often let through the remainder of the MVT (such as the Sonenborne Cure N' Seal). This is risky and not a time to experiment. There are a few companies who have specific coatings for this depending on the MVT rate.
3. Put in good concrete.
4. Use DRYCRETE to plug up the concrete and purge out contaminants- will purge chlorides btw- from within the concrete. Selective coatings will stick to this.
5. Yell at the flooring guy- quite a popular approach. This won't change the MVT levels but you will feel better.

HOW TO SPECIFY CONCRETE TO MINIMIZE MVT TROUBLES

I won't go into concrete blends because you are probably more knowledgeable in blends for specific uses.

1. DO NOT put in chloride accelerators. These give a moisture transmission problem, void most warranties especially for barrier topping materials, and will corrode any steel rebar in the concrete. There are non chloride accelerators that work but you need to check them. One that was used still caused a problem. We checked and found that non chloride actually meant low chloride and the material had 1/3 of the usual chloride level… Sooooo the contractor had to use 3 times as much…
2. Low water/cement ratio. 0.45 is pretty good.
3. Do not allow any water addition in the field to make the concrete easier to place.
4. Water reducers work.
5. For a better chance of success install a plastic vapor barrier- 10 mils minimum- under the slab. This is particularly important for thicker epoxy surfaces- ¼" or so, and for installations where fix ups will be very costly or cause unacceptable down time. Put the vapor barrier under the slab so as not to rip it up with screed stakes or during the concrete placement.

I hope this helps

Tom Hennessy

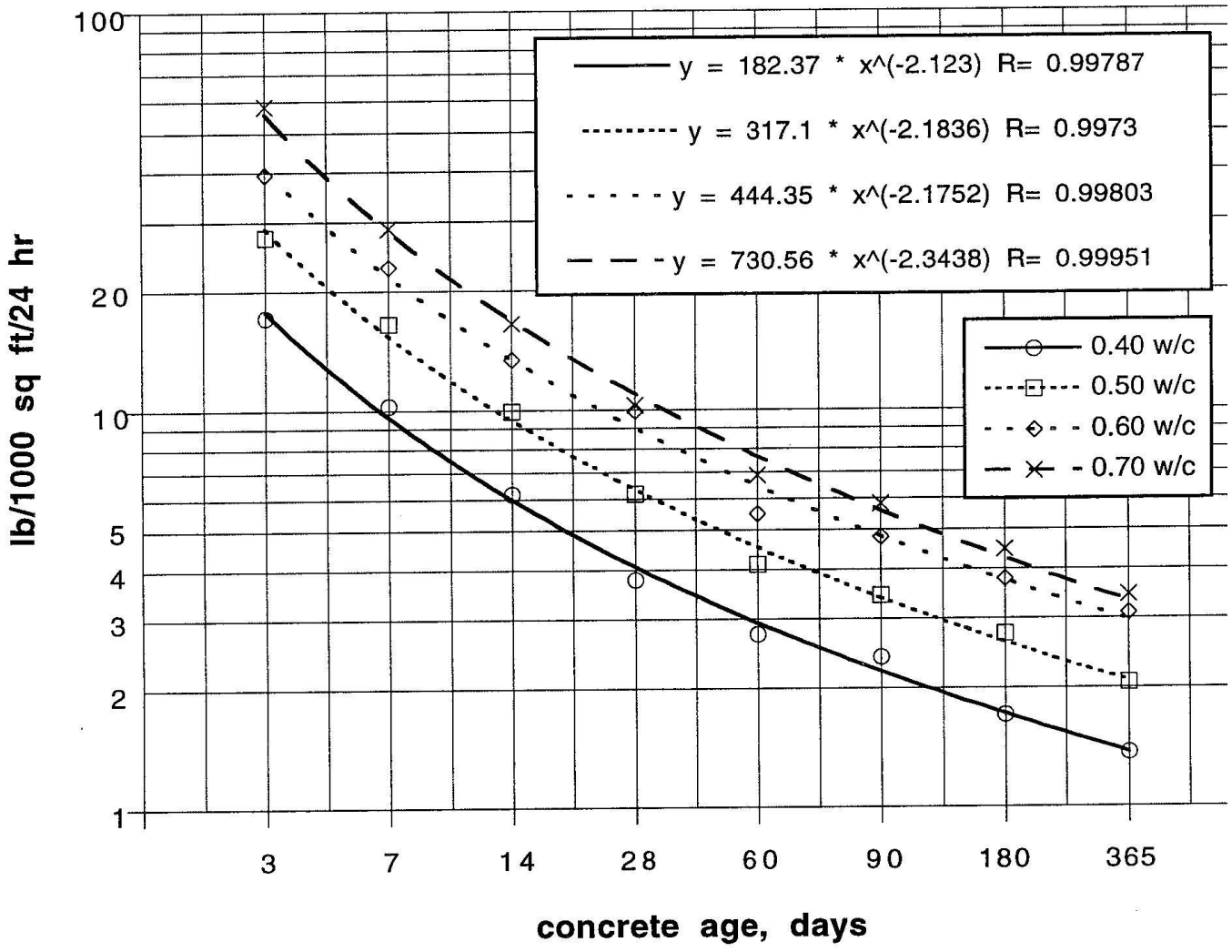
www.Concr...defense.com

PRODUCTS, INC.

918 N. Union Street
Appleton, WI 54911
920-739-8685
or 1-800-221-6381
Fax: 920-739-8704
EMAIL: CDPEPOXY@AOL.COM

Epoxy & fiberglass flooring, seamless fiberglass wall systems, sealers, high performance coating systems, and industrial cleaners

Moisture Vapor Emission Rates From Concretes



Data from H. W. Brewer, "Moisture Migration-Concrete Slab-on-Ground Construction" Jnl PCA R&D Labs, vol 7, no 2,1965. (4" slabs, dried one side at 73F/50%RH, moisture vapor other side)