

## CAST STONE AND LEED® v4

### INTRODUCTION

Sustainable design has become one of the most prominent trends in the building industry. Designers aiming for a more environmentally-friendly building design often turn to building rating systems and certification programs to help them assess the environmental impact of a building and its components. The most widely used system in the U.S. is the LEED® green building certification program.

The U.S. Green Building Council (USGBC) developed the LEED rating system; LEED stands for Leadership in Energy and Environmental Design. A separate entity, the Green Building Certification Institute (GBCI) administers LEED project certification and professional credentialing programs. The LEED certification program was developed to provide a method to define and measure what are commonly called “green buildings.” From its inception as a pilot program for new buildings in 1998 to the present, the LEED certification program has expanded and grown dramatically. There are numerous LEED rating systems organized by type of construction and end use, including:

- BD+C (Building Design and Construction): New Construction, Core & Shell, Schools, Retail, Hospitality, Data Centers, Warehouses & Distribution Centers, Healthcare
- ID+C (Interior Design and Construction): Commercial Interiors, Retail, Hospitality
- EB:O+M (Existing Buildings: Operations and Maintenance): Existing Buildings: Operations & Maintenance, Schools, Retail, Hospitality, Data Centers, Warehouses & Distribution Centers
- ND (Neighborhood Development): Neighborhood Development Plan, Neighborhood Development
- Homes: Homes, Mid-Rise

The most widely used rating system in the U.S. is currently LEED® BD+C: New Construction™ (LEED for New Construction) though LEED Existing Buildings: Operations and Maintenance is also widely used. While each rating system is distinct, most of the topics covered can be grouped into the same general categories. This Bulletin examines the requirements of LEED v4 for BD+C: New Construction and its relevance to cast stone.

### THE USE OF CAST STONE

Cast stone is used primarily on the exterior of buildings. Cast stone veneer may be used alone or as an integral part of a clay or concrete masonry veneer. Cast stone may also be used as an accent or trim material on the exterior of buildings sheathed with other materials such as synthetic stucco. Other opportunities for use of cast stone include caps and copings on building walls and landscape walls, stair treads, and column covers. Though not as common, cast stone can also be used as pavers and in interior applications. Many of these applications can be part of a strategy to earn points in the LEED rating systems.

### LEED® v4

When LEED v4 was approved in July 2013 after a lengthy revision process, it contained significant changes from the previous version (LEED 2009) particularly in the area of materials and resources. LEED v4 is organized into six environmental categories plus credits for integrated design, innovation and regional priorities. In LEED v4 the credits related to the building site and location are split into two separate categories, Sustainable Sites and Location and Transportation. Each of the six credit categories may contain mandatory prerequisites as well as voluntary credits that are worth points toward a building project’s certification. Figure 1 shows the points allocated to each category.

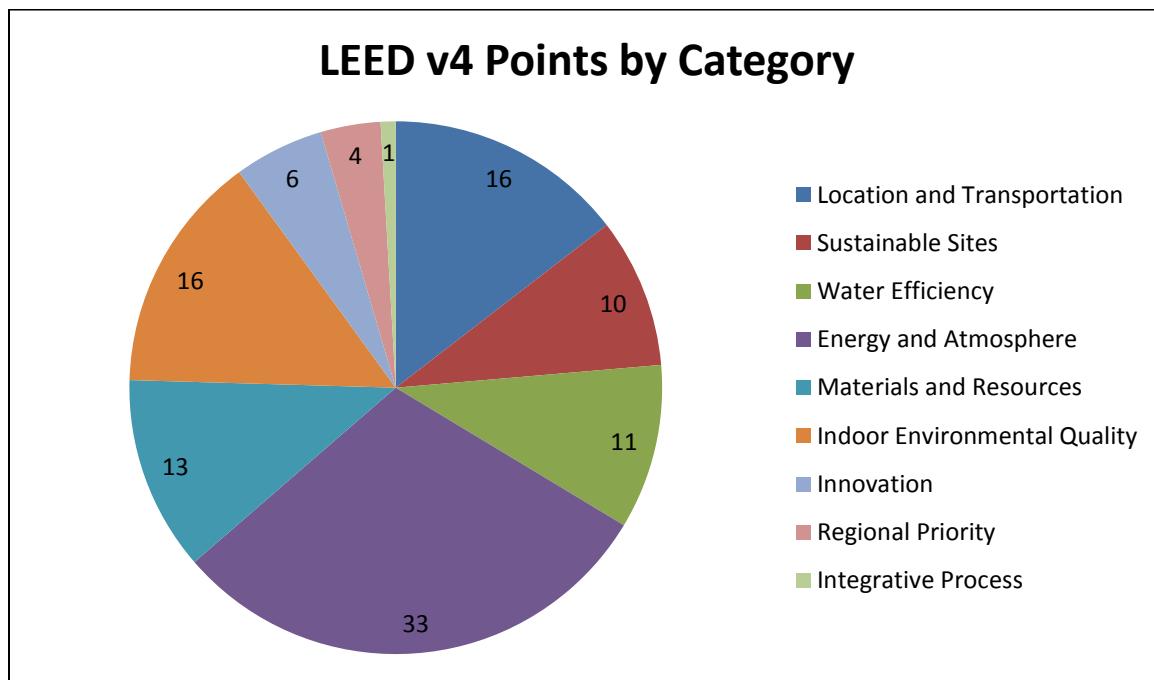


Figure 1: LEED v4 Points by Category

#### CERTIFICATION

Under LEED for New Construction a building project must earn at least 40 points out of a possible 110 to be a LEED-certified project. In the LEED rating systems, the more points a building project earns, the “greener” the building. The USGBC recognizes four levels of LEED certification (Figure 2).

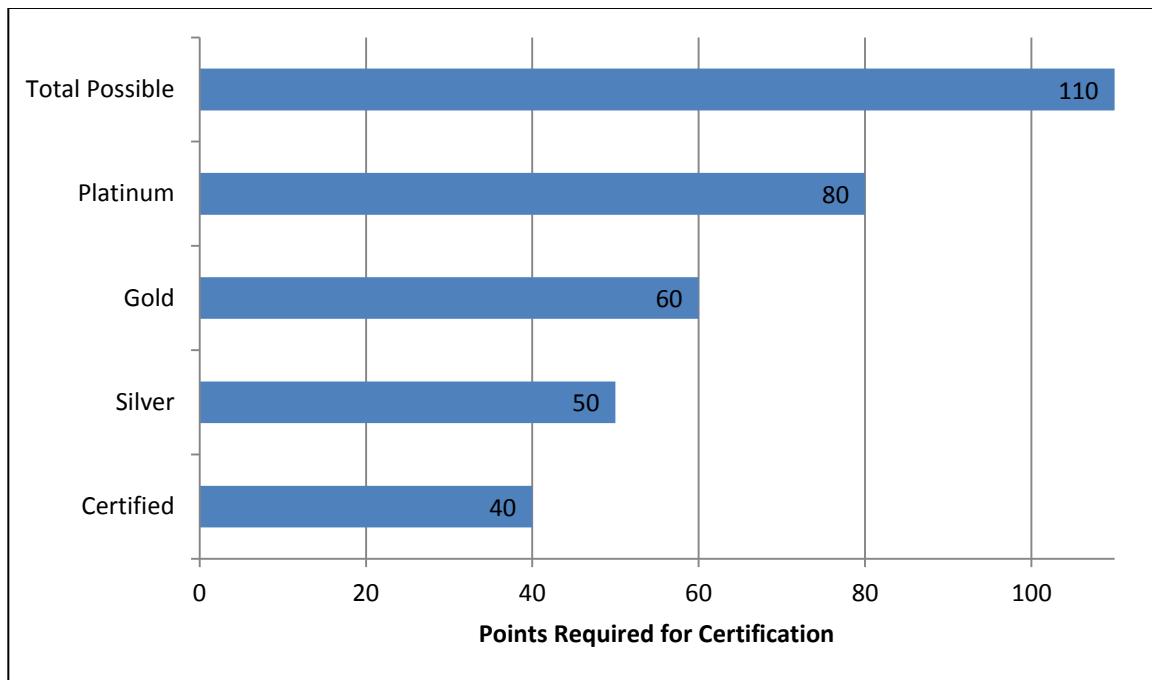


Figure 2: LEED for New Construction 2009 certification levels



## EARNING LEED POINTS

Cast stone masonry can make a significant contribution toward earning LEED points on a project. While no product or material alone can earn LEED points, cast stone masonry can be used as part of a strategy to earn points in many credits. It is important to remember that the calculations for these credits require inclusion of the entire building project and materials to determine the percent of qualifying material.

### LOCATION AND TRANSPORTATION (LT)

This category addresses issues related to the location of the project site and its connection to the surrounding community. A total of 16 points are available in this category with the majority given for locating the project in a densely developed area with a diverse array of businesses, residential areas, and services.

LT Credit 4 - Surrounding Density and Diverse Uses (1-5 points) – the intent of this credit is to encourage development in urban areas with existing infrastructure. Building products do not directly contribute to this credit. However, masonry materials are often used for urban infill development because of their appearance, size and scale, fire ratings, as well as for benefits in space required for construction. Cast stone masonry can often be installed without the use of a crane, thus helping to minimize the need for large equipment on site.

### SUSTAINABLE SITES (SS)

This category addresses issues associated with site preparation as well as impacts on surrounding areas after construction is complete. A total of 10 points are available in the Sustainable Sites category. Cast stone may play a role in strategies associated with SS credit 5.

SS Credit 5: Heat Island Reduction (2 points) – the intent of this credit is to reduce the retention of heat due to dark colored surfaces by providing shade, using materials that meet solar reflectance criteria, or other strategies for the roof and non-roof areas such that their weighted area exceeds the sum of the area of site paving and total roof area. Cast stone used as caps on landscaping walls, stair treads, and pavers on the site or on the building roof can meet the criteria for earning this point.

This credit requires that paving materials have a three-year aged solar reflectance (SR) value of at least 0.28. If three-year aged value information is not available, materials must have an initial SR of at least 0.33 at installation. A study [Ref. 1] by the Portland Cement Association of 135 concrete specimens all had a SR of at least 0.33. One specimen made with white Portland cement had a SR of at least 0.64. Cast stone elements typically meet the LEED requirements for solar reflectance, especially if white Portland cement is used.

### ENERGY & ATMOSPHERE (EA)

The Energy and Atmosphere category covers a variety of issues related to energy use associated with heating and cooling buildings including reduction in energy use, ozone reduction and use of renewable energy. There are four mandatory prerequisites and seven voluntary credits that have a total of 33 points associated with them. The thermal mass associated with cast stone and other masonry materials can help reduce the amount of energy used for heating and cooling a building. There is one prerequisite and one credit associated with this intent.

EA Prerequisite 2: Minimum Energy Performance (0 points) – as part of a masonry wall, cast stone can help mitigate temperature swings and achieve the required energy performance particularly when interior masonry is left exposed.

EA Credit 2: Optimize Energy Performance (up to 18 points) – as part of a masonry wall, cast stone can be used to help reduce the amount of energy consumed by the building. The benefit of thermal mass is best recognized when using energy modeling tools such as BLAST or EnergyPlus.

## MATERIALS & RESOURCES (MR)

The intent of this category is to minimize the impact on the environment, encourage product transparency, and reduce construction waste. There are a total of 2 prerequisites and 13 points available in the Materials and Resources category. Several of the MR credits in LEED v4 are focused on specific manufacturer practices such as developing an environmental product declaration or disclosing material ingredients. As a result, achieving the credits in this category may vary widely depending upon the specific manufacturer. A brief overview of each of the MR credits is provided below.

**MR Credit 1: Building Life-Cycle Impact Reduction (up to 5 points)** – this credit incorporates the former Building Reuse and Material Reuse credits, and gives more weight (points) to reuse of whole buildings than the previous version of LEED. This credit contains four different paths, with the first three focused on building and material reuse and the last on new construction. Masonry buildings, many of which incorporate cast stone details, are good candidates for reuse. Cast stone features on the building interior such as columns, fireplace mantels and surrounds, stair treads, etc. are also good candidates for reuse. Anchoring details that allow for disassembly can facilitate this. Larger elements not set in mortar are especially suited for salvaging. In addition, cast stone can be repaired to conceal damage that may occur during disassembly and removal.

**MR Credit 2: Building Product Disclosure and Optimization** – Environmental Product Declarations (2 points), is a new credit in LEED v4. This credit has two options, worth one point each. The first option focuses on reporting of environmental impact data via an Environmental Product Declaration (EPD), while the second rewards improved performance in specified environmental impact categories through life cycle assessment. Cast stone elements produced by manufacturers having an EPD can count toward this credit.

**MR Credit 3: Building Product Disclosure and Optimization** – Sourcing of Raw Materials (up to 2 points) has two different options worth one point each. Option 1, Raw Material Source and Extraction Reporting, requires use of at least 20 different permanently installed products sourced from at least 5 different manufacturers that have publicly released a report from their raw material suppliers. Third-party verified corporate sustainability reports are counted in full. Self-declared reports count as only  $\frac{1}{2}$  value, so for example, if only self-declared reports are used, 40 products would be required instead of 20.

The second option incorporates aspects of the recycled content, rapidly renewable, certified wood and material reuse credits found in LEED 2009. Option 2, Leadership Extraction Practices, requires use of products that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project. When calculating the value of the products, those demonstrating extended producer responsibility are valued only at 50% of their cost. Other extraction criteria are valued at the full amount.

- Extended producer responsibility
- Bio-based materials: Sustainable Agriculture Standard
- Wood products: FSC certified
- Materials reuse
- Recycled content: post consumer +  $\frac{1}{2}$  pre-consumer
- USGBC approved program

Cast stone elements can help earn this credit when they incorporate recycled materials into their mix, most often as aggregates or supplementary cementitious materials. Pre-consumer (post-industrial) recycled materials that may be incorporated into cast stone include recycled aggregate or slag that can be used as an aggregate and supplementary cementitious materials like fly ash. Color may be affected by incorporation of certain recycled materials, so contacting the cast stone manufacturer is recommended.

**MR Credit 4: Building Product Disclosure and Optimization** – Material Ingredients (up to 3 points) – This credit has three options worth 1 point each. All three options require documentation of the raw material ingredients for building products. Several chemical and ingredient screening programs are listed as compliance paths including the GreenScreen™ for Safer Chemicals, Cradle to Cradle certification, and the Health Product Declaration (for more information see Resources), but Material Safety Data Sheets (MSDS) are not considered compliant with this credit. Cast stone producers that provide the chemical inventory for their products using the Chemical Abstract Service Registry Numbers (CASRN) can count toward Option 1 of this credit.

**MR Credit 5: Construction and Demolition Waste Management (up to 2 points)** – The intent of this credit is to eliminate construction waste from landfills. Up to two points can be earned for recycling or salvaging specified amounts of construction waste, or two points can be earned if the project does not generate more than 2.5 lbs of construction waste/ft<sup>2</sup> of the building's floor area. On-site waste from cast stone elements is limited primarily to packaging materials. Cast stone elements are carefully detailed and exact amounts are delivered to the site so that waste stone is nearly eliminated helping meet the reduction of total waste goal. Any waste cast stone elements that are present can be crushed and used as aggregate or fill.

#### INDOOR ENVIRONMENTAL QUALITY (IEQ)

This category aims to ensure quality indoor air among other goals. One way to achieve this is by reduction or elimination of volatile organic compounds (VOCs) in materials used in the interior of a building.

**IEQ Credit 2 – Low-Emitting Materials (up to 3 points)** – This credit focuses on volatile organic compound (VOC) emissions, rather than content. It also explicitly lists stone, glass, concrete, and clay brick as “...inherently non-emitting and comply without any testing if they do not include integral organic-based surface coatings, binders, or sealants.” Thus cast stone elements without integral organic-based materials used on exposed interior walls or floors meet this credit without any testing required.

#### SUMMARY

LEED v4 for BD+C: New Construction rating system is one of the most commonly used tools in the U.S. for assessing the impact of a building and its components on the environment. LEED covers six environmental credit categories each containing numerous credits. Cast stone, like other masonry materials, can play a role in strategies designed to achieve many of these credits, particularly in the Materials and Resources credit category.

Designers utilizing the LEED v4 for BD+C: New Construction rating system are encouraged to contact cast stone manufacturers to determine relevant practices for achieving LEED credits and to look for opportunities and the synergy that can occur when cast stone is chosen for use on a project.

#### REFERENCES

1. “Concrete Shines as Solar Reflectance Material,” <http://www.cement.org/for-concrete-books-learning/concrete-technology/concrete-construction/concrete-as-solar-reflectance-material>, accessed February 5, 2014.
2. LEED v4 User Guide (June 2013), U.S. Green Building Council, Washington, DC, <http://www.usgbc.org/resources/leed-v4-user-guide>.



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This Technical Bulletin addresses generally accepted practices, methods and general details for the use of Architectural Cast Stone. This document is designed **only as a guide** and is **not** intended for any specific application or project. It is the responsibility of design and construction professionals to determine the applicability and appropriate application of any detail to a specific project based on professional judgment, specific project conditions, manufacturer's recommendations and solid understanding of product characteristics. The Cast Stone Institute makes no express or implied warranty or guarantee of the techniques or construction methods identified herein. Technical references shall be made to the edition of the International Building Codes for the location of the structure, the latest edition of the TMS 402/406 Masonry Standards document and TMS 404, 504, 604 Standards for Design, Fabrication and Installation of Architectural Cast Stone.

The Cast Stone Institute (CSI) is a not-for-profit organization created to advance the design, manufacture and use of Architectural Cast Stone. To further this goal, the CSI continually disseminates information to targeted construction industry audiences through presentations, programs and technical publications.

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