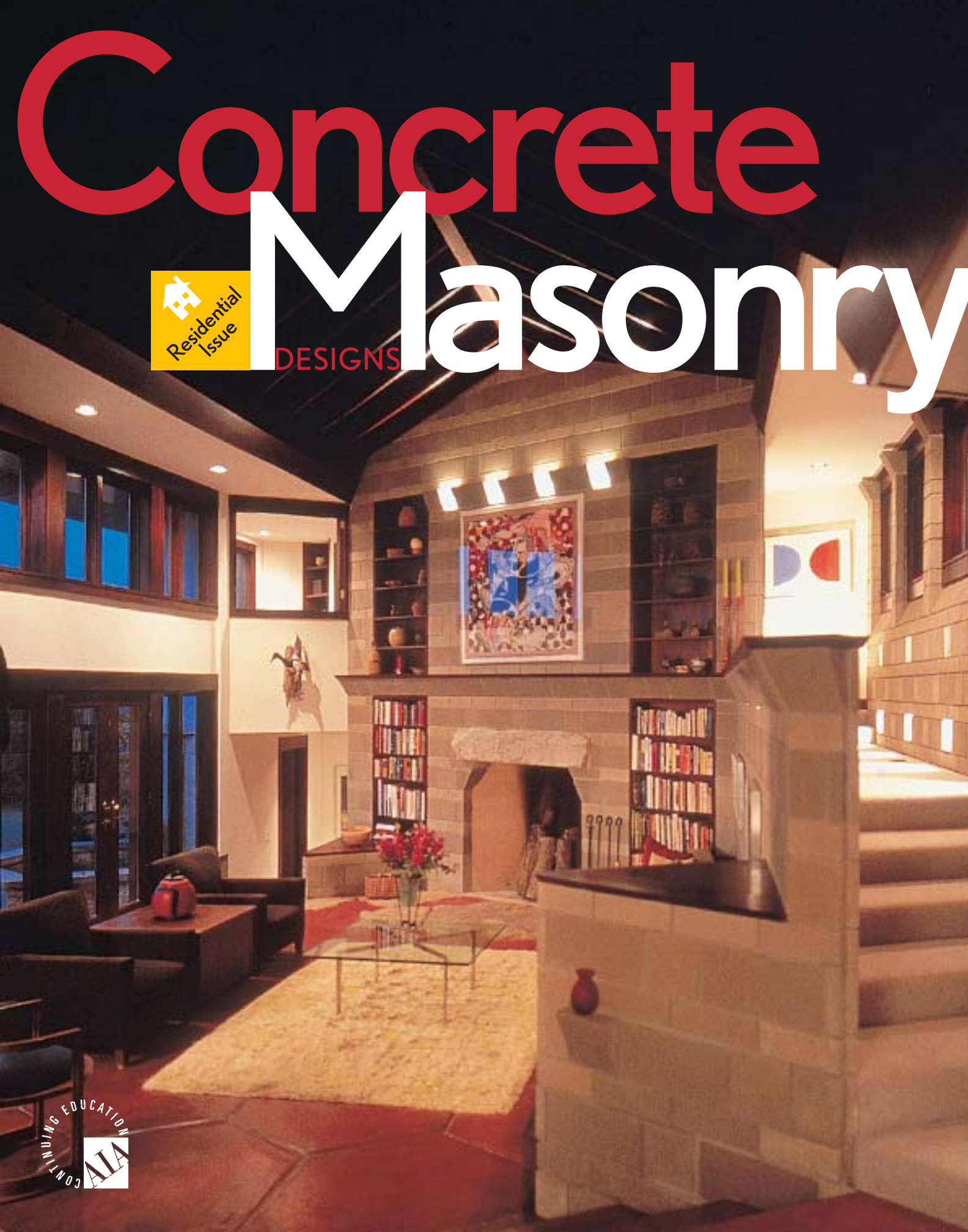
Concrete Masonry DESIGNS

Residential Issue



CONTINUING EDUCATION AIA

You Have the Freedom to Choose, Don't Be Afraid to Build With Concrete Masonry

Have you ever read the fairy tale about the three little pigs? You quickly learn that a home built using masonry material resists not only the big, bad wolf but also fire, wind, wood-destroying insects and mold.

In addition, masonry-built homes provide a sustainable and durable method of construction that not only gives the homeowner peace of mind but also security. Along with protecting your family and your investment, advances in architecture, technology and construction methods offer contemporary block homes amazing design flexibility and curb appeal as well.

This month's *Concrete Masonry Designs* magazine features a condominium built in a Chicago suburb, a luxury condominium complex near Cape Canaveral and a family home near Des Moines, Iowa. Although located in different parts of the country, each utilizes the attributes of concrete masonry products and allows them to add to the quality, function and safety of the residence.

Concrete masonry homes are more energy efficient than wood homes, especially in hot, humid, sun-baked climates like Florida. However, in areas such as Iowa and Illinois, concrete masonry's thermal mass also plays a major role in energy efficiency when it comes to heating and cooling. These homes are also virtually soundproof if you purchase higher quality windows and doors that have excellent weather-stripping.

Residential house fires in single, as well as multi-family homes, cost not only thousands of lives each year, but billions of dollars in property damage, and insurance costs continue to increase. Hurricanes, tornadoes and high winds are life-threatening as well as costly to property and insurance rates.

As a home building industry, we must address our methods of construction and materials used. Open any history book or visit Europe and you will discover that structures built with masonry materials can last for thousands of years.

In areas that suffer from earthquakes, additional reinforcement can be placed into any number of cells and bond beams that when grouted in, imparts incredible strength to the structure. Of course, the amount and location of reinforcement should be determined by a registered engineer to help develop the specification for this reinforcing steel.

All too often, certain building methods are kicked to the curb in favor of newer methods. New does not always mean better, not by a long shot.

There have been many innovations with concrete block over the years. Any National Concrete Masonry Association (NCMA) block producer member and supplier can provide you with information on many of these new products and systems.

Beauty, durability and economy are the features that make concrete masonry homes your best choice. In addition, when it comes to the place you and your family will live, don't you deserve the best?

Take it from one who should know. I've lived in nothing but concrete masonry homes in various parts of the United States since 1975. ■

Dennis W. Graber, P.E.
NCMA, Director of Technical Publications

Find out what the *Movers* and *Shakers* of the concrete masonry industry know.

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Concrete Masonry DESIGNS

7/04

ON THE COVER:

The Clause residence near Des Moines, Iowa

FEATURES

DEPARTMENTS

Concrete Masonry Designs showcases the qualities of design and construction using concrete masonry.

Concrete Masonry Designs is devoted to design techniques using standard and architectural concrete masonry units: concrete brick, unit concrete pavers and segmental retaining walls, and other concrete masonry products around the world. We welcome your editorial comments, ideas and submissions.

It is the policy of **Concrete Masonry Designs** magazine to provide the names of authors of articles appearing in the magazine upon request.

Concrete Masonry Designs is published monthly by the National Concrete Masonry Association and distributed to advance and support the concrete masonry industry and the public interest through research and educational programs designed to meet the future needs of the industry.

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Designed for

As an area that is threatened with hurricanes each year, one of Florida's newest

Strong Winds

coastal residences utilizes concrete masonry to stand up against high winds.

The warm waters of the Florida coast have been attracting beach lovers for decades. The small town of Cocoa, known for its close proximity to Cape Canaveral, brings an enjoyable living environment to residents. Whitley Bay is a 13-story concrete masonry luxury condominium complex with two lower levels of parking located on the Indian River Intercoastal Waterway. The complex also includes a 10-story building with two lower levels of parking and a three-story retail and marina building that features an elevated swimming pool on the third floor. According to Maath Bennett, vice president of Benko Construction, "We use concrete masonry for these buildings because the material stands up to abuse. Our customers like the look and feel, the solidness of concrete masonry."

"We have been involved with construction in this area for more than 70 years and there is no other building material like concrete block," says Michael Mervis, assistant to the chairman of Zilber, Ltd., the owners of Whitley Bay. "We have an extremely high level of laborers in our area. With a great product like block and a great labor force, there is no other way to construct a building. The durability, ease of design flexibility and general quality of construction, make concrete block the material of choice."

Filling in with Concrete Masonry

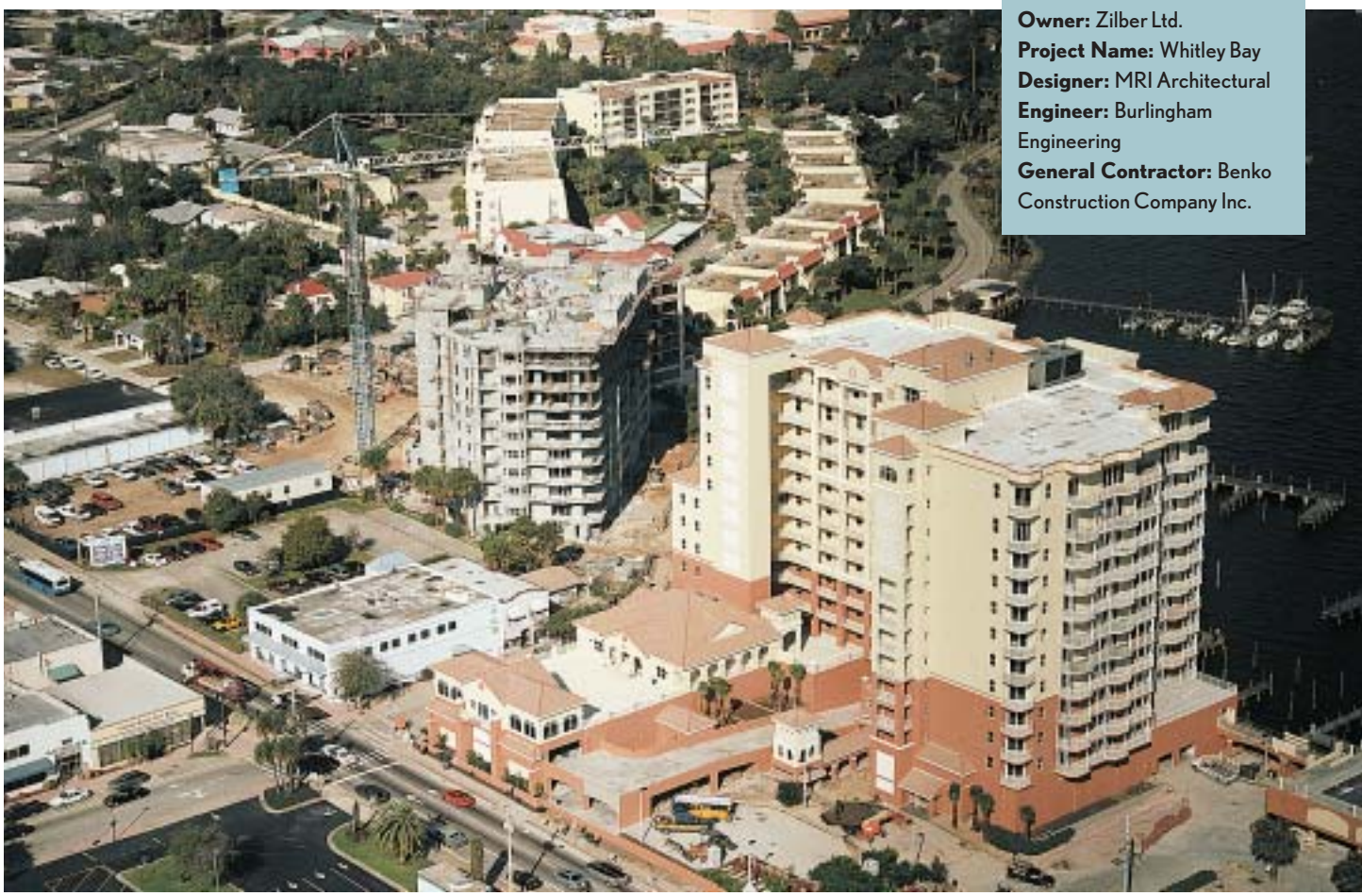
The condominiums at Whitley Bay are designed using high-strength (f'm = 2000 psi) 8- and 12–inch (203, 305 mm) reinforced concrete masonry. According to Sean C. Burlingham, P.E. of Burlingham Engineering, structural engineer for the project, "We used several types of masonry construction methods. Some of the walls were constructed with the building. For example, the walls were built with the building prior to the floor slabs above them. But the vast majority of the building's masonry walls were built using 'infill masonry.'"

Infill masonry is a typical design method for multi-story buildings. Infill concrete masonry walls utilize the concrete masonry as cladding and interior partitions between concrete or steel frames, which form part of the structural load-resisting system. Concrete masonry walls are often used in this application because of the cost-effectiveness and ease of construction. At the Whitley Bay complex, the concrete masonry walls are the structural ele-

LEARNING OBJECTIVES:

After reading this article, you should understand:

1. infill concrete masonry construction
2. the characteristics of a high wind event, and
3. concrete masonry design strategies for dealing with these events.



PROJECT INFO:
Owner: Zilber Ltd.
Project Name: Whitley Bay
Designer: MRI Architectural
Engineer: Burlingham Engineering
General Contractor: Benko Construction Company Inc.

High Wind Facts

Hurricanes are categorized based on The Saffir-Simpson Hurricane Scale which is a 1–5 rating based on the hurricane's present intensity. The rating generally gives an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region. The wind speeds indicated are 1-minute sustained. To convert to 3-second gust, which is the wind speed the building codes are based on, multiply the speeds shown by 1.3. (ref http://www.louisianahouse.org/wind/saffirsimp.asp)

Category One Hurricane: Winds 74–95 mph (119–153 km/hr). No real damage to building structures.

Category Two Hurricane: Winds 96–110 mph (154–177 km/hr). Some roofing material, door, and window damage of buildings. Considerable damage to shrubbery and trees with some trees blown down.

Category Three Hurricane: Winds 111–130 mph (178–209 km/hr). Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures.

Category Four Hurricane: Winds 131–155 mph (210–249 km/hr). More extensive curtainwall failures with some complete roof structure failures on small residences. Extensive damage to doors and windows.

Category Five Hurricane: Winds greater than 155 mph (249 km/hr). Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away.

Reference
National Hurricane Center of the National Oceanic Atmospheric Administration.

ments that transmit the wind into the building structure; loads that are then transmitted into the foundation system through the concrete shear walls. Most of the wind pressure on the building is being applied to its masonry walls, which must be structurally adequate to handle these heavy and dynamic loads. Reinforced concrete masonry performs this vital task quite well.

Burlingham explains, "We cast grout ports into the floor slabs, through which vertical reinforcing and grout was placed into the cells of the walls built between the floors. This method allows us to quickly erect the building skeleton (the columns, shear walls, elevator shafts, stairwells and floor slabs) while leaving the building sidewalls open for access to the flying forms used for the floor slabs."

"The infill construction method also keeps the masons on site and busy full time because they are building walls at the working deck level and, at the same time, constructing infill walls several floors below the working deck," adds Burlingham.

Battling Strong Winds

In addition to designing a home that met the needs of its residents, the designers had to consider the high wind activity that often hits coastal Florida. While Florida typically experiences only one hurricane per year, according to the National Hurricane Center, the result of these high winds associated with strong coastal storms can be devastating and cause millions of dollars in damage. As with all building construction, a multi-story building with proper siting, design and construction perform well during these high wind events.

"The Whitley Bay was designed to withstand a 133 mph (214 km/hr) hurricane wind without damages. It is also rated as 'Exposure D,' which is for hurricane wind coming across open water; the most stringent of wind design requirements," says Burlingham.

Exposure D requires the designer to consider much higher wind pressures for a given wind speed. For example, suppose you have two buildings designed for 133 mph (214 km/hr) wind. One is rated as Exposure B, which is for urban areas surrounded by houses, small buildings and wooded areas (a typical suburb). The other is rated as Exposure D (such as Whitley Bay) which is for wind flowing over open water before hitting the building. The design wind pressures for the building rated as Exposure D are 30–40% higher than those for the Exposure B building. Both are designed for the same wind speed, but the physical location of the building and presence of obstructions that can help block out some of the wind become a large factor in determining the actual wind pressure that the building is designed to withstand.

Connecting All the Pieces

Connections between individual building elements—roof, walls, floors and foundation—are critical to maintaining structural continuity during a high wind event. The critical damage to buildings in such events typically occurs due to uplift on the roof, resulting in the loss of crucial diaphragm support at the top of the wall. A primary goal for buildings subjected to high winds is to maintain a continuous load path from the roof to the foundation. This allows wind uplift forces on the roof to be safely distributed through the walls to the foundation. If one part of the load path fails or is discontinuous, building failure may occur.

Connections between building elements is key to the performance of the structures and should therefore be considered carefully during the design process. Connections should be simple and easy to construct and, where necessary, should accommodate building movements from expansion and/or contraction of building materials.

Concrete masonry multi-story buildings have been capable of withstanding some of the most severe windstorms with little damage. Burlingham believes the concrete masonry in the Whitley Bay Project helps put the safety and strength behind it: "This building is where I would hide if another Hurricane Andrew were to take aim at our county." ■

References:

NCMA TEK 3-12, Construction of High-Rise Concrete Masonry Buildings (1998)

NCMA TEK 5-11, Residential Details for High Wind Areas (2003)

Quality Built Condominiums in the Chicago Suburbs

LEARNING OBJECTIVES:

After reading this article, you should understand:

1. benefits that density of concrete masonry walls and floors provide

2. sustainable benefits that concrete masonry provides.

The old adage, "if it isn't broken, don't fix it," is a fitting philosophy for Norwood Builders, Inc., who for half a century has been building quality homes in Chicago and the surrounding suburbs. Purveyors of single-family homes, town homes, condominiums and most recently, mixed-use developments that combine residential and retail, Norwood has established a niche by responding to market needs, giving homebuyers what they want, and standing behind their commitment to quality and value.

"Our buyers know what they like," explains Ron Radzik, Norwood's Vice President of Construction. "We've created a product that over the decades has developed and matured and proven to be very dependable."

Radzik points out that for the last 30 years, Norwood has marketed its product to homebuyers who are familiar with block and masonry construction. Many, in fact, grew up in such homes and therefore know of the myriad benefits of concrete. A good number of Norwood's condominium homebuyers fit this profile, buyers who have experienced single-family home living and are ready to make the transition to multi-family housing.

"As buyers' lifestyle needs change, their priorities do as well. Issues such as aesthetics, soundproofing, and fire safety become more important," says Radzik. "These needs are what drive the design and use of concrete masonry in our buildings."

According to Chuck Ostrander, P.E., Executive Director of the Illinois Masonry Institute, "Concrete masonry offers simplicity of design, inherent quietness, and built-in fire resistance. This type of quality construction has become a trademark for Norwood developments. That is why Norwood and other builders who build this way are considered 'master developers.'"

Norwood responds to homebuyer demand by building homes that, owing to their concrete and block construction, promise durability, energy

efficiency, and numerous aesthetic advantages. In projects like River Mill Condominiums in Des Plaines and The Shops and Lofts at Village Centre in Mount Prospect, concrete masonry wall units, measuring 8" (203 mm), 10" (254 mm) or 12" (305 mm), are standard, along with 10" (254 mm) hollow-core concrete planks in the ceilings and floors. The density of these materials not only produces a mass sound dampening effect, but also provides protection against fire and bolsters thermal insulation.

"Fire safety is a big area of concern with condominium buyers," explains Radzik. "When you're looking to live in a mid- to high-rise residence, you want to know that the building is constructed with non-combustible materials. That's just one of the many benefits of using concrete."

"In general, we often recommend the use of concrete masonry for most building types because of its structural characteristics, durability, and fire resistance qualities," explains Matt Haylock, President of Haylock Design, architects on many Norwood projects.

At River Mill, a community of luxury condominiums that offers one-, two-, two-plus-den, and three-bedroom floor plans, Norwood used concrete masonry units for both the interior and exterior bearing walls. Exterior walls are insulated masonry cavity walls.

"The CMU bearing walls worked very well with the precast floor slabs in the River Mill building," says Haylock. "With this system, we were able to clear span the floor structure over 38 feet (11.58 m). This led to the design of open and efficient condominium floor plans which were not interrupted by columns or other structural members."

In a climate where winter temperatures often drop to subzero temperatures, warmth is also a key factor in building design and mechanics. In Norwood properties such as The Shops and Lofts at Village Centre, a three-story building featuring loft residences on the second and third floors and retail shops on the first, the thermal efficiency of the hollow-core is complemented by the use of radiant floor heating, a circulating hot water system encapsulated in the concrete floor topping. Copper tubing was laid on the perimeter radius of each unit's deck and then mechanically fastened to the floor planks. A 2" (50.8 mm) lightweight concrete pour was then applied to the entire deck system.

"Concrete and masonry are great absorbers of heat. Heating the floors with this type of system effectively turns the concrete slab into a radiant panel that delivers heat evenly throughout the livable space. It makes a very efficient, clean, and quiet heat source," says Radzik, adding that all pedestrian and auto ramps in the condominium buildings have the same circulating hot water system embedded in the concrete slabs.

The radiant floor heat and outstanding thermal mass of the concrete and masonry hold particular appeal for homeowners at The Lofts, where ceiling heights range from nine-and-a-half to 15 feet (4.57 m). Concrete masonry units in the wall also contribute to the reduced air infiltration, energy efficiency, and overall comfort of the residences in this community, which in 2002 received a Crystal Key Award for innovation and creativity in home building from the Chicago Home Builders Association.

The heat absorption and air tightness imparted by concrete masonry walls translates to energy efficiency and cost savings passed on to the homeowner. With today's high utility prices, the economic advantages of concrete masonry are a big draw for builders and buyers alike.

"It's proven to be very beneficial for homeowners as well as building associations, who bear the cost of maintenance and utilities for common areas," according to Radzik.

Indeed, when comparing the energy savings of concrete with heating and cooling systems associated

with conventional wood-frame walls, the advantages of concrete and masonry are evident. Studies have shown that houses with thermal mass systems such as concrete masonry require less energy to heat and cool than a frame house with comparable insulation values.

"The greater insulation, tighter construction, and temperature-smoothing mass of the walls conserve heating and cooling energy much better…," according to the report from the Portland Cement Association, which went on to estimate the annual heating savings in cold climate to be anywhere from $200 to over $400, depending on the size of the home. The PCA study also points to thermal mass, the ability to smooth out large swings in temperature, as a major contributor to reduction in energy loss in concrete homes.

Of course, for the discerning homebuyer, it's not enough to feel good—a new home must also look good. Concrete masonry provides many options for the builder with regard to color and texture.

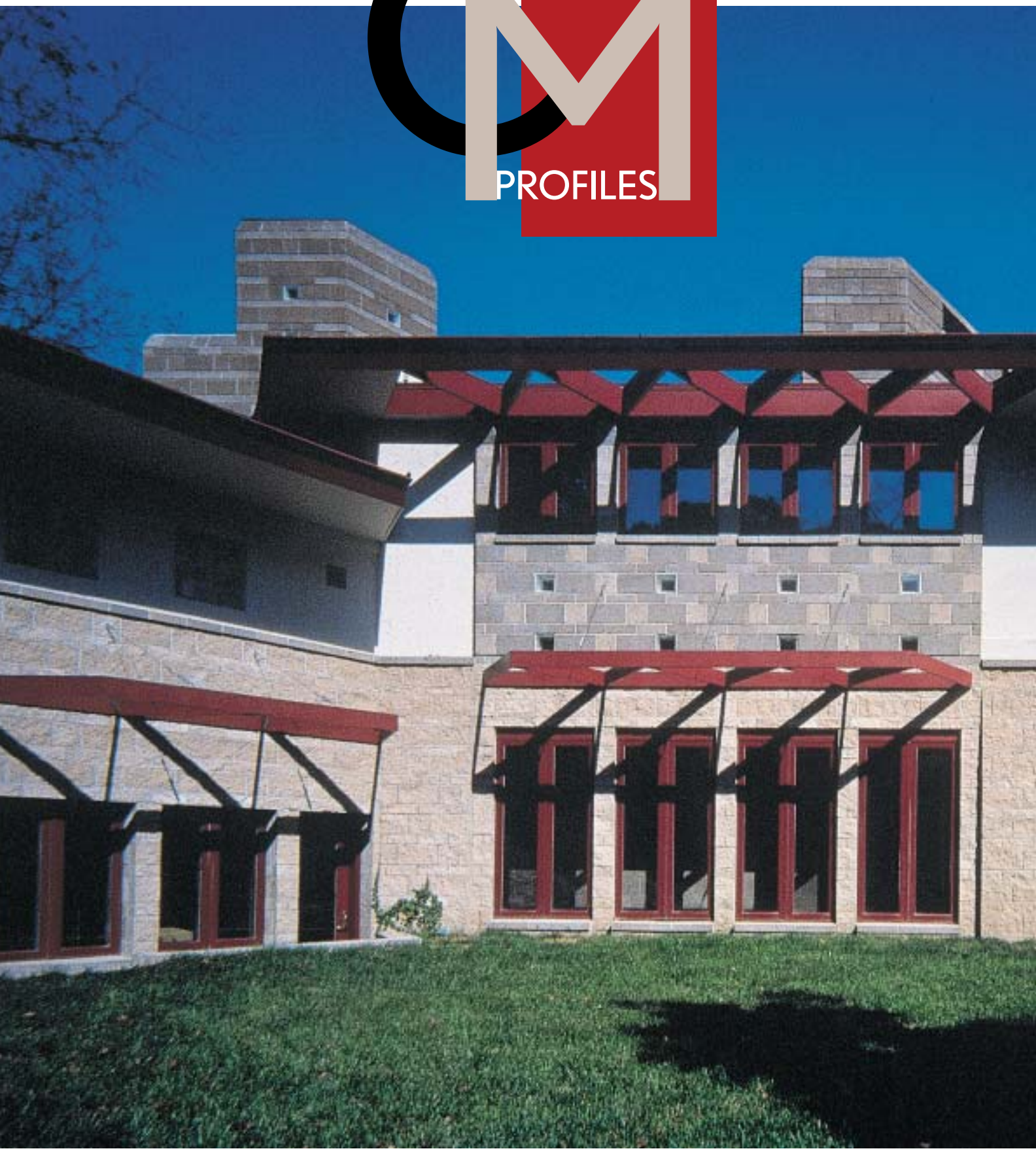
"Between brick, stone, and other concrete products, architects can really show off their designs and give buyers what they're looking for," says Radzik.

At the Shops and Lofts at Village Centre, the CMUs were used as a backup wall system for the building's brick and stone veneer, according to Haylock. "Used in conjunction with the masonry veneer, the concrete masonry units allowed us to create a variety of unique façade details, while keeping the developer's budget in line," he explains.

Known for their accessibility, superior architectural design, and high construction standards, Norwood developments bear the hallmark of 50 years of providing Chicagoland homebuyers with quality homes that serve their individual needs. While wood-frame homes may be built for less money on a per-square-foot basis, Norwood customers are willing to pay more for the quality and dependability inherent in concrete masonry. For all that it offers in solid construction, appearance, safety, energy efficiency, and added property value, it is easy to see why hollow-core planks and masonry have become the products of choice in all Norwood projects.

"For the homebuyer who was born and raised in a masonry home, its performance comes as no surprise," says Radzik. "It's a product they already believe in." ■

CM PROFILES



Designing Outside the Box

Designing the family home gives an architect the unique opportunity to push the envelope in terms of both aesthetics and performance. Tom Clause, of Clause Architects, chose concrete masonry as a primary material for his new 2750 square-foot (255-m^2) home near Des Moines, Iowa because he relished the opportunity to "explore the possible uses of concrete masonry in new ways, new placement of existing shapes and new context within the framework of a single family residence. I've always been fascinated by concrete block and felt it has much more potential than the typical residential foundation wall we're used to seeing."

Clause found that a major benefit of using concrete masonry for its beauty, durability and low maintenance is its substantial thermal storage capability. This capacity, often called thermal mass, tends to make interior spaces more comfortable and increase the building's energy efficiency. For Clause, this fit in beautifully with his overall sustainable design approach, which includes natural ventilation, durable and long-lived materials, careful landscaping and site placement to block the home from prevailing northerly winds, in addition to comfort and energy considerations.

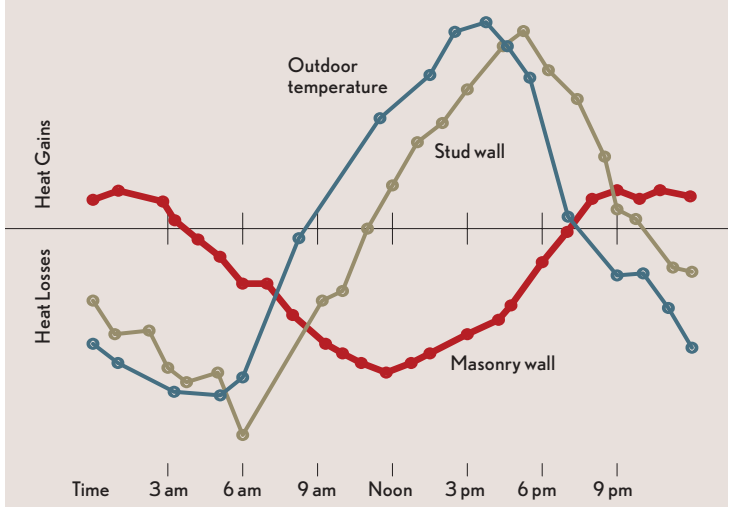
Concrete masonry heats up and cools down slowly, which translates into increased comfort for building occupants as well as the potential to be used as a heat sink, effectively storing heat from the mechanical system or from the sun. Less massive building systems, such as wood and steel frame walls, do not have this capability. Figure 1 shows just how dramatic the results can be. The graph illustrates how a concrete masonry building and an identical wood frame building react to outdoor temperature changes. The thermal mass effect causes heat transfer to be delayed and reduced through concrete masonry. Note that the interior temperature of the concrete masonry wall never gets to the extremes that the wood stud wall reaches—the concrete masonry building stays comfortable without mechanical conditioning despite the wide temperature swings outside. Design calculations confirmed this for Clause, "We used an ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) standard to calculate the performance. Putting more mass inside of the insulation has the effect of increasing the wall's R-value."

Clause uses masonry to store the sun's warmth in winter, to store cool nighttime air temperatures in summer, and to maintain comfort year-round. All of the home's walls—inside and out—are concrete masonry. The exterior walls were a particular priority. According to Clause, "one design goal was to create a sheltering living envelope to cope with severe weather extremes: in winter, we can have -20° F (-29 C) temperatures, and then get over 100° F (38° C) in summer coupled with high humidity in June and July." The exterior walls, insulated double-wythe masonry cavity wall construction, provide the dual benefits of a high R-value along with significant thermal mass benefits.

Clause also wanted to fully access the site's beauty. To open his home to the views, Clause used a higher number of windows than is typical in single family homes, comprising about twenty percent of the exterior wall area. Because window thermal performance is much lower than that of the wall, windows can make or break the building's energy performance. Glass area and placement require thorough consideration to control unwanted heat loss in winter and overheating in summer. "I was careful with window overhangs," describes Clause, "they're about four feet (1.22 m) wide to shade the windows and avoid summer heat gains." In the winter, the heat from the sun floods the house. The interior concrete masonry walls and concrete floors hold that heat, effectively offsetting mechanical heating and preventing the interior from becoming uncomfortably hot.

"For example, one of the south-facing walls is entirely glass, with a concrete masonry wall three feet (0.91 m) away across a corridor. The winter sun hits that interior wall and stores the solar energy." Heated air from within this masonry wall is passed through a forty-five ton (41,000 kg) sand heat sink beneath the living room floor. The air is drawn from an inlet in the wall through PVC pipe using an in-line fan; two lay-

Figure 1: Temperature Damping and Thermal Lag



Source: Berkeley Solar Group and Eley Associates, Energy Basics Book. Concrete Masonry Association of California and Nevada and Western States Clay Products Association, 1996.

Experimenting With Concrete Masonry

One of Clause's design goals for his home was to "explore and experiment with standard concrete masonry materials for use in unusual and unique ways." His home's interior incorporates many such examples. For example, bond beam units, with a U-shaped cross section to accommodate horizontal reinforcement, were used 90° out-of-plane to construct a built-in wine rack. Clause also used corbel block in various applications throughout the home. These units have a sloping front face that projects out from the plane of the wall, and are typically used to allow for a change in wall thickness. Clause uses the projections to create a living room mantle, small accent shelves, as a "column top" at the ceiling between windows, to support the wood floor joists and even as part of a masonry headboard in the master bedroom.

ers of piping wind through the sand, creating a heat exchanger under the floor. In the summer, the fan can be reversed, so that the cool under-floor temperature can be distributed to help cool the house.

The three wings of the home join at a central staircase, leading to a lookout tower. Clause describes the hexagonal staircase as a "cooling chimney. In the early warm days of summer, we open the door at the top of the tower and open the windows downstairs, and the warm air goes up the staircase like a chimney, you can really feel the air moving. Then we button up the windows in the morning, and the house stays cool." The masonry in the stairwell provides even more thermal storage and also lends structural support to the roof beams from the three wings of the home.

In addition to beauty and superior performance, Clause's enjoyment of his home is enhanced by its low maintenance. Both the interior and exterior masonry are unpainted, providing a warm natural aesthetic and eliminating future repainting chores. The interior units were treated with a steel brush and light acid wash across the surface. According to Clause, this "warms it up by exposing a little of the aggregate. We have a river sand aggregate here that gives it a warm look. The combination of the concrete masonry with the warmth of the dark stained finish wood is really beautiful."

In the three years since completion, Clause and his family have been amply rewarded for his diligence during design. "We're out in the country, so there's no way to directly compare utility costs," with a frame home, according to Clause, "but when the house gets warm or cool, it tends to be pretty stable. We just really enjoy the low maintenance and the character of it." ■

Retaining Walls—A Building Guide and Design Gallery
The essential guide to constructing segmental retaining walls with detailed, easy to follow full color diagrams/charts for do-it-yourself homeowners and landscape contractors. Professional price: $24.95

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Create customized paver layouts in a fraction of the time! This powerful software is both a drawing tool and a structural design tool. It contains a library of 56 popular patterns and 43 generic and proprietary shapes to fill a drawn or imported paved area, determines the quantities of pavers needed, and the type and thickness of base for the project. Professional price: $50.00

e-TEK and e-Details
NCMA's TEK series and details are available online FREE to architects, engineers and specifiers. The TEKs include more than 130 technical bulletins on various topics related to concrete masonry with a new TEK published monthly. In addition, many others are revised and updated to reflect code or building design changes as necessary.

The Web site-accessible e-TEK and e-Details service can be reached through NCMA's member Web sites that sponsor the program. A listing of sponsors with hotlinks to their sites can be found at www.ncma.org. Click on the "Select Your State" pulldown menu and then select your local concrete masonry producer. Click on "Technical Details" for e-Tek or "Technical Manual" for e-Details. e-Details has all drawings downloadable in various electronic formats including DWG for AutoCAD and DXF. This service allows viewers to be supplied with the latest up-to-date information on concrete masonry. For those who still prefer the hard copies, they are available from NCMA at www.ncma.org or by calling the publications department at 703.713.1900. ■

Concrete Masonry Designs' AIA Continuing Education Learning Program

Learning Units Reporting Form

To receive one learning unit, read "Designed for Strong Winds" (page 5), and "Quality Built Condominiums in the Chicago Suburbs" (page 8) and complete the following questions on both articles. Return this form to the National Concrete Masonry Association. Only original forms will be accepted for learning unit credit.

Forms received after July 2005 will not be accepted for learning unit credit.

❑ I am a non-AIA architect or design professional. Please send me a certificate stating the learning units earned that I can use for documentation to fulfill other continuing education requirements.

Send completed Report Form to: AIA CES, National Concrete Masonry Association, 13750 Sunrise Valley Drive, Herndon, VA 20171-4662. If you have questions, please contact NCMA at 703.713.1900.

July 2004

AIA Questions:

1. What is infill concrete masonry construction?

2. What is Exposure D?

3. What type of load path is necessary in order to prevent building failure? How is this accomplished?

4. What benefit does the density of concrete masonry walls and floors provide?

5. What sustainable benefits does concrete masonry provide?

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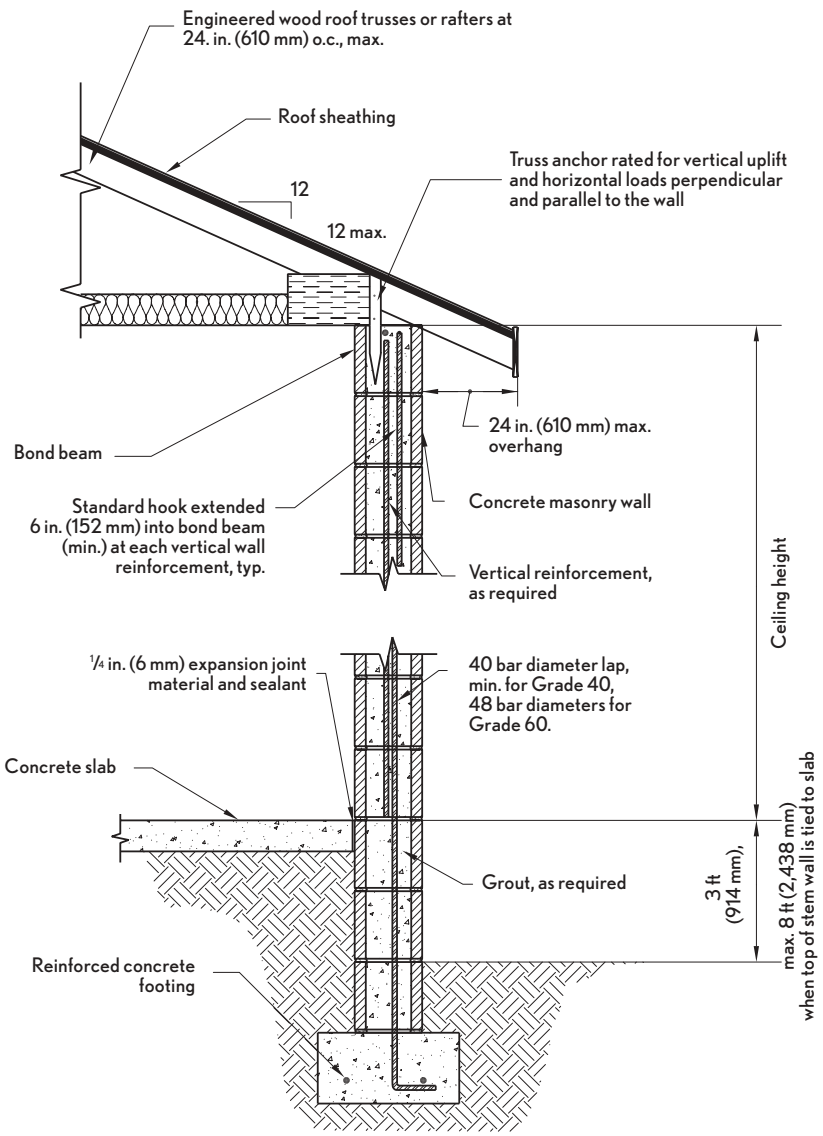
☐ Check here to request a catalog of concrete masonry technical literature.

High Wind Exterior Loadbearing Wall

High winds subject buildings to large horizontal forces as well as to significant uplift. Reinforced concrete masonry is well suited to resist the large uplift and overturning forces due to its relatively large mass. Connections between individual building elements—roof, walls, floors and foundation—are critical to maintaining structural continuity during a high wind event. The critical damage to buildings in such events typically occurs due to uplift on the roof, resulting in the loss of crucial diaphragm support at the top of the wall. A primary goal for buildings subjected to high winds is to maintain a continuous load path from the roof to the foundation. This allows wind uplift forces on the roof to be safely distributed through the walls to the foundation. If one part of the load path fails or is discontinuous, building failure may occur.

Proper detailing and installation of mechanical connectors is necessary for maintaining continuous load paths. In addition to a continuously reinforced bond beam at the top of the wall around the entire perimeter of the building, vertical reinforcement must be placed throughout a wall to resist the high uplift loads and provide continuity, including: at corners and wall intersections; on each side of openings wider than 6 ft (1,829 mm); at the ends of shear segments; and where girders or girder trusses bear on the concrete masonry wall. Figure 1 shows a typical loadbearing wall. Vertical reinforcement should be placed in the center of the concrete masonry cores to adequately resist both positive and negative wind pressures. Bond beam depth and minimum horizontal reinforcement varies with design wind velocity, ceiling height, roof truss span and spacing of vertical wall reinforcement.

For more information on concrete masonry high wind details, please refer to TEK 5-11 "Residential Details for High Wind Areas" and section 8B of the NCMA "Annotated Design and Construction Details for Concrete Masonry" TR90B. Both are available on sponsoring NCMA member web sites. For a list of those members and links to the TEK and Technical Details on their sites go to www.ncma.org and click on the "Select Your State" pull down menu in the blue rectangle on the left. ■



MOLD UPDATE

The **August issue** of Concrete Masonry Designs will focus on hot topics related to mold in commercial buildings. In addition, a building designed by architect Christopher Huckabee in Texas will be featured.

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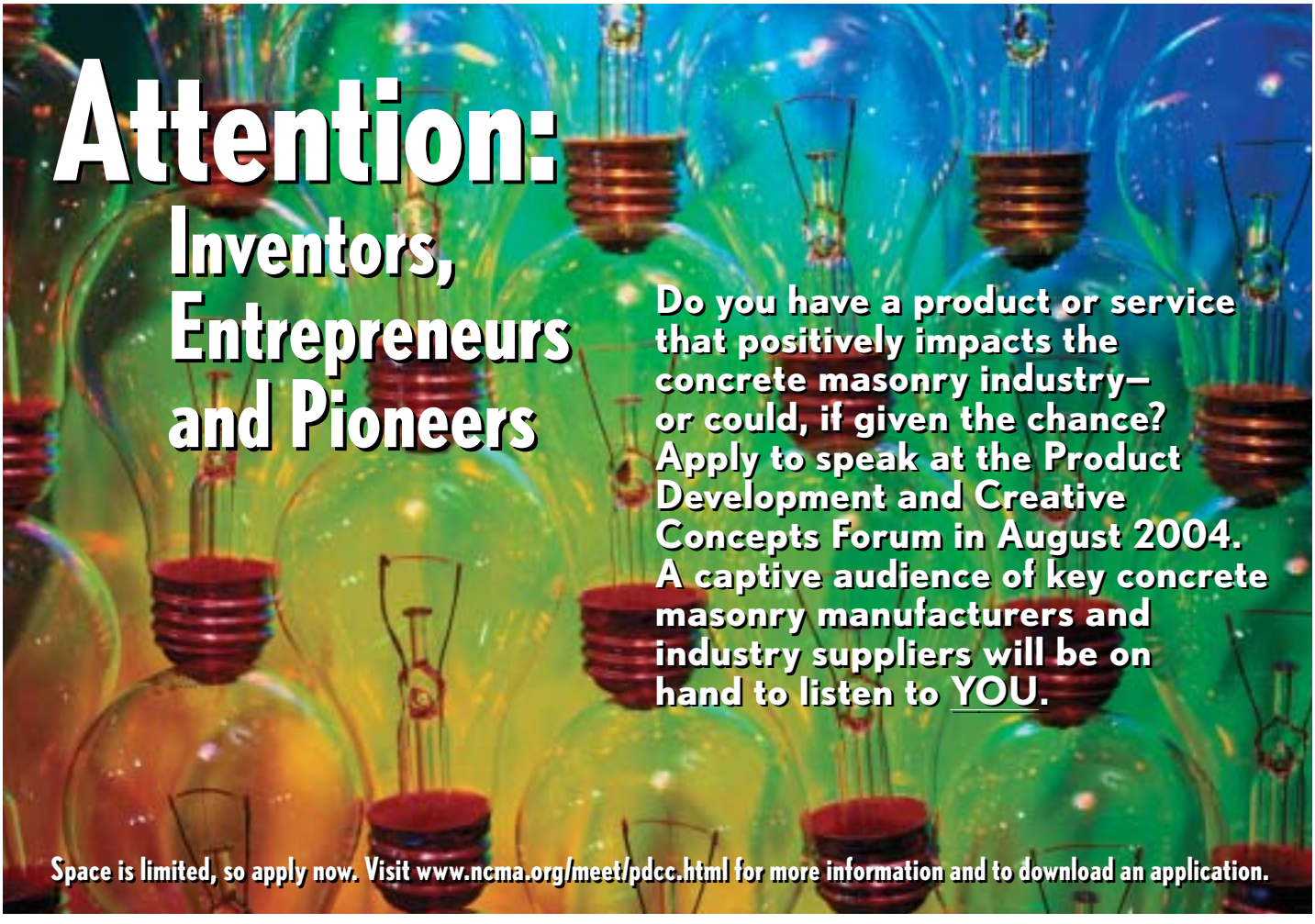

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