Concrete destructive Forces... Uncontrolled water vapor transmission through concrete driveways, walkways and decks causes millions of dollars of damage to your investment annually; let us show you how and why.

WILL CONCRETE TRANSMITE MOISTURE?

Yes. Regardless of the concrete composition, concrete is a hygroscopic material. Like a sponge, it will absorb moisture from the air and often expand. And if the humidity on one side of the slab is different from that on the other, it will transmit moisture, like a dry sponge dropped on a puddle of water. The greater the cement content in relation to the original water content (cement psi), the lower the rate of moisture transmission will be under given conditions.

Two Identifiable methods of Water Transmission

1.Hydrostatic Water Pressure. Hydrostatic, or "headpressure," is the force caused by a column of liquid water. Imagine pushing an empty bucket into a basin of water and what you feel is head pressure. The deeper you push, the more pressure. While hydrostatic water pressure typically will not harm solid concrete, denser concretes - those created with a water-to-cement *(w/c)* ratio of 0.40 or lower- have higher resistance to moisture transmission from hydrostatic and vapor pressures. However, hydrostatic water pressure will force itself as a liquid through quality concrete when defects such as sand streaking, honey combing, cracks and leaking joints have not been properly repaired and/or sealed.

Concretes with higher *w/c* ratios typically form more permeable cement paste, which encourages capillary movement of water as liquid and vapor. Hydrostatic pressure is only a problem when the water is in direct contact with the concrete surface.

2.Water Vapor. Water can exist with concrete as a solid (ice), liquid (water) or gas (vapor). Water vapor molecules more easily take the shape required to pass through the concrete mass, whereas the liquid state becomes a solid that maintains a definite volume or size.

Water vapor problems are typically associated with slabs-on-grade that are located in high water table areas, and where water membrane systems have been damaged and are holding water between the membrane and concrete slab.

Water in a liquid state is an essential part of portland cement concrete technology. It smears with about half the cement molecules in the concrete mix to create an adhesive cement paste - that bonds the sand and stone aggregates together. The other half is left as inert filler within the concrete mass. And of these filler molecules, about 25 to 40 are water-soluble.

WHAT CAUSES VAPOR TO MOVE WITHIN THE CONCRETE?

Since gases are capable of expanding and changing shape, they are capable of wiggling through the unused cement molecules and tiny voids as small as 5 micrometers within the concrete mass.

In general, the gas is harmless to the concrete mass as it moves through the structure. The problems start when the gas changes into a liquid state.

Typically, the gas does not turn into a liquid until the condensation process of reduction of matter into a denser state takes place. This is believed to only happen when sufficient size voids are present. Concrete can only contain a certain amount of vapor at a given temperature. As the temperature of the concrete rises, so does the volume of vapor, and it decreases as the temperature falls. This is often referred to as the "yo-yo effect." As the concrete cools further, the excess water vapor condenses within any surface void. If the temperature drops below the freezing temperature of water, frost is formed within the concrete.

As the condensation process takes place, the new water in liquid state contains a pH value of 7 or neutral. Water at a pH of 7 will attack other sources of ions that are available to change its chemistry. The weakest source of ions present within the void is the cement molecules. The cement molecules that are soluble are the first to be dissolved. As the process of condensation continues, so does the dissolving of the cement ions and the void continues to enlarge.

As the soluble molecules change their state, other molecules become exposed to the same destructive condition. Other insoluble cement ions and sand particles are affected by the lost of a solid material with which to bond. And when these voids within the concrete are closer to the floor surface, a large enough void causes overlay debonding, cracking and deterioration.

MORE DAMAGING FORCES

When the gas turns into a liquid, another new force is introduced, called capillary action. The liquid molecules are attracted more to the surrounding surfaces than its own
surfaces. This force allows the liquid water molecules to travel in horizontal or vertical directions. Capillary action allows the water to travel through the accelerated deteriorating concrete.

Water liquid molecules behave as though they have a delicate skin on their surface, and this holds them together in droplets. The water molecules that are closer to the outer concrete surface or to larger voids within the mass will exhibit another surface tension property, that of wetting out and dissolving the cement molecule to which they attach. Concrete is often subjected to wet and dry cycles. During the dry cycles, the water evaporates from the solution, leaving a dust or powder, called effervescence.

Can water transmission be stopped within an existing slab?

The good news is: Yes! With a good concrete sealer you can greatly reduce the transmission of water through you concrete investment.; Saving you money and aggravation down the road.

Call us to see how we can help...