ARCHITECTURAL RECORD

Masonry Construction

eBook

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MASONRY CONSTRUCTION is one of the oldest styles of building, and yet there is still plenty of innovation happening within this sector. With advances in product offerings and installation techniques, architects still turn to masonry for a stately appeal and traditional aesthetics when designing schools, museums, residences and so many more building types. This eBook, produced by ARCHITECTURAL RECORD and Oldcastle Architectural's Echelon Masonry brand, shows some great examples of buildings where masonry was utilized, and includes some good information for those wishing to learn more about this building material and its possibilities. We hope you find this eBook interesting and useful.

Alex Bachrach, Publisher
ARCHITECTURAL RECORD

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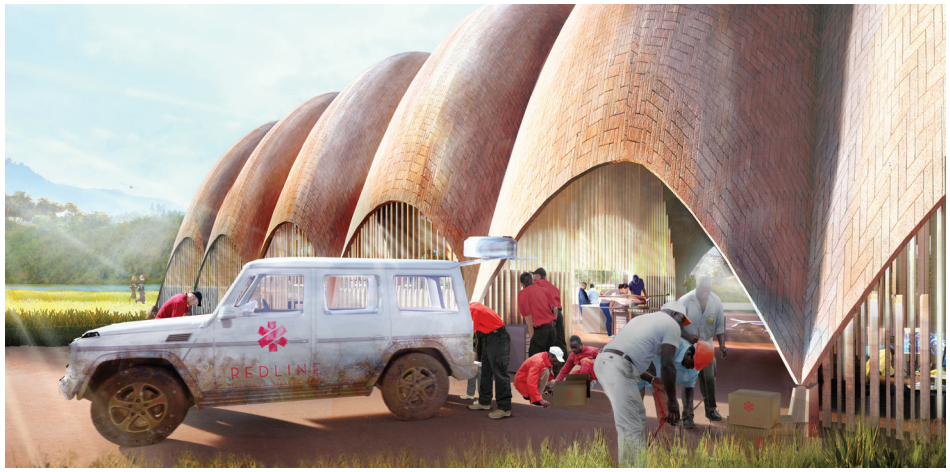
Brick by Brick

Architects and engineers enlist one of the oldest building technologies to create innovative 21st-century structures.

By Michael Cockram

IMAGE: © NIGEL YOUNG AND THE NORMAN FOSTER FOUNDATION



This past summer, a team of architects and engineers built an unusual brick vault at the Venice Biennale. The structure was the first step in the creation of a network of cargo droneports for developing countries. The first facilities, planned for Rwanda, would be made of multiple vaults in a variety of configurations, depending on local needs (left and above).

VENICE IS a city built of bricks and one enriched by the wooden cargo ships that helped lift the former Venetian Republic to greatness. So it's fitting that last May at the 2016 Venice Biennale, a handful of architecture and engineering students from the Massachusetts Institute of Technology and several European schools joined a team of professionals to build an experimental brick structure in the courtyard of the historic Arsenale, where naval and trading vessels were once constructed. Under the guidance of Foster + Partners architects, the team tested new approaches to traditional brick. Lord Norman Foster, known for his groundbreaking works in steel and glass, developed the design for the graceful, thin-shell masonry vault, demonstrating that common brick, with its durability, relatively low cost, and almost universal availability, continues to inspire form and innovation.

The vault built for the Biennale was a full-scale mockup of a cargo droneport and is an early step in the creation of a network of such facilities for developing countries. The concept is the brainchild of Jonathan Ledgard, director of the Ecole Polytechnique Federale de Lausanne's Afrotech initiative and its offshoot Redline, a drone developer. The team is currently exploring sites for the first droneports in Rwanda, where, as in many emerging countries, roads are sparse and difficult to navigate. Cargo drones have the capacity to carry small freight such as medical supplies to remote places, and "leapfrog" over the lack of adequate infrastructure, says architect Narinder Sagoo, a part-

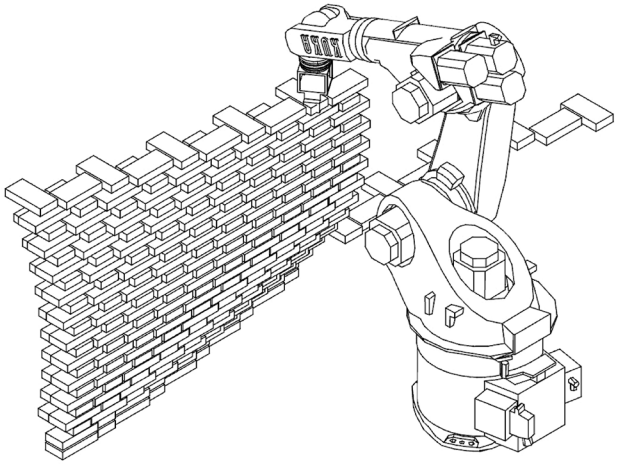
IMAGES: COURTESY FOSTER + PARTNERS

To convert an old industrial building in Shanghai into artists' studios and a gallery, architects from Archi-Union salvaged the bricks from the original structure.

ner at Foster + Partners.

Foster's idea was to create a module that could be replicated and expanded by combining the units into different configurations, depending on local needs. In addition to housing drones and supplies, part of each facility could also serve community functions, such as a clinic or a post office.

The form of the droneport evolved from Foster's revolutionary airport designs with their structurally expressive roofs. Similar to the firm's upcoming airport for Mexico City, the droneport's vaulted envelope "comes up from the ground and becomes the cladding and roof in one continuous system," says Sagoo. "Instead of columns, slabs, and roofs, we wanted to create a model that is structurally efficient, maximizes spans, and is built with a single building system that is easy to construct."



They created the new undulating facade (left and top) with the help of a bricklaying robot (above).

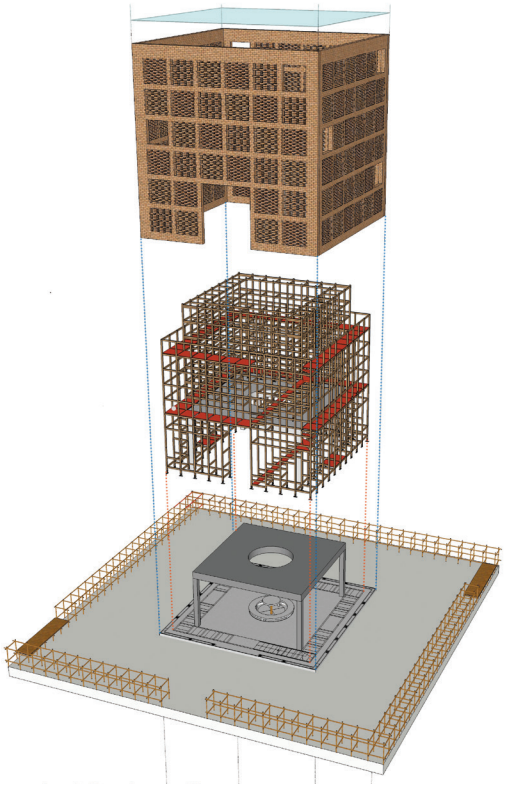
Following Foster's mantra to "do more with less," the architects worked with engineers from Cambridge, Massachusetts–based Ochsendorf DeJong and Block (ODB) early in the process to optimize the structure. Because the materials for making brick are readily available in Africa, the team decided to explore using an unreinforced masonry system.

The first step was a process that John Ochsendorf, an MIT professor of engineering and a partner in ODB, calls "form finding." Because unreinforced masonry performs well in compression but not in tension, the engineers relied on digital models to find a geometry that works only in compression under all expected load conditions, Ochsendorf explains. The digital modeling tool they used is similar in concept to the famous experiments in which the Spanish architect Antonio Gaudí suspended chains to find the most efficient shape for arches and domes. When slung between two points, a string or chain will inflect to a curve, or catenary, that is uniformly loaded in tension. If that shape is inverted and constructed of a rigid material like masonry, it forms an efficient arch in compression.

The technique used to build the droneport is indebted to another Spaniard, Rafael Guastavino, who immigrated to the U.S. in the late 19th century. He developed a method of making thin-shelled masonry domes and vaults with little or no formwork. It relied on a quick-drying mortar to cantilever the tiles in place until the finished form was completed. Guastavino's distinctive vaults were incorporated into many notable projects, including Grand Central Terminal in New York and the Boston Public Library.

To build the droneport mockup, Foster's team erected scaffolding and light fiberglass poles sprung into arches every few feet in each

Tropical Studio organized the four walls enclosing a studio for a ceramist near Hoi An, Vietnam, so that they resemble a quilt, each with a grid of 36 squares. Within these squares, some bricks are omitted to create different patterns with various levels of transparency.



direction. Over these temporary supports, they laid three layers of masonry, each at a different orientation, to increase strength.

The two outermost layers are made with an experimental 1½-inch-thick earthen brick, developed in collaboration with LafargeHolcim Foundation, a partner in the droneport project. Traditional air-cured earthen bricks, like adobe, typically consist of clay-based soil that contains sand or silt and organic material such as straw. Although easy to produce, these bricks are heavy and lack the strength, durability, and weather resistance of the kiln-fired variety. But those used for the Droneport include a small amount of Portland cement, which strengthens the bricks through a chemical curing process. The formula was conceived

IMAGES: © OKI HIROYUKI (LEFT); COURTESY TROPICAL STUDIO (RIGHT)

for situations where appropriate soils are plentiful but the resources for the energy-intensive production and firing of traditional bricks are scarce.

Due to time and technical constraints on the Venice project, the designers specified a 1-inch-thick Spanish-fired brick for the prototype's initial interior layer. Although the fiberglass poles and the steel for the scaffolding would be imported for the actual drone-ports, the idea is to rely on bricks made from raw materials found near the building site, Ochsendorf says.

Air-cured bricks that incorporate a small amount of cement have a significantly smaller carbon footprint than those that are fired. But researchers are studying ways to make modified earthen bricks even more green with additives that could replace the Portland cement, which has a high embodied energy due to a manufacturing process that includes heating limestone in a high-temperature kiln. MIT professor Elsa Olivetti, who teaches in the materials science department at MIT, is working with Ochsendorf to explore the potential of industrial by-products, such as boiler ash, which contains silicates and aluminates. These substances could chemically harden bricks in the same way that Portland cement does, but with fewer environmental consequences, she says.

One way to offset the negative impact of brick is to reuse it. That is what the architects, local firm Archi-Union, did for the Chi She Gallery in Shanghai. They repurposed much of a 70-year-old aircraft repair building, including the brick, and converted it

Inside the two-story ceramist's studio, a stout 16-inch-thick slab is supported on four concrete columns.

PHOTOGRAPHY: © OKI HIROYUKI

Between this slab and the exterior brick screen, a timber frame extends to a second level and to the building's glass roof, housing stairs and shelves for display.

into galleries and workspaces for several artists. Archi-Union stripped down the building to its concrete walls and floor slabs and raised the roof level to allow for a clerestory that lets daylight into an upper-level gallery. The ground level contains a multiuse space and studios.

The most distinctive feature of the project is the rippled brick facade. Made from the salvaged gray-green bricks of the original building, the non-load-bearing wall billows out over the entry. In addition to endowing the structure with a new sculptural presence, the designers made the facade appear lighter and screenlike near the top by omitting bricks in its Flemish bond (a pattern that alternates stretchers, or bricks laid flat with the long face exposed, with headers, or those turned so the short end is exposed).

To achieve the complex curvilinear geometry, the firm tapped into the new technology of robotic bricklaying, which is conceptually similar to CNC (computer numerical control) fabrication techniques. But instead of relying on machines for cutting, milling, or grinding, here a robotic arm was programmed to propel itself along a track while applying mortar to each brick and placing it with precision. Because the technology is not yet sufficiently developed to perform fine finishing tasks, masons followed behind the robot to strike, or shape, the mortar joints between the bricks.

For projects where crisp lines and uniformity are important, bricks that have a consistent hue and surface treatment are available and can be combined with robotic technology. But, like pottery, the elemental beauty of a hand-laid wall of bricks with subtle changes in color and texture is part of our 10,000-year love affair with the material. For a studio for ceramics artist Le Duc Ha near Hoi An, Vietnam, the architects at Ho Chi Minh City–based Tropical Studio show how simple forms can be enriched by taking advantage of variations in locally sourced brick as well as its potential for pattern-making and composition.

According to Tropical Studio principal Tran Thi Ngu Ngon, the firm envisioned the shape of the building as being as elemental and strong as the clay that forms the artwork. The cubic structure, 21 feet in all dimensions, contrasts with its pastoral setting, the edge of a field overlooking the Thu Bon River.

One goal was to relate the building to the historic brick construction of the region, says Nguyen Hai Long, a partner in the firm. Brick construction in central Vietnam dates to the 4th century, when the Champa culture began building Hindu temples in sacred complexes throughout the area, according to Nguyen. The site organization of the studio, with a path centered on the intricately detailed building, recalls the ceremonial layout of the Champa period.

The walls of the studio were constructed by first pouring a concrete frame for the exterior. To respond to the client's desire that the studio provide shelter but be open to sunlight and cool river breezes, the architects devised a grid of openwork panels. Each wall is divided into 36 squares made up of several patterns of brick screens with various levels of transparency—created by leaving voids in the brickwork—fitted like patchwork pieces to make the larger square.

Masons laid the brick so that the concrete frame would be hidden both inside and out, with the brick sawed to fit around the concrete members. The resulting perforated walls are about 8 inches thick, the length of one brick.

Inside the two-story volume, four concrete columns support a stout 16-inch-thick concrete slab. Because the slab is separated from the brick walls by a 2-foot gap, it forms a tablelike pedestal between the lower and upper levels. A timber frame surrounds the workspace and passes up through the gap between the slab and the exterior wall to extend to a flat glass roof. This wooden matrix houses shelves for display and stairs to the upper level.

At the center of the ground floor, Le's potter's wheel sits directly below an oculus that penetrates the floor slab. Daylight fills the upper-level display space and focuses a Pantheon-like disk of light on the artist's workspace below.

The elemental purity of the ceramist's studio, along with the dynamic expression of the Shanghai gallery and the structural elegance of the droneport project, prove brick's continued relevance. "Great buildings often go through considerable complexity to reach simplicity," says Foster + Partners' Sagoo. In selecting materials for these three projects, the designers found that simplicity in a humble and age-old material. ■

Michael Cockram is a freelance writer and director of Bowerbird Design in Fayetteville, Arkansas.

Continuing Education

To earn one AIA learning unit (LU), including one hour of health, safety, and welfare (HSW) credit, read "Brick by Brick," review the supplemental material at architecturalrecord.com, and complete the online test. Upon passing the test, you will receive a certificate of completion, and your credit will be automatically reported to the AIA. Additional information regarding credit-reporting and continuing-education requirements can be found online at continuingeducation.bnpmedia.com.

Learning Objectives

1 Describe different methods of building brick vaults.

2 Compare the environmental profile of air-cured, earthen brick with that of fired brick.

3 Describe efforts to enhance the durability and strength of air-cured, earthen brick.

4 Describe some of the limitations of robotic brick-laying technology.

AIA/CES Course #K1702A

FOR CEU CREDIT, READ "BRICK BY BRICK" AND TAKE THE QUIZ AT CONTINUINGEDUCATION.BNPMEDIA.COM, OR USE OUR ARCHITECTURAL RECORD CONTINUING-EDUCATION APP, AVAILABLE IN THE ITUNES STORE.

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The Museum at Prairiefire honors the region's most prominent features—its prairie fire burns and rolling landscapes. Hear the vision behind the museum from its designers, and see how Echelon Masonry helped its creators achieve the seemingly impossible.

See the full story at EchelonMasonry.com/Inspiration

PRODUCTS USED

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The Museum at Prairiefire

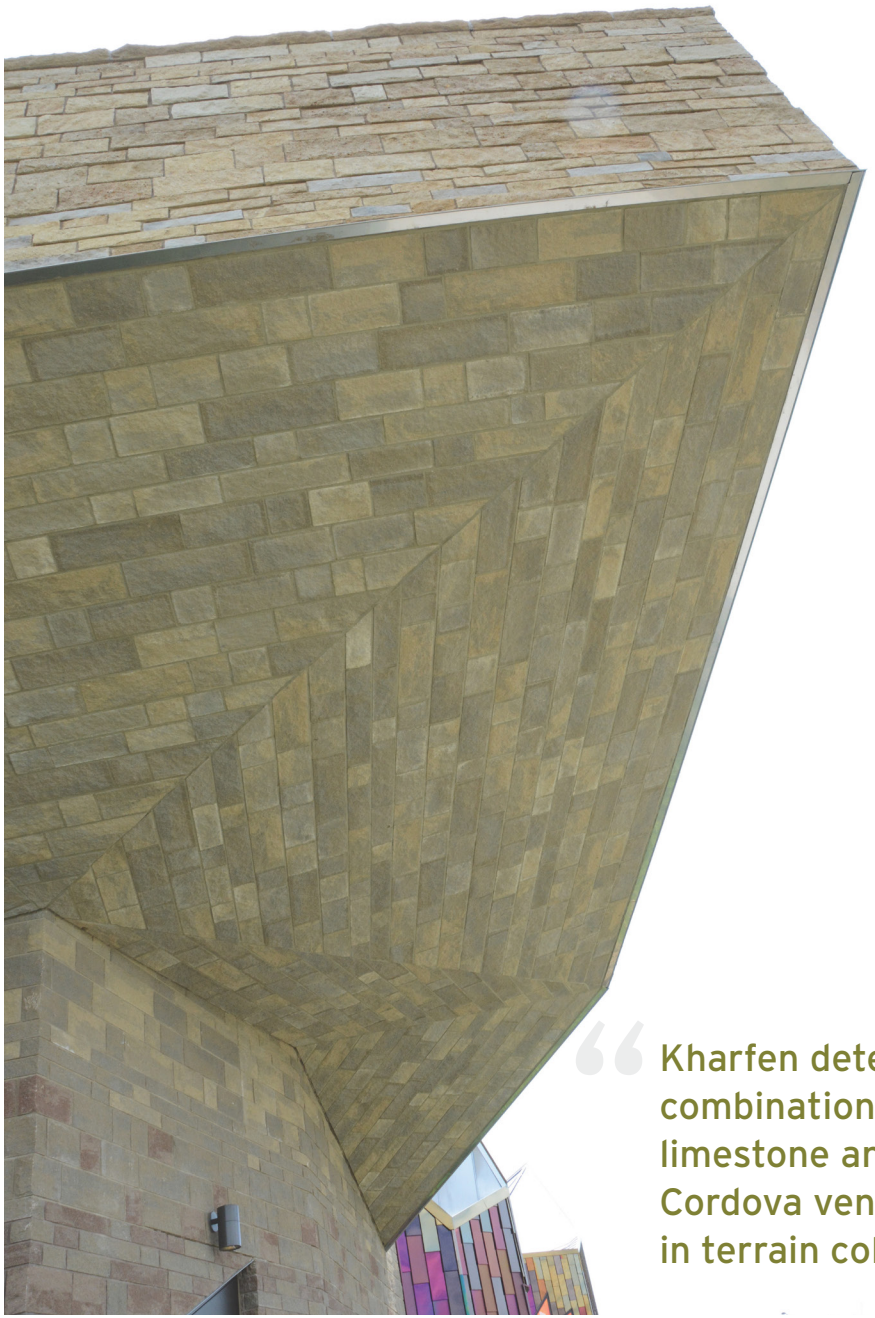
OVERLAND PARK, KANSAS

Stone and Fire: The Museum at Prairiefire Blends Natural and Man-Made Materials to Create an Architectural Icon on the Midwestern Prairie

THE MUSEUM AT PRAIRIEFIRE, located in Overland Park, Kansas, tells a story of geology, culture and the practice of prairie landscape management through intentional burns. The 41,000 sq. ft. architectural marvel, with a stone-clad backdrop that represents the undulating hillside, is alive with fiery sparks of color. The fire element is represented by a unique film material and the stones are in vast range of colors. The museum features a rotation of exhibits from New York City's American Museum of Natural History (AMNH).

The vision of Jonathan Kharfen, AIA, LEED senior associate, Verner Johnson Inc. of Boston, MA, the stonework is a mix of regionally-source natural limestone and manufactured stone veneer from Oldcastle Architectural's Echelon product line, set by the masterful hands of D&D Masonry. With a budget of $17.1 million, the Museum at Prairiefire has won several awards and recently achieved a LEED Silver rating.

Because Mother Nature doesn't always have the colors you



> He [Kharfen] was right on the money from the first sketches to final construction. It was his vision that brought the glass, Echelon Cordova veneer and natural stone together, to represent the char, smoke and colorful flames.
>
> – Fred Merrill, Founder and President of Merrill Companies

want in stock and at the right price, Kharfen went with manufactured stone veneer for the darker spectrum to achieve the desired "charred" gradient effect. "We incorporated four standard Echelon Cordova veneer colors and then worked closely with Oldcastle to create two custom colors," said Kharfen.

For the second-floor stone balcony, with views of the wetlands park, a specialized wall system was required. "The design intent was for this cantilevered stone promontory to be completely wrapped in stone, even its sloping soffits," said Kharfen. With the help of an Oldcastle subsidiary, Kharfen became familiar with the IBP Fast Track Stone System, which allows kerfed stone to sit in a lipped track system, which mechanically holds the stone in place, despite the gravity load of the sloping soffit. The two long sides of each stone are secured in the track top and bottom.

> Kharfen determined that a combination of stone—both natural limestone and man-made Echelon Cordova veneer - offered the range in terrain colors he was looking for.

Kharfen sloped the headers (and sometime sills) of all windows and doors located in the stone walls. Concerned about the stone cracking at these unique and sometimes ex-

treme header geometries, Kharfen found a clever way to support the stone to minimize any potential cracking over time. Whereas a typical window lintel spans horizontally to the window jambs, Kharfen designed a double lintel with a horizontal leg as well as a sloped leg. The sloped leg only supports the minimal triangular area of stone directly above the window, with the horizontal leg supporting the rest of the stone above, thereby minimizing the potential for cracking. "You can't tell when you see it, that there are two lintels above each window and door," he said.

Like a proud parent, Kharfen beams with pride when he talks about the Museum at Prairiefire, with its seamless blend of natural and man-made materials and incredible colored film that creates a kaleidoscope of colors against the exquisitely crafted stone backdrop. Like a splendid Phoenix rising from the ashes, the Museum at Prairiefire will dazzle visitors for generations to come. ■

> "The use of Cordova veneer mixed with traditional Kansas Limestone was what allowed this project to come in on budget and under a very tight timeframe."
>
> – Jonathan Kharfen, Verner Johnson, Inc.

About Echelon™ Masonry
Echelon is the consolidated brand for all masonry products and services of Oldcastle Architectural including Trenwyth® Architectural Masonry, Artisan Masonry Stone Veneers®, Quik-Brik® Concrete Masonry Units, Amerimix® Bagged Goods and a complete portfolio of Performance Upgrades. As a single source masonry portfolio solution, Echelon delivers consistent, reliable product manufactured locally at more than 150 locations and delivered by an unrivaled logistics network. For more information, visit EchelonMasonry.com.

About Oldcastle® Architectural
Oldcastle Architectural is the largest concrete products manufacturer in North America. With more than 170 locations and a company culture characterized by a commitment to customer satisfaction, Oldcastle adheres to a level of service and consistency that no other supplier can match. Our combination of local market presence and national capabilities allows us to meet and exceed the demanding needs of an ever-changing industry. Learn more at Oldcastle.com.

Project Details

Manufactured by
Oldcastle Architectural, Echelon Masonry

Project Size
41,000 SF

Products
Concrete Masonry Units:
Echelon Cordova Veneer
4 Standard and 2 Custom Colors

Project Type
Museum at Prairiefire, a mixed use suburban development

Location
Overland Park, Kansas

Property Owner
Fred Merrill,
Founder and President of Merrill Companies

Architect
Jonathan Kharfen, AIA and LEED Sr. Assoc.,
Verner Johnson, Inc., Boston, MA

Masonry Contractor
D&D Masonry, Kansas City, MO

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Amerimix offers a full line of Preblended Mortars, Stuccos and Grouts. We work alongside the craftsman to develop innovative products with an unwavering focus on consistency and durability. Amerimix products are engineered to perform, backed by proven results and designed to empower you to build better.

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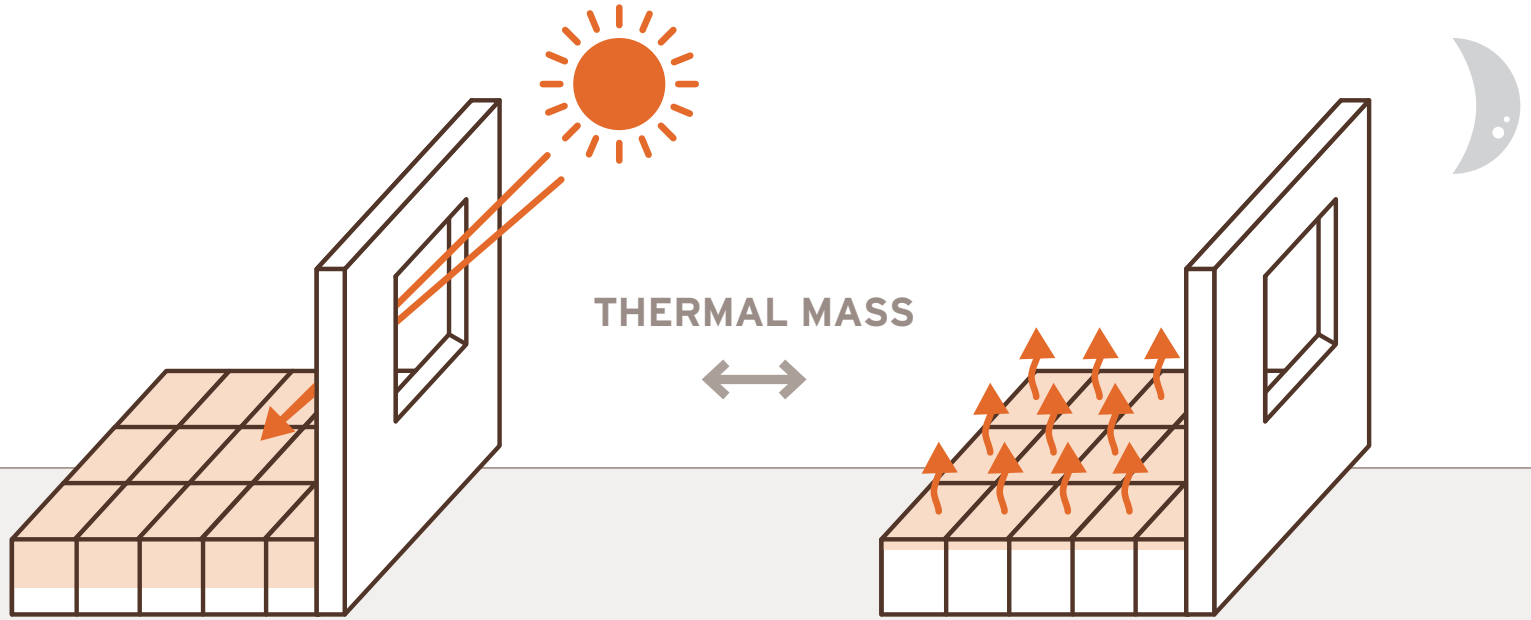
Capitalizing on Thermal Mass to Improve Efficiency

Masonry in the Building Envelope Can Reduce Heating, Cooling Demands



DAY
During the day, thermal mass absorbs and stores the solar heat.

NIGHT
During the night, thermal mass releases the stored solar heat.

Researchers have noted thermal mass is most effective if it is used on the interior of the insulation in the building envelope.

IN SUSTAINABLE PROJECTS, the design of the building envelope impacts materials use, indoor air quality, life-cycle performance and energy efficiency. Achieving an energy efficient envelope requires consideration of both the insulating value and the thermal mass of its materials. Thermal mass as found in masonry products helps to reduce indoor temperature swings and often leads to reduction in the size of mechanical heating and cooling systems.

In addition to saving money on the size of the HVAC system and life cycle heating/cooling, proper use of thermal mass can contribute to reduced insulation costs. ASHRAE 90.1 recognizes that thermal mass works with insulation to reduce thermal transfer, so it requires less insulation in a thermal mass solution than in a stud wall solution. For example, a typical wall R-Value requirement of R-18 might be met by a high-thermal-mass masonry wall

Less insulation is needed in a thermal mass solution.

A stud wall solution uses **R-18** VS A thermal mass solution uses **R-7**

> Most often this is in extremely hot, dry climates with cool nights. Research has found homes in these climates that also have exterior walls of high thermal mass need less energy for air conditioning than wood-framed houses with similar insulation but low thermal mass.

with an R-Value of R-7.

The International Masonry Institute notes, "Masonry systems, with the ability to enhance a building's thermal performance, provide one of the best passive design options and result in an integrated passive design strategy that balances building performance with heating and air conditioning requirements." They add, "Passive measures are paid for once, yet perform repeatedly over the life of the building."

Researchers have noted thermal mass is most effective if it is used on the interior of the insulation in the building envelope. This includes load-bearing concrete masonry as part of a cavity wall system, as well as interior concrete masonry walls and interior stone applications.

Oldcastle® Architectural's Echelon™ Masonry product line offers two masonry systems that combine the thermal mass benefits of concrete masonry with integral insulation – the **InsulTech™ Insulated Concrete Masonry System (ICMS)** and **EnduraMax™ High Performance Wall System.** Additionally, many Trenwyth® concrete masonry units offer the option for factory-installed expanded polystyrene insulation in the cells of the units. In fact, all Echelon Masonry products provide some

measure of thermal mass.

The use of materials with thermal mass is most advantageous where there is a big difference in outdoor temperatures from day to night (or, nighttime temperatures are at least 10 degrees cooler than the thermostat set point).

While not every project takes place in such an ideal climate, thermal mass will provide benefits in almost every environment. In variable, four-season climates, the benefits are usually maximized during spring and fall, when a building can be warmed passively by day and cooled with natural ventilation at night. In

The use of materials with thermal mass is most advantageous where there is a big difference in outdoor temperatures from day to night.

cold regions where heating systems are predominant throughout the year, thermal mass can be used to effectively store heat gains achieved during the day (through solar and/or mechanical means) to reduce mechanical heat usage to off-peak hours.

Designing a building with a high thermal mass can reduce construction costs (insulation and HVAC system costs), as well as the cost of energy over the lifetime of the building. As many masonry wall systems are of high thermal mass and have added benefits for moisture resistance and façade aesthetics, they can be a single solution for many needs. ■

WANT TO LEARN MORE? SIGN UP FOR A LUNCH & LEARN

This lunch and learn will review exterior envelope R-Value requirements and masonry wall compliance options in regards to the 2012 IECC (International Energy Conservation Code). Also, review exterior wall R-Value requirements and define Continuous Insulation (CI) as well as present design opportunities and innovative wall systems that comply with the 2012 IECC.

SIGN UP FOR LUNCH & LEARN

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PURE HARMONY

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A masterpiece of acoustics and aesthetics, the Mesa Community College Performing Arts Center is where generations of musicians and performers discover and share their art with the world. This passion is embodied from the outside in — the opening crescendo of Rhapsody in Blue dramatically rising along the exterior wall. Hear the vision from its designers and see how Echelon Masonry helped create an enduring home for music.

See the full story at EchelonMasonry.com/Harmony

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Design of the Public Realm

Bowman Senior Residences by Poster Frost Mirto

Nogales, Arizona

By Alex Klimoski

PHOTOGRAPHY: © LIAM FREDRICK PHOTOGRAPHY

Nogales may be Arizona's largest border city, but factors such as its hilly topography and lack of public transportation have limited adequate housing options, especially for seniors. A long-abandoned hotel in this quaint frontier town, however, has been adapted to provide affordable apartments for residents 62 and over.

Originally built in 1917 as temporary lodging for workers passing through the border, the erstwhile Bowman Hotel's century-old structure recalls a time when the railroad was new to Nogales, then a nascent hub of transportation and business. In 1976, the guesthouse ceased operation, and the three-story building's top floors were left vacant for 40 years. Seeing an opportunity to revitalize the city's sleepy downtown, the nonprofit Nogales Community Development Corporation partnered with Tucson-based firm Poster Frost Mirto and affordable housing developer Gorman & Company to give the weathered brick edifice a new life.

"The historic facade has been important to the fabric of Nogales," says Poster Frost Mirto principal Corky Poster, "so a main priority was to salvage as much of the original building as we could." In order to support the masonry and preserve the street front while gutting the interior, the firm expanded the building's height and length by adding a new concrete masonry unit structure, like a Tetris piece. Using funds from low-income housing tax credits and bank loans to finance the $8 million project, the team created 48 units at 650 square feet each.

The architects brought light and air into the 50,000-square-foot facility by placing a courtyard on the ground level and carving

out a four-story atrium so that residents are connected to the outside when entering and exiting apartments. To foster a sense of community, the architects included a fitness center, business center, multipurpose room, and shared kitchen.

A result of close collaboration with the community, the Bowman residences—which opened last year—exemplify how partnership and a respect for the past can resuscitate an aging landmark while adding social value.

New ASTM Code Assures Water-Repellancy of Mortar at Job Site

RECENTLY, ASTM INTERNATIONAL upgraded the section for determining water-repellancy of pre-blended mortars in ASTM C1714, "Standard Specification for Pre-blended Dry Mortar Mix for Unit Masonry." The new standard, C1714-16, introduced a new water-repellancy requirement for mortar that better ensures the mortar delivered to the job site is what the manufacturer claims.

Craig Walloch, vice president for technical development at ACM Chemistries, Inc. was a member of the ASTM's C12.03.08 task group on pre-blended mortar, the group responsible for C1714 which wrote the revision.

Echelon's RainBloc® Integrated Water Repellant System is the premier system that provides continuous moisture protection with fully-integrated water repellancy technologies factory engineered into both the masonry and mortar. Additionally, it has a patented tracer in the mortar that allows the hardened mortar to be tested to verify that it contains RainBloc GP water-repellant additive.

Echelon guarantees that Amerimix™ Mortar with RainBloc GP meets the new standard due to rigorous Quality Control testing of production batches, while others may not meet this new standard.

Water repellancy – or the lack thereof – impacts aesthetic issues such as efflorescence, as well as larger concerns related to moisture penetration. This extra level of testing brings much-needed assurance to builders, verifiable on a project-by-project basis. ■

> By taking dry mortar from the job site (as delivered) and having it tested in the lab, builders can verify they have received the quality, water-repellant product they specified.
>
> – Craig Walloch

CEU COURSE LOOKS AT MASONRY, NEW CODES

Oldcastle's newest CEU course, "Masonry Wall Systems Well Positioned to Meet Evolving Codes," looks at topics such as prevailing energy codes and the characteristics of a code-compliant high-performance wall, among others. **More information about the course is available online.**

TAKE CEU COURSE

Featured House

Riverview House

Site size: 6,297 square feet

Project size: 3,143 square feet

Program: A four-bedroom house for a family of five.

Location: A suburban street in Sydney, Australia.

Solution: The two-story brick house is organized around a central interior courtyard, which is enclosed by the living and dining areas, with the master bedroom tucked into one corner. In back, a sliding glass door off the living room opens out to a garden. There are additional bedrooms and a playroom upstairs.

Construction methods: Load-bearing masonry; painted brickwork.

PHOTOGRAPHY: © PETER BENNETTS

Architect: Bennett and Trimble
Suite 6, Level 2, 24 Hickson Rd
Sydney NSW
Australia
+61299178700
office@bennettandtrimble.com

Personnel in architect's firm who should receive special credit:
Marcus Trimble (registered architect)
Matthew Bennett (registered architect)
Collaborators: Erin Field
Interior designer: Bennett and Trimble
Engineers: Northern Beaches Engineers
General contractor: Out N Up
Photographer: Peter Bennetts

Products

Structural system: Load bearing masonry

Exterior cladding: Masonry (Painted brickwork)

Roofing: Metal (Lysaght Longline)

Windows: Metal frame (AWS Elevate Aluminum Windows)

Glazing: Glass (Single, clear)

Doors: Entrances (Solid core pivot door), Wood doors (solid core doors), Sliding doors (solid core doors)

Hardware: Madinoz

Interior finishes:

Cabinetwork and custom woodwork: Styline Kitchens

Paints and stains: Dulux

Floor and wall tile: Bathrooms - Vixel Glass Mosaic Tiles, Entry - Johnson glazed tile

Resilient flooring: Precision Flooring European Oak Engineered Flooring

Carpet: Godfrey Hirst

Furnishings

Chairs: Series 7 Fritz Hansen

Table: Soverin Table, Andreu World

Sofa: Arflex Marenco

Lighting

Interior ambient lighting: Flos Pure Spot, Euroluce

Downlights: Flos