A new Era for the Concrete Curing Rack · part 1

Condensation causes Corrosion

Everyone who works in concrete block, paver or slab production knows the effect: when entering a curing chamber that is in operation, the lenses in your glasses fog as a result of the humidity in the chamber. After some time, however, the effect diminishes and your lenses clear. This is a simple example of one of the numerous physical processes that occur in a concrete curing chamber. As simple as this may seem, there are cases in which it is not so easy to get the forces of nature working for you and not against you.

High humidity is desired in concrete curing chambers. Humidity improves the quantity and quality of hydration in the concrete. However, it is important to maintain the equipment and other metal structures in the chamber in a dry state in spite of high humidity in order to prevent condensation. In most curing racks, condensation leads to the development of corrosion at the base of the columns.

"Corrosion is the result of condensation, the enemy of steel," says concrete curing expert Michael Kraft. Condensation is the transition of water from a gaseous (hot humid air) to its liquid state. Condensation of water will always occur when hot humid air meets with a colder surface, such as on the lenses of your glasses at the moment you enter the curing chamber. You and your glasses enter the chamber from a colder environment and subsequently your glasses are colder than the air in the chamber.

Condensation is the process that causes clouds, fog, frost and dew. Temporary condensation does not constitute a problem. After some time, your spectacles will no longer fog over because they have adapted to the temperature conditions in the chamber.

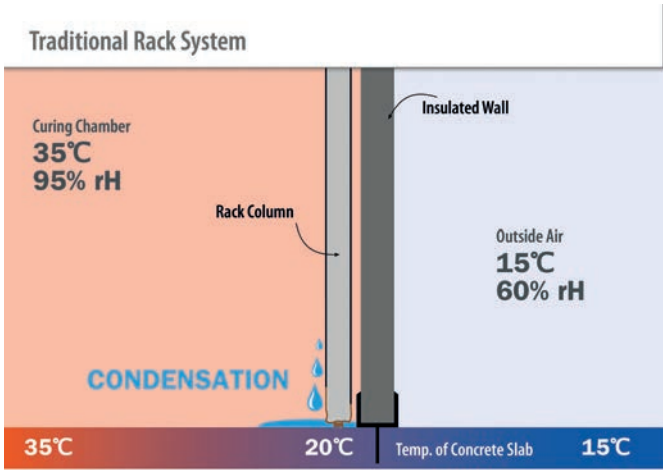
Column corroded due to condensation. This completely corroded lower column portion is only held in place by the rest of the rack system and requires immediate replacement

Typical effect of condensation: columns closer to the chamber's center are dry and free of corrosion while those located at the perimeter (right) have corroded at the bottom

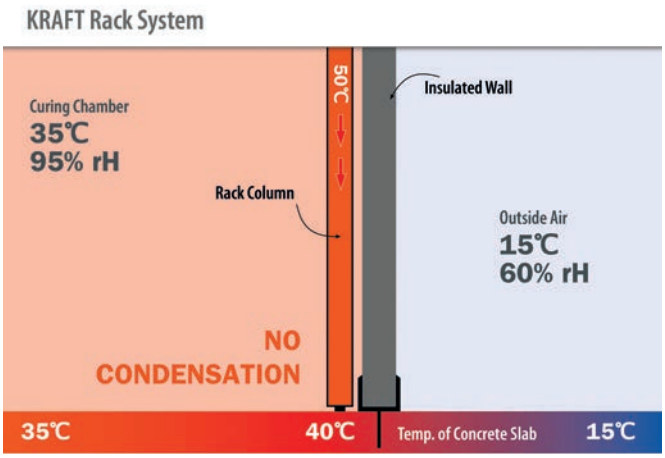
Condensation is beneficial to semi-dry concrete. When the concrete blocks, pavers or other products enter the chamber they are cold. Hence, condensation forms on the surface of the concrete – approximately 5 grams (2.6% of the total water weight) for a standard rectangular paver with a total green weight of 3,406 grams and a green water content of 191 grams. This additional water is utilized by the cement in order to form additional CSH gel for a more dense surface and harder corners and edges.

But why do some columns in curing chambers corrode while others do not? One would expect that all columns adapt to the prevailing temperature over time. However, if you look at which columns are affected, one will usually find the perimeter columns corroded.

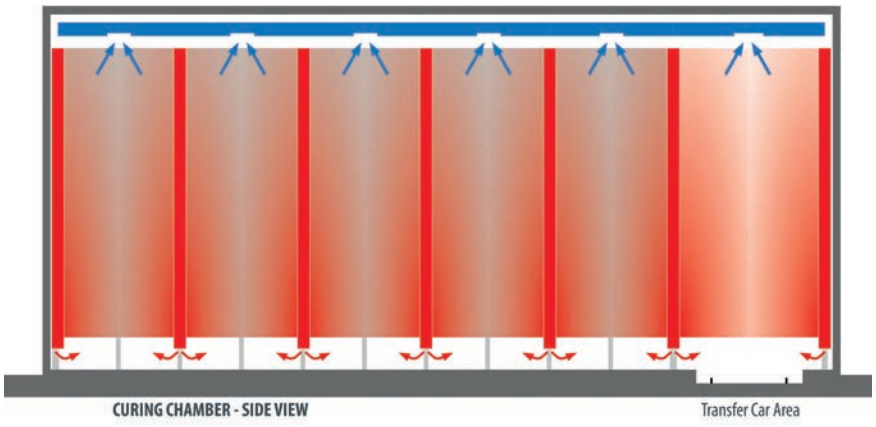
Let us get, literally, to the bottom of the problem: the cause for the build-up of water at the perimeter of the curing chamber is not typically due to ground water leaching out of the concrete slab. Instead, what is actually happening is that the concrete slab acts as a thermal bridge between the colder outside and the warmer, more humid inside of the chamber – transferring coldness through the slab under the insulated chamber wall and cooling the lower portion of the perimeter columns. As a result of the cold floor at the perimeter, condensation appears, just like in our glass lens example. However, unlike the lenses, the lower portion of the perimeter columns has no chance to adjust to the chamber temperature because of the constant thermal bridge bringing coldness into the chamber. The bottom of the perimeter columns remain colder than the warm moist air inside the chamber on a permanent basis. When the warm moist air comes in contact with the colder surface of the floor and lower portions of the columns, condensation appears on the columns, drips down



Columns at chamber perimeter corrode because the concrete slab below, acting as a thermal bridge, cools them. The temperature difference between the column and its warmer environment fosters the occurrence of condensation, with the result that the support will continuously be damp in its lower section, eventually showing corrosion.



No condensation with the new Kraft Rack: the columns, used as air ducts, become part of the curing system and remain warm and dry. The concrete floor/slab can no longer act as a thermal bridge.



The new Kraft Rack system achieves superior distribution of the curing chamber environment by using the supports as air ducts.

and creates puddles in which the columns stand and eventually corrode.

A theoretically feasible solution would be an appropriate insulation of the foundation slab. This measure, however, exceeds what would be considered a reasonable effort and investment.

Kraft Curing offers a much more obvious solution. Kraft's new integrated curing rack is designed in such a way that the air distribution system for the curing chamber is incorporated in the load-bearing structure – the columns. The rack steel is used as ducts to consistently distribute air, humidity and heat evenly throughout the entire curing chamber, independent of the chamber's size.

The perimeter columns are heated up and, in turn, heat up the concrete floor, moving the thermal bridge to the outside of the chamber and preventing the formation of condensation. The warm concrete floor radiates heat into the chamber, contributing to the curing process. This elegant solution does not only result in an extremely uniform curing climate, but also guarantees that the entire load-bearing structure remains dry on a permanent basis despite providing optimum moisture for the concrete curing process. All columns, including those located at the chamber's walls, will permanently remain dry and protected from corrosion. Consequently, the complete rack system will remain intact and will not have to be replaced even after years of operation.

Kraft Curing is confident that this technology is the way forward for the future and offers a 50-year corrosion warranty for its new curing rack when a Quadrix curing system is incorporated, a promise unheard of so far in the industry.

For further information on the new Kraft® Rack please refer to www.kraftracks.com.

FURTHER INFORMATION

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