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LEED* OR GET OUT OF THE WAY!

What does the precast industry need to "go green"?

* LEED is a trademarked name for the Leadership in Energy and Environmental Design developed by the U.S. Green Building Council.

By Greg Stutz

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Recent industry-wide workshops conducted by the American Concrete Institute and the concrete industry's Strategic Development Council have concluded that the concrete industry has an opportunity to improve upon its credibility as a "green" industry. The precast concrete industry is part of the global concrete industry that now has the reputation for a lack of response toward global warming and the environment. The precast sector of the concrete industry offers several advantages.

Are we the "LEEDing" edge?

Look at us! We haven't changed much. There is evidence that Egyptians used gypsum mortars and mortars of lime in the construction of the pyramids (3,000 B.C.). The Romans used pozzolana cement from Pozzuoli, Italy, near Mt. Vesuvius to build the Appian Way, Roman baths, the Coliseum and Pantheon in Rome, and the Pont du Gard aqueduct in southern France (300 B.C. to 476 A.D.). They used lime as a cementitious material.

This is not to say that the precast industry hasn't had its share of innovations over the centuries. However, have we really changed the way we have looked upon the environment and its resources? An introspective evaluation of our environmental conscience would indicate that perhaps we can do more. Where do we start?

There's danger in our comfort zone

The contract of understanding and obligation between precast manufacturers and the environment is changing. The precast industry has had a powerful and implicit contract where the raw materials are plentiful and always available. However, the carbon footprint for this industry to produce one cubic yard of concrete is rising in both cost and its effects on the atmosphere.

Studies of various industries' consumption have identified the concrete industry's carbon footprint in an unfavorable light. There is a growing consensus that the rule of thumb for any concrete producer is "a ton of concrete equals a ton of CO₂ (carbon dioxide) emissions into the earth's atmosphere." The following tables are samples of data that are available to the general public.

Global CO₂ Emissions Attributable to Clinker Production, million metric tons

	1990	2005
Cement Consumption / Production	1,044	2,270
Complementary Cementing Materials*	104	340
Portland Clinker Produced	940	1930
CO ₂ Released**	940	1737

Source: Professor Emeritus P.K. Mehta, Civil and Environmental Engineering, University of California Berkley – presentation at ACI sponsored Sustainability of Concrete Industry Session, Washington, D.C., March 29, 2007

*Complementary cementing materials (CCM) that enhance the performance of portland clinker include gypsum, coal fly ash, granulated blast-furnace slag, limestone powder and natural pozzolans. It is assumed that 10 percent CCM was used in 1990 and 15 percent in 2005.

**It is assumed that CO₂ emitted was 1 tonne/tonne of clinker in 1990, and 0.9 tonne/tonne of clinker in 2005 (due to significant quantities of low carbon byproduct fuels used for making clinker).

Carbon Footprint by U.S. Industry

Carbon Footprint by US Industry	2005 (Terragrams CO ₂ Equivalent *)	% Change since 1990
Fossil Fuel Combustion	5751.2	20.3%
Non-Energy Use of Fuels	142.4	21.4%
Cement Manufacture	45.9	38.0%
Iron & Steel Production	45.2	(46.7)%
Natural Gas Systems	28.2	(16.4)%
Municipal Solid Waste Combustion	20.9	91.0%
Ammonia Manufacture and Urea Application	16.3	(15.5)%
Lime Manufacture	13.7	21.2%
Limestone and Dolomite Use	7.4	33.7%
Soda Ash Manufacture and Consumption	4.2	2.1%
Aluminum Production	4.2	(38.4)%
Petrochemical Production	2.9	30.5%
Titanium Dioxide Production	1.9	46.9%
Ferroalloy Production	1.4	(35.3)%
Phosphoric Acid Production	1.4	(9.5)%
Carbon Dioxide Consumption	1.3	(6.5)%
Zinc Production	0.5	(51.0)%
Lead Production	0.3	(7.2)%
Silicon Carbide Production Consumption	0.2	(41.6)%

Source: U.S. Inventory of Greenhouse Gas Emissions and Sinks 1990-2005 (EPA 2007)

*Conversion: 1 terragram = 109 kilograms = 106 metric tons = 1 million metric tons 1 ton (2,000 lbs) = 0.9072 metric tons

Whether you agree with this data or not, perception is reality in the eyes of specifiers, and the precast industry needs to emphasize its advantages over other types of construction that require more energy consumption.

Sustainability of precast concrete

A wide variety of precast manufacturing methods and products give designers and specifiers the techniques to create both beauty and function in ways that improve the impact of buildings on the environment. Sustainable development is about balancing human needs and functions with the earth's capacity of raw materials to meet them. This balance is achievable through the use of precast products.

The following possible sustainability solutions provide an overview of the environmental challenge and show how precast can integrate with LEED building principles. By focusing on the benefits of precast as a green material, the industry can provide specifiers with:

- More details on the specific precast applications that can help meet the environmental challenge;
- Examples of buildings that used precast to reach their green building goals;
- Related “green practice” technical briefs, which provide more detailed information on the sustainability solutions; and
- Related reference library resources – research studies, articles and Web sites – providing further depth to a project team's search for more information.

“Green” can now be quantified through the recent project rating systems developed within the last decade.

What is LEED?

The LEED™ (Leadership in Energy and Environmental Design) Green Building Rating System is a voluntary, consensus-based program for developing high-performance, sustainable buildings. These LEED standards have been developed by the U.S. Green Building Council (www.usgbc.org). Based on well-founded scientific standards, LEED emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

The LEED programs currently available include:

- LEED-NC: New commercial construction and major renovation projects
- LEED-EB: Existing building operations
- LEED-CI: Commercial interiors projects
- LEED-CS: Core and shell projects
- LEED-H: Homes
- LEED-ND: Neighborhood development
- LEED Application Guides: Retail (currently a pilot project), Multiple Buildings/Campuses, Schools, Healthcare, Laboratories, Lodging

LEED for new construction and major renovations (LEED-NC) is the most used rating system. It was designed to guide and distinguish high-performance commercial and institutional projects with a focus on office buildings. Practitioners have also applied the system to K-12 schools, multi-unit residential buildings, manufacturing plants, laboratories and many other building types. A sixth category, innovation and design process, offers points for creative approaches to sustainable construction. The more points that a building gains based on its design and construction, the higher its LEED rating.

Understanding LEED programs, points and credits

LEED provides a complete framework for assessing building performance and meeting sustainability goals. Based on a system of prerequisites and credits, LEED projects earn points during the certification process and then are awarded one of the four certification levels:

1. Certified Level
2. Silver Level
3. Gold Level
4. Platinum Level

There are five environmental categories and one “innovation” category that are further divided into credits. For each credit, the rating system identifies the intent, requirement, and technology or strategy to attain the credit. One or more points are available within each credit, and the points are added to determine the level of certification.

Points for certification for LEED-NC v2.2

A building (new construction) requires at least 26 points for certification. Silver, gold and platinum levels are also awarded for reaching higher point totals.

Credit Category Points Available	
Sustainable Sites	14
Water Efficiency	5
Energy and Atmosphere	17
Materials and Resources	13
Indoor Environmental Quality	15
Innovation and Design Process 5	
Total Core Points 64	

LEED Certification Levels	
Certified	26 - 32 Points
Silver	33 - 38 Points
Gold	39 - 51 Points
Platinum	52 - 69 Points

Benefits of LEED Certification

While LEED is a voluntary program, obtaining LEED certification projects a positive environmental image to the community. Additionally, meeting many of the green building practices can result in energy and cost savings over the life of the structure. Other advantages include better indoor air quality and plenty of daylight. Studies have shown that workers in these environments have increased labor productivity, job retention and days worked. These benefits contribute directly to a company's profits, because salaries – which are about 10 times higher than rent, utilities and maintenance combined – are the largest expense for most companies occupying office space. In addition, students in these environments have higher test scores and lower absenteeism. Retail sales are higher in daylit buildings. Many cities

and states either provide tax credits or grants for green buildings or require green building certification for public buildings.

The U.S. government is adopting green building programs similar to LEED through the General Services Administration (which owns or leases more than 8,300 buildings), the U.S. Army, the Department of State, the Department of Energy (DOE) and the Environmental Protection Agency (EPA). Eight states including California, New York, Oregon and Washington have adopted its use for public buildings. Many agencies are requiring LEED silver certification as a minimum. Thirteen countries have expressed interest in LEED including China and India; these countries have exceptionally high new building construction. Conditions vary and the list is growing, so please contact local jurisdictions or USGBC for details. Support for green buildings has increased rapidly each year over the past five years.

The LEED Green Building Rating System for New Construction, Version 2.2, promotes environmentally sustainable buildings for the improvement of outdoor and indoor building quality, the conservation of resources and the reduction of waste during the building process. Concrete can be used in conjunction with the LEED program to earn a LEED certification.

What does this mean for precasters? If you're supplying products to builders or the government, you need to understand LEED – because LEED building is not just a trend, it's the future.