Green Masonry

Achieving Sustainability with Clay Masonry

By Brian E. Trimble, P.E., CDT

We hear about green buildings, high performance buildings, whole building design and the like every day. Sustainable design is certainly altruistic, but what can we do to really have an impact? Clay masonry fits into numerous categories when discussing sustainable design, if given a little forethought.

Sustainability

Sustainability is the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. While this may make sense to many people, deciding how to accomplish it allows us to use our skills. The savvy engineer will work closely with the architect to create an efficient building.

Why Would a Structural Engineer Choose Clay Masonry?

1 Masonry has been a sustainable material over the millennia. Old brick structures still stand and function as originally intended. With all of the emphasis on recycled materials and recycling, we may have lost sight of materials that will last longer.

2 It uses embodied energy efficiently. *Table 1*, adapted from values given in AIA's *Environmental Resources Guide*, summarizes the energy required to manufacture typical building materials.

3 When the impact of transporting the brick to the jobsite is included, the embodied energy is approximately 4,000 BTU/lb.

4 Readily available materials. The clay and shale used to make brick are obtained from the earth and are abundant; production is conducted worldwide. In the U.S., brick is produced in 38 states. Bricks are transported within their own region of the U.S., generally around 150 miles.

Table 1: Embodied Energy of Various Materials

Material	BTU/lb of material
Brick	300 - 1,750
Wood	2,625
Concrete	2,900
Glass	6,750 - 7,500
Steel	19,000
Aluminum	85,000 - 103,000

5 Many manufacturers have been cited for helping the environment. Robinson Brick in Colorado was given an award by the Department of Mines for its work in reclaiming mined areas. Mines remediation can create landfills, golf courses or natural habitats.

6 Efficient use of materials. Almost all of the mined material is used. On occasion, special clays and other materials are used to change certain properties of the brick. Recovery, or the percentage of brick that can be used or sold after firing, is near 100 percent. Any brick not meeting the quality standards can be crushed and reused in the manufacturing process, or used as landscaping chips or a subbase.

7 Some manufacturers include unwanted or useless materials from other industries; examples include fly ash, sewage sludge, waste glass and unwanted chemical wastes. Other materials have been added as a burn-off fuel, including coal and sawdust. One battery manufacturer sent material discarded from their production to the local brick manufacturer, who used it in making brick for the battery company's headquarters.

8 High-firing temperatures lock the waste materials into the brick to effectively encapsulate it a non-hazardous manner. The emissions resulting from the firing are not increased; some emissions are decreased. Emissions from

brick plants, including sulfur dioxide and trioxide and hydrogen fluoride, are regulated. Manufacturers address emissions by using pollution control devices such as scrubbers or by encapsulating additives in the clay mix.

The structural engineer can assist the architect in designing the most efficient structure possible. As a material, brick can provide both structure and exterior (or interior) finish thereby minimizing the materials on a project. During its long life, there is little maintenance needed and fewer resources are necessary for repairs and replacement.

Brick and LEED

The US Green Building Council's LEED rating system breaks down the credits into six categories; masonry fits into five easily.

Sustainable Sites

The development density credit is intended to channel development to urban areas. Masonry suits urban sites both aesthetically and from a durability standpoint.

In the Stormwater Management credit, the use of a flexible brick pavement can allow water to percolate back into the ground. Designers can take advantage of the Heat Island Effect by selecting brick pavers with lighter color.

Energy & Atmosphere

Using the thermal mass benefits of brick can increase the energy performance of a building. It absorbs the heat and slowly releases it. Current codes take masonry mass into account by requiring a lower R-value for heavyweight walls. Not only does masonry dissipate heat transfer through walls, it also shifts it into off-peak times possibly resulting in reduced energy costs.

One item that continues to be a challenge is when brick veneer/steel stud wall assemblies are used; a certain amount of thermal bridging occurs through the studs and bypasses the insulation. Recent codes account for this energy loss.

Material & Resources

Brick can fulfill Building Reuse credits, Resource Reuse credits, Recycled Content and Regional Materials credits using the durability and longevity of brick. Many structures have been renovated thus saving the façade. Since brick is manufactured regionally, the LEED requirement for a material within 500 miles is not a problem.

Indoor Environmental Quality

Brick is an inert material with no off-gassing and no emissions of toxic substances.

Innovation & Design Process

Switching structural systems from one that requires many layers to a system that rolls all performance requirements into one could deserve an additional credit. Clay masonry reduces the need to produce other materials and the amount of embodied energy. Using prestressed masonry or reinforced cladding uses the materials to their fullest.

Conclusion

As sustainable design continues to take hold, we must be able to use the information we have to incorporate materials efficiently. Following principles outlined in USGBC's LEED rating guide will assist us. Using common sense about how our buildings are designed and ultimately used will also allow us to design for the future. Brick will be a part of that future.▪

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TMS (**The Masonry Society**) has a **Sustainability Subcommittee** chaired by Pat Rand to support the use of masonry in sustainable design. To participate on this committee or for further information, contact The Masonry Society at **www.masonrysociety.org**.

At the 10th Canadian Masonry Symposium in Banff, Alberta held June 8 – 12, 2005, a paper was presented titled Sustainable Design Of Masonry Buildings by W.C. McEwen and R.R. Marshall. The paper highlights the characteristics of LEED Canada-NC 1.0 which has some distinct differences from LEED in the United States. A document titled Guide to Sustainable Design with Concrete also applies to masonry and is available at **www.cement.ca.**

Green masonry as it relates to concrete masonry was presented in an article titled Green Building in the November 2004 issue of MASONRY magazine, which is available on-line at **www.masonrymagazine.com/11-04/green.html.**▪