Masonry LEED Credits:

EA1 - Optimize Energy
- Thermal Mass in masonry walls moderates temperatures to reduce energy consumption and HVAC system size.

MR1 – Building Reuse
- Historic masonry building durability allows for reuse and renewal.

MR2 – Construction Waste Management
- Modularity minimizes waste.
- Demolition & construction waste can be crushed & recycled.

MR3 – Resource Reuse (salvage)
- Existing brick can be reused.

MR4 – Recycled Content
- Cement replacement with fly ash and slag in concrete products
- Recycled materials can replace aggregates in brick & block

MR5 - Local/Regional Materials
- Brick and block are usually available within 800 km

MR8 - Durable Building
- Masonry is a proven material for durability

Masonry benefits not in LEED

Structure/Finish Combination:
Masonry can provide both the building structure, and the interior or exterior finishes. This reduces the need for the production, installation & maintenance of additional finish materials.

Indoor Air Quality:
- No off-gassing, toxicity or VOC's.
- Masonry does not support mould growth and is easily cleaned.

Recently the construction industry has seen an increased emphasis on sustainable design and "building green" by governments, design professionals and building owners. B.C. is leading the rest of Canada in accepting environmental building practices, and in the adoption of the LEED® rating system. This section reviews the positive environmental impacts of concrete block and clay brick masonry, and details how credits can be achieved under LEED.

SHADES OF GREEN

A measurement system is required if buildings are to be evaluated for their predicted environmental performance. The two systems that have received the most acceptance are LEED® (Leadership in Energy and Environmental Design), and Green Globes®. LEED will be recognized by most designers, as it has become the best known environmental assessment system in North America. It was developed in the U.S. by the US Green Building Council, and has been adapted for Canada under the Canada Green Building Council (www.cagbc.org). LEED Canada-NC 1.0 was issued in late 2004 and updated this past spring. Green Globes is a web based assessment tool that is administered by the Green Building Initiative (www.thegbi.org). These systems provide a long list of credits and points that may be achieved by meeting defined criteria. They provide rating levels based on the number of points awarded (i.e. LEED Gold). Other green building checklists have been developed for specific building types and geographic regions.

All of these systems are quite basic, with fixed credit weightings, and no climatic options such as those we are familiar with in our established building codes. They also fail to cover some of the sustainable design benefits provided by certain materials. The next stage in building evaluation will be the refinement of Life Cycle Assessment (LCA) tools such as the “Athena® Environmental Impact Estimator for Buildings”(www.athenasmi.ca). LCA attempts to provide a more detailed assessment of the environmental impact of various building materials over their full life cycle.

The key sustainable design topics that are addressed by masonry materials are discussed below.

DURABLE MATERIALS

The use of durable building materials is one of the most obvious characteristics of a building constructed in a sustainable manner. While durability is generally recognized as an important green building issue, it has proven to be difficult to incorporate into evaluation systems. While we all may feel we know it when we see it, durability is difficult to quantify, particularly for newer materials. One problem with the current U.S. LEED system is that it does not consider this key issue in its points system. This situation has been partially resolved in LEED Canada by the addition of a durable building credit. It only accounts for one point of the 70 available, but is a good step in the right direction.

The proven durability of masonry for structural, building envelope and interior finish applications will conserve resources over the building life cycle and reduce waste. The building itself can stay in service longer, with lower repair and maintenance requirements. Brick, block and stone products can last for the life of a building and can help a project qualify under this credit. However, masonry durability is best identified through the use of a life cycle assessment of maintenance, repair and replacement requirements.

The LEED Durable Building Credit MR8 references the Canadian Standard Association (CSA) standard *S478-95 - Guideline on Durability in Buildings*, and requires that the expected service life of components equal or exceed the design service life of the building. There was some initial concern about administrative requirements and liability issues for this credit, so the CaGBC has simplified and clarified the process, while maintaining the rigor of the credit.

PREDICTED SERVICE LIFE LIFE (Materials)	>	DESIGN SERVICE LIFE (Building)

LOCAL MANUFACTURE

The transportation of building products that are produced at a great distance from a construction project generates substantial environmental impacts. These impacts can obviously be reduced if materials from the local region are specified. In LEED credit MR5, the distance limit from the construction site for both the raw material and the production plant is defined by a 800 km radius by truck, and a 2400 km radius for rail or water transport.

Because there are dozens of concrete block plants located across Canada, there is a high likelihood that concrete block can be sourced within the LEED radius and in many cases much closer to a project. Modern, highly efficient brick plants produce a high volume of product. As a result there are less than a dozen large operations located across the country. However, because these plants are located close to the major construction markets, in most cases construction projects will fall within the LEED radius.

In B.C., all major centres are serviced by regional block and brick plants. In addition, mortar and blockfill grout materials are also locally available.

RECYCLED CONTENT

The use of recycled materials in the production of building materials is beneficial because it reduces the impacts from both the sourcing of new raw materials and the disposal of waste materials. For clay brick, recycled materials can replace some of the new clay or shale required for brick production. For concrete block, recycled materials can replace a portion of both the cement and the aggregate in the block mix design.

While clay and shale are abundantly available for brick production, it is worthwhile to minimize the amount of virgin material that must be processed and transported. In many cases, brick operations already grind and reuse any reject fired units as part of their raw material input. While environmentally sound, the recycling of this “grog” does not presently qualify as recycled content under LEED credit MR4 because it stays on the property and is considered as internal process waste. The use of other recycled materials from consumer or industrial products waste streams is under active investigation by the brick industry in Canada.

Supplementary Cementing Materials (SCMs), such as fly ash and ground granulated blast furnace slag (GGBFS), are being used increasingly as a replacement for part of the cement content in all concrete products. This now includes replacing some of the cement that makes up about 10% of a typical concrete block mix design. Fly ash is used in the west, while GGBFS from steel making is more common in eastern Canada. Fly ash is generated from cleaning the stack emissions of coal-burning electrical generating plants. Both of these materials have cementitious properties that make them suitable as replacements for 20 – 25% of the cement in concrete block.

The positive effects of SCM substitutions are given a very high weighting in LEED Canada because of their double benefit of reducing cement requirements while utilizing a waste material. The LEED Canada credit applies a multiplier of 2 to the reduction in cement content between the mix with SCMs and a base mix without SCMs. This cement reduction factor is not applied to the cement only, but rather, to the entire concrete product. The combination of these two factors can result in a **20-fold** increase in the impact for SCMs in concrete block, compared to what it would be if applied solely to the percentage of recycled content. SCMs are considered as pre-consumer recycled content.

Recycled materials can also replace some of the sand and gravel aggregate in concrete block production. Aggregate replacements could include post-consumer products such as recycled glass or recycled building demolition waste. They could also include pre-consumer recycled materials that have not passed through the consumer waste stream, but are waste products from manufacturing processes. While a multitude of potential recycled materials are being investigated, they must be carefully evaluated to determine if they are suitable for the manufacture, construction and long term serviceability of concrete block.

MIBC block producer members can supply product information that outlines their recycled content.

ENERGY REDUCTION WITH THERMAL MASS

Mass on both the exterior and interior of buildings can improve thermal performance. High mass materials such as concrete block and clay brick can produce energy savings over the life of a building, and their inclusion in project designs can help to achieve LEED credits. When compared with light weight buildings, with all other building conditions kept constant, thermally massive buildings can show energy savings benefits for two reasons:

1) There are reduced peaks and valleys in heating and cooling requirements, since mass absorbs, stores and releases heat to slow the building response time. These moderated demands can reduce overall heating and cooling energy, as well as reducing the size and cost of HVAC equipment.

2) Thermal mass can delay heating and cooling loads, and shift them to more efficient times in a 24-hour cycle.

Unlike insulation values, the effects of thermal mass are not simple to determine. However they can be identified by using computer simulations of building behavior. These programs are now often used in the evaluation of sustainable building projects. To illustrate how these principles may pertain to energy credit requirements; two computer simulation model analyses have been performed using masonry and concrete options on three versions of a typical 4-storey office building. The three versions varied in their respective weights, based on increasing amounts of masonry and concrete for structural and cladding materials. The high thermal mass case included brick veneer over a block back-up wall, along with concrete columns, floors and roof.

The results of these energy analyses showed that the use of high thermal mass can provide energy savings for each of five sample locations across Canada – including Vancouver. These forecasted energy savings can also be used to achieve higher energy credits under LEED. Contact the MIBC office for further information on these studies.

OTHER BENEFITS

- Building Reuse:
  The durability of historic brick and stone masonry allow older structures to be restored and renewed, rather than demolished. LEED Credit MR1.

- Resource Reuse:
  Brick and stone units can be reused as salvaged materials on new projects. Brick and block can be crushed and reused as structural fill and landscape material. LEED Credit MR3.

- Construction Waste Management:
  The modularity of masonry units minimizes site waste compared to other materials. Demolition and construction waste can be crushed and recycled. LEED Credit MR2.

- Structure/Finish Combination:
  Masonry structural and partition walls can be left exposed – eliminating the need for the installation and maintenance of additional finishes.

- Fire Resistance:
  The fire separation provided by concrete block fire walls saves lives and properties from destruction – and reduces material use and landfill waste due to replacement of fire damaged structures.

- Low Volatile Organic Compounds (VOC's):
  Most masonry products are "self-finishing", and require no coatings or finishes in interior applications. This eliminates the question of low VOC coverings. The masonry industry proposes that in the future, these products should therefore also qualify for low VOC credits.

CONCLUSION

The builders of the Great Wall in China, the Taj Mahal, and the domes of Florence and St. Peters may not have had LEED certification to consider, but their specification of durable masonry materials made their structures lasting examples of sustainable design. Today's masonry industry is actively exploring new raw materials, manufacturing improvements and wall system refinements to maximize the positive impact of masonry on modern construction – and welcomes questions and suggestions from designers, specifiers and owners in this effort.

For more information see "Guide to Sustainable Design with Concrete" at www.cement.ca.