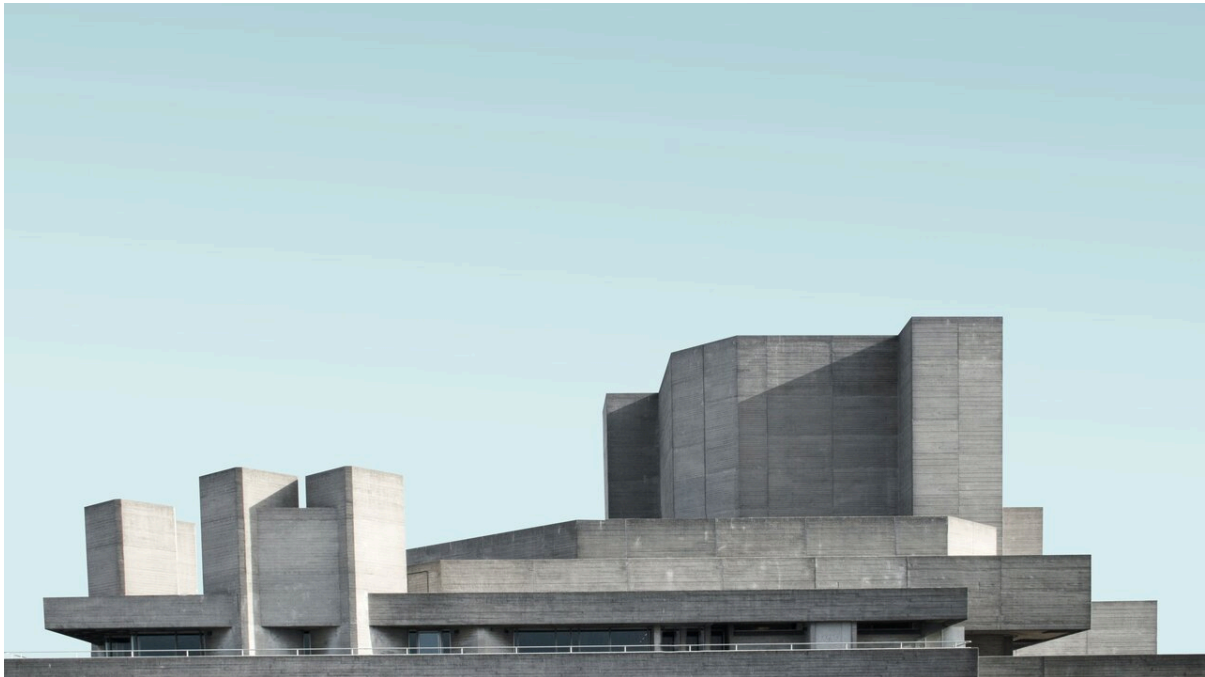


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What's New in Concrete

Tech Bulletin #30 - June 2024



What's new in the Concrete Industry?

Concrete is ever-evolving. New technologies, materials, methods, standards, specifications, and ideas are continuously driving innovation and improvement in our industry. While there is nearly an infinite amount of new topics that could be covered here, below is a collection of some of the most exciting or relevant.

Materials

Strength Enhancing Admixtures

One of the most exciting new developments in the concrete industry is the introduction of strength enhancing admixtures. These products work by replicating the early strength boost of a powerful accelerator, *without affecting set time*. This could be critical for early-open construction or scenarios where, traditionally, an over-

cemented mix design would be necessary for the strength development needed to meet a given specification.

Reclaimed, Remediated, and Harvested Fly Ash



As the supply of fly ash from coal-fire power plants continues to restrict, innovative strategies to increase fly ash supply have resulted in a new trend: reclaimed fly ash. How this works: bottom ash or fly ash that has been landfilled or dumped in ponds over the years are mined, ground to size and marketed as a fly ash alternative. Typically, this works best with Class F ashes that would not hydrate when exposed to water. Reclaimed fly ash performance will likely vary widely depending on chemical and physical properties and reclamation method. At best, they might provide the pozzolanic reaction and associated strength gain and chemical resistances ([Tech Bulletin #5](#)) without a benefit to workability, finishability or pumpability.

Calcined Clay

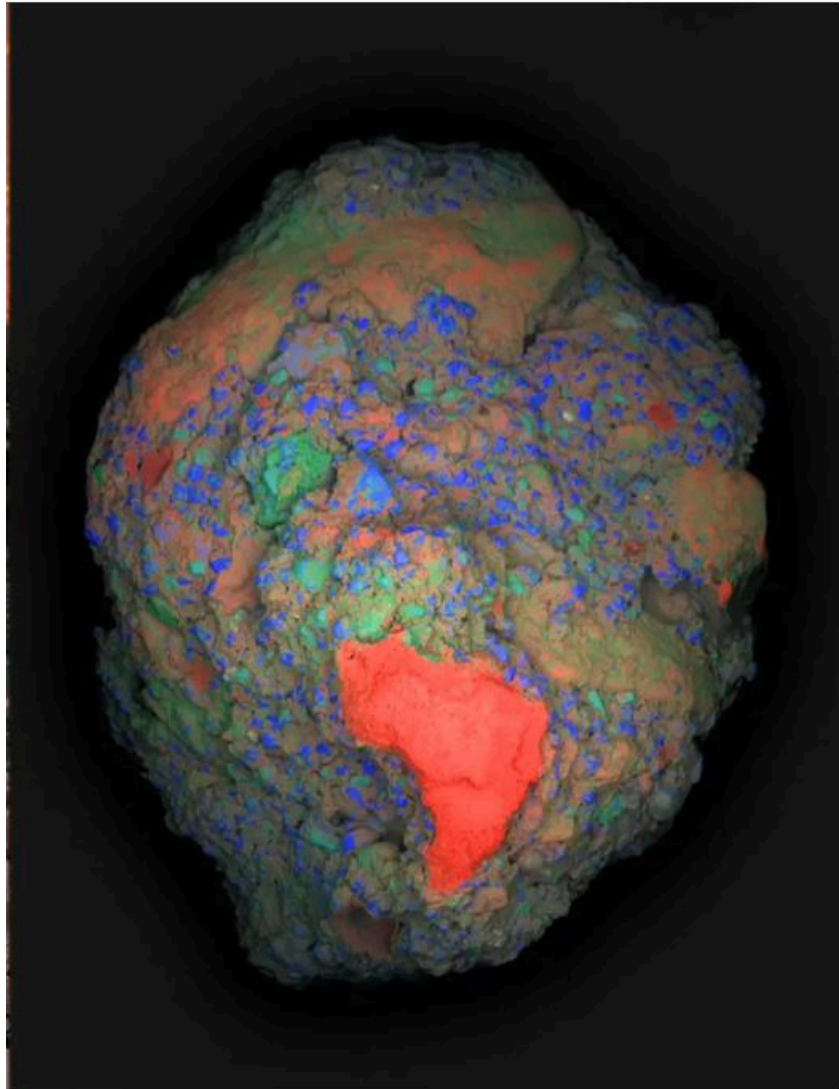
While not necessarily new, a lot of work has been done on developing and understanding another possible supplementary cementitious material that could be used in lieu of or with fly ash, called Calcined Clay. These clays, mostly Kaolinite, are burnt and thus gain pozzolanic properties. Very high calcium clays can produce Metakaolin, which is a silica-fume like material. As fly ash supply dwindles, calcined clays are likely to be a common replacement.

Kilnless Cements

Some startups like [Sublime](#) and [Brimstone](#) are using alternative methods to make cement that have drastically reduced emissions and carbon release. A great article on how they are accomplishing this feat and what it could mean for the industry can be found [here](#).

Concrete Mix Types

Self-Healing Concrete



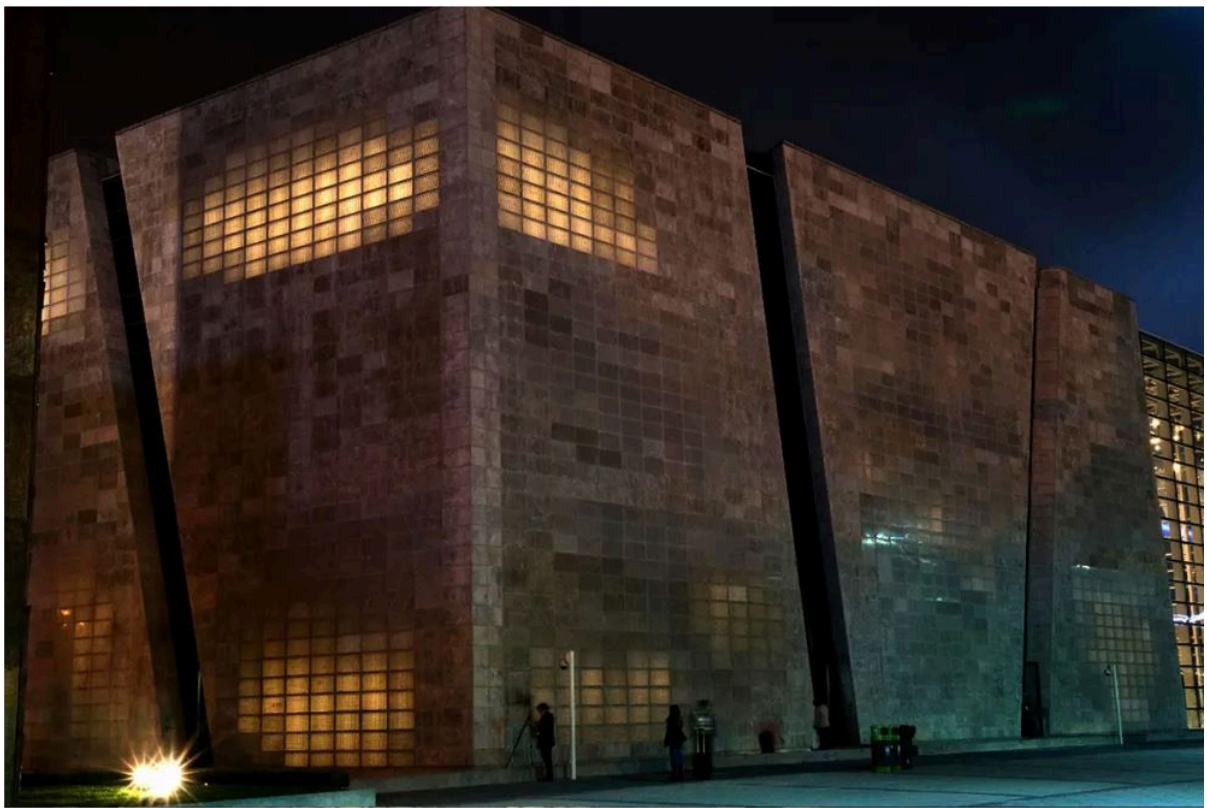
There has been a great deal of work on "self-healing" concrete mixes, from those utilizing hydrophilic crystals, to microcapsules filled with colloidal silica. The recent development that is most interesting, however, is a microbial concrete that uses bacteria that secrete calcium carbonate (also known as limestone) as waste. The bacteria would thrive in voids and cracks, slowly filling them with calcium carbonate that would bond and bridge the gaps in the concrete, thus "healing" any fissures.

Glowing Concrete



Another fun new trend, is the ability to introduce glowing particles to a concrete mix. The above trail, "Nathan's Miles", in Vinton, IA had 1lb per 16ft² of glowing stone broadcast on it's surface to make the concrete glow.

Translucent Concrete



Translucent Concrete is done by imbedding transparent resin members or fibers that allow light transference through a concrete element. Thus far, this has only been done with precast concrete, but it creates quite a remarkable aesthetic.

Electrically Conductive Concrete



Another neat innovation is the development of electrically conductive concrete for snow and ice melt. Electrodes are placed in a steel-fiber reinforced concrete slab at regular intervals and pass a low-voltage current through the slab to keep the slab above 32 degrees and melt any snow or ice that may accumulate on it. While an expensive option, it could be useful for critical elements that must be protected from moisture freezing on the surface.

3D Printed Concrete



A form of concrete receiving a lot of attention recently, particularly in Muscatine, is 3D printed concrete. 3D printed concrete is typically produced by site mixing a bagged mortar mix and pushing it through an extruder with a mapped placement plan. It could be useful for pouring concrete in remote locations (like Mars!), and does not require any forming. However, the current technology results in a lower quality concrete wall with incredibly long construction durations and exponentially higher cost. 3D concrete is typically printed on top of a slab and footing that has already been poured conventionally.

AI

Software companies are starting to look at AI solutions in the concrete industry. Some of these deal with equipment logistics or preventative maintenance, while others are leveraging AI to optimize mix designs for strength, performance, and cost.

Specifications & Standards

C-SUD Mixes for Handwork

The C-SUD mixes were developed out of the PEM program run by the Concrete Pavement Tech Center in Ames to extend joint life and durability. The C-SUD mixes were adopted in the Statewide Urban Design And Specifications (SUDAS) to be used as standard specs for municipalities throughout Iowa. These C-SUD mixes were specifically designed with slip form paving operations in mind, but have often been used for handwork. A new update from the Iowa DOT clarifies that **C-SUD mixes are for slip form paving operations ONLY and are not to be used on handwork pours**. The extremely low w/cm ratios of the C-SUD mixes will result in a sticky mix that is difficult to finish at handwork slumps, and is more prone to plastic shrinkage cracking. An Iowa DOT C-3WR or C-4WR would be appropriate for these types of placements.

C-Mix Water/Cement Ratio Limits

The Iowa DOT has long set the maximum water/cementitious ratio limit for all class C mixes at .489. This limit has been adjusted down to .45 to better match [ACI 318 durability limits](#) and the F2 requirement that concrete exposed to freezing and thawing be a .45 w/cm or lower.

Environmental Product Declarations

Coming soon to projects near us, Environmental Product Declarations (or EPD's) are certified statements of the embodied carbon emissions in the production and transport of the related material. With EPD's, a consumer could compare the carbon footprint difference between two different mix designs or two different ready mix suppliers. Due to the fact that these documents are required to be developed by an independent third party, EPD's are costly and are not quickly produced. Thus far, we have not seen a requirement to provide EPD's, but they are becoming increasingly common on the coasts and will likely make their way here.

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Hahn Ready Mix

3636 West River Drive , 52802, Davenport

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