

Waterproofing—Is it Necessary in Pool Construction?

By Jerry B. Werner

Of course, we are talking about reducing water penetration through concrete—or waterproofing, as it is known in the pool industry. There seems to be a wide range of opinions on this subject. I have sat through presentations where it was stated that waterproofing was indicated, but understanding the reasons why it was needed and what type of system may be available were not mentioned. I have also read articles in pool trade magazines that would lead one to believe that moisture intrusion into concrete was not a bad thing. There is also the camp that would say that all you need is the proper compressive strength and everything else will take care of itself. Concrete, one would think, will last forever. Unfortunately, this is not the case. The world outside the pool industry has a completely different set of ideas. I am not a pool builder or a pool designer. I am a Civil Engineer and a Florida State Certified Building Contractor and came into the pool industry from nearly 20 years in the concrete repair industry. Before moving to Atlanta, GA, I served on the Board of Directors of the Southeast Florida Chapter of the International

Concrete Repair Institute (ICRI). My company was an investigative and forensic engineering group that reviewed failures and recommended methods of repair. Parking garages were leaking mineral deposits on very expensive automobiles, balconies were literally falling off condominiums, building structures were leaking moisture through concrete and stucco, and bridges were failing. While working with the Federal Highway Administration and local Florida Department of Transportation (FDOT) officials, vast sums of money were being spent to address these issues. Epoxy-coated reinforcing bar and other methods such as cathodic protection were being analyzed. Why? Because concrete in itself is not watertight or waterproof. Protection of the reinforcing bar is very important. As steel rusts, it expands and can cause as much as 10,000 psi (69 MPa) force on the concrete, causing it to crack. Once cracks appear, the process only worsens and the downward spiral begins. More cracks mean more water intrusion, which results in faster deterioration. In coastal Florida, we were also dealing with salt intrusion, which acts as a catalyst that accelerates the process. Unsightly efflorescence is mainly an aesthetic issue but its presence may indicate other issues that could lead to structural damage and debonding of tile if left unattended.

To say that reducing the ingress of water in concrete is not required is to ignore the history that we see every day. Over 30 years ago, concrete bridge structures across the U.S. were reported as being structurally deficient. To date, not much has been done to resolve this problem.

Having said all that, is there any correlation between general construction practices and pool construction? Are the rules and processes any different? Well, let's start from the beginning: what is required to ensure that water infiltration issues are being addressed?

First of all, we start with quality construction and proper preparation of the subgrade. If your pool and deck are sinking due to improper soil compaction, cracking will eventually occur, and so will leaks. Secondly, proper steel placement



Bridge abutment deterioration

Pool & Recreational Shotcrete Corner

and cover must be maintained for the protection of steel reinforcement. Thirdly, use the proper concrete for the conditions that you are confronted with. Whether you are using wet- or dry-mix shotcrete or cast-in-place concrete, there are minimum requirements to meet. ASA has adopted the 4000 psi (27.6 MPa) standard that is found in ACI 318-08. That, however, is a minimum for normal construction for concrete that is in contact with water. There are two other conditions that would require 4500 psi (31 MPa) minimums for freeze-thaw zones and 5000 psi (34.5 MPa) minimums for concrete subject to chloride ion exposure.

All highway departments start with these minimum concrete standards but continue to experience continued deterioration. Many attempt to use protective coatings, but by their own reporting have had only moderate success because they continue to use inexpensive surface materials that fail to provide long-term effectiveness.

Fourthly, the next process, of course, is the plaster coat. Five years ago most pool builders I spoke to about the benefits of waterproofing would tell me that the plaster coat was all the waterproofing that was needed. This was interesting to me, as my past experience was with exterior stucco. My guide was the Portland Cement Plaster (Stucco) Manual—which referred to stucco as weather-resistant—and ASTM Standard C926, “Application of Portland Cement-Based Plaster,” which states that “plaster shall not, however, be considered to be waterproof.” Investigating further, I contacted the National Plasters Council and received the National Plasters Council Technical Manual, which states, “In fact, cementitious surface coatings are not intended to completely stop moisture penetration. The coating should be expected to greatly reduce the rate in which moisture penetrates through the coating and into the substrate.”

That leaves us with the fact that pool construction should be as good as or better than general construction methods—being subject to continuous water and chemical action—and understanding that concrete and plaster are not waterproof.

What are the proper methods, then, to address all the issues that will provide proper protection of the concrete and reinforcing bar, and prevent efflorescence problems? We have to understand that water comes from the pool, from rain, and from the ground. In a vanishing edge condition, water flows over the top of the weir and sometimes results in efflorescence from the grout on the



Applying sealer to pool on 14th floor condo



Vanishing edge sealer application

surface of a tile application. Therefore, we have to match sealing methods with the conditions that we want to prevent. It is not just something that you apply to the inside of the pool. Sealers must also be considered for patios, stone features, and waterfalls. Water that penetrates through a patio can find its way to the back of the shell wall and tile through the groundwater supply. If stone and copings are left untreated, moisture intrusion and thermal changes can result in spalling. This can also be exasperated in salt-generated pool systems. All of these conditions can be mitigated, however, by proper sealing methods.

Pool & Recreational Shotcrete Corner



Efflorescence spa



Efflorescence vanishing edge



Efflorescence vanishing edge (another view)

Efflorescence is an indicator and is the first sign that you are experiencing water intrusion problems. It occurs when moisture that has migrated into the shell wall or mortar and grout dissolves soluble salts in a cementitious mixture and then deposits the residue upon evaporation onto the exposed surface. It will occur very quickly and become a continuous problem for you and your client. To remedy these potential troubles of deteriorating concrete, rusting reinforcing bar, and efflorescence—not to mention leaching chemicals from your pool into the groundwater supply—you need to consider some type of protection beyond quality construction. Quality construction should include a review of the waterproofing needs of your project.

Waterproofing systems basically come in three different types: admixtures; surface-applied systems, such as membranes, cementitious applications, and surface sealers; and deeply penetrating sprayed-on applications that change state from a liquid and reduce permeability from the inside out. In many cases, these products can be used in combination. Compatibility, however, must be evaluated for maximum benefit. Perform your due diligence and select your waterproofing solutions well. For a client to spend a lot of money on their dream pool only to inherit a nightmare is just plain trouble for the pool contractor. The expense and extra effort to make sure you have addressed all of the water infiltration issues will be well worth not having to make a callback.



Patio protection

Pool & Recreational Shotcrete Corner



Jerry B. Werner, Director, Aquaron Aquatics Division, Aquaron Corporation International, is a Civil Engineer and a Florida State Certified Building Contractor (inactive) CBC033127. Werner is also President of Concrete Preservation Systems and works exclusively for the Aquaron Corporation.

As past President of Omega Engineering Consultants, an investigative and forensic consulting firm located in South Florida, Werner performed investigations related to damages and failures from hurricanes and other natural disasters for insurance companies, home owners, and condominium associations. The majority of work, however, focused on moisture intrusion through building systems, much of which was through concrete such as parking decks, concrete or block and stucco wall systems, and seawall protection.

Because of moisture and salt intrusion, condominium balconies along the coast lines of Florida were being destroyed to the point of falling off the structures.

Werner comes into the pool industry, therefore, from a different perspective. Serving on the Board of Directors of the Southeast Florida Chapter of ICRI prior to moving to the Atlanta area in 2003, he had to deal with numerous cases of concrete failures that were caused by moisture intrusion. In 2008, he helped create the Aquatics Division of the Aquaron Corporation, bringing concepts learned over the past 20 years in waterproofing and protecting concrete, and applying them to the pool industry.

A recent member of ASA, Werner now serves on the Pool & Recreational Shotcrete Committee. He has authored several articles for Condo Management magazine and others, and provides technical direction and training for applicator certification for the Aquaron Corporation, Aquatics Division. Waterproofing and control of efflorescence are a main focus for the Aquatics Division of the Aquaron Corporation.