



So, what is internal curing (IC)? Well, let's start with what internal curing is not going to do for you. It's not an elixir to extend your life. It's not repairing kidneys, livers, hearts, backs or relationships with your spouse, friend or mother-in-law.

It's the curing of concrete from the inside out. How do you do that? By placing small quantities of water in strategic locations throughout the concrete, the curing process is extended. In other words, you get better hydration and don't waste valuable cement.

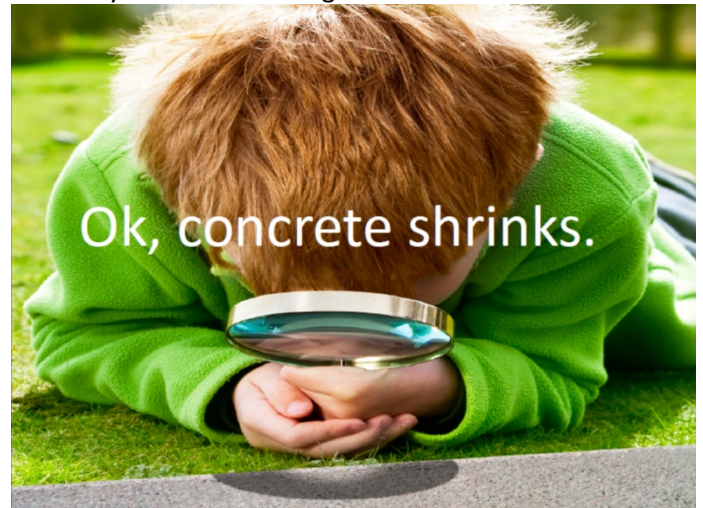
The great news about this very clever internal curing idea is that a 100-year-old sustainable aggregate technology is used to provide and transport the water. By replacing approximately 20% of natural fine aggregate with pre-wetted expanded shale clay or slate (ESCS) lightweight aggregates, the internal curing process magically happens within an ordinary concrete mixture.

What is lightweight aggregate (LWA)? The Earth has been producing LWA from volcanoes since the beginning of time. This natural material, however, is inconsistent and very little is suitable for making concrete. ESCS is specially made for concrete and has been manufactured from surface-mined raw shale, clay or slate for nearly 100 years. (ESCS raw materials typically do not have any other conventional purpose in the construction industry because they are too soft.) The raw materials for ESCS production are placed into a rotary kiln where heat is applied until it turns into a strong consistent material which is called expanded shale, clay or lightweight aggregate or just ESCS for short. ESCS is a uniform, high quality, ceramic aggregate that's about ½ the weight of natural aggregates.

Pores are created in ESCS during the manufacturing process as gases escape due to the application of heat. The newly-created pores are ideally suited to accommodate the absorption of water, much like a sponge. ESCS's greatest contribution, however, is its ability to desorb water. Unlike a sponge, it does not have to be squeezed for the water to be released. This characteristic naturally permits water to egress or be desorbed from the pores of pre-wetted ESCS when the cement demands more water during the hydration process.

The physical ability of the pores to manage water movement is the key to internal curing.

Why is internal curing important? Because concrete has the nasty habit of shrinking.

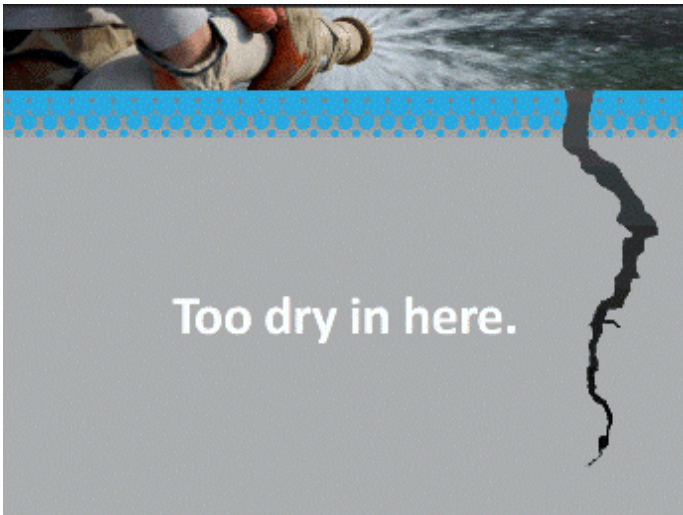


Many times this shrinkage is benign but other times it's a problem waiting to crack wide open and it often does.



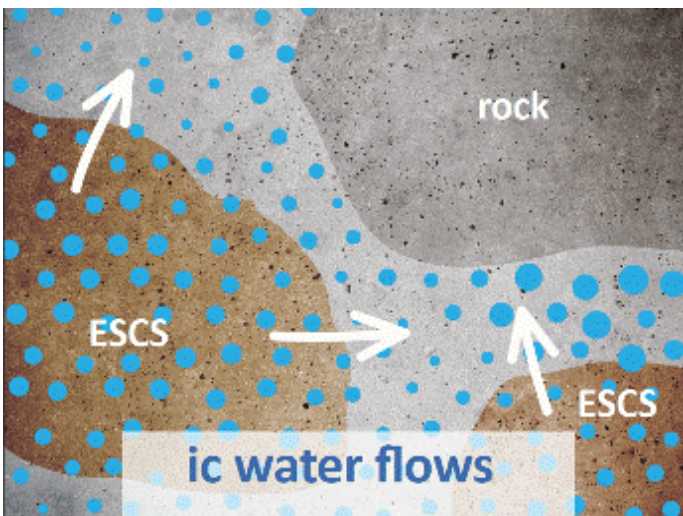
Since concrete cracking is most often the result of overt shrinkage, the life of concrete can be severely reduced as early age cracks grow in size.

Cracks weaken the concrete by exposing its insides to many deleterious things from its in-situ environment. Over time, concrete cracks become exacerbated as small cracks grow into larger cracks.



Even properly externally cured concrete cannot prevent shrinkage, micro-cracking or the start of internal cracking.

The internal curing process mitigates the propensity for concrete to crack by providing uniformly dispersed water via ESCS when the hydrating cement demands it.



In other words, even after the concrete initially gets hard, cement still demands water for a few days. This water is provided to the cement via the pores of the pre-wetted ESCS. This process is not visible to the naked eye but can be measured in the laboratory.

How much IC water is needed? Common IC concrete mixture designs utilize approximately five cubic feet of ESCS for every one cubic yard of concrete. This amount

of ESCS, at a water absorption of 18%, can provide as much as 50 lbs or 6 gallons of water for each cubic yard of concrete. (IC mix designs do vary, therefore, please check with your local producer.)

Due to the appropriate amount of IC water available, the concrete doesn't get thirsty after initial set and therefore shrinkage is greatly reduced or eliminated. (The actual amounts of water capacity per ESCS source vary so check with your local ESCS producer on their recommended material capacity values.)

The next big question should be, "How much shrinkage reduction are we talking about?"

50% or more reduction in shrinkage cracking is easily achievable which can make the concrete appear nearly crack free.



In addition, since ESCS aggregate is an aggregate, looks like an aggregate and handles like an aggregate, concrete product producers can easily accommodate ESCS into their mix designs.



During install, this product is applied in the field like any other concrete. No special equipment required.



Where is it available? Rotary Kiln ESCS for internal curing is available from coast to coast in the United States. Visit www.ESCSI.org to find a producer.

How much does it cost? For a conventional concrete mix, average cost range from zero to a 20% premium above your conventional normal weight concrete price. If IC extends the life of concrete by 50%, how much would you pay? Let's assume we are extending the life of a bridge, road or parking garage by 50%. What is the real value?

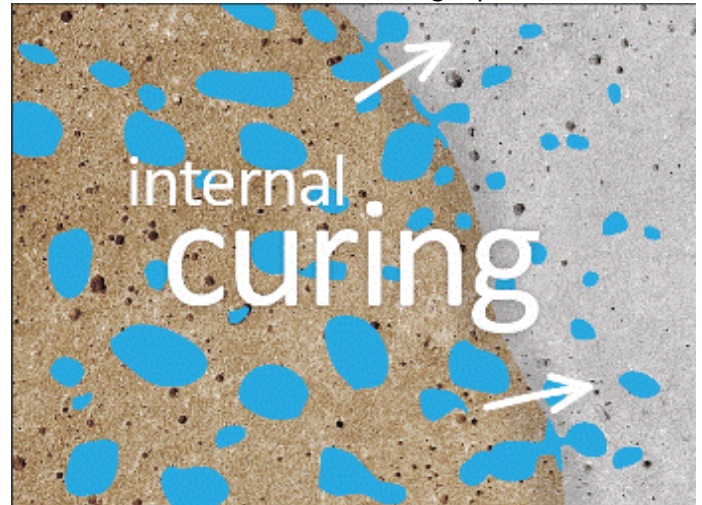
On-site skilled construction labor cannot be exported or imported. Our quality of life in the U.S. carries with it a high labor cost component. Extending the life of concrete reduces the long term construction and maintenance cost of structures, which brings us to the topic of sustainability:

The following excerpt from The Expanded Shale, Clay and Slate Institute (ESCSI) gives our industry's position on this timely subject:

"By definition, sustainability must be looked at with a long-term perspective. A product that is considered 'green' today but lowers the durability and long-term performance of structures is not sustainable. Conversely, when the energy used to produce a product, in this case, ESCS lightweight aggregate, is quickly recovered both in first and ongoing life cycle costs, the material is undoubtedly sustainable. ESCS has been contributing to the sustainability of the site and structure of building projects long before the current green movement came to the forefront."

Expanded Shale and Clay Institute (ESCSI)

The internal curing process utilizes cement more efficiently during the hydration process. In other words, in many instances, less cement is required in the concrete to achieve the same strength performance.



IC also greatly contributes to the extension of cement and aggregate sources by increasing the life of the structures and can be utilized on nearly any project requiring concrete.

This unconventional idea can save the U.S. billions in concrete repair/maintenance of our infrastructure and redefines the term "sustainability." Internal Curing is one of the most promising concrete technological advancements in decades reinforced with the benefits of a 100 year proven track record.

To date, one of the ESCSI members, TXI, a.k.a. Texas Industries, has nearly two million cubic yards of internally cured concrete installed in Texas. This concrete is the best performing concrete when compared to its peers in similar applications.

TXI has named their internal curing process: *intraCure™ - the practical solution to concrete shrinkage.*

On a new project in Colorado during summer 2010, internally cured concrete was placed at the same time in a side-by-side comparison.

Concrete utilizing internal curing is shown on the left and ordinary concrete is on the right. Outside temperature was about 90° F with 20 percent relative humidity. As you can see, the internally cured section looks nearly green (wet) after 20 hours, yet is as hard as the ordinary concrete on the right. From a field and laboratory perspective, internally cured concrete performed outstandingly.



In closing, we encourage you to research the topic of internal curing at www.ESCSI.org and on ESCSI members websites .

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