

Soaking up the Sun

Trombe Walls and Solar Gain

Concrete masonry plays major role in the “green” movement.

At the base of the Sangre De Cristo Mountains in Taos, N. M., sits a small group of what appear to be traditional adobe pueblo homes. In reality, these are the Sueños del Cañon luxury condominiums, a cutting-edge model of sustainable development in Southwestern guise.

Living Designs Group (LDG) and Dreamcatcher Real Estate & Construction teamed up to create Sueños del Cañon as an affordable, ecological community. LDG is a consulting and design firm where engineers, architects, and ecologists work together to incorporate workable sustainable concepts into each of its design projects. The group's expertise includes water conservation, ecological preservation, and integrating interior and exterior environments to maintain a healthy “living design.” For this particular project, concrete masonry was a key part of LDG's energy conscious plan.

Because of its high thermal mass, masonry stays warm or cool longer than other materials, which reduces the strain on heating and

cooling systems by moderating temperature changes inside a building. This feature makes masonry a prime material for projects geared toward energy conservation.

Special concrete block Trombe walls are being added to the wood frame construction of the Sueños del Cañon condo units to allow for passive solar gain. Trombe walls (most often pronounced like ‘trome’) are named after a French inventor, Felix Trombe, who popularized the concept in the 1960s, although the design was originally patented in the 1800s.

The Trombe wall is an early version of the double wall, or dual skin, building envelopes which are common today. It is typically a south-facing wall of 8-in. to 16-in. masonry units, with an external pane of single or double layer glass. A $\frac{3}{4}$ in. to 2 in. space is left between the glass and masonry. The sun shines through the glass and heats the masonry wall, which is coated with dark paint or stucco to better absorb heat.

It takes 8 to 10 hours for heat to pass through an 8-in. Trombe wall, so as the sun

goes down, the radiant heat from the wall warms the room. By morning, the wall begins to cool, and the whole process begins again when the sun rises. The denser the wall, the more effective it is for thermal storage. Therefore, to maximize the mass the masonry wall is completely filled with concrete. At Sueños del Cañon, 3000-psi concrete was used to provide additional reinforcement. Although a special mix is not required for Trombe walls, recycled content like fly ash can be used to create density and a more environmentally-friendly finished product.

Nature's heating system

Trombe walls are naturally most effective in sun-filled climates like New Mexico or Arizona where long stretches of overcast days are uncommon. Some design modifications can be made, such as adding vents at the top and bottom of the wall, to take advantage of natural convection. As the air between the glass and masonry wall is heated, it rises and circulates into the room through

the top vent. As it cools, air is drawn down through the vent at the bottom of the wall. This action allows for a more direct gain of warm air throughout the day.

One drawback of this design is the potential for too much heat loss at night. Adjustable vent covers can be closed to prevent this backflow of warm air out of the room.

At Sueños del Cañon, windows and Trombe wall panels are used together to take advantage of both direct and indirect passive solar gain. As sunlight shines through the ½-in. thermal pane windows and warms the room, it provides a direct solar gain. When the sun's heat is absorbed into the Trombe wall, an indirect solar gain is created. The window installation is standard, with no special techniques needed. However, for optimal solar gain the glass is usually treated with a low-emittance (low-E) coating, which prevents heat from escaping back out.

The versatility of masonry is an asset to projects like this, where mass is needed but the entire structure is not block or brick. In this case, the 8-ft freestanding Trombe walls are added to wood frame construction. By using masonry, the builder is able to incorporate a solar feature, which will create long-term energy savings and still stay within a tight construction budget.

Although the concept of Trombe walls is not new, it is being revived by innovative designers focused on sustainable building.

“Green” amenities distinguish Sueños del Cañon from other condominiums with comparable price tags. Trombe walls are actually offered as a \$3500 upgrade to each unit in this community.

Solar takes the “LEED”

As more architects and engineers begin to follow this trend, the masonry industry is challenged to stay one step ahead and differentiate its products from other building materials. Masonry professionals may gain a competitive edge by seeking out projects where masonry can contribute to environmental sustainability, and providing education about the “green” benefits to help architects and engineers meet their clients’ sustainability requirements. If masonry is not already on the radar screen, it’s up to contractors to be sure these products are top-of-mind and serve as key components of sustainable building.

Many industry professionals are already familiar with the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. LEED is the accepted standard for measuring the human and environmental health of the design, construction, and operation of “green” buildings. Buildings can become LEED certified if they meet certain criteria and earn LEED points in several categories: Sustainable Sites, Energy and Atmosphere, Materials and

Resources, Indoor Environmental Quality, and Water Efficiency. There are four levels of LEED certification (Certified, Silver, Gold, and Platinum), depending on how many unit points a project earns.

As contractors become more familiar with the role of masonry products in green building, they can better communicate the possibilities, like LDG currently does with its design partners. For instance, “Solar features like Trombe walls can be stereotyped as a 1970s solar thing,” said Doug Patterson, director of Systems Design and Architecture at LDG. “You just have to look at it differently. The product can be a value-added green feature that doesn’t need to be expensive, and fits within a contemporary design”

In addition to energy efficiency, masonry can contribute to LEED certification by reducing jobsite waste, increasing the use of recycled materials, and improving indoor air quality. Fortunately, these benefits can be achieved in relatively simple ways, like building new structures from recycled or historic brick, stone, or block; adding fly ash in concrete block; and using the face of masonry as a finished interior surface (which eliminates chemicals from paint).

“Concrete block is a mature, widely used building material that needs to overcome its image for utilitarian use and design” explained Patterson. “Like many products in the sustainable green design world, concrete



A freestanding masonry Trombe wall is added to the wood frame construction of Sueños del Cañon condos to increase energy efficiency.



The outside masonry surface is painted a dark color before the windows are installed to increase heat absorptency.



The finished wall panels have the same appearance as adjacent windows.

block needs to reinvent and re-market itself. Otherwise, people aren't going to see it as a contemporary material for high-end design." Promoting the environmentally-friendly properties of masonry may be an important factor in creating this new image.

To learn more about the environmentally sustainable work of Living Designs Group, visit www.livingdesignsgroup.com. For more information about LEED certification, visit www.usgbc.org.

Upcoming Sustainability Events

Building Energy '07 Conference

March 13 - 15
Boston, Mass.
Northeast Sustainable Energy Association
www.buildingenergy.nesea.org
413-774-6051

Engineering Sustainability 2007: Innovation that Spans Boundaries

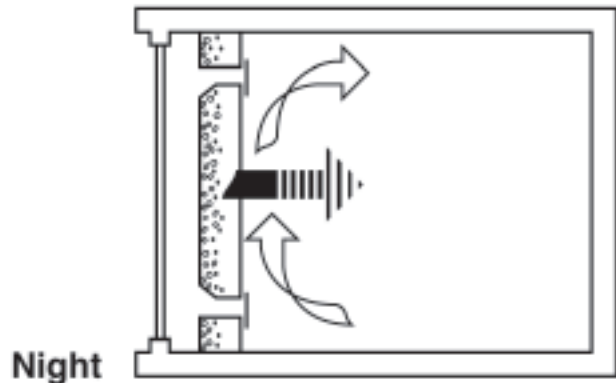
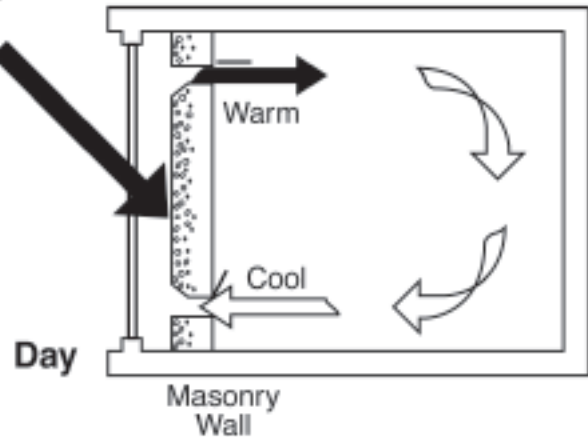
April 15 - 18
Pittsburgh, Pa.
Mascaro Sustainability Initiative at the University of Pittsburgh
www.engr.pitt.edu/msi/
412-624-9698

Common Ground, Consensus Building, and Continual Improvement: Standards on Sustainable Building

April 19 - 20
Washington, D.C.
ASTM International
www.astm.org
202-564-8859

AIA Convention 2007: Growing Beyond Green

May 3 - 5
San Antonio, Texas
American Institute of Architects
www.aiaconvention.com
800-242-3837



Reducing Pollution One Brick at a Time

Jenkins Brick Co. is reducing its environmental impact even before products are ready for the jobsite. The company is strategically building its newest plant next to a waste site in Moody, Ala., so the company can use clean-burning landfill gas to fuel its kilns. When the 220,000-sq-ft facility opens in 2008, landfill gas will supply 40% of the plant's energy. Eventually, the supply is expected to reach 100% as the landfill grows over the next 10 years.

This fuel use is environmentally significant because landfill gas accounts for over 25% of all methane emissions in the country. The gas is created by the natural deterioration of landfill materials, and contains approximately 50% methane, one of the most harmful greenhouse gases. "Reducing methane emissions provides immediate environmental benefits because methane... is over 20 times as potent as carbon dioxide at capturing heat in the atmosphere," according to a press release from Jenkins Brick.

By using landfill gas, the brick plant is expected to reduce greenhouse emissions by 62,000 metric tons of carbon dioxide equivalent per year. The effect will be equal to removing the emissions of 13,700 vehicles, reducing oil consumption by nearly 166,600 barrels, or planting 19,600 acres of forest, according to the EPA.

Jenkins Brick has been using landfill gas to fuel its Montgomery, Ala., location since 1998, and actually helped the city meet Clean Air Act standards for landfill gas emissions. This initial success, and the opportunity to reduce operating costs, were factors in the company's new plant design.

For several years, Jenkins Brick also has been involved with the EPA's Landfill Methane Outreach Program (LMOP), promoting the use of the gas as a renewable, green energy source. The LMOP provides technical expertise and assistance for methane reduction projects in the U.S. and other countries.

Visit www.epa.gov/lmop for more information about the LMOP, or www.jenkinsbrick.com to learn about the new Jenkins brick plant.