Natural Stone Council

The United Voice of the Natural Stone Industry

Case Study:
Application of Green Building Certification Programs to Natural Stone

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Natural stone has many innate attributes that make it a green building product: it is natural, low-maintenance, and exceptionally durable. However, with the growth of the green building movement, it is worth considering how these and other properties of stone can contribute to sustainable design projects and green building certifications.

LEED

The U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system has helped to shape the green building movement in North America. LEED addresses all building types, including new construction, existing buildings, commercial interiors, core & shell, operations and maintenance, homes, neighborhoods and specific applications such as retail, multiple buildings/campuses, schools, healthcare laboratories and lodging.[1]Through mid-2008, more than 1,540 construction projects have been LEED-certified.[2]

LEED-NC

LEED-NC, for New Construction projects, is the most widely used green building rating system in the US.[3] LEED-NC emphasizes six categories for environmental improvement:

1. Sustainable Sites (SS)
2. Water Efficiency (WE)
3. Energy and Atmosphere (EA)
4. Materials and Resources (MR)
5. Indoor Environmental Quality (IEQ)
6. Innovation and Design. (ID)

Natural stone products, such as those made from granite, marble, and limestone, among others, can contribute to points in several of these categories.

- SS Credit 7.1: Heat Island Effect, Non-Roof: Using light-colored natural stone with a solar-reflective index of 29 or greater can reduce heat-island effects. For instance, the use of light colored stone as caps on such features as landscaping walls, stair treads, and pavement may generate a credit.[4]

- EA Credit 1: Optimize Energy Performance: Natural stone has good thermal mass (the ability of a material to store heat and slowly release it), which positively impacts indoor ambient air temperature, and thus, energy efficiency. The number of points in this credit category (1-10) is dependent on the thermal mass of the specific type of stone used.[5]

- MR: Due to the durability of stone, there are several credits in the MR category that can potentially be garnered.
    - MR Credits 1.1 & 1.2 Building Reuse, Maintain 75-95% of Existing Walls, Floors, and Roof: These credits apply if the life-cycle of existing building stock can be maintained in a project.

- MR Credits 2.1 & 2.2 Construction Waste Management, Divert 50-75% from Disposal: These credits apply if "waste" stone used in construction is diverted to a beneficial use rather than being disposed.
- MR Credits 3.1 & 3.2 Materials Reuse, 5-10%: These credits apply if salvaged stone products can be reused for another purpose in a building design.
- MR Credits 5.1 & 5.2 Regional Materials, 10-20% Extracted, Processed & Manufactured: These credits apply if the project uses natural stone that has been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10% (based on cost) of the total materials value (if only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage, by weight, contributes to the regional value.).

- ID Credit 1: Use of natural stone may contribute to exceptional performance in areas such as life-cycle cost and durability, mold resistance, and improved air quality.[6]

LEED 2009

In anticipation of the development and release of LEED 2009, a revised point system based on the application of life-cycle assessment to support LEED credits, the Natural Stone Council has just completed an extensive benchmarking exercise of its member operations. The resulting life-cycle inventory data sets have been made publicly available on the NSC website to make transparent the extent and affect of their operations and to support an informed decision regarding stone products. The datasets can be accessed at http://www.genuinestone.com/env_researchandresults.

Beyond LEED

The green building movement has inspired numerous other green building certifications and programs in the US and abroad. Some of these programs, such as The Living Building Challenge, seek to inspire builders, owners, architects, engineers, and design professionals to build environmentally sound and self-sustaining buildings—buildings which actually "give back" to the ecosystem in which they are built. Developed in 2005 by the Cascadia Region Green Building Council, the Living Building Challenge promotes "no credits, only prerequisites;" buildings must meet requirements such as generating all of its own energy with renewable resources, capturing and treating all of its water on site, and using resources efficiently and for maximum beauty.[7] The program is comprised of six performance areas, or "petals," including Site, Energy, Water, Materials, Indoor Quality, and Beauty & Inspiration. Each petal includes prerequisites that must be met in order to achieve that specific performance area designation.

Another program, directly based on LEED 2.0 is the Sustainable Project Rating Tool, or SPiRiT, developed by the U.S. Army Corps of Engineers. SPiRiT is tailored to Army-specific needs and includes checklists, strategies and scoring mechanisms to allow

Army installations to rate themselves in creating and maintaining sustainable facilities, as well as to improve the process of planning, programming, designing, building, and maintaining those facilities.[8] SPiRiT incorporates all of the LEED 2.0 categories for environmental improvement except the Innovation and Design category. However, it includes three additional categories: Facility Delivery Process, Current Mission, and Future Missions.[9]

The Living Building Challenge and SPiRiT are just two of many examples of green building standards and programs that have taken off since the success of the USGBC's LEED program. Their existence demonstrates the continued growth in the green building movement and the ways in which such tools can be used to develop and inspire eco-efficient, healthier buildings.

Examples:

ImaginOn, The Joe and Joan Martin Center
Charlotte, North Carolina
Silver LEED Certification
Designed by Holzman Moss Architecture
Completion Date: 2005

ImaginOn is the new facility of the Public Library of Charlotte-Mecklenburg County and the Children's Theatre of Charlotte. This first-of-its-kind facility "serves as a catalyst for all ImaginOn's visitors to experience the written, spoken and electronic word in an integrated environment."[10]

ImaginOn is also the first, USGBC LEED-certified public building in Charlotte, achieving a silver rating. The architects selected materials to challenge, inspire and excite young minds, with significant emphasis placed on the use of natural, local, and regionally produced materials used in conjunction with recycled-content materials. Whimsical design features of the building, such as representations of a parallelogram, a helix, and a cube also provide unique vehicles to highlight environmentally-sensitive materials. Stone cladding is featured in the helix, representing the architect's innovative use of a remnant material. The cladding is a Split-Face Ashlar from the Dakota Granite Company is a reused by-product of monument slabs when the polished slabs are cut to size; this innovative use of stone contributed to a LEED MR credit.[11]

The creative use of materials and sustainable design of ImaginOn are further used as teaching tools. The ImaginOn website offers the opportunity to "Go on a Green Hunt" to identify green building materials used in the building, including compressed wheat fiberboard, wool, and stone.[12]

Jefferson Hall Library and Learning Center
United State Military Academy at West Point
West Point, New York
SPiRiT Bronze Rating
Designed by Holzman Moss Architecture
Completion Date: 2008

The Jefferson Hall-USMA Library and Learning Center opens in September 2008, making it the first new academic building on the historic West Point campus in more than thirty-five years. The facility, designed by STV and Holzman Moss Architects, "celebrates the charge to provide a building of quality and character that will be perceived as a progression of past success that also leads to future opportunities."[13]

This vision required careful consideration of the West Point National Historic Landmark District in the design and materials decisions. The facility sits on the edge of West Point's 70-acre parade ground known as the "Plain." Building on the Plain required careful consultation with the New York State Historical Preservation Office, requiring a "statement of adverse effect." According to Malcolm Holzman, FAIA, of Holzman Moss Architecture, "designing a facility that reflects the spirit and values of the 21st century Army and still honors the academy's architectural values was imperative."[14]

Natural stone is a key aspect of the design. East and West granite-clad towers provide harmonization with adjoining Gothic style structures, using regional stone and contributing points to the bronze SPiRiT certification. In order to match the stone used in the adjoining Eisenhower Barracks, a section of the Fletcher Granite Quarry was reopened, contributing more than 130 tons of hand-tooled stone blocks.

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References

[1] U.S. Green Building Council. 5 September 2007. <http://www.usgbc.org/>.
[2] Ibid, 30 July 2008.
[3] Subasic, C.A. "Sustainable Design and Natural Stone," M*asonry Construction Magazine*, January 1, 2008.
[4] Ibid.
[5] "Thin Brick and Thin-Cut Stone Take on Full Dimension Masonry Products," *Architectural Record*, December 2007.
[6] Ibid.
[7] Cascadia Region Green Building Council Living Building Challenge, 26 August 2008. <http://www.cascadiagbc.org/lbc>
[8] U.S Army Corps of Engineers Engineer Research and Development Center. *Sustainable Project Rating Tool (SPiRiT)*, January 2008.
[9] U.S Army Corps of Engineers U.S. Army Assistant Chief of Staff for Installation Management. *Sustainable Project Rating Tool (SPiRiT), Version 1.4*, April 2001.
[10] Holzman Moss Architecture. *Case Study: ImaginOn: The Joe and Joan Martin Center*.
[11] Holzman Moss Architecture. *Architectural Fact Form: ImaginOn: The Joe and Joan Martin Center*.
[12] http://www.imaginon.org/Just_For_Fun/greenhunt.asp
[13] Holzman Moss Architecture. *Case Study: Jefferson Hall-USMA Library and Learning Center*.
[14] "West Point Builds a Commanding New Library and Learning Center for the Information Age," press release, June 2008.