May | June 2010

CONCRETE MASONRY DESIGNS

Alton Riverfront Amphitheater: Balance and Harmony

San Elijo Lagoon Nature Center–NCMA/ICPI Design Award of Excellence Winner—Sustainable Building

Concrete Masonry and LEED

Infill Projects Produce Green Homes

Single Wythe Core-Insulated CM Wall Energy Code Compliance

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4 Alton Riverfront Amphitheater: Balance and Harmony
Music lovers at the Alton Riverfront Amphitheater aren't consciously aware that segmental retaining wall (SRW) units and concrete pavers really have a starring role.

6 San Elijo Lagoon Nature Center–NCMA/ICPI Design Award of Excellence Winner—Sustainable Building
With many site constraints, the San Elijo Nature Center was carefully designed to preserve the endangered species habitat and wetlands. The unique-shaped design was then organized to maximize daylighting and views to the lagoon.

10 Concrete Masonry and LEED
Concrete masonry and hardscape products have been and will continue to be a green building material.

14 Infill Projects Produce Green Homes
Unused or underutilized spaces in previously developed areas are getting a second chance to prosper through citywide and individual infill projects.

30 Single Wythe Core-Insulated CM Wall Energy Code Compliance
Regardless of the project goals, single wythe concrete masonry construction can fulfill the project's energy efficiency requirements, while also providing superior structural capacity, durability, and resistance to fire, sound transmission, insects and mold.

17 TEK 6-11A, Insulating Concrete Masonry Walls
21 TEK 15-3A, Roles and Responsibilities on Segmental Retaining Wall Projects
29 Green Scene
34 NEWS
40 Marketplace
43 AIA Continuing Education Learning Program

Concrete Masonry Designs magazine show-cases the qualities and aesthetics 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, segmental retaining walls, and other concrete masonry products around the world. We welcome your editorial comments, ideas, and submissions.

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Alton Riverfront Amphitheater

While concert-goers enjoyed the inaugural Big Gig live music festival, many of them admired the beautiful new Alton Riverfront Amphitheater where the event was held. But most of the music lovers weren't consciously aware that weathered segmental retaining wall (SRW) units and concrete pavers had a starring role in this project.

The new Amphitheater, part of the Alton Riverfront and Marina District Master Plan recently completed for the City of Alton, Illinois is the centerpiece of the ambitious renewal of the Alton riverfront vicinity of this historic town on the Mississippi River. This stunning redevelopment project was lead by a team of construction and design companies who worked hand in hand with the City of Alton leaders and municipal representatives including Phil Roggio, Director of Development and Housing, Design and Construction.

Balance and Harmony

The project design team and construction oversight was lead by Dan Bockert of Planning Design Studio, who is the company's Principal and also served as the Project Manager.

According to Bockert, the diverse options of the SRW and concrete paver product lines made a major difference in the aesthetics of the overall project vision. "The range of material color and texture choices offered helped us to coordinate finishes between all the concrete in the project."

The Amphitheater portion of the project was designed by Planning Design Studio to be seen as part of the overall open space concept, and centers on a central circular fountain geyser and a concentric circle of pedestrian-friendly, smaller vertical fountains. This central fountain area consists of a series of decorative paved areas and grassy open space, and the paving was created with contrasting color and texture to depict the theme of "the meeting of the great rivers", graphically illustrating the plan view of the Mississippi River from the confluence with the Illinois River through the Missouri River Confluence to the St. Louis Riverfront.

The plaza area pavement was constructed using concrete pavers. The plaza paving is used symbolically to represent the Alton street grid in the area around the fountain, and the fountain represents the geographic location of Alton along The Mississippi River when viewed from above the plaza. The varied modular paver units radiate from the "center" fountain, which represents the City, with the rest of the plaza paving symbolizes the region.

The Amphitheater, with a total seating capacity of 4,000 for organized events, includes 600 weathered bench-type seats using retaining wall units for the amphitheater seating and the handicap-accessible ramps. Bockert notes, "The seating walls and coping blends the line and shape of the amphitheater's formal geometry to the natural open space of the surrounding riverfront landscape."

According to Sheppard, Morgan & Schwaab, Inc. Principal Charles Sheppard, P.E., "The weathered retaining wall units were selected for the low seating walls and handicap ramp walls because of their natural look, versatility, and ease of construction considering the varying elevations of the amphitheater bowl."

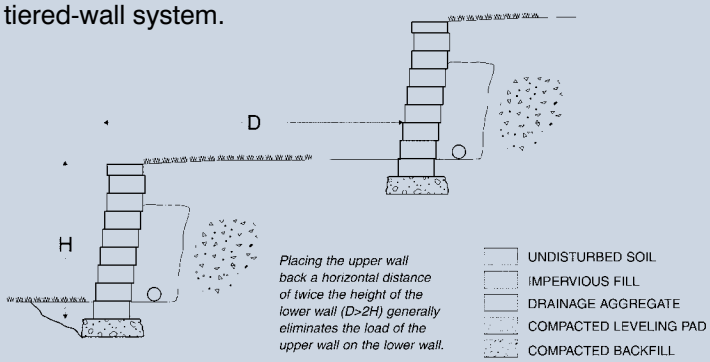
The cost of the total riverfront renovation project was approximately $4.4 million. Bockert credits the flexibility of the material with keeping the material costs low while providing a beautiful finished product. CMD

PROJECT
Alton Riverfront Amphitheater, Alton, Illinois
DESIGN
Planning Design Studio, St Louis, Missouri
EWR Associates, Fairview Heights, Illinois
ARCHITECT
Sheppard, Morgan and Schwaab, Inc., Alton, Illinois
GENERAL CONTRACTOR
RCS Construction, Inc., Wood River, Illinois
SRW AND PAVER PRODUCER
Kirchner Block & Brick division of Midwest Products Group, Bridgeton, Missouri
SRW LICENSOR
VERSA-LOK

SRW TIERED WALLS

A tiered retaining wall system is a series of two or more stacked walls, each higher wall set back from the underlying wall. When designed properly, they not only retain soil and support loads, but also deliver an attractive appearance and provide room for plantings or seating as in the Alton Riverfront Amphitheater.

When an upper-tier wall is placed within a horizontal distance less than twice the height of the underlying wall, the upper wall will apply a surcharge load on the lower wall. The wall design engineer must carefully analyze the site soil conditions and spacing between walls to determine overall stability of the entire tiered-wall system.



Source: VERSA-LOK Technical Bulletin 7.

San Elijo Lagoon

Nature Center

NCMA/ICPI Design Award of Excellence Winner
Sustainable Building

One of few remaining coastal wetlands of San Diego County, San Elijo Lagoon is home to an exceptional number of animals and plants. The lagoon is part of San Elijo Lagoon Ecological Reserve, a county and state regional park of nearly 1,000 acres (405 hectares) of diverse habitat including six plant communities: coastal strand, salt marsh, brackish/freshwater marsh, riparian scrub, coastal sage scrub and mixed chaparral. In the reserve, visitors can access over seven miles (11 kilometers) of trails via eight trailheads and encounter a wide variety of flora and fauna. The San Elijo Lagoon Conservancy has been providing programming to the area residents for several years. Department of Parks and Recreation County Supervisor Pam Slater-Price was instrumental in pushing the county government and private funders to improve the existing facility. Nestled in the banks of the San Elijo Lagoon, the new 5,600-square-foot (520 square-meter) Nature Center serves to educate and encourage exploration of the surrounding wetlands. The building itself serves as an educational example of sustainable design.

According to the architectural firm of Zagrodnik + Thomas Architects, the building's compatibility with adjacent lagoon environment was extremely important to the Department of Parks and Recreation. "In addition, we wanted to maximize the view to the adjacent lagoon and ocean while minimizing the building's impact on the lagoon itself," says Jean Zagrodnik. The building's design also was expected to incorporate "green" elements which resulted in making it a Leadership in Energy and Environmental Design (LEED) Platinum certified building.

With many site constraints, the building was carefully designed to preserve the endangered species habitat and wetlands; the footprint was limited to a previously developed area which comprised of shade structure and restrooms. The unique-shaped design was then organized to maximize daylighting and views to the lagoon. Visitors in the exhibit room can learn about the native plant and animal life through interactive exhibits while looking out the windows to see the wildlife. Additional exhibit panels identify the "green" features of the building that sit in this very sensitive habitat.

Considered sustainable, concrete masonry units were incorporated into the project for their aesthetic qualities, flexibility, durability and affordability. Burnished block was selected for its exposed aggregate and integral color. Two earth-tone colors of concrete masonry units were installed in a

PROJECT
San Elijo Lagoon Nature Center, Encinitas, California
ARCHITECT
Zagrodnik + Thomas Architects, San Diego, California
ENGINEER
Curry Price Court, San Diego, California
OWNER
County of San Diego Department of Parks and Recreation, San Diego, California
BLOCK PRODUCER/SUPPLIER
RCP Block Company, Lemon Grove, California

random pattern for an "earthy organic" appearance which complemented the site. The NCMA Design Awards jury felt the color selection of the concrete masonry provided a natural look that blended well with the surrounding environment. The Nature Center's concrete masonry walls incorporate recycled material and were made with materials regionally harvested and regionally manufactured for LEED credits.

The Design Awards of Excellence jury found the rectilinear concrete masonry walls provide a solid anchor to the more playful lines introduced by the metal and wood elements of the building.

The concrete masonry units' inherent thermal mass qualities also provide heating and cooling throughout the day which enhances the energy saving design by maximizing natural daylighting. There are tall windows in main habitable spaces. The windows are also energy efficient low-E dual glazed insulated glass minimizing the need to warm and cool the interior spaces. The windows are strategically located to catch the site's prevailing breezes.

The trellis of the upper deck supports photovoltaic panels. Water conservation is provided with a 2-button flush toilet, low-flow faucets, native landscaping, recycled water for irrigation and flushing toilet.

Overall, the Design Awards jury felt the Nature Center deserved recognition because it beautifully reflects concrete masonry's presence in a building designed for LEED certification. CMD

Recycled Content in Concrete Masonry

LEED points can be earned based upon the percentage of material in a product that is either postconsumer or preconsumer recycled content. It is determined by dividing the weight of the recycled content by the overall weight of the assembly.

$$\% \text{ recycled content} = \frac{\text{Weight of recycled content (preconsumer or postconsumer)}}{\text{Total material weight}}$$

The two types of recycled content as defined by the 2009 Edition of the *LEED Reference Guide for Green Building Design and Construction*:

Postconsumer recycled content is the percentage of material in a product that was consumer waste. The recycled material was generated by household, commercial industrial, or institutional end-users and can no longer be used for its intended purpose. It includes returns of materials from the distribution chain (ISO 14021). Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings).

Preconsumer recycled content, formerly known as postindustrial content, is the percentage of material in a product that is recycled from manufacturing waste. Examples include planer shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventories. Excluded are rework, regrind or scrap materials capable of being reclaimed within the same process that generated them (ISO 14021).

LEED 2009 for New Construction and Major Renovations and the LEED Reference Guide for Green Building Design and Construction also provide an alternate method to calculate and report the recycled content for concrete products that use supplementary cementitious materials (SCMs), such as fly ash or ground blast furnace slag cement. This alternate method allows the recycled content calculation to be based on only the cemenitous materials, rather than on all materials in the concrete mix. This method helps offset the fact that the recycled content calculation is based on weight, and SCMs are typically very low in weight. For concrete mixes with SCMs as the only recycled content, this alternate method will result in a higher recycled content value than the conventional approach. For concrete mixes that incorporate both SCMs and other recycled materials, the manufacturer may want to evaluate the percent recycled content using both methods to determine which method yields the best result.

The basic calculation is the same as the described above, except:

- when determining the percent postconsumer and percent preconsumer recycled content, divide by the total weight of the cementitous materials only, and
- when determining the recycled content value, multiply the percent recycled content by the total value of the cementitious materials only.

Source: NCMA TEK 6-6B.

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Arnold & Mabel Beckman Center for Conservation Research, San Diego, California
Winner of the 2008 NCMA/ICPI Award of Excellence for Sustainability

How Concrete Masonry and Hardscape Products Qualify for LEED Points

LEED FOR NEW CONSTRUCTION 2009

SS—Sustainable Sites		**26 Points**
Prerequisite 1	Construction Activity Pollution Prevention	
Goal	The goal is to reduce pollution generated by construction activities, such as erosion, waterway sedimentation and dust generation.	
Contributions	Articulating concrete blocks can be used to prevent soil erosion, to provide a drivable surface, which will reduce dust generated by truck traffic, and to construct sediment basins. They also support vegetation growth, which provides increased stormwater quality.	ACB
	Grid pavers can be used as a driving surface to reduce dust generation and dirt tracking which leads to sedimentation.	Paver
Credit 2	Development Density and Community Connectivity	5 points
Goal	The goal is to protect undeveloped land and preserve habitats by channeling development to urban areas with existing infrastructure.	
Contributions	The use of both concrete masonry units and segmental retaining wall units can contribute, as they are modular and relatively small, so are well-suited for use on small and irregularly shaped lots. The reduction of large material and equipment staging areas and the reduced requirements of large pieces of equipments is important when developing infill lots in urban areas.	CMU SRW
Credit 5.1	Site Development: Protect or Restore Habitat	1 point
Goal	The goal is to conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.	
Contributions	Restore erosion prone areas of the site with articulated concrete blocks or grid pavers, which will retain soil while promoting growth of native plantings.	ACB Pavers
	Use segmental retaining walls (SRWs) to maximize site usage and thereby reduce the total percentage of site use for development.	SRW

Concrete masonry and concrete hardscape products are made from abundant local raw materials and are manufactured close to construction sites, minimizing fuel requirements for handling and transportation.

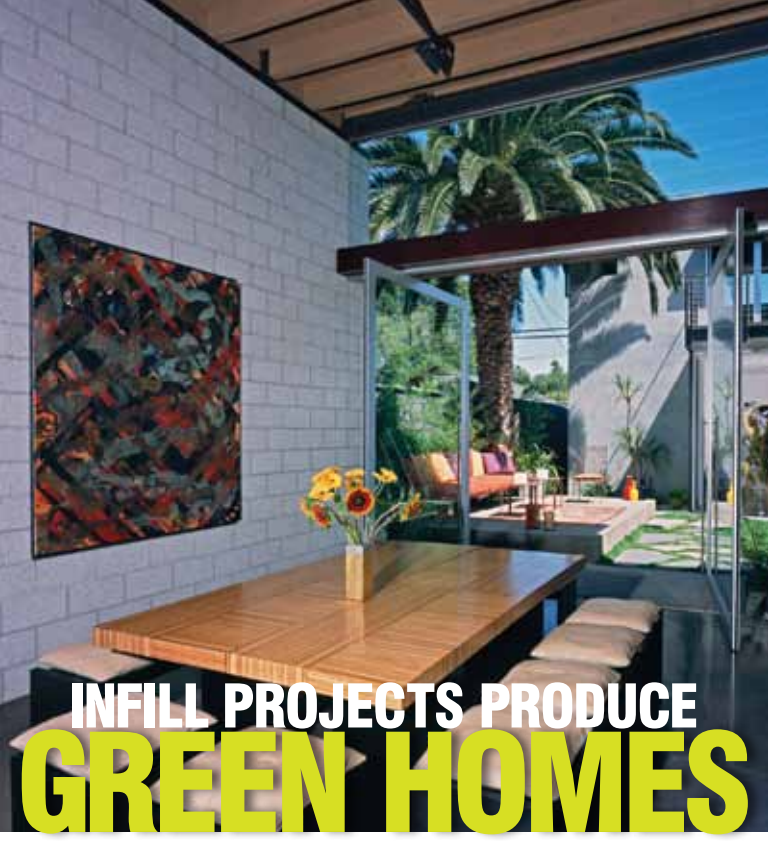
Credit 5.2	Site Development: Maximize Open Space	1 point
Goal	The goal is to conserve existing natural areas on the project site by maximizing the amount of open space relative to the development footprint.	
Contributions	For urban projects that earn Sustainable Sites Credit 2, pedestrian-oriented hardscape areas, such as those constructed with concrete pavers, can contribute towards this credit.	Pavers
	Ponds constructed using articulated concrete block may count as open space as long as they are vegetated and meet the LEED specified maximum side slope gradient average of 1:4 (vertical : horizontal).	ACB
Credit 6.1	Stormwater Design: Quantity Control	1 point
Goal	The goal is to reduce the amount of stormwater runoff.	
Contributions	Limit stormwater runoff by using pervious or grid pavers to minimize impervious surfaces. The stone filled gaps and joints in the pavement provide 100% surface permeability allowing stormwater to be absorbed into the base materials gradually recharging the underlying groundwater.	Pavers
	Protect receiving stream channels from erosion using articulated concrete blocks, which can be planted, contributing to the overall site aesthetics and ecology.	ACB
Credit 6.2	Stormwater Design: Quality Control	1 point
Goal	The goal is to improve the quality of the runoff by providing filtration or other stormwater treatment	
Contributions	Strategy is ACBS can be used for stormwater settling ponds or channels that allow sediment and other solids to settle out of the water, improving the quality of the runoff	ACB
	Permeable/Pervious pavers filter ground water as it passes through the joints and base material.	Paver
Credit 7.1	Heat Island Effect: Nonroof	1 point
Goal	The goal is to reduce heat islands and minimize the resulting impacts on microclimate and human and wildlife habitat.	
Contributions	Pavers with a Solar Reflectance Index (SRI) of at least 29, such as using light-colored pavers vs asphalt (SRI of new gray concrete = 35) to reflect heat instead of absorbing it.	Pavers
	Open grid pavement system with grass in the gaps.	Paver
EA – Energy and Atmosphere		**35 points**
Prerequisite 2	Minimum Energy Performance	
Goal	The goal is to establish a minimum level of energy efficiency for the proposed building and systems to reduce the environmental and economic impacts.	
	Concrete masonry has a unique quality known as thermal mass, or the ability to store heat. The energy efficiency of this quality is recognized by ASHRAE Standard 90.1 and can be used to achieve the energy efficiency thresholds mentioned on the previous slide. The ways this quality affect energy efficiency are the shifting of peak heating and cooling loads to non-peak hours; the reduction of peak heating and cooling loads; the reduction in HVAC systems; and a moderation in interior temperature swings.	CMU
Credit 1	Optimize Energy Performance	1-17 points
Goal	The goal is to achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.	
Contributions	Concrete masonry has a unique property known as thermal mass, or the ability to store heat with very little change in temperature. The energy efficiency of this property is recognized by ASHRAE Standard 90.1 and can be used to achieve the energy efficiency thresholds mentioned on the previous slide. The ways this property affect energy efficiency are the shifting of peak heating and cooling loads to non-peak hours; the reduction of peak heating and cooling loads; the reduction in HVAC systems; and a moderation in interior temperature swings.	CMU

Concrete hardscape products filter stormwater run-off and support grass or other plant growth with open cell product designs.

MR—Materials and Resources		**14 Points**
Credit 1.1	Building Reuse: Maintain Existing Walls, Floors and Roof	1-3 points
Goal	The goal is to achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.	
Contributions	Concrete masonry buildings, because of their exceptional durability, lend themselves very well to renovation rather than teardown. This strategy helps conserve natural resources, retain cultural resources, reduce waste, and reduce the environmental impacts of materials manufacturing and transport.	CMU
Credit 1.2	Building Reuse: Maintain Interior Nonstructural Elements	1 point
Goal	The goal is to extend the lifecycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials, manufacturing and transport.	
Contributions	Concrete masonry buildings, because of their exceptional durability, lend themselves very well to renovation rather than teardown. This strategy helps conserve natural resources, retain cultural resources, reduce waste, and reduce the environmental impacts of materials manufacturing and transport.	CMU
Credit 2	Materials and Resources: Construction Waste Management	1-2 points
Goal	The goal is to divert construction and demolition debris from disposal in landfills and incineration facilities, to redirect recyclable recovered resources back to the manufacturing process, and reusable materials to appropriate sites.	
Contributions	Strategies include redirecting broken or damaged concrete products back to the manufacturing process (possible for use in CMU, but more commonly in other products/materials). Concrete masonry and hardscape products that are not used and are reusable can be donated or redirected to another project.	CMU Pavers SRW ACB
Credit 3	Materials and Resources: Material Reuse	1-2 points
Goal	The goal is to reuse materials and products to reduce demand for virgin materials and reduce waste, thereby lessening impacts associated with the extraction and processing of virgin resources.	
Contributions	Some concrete masonry products such as SRW units, pavers and ACBs can often be removed from one location and reused in another.	SRW Pavers ACB
Credit 4	Materials and Resources: Recycled Content	1-2 Points
Goal	The goal is increase the demand for materials with recycled content and to lower the demand for virgin materials.	
Contributions	The inert nature of masonry lends itself well to incorporating recycled materials. Concrete masonry units are routinely manufactured with by-products from other industries as well as some post-consumer materials.	CMU Pavers SRW ACB
Credit 5	Materials and Resources: Regional Materials	1-2 Points
Goal	The goal is to increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.	
Contributions	Concrete masonry units are typically manufactured very close to the point-of-use. Also the raw materials that are used in the manufacturing of concrete masonry units are typically extracted close the production facility including the recycled materials that are often incorporated into the product.	CMU Pavers SRW ACB

Concrete hardscape products reduce storm-water runoff with permeable concrete pavers and ACB units.

ID—Innovation in Design		**6 Points**
Credit 1	Innovation in Design	1-5 Points
Goal	The goal is to provide design teams and projects the opportunity to achieve exceptional performance above the requirements set by the LEED Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED Green Building Rating System.	
Exemplary Performance Contribution	**Site Development**—an additional point can be achieved by having a larger percentage of the site undisturbed or restored than the original credit. SRW, ACB and paver units can assist in minimizing site disturbance and restoring erosion prone areas. **Stormwater Design**—using paver and ACB units can assist in reducing and improving stormwater to increase the requirements in the original credits. **Heat Island Effect**—using high-albedo or open grid paver units on all non-roof impervious surfaces will yield an additional point. **Optimizing Energy Performance**—using concrete masonry walls strategically can assist in achieving the 50% efficiency level needed to get this additional point. **Construction Waste**—crushing and reusing concrete masonry materials can assist in accomplishing the 95% diversion from landfill threshold established for this credit. **Material Reuse**—salvaging paver, ACB and SRW units can make the 15% material reuse level attainable. **Recycled Material**—a 30% recycled content level will yield a point.	CMU Pavers SRW ACB
Innovation Contribution	To earn these credits, the design team must develop their own criteria and document the performance. Concrete masonry can contribute in a variety of ways. **Durability** One of the most obvious characteristics of concrete masonry is its durability and long life expectancy, with minimal care, upkeep and maintenance. Each of these factors contributes to a building's lasting beauty, comfort, convenience, economy, and returns benefits to the environment when concrete masonry is used. **Low/No VOCs** Unpainted concrete masonry is not currently recognized under the LEED low-VOC credit (Environmental Quality credit 4.2). However, the use of unpainted masonry may be able to qualify under a LEED interpretation ruling for that credit. **Acoustics** Currently there isn't a sound level requirement for LEED for New Construction. By using IEQ credit 9 in LEED for Schools as a guide an ID credit could be developed taking advantage of concrete masonry's acoustical properties. **Mold Inhibitor** Using the Mold Prevention credit in LEED for Schools, a project team could develop an ID credit capitalizing on concrete masonry's natural ability to resist mold growth due to it not being a food source for mold.	CMU Pavers SRW ACB
RP—Regional Priority Credits		**4 Points**
Goal	The goal of this category is to encourage design teams to focus on regional priorities.	
Contributions	The content of these credits varies by zip code across the country. The requirements operate similar to the Innovation in Design Exemplary credits in that they typically require a higher requirement threshold for existing credits and are not new credits. Concrete masonry units will assist in achieving these credits in the same manner as previously described under each credit.	CMU Pavers SRW ACB



INFILL PROJECTS PRODUCE GREEN HOMES

Across the country, urban and suburban communities are taking advantage of a growing trend—infill projects. Unused or underutilized spaces in previously developed areas are getting a second chance to prosper through citywide and individual infill projects.

Infill sites are best described as neglected public spaces and clusters of vacant or nearly-empty buildings and land. Over time, these sites can obstruct community development plans and even inhibit neighborhood safety and growth. Infill projects make it possible for communities to leverage existing assets and rethink the use of older spaces rather than continually seeking out new spaces.

Concrete masonry units (CMU) are an ideal building material for these infill projects because there is often no adjacent space available for large equipment or staging areas. And because these projects tend to be tall and thin, closely situated to the site lines, and frequently mixed-use; the inherent strength, fire resistance, and noise abatement of CMUs provide an economic, one-step solution.

Here are two examples of homes that were infill projects. One is single family, one is multi-family. Both utilize block for its strength, beauty, and ability to mix well with other building materials.

700 PALMS RESIDENCE VENICE, CALIFORNIA

ARCHITECT
Ehrlich Architects, Culver City, California
STRUCTURAL ENGINEER
Parker Resnick Structural Engineering, Los Angeles, California
GENERAL CONTRACTOR
Mark Shramek Construction, Huntington Beach, California
MASONRY CONTRACTOR
Creative Masonry, Malibu, California
BLOCK PRODUCER
ORCO Block Company, Inc., Stanton, California

The exuberant bohemian spirit of Venice, California, is expressed within urban residential constraints in this single family home. The design maximizes volume, light, sustainability, and privacy on a narrow 43 x 132 foot (13 x 40 meters) urban infill lot, with sensitivity to the scale of its eclectic neighborhood of beach bungalows a half mile (0.8 hectare) from the Pacific Ocean. The house dissolves the barriers between indoors and out, creating flexible spaces that take advantage of the benign climate.

A variety of raw materials fit in with the grittiness of the Venice environment; the maintenance-free exterior of concrete masonry units (CMU), synthetic reinforced stucco, corrosion retarding steel, composite decking, and copper weathers naturally and eliminate the use of paints and sealants. All materials involved in the project were carefully selected for their durable, low maintenance characteristics and significant recycled content and recyclable potential.

Flexibility and transformation have been fully realized throughout the house. The wood-and-steel frame structure is outlined by a steel exoskeleton, from which electronically controlled light scrims roll down and horizontally to shield the front façade from the southwestern sun.

Shifts from confined to lofty spaces animate the design. Space is compressed at the low front entrance of the house, and then explodes into the main volume. The 16-foot-high (4.9 meter) living–dining area opens up with sliding and pivoting glass doors on three sides; when opened entirely to the elements, the structure is an airy pavilion with temperate ocean breezes. A glass bridge spans the living room and connects to the upper floors.

Rough and smooth surfaces are contrasted throughout the house. The western front facade, a clearly defined mass, is clad inside and out in rusted steel. Ample roof overhangs and fascias are of metal and high-density timber panels. The white interior back wall of shot-blasted

structural CMU with white mortar serves as a backdrop for artwork. All interior surfaces rely on varying tactile materials such as pumice-aggregated CMU, carbon steel and plaster which are left unpainted. As a result, there are practically no VOC emissions for enhanced indoor occupant health

This eco-friendly residence is designed as a high-performance home, dissolving the barriers between indoors and outdoors. It utilizes raw, honest materials appropriate to the bohemian grittiness of the surrounding community and has a small carbon footprint in balance with lifestyle.

Three garden courtyards embrace three 80-year-old trees. The courtyards afford privacy and enhance the well being of its occupants. The overall massing maximizes volume and natural light on the narrow lot, yet displays sensitivity of scale to the eclectic neighborhood. Exterior sunshades on an exoskeleton of steel control the heat gain from the Southwestern exposure. Flexible, transformative spaces were created through the use of extensive operable glass doors. When open to the elements, the living area is transformed into an airy pavilion.

The design takes full advantage of the local climate such that a net zero energy building is obtained. This was done by employing a highly efficient building envelope and incorporating passive solar gains. Radiant floors and solar thermal energy are utilized for space heating and domestic hot water heating. The house also relies on natural ventilation, thermal mass provided by concrete masonry walls and concrete floors and operable shading to eliminate mechanical cooling, despite the large glazing areas. Finally, by employing ultra-efficient appliances and lighting and by incorporating solar electric power for the remaining loads, the house achieves its goal for a net zero energy home.

CONCRETE MASONRY ASSOCIATION OF CALIFORNIA AND NEVADA DESIGN AWARD PROGRAM GRAND AWARD WINNER, RESIDENTIAL

Jury Comments: A fabulous design—a Net Zero Energy building. The perfect example of what is possible. Supremely livable, while adeptly incorporating technology is clear with every view. The spaces are open yet defined, having innovative daylighting techniques as the star of the show. The concrete masonry becomes a critical backdrop to intersecting materials, exterior landscaping, and art. It is essential to the design, yet is in no way overwhelming. The integrated sustainable properties of this house left no doubt in the Jury's mind that our Grand Award Winner had been found.

MEZZO
PHOENIX, ARIZONA

ARCHITECT
Will Bruder Partners Ltd., Phoenix, Arizona
STRUCTURAL ENGINEER
rudow + berry, inc., Scottsdale, Arizona
GENERAL CONTRACTOR
cz multi, inc., Phoenix, Arizona
MASONRY CONTRACTOR
Pioneer Masonry Inc., Glendale, Arizona
BLOCK PRODUCER
Western Block Company Inc.

With a total of ten units, Mezzo fits distinctively into its 1950s mid-town Phoenix residential neighborhood. Five units are entered from the east through street-side garden courtyards of weathered, welded wire mesh and five units are accessed from the west along a "common mews" walkway of broken concrete pavers. At the heart of the complex is a shared auto court and raised bed community vegetable garden.

Each home of 1,525 square feet (142 square meter) consists of: an entry, study, and carport on level 1; a living room, dining room, and kitchen on level 2; and two bedrooms with on-suite baths on level 3. Delineated by expressed masonry bearing walls, the simply sculpted spaces are given memorable identity by the use of carefully positioned window apertures and triangular pop out kitchen bay windows. Angular geometries of interior walls add to the dynamism and interest of the interiors and complement the finishes of sand-lasted block, stone floors, and cherry cabinets.

Exterior finishes and textures of masonry and perforated metal play against Mezzo's dramatically positioned planes of colored plaster. Mezzo carves out its own unique place in the eclectic neighborhood while offering comfortable urban living appropriate to its desert climate.

Instead of building an expensive and eco-wasteful pool the developer developed a "community garden" with each home owner having his or her own "box." The homeowners association plans to bring in a professional organic gardener once a month to check on and teach the residents how to grow their own vegetables.

A creative use of masonry is at the core of the architecture of the Mezzo condo complex.

Simple, sculptural planes of expressed concrete block in 4 and 8 inch (102 and 203 mm) modules define and bracket project experience from both the both the exterior and interior.

Integrally colored green 4 inch (102 mm) high block and sandblasted gray 8 inch (203 mm) high block are articulated with three joint types: flush, weeping and raked. In light and shadow these surfaces change across both days and seasons. Carefully composed surfaces of galvanized metal and weathered steel, as well as strongly chromatic cobalt blue plaster planes, the masonry grounds the project in its desert landscape and historic neighborhood context. CMD

NATIONAL CONCRETE MASONRY ASSOCIATION
Sustainable Concrete Products for Structures and Hardscapes

INSULATING CONCRETE MASONRY WALLS

TEK 6-11A
Energy & IAQ (2010)

INTRODUCTION

The variety of concrete masonry wall constructions provides for a number of insulating strategies, including: interior insulation, insulated cavities, insulation inserts, foamed-in-place insulation, granular fills in block core spaces, and exterior insulation systems. Each masonry wall design has different advantages and limitations with regard to each of these insulation strategies. The choice of insulation will depend on the desired thermal properties, climate conditions, ease of construction, cost, and other design criteria.

Note that insulation position within the wall can impact dew point location, and hence affect the condensation potential. See TEK 6-17A, *Condensation Control in Concrete Masonry Walls* (ref. 1) for more detailed information. Similarly, some insulations can act as an air barrier when installed continuously and with sealed joints. See TEK 6-14, *Control of Infiltration in Concrete Masonry Walls*, (ref. 2) for further information.

MASONRY THERMAL PERFORMANCE

The thermal performance of a masonry wall depends on its steady-state thermal characteristics (described by R-value or U-factor) as well as the thermal mass (heat capacity) characteristics of the wall. The steady state and mass performance are influenced by the size and type of masonry unit, type and location of insulation, finish materials, and density of masonry. Lower density concrete masonry mix designs result in higher R-values (i.e., lower U-factors) than higher density concretes.

Thermal mass describes the ability of materials to store heat. Because of its comparatively high density and specific heat, masonry provides very effective thermal storage. Masonry walls remain warm or cool long after the heat or air-conditioning has shut off. This, in turn, effectively reduces heating and cooling loads, moderates indoor temperature swings, and shifts heating and cooling loads to off-peak hours. Due to the significant benefits of concrete masonry's inherent thermal mass, concrete masonry buildings can provide similar performance to more heavily insulated frame buildings.

The benefits of thermal mass have been incorporated into energy code requirements as well as sophisticated computer models. Energy codes and standards such as the *International Energy Conservation Code* (IECC) (ref. 5) and *Energy Efficient Standard for Buildings Except Low-Rise Residential Buildings*, ASHRAE/IESNA Standard 90.1 (ref. 6), permit concrete masonry walls to have less insulation than frame wall systems to meet the energy requirements.

Although the thermal mass and inherent R-value/U-factor of concrete masonry may be enough to meet energy code requirements (particularly in warmer climates), concrete masonry walls often require additional insulation. When they do, there are many options available for insulating concrete masonry construction. When required, concrete masonry can provide walls with R-values that exceed code minimums (see refs. 3, 4). For overall project economy, however, the industry suggests a parametric analysis to determine reasonable insulation levels for the building envelope elements.

The effectiveness of thermal mass varies with factors such as climate, building design and insulation position. The effects of insulation position are discussed in the following sections. Note, however, that depending on the specific code compliance method chosen, insulation position may not be reflected in a particular code or standard.

There are several methods available to comply with the energy requirements of the IECC. One of the options, the IECC prescriptive R-values (IECC Table 502.2(1)) calls for "continuous insulation" on concrete masonry and other mass walls. This refers to insulation uninterrupted by furring or by the webs of concrete masonry units.

Related TEK:
6-1B, 6-2B, 6-13, 6-14, 6-17A

Keywords: basement walls, energy conservation, insulation, multi-wythe walls, R-values, thermal insulation, thermal properties, thermal mass

Examples include rigid insulation adhered to the interior of the wall with furring and drywall applied over the insulation, continuous insulation in a masonry cavity wall, and exterior insulation and finish systems. If the concrete masonry wall will not include continuous insulation, there are several other options to comply with the IECC requirements—concrete masonry walls are not required to have continuous insulation in order to meet the IECC. See TEK 6-12C, *International Energy Conservation Code and Concrete Masonry* and TEK 6-4A, *Energy Code Compliance Using COMcheck* (refs. 7, 8).

INTERIOR INSULATION

Interior insulation refers to insulation applied to the interior side of the concrete masonry, as shown in Figure 1. The insulation may be rigid board (extruded or expanded polystyrene or polyisocyanurate), closed-cell spray polyurethane foam, cellular glass, fibrous batt, or fibrous blown-in insulation (note, however, that fibrous insulation is susceptible to moisture). The interior wall surface is usually finished with gypsum wallboard or paneling.

Interior insulation allows for exposed masonry on the exterior, but isolates the masonry from the building's interior and so may reduce the effects of thermal mass.

With rigid board insulation, an adhesive is used to temporarily hold the insulation in place while mechanical fasteners and a protective finish are applied. Furring may be used and held away from the face of the masonry with spacers. The space created by the spacers provides moisture protection, as well as a convenient and economical location for additional insulation, wiring or pipes.

As an alternative, wood or metal furring can be installed with insulation placed between the furring. The furring size is determined by the type of insulation and R-value required. Because the furring penetrates the insulation, the furring properties must be considered in analyzing the wall's thermal performance. Steel penetrations through insulation significantly affect the thermal resistance by conducting heat from one side of the insulation to the other. Although not as conductive as metal, the thermal resistance of wood and the cross-sectional area of the wood furring penetration should be taken into account when determining overall R-values. See TEK 6-13A, *Thermal Bridges in Wall Construction* (ref. 9) for more information.

Closed cell spray polyurethane foam is typically installed between interior furring. The foam is applied as a liquid and expands in-place. Proper training helps ensure a quality installation. The foam is resistant to both air and water vapor transmission.

When using interior insulation, concrete masonry can accommodate both vertical and horizontal reinforcement with partial or full grouting without interrupting the insulation layer.

The durability, weather resistance, and impact resistance of the exterior of a wall remain unchanged with the addition of interior insulation. Impact resistance on the interior surface is determined by the interior finish.

INTEGRAL INSULATION

Figure 2 illustrates some typical integral insulations in single-wythe masonry walls. Integral insulation refers

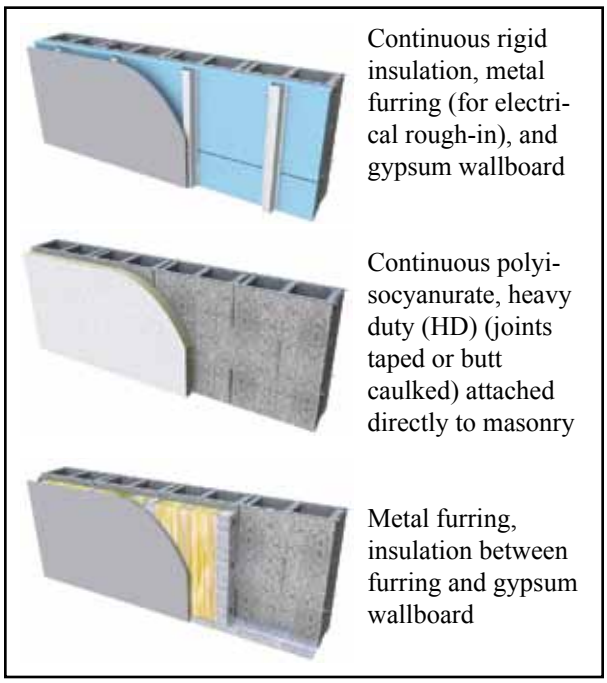


Figure 1—Examples of Interior Insulation

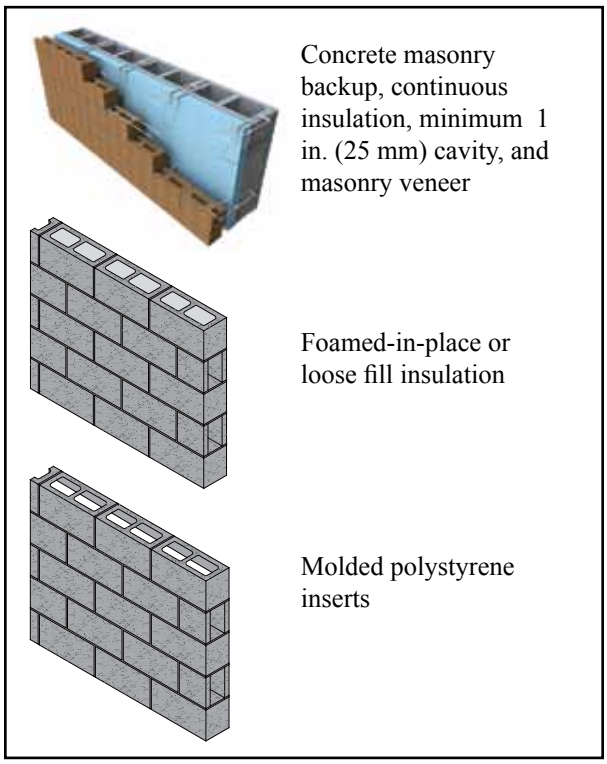


Figure 2— Integral Insulation Examples

to insulation placed between two layers of thermal mass. Examples include insulation placed in concrete masonry cores and continuous insulation in a masonry cavity wall (note that an insulated masonry cavity wall can also be considered as exterior insulation if the thermal mass effect of the veneer is disregarded).

With integral insulation, some of the thermal mass (masonry) is directly in contact with the indoor air, which provides excellent thermal mass benefits, while allowing exposed masonry on both the exterior and interior.

Multi-wythe cavity walls contain insulation between two wythes of masonry. The continuous cavity insulation minimizes thermal bridging. The cavity width can be varied to achieve a wide range of R-values. Cavity insulation can be rigid board, closed cell spray polyurethane foam, or loose fill. To further increase the thermal performance, the cores of the backup wythe may be insulated.

When rigid board insulation is used in the cavity, the inner masonry wythe is typically completed first. The insulation is precut or scored by the manufacturer to facilitate placement between the wall ties. The board insulation may be attached with an adhesive or mechanical fasteners. Tight joints between the insulation boards maximize the thermal performance and reduce air leakage. In some cases, the joints between boards are set into an expandable bead of sealant, or caulked or taped to act as an air barrier.

Integral insulations placed in masonry cores are typically molded polystyrene inserts, foams, or expanded perlite or vermiculite granular fills. As for the furring used for interior insulation, the thermal resistance of the concrete masonry webs and any grouted cores should be accounted for when determining the thermal performance of the wall (see TEK 6-2B, ref. 3, for tabulated R-values of walls with core insulation). When using core insulation, the insulation should occupy all ungrouted core spaces (although some rigid inserts are configured to accommodate reinforcing steel and grout in the same cell).

Foamed-in-place insulation is installed in masonry cores after the wall is completed. The installer either fills the cores from the top of the wall or pumps the foam through small holes drilled into the masonry. Foams may be sensitive to temperature, mixing conditions, or other factors. Therefore, manufacturers' instructions should be carefully followed to avoid excessive shrinkage due to improper mixing or placing of the foam.

Polystyrene inserts may be placed in the cores of conventional masonry units or used in specially designed units. Inserts are available in many shapes and sizes to provide a range of R-values and accommodate various construction conditions. In pre-insulated masonry, the inserts are installed by the manufacturer. Inserts are also available which are installed at the construction site.

Specially designed concrete masonry units may incorporate reduced-height webs to accommodate inserts in the cores. Such webs also reduce thermal bridging through masonry, since the reduced web area provides a smaller cross-sectional area for heat flow through a wall. To further reduce thermal bridging, some manufacturers have developed concrete masonry units with two cross webs rather than three.

Vertical and horizontal reinforcement grouted into the concrete masonry cores may be required for structural performance. Cores to be grouted are isolated from cores to be insulated by placing mortar on the webs to confine the grout. Granular or foam insulation is placed in the ungrouted cores within the wall. Thermal resistance is then determined based on the average R-value of the wall area (see TEK 6-2B, ref. 3, for an explanation and example calculation). Some rigid inserts are configured to accommodate reinforcing steel and grout, to provide both thermal protection and structural performance. When inserts are used in grouted construction, the code-required minimum grout space dimensions must be met (see TEK 3-2A, ref. 10).

Granular fills are placed in masonry cores as the wall is laid up. Usually, the fills are poured directly from bags into the cores. A small amount of settlement usually occurs, but has a relatively small effect on overall performance. Granular fills tend to flow out of any holes in the wall system. Therefore, weep holes should have noncorrosive screens on the interior or wicks to contain the fill while allowing water drainage. Bee holes or other gaps in the mortar joints should be filled. In addition, drilled-in anchors placed after the insulation require special installation procedures to prevent loss of the granular fill.

EXTERIOR INSULATION

Exterior insulated masonry walls are walls that have insulation on the exterior side of the thermal mass. In these walls, continuous exterior insulation envelopes the masonry, minimizing the effect of thermal bridges. This places the thermal mass inside the insulation layer. Exterior insulation keeps masonry directly in contact with the interior conditioned air, providing the most thermal mass benefit of the three insulation strategies.

Exterior insulation also reduces heat loss and moisture movement due to air leakage when joints between the insulation boards are sealed. Exterior insulation negates the aesthetic advantage of exposed masonry. In addition, the insulation requires a protective finish to maintain the durability, integrity, and effectiveness of the insulation.

For exterior stucco installation, a reinforcing mesh is applied to reinforce the finish coating, improving the crack and impact resistance. Fiberglass mesh, corrosion-

Exterior stucco or insulation and finish system (rigid insulation and synthetic stucco)

Figure 3—Exterior Insulation Example

resistant woven wire mesh or metal lath is used for this purpose. After the mesh is installed, mechanical fasteners are placed through the insulation, to anchor securely into the concrete masonry. Mechanical fasteners can be either metal or nylon, although nylon limits the heat loss through the fasteners.

After the insulation and reinforcing mesh are mechanically fastened to the masonry, a finish coating is troweled onto the surface. This surface gives the wall its final color and texture, as well as providing weather and impact resistance.

BELOW GRADE APPLICATIONS

Below grade masonry walls typically use single-wythe wall construction, which can accommodate interior, integral, or exterior insulation.

Exterior or integral insulation is effective in moderating interior temperatures and in shifting peak energy loads. The typical furring used for interior insulation provides a place to run electric and plumbing lines, as well as being convenient for installing drywall or other interior finishes.

When using exterior or integral insulation strategies, architectural concrete masonry units provide a finished surface on the interior. Using smooth molded units at the wall base facilitates screeding the slab. After casting the slab, a molding strip, also serving as an electric raceway, can be placed against the smooth first course. The remainder of the wall may be constructed of smooth, split-face, split ribbed, ground faced, scored or other architectural concrete masonry units.

Insulation on the exterior of below grade portions of the wall is temporarily held in place by adhesives until the backfill is placed. That portion of the rigid board which extends above grade should be mechanically attached and protected.

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ROLES AND RESPONSIBILITIES ON SEGMENTAL RETAINING WALL PROJECTS

TEK 15-3A
Structural (2010)

INTRODUCTION

On all construction projects, including those involving segmental retaining walls (SRWs), it is the owner's responsibility to achieve coordination between construction and design professionals that ensures all required design, engineering analysis, and inspection is provided. In many cases, a design professional such as a site civil engineer or an architect acts as the owner's representative. In either case, the owner or owner's representative should ensure that the engineering design professionals' scope of work, roles and responsibilities are clearly defined so that there is no ambiguity regarding responsibility for investigation, analysis and design, and that all required testing is performed.

The roles outlined in this TEK are typical industry roles for various engineering disciplines. SRW design and construction should generally follow these traditional roles. However, these roles may vary from project to project, depending on the contractual obligations of each consultant. For example, for simpler projects, such as residential landscapes, one design professional may take on the responsibility of several roles, if acceptable to local building code requirements.

For tall or complex walls and for commercial projects, each of these roles is likely to be provided by separate firms, each with expertise in a particular discipline. The discussion in this TEK is generally oriented towards projects where several design professionals are contracted.

Reinforced SRWs, because of their nature as composite soil structures, may have unique design and inspection considerations for the site civil engineer, the geotechnical engineer, and the independent testing agency. These considerations are discussed in further detail in the following sections.

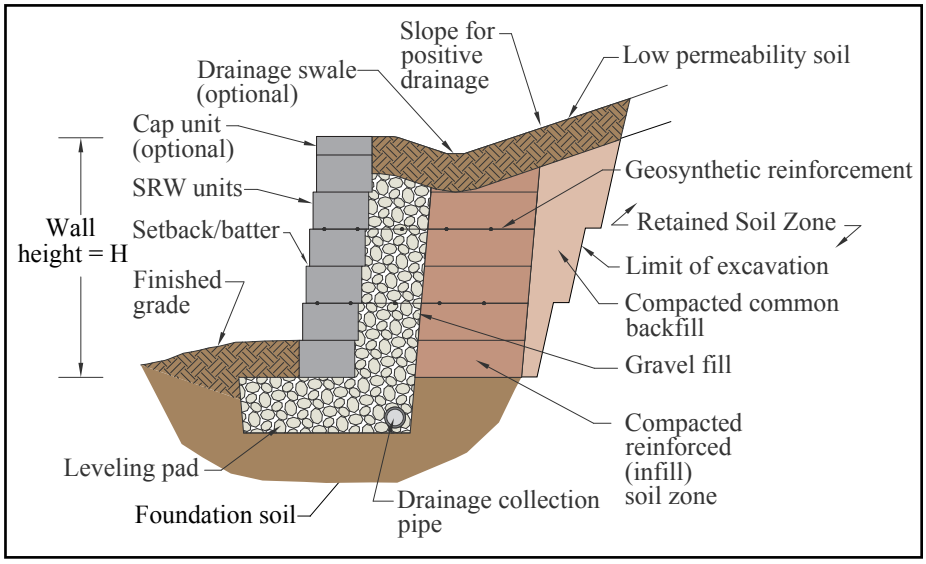

Figure 1—Reinforced Segmental Retaining Wall System Components

Related TEK:
8-1A, 8-2A, 8-3A, 8-4A, 18-11A

Keywords: contracts, construction, design, details, inspection, maintenance, responsibilities, roles, scope of work, segmental retaining walls, soils, SRW, stability, testing

Table 1—Suggested Roles for a Segmental Retaining Wall Project

Owner/Developer or Owner's Representative:
Ensure that design professionals are contracted to provide all required engineering evaluation, layout, design, testing and inspection.
Construction Observation and Testing Agencies:
Earthwork inspection preferably performed by the geotechnical engineering consultant.
Inspect SRW foundation area, including area below planned geosynthetic-reinforced soil fill, to verify that bearing, soil, and groundwater conditions meet design assumptions.
Inspect native soils in retained zone for consistency with reported soil types and properties.
Monitor fill placement and laboratory- and field-testing to ensure specified soil types used for fill and specified compaction achieved.
Inspect overall wall material installation–preferably contracted directly with SRW engineer or site civil engineer.
Observe placement of SRW units and geosynthetic reinforcement installation.
Review material submittals for conformance with specifications.
Additional review of soil properties and earthwork testing, provided by the geotechnical engineer, for conformance with wall material specifications.
Geotechnical Engineer:
Subsurface investigation, including any required soil borings and laboratory soils testing.
Define pertinent subsurface conditions including soils, rock and groundwater conditions in the area of SRWs.
Determine properties and strengths of retained soil/rock behind and foundation material underneath the SRWs as well proposed soil for use as reinforced fill.
Evaluate foundation capacity below SRW, including bearing capacity and settlement estimates and recommendations for any required foundation improvements.
Global stability analysis throughout site including above and below SRWs.
Supervise and coordinate slope stability evaluation and corrections around the SRW with the SRW engineer.
Evaluate seismic potential and recommended design accelerations, if applicable.
Construction inspection and testing of on-site and fill soils (generally on a time and materials basis, separate from the soils exploration report contract).
Landscape Architect/Architect:
May act as specifier of retaining walls, rather than site civil engineer, primarily for walls near building structures (architectural walls) or for landscaping features.
Specify retaining walls appropriate to project conditions, if not civil engineer's responsibility.
For walls near building structures or for landscaping, retaining wall layout and alignment on site plan, if not site civil engineer's responsibility.
Coordinate SRW layout with site civil engineer's site and grading plans.
Structural Engineer:
Structural design of appurtenant structures to SRW such as guide rails, traffic barriers and structural slabs at top or bottom of wall.

Table 1—Suggested Roles for a Segmental Retaining Wall Project (continued)

SRW Engineer:
Design SRW for structural stability including external stability (sliding and overturning), internal stability, and facial stability.
Determine maximum unreinforced height of SRW.
Design geosynthetic reinforcement layout, when required.
Determine minimum embedment of wall (except in the case of scour depth or erosion control issues, which should be determined by site civil).
Specify SRW unit, geosynthetic reinforcement, drainage material within wall structure and reinforced soil properties.
Determine which structures can or cannot be placed within the reinforced soil zone and wall face, and detail the SRWs to accommodate acceptable structures.
Under the direction of geotechnical engineer, assist in coordination of slope stability evaluation around and through the SRW and the geosynthetic reinforcement design in reinforced SRWs to address slope stability in vicinity of SRW, as required.
If contracted to and notified, observe construction of the overall SRW installation and review SRW material submittals (generally on a time and materials basis, separate from the wall design contract). See *Construction Observation and Testing Suggested Roles Overview* below.
When required by state law that the SRW engineer be a licensed professional structural engineer (S.E.), structural engineer also takes on SRW engineer role. In this case, the general project structural engineer often may be a different firm than the SRW structural engineer, depending on the project structural engineer's familiarity with SRWs and interest in designing SRWs.
Site/Civil Engineer:
Specify retaining walls appropriate to project conditions.
Act as SRW Engineer (see above) when wall design performed in-house.
Prepare site plan and grading plan, including slopes and SRW heights and alignments.
Address any space limitations and easement issues relevant to SRW layout.
Design surface grading for drainage and design for erosion control around SRWs.
Design storm water collection structures and detention/retention ponds.
Utility design and layout around SRWs.
Pavement section design and grading above SRWs.
Layout of traffic control structures, such as pedestrian fall protection, curbs, wheel stops, guide rails and traffic barriers behind walls.
Hydrologic evaluations including water flows, scour depths, flood areas and high water level predictions around SRW.
Ensure SRW engineer contracted for involvement in pre-construction meetings and construction inspection services coordination.
Observe construction of the overall SRW installation and review SRW material submittals, if SRW engineer not contracted specifically for these services.
Owner (after installation):
Maintenance and cleaning.
Ensure landscaping and other site work does not damage or impair the SRW installation.

Detailed guidance on SRW design, construction and inspection can be found in references 1 through 3.

OVERVIEW OF ROLES

The owner/developer, or a designated representative, is ultimately responsible for ensuring that all applicable requirements of governing authorities for the permitting, design, construction and safety on the project are addressed. The owner or owners' representative should ensure that the types of retaining walls specified are appropriate for the site conditions and ensure the wall alignment fits within the site's space limitations. It is the owner's or owner's representative's responsibility to contract an engineer to provide site civil engineering including site layout, drainage and grading. The owner must also ensure that a geotechnical engineer and testing agency are contracted to provide all necessary and required soils exploration, analysis and earthwork inspection for the entire project, including in the vicinity of the SRWs, just as they do in the vicinity of building structures. The owner or owner's representative must also ensure that a qualified wall design engineer provides an SRW structural design.

The most straightforward means for the owner or owner's representative to ensure all engineering roles are well-defined is for the SRW design engineer's assigned roles to be the same as those traditionally given to a structural engineer designing a cast-in-place concrete retaining wall, and for the other design professionals, such as site civil and geotechnical engineers, to also provide the same roles and services as they would for a cast-in-place retaining wall.

Table 1 contains an itemized list of the suggested roles for each professional discipline for larger walls and commercial projects involving SRWs. A more thorough explanation of the site civil engineer's, geotechnical engineer's and SRW engineer's roles, and construction observation and testing roles is provided in the following sections. The actual responsibilities for each discipline should be contractually based.

SITE CIVIL ENGINEER SUGGESTED ROLES OVERVIEW

It is suggested that the site civil engineer be contracted for all traditional site civil duties, including the design of surface drainage, storm drainage collection structures, utility layout, erosion control and scour protection. The site civil engineer is also typically responsible for site layout and grading plans, including slopes and retaining wall locations. The site civil engineer should, in consultation with the geotechnical engineer, ensure that all planned grades, including those at the top and bottom of SRWs, do not exceed the stable slope angles and do not cause surface drainage or erosion problems.

The site civil engineer should also plan the wall alignment so that the SRW structure does not encroach on any easements. In addition, the site civil engineer should be responsible for any other issues related to the wall location, such as proximity to property lines, utilities, watersheds, wetlands, or any other easements. In some cases, the site civil engineer may also act as the SRW Design Engineer and take on suggested roles for the SRW Engineer discussed below.

The site civil engineer should evaluate and design for any hydrologic issues and structures such as: culverts, open channels, detention/retention ponds, scour and erosion control details, as well as defining high water levels, flow volumes, flood areas and scour depths. The site civil engineer should provide any pertinent hydrologic data that may affect the SRW to the SRW engineer.

Often, when not designing the SRW in-house, the site civil engineer specifies the engineering design of SRWs to be part of the SRW construction contract (a design/build bid). While a common practice, this type of bid can place the SRW engineer in a different position than other project engineers. Unlike other engineers working directly for the owner, the SRW engineer in this design/build case is often working directly for a contractor, who is often a subcontractor to other contractors. This can cause design coordination issues because the SRW engineer may not be included in project discussions with other engineers, such as pre-construction meetings. Therefore, it is suggested that the site civil first determine if it is appropriate to have the SRW engineering specified as part of the wall construction contract. For some more complicated projects, it may be preferable to have the SRW design engineer perform the design prior to bidding the construction rather than as part of a design/build bid. If the site civil engineer chooses to specify the SRW design as part of the construction bid, it is recommended that the site civil engineer ensure that the SRW design engineer is involved in any required design and construction observation services before and during construction, similar to the way geotechnical engineers are often contracted for their services during construction.

GEOTECHNICAL ENGINEER SUGGESTED ROLES OVERVIEW

The geotechnical engineer should typically be contracted to provide the same engineering roles in the vicinity of the SRW as they do for all other structures on site. The geotechnical engineer's typical roles are the investigation, analysis and testing of the site soil materials and groundwater conditions. Just as geotechnical engineers traditionally provide bearing capacity, settlement estimates and slope stability analysis for building structures, it is suggested they do the same for SRWs. The geotechnical engineer's role should include providing soil properties such as soil shear strength parameters, ground water elevation, seismic conditions, and bearing capacities to the SRW engineer.

Responsibility for slope stability evaluation around an SRW can be a source of confusion, because the SRW engineer can often address slope stability issues near a geosynthetic-reinforced SRW by modifying the geosynthetic reinforcement layout. Thus, the SRW engineer is sometimes requested to evaluate and design for slope stability by the civil engineer's specifications. However, involving the SRW engineer in addressing slope stability should not remove ultimate global/slope stability responsibility from the geotechnical engineer.

It is therefore suggested that, regardless of the SRW engineer's involvement, the geotechnical engineer be contracted to have the ultimate responsibility for the site's slope stability, including: determining when and where global stability analyses are required, determining the appropriate soils and groundwater properties to be used for the analyses, and ensuring that all required failure planes are analyzed. While the geotechnical engineer may need to coordinate with the SRW engineer for evaluating potential failure planes that pass through the reinforced soil (compound failures), the geotechnical engineer has the primary responsibility for these analyses.

When the geotechnical consultant is retained to provide construction observation and soils testing for a project, the contract should include inspection and testing of SRW earthwork along with all other earthwork on site. See TEK 18-11A, *Inspection Guide for Segmental Retaining Walls* (ref. 3) for further discussion of inspection roles.

While geotechnical engineers should be contracted for the same traditional roles regarding SRWs as for other structures, the soils engineering for SRWs may require some slightly different methods of analysis compared to evaluating soils below rigid structures on spread footings. Design guidelines for SRWs are provided in Reference 1.

SRW DESIGN ENGINEER SUGGESTED ROLES OVERVIEW

As noted previously, the SRW design engineer should serve the same roles for SRWs as a structural engineer would for the design of a cast-in-place concrete retaining wall. In some cases, the site civil engineering firm may also act as the SRW engineer, while in others, the SRW design engineer will be a separate firm. The SRW design engineer should design a stable SRW, given the specified wall geometry and site conditions provided by the site civil and geotechnical engineers. The SRW engineer's duties typically include determining the SRW's maximum stable unreinforced height and providing a geosynthetic reinforcement layout design when required.

The SRW design engineer is typically responsible for preparing the SRW construction drawings, and for determining the internal stability, facial stability of the SRW units, internal drainage of the SRW (both at the face of the wall and at the rear of the reinforced soil mass, if required), external stability (sliding and overturning), and internal compound stability.

The SRW designer engineer's output generally consists of specifications of wall components, a wall elevation detail, typical cross sections, details for any required drainage materials within or just behind the wall system, and details for how to incorporate any other structures (utilities, pipe penetrations, posts, etc.), if feasible, within the reinforced zone and wall face.

The SRW design engineer should typically not assume any duties typically relegated to the geotechnical engineer elsewhere on site. While an SRW engineer may be asked to participate in addressing the slope stability immediately around the SRW or foundation improvements in the soil below an SRW, it is recommended that the geotechnical engineer be clearly contracted to have ultimate responsibility for all slope stability and bearing capacity/settlement concerns on site, including those below and around SRWs.

It is appropriate that the SRW engineer be contracted to provide services during construction, especially on larger projects, but it is recommended that these not be included in a design/build contract for the wall construction. Time lag between design and construction can make it impractical to expect the designer to be available for services during construction and, given the often unpredictable extent and timing of construction, it

Table 2—Example SRW Maintenance Schedule (ref. 4)

Task:	Frequency
Check overall appearance of the structure for any signs of damage or poor performance.	Periodically
Examine drainage outlets to ensure proper function.	Biannually
Check to ensure roof drains, downspouts and other water sources are directed away from the wall. Check that water collection structures are operating properly. Clean and repair as necessary.	Spring and fall
Check for locations and sources of water.	Annually (spring)
Check to ensure grade slopes away from wall or that drainage swales are working properly.	Annually (spring)
Examine drainage outlets for presence of vermin. Remove nests and clean as necessary. Install vermin caps or screens as necessary.	Annually
If a coating has been applied, examine the condition of the coating.	Annually
Examine the condition of cap units and the effectiveness of cap unit adhesive.	Annually
If large trees and/or shrubs are present, examine the impact of root structures on the wall.	Annually
Check for the presence of dirt, efflorescence and graffiti. Clean as necessary.	Annually
Check vertical and horizontal alignment of wall surfaces.	Every 2 to 5 years

is inappropriate to have services during construction be in a lump-sum design/build contract. Rather, it is suggested that the SRW engineer be hired under a separate contract directly with the owner or owner's representative to provide services during construction. These services may include preconstruction correspondences and meetings, review of materials submittals, review of earthwork testing performed by the geotechnical engineer, and review of the wall contractor's building practices.

CONSTRUCTION OBSERVATION AND TESTING SUGGESTED ROLES OVERVIEW

The soil in the reinforced zone should be checked to ensure it meets specifications; just as concrete and steel are inspected in a cast-in-place concrete retaining wall.

The wall contractor is responsible for quality control of the wall installation: performing necessary observation and testing to verify that the work performed meets minimum standards.

It is the owner's or owner's representative's responsibility to perform quality assurance: auditing and verifying that the quality control program is being performed properly.

Just as is done for building structures and cast-in-place concrete retaining walls, foundation and retained soils should be evaluated for consistency with the soil properties used in the design. Generally, the geotechnical engineer evaluates the onsite soil conditions and performs earthwork testing. It is suggested that the geotechnical engineer perform any field and laboratory testing they deem required to verify soil conditions. The geotechnical engineer should confer with the SRW engineer regarding the reinforced soil specifications and provide the SRW engineer with the fill soil test results. The geotechnical engineer should also determine the frequency of tests required to ensure that compaction of the SRW reinforced fill meets the project specifications.

OWNER SUGGESTED ROLES OVERVIEW

Segmental retaining walls are designed to provide a long life with little to no maintenance required. After the SRW installation is complete, some very basic maintenance will help maximize the SRW project's beauty and durability.

The most basic maintenance task is a periodic visual assessment of the SRW units and overall wall. If coatings have been applied to the wall, the need for re-coating should be assessed based on the coating manufacturer's recommendations and the exposure conditions of the wall. Table 2 lists regular inspection tasks that can be performed on SRWs and their suggested frequency.

Periodic cleaning of SRWs may be desired to maintain the wall's aesthetics. Cleaning recommendations for SRWs are essentially the same as those for other concrete masonry walls. The reader is referred to: TEK 8-4A, *Cleaning Concrete Masonry*; TEK 8-2A, *Removal of Stains from Concrete Masonry*; and TEK 8-3A, *Control and Removal of Efflorescence* (refs. 5, 6, 7), for more detailed guidance.

In addition to maintenance and cleaning, the owner is also responsible for ensuring that subsequent digging or trenching, such as for landscaping, does not impact the SRW installation. During any excavation, care should be taken to leave a zone of undisturbed soil behind the segmental retaining wall. Particular care should be taken to ensure that excavation does not damage, cut or remove the geosynthetic soil reinforcement, if present. For this reason, the owner should maintain a record of the installation, including the locations of geosynthetic reinforcement.

Once established, tree roots do not typically damage an SRW. The roots will typically not damage the wall face from behind because the drainage aggregate behind the SRW face does not support root growth. In fact, the root system can act as additional soil reinforcement, helping to further stabilize the soil. When newly planted, trees and other large vegetation should be adequately supported to prevent them from toppling and potentially damaging the SRW.

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3. *Inspection Guide for Segmental Retaining Walls*, TEK 18-11A. National Concrete Masonry Association, 2010.
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7. *Control and Removal of Efflorescence*, TEK 8-3A. National Concrete Masonry Association, 2003.

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The VERSA-Green system can be installed up to 3.5 feet tall in most applications by anyone with a basic knowledge of retaining wall systems. If soil reinforcement is required, the wall should be designed only in accordance with final, stamped, professionally engineered construction drawings.

For more information on VERSA-Green, contact VERSA-LOK, 800.770.4525, or email at versalok@versa-lok.com

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Single Wythe Core-Insulated CM Wall Energy Code Compliance

Introduction

Today's buildings are being designed in a changing environment with regard to energy efficiency. From a recent past of very basic energy requirements, a new generation of energy codes has evolved, as have more comprehensive programs where building energy efficiency is only part of the larger design goal of sustainability.

Although masonry is an ancient material, today's concrete masonry can be a significant benefit to modern sustainable buildings. In addition to its energy efficiency, concrete masonry is a locally-produced natural material that is durable and long-lived, minimizing the need for repair or replacement. Concrete masonry can incorporate recycled materials, and can itself be reused or recycled at the end of its life. Various architectural finishes are available that can eliminate the need for paint or other coatings which can impair indoor air quality.

Today's buildings have varied energy efficiency goals. Programs such as LEED and Green Globes make it easier for designers to integrate sustainability throughout the design and produce a comprehensively "green" building. For these projects, the energy efficiency goal for the building envelope is often to minimize energy use. Another approach is taken on projects where economy is the top priority. For these buildings, the design goal is to meet the current energy code requirements as economically as possible. Between the two are a range of building types and design goals that must be met.

Regardless of the project goals, single wythe concrete masonry construction can fulfill the project's energy efficiency requirements, while also providing superior structural capacity, durability, and resistance to fire, sound transmission, insects and mold. This article discusses exterior wall performance for commercial buildings with an emphasis on concrete masonry walls. Where examples are given, they are based on the 2006 IECC and LEED 3.0.

Concrete Masonry Construction

The thermal performance of a masonry wall depends on its steady-state thermal characteristics (described by R-value and U-factor) as well as its thermal mass (heat capacity). The steady-state and thermal mass performance are influenced by the size and type of masonry unit, type and location of insulation, finish materials, and density of masonry. Lower density concrete masonry mix designs result in higher R-values (i.e., lower U-factors) than higher density concretes.

Thermal mass (thermal inertia) is the ability of materials such as concrete masonry to store heat—they heat up and cool down slowly, which can help mitigate heat loss. Due to the significant benefits of concrete masonry's inherent thermal mass, concrete masonry buildings can often provide similar performance to more heavily insulated frame buildings.

The effectiveness of thermal mass varies with factors such as climate, building design and insulation position. For example, insulation placed on the exterior of the masonry or in the cavity of a masonry cavity wall keeps masonry in direct contact with indoor air, providing maximum thermal mass benefits. Interior insulation, on the other hand, may reduce thermal mass benefits.

The benefits of thermal mass have been incorporated into energy code requirements as well as sophisticated computer models. Energy codes and standards such as the *International Energy Conservation Code* (IECC) and *Energy Efficient Standard for Buildings Except Low-Rise Residential Buildings*, ASHRAE/IESNA Standard 90.1, permit concrete masonry walls to have less insulation than frame wall systems to meet the energy requirements.

Although the thermal mass and inherent R-value of concrete masonry may be enough to meet energy code requirements (particularly in warmer climates), concrete masonry walls often require additional insulation. When they do, there are many options available for insulating single wythe concrete masonry construction. Rigid insulation inserts or foamed-in-place insulation can be placed in either conventional concrete masonry units or in a variety of proprietary units designed to provide higher R-values. Insulation can be applied to the interior side of the masonry (using rigid insulation attached directly to the wall or utilizing wood or steel furring) or to the exterior. With the variety of concrete masonry units and insulation types and thicknesses in use, R-values from 5 to over 25 are available.

Energy Tools for the Building Envelope: LEED and Other High Performance Buildings

Depending on the project goals, there are various tools available to either help determine energy code compliance or to minimize energy use. For a building being designed to exceed the energy code minimums, such as a LEED-certified building, a whole-building energy analysis program is required to be used, such as EnergyPlus,

DOE-2 or BLAST. These programs analyze the energy impacts of the entire building, including factors such as interior components, lighting, HVAC, and occupancy patterns. The result is an estimate of annual energy use and/or cost for the building as a whole. The comprehensiveness of this analysis lends itself to parametric studies to evaluate the impacts of varying individual building elements, or the effectiveness of a particular strategy.

For LEED projects, a whole-building analysis must be used for Energy and Atmosphere (E&A) Prerequisite 2, *Minimum Energy Performance*, and for E&A Credit 1, *Optimize Energy Performance*. The whole-building analysis is performed in accordance with ASHRAE/IESNA Standard 90.1 Appendix G, *Performance Rating Method*. Using Appendix G, LEED credits can be earned by demonstrating that the proposed building exceeds the Standard 90.1 minimums. E&A Credit 1 provides LEED credits incrementally from 1 to 19 credits for buildings that exceed the minimum requirements of ASHRAE/IESNA Standard 90.1-07 by 12 to 48%. This percentage reflects the performance of the entire building; improving the thermal performance of any one individual building element by 48% will do little to improve the overall building performance.

Although, in general, higher R-values reduce heat flow through a building element, R-values have a diminishing impact on the overall building envelope energy use. In other words, it's important not to automatically equate higher R-value with improved energy efficiency. As an example, consider a two-story elementary school in Bowling Green, Kentucky. If this school is built using single wythe concrete masonry walls with core insulation only and a wall R-value of 7 hr.ft^{2}·°F/Btu, a simplistic estimate of the building envelope energy use is 27,800 Btu/ft^2. If we replace that wall with an R14 wall, the building envelope energy use drops by 2.5%, not in proportion to doubling the wall R-value. Figure 1 illustrates the trend: as wall R-value increases, it has less and less impact on the building envelope performance. In this example, a wall R-value larger than about R12 no longer has a significant impact on the envelope energy use. At this point, it may make more sense to invest in energy efficiency measures other than wall insulation.

When required, concrete masonry construction can provide walls with high R-values. For overall project economy, however, the industry recommends a parametric analysis similar to that shown in Figure 1 to determine reasonable insulation levels for the building envelope elements.

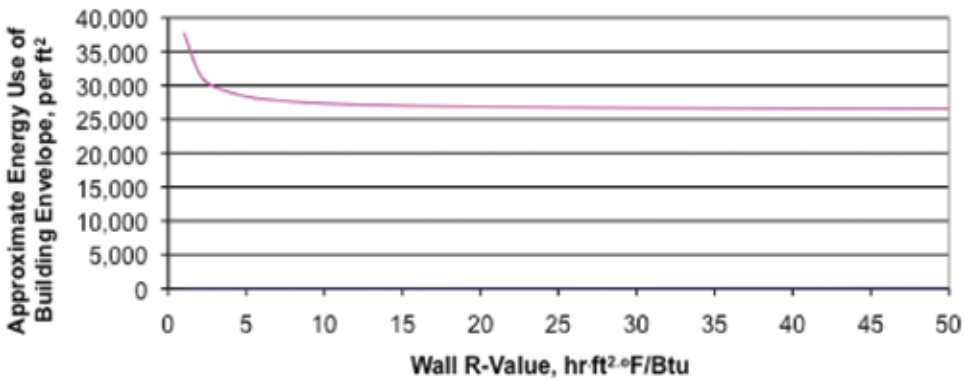
Energy Tools for the Building Envelope: Energy Code Compliance

If the project goal is to meet, rather than exceed, the energy code requirements, most codes allow three different methods to be used to show compliance: prescriptive, trade-off or system performance, and whole building energy analysis. The project need only comply under one of these methods, not all three.

Of the three compliance methods, the prescriptive method is the easiest to apply and perhaps the most well-recognized. Requirements for building envelope components are listed in table format, with requirements listed separately for each component and climate zone, as shown in Table 1. Table 1 shows that in Chicago (Climate Zone 5), a flat roofed building must have R20 continuous insulation and masonry (Mass) walls must have R 7.6 continuous insulation to comply prescriptively. There is a misconception that these elements must have continuous insulation in order to meet the IECC. In fact, continuous insulation is required only to comply with this particular table—other compliance options are available, as discussed below.

Using these prescriptive tables, the requirements for individual elements are independent of each other. If in Climate Zone 5 the wall has R10 insulation and the roof has R18, the building cannot comply prescriptively based on R-value. Hence, although using the prescriptive tables

FIGURE 1: DIMINISHING RETURNS OF ADDED WALL INSULATION



Notes: Analysis is based on a two-story school in Bowling Green, Kentucky. Other building types and climates will have a similarly-shaped curve, although the individual numbers vary on a case-by-case basis. The y-axis values approximate the total heating and cooling energy associated with an average square foot of surface of building envelope. This analysis was performed using ENVSTD version 5.0.

TABLE 1: EXCERPT FROM 2006 IECC TABLE 502.2(1) SHOWING PRESCRIPTIVE WALL AND ROOF R-VALUE REQUIREMENTS

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roofs								
Insulation entirely above deck	R-15 ci	R-15 ci	R-15 ci	R-15 ci	R-20 ci	R-20 ci	R-25 ci	R-25 ci
Metal buildings (with R-5 thermal blocks[a])[b]	R-19 + R-10	R-19	R-19	R-19	R-19	R-19	R-19 + R-10	R-19 + R-10
Attic and other	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38
Walls, Above Grade								
Mass	NR	NR	R-5.7 ci[c, e]	R-5.7 ci[c]	R-7.6 ci	R-9.5 ci	R-11.4 ci	R-13.3 ci
Metal building[b]	R-13	R-13	R-13	R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13
Metal framed	R-13	R-13	R-13	R-13	R-13 + R-3.8 ci	R-13 + R-3.8 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13 + R-7.5 ci

Notes:
NR = not required, i.e., and uninsulated concrete masonry wall complies in these climate zones.
Footnote c = Concrete masonry single wythe exception applies: ASTM C90 concrete masonry, grouted up to 32 in. (813 mm) o.c. vertically and 48 in. (1219 mm) o.c. horizontally, with ungrouted cores filled with insulation, is deemed to comply.
Footnote e = Insulation is not required for mass walls in Climate Zone 3A located below the "warm-humid" line, and in Zone 3B.

is very straightforward, it is also very limiting in terms of design flexibility.

Although concrete masonry with insulated cores cannot comply under the prescriptive requirement for continuous insulation applied to the wall (because the webs of the masonry units interrupt the insulation) according to the IECC these walls can comply prescriptively based on the overall U-factor of the wall, per ASHRAE/IESNA Standard 90.1 (U-factor is the inverse of R-value, i.e. U = 1/R and R = 1/U). In this case, the U-factor of the wall must meet the prescriptive U-factor requirement instead of the insulation meeting the R-value shown in Table 1. For example, the equivalent mass wall U-factor requirement for Chicago is U0.123 (which corresponds to an R-value of 8.1). As long as the wall as a whole (not the insulation alone) meets the U0.123/R8.1 requirement, the wall complies with the IECC in Climate Zone 5.

The prescriptive U-factor requirements for mass walls are shown below in Table 2. NCMA TEK 6-2B, *R-Values and U-Factors of Single Wythe Concrete Masonry Walls*, lists these values for various concrete masonry walls.

If the building does not comply using the either the prescriptive R-value or U-factor requirements, another option is to use a software tool such as COMcheck. COMcheck determines compliance for the building envelope based on the specifics of the building under consideration and on the project location. Using this option, the designer "builds" a description of the building, entering basic data (size, type of construction, R-value of insulation, etc.) for the building envelope elements (roof, exterior walls, windows, doors, floor, basement and skylight). After the building envelope description and climate are entered, the program displays how close the envelope as entered comes to meeting the specified code requirements. If the envelope fails to comply, it is a typically simple matter to adjust individual elements to bring the envelope into compliance.

COMcheck provides enhanced design flexibility with a little bit of added complexity over the prescriptive tables. Note that using COMcheck is an alternative to complying via the prescriptive requirements (either continuous insulation or U-factor requirements)—the envelope components do not need to meet the prescriptive requirements if the envelope is shown to comply using COMcheck. COMcheck is available for free download from www.energycodes.gov, and includes compliance for various editions of the IECC as well as various editions of ASHRAE/IESNA Standard 90.1.

The final option for energy code compliance is to use a whole-building energy analysis, as discussed above for LEED and other high-performing buildings. Similar to COMcheck, if a building is shown to comply using an approved whole building analysis, individual elements of the building do not have to meet the code prescrip-

TABLE 2: PRESCRIPTIVE MASS WALL U-FACTOR REQUIREMENTS BY CLIMATE ZONEA

Climate Zone:	1	2	3	4	5	6	7	8
U-factor requirement	NR[B]	NR[B]	SW[C]	SW[C]	0.123	0.104	0.090	0.080
Corresponding overall wall R-value	NR[B]	NR[B]	SW[C]	SW[C]	8.13	9.61	11.1	12.5

[A]U-factors from ASHRAE/IESNA Standard 90.1-04 Table. R-value = 1/U-factor.
[B]Insulation is not required, i.e., and uninsulated concrete masonry wall complies.
[C]Concrete masonry single wythe exception applies: ASTM C90 concrete masonry, grouted up to 32 in. (813 mm) o.c. vertically and 48 in. (1219 mm) o.c. horizontally, with ungrouted cores filled with insulation, is deemed to comply.

tive requirements, nor does the building have to pass when analyzed using COMcheck. The whole building approach provides the most design flexibility, but is also the most complex.

An overview of these code compliance options is available on the NCMA website at http://www.ncma.org/resources/design/Documents/Single%20Wythe%20White%20Paper.pdf

Summary

Regardless of a project's energy efficiency and sustainability design goals, concrete masonry walls are available to help meet those goals. Various methods are available for energy code compliance and higher-level analyses, and the best approach often depends on the project goals. When core-insulated single wythe masonry is desired for its aesthetics, durability, economy and low maintenance, energy code options other than the prescriptive continuous insulation requirements should be used, such as using prescriptive wall U-factor requirements or using COMcheck. If the project is LEED-registered, a whole-building analysis must be used, and the prescriptive and COMcheck approaches should be disregarded. CMD

NEWS

ASSOCIATION NEWS

NEW ONLINE MEMBER RESOURCE LAUNCHES—TAKE ADVANTAGE OF DISCOUNT!

NCMA is pleased to announce the launch of its new online CareerCenter. As our industry climbs back from this nation's worst recession in history, member companies will have a need for experienced industry professionals and skilled workers. Where better to turn than your own association! The NCMA CareerCenter is a new online resource designed to connect employers with the largest, most qualified audience of concrete masonry professionals. The site offers benefits for employers and job seekers. Employers gain: easy online management of job postings, access to searchable resume database, competitive pricing, automatic email notification when new resumes match your criteria. Job seekers have the opportunity to post resumes for free and to search available job opportunities. Members receive a discounted rate for posting jobs, and can take advantage of an **additional 25% Launch Promo Discount [enter code: CAREER25]**. For more information, please visit the NCMA website or http://careers.ncma.org/.

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NCMA WELCOMES NEW MEMBERS

Please extend a warm welcome to our newest members, and take a moment to reach out to them and introduce yourself. When you run into these folks at associaiton meetings, please help to get them acclimated.

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- **Mudbug Pavers**, Charles Wagner, Hammond, LA, charles@mudbugpavers.com, sponsor: Pavestone.

INDUSTRY NEWS

SKILLS USA EXECUTIVE UPDATE

The most recent issue of Executive Update has been added to the Skills USA Web site. To access the current issue and issue archive go to the link: http://www.skillsusa.org/EXU. Some headlines from the April 15 issue: Executive Director's Report, Pepsi Refresh Program, Timberland PRO Community Service Project During NLSC 2010, Crisis Contact Information, Alumni Training and National Conference Volunteers, International Degree, State Association Director Certification, and more.

ASTM MASONRY SYMPOSIUM

A Symposium on Masonry, sponsored by ASTM Committees C01 on Cement, C07 on Lime, C12 on Mortars and Grouts for Unit Masonry, and C15 on Manufactured Masonry Units, will be held June 8, 2010. The symposium will be held at the Renaissance St. Louis Grand and Suites Hotel, in conjunction with the June 8-11 standards development meetings of the sponsoring technical committees. The objective of the symposium is to gather and disseminate the latest information on all aspects of masonry, including innovations in materials, design, specification, construction, maintenance, and rehabilitation. It will emphasize the application of ASTM standards to those areas, and their coordination with building codes, project specifications, and interna-

tional standards. Visit the ASTM website, www.astm.org, for more information.

NORTH AMERICAN MASONRY CONFERENCE

The 11th North American Masonry Conference (NAMC) will be held in Minneapolis Minnesota from June 5-8, 2011. The NAMC is a forum for engineers, architects, contractors and others interested in masonry for the exchange of scientific, engineering, architectural, construction, evaluation, and repair information on masonry. This conference seeks to bring together worldwide expertise to address current issues related to masonry in seismic regions and green technology applications in masonry. Papers on research and practical applications to create opportunities for more effective and expanded use of masonry are solicited. For more information please visit www.masonrysociety.org/NAMC/.

INTERNATIONAL MASONRY CONFERENCE

On July 4th 2010 the 8th International Masonry Conference will be held in Dresden, Germany. The objective of the conference is to provide a forum for engineers, architects, contractors and others interested in masonry to meet and discuss new developments and topics of mutual interest. The slogan of the 8IMC is: "*Innovative Solutions for Sustainable Masonry Construction*". Visit masonry-conference.com for more information on the conference.

DIRECT DESIGN HANDBOOK FOR MASONRY STRUCTURES COMPLETED

The Masonry Society's Design Practices Committee has produced a Direct Design Handbook for

NCMA ANNUAL MEETING HIGHLIGHTS

NCMA PAC RECEPTION

The popular NCMA PAC reception was a big hit this year. The reception drew over 60 people and over $8,000 for the PAC.

PDCC

NCMA would like to thank the presenters and those that attended the Product Development and Creative Concepts Meeting at the recent San Antonio Convention. Products from Rosetta Hardscapes, LLC and North East Solite Corporation's Solar Stud Block were hi-lighted and a sustainable curing presentation was given by Kraft Energy. Audience turn out for the meeting was outstanding and the audience enjoyed the opportunity to get some hands-on experience with the various systems. With such a positive experience behind us, we look forward to offering the same venue to any new products in development or creative concepts that benefit the dry cast concrete industry. We are currently looking for new ideas and methods to be in the spotlight for the next Product Development and Creative Concepts meeting to be held in Chicago at our Midyear meeting. For more information please contact Mike Maroney at mmaroney@ncma.org. Thanks again to the presenters. For more information on their products you can reach them at:
Rosetta Hardscapes, LLC, www.discoverrosetta.com
Northeast Solite Solar Stud CMU, www.solarstudblock.com
Kraft Energy Systems, www.kraftenergy.com

MIKE FINCH, NCMA 2009 CHAIRMAN OF THE BOARD

"We are in challenging times economically, but we know the networking and services that NCMA provides—along with our extensive partnering with other concrete industry associations—will help our members and association ride out the storm," affirms 2009 National Concrete Masonry Association Chairman Mike Finch, who is president of Lemon Grove, California based RCP Block & Brick, Inc.

MARK WILHELMS, NCMA 2010 CHAIRMAN OF THE BOARD

"Vision 2020 will work in local markets, on local codes and municipal bodies to develop masonry-preferred ordinances," says 2010 NCMA Chairman Mark Wilhelms, sales and marketing manager, Kirchner Block & Brick division of Midwest Products Group, Jefferson City, Missouri.

Masonry Structures that provides a direct procedure for the structural design of single-story, concrete masonry structures. This Handbook provides designs for both reinforced and unreinforced masonry. The procedure is based on the strength design provisions of TMS 402-08/ACI 530-08/ASCE 5-08 Building Code Requirements for Masonry Structures and ASCE 7-05 Minimum Design Loads for Buildings and Other Structures. The document is applicable to both residential and commercial structures. The manual is available through the NCMA bookstore. Publication number is TR232.

THE MASONRY SOCIETY SPRING MEETINGS

The Masonry Society (TMS) will be holding its Spring 2010 meetings in Orlando Florida from May 11-15 at the Rosen Plaza Hotel. A preliminary schedule for the meetings can be viewed at www.masonrysociety.org. TMS will hold its business meetings early in the meetings (May 11-13) and the Masonry Standards Joint Committee will then meet on May 13-15. The Structural Engineering Institute (SEI) will also be hosting the 2010 Structures Congress nearby so those interested may wish to attend both events.

ICON EXPO NEWS AND HIGHLIGHTS

A WINNING COMBINATION IN 2011: ICON EXPO—CONEXPO-CON/AGG!

By now you've heard the buzz about ICON EXPO 2011 being "co-located" with CONEXPO-CON/AGG in Las Vegas, but what do you really know about this show? Here are some facts and figures, and behind-the-scene details that will provide greater understanding of how this show will benefit attendees and exhibitors:

- The International Concrete Exposition (ICON EXPO) premiered in 2009 in Indianapolis, filling an industry need.
- ICON EXPO continues to develop partnerships and relationships with allied industry groups including: International Concrete Paver Institute (ICPI), the Cast Stone Institute (CSI), the Portland Cement Association (PCA), and the Expanded Shale, Clay and Slate Institute (ESCSI).
- The Association of Equipment Manufacturers (AEM) has invited ICON EXPO to participate in their well-established show, CONEXPO-CON/AGG, which is held every 3 years.
- CONEXPO-CON/AGG represents the construction and concrete aggregate industries, and attracts as many as 140,000 attendees from 135 countries.
- CONEXPO-CON/AGG is sponsored by: AEM, National Ready Mixed Concrete Association (NRMCA), National Stone, Sand & Gravel Association (NSSGA) and the Associated General Contractors of America (AGC).

So what does it mean that ICON EXPO is "co-located" with CONEXPO-CON/AGG?

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- ICON EXPO will maintain its own show identity as a Pavilion within the CONEXPO-CON/AGG show.
- The ICON EXPO Pavilion will be featured on the first floor of the South Hall, the concrete products hall, opposite CONEXPO-CON/AGG exhibitors.
- There will be a separate entrance to the ICON EXPO Pavilion
- The Pavilion will be easily identified by banners, signage, show colors and Directory map.
- Exhibitors will have greater exposure to a larger audience, both national and international, and will benefit by expanded marketing and promotion.
- Attendees will have the opportunity to view the widest range of equipment and services, the latest in technology and the largest selection of educational programs to meet their every need.
- In addition, the annual meetings for NCMA, ICPI and CSI will be held in conjunction with the show.

ICON EXPO-CONEXPO-CON/AGG is being held March 22-26, 2011 at the Las Vegas Convention Center, Las Vegas, NV. For more information, visit www.iconexpo.org or contact us at info@iconexpo.org.
A WINNING COMBINATION!

San Antonio, Texas provided the backdrop for the International Concrete Exposition (Icon Expo). The 2010 Icon Expo, an education based tradeshow hosting events linking members, business partners and industry leaders, was held at the Henry. B. Gonzalez Convention Center, March 19-20. The new San Antonio Grand Hyatt hosted the National Concrete Masonry Association (NCMA) and the Cast Stone Institute (CSI) and the Marriott Riverwalk hosted the Interlocking Concrete Pavement Institute (ICPI).

NCMA/ICPI SAFETY AWARDS PROGRAM

For the fourth year in a row, NCMA and ICPI partnered together to recognize the concrete masonry, SRW, and concrete paver manufacturers with the best worker-safety records. 135 facilities entered the program this year, up from 104 last year-a growth of 30%. Four Silver Awards (second-best, non-zero recordable injury incidence rate, within several categories based on hours worked), five Gold Awards (best, non-zero incidence

Join industry leaders and your fellow colleagues at the National Concrete Masonry Associations annual Midyear Meeting in Chicago, Illinois, July 28-August 1, 2010. During this critical time in the industry, your input is very important in assisting the association put dollars in the right programs. The NCMA Midyear Meeting is where attendees will help set the stage for the future of NCMA programs and marketing efforts. Join us and help to determine the direction of the association!

rate), and 120 Platinum Awards (zero recordable injuries during the calendar year-up 38% from last year) were presented at the NCMA / ICPI Safety and Design Awards Banquet on Saturday, 20 March 2010. For the first time, a Milestone Award was presented, to the Basalite Sparks facility, recognizing zero recordable injuries in 2005, 2006, 2007, 2008, and 2009. For a full list of the Safety Awards winners, visit www.ncma.org/news.

DESIGN AWARDS

As part of the 2009 NCMA/ICPI Design Awards of Excellence and Safety Awards Banquet held Saturday evening, March 20h , in San Antonio, architects were recognized for contributions in the design of projects utilizing concrete masonry, SRW and concrete pavers. These were the 2009 winners chosen by a jury of peers in the categories of commercial, residential, hardscapes, both SRW and concrete pavers, along with sustainability. NCMA Chair of the Board, Michael Finch and ICPI Chairman of the Board, Ed Fioroni presented a plaque and check to each architect representing the winning firms. The architects spoke about their projects and how concrete masonry and concrete projects not only help to produce beautiful and durable buildings but make design work easier for their clients. Along with their projects being shown at the banquet, a display panel of the projects was on display throughout the ICON EXPO Show. ACM Chemistries graciously sponsored the banquet. For a full list of the Design Award winners, visit www.ncma.org/news.

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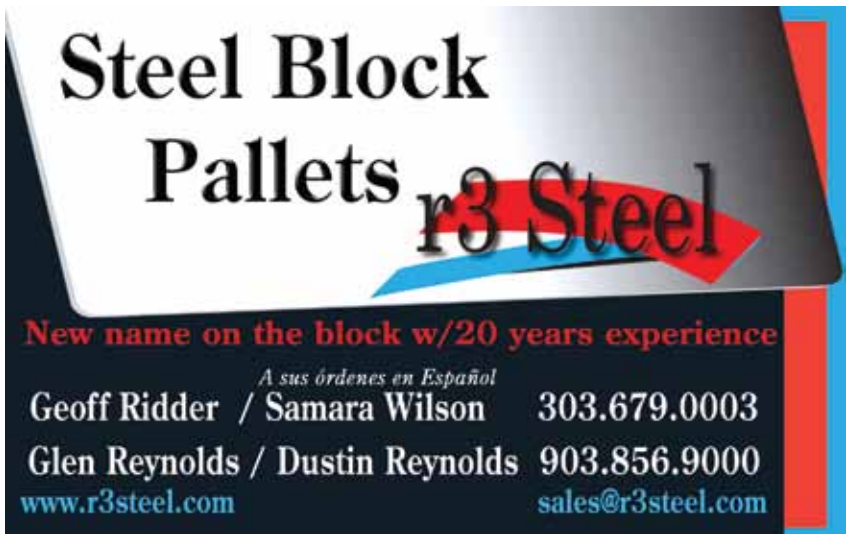
ICON EXPO EDUCATION PROGRAMS

The educational component of Icon Expo was popular with attendees. The sessions contained many helpful and timely topics and each presenter should be applauded for their enthusiasm and effort. In addition to the education tracks, there were12 Production-Focused, Vendor-Spe-

NCMA Chair of the Board, Michael Finch (left) and ICPI Chairman of the Board, Ed Fioroni (right) presented the 2009 NCMA/ICPI Design Awards of Excellence.

The most highly anticipated Icon Expo education program was theVision 2020 Track.

cific Seminars. The most highly anticipated Education Track was theVision 2020 Track that "Kicked Off" at the NCMA Annual Convention. Highlights for the Vision 2020 Program included updates given by Chris Fisher and Michelle Siemer of Ducker Worldwide, who are in the midst of the research and survey called Knowledge Capital. This study will provide the industry with a baseline on market share of CMU and SRW, markets for potential growth and suggestions to help in the planning of goals set in the Vision 2020 program to grow market share. The study will be completed by the end of April. In the various Vision 2020 educational programs held in San Antonio, four new "Tool Kits" were presented along with the NCMA web site of the Vision 2020 program www.ncma.org/resources/Vision_2020 which will allow members to learn more about the program and access the resources and tool kits available. If you would like to learn more about Vision 2020, go to the link above and or contact NCMA. CMD



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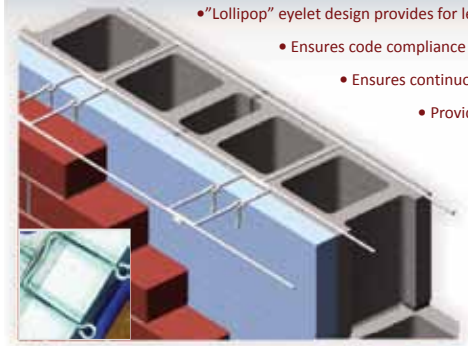

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Learning Units Reporting Form

AIA Questions (Circle the correct answer)

1. A tiered retaining wall system is a series of two or more stacked walls
   a. Parallel to each other and with the same top elevation
   b. Each higher wall set back from the underlying wall
   c. Stacked directly on top of each other
   d. Perpendicular to each other

2. In tiered walls, placing the upper wall back a horizontal distance at least the height of the upper wall generally eliminates the load of the upper wall on the lower wall.
   a. True
   b. False

3. Postconsumer recycled material is
   a. Consumer waste
   b. Generated by household, commercial, industrial or institutional end users and can no longer be used for its intended purpose
   c. Formerly known as postindustrial content
   d. a and b above
   e. All of the above.

4. Preconsumer recycled content is
   a. Recycled from manufacturing waste
   b. Includes culls
   c. Includes obsolete inventories
   d. Includes trimmed materials
   e. All of the above

5. The alternate method allows the recycled content calculation to be based only on the cementitious materials, rather than all the materials in a concrete mix.
   a. True
   b. False

6. Unpainted exposed concrete masonry walls generate no VOC emissions
   a. True
   b. False

7. Although concrete masonry is an ancient material, today's concrete masonry can be a significant benefit to modern sustainable buildings due to
   a. Energy efficiency
   b. Locally produced material
   c. Durability
   d. Ability to incorporate recycled materials
   e. All of the above
   d. None of the above

8. The insulation location for maximum effectiveness for thermal mass effects is
   a. On the interior side
   b. Sandwiched between two layers of insulation
   c. On the exterior side or in the cavity of a masonry cavity wall
   d All of the above

9. With the variety of concrete masonry units and insulation types and thicknesses in use, the following R-values are available
   a. No more than 5
   b. 5 to no more than 10
   c. 5 to over 25
   d. 25 to 100

10. The energy tool to meet energy code compliance for the building envelope is
    a. Prescriptive method
    b. Trade-off or system performance
    c. Whole building energy analysis
    d. Any of the above but it is not required to meet all three.

To receive one learning unit, read "Alton Riverfront Amphitheater: Balance and Harmony", "San Elijo Lagoon Nature Center", "Single Wythe Core-Insulated CM Wall Energy Code Compliance", and complete the questions on this page. Return this form to the National Concrete Masonry Association.

Return forms before May 2011 to receive learning unit credits.

☐ I am a non-AIA architect or design professional. Please mail me a certificate stating that the learning units earned can be used to fulfill other continuing education requirements.

Send completed Report Form to:
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If you have questions, please contact NCMA at 703-713-1900.

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