Provided by:
Midwest Block and Brick, Inc.

NCMA TEK

National Concrete Masonry Association
an information series from the national authority on concrete masonry technology

CONCRETE MASONRY AND THE LEED® PROGRAM

TEK 6-9B
Energy & IAQ (2006)

Keywords: building certification, energy efficiency, environmental impact, green buildings, LEED program, recycling, sustainability, thermal mass

INTRODUCTION

Concrete masonry can make a significant contribution to meeting LEED Green Building certification. Leadership in Energy and Environmental Design (LEED) (ref. 1) is a voluntary rating system developed by the United States Green Building Council (USGBC) to evaluate a building's environmental impact and performance. LEED provides a design guideline as well as national third-party certification for defining what constitutes a "green" building. LEED's overall goals are to improve occupant well-being, environmental impacts and economic returns of new buildings. The USGBC offers several green building certification programs, each tailored for a specific market or application. This TEK provides details on the predominant LEED NC (new construction) version 2.2.

Using concrete masonry and concrete landscape products can help capture points toward certification in the following LEED categories: Sustainable Sites, Energy & Atmosphere, Materials & Resources, and Innovation in Design.

POINTS FOR CERTIFICATION

LEED NC 2.2 provides a checklist of mandatory prerequisites as well as voluntary credits in six basic categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation and design process. Projects earn one or more voluntary credits by meeting or exceeding a checklist item's technical requirements. Figure 1 illustrates the areas where concrete masonry products can contribute.

Points for voluntary credits add up to a final score which can earn the building one of four possible levels of certification. A building must earn at least 26 points for LEED certification. As shown in Figure 1, concrete masonry can make a significant contribution to LEED certification. Silver, gold, and platinum certification levels are also available. A total of 69 points is available from the six credit categories.

EARNING LEED POINTS

The following sections briefly describe how concrete masonry products can contribute to earning LEED points in each of the LEED credit categories.

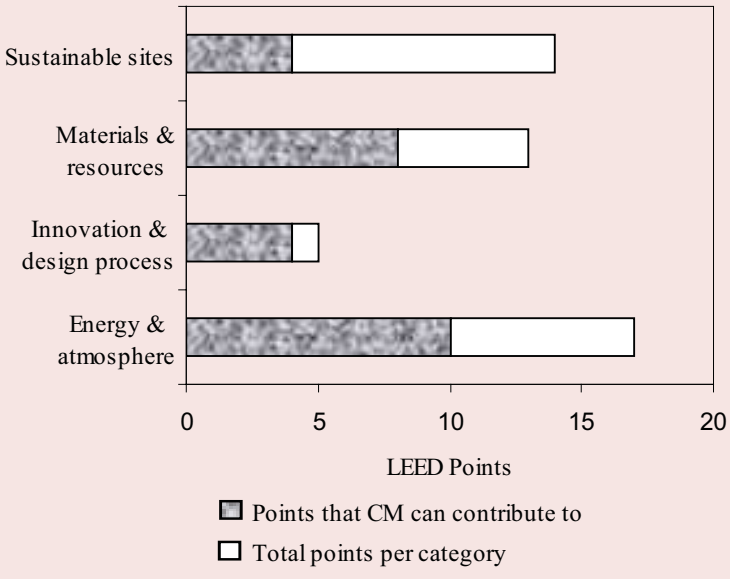

Figure 1—Potential Concrete Masonry Contribution to LEED NC Version 2.2 Rating Points

Sustainable Site Credit—Development Density

Developing an urban lot in lieu of an undeveloped "greenfield" area can earn the project one point towards certification. Concrete masonry and segmental retaining walls enable designs that take advantage of small, irregularly shaped lots, where access and open area are often at a premium. Concrete masonry, because of its relatively small, modular size does not require large equipment for delivery or placement, nor are large staging areas required for construction.

Sustainable Site Credit—Stormwater Management

The intent of this LEED credit is to limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, and managing stormwater runoff. One of the suggested strategies is to use pervious paving that promotes infiltration.

The requirement for controlling stormwater rate and quality depends on the existing imperviousness of the site. If the existing site is less than or equal to 50% impervious, LEED credit can be earned by implementing a stormwater management plan to prevent post-development peak discharge from exceeding pre-development peak discharge and quantity for one- and two-year 24 hour design storms, OR implementing a plan that protects the receiving streams from excessive erosion.

If the existing site is more than 50% impervious, the stormwater management must result in a 25% decrease in the volume of stormwater runoff from the two-year, 24- hour design storm in order to earn the LEED credit.

An additional point may be earned by implementing a Best Management Practices (BMP) to capture and treat no less than 90% of the average annual rainfall and removing 80% of the post-development suspended solids.

Pavements are major contributors to stormwater runoff, and permeable pavements that directly pass water from the pavement surfaces to the underlying soil can help alleviate runoff. Benefits of permeable pavements include reduced stormwater runoff, direct recharge of underlying groundwater systems, partial treatment of pollutants in the runoff and increased usable space. Both permeable pavers and open-cell pavers (also known as turf stone or grid pavers) offer the option of replacing impermeable pavement with permeable pavement. References 4, 6, 7 and 8 provide more detailed design information for these pavements.

Pavers can help earn one point each for reducing stormwater and for treatment of stormwater.

Sustainable Site Credit—Landscape and Exterior Design to Reduce Heat Island Effects

Urban heat islands are localized areas of high temperature, caused by the retention of solar energy on constructed dark surfaces. The effect is elevated temperatures in urban areas and a greater energy demand for cooling.

LEED offers credit for non-roof heat island reduction on projects if 50% or more of the site hardscape (including roads, sidewalks, courtyards and parking lots) are either shaded or use paving materials with Solar Reflectance Index of at least 29. Typical values for SRI are 35 for new gray concrete and 19 for weathered (unclean) concrete.

This requirement can be met either by using light-colored concrete pavers in lieu of asphalt; or by using open-cell pavers, which can support grass or other plant materials in the pavers' open grid areas. This is worth 1 point.

Energy & Atmosphere Credit—Optimize Energy Performance

The intent here is to improve energy efficiency above baseline prerequisites (ASHRAE 90.1-2004, ref. 3) in the LEED system. Energy savings attributable to thermal mass inherent in concrete masonry construction contribute to this goal when used in conjunction with passive solar heating and/or ventilation cooling. Because concrete masonry has high thermal mass and specific heat, it provides very effective thermal storage. Masonry walls remain warm or cool long after the heat or air-conditioning has shut off. This, in turn, can effectively: reduce heating and cooling loads; improve occupant comfort by moderating indoor temperature swings; and shift peak heating and cooling loads to off-peak hours. In addition, the reflective properties of concrete pavers may allow designers to reduce energy requirements for lighting in parking areas.

The method of determining energy cost savings must meet the requirements of ASHRAE/IESNA 90.1 Section 11, *Energy Cost Budget Method.* Section 11 includes detailed criteria for the software used to determine the energy savings. The simulation program must be a comprehensive, whole-building analysis program, capable of projecting the building's energy consumption and associated costs based on an hour-by-hour simulation of a full year of weather data. Examples of such programs include DOE-2 and BLAST. These programs can accurately model concrete masonry's thermal mass and predict the associated energy savings. These energy simulations have been used to demonstrate in many cases that, with all other variables kept the same, a high mass concrete masonry building can be heated and cooled using less energy than a similar frame building. More detail on using Section 11 can be found in References 3 and 5.

One to 10 points can be awarded for energy cost savings (beyond the minimum requirements in ASHRAE 90.1) of 10.5% to 42% for new buildings and 3.5% to 35% for existing buildings. Note that for the purposes of this credit, savings attributable to the building thermal envelope are cumulative, and so are added to savings from high efficiency HVAC, heat recovery equipment, daylighting, etc. Thus, all incremental improvements contribute toward project certification.

Materials & Resources Credit—Building Reuse

The purpose of the building reuse credit is to extend the life of the existing building stock, thereby conserving resources and reducing waste and the environmental impacts of new construction. Credits are earned when developers maintain the majority of an existing building's structure and shell.

The building shell is the exterior skin and framing excluding window assemblies, interior walls, floor coverings and ceiling systems.

This credit is often obtainable when renovating buildings with exterior concrete masonry walls since concrete masonry is an exceptionally durable material, with a life cycle measurably longer than many other building envelope products. Concrete masonry construction provides the opportunity to refurbish the building should the building use or function change, rather than tear down and start anew.

This is worth 1 point if 75% of the existing building structure/shell is left in place and 2 points if 95% is left in place. Measurements are based on square footages of walls, ceilings and floors.

Materials & Resources Credit—Construction Waste Management

This checklist item encourages project constructors to divert demolition and land-clearing debris from landfills and incinerators.

The construction waste management credit is awarded based on recycling or salvaging at least 50% of construction waste. Measurements are made either by weight or by volume. Because concrete masonry is a relatively heavy construction material and can be recycled into aggregate for road bases or other concrete products, pipe bedding or construction fill, this credit is obtainable either when buildings with concrete masonry are demolished or, in new construction when saw-cut scraps and broken pieces of concrete masonry are crushed and reused. In addition, intact and unused concrete masonry units can be redirected to other projects or donated to charitable organizations such as Habitat for Humanity.

This credit is worth 1 point if 50% of the construction, demolition and land clearing waste is recycled or salvaged and 2 points for 75%.

Materials & Resources Credit—Materials Reuse

This checklist item encourages the reuse of salvaged materials on the project, such as crushed concrete masonry, and it awards one point if the value of all reused materials is at least 5% of the total value of materials on the project. Two points are awarded at the 10% threshold. Note that the same materials cannot be claimed for both the construction waste management credit, above, and the materials reuse credit.

Materials & Resources Credit—Recycled Content

The use of building products with recycled content can earn the project one or two LEED points. The requirements of this credit state: "use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% of the total value of the materials." The value of the recycled content portion is determined by multiplying the cost of the item by the percent of recycled materials in that item (based on weight). Note that to earn the credit, the project must meet the threshold percentage based on the total of all building materials used in the project.

Concrete masonry can potentially incorporate recycled materials. However, due consideration must be given to ensure that the use of these materials does not adversely affect the quality of the masonry units or construction. Some recycled materials can be used as a partial replacement for cement. These include pozzolanic materials such as fly ash, silica fume and slag cement, which are considered pre-consumer. Post-consumer recycled materials are those that have been used for their intended purpose, then reused. For example, concrete masonry units salvaged from a demolished building, then crushed and used as aggregate are considered post-consumer. Damaged or broken units discarded at the manufacturing plant, then crushed and reused are not considered post-consumer. Note that some recycled materials may only be regionally available. Designers should work closely with concrete masonry manufacturers to substantiate recycled content claims.

This credit is worth 1 point for the quantities quoted above or 2 points for 20% combined post-consumer and 50% post-industrial recycled content.

Materials & Resources Credit—Regional Materials

Using materials and products that are extracted and manufactured within the region support the use of indigenous resources and thereby reduce environmental impacts of transportation. Concrete masonry materials are most commonly extracted and manufactured close to the jobsite, thus helping to fulfill this LEED checklist item.

The LEED requirement is to "specify that a minimum of 10% of building materials be extracted, processed & manufactured within a radius of 500 miles." Concrete masonry usually qualifies, since block plants are typically within 50 mi (80 km) of a job site. The percentage of materials is calculated on a cost basis. If only a fraction of a product or material is extracted/harvested/recovered and manufactured within the region, then only that percentage (by weight) contributes to the regional value.

This credit is worth 1 point. An additional 1 point is earned if 20% of the regionally manufactured materials are extracted, harvested or recovered within 500 mi (80 km).

Innovation and Design Process

The intent of this item is to provide design teams with an incentive to go beyond the LEED requirements and/or to award points for innovative strategies not specifically addressed in the LEED rating system. Examples that may qualify are: substantially exceeding the building energy performance criteria (*Energy & Atmosphere* Credit 1), or including characteristics not directly referenced by LEED, such as acoustic performance and life cycle analysis of materials used. To earn credits (up to 4), the design team must submit the intent of the proposed credit; the proposed requirement for compliance; submittals to demonstrate that compliance; and the design approach used to meet the requirements.

Potential contributions of concrete masonry include:

- decreased life cycle environmental impacts, due to concrete

masonry's low embodied energy compared to products such as steel and aluminum and to the product's long life, durability and low maintenance needs;
- improvements to indoor air quality by eliminating the need to paint or adhere finishes by choosing architectural or prefaced concrete masonry units. This reduces volatile organic compounds (VOCs) that can be released into indoor air.
- improvement to indoor air quality due to the reduced potential for mold growth (concrete masonry does not provide a food source for mold) and ease of cleaning should mold growth occur;
- efficient use of materials through strategies such as partial grouting of masonry or prestressed masonry;
- increased acoustic performance; and
- increased fire safety.

REFERENCES

1. *LEED-NC for New Construction v2.2 Reference Guide.* First Edition, U. S. Green Building Council, October 2005.
2. *LEED Green Building Rating System and Concrete*, brochure EV27.01. Environmental Council of Concrete Organizations (ECCO), 2003.
3. *Energy Standard for Buildings Except Low-Rise Residential Buildings*, ASHRAE/IESNA Standard 90.1-2004. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. and the Illuminating Engineering Society of North America, 2004.
4. *Permeable Pavements for Commercial Parking Lots*, TEK 11-11. National Concrete Masonry Association, 2002.
5. *Standard 90.1-2004 User's Manual*. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 2004.
6. *Concrete Grid Pavements*, TEK 11-3. National Concrete Masonry Association, 1996.
7. *Concrete Grid Pavements*, TECH SPEC 8. Interlocking Concrete Pavement Institute, 2005.
8. *Achieving LEED Credits with Segmental Concrete Pavements*, TECH SPEC 16. Interlocking Concrete Pavement Institute, 2005.

Provided by:
Midwest Block and Brick, Inc.