Preventing the absorption of moisture in concrete and its damaging results is a major challenge for professionals within the building industry. After concrete has cured, how do we prevent the absorption of moisture from outside sources? Should this be a concern?

In order to answer these questions, we need to begin with a basic understanding of the *water cycle*.

According to the ***U.S. Geological Survey (USGS),*** "The *water cycle* describes the existence and movement of water on, in, and above the Earth. Earth's water is always in movement and is always changing states, from liquid to vapor to ice and back again".[1]

"The USGS has identified 16 components of the *water cycle*"[2]…composed of storage, movement, and exchange. Let's briefly consider those that can directly impact moisture levels in concrete…

- Evaporation
- Condensation
- Precipitation
- Surface runoff
- Infiltration
- Groundwater discharge

"**Evaporation** is the process by which water is changed from liquid to a gas or vapor.

Condensation is the process in which water vapor in the air is changed into liquid water. Condensation is the opposite of evaporation.

Precipitation is water released from clouds in the form of rain, freezing rain, sleet, snow, or hail.

Infiltration is the downward movement of water from the land surface into soil or porous rock. Some water that infiltrates…will gradually move vertically and horizontally through the soil and subsurface material".[3] "Infiltration is governed by two forces…gravity and capillary action".[4]

"Surface runoff is precipitation runoff over the landscape. When rain hits saturated or impervious ground it begins to flow downhill".[5] "If the rainfall intensity exceeds the evaporation rate and infiltration capacity of the soil, surface runoff occurs".[6]

"Groundwater discharge is the movement of water out of the ground".[7]

Concrete is a porous material…

Pete Robitaille, in an article written for ***Construction Canada***, wrote that "Moisture in concrete can result from a lack of protection of an efficient vapor retarder beneath a slab, as water moves up from the ground through capillary action or hydrostatic pressure. The concrete acts like a sponge, drawing up moisture from damp areas below to dry areas toward the surface until it reaches a natural balance. The problems may arise either soon after installation or during the structure's lifetime due to changes in climate or the environment. **Moisture rising from concrete slabs can come from numerous sources, including concrete, drainage, burst pipes, condensation, aggregate above a membrane, and the ground itself**".[8]

Along with capillary action, concrete can absorb moisture through osmosis. This is the movement of fluid from an area of lower concentration to an area of higher concentration until equilibrium is attained. The moisture content of concrete is in a constant state of change…especially at the surface. **This is a very important reason to *always perform* Relative Humidity (RH) testing prior to sealing or covering concrete!**

We discussed a list of possible sources. What can be done to help prevent this potential problem?

Here are some simple solutions to consider…

- Provide an approximate 6-8" gravel barrier between the subsurface and the concrete.
- Install a vapor barrier in accordance with ASTM E1745 standards. Vapor barrier should be installed along vertical as well as horizontal concrete surfaces to achieve adequate moisture protection. **Concrete 101!**
- Plan and provide for adequate drainage in accordance with local and national building codes. If you are in an area that has significant moisture challenges, consider having an engineer who specializes in drainage, consult and advise you on best practices. You may even need the builder to install a "French Drain" system that connects to all the downspouts of the gutter system! **Bottom line…Minimize your risk!**
- Keep your concrete mix as dry as possible during the pour. A concrete mix containing less water, becomes denser as it cures (less porous).
- Allow the concrete to cure adequately prior to sealing or covering. **Very important!**
- Always…always perform Relative Humidity (RH) testing prior to sealing or covering.

Probably one of the greatest solutions to preventing moisture-related problems in concrete includes a vapor barrier.

"To reduce this ingress of moisture, a well-designed floor system will have a capillary break and an effective and intact moisture vapor retarder in place. Slabs on and below grade can be affected by both water vapor and capillary rise. Below-grade slabs are closer to the water table, have poorer ventilation for drying and have the added risk of hydrostatic pressure. On-ground concrete slabs and below-grade slabs must have an effective and functional vapor

retarder directly beneath the concrete to prevent ingress or moisture from the sub-base and subgrade soil".[9]

It should be the type of vapor retarder that…"conforms to the requirements of **ASTM E1745, Standard Specification for Water Vapor Retarders Used in Contact with Soil of Granular Fill Under Concrete Slabs**".[10]

Concrete is a porous material and is always subject to absorbing moisture...(with potentially disastrous effects). Solutions and resources are available to minimize the problem. Proper planning, consulting with experts, and a healthy dose of common sense…can keep concrete professionals sleeping restfully at night!

Leave a comment below about your experience…or email us today and let us know how you prevent moisture problems when pouring concrete!

*Always review ASTM standards to ensure that your project is planned and completed in accordance with current ASTM specifications.

References

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