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MID-STATES CONCRETE INDUSTRIES

Technical Brief

Precast wall systems and the evolution of sustainability

Above: Southside High School, Greenville, S.C.
Precaster: Metromont

The concept of sustainability in construction has been steadily redefined over the past decade.

Originally, much of the debate about sustainable building products revolved around the environmental friendliness of the manufacturing process. Where did the raw materials originate? Were they virgin materials or recycled? How much energy was used in their manufacture and transport to the job site? And how much waste was generated during production and installation?

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C-GRID® REINFORCED
C-GRID is a trademark of Chomarat, NA

Introduction *continued*

Above: "Sustainability" encompasses the life cycle from cradle to grave, including installation and commissioning.

Not only must a building product be manufactured in a sustainable manner and provide an environmental benefit once commissioned, it must deliver those benefits over an extended period of time.

The concept quickly encompassed how the product or system performed to reduce energy usage in a building or reduce the building's operating carbon footprint. Would the product reduce energy draw? Use less water? Enhance daylighting? Improve indoor air quality?

More recently, the idea of "resiliency" has come to the forefront. Not only must a building product be manufactured in a sustainable manner and provide an environmental benefit once commissioned, it must deliver those benefits over an extended period of time — with the impact of maintenance factored in. For example, a building system that promises to reduce the carbon footprint 20% over a 50-year lifespan will probably be less "sustainable" than a more durable one that reduces the carbon footprint 15% but lasts 100 years or more and can resist extreme weather or seismic events.

Incorporating the embodied energy of a building system is critical to determining how sustainable it is. For example, the energy embodied in a building envelope is 8-10 times (800% - 1000%) more than the annual energy used to heat and cool the building. That's a huge initial energy premium to consider. Building systems that last longer (and are more resilient) will allow a structure to avoid incurring the embodied energy costs of a replacement system.

The bottom line is that sustainability — no matter what you call it — is not going away. Building trends come and go. But saving money is definitely not a trend. It is an integral and natural part of our business culture. If reducing energy usage can reduce energy costs, you can rest assured that building owners will want to find ways to translate the benefits of sustainability into enhanced profitability.

What is green?

What yardstick do you use? And do you need one?

It's safe to say that the evolution of the concept of "sustainability" has followed the development of the guidelines and certifications that validate it. The rating systems have migrated from a construction-centric "first-cost" approach to a measured performance approach.

Offered through the U.S. Green Building Council, LEED (Leadership in Energy & Environmental Design) is generally recognized as the industry standard of sustainable design. It is fully mainstream, accredited, accepted and practiced by most architects. Since LEED's inception more than 23,500 commercial projects covering 3.3 billion square feet have been certified.

Other rating systems have entered the playing field in the last several years, the most notable being Green Globes International (GGI). According to the Green Building Initiatives website, Green Globes is the first web-enabled, fully interactive green building assessment and certification program. It includes an on-site visit by a third-party assessor and comprehensive customer support throughout the project.

GGI presents itself as an efficient and affordable alternative to LEED and claims to offer a more effective way to advance the overall environmental performance and sustainability of commercial buildings.

The acceptance of an alternative like GGI is not surprising. LEED "fatigue" has affected many owners who are unwilling to spend the money to pursue the official designation. Many architects now design with LEED standards as the benchmark and baseline even though they do not intend to seek official certification.

Most cities, states and federal government projects require some form of LEED certification for green buildings. The U.S. government's General Services Administration (GSA) recognizes both LEED and GGI rating systems. Most federal government buildings require LEED silver certification at minimum.

PHOTO: CLARKE SNELL

Above: Thermally efficient CarbonCast High Performance Insulated Wall Panels were selected by students from UNC Charlotte for the exterior of UrbanEden, the "People's Choice Award" at the U.S. Department of Energy Solar Decathlon 2013.

In response to criticism that LEED is too expensive and difficult to implement, the USGBC has introduced Version 4 along with more transparency and a focus on measured performance in the materials selection. For example, LEED Version 4 sets the building envelope energy baseline at 10% more than ASHRAE 2010 standards.

The concept of LEED is that buildings should not only be built to specific level standards but should operate to them as well. The future goal is to have a dynamic situation where buildings are measured to reflect actual performance in terms of energy, water, waste and other criteria.

The ultimate standard for many high-end designers and owners is a "net zero" building where the total amount of energy used annually by the building is roughly equal to the amount of renewable energy created on the site. They return as much (or more) energy to the grid as they pull from it.

In a world where fossil fuel costs will inevitably rise and natural resources will become increasingly scarce, it is likely that the standards and rating systems will continue to become more comprehensive and stringent. As a result, building owners and architects will be looking for building products that can provide benefits on many levels.

Above: LEED® is a registered trademark of the U.S. Green Building Council. Green Globes® is a registered trademark of the Green Building Initiative.

The CarbonCast sustainability story

The core of the word "sustainability" is "sustain," which means "to endure." Products that reduce environmental impact during production and their time service but don't last very long are not very sustainable. They provide short-term benefits but in the long run might degrade our environment rather than help it. That's one of the main areas where precast offers significant benefits, which are amplified by CarbonCast technology. And as climate change turns our attention to the possibility of increasingly likely disaster scenarios, resilient design serves to remind us to design for durability over time.

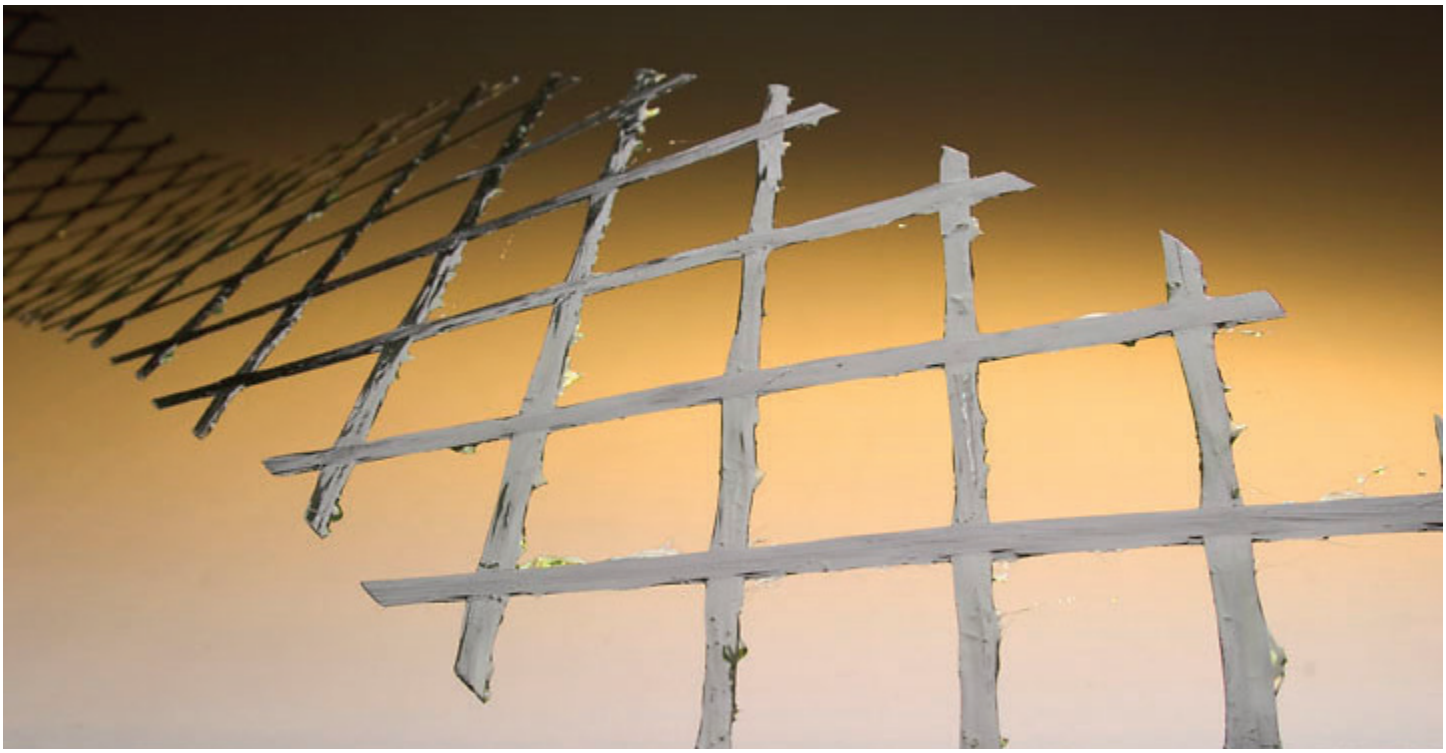
Let's examine some of the key sustainability features of conventional precast and CarbonCast, which features carbon fiber grid as a wythe connector and sometimes as secondary reinforcement in the panel face.

MANUFACTURING: Precast concrete is made from materials harvested within 500 miles of the precast plant – and often closer. (Many have their aggregate supply adjacent to the manufacturing facility.) Precast wall panels do use a high-carbon-footprint material: Portland cement, which is a large contributor to greenhouse gases. However, cement usage can be reduced through the use of admixtures such as silica fume or blast furnace slag, both of which are reclaimed waste materials. The use of C-GRID® in CarbonCast technology for insulated wall panels can further limit the amount of concrete and cement through the use of insulation instead of solid concrete. CarbonCast panels can now be thinner than conventional precast sandwich wall panels by using composite panel design, which lessens their environmental footprint.

Sustainability is one of the main areas where precast offers significant benefits, which are amplified by CarbonCast technology.

Above: The use of C-GRID® in CarbonCast technology can further limit the amount of concrete and cement through the use of insulation instead of solid concrete.

TRANSPORT: Precast concrete panels can be heavier than other exterior wall systems such as metal panels, but about the same as tilt-up or brick and block. Insulated CarbonCast panels can significantly reduce weight for transport and could even permit more panels on a truck, leading to fewer trips to the job site. Lighter panels can also be larger translating into fewer connections, seams and joints.

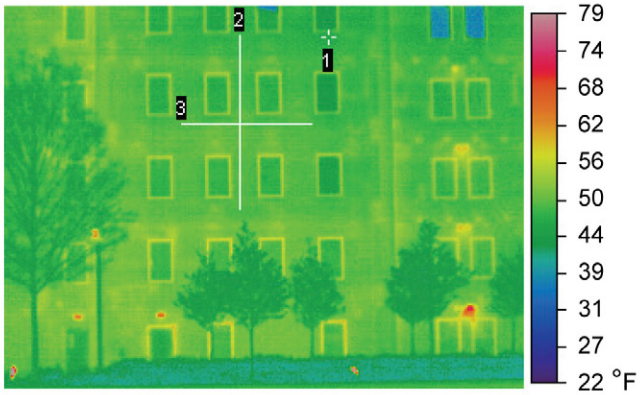


The CarbonCast sustainability story *continued*

ERECTION: Precast wall panels minimize jobsite disruption and waste. They arrive ready to be lifted into place and installed. The potentially lighter weight of CarbonCast products can result in a smaller crane that requires less energy for operation.

ENERGY CONSUMPTION: Most CarbonCast Enclosure Systems feature continuous insulation to meet and exceed ASHRAE 90.1 code requirements. Additional inches of insulation can significantly reduce energy consumption to heat and cool buildings. The more vertical a building is — or the higher the ratio of exterior wall area (less windows) to roof area — the greater the potential savings. The use of carbon fiber grid as a wythe connector virtually eliminates thermal shorts through the panel, allowing the insulation to deliver its full effective R-value.

DURABILITY: Few products, if any, can match the durability of precast concrete. Its lifespan is measured in decades. It is engineered to withstand extreme weather and seismic events and it requires very little maintenance beyond inspection of the joints and potential recaulking. Furthermore, precast concrete can be recycled back into other concrete or utilitarian products should the building need to be decommissioned.



Above: The use of carbon fiber grid as a wythe connector virtually eliminates thermal shorts through the panel. On this thermal image, the red areas to the left are lights and on the right are bathroom vents.

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Conclusion

Sustainability has gone from a buzzword to an everyday consideration in construction. The ability of a building system to reduce a structure's embodied energy and operational energy usage has been augmented by the concept of resiliency, which takes into account the service life of a building system and its ability to withstand the tests of time, weather, natural disasters and everyday wear and tear.

The evolution of energy codes has resulted in a greater focus on long-term system performance. Precast insulated wall panels with carbon fiber grid offer many benefits that wholly embrace the concept of resiliency. Their long-term performance will provide a lifetime of benefits and fulfill the evolving scope of sustainability for decades to come.

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For more information go to **altusprecast.com** and learn how CarbonCast® can deliver LEED points for your project as well as lasting performance results that generate positive ROI.

Call us today to speak with a technical representative or request a lunch-and-learn program.