



New Technologies

REMOVING OR KEEPING WATER OUT OF CONCRETE

By Chris Stanley

We are all aware of the traditional methods of keeping water out of concrete by using sheet or spray applied membranes or by using penetrating spray on chemicals such as Silanes. Other well known methods include the use of waterproofing admixtures.

How Does Water Penetrate Concrete

We all know that water penetrates concrete through defects such as cracks, tie-bolt holes, & badly formed construction joints. What is not generally known is that water often passes through concrete via small capillaries.

When we mix concrete we add more water than is actually needed to set the cement. This additional water is added to make the concrete workable enough to enable us to mould it into the shape of the formwork in which it is placed with the minimum amount of effort.

What happens to all this excess water after the concrete hardens? The answer is that it slowly dries out of the concrete leaving very small passages known as capillaries. These are too small to be seen by eye but they are present in all concrete. And if water can get out of the concrete it follows that it can also get back in.

Causes of Water Ingress due to Capillary Action

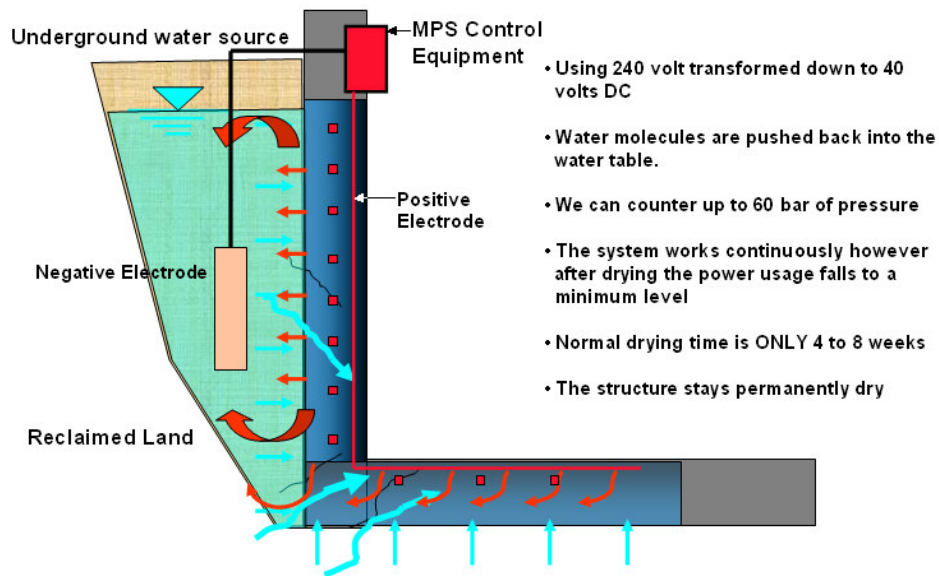
If one side of a concrete wall or floor is wet relative to the other, as for example happens in a basement or tunnel or underpass, the water can migrate through the concrete especially if there is a temperature or water pressure difference from one side of the concrete to the other. The water passes through the fine capillaries, in much the same way as tea will climb up a sugar cube if it is placed in contact with the surface of the tea. Even more important, the finer the capillaries, the greater is the water or vapour pressure within them. Water will therefore pass through the body of the concrete as well as through defects such as cracks. This will cause any painted surfaces to bubble & blister as well as surface dampness on the concrete leading to the formation of mould & algal growths in addition to providing perfect breeding grounds for the growth of potentially harmful bacteria.

A new technology to the Asian region

One of the ways to draw water out of concrete and keep it dry is by electro osmosis. This is an evolutionary technology built on well proven scientific theory. It can give new life to existing structures & is also very useful when applied to new build projects. It can offer an economic & permanent solution to all water ingress problems, which are very common on many projects in Hong Kong.

How does it Work

The system works by applying a very low electric charge which is passed through electrodes in the form of probes or wires which are strategically placed within the portions of the walls or floors that are wet. By passing a low voltage pulsating charge between negative & positive electrodes within a structure, any water present within the capillaries becomes ionised. This causes the water to travel towards the negative probe which is placed in damp soil or earth located on the outside of the structure. This permanently prevents water from intruding back into the structure. The wet areas of the concrete are eradicated and will remain dry for the life of the structure. It can prevent water even with a head of 600metres (60 bar) penetrating the concrete as long as the electric power is switched on.



Applications and Installations

The system is widely used in basements, carpark, tunnels, underground carpark, dams, marine structures, foundations, bridge abutments, arches & box sections of segmental bridges.

The installation of the system is simple. Fine titanium wires are embedded just below the surface of the concrete in a conductive grout. Another electrode is positioned in the ground outside the structure. These are connected via a box that provides a pulsating current the action of which drives the water out of the concrete. The system is easy to install and highly competitive in cost when compared with traditional membrane systems.

Advantages

The power consumption is minimal at about 10 watts per 1,000m² of concrete area. The concrete is touch safe, & the system also prevents the corrosion of any embedded steel reinforcement. In addition by minimising water in the concrete it will help to prevent the development of alkali-aggregate reaction taking place within the concrete. Because it eliminates the presence of moisture in basements it reduces the corrosive environment for plant and equipment, fixtures and fittings.

Project Reference

In Hong Kong it has been installed in a section of the MTR & in a basement for Swire Properties amongst other projects. It has also been successfully employed in the London underground system and in housing estates, dams and offices etc.

For further information contact the HKCRA, <http://www.hkcra.com.hk>