November | December 2010

CONCRETE MASONRY DESIGNS

SRW Flood Proofing on Kilkenny Drive

Hardscape North America SRW Award Winners

CMU Historic Preservation: Kahn Bath House

Reinforcement for High Wind Areas

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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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SRW Flood Proofing on Kilkenny Drive

In 1997, the Red River "Flood of the Century" impacted the City of Winnipeg's residential areas along the riverbank. Protected by temporary sand bags. Following the flood, the Kilkenny Drive North Community qualified for funding to implement permanent flood proofing measures. With residents experiencing flooding up to 6 ft (1.8 m), Winnipeg was faced with finding a solution to provide permanent flood proofing. A community ring dike that retained water and was structurally sound and aesthetically pleasing was the solution. The design goal also included a desire to avoid future risk, stress, and disruption to residents as well as minimize environmental impacts to preserve existing trees and vegetation in the riverbank setting.

PLAN

J. Bert Smith, PE, of KGS Group in Winnipeg, Manitoba, developed numerous layouts to address the varied priorities of the individual residents. "A composite of curvilinear dike structures were developed with a central clay core utilizing vertical segmental retaining wall (SRW) units to minimize the footprint; terraced SRW's for stability and to incorporate access ramps plus landscaping, and earth dike slopes for economy where space was available" says Smith. "Dike limits had to be entirely within the property limits of the four residents with location varied to preserve trees and maximize yard use and aesthetics," added Smith. It was determined that concrete SRW units would be the best material for the job.

DESIGN

SRWs offered a permanent flood protection dike up to 8 ft (2.4 m) in height with a central clay core and seepage cutoff trench. The walls were installed with horizontal geogrid to provide the necessary stability under flood events. A vertical outer wall with a safety fence was specified to maximize yard areas for children and a lower crest was used for aesthetic yard view, complete with high ground tie-in. The terraced SRW wall provided stability plus met the City's bylaw safety requirements on maximum vertical drop of two feet without a safety fence. *Local code requirements vary, it is recommended to consult local requirements to ensure the adequate drop protection is provided.*

When there is sufficient space, the easiest and most cost-effective way to install fences and guardrails above SRW walls is to place them several feet (0.5–1 m) behind walls. With sufficient embedment and setback, the soil can provide a stable foundation.

When there is not enough room to set fall protection behind walls, they can be installed within top wall units prior to backfilling behind the wall modifying the units to accommodate and receive the posts and creating a concrete foundation with dimensions and reinforcement necessary to perform under the conditions and loading of the project.

For concrete traffic barriers, when there is no room to set guide rails behind a wall, traffic barriers can be placed directly on top of a wall. These can be cast-in-place concrete or precast barriers (such as Jersey barriers) or a combination of both. Concrete barriers should be designed for stability, independent of the wall. The foundation can be extended behind the wall (moment slab) to act as cantilevered resistance to lateral and overturning loads. It is recommended to get them designed by a qualified engineer familiar with the subject for the project-specific conditions.

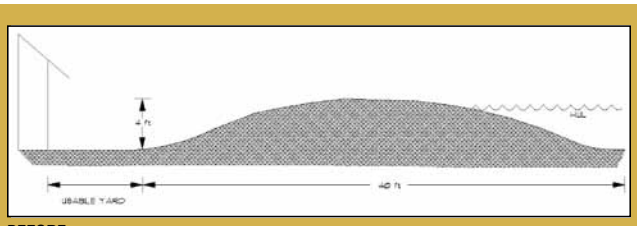
PROJECT LOCATION
Kilkenny Drive, Winnipeg, Manitoba, Canada
PROJECT OWNER
City Of Winnipeg
LOCAL ENGINEER
Kgs Group
GENERAL CONTRACTOR & WALL BUILDER
Jc Paving Ltd
SRW LICENSOR
Allen Block
SRW MANUFACTURER
Cci Industries—Winnipeg, Canada

POSTS PENETRATING GEOGRID

For walls requiring soil reinforcement, fence and guide rail posts will often extend below the top layer or two of geogrid. Often the geogrid can be cut to fit around the planned post locations. Usually the top layers of geogrid can accommodate small intrusions while still maintaining overall tensile strength. However, the area cut from the geogrid should be no more than the minimum needed to fit the post. The wall design engineer must evaluate any planned post intrusions into geogrid layers to ensure they do not reduce strengths below needed minimums. Augering or driving through backfilled geogrid after wall construction is generally not suggested because it may excessively disturb or pull geogrid from the soil or the wall units.

BUILD

The outer dike shells incorporated free-draining granular zones plus weeping tiles for stability and geogrid. Yard drainage is provided through three culverts with gate valves, watertight caps and plugs. Since its installation the residents have not experienced a high flood event, but they have peace of mind knowing their homes will be safe in the future. CMD



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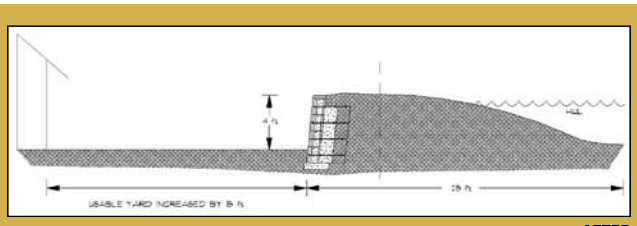

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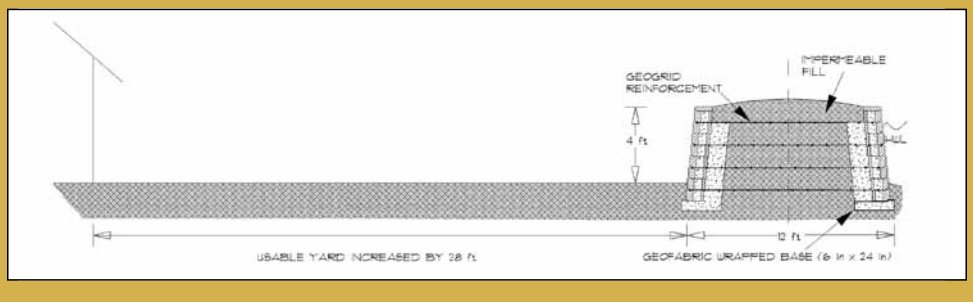


DIKE SYSTEM

AWARD WINNERS

The Interlocking Concrete Pavement Institute (ICPI) along with the Brick Industry Association (BIA) and National Concrete Masonry Association (NCMA) announced the 3rd Annual HNA Project Award winners on Saturday, October 30th at the Kentucky Exposition Center, Louisville, KY during the Hardscape North America trade show which was co-located with the GIE+Expo trade show.

The Hardscape Project Awards recognize outstanding hardscape projects by contractors in residential and commercial/industrial applications. “Recognizing a project through these awards is important to the industry”, said Roberto Nicolia, Chairman of the Interlocking Concrete Pavement Institute, “this awards program acknowledges some of the best hardscape installations in North America.” Projects include but are not limited to walkways, patios, driveways, plazas, parking lots, etc. In its third year, the awards program received 77 entries. A total of 18 award winners were recognized in an awards ceremony

The Commercial/Industrial HNA Hardscape Project Awards winners were recognized in categories of clay brick, concrete paver, segmental retaining wall and a combination of all hardscape products in project sizes of 1,000 to 10,000 square feet, 10,000 to 50,000 square feet and more than 50,000 square feet.

Other HNA Winners

COMMERCIAL

Combination

1,000–10,000 square feet
Ryan Palmer Foundation Healing Garden at The Children’s Hospital Northwest Texas Heathcare Systems Project
Contractor: Krause Landscape Contractors
Amarillo, TX

10,000–50,000 square feet
Bleachers from Block Project
Contractor: BC Hardscapes
Lawrence, KS

Concrete Paver

1,000–10,000 square feet (tie)
Chickasaw Medical Center
Contractor: Heartstone of Oklahoma
Ada, OK

1,000–10,000 square feet (tie)
Ocean View
Contractor: Torrison Stone & Garden
New Haven, CT

10,000–50,000 square feet
Embassy Suites Mandalay Beach Hotel and Resort
Contractor: Pacific Outdoor Living
Oxnard, CA

More than 50,000 square feet
The Boulevard Mall of Louisiana
Contractor: Syrstone, Inc.
Baton Rouge, LA

Clay Brick

1,000–10,000 square feet
Miami Conservancy District
Contractor: Outdoor Enterprise
Dayton, OH

10,000–50,000 square feet
Imaginary Garden
Contractor: Fred Adams Paving Company
Cary, NC

RESIDENTIAL

Combination

Under 1,000 square feet
Church Residence
Contractor: Pajtas Companies, Inc.
Perry, MI

1,000–5,000 square feet
Miller Residence
Contractor: Krause Landscape Contractors
Amarillo, TX

More than 5,000 square feet
McGraw Residence
Contractor: Oak Leaf Landscaping
Howard, OH

Concrete Paver

Under 1,000 square feet
Owens Residence
Contractor: Landis Hardscape Specialist
Harrisburg, PA

1,000–5,000 square feet
Lamontagne Residence
Mechanicsburg, PA

More than 5,000 square feet
Harmon Residence
Contractor: Stone Creations
Scottsdale, AZ

Clay Brick

Under 1,000 square feet
Reese Residence
Contractor: Switzer’s Nursery & Landscaping, Inc.
Northfield, MN

Winning Segmental Retaining Wall Projects

1 to 10,000 SQUARE FEET COMMERCIAL CATEGORY

Pauls Landscaping Lake Arrowhead Golf Club

Patrons to the Lake Arrowhead Golf Club can now enjoy the views overlooking the golf course while relaxing or dining on a newly completed, spacious patio.

The patio is a beautiful extension to the upper clubhouse that previously offered no outdoor patio areas. Newly installed doors allow patrons to access and take advantage of outside seating for dining and relaxing. The raised patio was constructed with concrete retaining walls in a two-tone brown color that compliments the clubhouse architecture. The serpentine retaining walls were terraced to achieve the proper elevation for the patio with the upper entry doors. The terraces also accommodate vibrant planting beds that provide a beautiful backdrop to the course.

Tumbled concrete landscape units were used to create attractive and functional garden wall that encircles the spacious patio. Stairs located on each side of the patio, constructed of concrete retaining wall units, provide easy access down to the lower Pro Shop and golf course. The patio's construction with concrete hardscape products ensures lasting durability for the high-use area that accommodates a large amount of people traffic during peak golfing months. The natural textures and colors further compliment the clubhouse and achieve the desired aesthetics for this prominent facility.

10 to 50,000 SQUARE FEET COMMERCIAL CATEGORY

Soil Retention Products, Inc. The Shops at Sycamore Creek

A 36,000 s.f. segmental retaining wall system is the foundation for The Shops at Sycamore Creek retail center in Corona, CA The site is primarily in a fill condition and no building construction was possible before pad delivery. Maximum wall height reaches 34 feet and covers a distance of 1,400 lineal feet. The system used was chosen for its strength, plantability and ability to be installed concurrently with site grading.

Due to the high form capacity of the system used, compaction can be achieved all the way out to the face of the wall.

Reinforced Zone Compaction

- Backfill lift thickness must be limited to the height of the concrete block, or a maximum of 8 in. (203 mm).
- Large compaction equipment must not be used within 3 ft (1 m) of the face of the wall. Smaller, hand operated equipment, preferably a vibrating plate compactor with a minimum weight of 250 lbs (113 kg), can be used at the face of the retaining wall.
- Project compaction requirements must be met in all areas. The requirement is usually a percentage (95% to 98%) of the Standard Proctor dry density of the material and is set by the SRW design engineer. Testing of the compacted fill must be carried out at regular intervals.

It is important that the soil within the first three feet is well compacted in order to minimize the potential of settlement of the reinforced fill directly behind the SRW units, which may cause the connection between the reinforcement and the SRW unit to be overstressed. The remainder of the reinforced soil zone can be compacted with walk-behind or riding self-propelled compaction equipment, depending upon soil type and available operating area. Non-uniform compaction procedures can result in vertical and horizontal alignment control problems. Upon completion of the wall, heavy construction equipment should be kept at least five feet (1.5 m) behind the wall face. The block has a lip for high shear capacity and a "positive mechanical connection" between the block and the geogrid. Using this installation method the wall was built in 14.5 days! The project is highly visible from heavily traveled I-15 and a fully planted wall face was required by the local agency to soften the look of the massive retaining structure. This plantable and free-draining system did not require gravel behind the blocks, but gravel fill is recommended for nearly all walls.

Gravel Fill is a free-draining (with less than 5% of fines), coarse grained aggregates placed in the cores and between the SRW units extending 12 in. (305 mm) behind the tail of the units regardless of the unit type. The gravel fill acts as a compaction aid to reduce horizontal compaction stresses on the back of the SRW units during construction and to facilitate drainage at the face of the wall by intercepting incidental water and thereby relieve hydrostatic pressure or seepage forces. This is not meant to be a primary drainage path for typical applications.

1,000 to 5,000 SQUARE FEET RESIDENTIAL CATEGORY

Wickenburg Landscape & Irrigation, Inc. Landel Residence

Challenges specific to this job were three fold. First a tiered railroad tie wall that had failed was replaced while trying to save the existing mature trees on the lower tier. Second, the wall which is adjacent to a wash, had to be protected from eroding during flooding in heavy monsoon rains, and deal with the property drainage around and through the wall from the top. Thirdly they had to allow for vehicle traffic along the north part of wall to within 3 feet of wall edge. During the project they had to cable trees for support and treat trees for shock and also work geo grid in around the trees for wall support structure. Also during wall construction they had to deal with uncommonly wet spring. Keeping the entire project dry during non work days and installing temporary drainage through and around project was a challenge. The final project simply out did everyone's expectations for the finish grade and they secured the base of the wall two feet deep with a rip rap rock area to provide extra erosion protection.

Erosion and Scour Issues

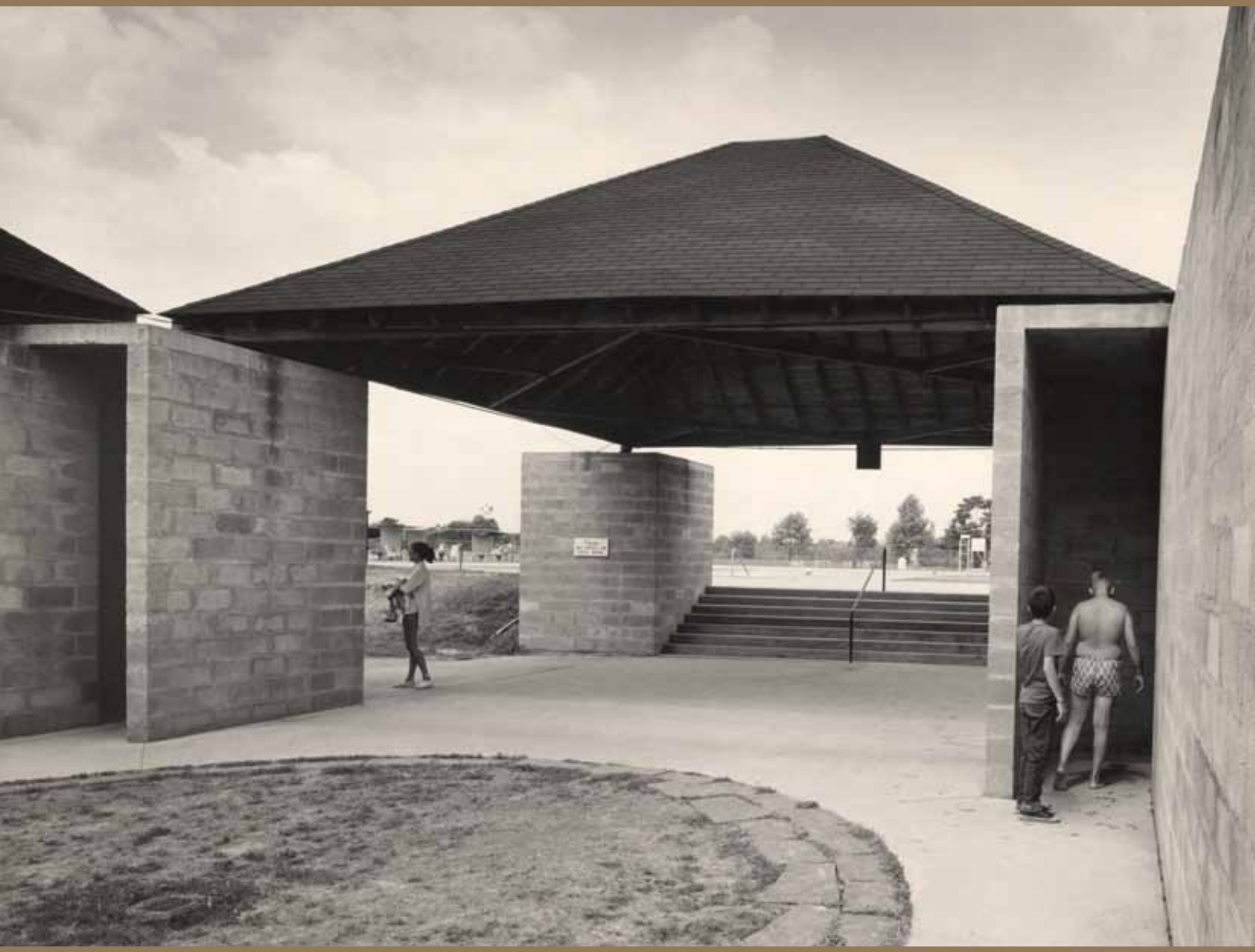
Slopes at the top or toe of a SRW, and grades at the ends of walls, are potentially susceptible to erosion from surface water. The potential for erosion around the SRW should be considered, as would be for the entire site, and appropriate erosion control measures included for any specified slopes, as required. Given SRWs are generally reinforced-soil structures, special attention to the erosion concerns in the site design is appropriate as erosion could compromise the wall material that provides wall stability; the reinforced soil mass.

In particular, areas around waterfront walls should be designed to protect against the scour and erosion at the wall base, ends of the walls, or even above and behind the walls, for walls that will be potentially fully-submerged during their design life. A common issue for walls along lakeshores, streams, rivers, or channels is the potential for scour at the base of the wall due to wave action or high water flows. Scouring concerns are generally addressed by extending the wall bottom below predicted scour depth and providing scour protection at the base of the wall. Scour protection typically consists of a geotextile overlain with rip rap. Articulated concrete blocks or other types of mats are often used for base protection of channels. Prediction of scour depths and wave forces or water flow velocities and design details to address these issues are typically the responsibility of the project civil engineer or an engineer specializing in hydraulic engineering.

Erosion around SRWs in water application walls can be a particular concern where water flow may wash away soils, such as at the ends of the wall and or even at the top of the wall, if the wall high water levels will overtop the wall. As with surface drainage issues, the grading and erosion control plans for water application walls should determine water flow patterns, evaluate areas of concern, and either direct water away from the wall area or provide means to protect edges of the wall from erosion. CMD

CMU HISTORIC PRESERVATION

Kahn Bathhouse



After a swim, 1955's Jewish Community Center members pass the structure's variegated block walls to enter its tranquil changing-rooms. Today, as the Ewing County Center for Seniors & Youth, it's a rare example of a restored landmark that still serves its original function.

WHO'D HAVE GUESSED THAT A TINY, DECREPIT CMU BUILDING NEAR TRENTON, NJ, WHERE SWIMMERS AT AN OLD DAY CAMP USED TO CHANGE THEIR CLOTHES, WOULD TURN OUT TO BE AN ARCHITECTURAL TREASURE?

Practically nobody, of course. Which may be why this starkly simple structure—designed by the late Louis Kahn, the subject of an Oscar-nominated documentary film, "My Architect"—was about to be demolished and replaced by high-density housing.

Built in 1955 as part of a Jewish Community Center, the Bath House marked the point at which Kahn turned away, forever, from trendy steel-and-glass buildings and toward more earthy, serene designs. Now the Jewish Community Center had decided to move to a new location, and its property was being eyed by developers in this heavily built-up region of New Jersey.

At first glance, the sturdy, unadorned Bath House might be a mini-temple dug up by an archaeologist. Just one story high, occupying less than 1/6th of an acre (0.07 hectare), it has no doors—just cleverly baffled doorways—and no windows, electricity, or heat. Its rough-surfaced block was ground from Delaware River rock that Philadelphia architecture critic Inga Saffron described as "the color of wet cardboard" (and she's an admirer!). But once you enter through the half-hidden doorway, you begin to sense Kahn's genius.

Built in the form of a Greek cross, the Bath House is composed of four equal-sized outer cubes (two changing-rooms, a storage room, and a covered porch facing the nearby Olympic-sized pool) with pyramidal roofs, all of which surround a central courtyard that's open to the sky. The roofs of the outer cubes "float" above their walls, leaving an open space that admits soft, indirect sunlight, and lets outside air flow freely through the building.

In a unique touch that also appears in Kahn's later works, all corner pillars are hollow and accessible. He called them "servant spaces." Some serve as baffled entries to the changing-rooms, others as closets or toilets. No space is wasted.

Inside, the Bath House is almost ethereal in its mood: quiet, calming, and infused with a gentle, flattering glow. By the mid-1990s, though, Kahn's Bath House was crumbling. A half-century of rain and snow, soaking the bare, unflashed block beneath the raised roofs, had caused serious damage. Inch-thick (25 mm) algae coated some walls, while cracks ran down their full height. The foundation-slabs were heaved and cracked. The mortar, which Kahn had directed his masons to apply in an oddly slap-dash fashion ("as if it had been applied straight from the tube," quipped Inga Saffron), was crumbling.

ARCHITECT
Farewell Mills Gatsch Architects LLC, Princeton, NJ
GENERAL CONTRACTOR
Wu Associates Inc., Cherry Hill, NJ
MASONRY CONTRACTOR
Jamison Masonry Restoration LLC, Oreland, PA
CMU PRODUCER
Clayton Concrete, Block & Sand Company, Lakewood, NJ.
MASONRY ACCESSORY SUPPLIER
Mortar Net USA, LLC, Burns Harbor, IN

Correcting Kahn's flashing omission with hidden 2010 technology, one of Cavalieri's masons grouts the flashing system into place.

Michael Mills, a partner in Farewell Mills Gatsch Architects LLC—an award-winning Princeton, NJ, firm—had run across the quirky Bath House 30 years before, while studying architecture at nearby Princeton University. "I didn't 'get' the building, back then," he laughs. But now, as a preservation expert and president of Preservation New Jersey (a statewide non-profit), he knew it was worth rescuing.

Donna M. Lewis, the visionary Mercer County, NJ, Planning Director, agreed, backed by County Executive Brian Hughes. They wanted to save the property as a much-needed recreational destination for the seniors and youth of Ewing Township, where the site is located. That would mean also repairing or replacing the pavilions of an old Day Camp, and constructing a new pavilion and snack-bar—adjacent to the Bath House—which had been proposed in Kahn's plan but never built.

These advocates all drew inspiration from Susan Solomon, a Princeton resident who had helped get the property placed on the National Register of Historic Places. In fact, Solomon literally wrote the book on it, titled "Louis I. Kahn's Trenton Jewish Community Center." The Bath House, she wrote, was "where Kahn established connections between structure and light."

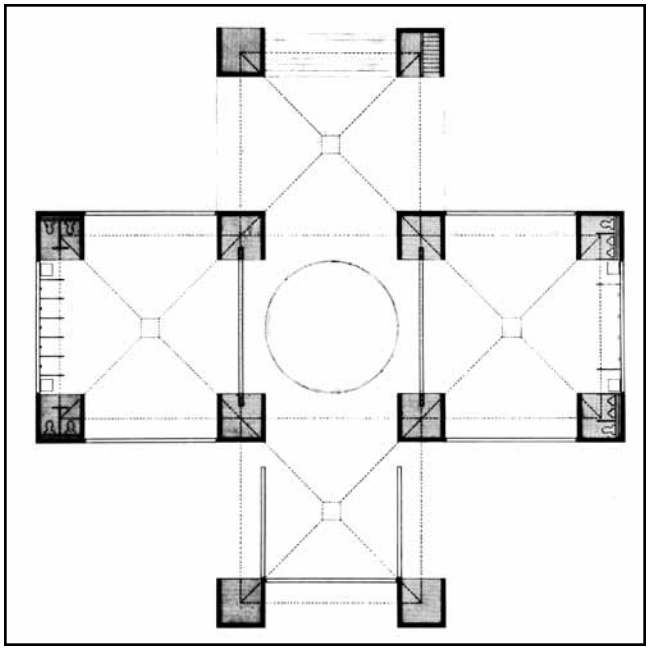
Then began a long and arduous trip through the money-maze. "Since one part of the $2.1-million project was historic preservation and the other was new construction," Mills recalls, "each needed separate funding sources." He managed to win a grant for restoring Kahn's original Bath House and Day Camp Pavilions, while Lewis sought funding to buy the land (another $8 million-plus) and to pay for constructing the new pavilion and snack-bar.

By the time the complicated financing was patched together, part of the team would technically be working for one funding-source and part for another. But the project could proceed. *Since none of the other portions of this project involved CMU restoration, the remainder of this article will focus exclusively on the Bath House.*

Wu Associates Inc., of nearby Cherry Hill, NJ—specialists in historical restoration—became General Contractor for this part of the project. Robert Rudolph would serve as its Project Manager. The masonry contractor was Jamison Masonry Restoration LLC, based in Oreland, PA, which also has a long record of historic restoration. John Cavalieri—the product of at least five generations of masons—was chosen to estimate and manage the masonry job.

In writing the property's Preservation Plan, Michael Mills needed to understand Kahn's original intentions and how the architect, who died in 1974, might have handled certain decisions now facing Mills. Luckily, Mills was able to interview two of Kahn's most influential advisers from that time. One of those sources was Anne Tyng, an artist who had been Kahn's longtime mistress and protege. Mills recalls her insights as being frank, witty, and supportive. She told him, "Louis would want you to do it your own way, rather than trying to fake his work." The other was Nick Gianopulos, a founding principal of Philadelphia's prestigious Keast & Hood Co. Gianopulos had been the structural engineer on Kahn's later projects. He was equally encouraging: "These were purpose-built buildings," he said, "and Louis would understand if you had to fix them." Gianopulos agreed to consult on the Bath House's engineering.

Armed with their advice—and blessings—Mills could design the restoration to meet modern building standards and prevent future deterioration, but without compromising Kahn's original vision. "The goal of preservationists," Mills says, "is to employ modern technology, but keep it invisible." As in all restoration projects, the teammembers couldn't be 100% certain what they were facing



This image shows the Bath House's classic "Greek cross" design. In two places, the edges of the suspended roofs are flush with the devising walls beneath them. Kahn envisioned rainwater pouring romantically down the unsealed, unflashed walls. It did—leading to premature wall-failure.

until they tore things apart. To get a better look, Cavalieri cleaned the walls with a pressure-washer, calibrating the pressure and the chemicals to eliminate the algae buildup without harming the wall-surfaces. "Our mockups were extensive," he recalls. "We debated which walls to demolish, which to patch, which joints to cut out, and a thousand other details."

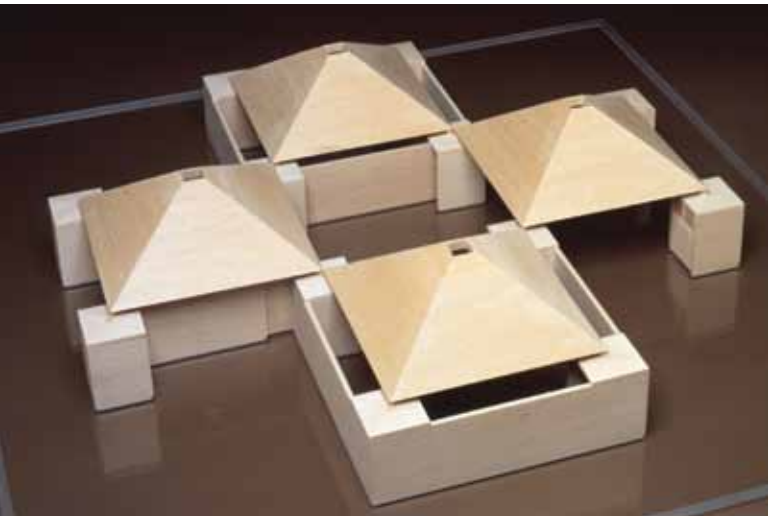
Two 28 foot (8.53 m) long demising walls, located where rain-water had poured directly onto them from the gutterless roofs—perhaps to let it run down the exterior in a "poetic" manner—were in dreadful shape. The top course of block had crumbled, and the walls were cracked from top to bottom.. "Those two walls were painful," Cavalieri recalls. "Try as we might, very little of the original block could be salvaged." The walls would be demolished and rebuilt using reproduced block. Salvageable units would be used as patchwork in other walls.

Rudolph tackled the challenge of reproducing the original block: "After about six attempts—using several color-matching techniques and different types of block—we settled on a lightweight block, similar to what Kahn had used, adding a Delaware River rock aggregate into the mix as Kahn had done. Then we colored it so it would match his tones throughout." This time, the block was also given a clear, water-repellent coating.

Samples were taken of the mortar and sent away for laboratory analysis, to help duplicate its color and texture.

With the mortar under control, Cavalieri had to teach his masons how to apply it in Kahn's peculiar fashion. Kahn's wide joints, though struck flush, were smeared and brushed over the edge, onto the block itself. "Copying it took some practice," Cavalieri recalls wryly, "because these were craftsmen who had spent their lives making clean, consistent joints." (As Robert Rudolph later remarked with a chuckle, "John trained them great! But they may have to be un-trained before their next job!")

Since water had caused the Bath House's downfall, Michael Mills specified a couple of technologically advanced products (invisible, of course) to address those moisture-control problems. At the bases of the walls exposed to roof-runoff, Mills used a uniquely engineered proprietary flashing system. It consists of tough, lightweight "flashing pans" that are laid atop the first above-grade course of CMU and grouted into place. They intercept the water as it runs down the CMU's cores and expel it through integrated, unobtrusive drainage spouts. To capture mortar droppings, proprietary feather-light



mesh squares can be swiftly inserted into the cores of the next course of CMU, replacing awkward pea-gravel.

Mills also specified a high-tech thermoplastic coating to be applied to the tops of the columns supporting the roofs and on the tops of the demising walls that were directly under the drip-lines of the roofs. "Again, the modern technology is completely hidden," Mills says, "but it will prolong the building's life."

Mills planned the project's logistics like a military campaign. Still, as the demolition proceeded, the team hit its first—and only—major setback. "We knew we'd have to replace the warped and buckled concrete slabs beneath the building," Rudolph recalls. "But we thought that was just because they had been laid directly onto the ground. Once the slabs were removed, though, we saw the problem was far more serious—it was the high water-table!" The land is just a few yards above sea-level, and the Delaware River flows nearby. Work was halted while engineers put their heads together. After extensive analysis, they decided to undercut the soil then drill two wells to give the ground-water an escape route. A geotextile filter fabric was installed, and a more stable type of crushed rock was put down where the new slabs would be laid. New storm and drain trenches were also dug.

It took several weeks for the wells and trenches to be dug and covered by a new foundation. Afterward, Robert Rudolph observed, "Now when you walk through the building it looks 100% historical, but beneath your feet are some very creative ways of dealing with what Mother Nature threw at us." (Ironically, Susan Solomon's book says that Kahn "tried to create a synthesis between the wonder of nature and the ability of humans to control it.")

Making the building conform to today's ADA requirements turned out to be relatively easy: the doorways and bathroom stalls were spacious enough to accommodate a wheelchair. Not much was needed except some grab-bars and outdoor ramps.

The corner-supports that held the raised roofs were strengthened. A gutter—connected into the building's drainage-system—was carefully concealed along the tops of the demising walls, to capture and divert the rainwater that had previously inundated the top courses of block. In building the new demising walls and replacing the unsalvageable units in the other walls, Cavalieri's masons used about 1,000 of the reproduced block-units.

When they had laid the final course of block—slathering the mortar as if they were making a peanut-butter sandwich, and feathering each joint lightly, as per the eccentric Louis Kahn—their work was indistinguishable from the original. "Looking at it today," Rudolph says, "you can't tell the repro block from the original."

Back in 1955, Kahn worked in near-anonymity (the Bath House was his first independent project). "I discovered myself after designing that little concrete block bathhouse in Trenton," he recalled a few years before his death in 1974.

In 2010, though, Mills and his team had a huge audience looking over their shoulders. He lists some of them: "Grantors, grantees, the county, the township, many contractors, the architectural community—locally, nationally, and even internationally. There was also a great interest in Kahn among people who had seen the documentary. They were all watching our progress and our design decisions. It can be a tough crowd!" Then Mills says with a smile, "They seem generally happy with it." Inspecting the finished walls, masonry contractor John Cavalieri expresses the pride of a preservationist: "You'd never even know we were there." **CMD**

Images on pages 10, 12, and 13 from the Louis I. Kahn Collection, The University of Pennsylvania and the Pennsylvania Historical and Museum Commission

Typical Reinforcement for High Wind Areas

High winds subject buildings to large horizontal forces as well as to significant uplift. The critical damage to buildings in such events typically occurs due to uplift on the roof. Reinforced concrete masonry is well suited to resist these loads due to its relatively large mass available to resist the large uplift and overturning forces. Additionally, the grout and reinforcing steel tie the walls into a strong, cohesive unit minimizing the number of connectors needed and reducing the margin for error, as a structure is only as strong as its weakest link.

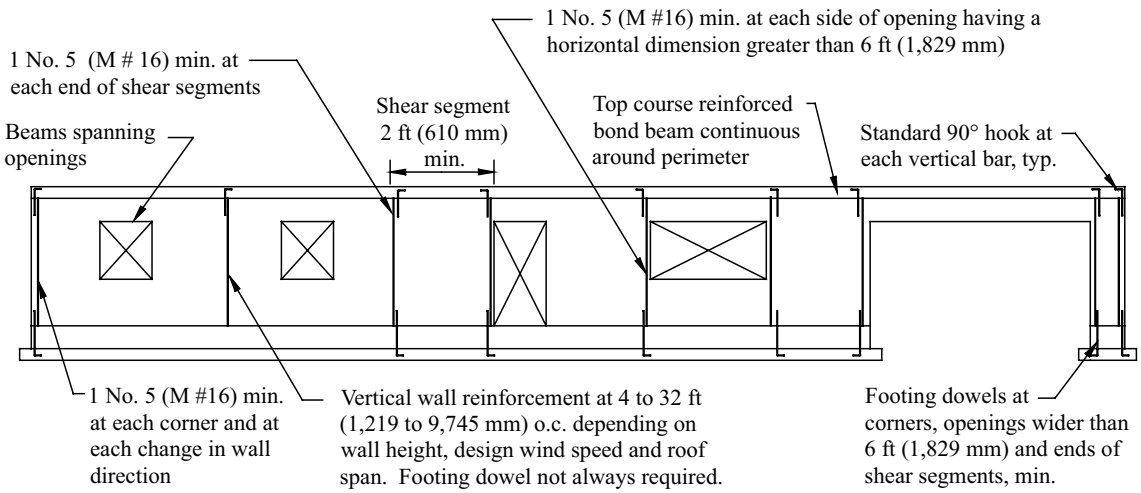
As with seismic design, connections between individual building elements—roof, walls, floors and foundation—are critical to maintaining structural continuity during a high wind event.

A primary goal for buildings subjected to high winds is to maintain a continuous load path from the roof to the foundation. This allows wind uplift forces on the roof to be safely distributed through the walls to the foundation, where they are dissipated into the ground. If one part of the load path fails, or is discontinuous, building failure may occur.

Proper detailing and installation of mechanical connectors is necessary for maintaining continuous load paths. Note that in order for connectors to provide their rated load capacity, they must be installed according to the manufacturer's specifications. In coastal areas, corrosion protection of the connectors is especially important due to the corrosive environment.

In addition, a continuously reinforced bond beam around the entire perimeter of the building with vertical reinforcement at strategic locations in the wall is needed to resist design loads. See the figure for recommended minimum amount of reinforcement.

More information can be found in TEK 5-11 Residential Details for High Wind Areas. TEK 5-11 and all other 140+ TEK are available free on line at NCMA member web sites sponsoring e-TEK. For a listing of sponsoring members and a link to their e-TEK sites go to www.ncma.org. CMD



Typical Reinforcement for High Wind Areas

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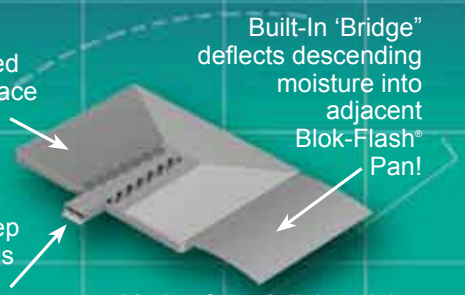

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THERMAL BRIDGES IN WALL CONSTRUCTION

TEK 6-13B
Energy & IAQ (2010)

INTRODUCTION

Thermal bridging occurs when a relatively small area of a wall, floor or roof loses much more heat than the surrounding area. Thermal bridging can occur in any type of building construction. The effects of thermal bridging may include increased heat loss, occupant discomfort, unanticipated expansion/contraction, condensation, freeze-thaw damage, and related moisture and/or mold problems for materials susceptible to moisture. The severity of the thermal bridge is determined by the extent of these effects.

Thermal bridges, and the subsequent damage, can be avoided by several strategies which are best implemented during the design stage, when changes can be easily incorporated. After construction, repairing thermal bridges can be both costly and difficult.

THERMAL BRIDGING

A thermal bridge allows heat to "short circuit" insulation. Typically, this occurs when a material of high thermal conductivity, such as steel framing or concrete, penetrates or interrupts a layer of low thermal conductivity material, such as insulation. Thermal bridges can also occur where building elements are joined, such as exposed concrete floor slabs and beams that abut or penetrate the exterior walls of a building.

Causes

Thermal bridging is most often caused by improper installation or by material choice/building design. An example of improper installation leading to thermal bridging is gaps in insulation, which allow heat to escape around the insulation and may also allow air leakage. For this reason, insulation materials should be installed without gaps at the floor, ceiling, roof, walls, framing, or between the adjacent insulation materials. Further, insulation materials should be installed so that they remain in position over time.

Although thermal bridging is primarily associated with conduction heat transfer (heat flow through solid materials), thermal bridging effects can be magnified by heat and moisture transfer due to air movement, particularly when warm, moist air enters the wall. For this reason, buildings with typically high interior humidity levels, such as swimming pools, spas, and cold storage facilities, are particularly susceptible to moisture damage. Proper installation of vapor and air retarders can greatly reduce moisture damage caused by thermal bridges. Concrete masonry construction does not necessarily require separate vapor or air retarders: check local building codes for requirements.

Minimizing moisture leakage will also alleviate thermal bridging due to air leakage for two reasons: air will flow through the same points that allow moisture entry; and water leakage can lead, in some cases, to degradation of air barriers and insulation materials.

Effects

Possible effects of thermal bridges are:

- increased heat loss through the wall, leading to higher operating costs,
- unanticipated expansion and/or contraction,
- local cold or hot spots on the interior at the thermal bridge locations, leading to occupant discomfort and, in some cases, to condensation, moisture-related building damage, and health and safety issues,
- local cold or hot spots within the wall construction, leading to moisture condensation within the wall, and possibly to damage of the building materials and/or health and safety problems, and/or
- local warm spots on the building exterior, potentially

Related TEK:
6-1B, 6-2B

Keywords: condensation, moisture, thermal bridging, thermal insulation, thermal properties

leading to freeze-that damage, such as ice dams, unanticipated expansion or contraction, and possible health and safety issues.

Not all thermal bridges cause these severe effects. However, the severity of a particular thermal bridge should be judged by the effect of the thermal bridge on the overall energy performance of the building; the effect on occupant comfort; the impact on moisture condensation and associated aesthetic and/or structural damage; and degradation of the building materials. Appropriate corrective measures can then be applied to the design.

Requirements

ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings* (ref. 1) (included by reference in the *International Energy Conservation Code* (ref. 2)) addresses thermal bridging in wall, floor and roof assemblies by mandating that thermal bridging be accounted for when determining or reporting assembly R-values and U-factors. For concrete masonry walls, acceptable methods for determining R-values/U-factors that account for the thermal bridging through concrete masonry unit webs include: testing, isothermal planes calculation method (also called series-parallel calculation method), or two-dimensional calculation method. NCMA-published R-values and U-factors, such as those in TEK 6-1B, *R-Values of Multi-Wythe Concrete Masonry Walls,* TEK 6-2B, *R-Values and U-Factors for Single Wythe Concrete Masonry Walls,* and the *Thermal Catalog of Concrete Masonry Assemblies* (refs. 4, 5, 6), are determined using the isothermal planes calculation method. The method is briefly described in TEK 6-1B as it applies to concrete masonry walls.

SINGLE WYTHE MASONRY WALL

In a single wythe concrete masonry wall the webs of the block and grouted cores can act as thermal bridges, particularly when the cores of the concrete masonry units are insulated. However, this heat loss is rarely severe enough to cause moisture condensation on the masonry surface, or other aesthetic or structural damage. These thermal bridges are taken into account when determining the wall's overall R-value, as noted above. In severe climates, in certain interior environments where condensation may occur under some conditions, or when otherwise required, the thermal bridging effects can be eliminated by applying insulation on the exterior or interior of the masonry, rather than in the cores. In addition, thermal bridging through webs can be reduced by using a lighter weight masonry unit, or by using special units with reduced web size, or by using units that have fewer cross webs.

Horizontal joint reinforcement is often used to control shrinkage cracking in concrete masonry. Calculations have shown that the effect of the joint reinforcement on the overall R-value of the masonry wall is on the order of 1 - 3%, which has a negligible impact on the building's energy use.

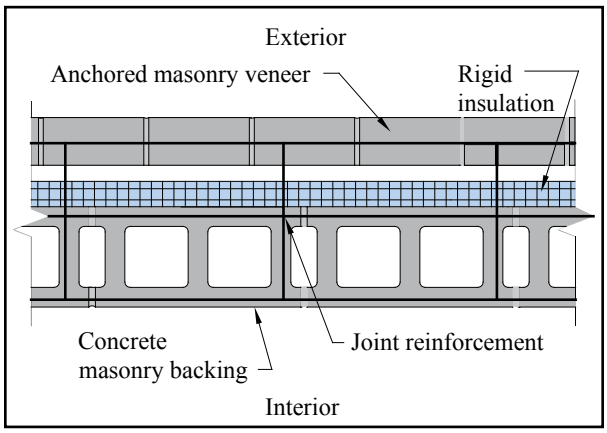

Figure 1—Insulated Masonry Cavity Wall

CONCRETE MASONRY CAVITY WALL

In masonry cavity walls, insulation is typically placed between the two wythes of masonry, as shown in Figure 1. This provides a continuous layer of insulation, which minimizes the effects of thermal bridging (note that some references term the space between furring or studs as a "cavity," which differs from a masonry cavity wall).

Because the wall ties are isolated from the interior, the interior surface of the wall remains at a temperature close to the building's interior temperature. The interior finish material is not likely to be damaged due to moisture condensation, and occupant comfort is not likely to be affected. As with horizontal joint reinforcement in single wythe construction, the type, size, and spacing of the ties will affect the potential impact on energy use.

MASONRY VENEER WITH STEEL STUD BACKUP

Figure 2 shows a cross section of a typical concrete masonry veneer over a steel stud backup. Steel studs act

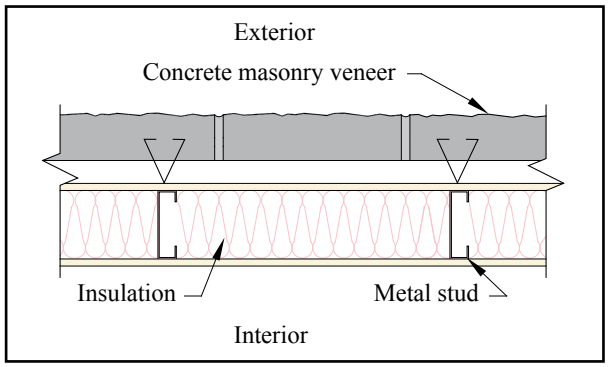

Figure 2—Concrete Masonry Veneer with Steel Stud Backup

as strong thermal bridges in an insulated wall system. Almost 1,000 times more heat flows through the steel than through mineral fiber insulation of the same thickness and area. The steel stud allows heat to bypass the insulation, and greatly reduces the insulation's effectiveness.

Just as for concrete masonry webs, the thermal bridging through steel studs must be accounted for. According to ASHRAE Standard 90.1, acceptable methods to determine the R-value of insulated steel studs are: testing, modified zone calculation method, or using the insulation/framing layer adjustment factors shown in Table 1. The effective framing/cavity R-value shown in Table 1 is the R-value of the insulated steel stud section, accounting for thermal bridging. Using these corrected R-values allows the designer to adequately account for the increased energy use due to the thermal bridging in these wall assemblies.

Table 1 shows that thermal bridging through steel studs effectively reduces the effective R-value of the insulation by 40 to 69 percent, depending on the size and spacing of the steel studs and on the R-value of the insulation.

Because the steel studs are typically in contact with the interior finish, local cold spots can develop at the stud locations. In some cases, moisture condenses causing dampness along these strips. The damp areas tend to retain dirt and dust, causing darker vertical lines on the interior at the steel stud locations. If warm, moist indoor air penetrates into the wall, moisture is likely to condense on the outer flanges of the steel studs, increasing the potential for corrosion of studs and connectors and structural damage of the wall. Gypsum sheathing on the exterior of the studs can also be damaged due to moisture, particularly during freeze-thaw cycles. These impacts can be minimized by including a continuous layer of insulation over the steel stud/insulation layer.

Table 1—Effective Insulation/Framing Layer R-Values for Wall Insulation Installed Between Steel Framing (ref. 1)

Nominal Cavity Depth, in. (mm):	Rated R-Value of Insulation, ft²·hr°F/Btu (m²·K/W)	Effective R-Value (ft²·hr°F/Btu (m²·K/W)) with Steel at 16 in. (406 mm) o.c.	Effective R-Value (ft²·hr°F/Btu (m²·K/W)) with Steel at 24 in. (610 mm) o.c.
4 (102)	11 (1.93)	5.5 (0.97)	6.6 (1.16)
4 (102)	13 (2.28)	6.0 (1.06)	7.2 (1.26)
4 (102)	15 (2.64)	6.4 (1.13)	7.8 (1.37)
6 (152)	19 (3.34)	7.1 (1.25)	8.6 (1.51)
6 (152)	21 (3.70)	7.4 (1.30)	9.0 (1.58)
8 (203)	25 (4.40)	7.8 (1.37)	9.6 (1.69)

SLAB EDGE & PERIMETER BEAM

Another common thermal bridge is shown in Figure 3. When this wall system is insulated on the interior, as shown on the left, thermal bridging occurs at the steel beam and where the concrete floor slab penetrates the interior masonry wythe.

A better alternative is to place insulation in the cavity, as shown on the right in Figure 3, rather than on the interior. This strategy effectively isolates both the slab edge and the steel beam from the exterior, substantially reducing heat flow through these areas and condensation potential, and decreasing heating loads (ref. 3).

A third alternative, not illustrated, is to install insulation on the interior of the steel beam. This solution, however, does not address the thermal loss through the slab edge. In addition, the interior insulation causes the temperature of the steel beam

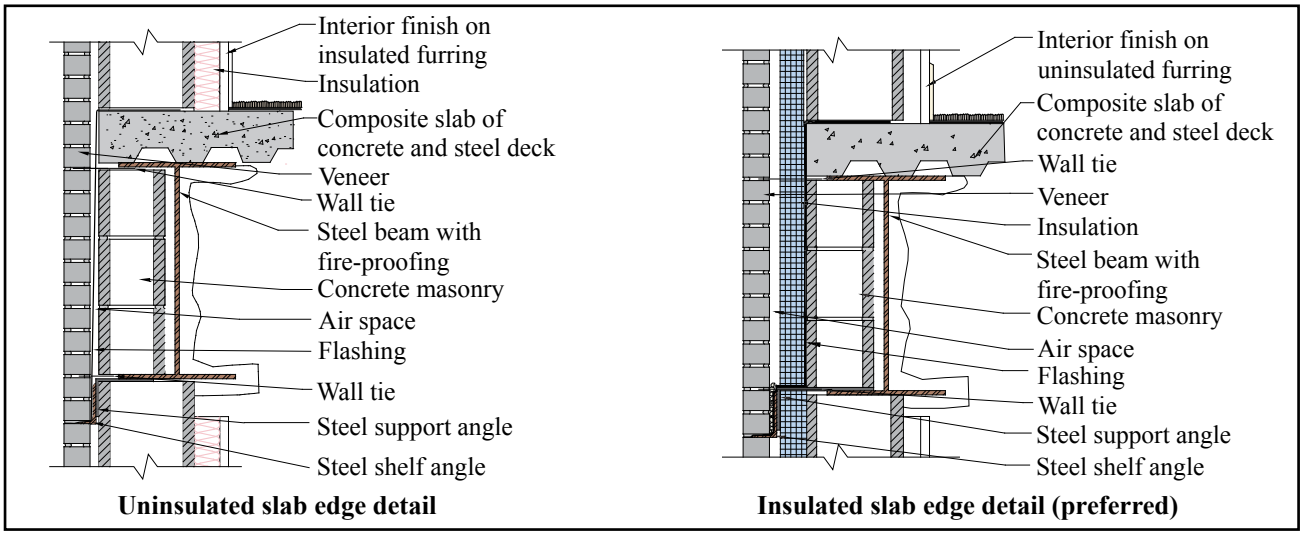

Figure 3—Alternative Insulation Strategies for Slab Edge and Perimeter Beam

to be lower, and can lead to condensation unless a tight and continuous vapor retarder is provided.

MASONRY PARAPET

Because a parapet is exposed to the outside environment on both sides, it can act as a thermal fin, wicking heat up through the wall. Figure 4 shows two alternative insulation strategies for a masonry parapet. On the left, even though the slab edge is insulated, the parapet is not. This allows heat loss between the roof slab and the masonry backup.

A better alternative is shown on the right in Figure 4. Here, the parapet itself is insulated, maintaining a thermal boundary between the interior of the building and the outdoor environment. This significantly reduces heating and cooling loads, and virtually eliminates the potential for condensation on the underside of the roof slab.

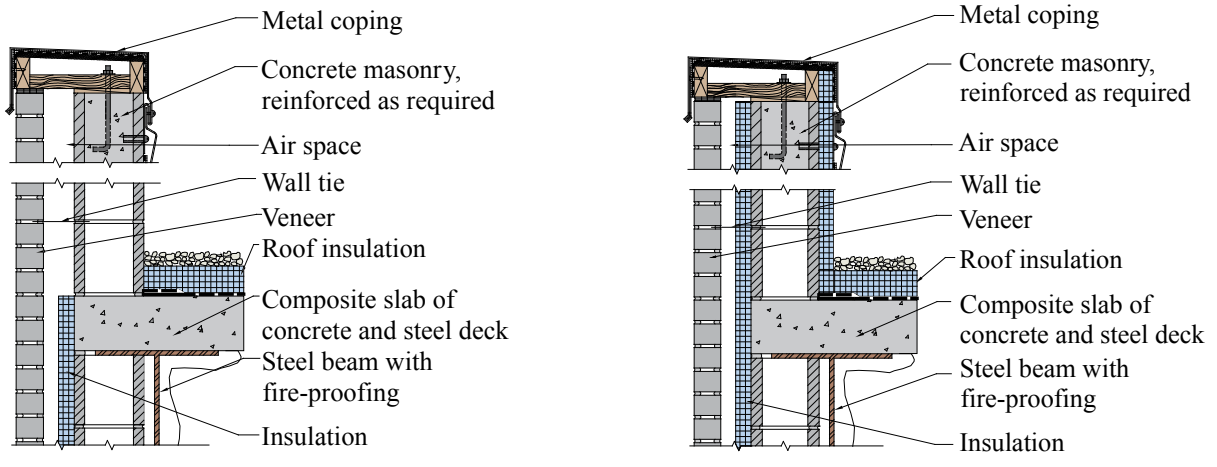

Figure 4—Alternative Insulation Strategies for a Masonry Parapet

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2. *ASHRAE Handbook—HVAC Applications*. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 2007.
3. *R-Values of Multi-Wythe Concrete Masonry Walls*, TEK 6-1B. National Concrete Masonry Association, 2009.
4. *R-Values and U-Factors for Single Wythe Concrete Masonry Walls*, TEK 6-2B. National Concrete Masonry Association, 2009.
5. *Thermal Catalog of Concrete Masonry Assemblies*, TR233. National Concrete Masonry Association, 2010.

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SOFTWARE FOR THE STRUCTURAL DESIGN OF CONCRETE MASONRY

TEK 14-17A
Structural (2010)

INTRODUCTION

Structural design of masonry can be tedious and complex. Software allows the design professional to quickly determine designs that work and therefore optimize solutions. This TEK describes the capabilities of Version 5.0 of *Structural Masonry Design System* software (ref. 1). The software includes the design of walls loaded out-of-plane, walls loaded in-plane (shear-walls), masonry and precast concrete lintels, and columns. Both concrete and clay masonry elements can be designed using either allowable stress design (ASD) or strength design (SD) using various editions of *Building Code Requirements for Masonry Structures* (MSJC) (1995, 1999, 2002, 2005 or 2008) and the *International Building Code* (IBC) (2000, 2003, 2006 or 2009) (refs. 2, 3). The software also includes Alternative Basic Load Combinations that permit the use of the one-third stress increase in allowable stress design per the IBC. See *Strength Design Provisions for Concrete Masonry*, TEK 14-4B, and *Allowable Stress Design of Concrete Masonry*, TEK 14-7B, (refs. 6, 7) for information on these design methods.

The engineer may specify the critical design forces or may choose to have them calculated from specified design loads, boundary conditions and dimensions. In the latter case, load combinations are calculated at very small intervals along the wall, and the critical design forces are determined and reported. Note that although dual units are shown in the text of this TEK, the software itself uses inch-pound units only. Finally, printable documentation is provided for inclusion in design calculations that may be submitted to building officials or to archive designs.

The software is limited to hollow unit masonry in single wythe construction, but the masonry can be fully or partially grouted (including ungrouted), and reinforcement may be included within grouted cells. The reinforcement location is specified by the user and may be off-center when an increase in effective depth is desired, such as for retaining wall construction.

THE DESIGN BASIS

The "Design Basis" icon located on the toolbar allows the designer to select material properties and design codes for all elements in a structure at one time without having to redefine them for each element (such as lintels, shear walls and columns). Figure 1 shows the "Design Codes" tab in the "Design Basis" window. The building code, design criteria (strength design or allowable stress design), type of masonry (concrete or clay), concrete building code (for precast concrete lintels) and design criteria are selected on this tab.

Figure 2 illustrates the options available for selecting

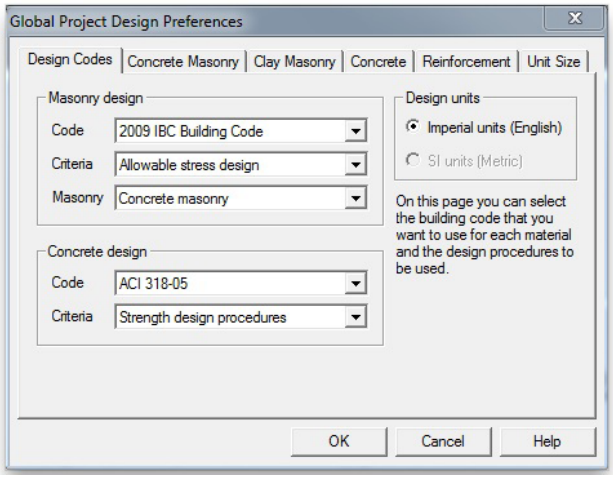

Figure 1—Design Basis—Building Code

Related TEK:
14-4B, 14-7B, 17-1C, 17-2A, 17-3A, 18-1A

Keywords: allowable stress design, columns, interaction diagram, in-plane loads, lintels, out-of-plane walls, plain concrete masonry, reinforced concrete masonry, shear walls, single wythe walls, software, strength design, structural design, walls

hollow concrete masonry unit properties as well as the mortar used with concrete masonry. The unit length and height are specified by the engineer because the spacing of reinforcement depends on unit length, and the height of masonry courses in lintels depends upon the unit height. Density of the material used in making the units is needed to calculate the masonry weight. Specified masonry compressive strength, f'_m, is entered by using either the unit strength method or the prism test method (see Reference 5 for information on masonry compressive strength). In the unit strength method, it is not necessary to test prisms to determine compliance with f'_m, so that is the option most often used. In Figure 2, a unit strength of 1,900 psi (13.1 MPa) with Type S mortar results in an f'_m of 1,500 psi (10.3 MPa) based on the unit strength method.

Unit size is specified on the "Unit Size" tab shown in Figure 3. The default values correspond to the minimum face shell and web thicknesses required by the applicable ASTM Standard. Sometimes units with thicker face shells and webs are desired, such as for fire ratings or sound attenuation. Engineers can now take advantage of the additional material in these cases by increasing the default values. Section properties and wall weights are adjusted in accordance with the selected web and face shell dimensions.

After specifying the design basis, the engineer is ready to select the type of component to be designed – lintel, wall with out-of-plane loads, wall with in-plane loads (shear wall) or column. The type of component is chosen using the "Design" drop-down menu just over the left tool bar or by using the appropriate icon on the tool bar.

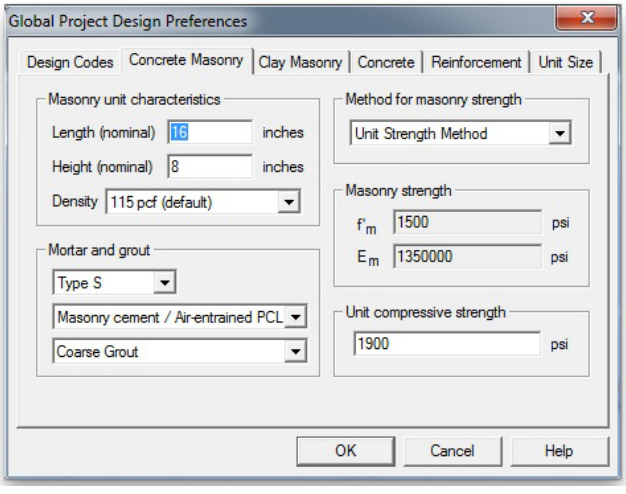

Figure 2—Concrete Masonry Properties

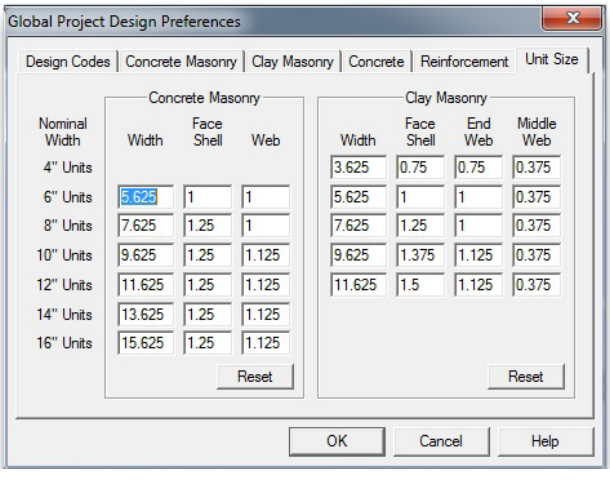

Figure 3—Design Basis—Unit Size

WALL DESIGN

Walls can be designed as either reinforced or unreinforced. Strength design of walls loaded out-of-plane includes the P-Delta effect if the wall is reinforced, including walls with boundary conditions other than simply supported. Graphical information makes it easy to quickly converge on an economical design.

The software takes full advantage of code provisions that optimize the design by using the beneficial effects of axial load on the moment capacity. Partially grouted construction is included as an option in the software to minimize the amount of grout required in reinforced masonry construction. Shear walls can be designed with special end-zone reinforcement that greatly increases the bending capacity of the wall with minimal increase in reinforcing steel area. Earth retaining structures can be designed with reinforcement placed off-center to optimize the capacity of retaining walls and basement walls.

WALLS WITH OUT-OF-PLANE LOADS

If "Wall Design for Out-of-Plane Load" is selected, Figure 4 will appear. The three tabs at the top of the window are "Design Data," "Construction Data" and "Load Data." "Design Data" includes the forces at the design section. The engineer can calculate these forces at the section assumed to control the design and specify them, or if the "Compute using load data" box is checked, the software will calculate the design forces based on information the engineer specifies on this and other tabs in the "Design" window. In this mode, the software divides the wall into one hundred increments along its height and designs for all required load combinations at each increment. This ensures that the critical design section and load combination is used in the final design. The engineer can select reinforced or unreinforced masonry and boundary conditions with the dropdown menu.

Use of the one-third stress increase button is limited to allowable stress design (ASD) when "Compute Using Load Data" is not selected. When "Compute Using Load Data" is selected, the software automatically uses the one-third stress increase for load combinations for which it is permitted (MSJC ASD and IBC ASD with alternative

basic load combinations only). Display options include "Design Calculations," "Interaction Diagram" or "Calculated Loads."

The "Construction Data" tab (Figure 5) allows the engineer to specify the wall thickness, wall height, location of reinforcement (centered or off-center), grouting (full or partial), bond pattern (running or stack), and horizontal spacing of reinforcement. Default values are recommended until an initial trial design is performed. Then these values can be quickly changed to arrive at an optimum design.

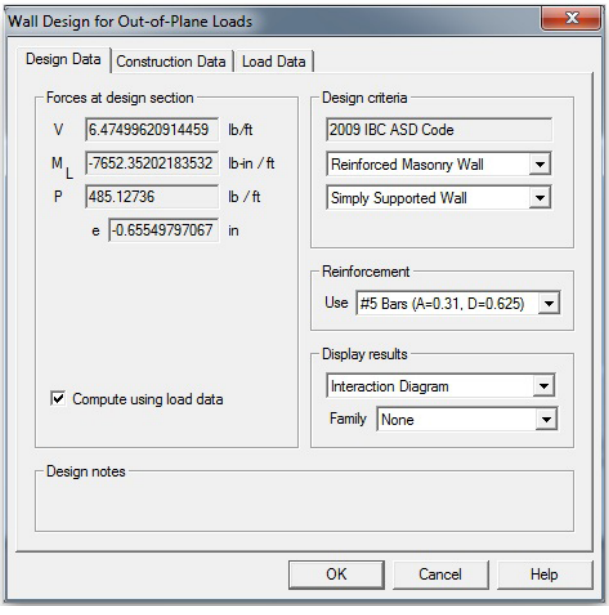

Figure 4—Design Data Tab for Out-of-Plane Walls

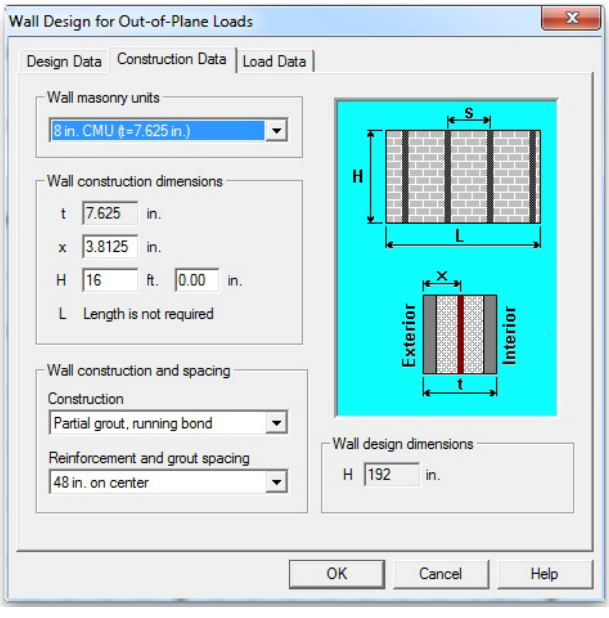

Figure 5—Construction Data Tab for Walls Loaded Out-of-Plane

Partially grouted construction requires that only the cells receiving reinforcement are grouted. In the example shown in Figure 5, with a grout spacing of 48 in. (1,219 mm), every sixth cell is grouted and the five cells in between are not. This can save significantly on grouting costs. Mortaring of the cross-webs is required adjacent to the grouted cells, however, and is included in the section properties for analysis. The internal calculations for partially grouted construction are rigorous. Performing such calculations by hand would be tedious and time-consuming, but the software does them almost instantaneously.

The value of x enables the engineer to position the reinforcing steel within the wall. The default location is the center of the wall, which is most common since most lateral loads such as wind and earthquake are reversible. However, in cases of lateral loads from soil, placing the steel farther from the soil (or, in the case of cantilever construction, closer to the soil) increases the effective depth of the reinforcement and can result in significant savings.

If unreinforced masonry is selected in the "Design Data" tab, then another option in the "Construction" drop-down menu is "ungrouted."

When a bar spacing is selected that exceeds six times the wall thickness or 72 in. (1,829 mm), the software uses only that width in conjunction with a single bar to calculate the wall resistance. A message will appear to notify the engineer in this case.

The "Load Data" tab (Figure 6) permits the engineer to specify various loads (dead, live, wind, etc.). As shown in the inset drawing in Figure 6, loads can be axial (with or without eccentricity), lateral distributed loads (such as wind or earthquake) that can vary with height (as with earth

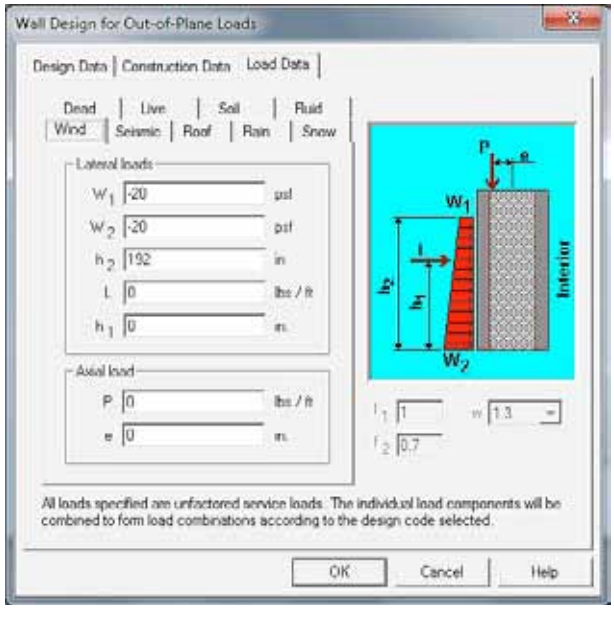

Figure 6—Load Data Tab for Walls Loaded Out-of-Plane

retaining walls), and concentrated lateral loads. Loads can be positive or negative. The directions of the loads shown in the inset in Figure 6 are positive in the directions shown. Depending on the code selected and whether ASD or SD was selected, the software uses the appropriate set of load factors and load combinations to conduct the design if the "Compute using load data" box is checked on the "Design Data" tab (Figure 4).

If "Interaction Diagram" was selected on the "Design Data" tab, it will be displayed. When "Family" is selected, the interaction diagram (Figure 7) allows the designer to quickly select the optimum bar spacing for the wall thickness selected. For example, in Figure 7, the different contours represent the interaction diagram for an 8 in. (203 mm) partially grouted wall with No. 6 (M#19) bars. Each contour corresponds to a different reinforcing bar spacing. The dots are the calculated or specified forces at the critical sections. By selecting any contour that encompasses all of the loading dots, an acceptable design for combined flexure and axial load results. The closer the dots are to the contour, the more optimum the design. Under "Family," if "none" is selected, only the single bar spacing selected is shown in the interaction diagram. Figure 8 shows the interaction diagram for a spacing of 48 in. (1,219 mm) only from the graph above where all of the loading dots clearly fall within the contour. The center of the loading dot must fall inside the contour, not its outer periphery.

If no satisfactory contour is displayed, the engineer can either select different bar sizes or different wall thicknesses. When a satisfactory wall design is determined from the interaction diagram, the "Design Calculation" display can be selected. The information on the design calculation page is intended to

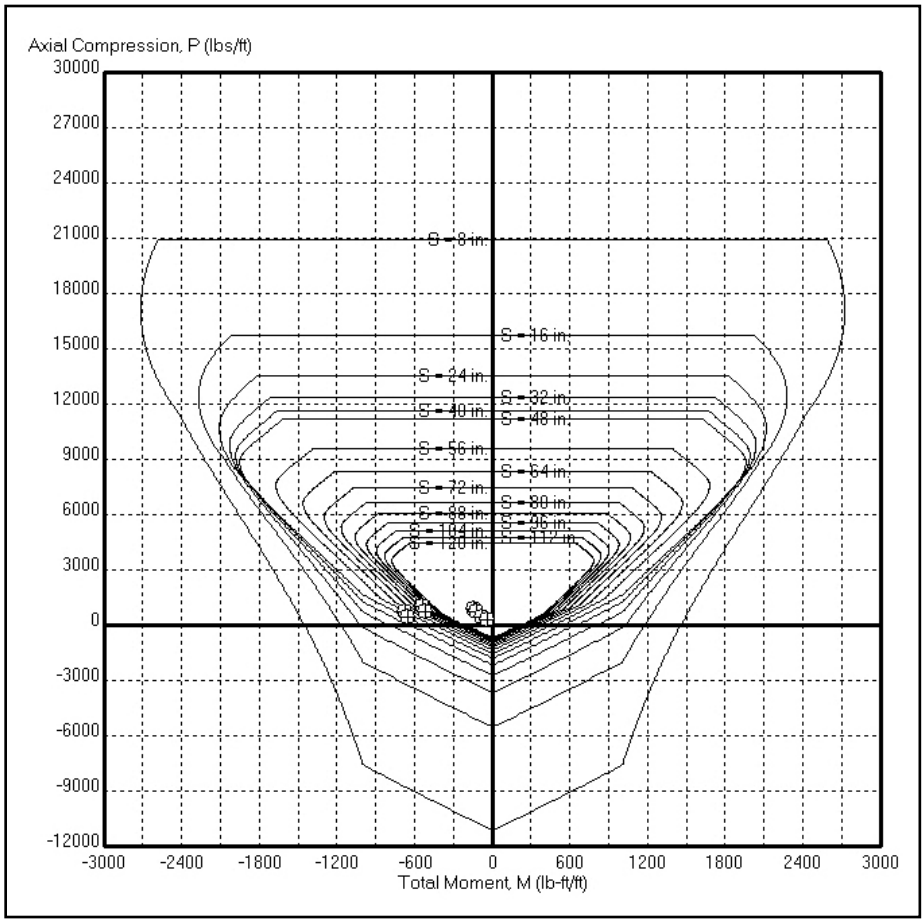

Figure 7—Interaction Diagram, Family of Curves

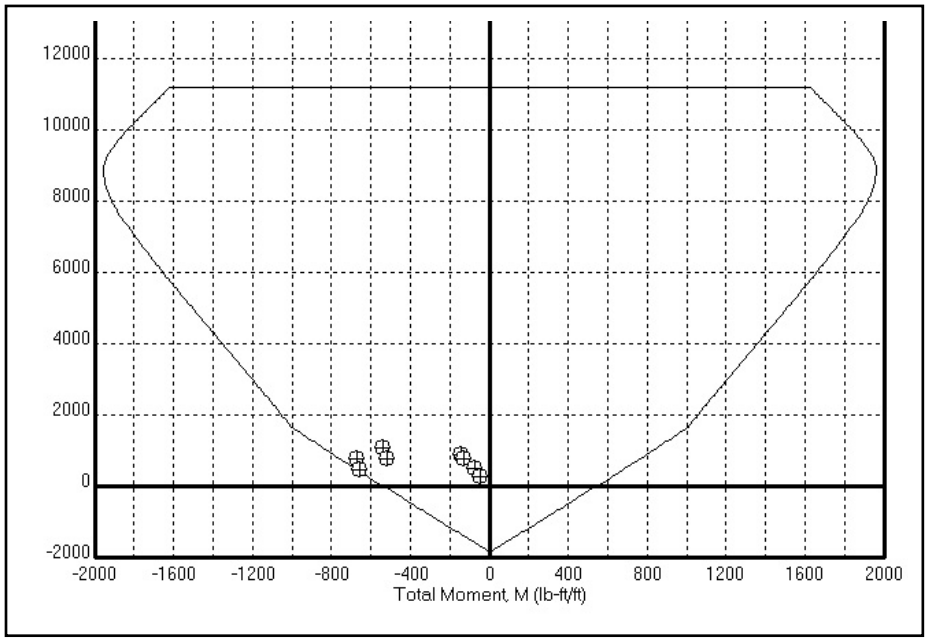

Figure 8—Interaction Diagram for Reinforcement Spacing of 48 in. (1,219 mm) Only

provide the engineer with more detailed information including shear design and reinforcing bar development and splice lengths. Specified design data is presented in a format intended to be suitable for submitting to building officials. Files can be easily saved electronically as well.

SHEAR WALL DESIGN

If "Wall Design for In-Plane Load" from the "Design" drop-down menu or icon at the top and the "Reinforcement" tab are selected, Figure 9 will appear. An end zone can be included in a shear wall to increase its moment carrying capacity with little increase in reinforcing steel. Reinforcement placed in such an end zone is subjected to higher stress than interior bars, and these steel forces have a larger lever arm than those for interior bars. End zone steel significantly increases moment capacity with little impact on the maximum area of reinforcement limitations in strength design and allowable stress design. All of the cells in the end zone are reinforced and grouted, whereas cells in the middle zone can be partially grouted and reinforced with different sized bars.

Loading for shear walls is specified in the window displayed when the "Load Data" tab is selected (Figure 10). The engineer specifies the shearing force, the bending moment, and the axial load at the top of the shear wall and the software internally calculates the forces at other locations. Walls with openings are not included in the design. However, a pier between two openings can be designed as a shear wall if the forces are determined using some other method, such as a finite element program.

After all information is entered, the interaction diagram can be displayed to determine if the wall has adequate capacity (see Figure 11). Since all of the loading "dots" fall inside the interaction diagram, the wall is satisfactory for flexure and axial loads.

Once a design is found that satisfies the interaction diagram, select "Design Calculations" on the "Design Data" tab, and Figure 12 is displayed. Only a portion of the design calculation output is shown in this figure. The critical loading combination and location for flexure and

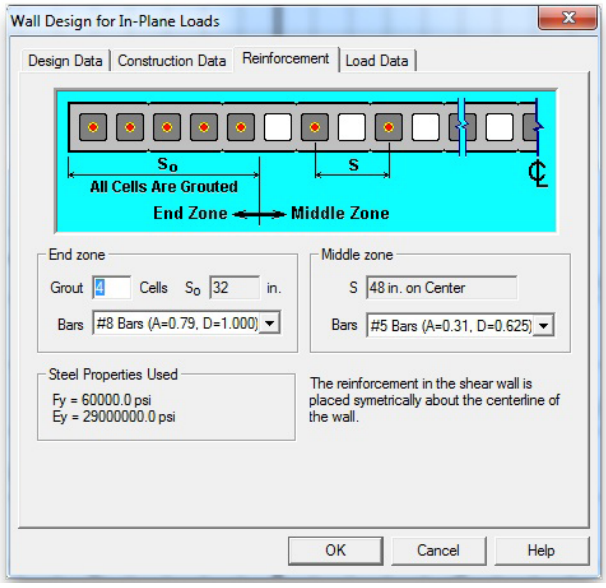

Figure 9—Reinforcement Tab for Shear Wall Design

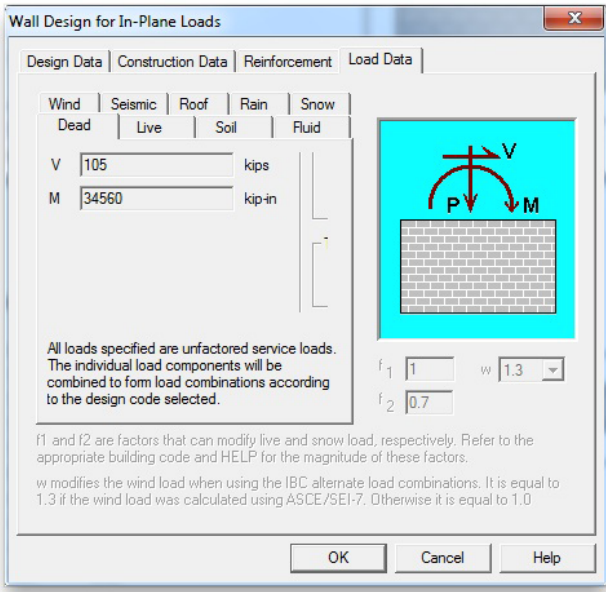

Figure 10—Load Data Tab for Shear Wall Design

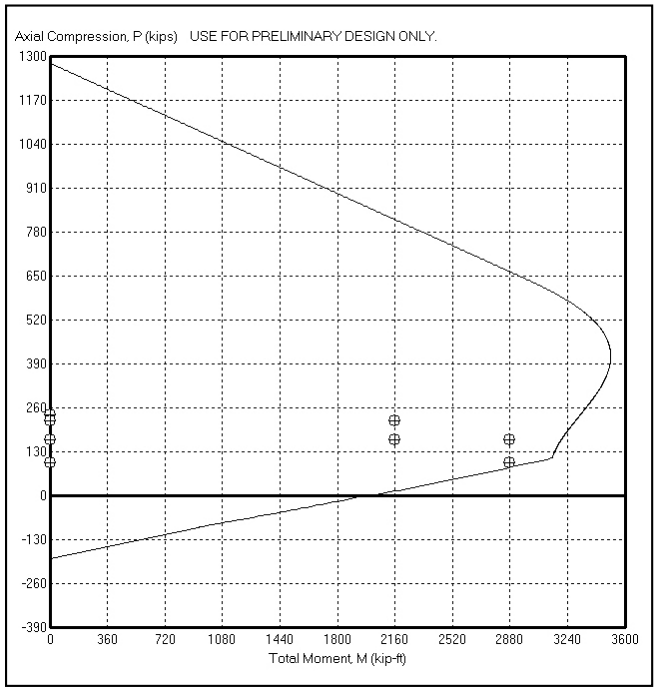

Figure 11—Interaction Diagram for Shear Wall

Controlling load case for bending moment: 0.6D + H + W
Controlling x/H ratio for bending moment: 0
M = 34560 kip-in (2880 kip-ft)
V = 105 kips
P = 100.199 kips
Controlling bending moment capacity: 36300.71 kip-in (3025.06 kip-ft)

Controlling load case for shearing force: D + W
Controlling x/H ratio for shearing force: 0
M = 34560 kip-in (2880 kip-ft)
V = 105 kips
P = 166.998 kips

The following design calculations are for the section with controlling bending moment

Section Design Forces Used
V = 105 kips (Computed from Loads)
M = 34560 kip-in (Computed from Loads)
P = 100.2 kips (Computed from Loads)

Computed Design Values

Wall Flexural Design Data
Maximum P = 751 kips (MSJC 2.3.3.2)
M = 3.63e+004 kip-in (3025 kip-ft) for Design P

Wall Shear Design Data
Design as a normal shear wall.
f_v = 0.04148 ksi (MSJC 2.3.5.2.1)
M/Vd = 3.456e+004 / (105 * 332) = 0.9914
F_v = 0.03539 ksi without reinforcement (MSJC 2.3.5.2.2)
F_v = 0.05826 ksi with reinforcement (MSJC 2.3.5.2.3)
Av/s = 105 / (2.4e+004 * 332) = 0.01318 (MSJC 2.3.5.3)

Figure 12—Design Calculations Output for Shear Wall

axial load are shown along with the applied loads and capacities. The same information is also shown for the critical shear case. When shear reinforcement is needed, suggested horizontal bar sizes and spacings are also displayed.

LINTEL DESIGN

Lintels also can be designed according to the MSJC, the IBC or, in the case of reinforced concrete lintels, the ACI 318 (2002, 2005 or 2008) Code (References 8 and 9 provide an overview of concrete masonry and reinforced concrete lintel design, respectively). As with walls, the critical shearing force and bending moment can be entered directly or the software can compute them from specified load data and dimensions. Stirrups can be used to resist shear forces if the masonry or concrete alone is not sufficient. Lintel deflections are also displayed for service dead and live loads. Service level loads are used for deflection calculation even if strength design is used to proportion the lintel.

The "Lintel" icon or the "Design" drop-down menu is used to activate lintel design. The "Design Data" tab (Figure 13) will first appear. The design shear and moment can be input by the designer, or, if "Compute using load data"

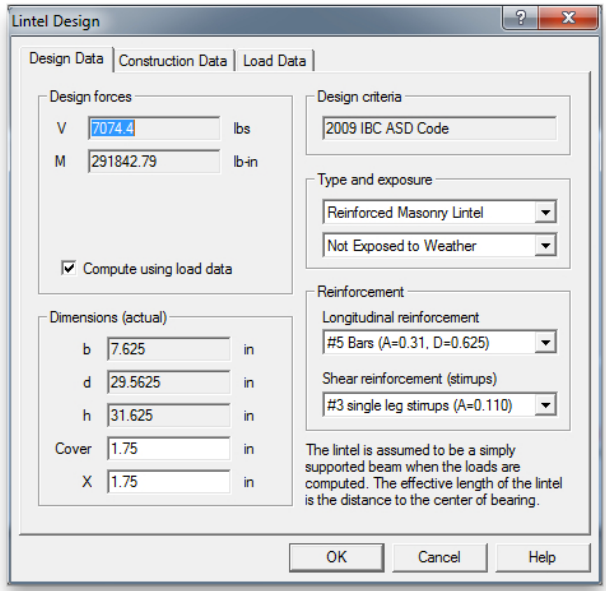

Figure 13—Lintel Design Data Tab

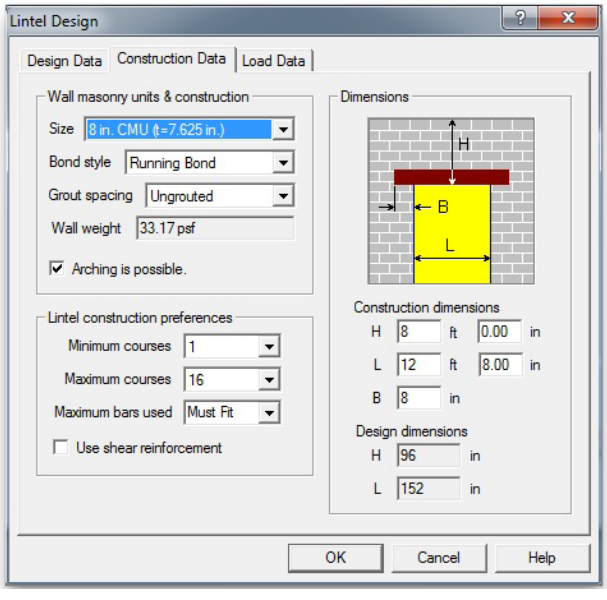

Figure 14—Lintel Construction Design Data Tab

is selected, the software will calculate the critical values of shear and moment based on input loads and geometry. Dimensions (*b*, *d* and *h*) are calculated by the software, not input by the user. Cover and distance from the bottom of the reinforcing steel to the bottom of the lintel (*X*) must also be input. The variable *X* is included to accommodate masonry bond beam units (units with recessed webs) used as a bottom course of the lintel. When these units are used, the reinforcement must be significantly farther from the bottom of the lintel or, if the architectural features of the unit permit, it can be placed upside down in the wall with the longitudinal reinforcement tied to hold it up in place.

Under "Type and Exposure," the type of lintel (masonry or precast concrete) and exposure to weather are selected. Finally, the bar size designation for longitudinal reinforcement and stirrup size and configuration are selected.

Under "Construction Data" (Figure 14), the user inputs the thickness of the wall in which the lintel is embedded along with bond pattern, extent of grouting in the masonry above the lintel, and whether or not arching is to be used. If the ratio H/L is too small or if the masonry is not constructed in running bond, arching will not be used regardless of whether the box is checked. Wall weight is displayed based on material densities selected in "Design Basis" and on extent of grouting.

Using "Lintel construction preferences," the user can affect the dimensions calculated by the software. A minimum and maximum number of courses and maximum number of longitudinal reinforcing bars can be chosen from drop-down menus. Also, the user can select whether or not shear reinforcement is to be used. If it is, the required width of the lintel to accommodate the stirrup and longitudinal reinforcement will be significantly increased. Finally the values of H, L and B are entered under "Construction Dimensions."

The "Load Data" tab is needed only if "Compute using load data" is selected on the "Design Data" tab. Three types of loads are permitted: uniform, joist and point loads. The location of each type of load must also be input. For example, a uniform load does not have to span the entire opening. In this case, the value of S_w and S_o are used to define where the load starts and stops. The self weight of the lintel and the wall above it are calculated by the software and are not to be included in the user input value of dead load.

When all data is entered, selecting OK prompts the design calculation sheet to appear (Figure 16). In addition to displaying the input, the lintel sizes (b, d and h) are displayed along with the required area of steel and number of reinforcing bars. Moment capacity, deflection and lap splice and development lengths are also provided.

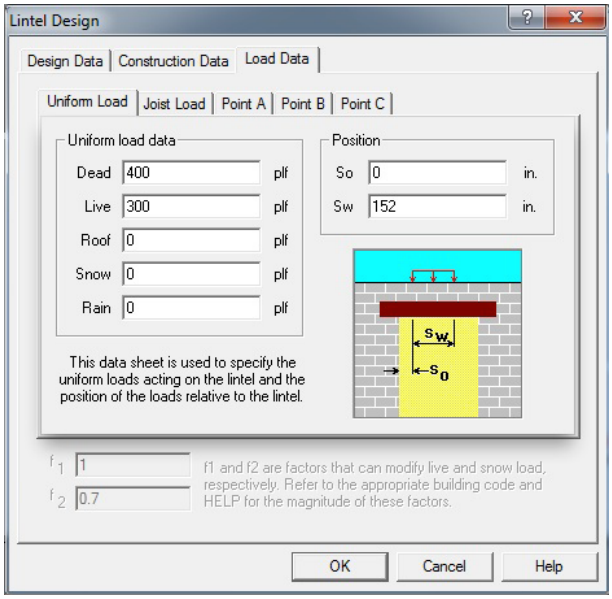

Figure 15—Lintel Design Load Data Tab

COLUMN DESIGN

Column provisions are very similar to those for shear wall design (Reference 10 provides an overview of masonry column design), with the main difference in the "Reinforcement" tab (Figure 17). The user can specify up to eight layers of reinforcing steel in a concrete masonry or clay masonry column. Columns are assumed to be symmetric, so only four of the eight layers need be identified. In the example shown in Figure 17, the column has four layers of reinforcement. Note that the figure displayed is generic and is not indicative of the number of units or reinforcing bars used in the design. All cells including the central core are solidly grouted in the design. Layers d_1 are symmetric about the column's axis of bending and include three No. 7 (M#22) bars located at 5.4 in. (137 mm) on each side of the axis. Layers d_2 include two No. 7 (M#22) bars located

Required Cross-Sectional Dimensions
- b = 7.625 in. (Specified)
- x = 1.75 in. (Specified)
- h = 31.63 in. (4 courses used)
- d = 29.56 in. (Computed for bars and dimensions specified)

Check Shear Capacity
- Maximum Permitted V = 8730 lbs without stirrups
- OK – Shear capacity is acceptable

Compute Required Steel Area
- Computing balanced conditions
- K_b = 1 / [1 + 24000/[21.4815(500)]] = 0.3092
- J_b = 1 - 0.3092/3 = 0.8969
- d_b = sqrt[(2(291843))/(500(0.3092)0.8969(7.625))] = 23.5 in

Section is under-reinforced – F_s controls

Conditions for this section
- K = 0.2529
- J = 1 - 0.2529/3 = 0.9157
- A_s = 0.449 sq.in (Required)

Use 2 #5 Bars (A_s Provided = 0.62 sq.in)
- Final K = 0.2897
- M_{max} = 397409 lb-in
- I_{cr} = 7469.05 in^4
- M_{cr} = 152521 lb-in
- I_{eff} = 9271.69 in^4
- Maximum deflection = -0.06215 in.
  - Maximum allowable deflection at L_e/240 = 0.6667 in.
  - Maximum allowable deflection at L_e/360 = 0.4444 in.
  - Maximum allowable deflection at L_e/600 = 0.2667 in.

Figure 16—Lintel Design Calculations Output

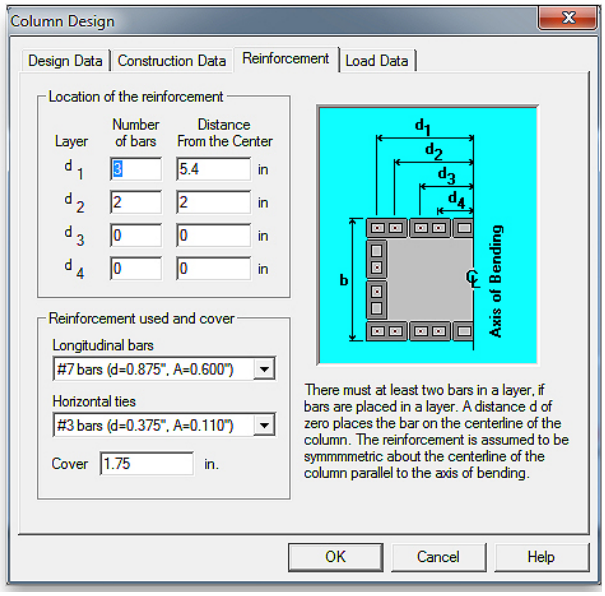

Figure 17—Column Reinforcement Data

at 2 in. (51 mm) on each side of the axis.

Allowable stress design and strength design procedures are supported, and code provisions such as maximum axial load or maximum steel area are calculated. Interaction diagrams can be displayed and compared to calculated axial loads and bending moments. The shearing force capacity is also calculated and compared to calculated design shearing forces. If needed, shear reinforcement (in the form of column ties) can be used to resist shear forces.

SUMMARY

Software to structurally design masonry has the capability to design masonry elements constructed with either hollow concrete masonry units or hollow clay masonry units. Masonry elements include lintels, walls loaded out-of-plane, shear walls and masonry columns using the newest building codes (IBC 2009 and MSJC 2008). Elements can be designed using allowable stress design or strength design and, with the exception of columns and lintels, can be either reinforced or unreinforced.

A free trial version of the software is available for download at http://www.ncma.org/Pages/StructuralMasonryDesignSoftware.aspx.

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4. *Building Code Requirements for Structural Concrete*, ACI 318-05. American Concrete Institute, 2005.
5. *Compressive Strength Evaluation of Concrete Masonry*, TEK 18-1A. National Concrete Masonry Association, 2004.
6. *Strength Design Provisions for Concrete Masonry*, TEK 14-4B. National Concrete Masonry Association, 2008.
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8. *Allowable Stress Design of Concrete Masonry Lintels*, TEK 17-1C. National Concrete Masonry Association, 2009.
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10. *Allowable Stress Design of Concrete Masonry Columns*, TEK 17-3A. National Concrete Masonry Association, 2001.

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ICON EXPO SCHEDULE OF EVENTS

7:00 AM, 7:15 AM, 7:30 AM, 7:45 AM, 8:00 AM, 8:15 AM, 8:30 AM, 8:45 AM, 9:00 AM, 9:15 AM, 9:30 AM, 9:45 AM, 10:00 AM, 10:15 AM, 10:30 AM, 10:45 AM, 11:00 AM, 11:15 AM, 11:30 AM, 11:45 AM, 12:00 PM, 12:15 PM, 12:30 PM, 12:45 PM, 1:00 PM, 1:15 PM, 1:30 PM, 1:45 PM, 2:00 PM, 2:15 PM, 2:30 PM, 2:45 PM, 3:00 PM, 3:15 PM, 3:30 PM, 3:45 PM, 4:00 PM, 4:15 PM, 4:30 PM, 4:45 PM, 5:00 PM, 5:15 PM, 5:30 PM, 5:45 PM, 6:00 PM, 6:15 PM, 6:30 PM, 6:45 PM, 7:00 PM, 7:15 PM, 7:30 PM, 7:45 PM, 8:00 PM, 8:30 PM, 9:00 PM

MON., March 21

NCMA	NCMA Executive Committee; NCMA Associate Member Division Board; NCMA Education & Training Committee
ICPI	ICPI Education Registration; ICPI Executive Committee Meeting
ICPI Education	ICPI Concrete Paver Installer Course (Day 1 of 2); ICPI ICIM Paver Technician Course (Day 1 of 2); ICPI Permeable Pavement Specialist Course (Day 1 of 2)
Registration	ICON EXPO Registration

TUES., March 22

NCMA	NCMA Masonry Technical Subcommittee; Environmental Health & Safety Subcommittee; NCMA Government Affairs Committee; NCMA SRW Technical Subcommittee; NCMA Masonry Workforce Development Comm.; NCMA Masonry Marketing Subcommittee; NCMA SRW Marketing Subcommittee; NCMA PAC Reception
Combined	ICPI / NCMA Hardscapes Initiative Meeting
ICPI	Hardscapes North Amer. Steering Committee; ICPI Executive Committee Meeting; ICPI Education Registration; ICPI Concrete Paver Installer Course (Day 2 of 2); ICPI ICIM Paver Technician Course (Day 2 of 2); ICPI Permeable Pavement Specialist Course (Day 2 of 2)
Education	CONEXPO Education; CONEXPO Education; CONEXPO Education; CONEXPO Education
Registration	ICON EXPO Registration
Tradeshow	Exhibits Open

WED., March 23

NCMA	NCMA Council Past Chairman of the Board; NCMA Masonry Committee; NCMA Member Recruitment Committee; NCMA Membership D&B; NCMA Business Lunch; NCMA SRW Contractor Subcommittee; NCMA Articulated Concrete Block Subcommittee; NCMA Foundation Endowment Committee
Combined	ICPI/NCMA Expo and Meetings Committee; NCMA/ICPI Safety Awards; NCMA/ICPI Joint Member Reception
ICPI	ICPI Government Relations Committee; ICPI Found. Prog. Comm.; ICPI Foundation Trustees; ICPI Contractor Education Subcommittee
Education	CONEXPO Education; CONEXPO Education; CONEXPO Education; CONEXPO Education
Registration	ICON EXPO Registration
Tradeshow	Exhibits Open

THURS., March 24

NCMA	NCMA SRW Committee; NCMA Executive Committee; NCMA Foundation Program Review Committee; NCMA Foundation Finance and Investment Finance Committee; NCMA Foundation Board of Trustees
ICPI	ICPI Chapter Subcommittee; ICPI Brunch Session; ICPI Construction Committee; ICPI Marketing Committee; ICPI PAC Reception
CSI	CSI Monsoon Dinner
NCMA Education	NCMA SRW Installer Certification Course
Education	CONEXPO Education; CONEXPO Education; CONEXPO Education; CONEXPO Education
Registration	ICON EXPO Registration
Tradeshow	Exhibits Open

FRI., March 25

NCMA	NCMA Board of Directors
ICPI	ICPI Technical Committee; ICPI Dues, Bylaws and Membership Committee; ICPI Board of Directors Meeting
CSI	CSI Board Meeting
NCMA Education	NCMA SRW ADVANCED Installer Certification Course
Education	CONEXPO Education; CONEXPO Education; CONEXPO Education; CONEXPO Education
Registration	ICON EXPO Registration
Tradeshow	Exhibits Open

SAT., March 26

ICPI	ICPI Board of Directors
Registration	ICON EXPO Registration
Tradeshow	Exhibits Open

KEY: NCMA Events; ICPI Events; Joint Events; CONEXPO-CON/AGG; CSI

WELCOME TO ICON EXPO 2011

NCMA HIGHLIGHTS

NCMA PAC RECEPTION

Tuesday, March 22 – 6:30 pm - 8:00 pm

Join your politically minded colleagues for an evening of food, drink and merriment at the ever-popular Political Action Committee (PAC) Reception. Join other members and spouses in NCMA's effort to raise visibility and support for the NCMA PAC's continuing mission to promote federal candidates who share industry view on issues that directly affect your business and the concrete masonry and hardscape industry.

NCMA/ICPI ANNUAL SAFETY AWARDS

Wednesday, March 23 – 6:30 pm - 7:30 pm

Join us to honor the winners of the NCMA/ICPI annual Safety Awards. This important industry event will not only highlight the safety-conscious Producer and Associate members of both organizations, but recognize member production facilities with the best recordable injury rates. Come see who will win the coveted Milestone Award, and who will walk away with a Platinum "Outstanding", or Gold or Silver "Excellence" award. Finally, the evening will culminate with networking, good food & drink at the very popular Member Reception (separate registration fees apply). This is one event you don't want to miss!

JOINT NCMA/ICPI MEMBER NETWORKING RECEPTION

Wednesday, March 23 – 7:30 pm - 9:30 pm

Join NCMA Chairman Mark Wilhelms, ICPI Chairman Roberto Nicolia and members for this highly anticipated and attended networking reception. Must be registered for a convention package to attend. **Premiere Sponsor: CCMPA**

ICON EXPO HIGHLIGHTS

ICON EXPO BOOKSTORE

The ICON EXPO Bookstore features publications on concrete masonry and hardscape issues pertinent to attendees and exhibitors; a collection of design, construction, technical and marketing material. Publications from NCMA, ICPI, CSI, PCA and other organizations are on display and available for purchase at member prces for all trade show attendees. The bookstore is conveniently located in ICON EXPO and is open during show hours.

NCMA RESEARCH & DEVELOPMENT LABORATORY

The ICON EXPO Lab booth will feature displays and demonstrations of testing methods used for concrete masonry and hardscape products. The booth is staffed by professional lab personnel who are able to answer questions related to testing procedures and product specifications.

OPTIONAL EVENTS

NCMA BUSINESS LUNCHEON

Wednesday, March 23 – 12:00 pm - 1:30 pm

Member $50 / Non-member: $60

Join NCMA members at the Las Vegas Convention Center for the 11th annual Business Luncheon where an industry specialist will present on this year's hot topic.

HOOVER DAM TOUR

Wednesday, March 23 – 11:00 am - 3:00 pm

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NCMA SPOUSE/ COMPANION PROGRAM

The following events are included in the NCMA Spouse/ Companion registration. All tours will depart from the Cosmopolitan of Las Vegas Resort & Casino.

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Tuesday, March 22

9:00 am - 11:00 am

GAMING LESSONS

Tuesday, March 22

2:00 pm - 4:00 pm

AFTERNOON WITH A SHOWGIRL

Thursday, March 24

8:45 am - 12:00 pm

NEON GRAVEYARD TOUR (OPTIONAL)

Friday, March 25

1:00 pm - 4:30 pm

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SIMULTANEOUS TRANSLATION IN SPANISH

	AGGREGATES	ASPHALT	CONCRETE	EARTHMOVING & SITE DEVELOPMENT	EQUIPMENT ASSET MANAGEMENT	MANAGEMENT BEST PRACTICES	WORKFORCE DEVELOPMENT	RECYCLING/ SUSTAINABILITY	SAFETY
7:30–9:00am	T-11 Managing Quarry Operations in Tough Financial Times T-12 Finding Value: Advancements for Waste Fines & Water Recovery	T-13 Parking Lot Paving—A Guide to Success	T-14 How to Produce Consistent Color in Concrete Production ICON EXPO SUPPORTED	T-15 It's Getting Easier Being Green		T-16 Pricing Your Product in a Hyper-Competitive Market ICON EXPO SUPPORTED		T-17 Enhancing the Sustainability of Concrete Pavements	T-18 How to Reduce Project Risk & Increase Profitability
9:30–11:00am	T-21 RFID/Wireless Technologies Practices for the Bulk Materials Industry	T-22 Best Paving Practices	T-23 New Pavement Design Methods—Effects on Operations	T-24 Purchasing Earthmoving Equipment—How to Decide New vs. Used		T-25 Healthcare Reform Implementation—A Business Owner's Guide	T-26 How to Maximize & Manage Your Field Production ICON EXPO SUPPORTED	T-27 Asphalt Shingle Recycling—An Economic Advantage	T-28 Energize Your Safety Training Programs ICON EXPO SUPPORTED
1:00–2:30pm		T-31 Porous Asphalt Pavements for Stormwater Management	T-32 How to Evaluate Concrete Mix Designs & Specifications ICON EXPO SUPPORTED	T-33 Expanding Your Earthmoving Business Services	T-34 Applications of Renewable & Alternative Energy Uses for the Equipment Industry	T-35 How to Secure the Most Profitable Projects in Your Market Area ICON EXPO SUPPORTED	T-36 Workforce 2012 & Beyond—Opportunity or Peril? ICON EXPO SUPPORTED	T-37 Triple Your Company's Bottom Line Through Sustainability ICON EXPO SUPPORTED	T-38 Cutting-Edge Safety Training for Roadway Construction
3:00–4:30pm		T-41 Quality Milling to Achieve Smoothness	T-42 Concrete Construction & Mother Nature	T-43 Introduction to Adopting Positioning Technology for Earthmoving Equipment	T-44 Crane Fleet Maintenance T-45 Effective Decision Making with Telematics Based Fleet Management Solutions ICON EXPO SUPPORTED	T-46 Estimating & Bidding—Overhead Recovery ICON EXPO SUPPORTED		T-47 Using Concrete Masonry to Build Energy-Efficient Buildings & Homes ICON EXPO SUPPORTED	T-48 Jobsite Audit—How to Stay Compliant with DOT, OSHA & EPA Regulations ICON EXPO SUPPORTED
7:30–9:00am	W-11 Maximizing Plant Productivity with Benchmarking & Performance	W-12 Slag—A Dynamic Construction Material	W-13 Resisting Scaling & Freeze-Thaw Damage—A Team Effort			W-14 Unlimited Alternative to Money—Business-to-Business Credit ICON EXPO SUPPORTED	W-15 The Accidental Boss ICON EXPO SUPPORTED	W-16 Sustainable Asphalt Pavements W-17 Sustainable LEED-Certified Fleet Facility Operational Planning or Renovation	W-18 How Leadership Behaviors Affect Health & Safety Management Systems ICON EXPO SUPPORTED
9:30–11:00am	W-21 Overcoming Community Opposition	W-22 Compaction Best Practices	W-23 How to Deal With Cracking of Concrete	W-24 Heavy Equipment Contractors—You're not Sellin', They're Buyin'!		W-25 The Economic Outlook for the Construction Industry	W-26 Effective Discipline ICON EXPO SUPPORTED	W-27 Optimizing Concrete Mixtures for Sustainability & Performance ICON EXPO SUPPORTED	W-28 Establishing Safety Expectations ICON EXPO SUPPORTED
1:00–2:30pm	W-31 Advanced Crusher Performance Management	W-32 Understanding Warm-Mix Asphalt	W-33 Pumping Air-Entrained Concrete	W-34 Maximizing Productivity & Improving Excavator Skills	W-35 Know Your Costs or Fly Blind ICON EXPO SUPPORTED	W-36 The Great Myths & Mistakes of Sales & Marketing ICON EXPO SUPPORTED		W-37 New Developments In Concrete & Asphalt Recycling	W-38 Highlights of Changes to OSHA Crane Rules/ New OSHA Crane Standard
3:00–4:30pm		W-41 A Guide to Full-Depth Reclamation	W-42 Design & Construction of Concrete Parking Areas & Site Paving	W-43 Directional Boring: Improving Accuracy & Production	W-44 Delaying Capital Expenditure—There Is No Such Thing as a Free Lunch	W-45 Assuring the Successful Continuation of Your Family Business ICON EXPO SUPPORTED	W-46 The Road Signs of Leadership ICON EXPO SUPPORTED	W-47 The Application of Ecosystem Services Reviews & Ecosystem Valuation Models at Construction Materials Sites	W-48 Safety Risk Management for Construction & Mining ICON EXPO SUPPORTED
7:30–9:00am	TH-11 Automating the Quality Control Process	TH-12 Building Joints That Last	TH-13 The Future of Concrete Dispatching		TH-14 Success & Challenges of Off-Road Diesel & Portable Engine Regulations	TH-15 Cash Management & Forecasting Through Tough Times ICON EXPO SUPPORTED	TH-16 Taking the Mystery Out of Managing Across Cultural Barriers	TH-17 Solar Energy Augmentation for Asphaltic Concrete Plants	TH-18 SAFE Program—A Unique Approach to Safety! ICON EXPO SUPPORTED
9:30–11:00am	TH-21 Game Change for Profit in Quarry Operations		TH-22 Roller-Compacted Concrete Pavements: Applications, Design & Construction TH-23 Quality Control—Reducing Concrete Variability ICON EXPO SUPPORTED	TH-24 Securing NRCS, USDA Federal Contracts: A Primer	TH-25 Efficiently Maintaining a Fleet with Today's Changing Environmental Restrictions	TH-26 How to Build Repeat & Referral Business	TH-27 Control-Point Productivity for Today's Ultra-Busy Professional		TH-28 Crane Safety Through Professional Equipment Management
1:00–2:30pm	TH-31 The Basics of Screening		TH-32 Troubleshooting Myths in Concrete Construction	TH-33 Excavation Contractor Utility Disruption	TH-34 Interim Tier4 & Non-Attainment—Impact on Our Business	TH-35 Using Online Social Media to Get Construction Work	TH-36 Generational Diversity—Making It Work in the Workplace ICON EXPO SUPPORTED		TH-37 Managing System-Driven Incidents—A Holistic Approach TH-38 Best Practices in Aerial Work Platform Training
3:00–4:30pm	TH-41 Washing 101	TH-42 Energy Efficiency at the Plant	TH-43 Why Pump Concrete?	TH-44 The 10 Myths of Equipment Security ICON EXPO SUPPORTED	TH-45 The Disappearing Workforce: Strategies for Avoiding a Future of Limited Resources ICON EXPO SUPPORTED	TH-46 Are Your Business Practices Ruining Your Financial Success? ICON EXPO SUPPORTED	TH-47 Business-to-Business Negotiating Skills ICON EXPO SUPPORTED		TH-48 Eliminating the Cost of Avoidable Injuries in the Manufacturing Plant ICON EXPO SUPPORTED
7:30–9:00am	F-11 Leverage Community Relations to Achieve Maximum Operational Goals	F-12 RAP-Up	F-13 Going Lean at Concrete Products Manufacturing Facilities F-14 The Volumetric Mixer in Today's World ICON EXPO SUPPORTED		F-15 Identifying Levels of Contamination in Hydraulic Systems ICON EXPO SUPPORTED	F-16 How To Contract For Today's Tough Economy & Evolving Technology ICON EXPO SUPPORTED		F-17 Selling Concrete for LEED Projects ICON EXPO SUPPORTED	F-18 Confined Space & Excavation Safety: What You REALLY Need to Know
9:30–11:00am		F-21 Maximizing HMA Productivity Through Efficient Rolling Patterns	F-22 Self-Compacting Concrete & Self-Consolidating Grout—Leveraging the Advantages ICON EXPO SUPPORTED	F-23 Tips on Working with Your Federal & State Legislators	F-24 Fleet Equipment Strategies—Repair vs. Replace vs. Rebuild vs. Scrap ICON EXPO SUPPORTED	F-25 Employee Benefits & Prevailing Wage Workshop ICON EXPO SUPPORTED	F-26 Project Management Essentials—Planning that Boosts Coordination, Control, and Cash Flow	F-27 Advances in Pervious Concrete Technology	F-28 Health in the Workplace—Silica & Ergonomic Considerations ICON EXPO SUPPORTED
1:00–2:30pm	F-31 Correct Operations & Tuning of a Vertical Shaft Impact Crusher F-32 Is Tire Slippage Robbing You of Production?		F-33 Supplementary Cementitious Materials for Use in Concrete ICON EXPO SUPPORTED	F-34 Avoiding the 10 Critical Business Insurance Mistakes	F-35 Benchmarking for Asset Managers ICON EXPO SUPPORTED	F-36 Building a Blog for the Construction Industry & Marketing With It ICON EXPO SUPPORTED		F-37 How to Become a Sustainable Production Facility ICON EXPO SUPPORTED	F-38 Avoiding Safety Discrimination Claims under the Mine Act & OSHA Act ICON EXPO SUPPORTED
3:00–4:30pm			F-41 Efflorescence Control for Concrete Products ICON EXPO SUPPORTED		F-42 Communicating with Your Top Executives— A How-To Guide ICON EXPO SUPPORTED	F-43 Ethics & Compliance—Make it Pay Off F-47 Know Your Numbers—The Metric of Success		F-44 New Opportunities with Permeable Interlocking Concrete Pavement ICON EXPO SUPPORTED	F-45 Surviving an OSHA or EPA Plant Inspection F-46 Concrete Pump Co-Worker Safety ICON EXPO SUPPORTED

Visit www.iconexpo.org to view a full listing of sessions and their descriptions.

A LOOK AHEAD AT THE 112th CONGRESS

Overview

The ascendance of the Republicans to control of the House of Representatives in the recent midterm election has raised new pro-business expectations for the 112th Congress. Despite the Democrats holding on to the Senate as well as the White House, Republicans will have significant input on the Obama Administration's legislative and policy agenda. Heeding the voters' call for jobs, Republicans will pursue a different economic policy agenda, rejecting the stimulus plans of the Democrats and seeking to spur economic growth and job creation through lower taxes and less regulation. As such, there will be a great deal of debate about individual and business taxes in both the lame duck session of the current Congress and after January and this will be tied to attempts to rein in regulation as seen in the health care and financial services reform bills. Issues like "cap & trade" and "card check" are dead in their current legislative form, but could re-emerge in the regulatory arena. Lastly, the need to address the nation's deteriorating infrastructure will not go away with a simple transfer of political power but the debate about how best to generate jobs and revive the economy will be joined.

With the new, divided power structure in Washington, NCMA will have opportunities in several policy areas such as taxes, health care, energy, environment, and infrastructure. Below is a discussion in more depth and detail on key issues and what the future might hold.

Health Care

LAW WILL BE CHALLENGED

The recently enacted Patient Protection and Affordable Care Act (PPACA) played a major role in the rise of the Tea Party, which characterized the law as a government takeover of the individual's health care. Republicans used the unpopularity of the law, referred to by opponents as "Obamacare," as a key campaign advantage, promising to repeal it altogether. Several conservative Democrats also advertised their opposition to the bill in an attempt to maintain their congressional seats. Speaker of the House John Boehner (R-Ohio) immediately confirmed intentions to repeal health care as a top GOP priority in the 112th Congress but declined to provide a timetable for such an effort next year only saying that the chamber would act quickly.

THE COURTS WEIGH IN

The unpopularity of the bill certainly helped Republicans at the polls in November and three states took another step by allowing voters to vote on constitutional amendments to ban enforcement of the health reform law's individual mandate, easily the most unpopular provision of the PPACA. Two states, Oklahoma and Arizona passed their bans while Colorado voted narrowly rejected theirs. If the courts determine that the PPACA is constitutional, the states cannot prevent its implementation.

HEALTH CARE IMPACTS SMALL BUSINESS

A very controversial provision of the PPACA bill is the new requirement for businesses to issue tax forms to all vendors that they do more than $600 of business with each year. The provision—known informally as the "1099 Form" would take effect in 2012 and would raise over $18 billion to help pay for the health care reform law. Business groups have maintained that the provision would financially crush thousands of small-and-medium-sized businesses who work for these companies. A new tax bill being crafted by Sen. Max Baucus (D-Mont.) would do away with the provision altogether.

Tax Debate Results in Compromise Deal for Extension of Bush Tax Cuts, Revived Estate Tax

The debate over tax cuts was resolved in early December when the White Hose and Congressional Republicans struck a deal to temporarily extend the 2001 & 2003 Bush tax cuts which was signed into law on December 17. The $858 billion Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 extends through 2012 all Bush-era tax reductions on income, capital gains and dividends. It also continues expanded unemployment insurance benefits through 2011, cuts payroll taxes by 2% during 2011, places a two year patch on the alternative minimum tax (AMT), and lets businesses write off 100% of capital investments between Sept. 9, 2010, and Dec. 31, 2011. Finally, the bill revives the estate tax with a top rate at 35% and gives a $5 million tax-free allowance per individual, or $10 million per couple. When first unveiled, many Congressional Democrats accused President Obama of surrendering to Republicans but when the final votes were counted, most fell in line and supported the deal after it was clear that the deal was a "take it or leave it" situation for Congressional Republicans.

THE BUSH–ERA TAX CUTS

Prior to the election, Congressional Democrats decided to punt on a vote to extend the Bush 2001 and 2003 tax cuts fearing that such a vote would imperil a number of the members just before the election. The election results, with the Republicans taking over the House and eroding the large Democratic majority in Senate, caused the President to seek a deal prior to the beginning of the 112th Congress before Democrats were in a weaker negotiating position. Congressional Democrats favored raising taxes on households earning more than $250,000 a year while extending tax breaks for those who made less. Congressional Republicans have argued for a permanent extension of the tax rates maintaining that raising taxes on anyone in a recession would damage the economy. At the end of the day, both sides backed off and found a middle position which puts off debate on the issue for at least a year.

ESTATE TAX

Another top issue in the debate is that of the Estate Tax, which expired in January 2010, but was set to return in full force at pre-2001 levels one year later, which means estates worth more than $1 million, will be hit with a tax that could be as high as 55 percent. Democratic leaders and the president wanted to resuscitate the 2009 law, which placed a 45-percent tax on estates exceeding $3.5 million. However, a bipartisan proposal by Sens. Jon Kyl (R-Ariz.) and Blanche Lincoln (D-Ark.), which would have increased those figures to 35 percent and $5 million respectively, was the final position as the deal was struck. This issue, along with the tax cuts for earners over $250,000, caused much anger among Congressional liberals with Sen. Bernie Sanders (I-Vt.) conducting a 9 hour one-man filibuster in the Senate on December 10. Despite the outcry, the final estate tax deal stayed in place in the bill.

ALTERNATIVE MINIMUM TAX

This resolution to the alternative minimum tax (AMT) debate was comparatively easy as there was agreement between Republicans and Democrats on the need to address this tax which has hit millions of middle-class taxpayers than was originally intended when it was introduced in 1969. The leaders of the Senate Finance Committee and the House Ways and Means Committee had written to the IRS Commissioner promising that "we plan to do everything possible to enact AMT relief legislation in a form mutually agreeable to the Congress and the President." The AMT was addressed in the tax cut extension bill with a two-year AMT "patch" for 2010 and 2011 will keep the AMT exemption near current levels and allow personal credits to offset AMT. Without the patch, an estimated 21 million additional taxpayers would have owed AMT for 2010.

Energy

CAP & TRADE SHORT-CIRCUITS

Immediately before the midterm elections, it became clear that the Democrats' plans to advance comprehensive legislation containing provisions capping greenhouse emissions and establishing the Renewable Energy Standards ("RES") were likely to fail. The entire Republican caucus in the Senate and some Democrats opposed the legislation, arguing that implementing cap-and-trade would be equal to imposing a new business tax that would result in a loss of millions of jobs. Moreover, the Republicans insisted that the costs resulting from the programs established by the bill would eventually be passed on to consumers and, finally, that cap-and-trade could force manufacturers to move businesses and jobs overseas.

The Senate Democrats conceded they could not obtain enough votes to pass the bill and decided to push for less controversial energy legislation that would focus on the response to the oil spill in the Gulf of Mexico and force British Petroleum to pay for clean-up efforts there. This alternative bill was also to include provisions facilitating creation of clean energy jobs, provisions incentivizing home owners to make their homes more energy efficient and promoting natural gas fueled heavy vehicles. It is yet unclear whether this lighter version of the bill will pass during the lame duck session of Congress. Yet the President has wide authority to implement his policies through executive orders and administrative action. It is possible, therefore, that President Obama will use his executive authority to issue regulations to reduce greenhouse gas emissions.

Environment

CAP & TRADE 2.0?

Sen. Jay Rockefeller (D-W. Va.) is trying to push forward a bill during the lame duck session of Congress that would suspend for two years the Environmental Protection Agency's ("EPA") regulation of greenhouse gases, including those emitted from burning coal. According to proponents of the bill, a two-year suspension is necessary to give the coal industry time to develop clean technologies and also to allow Congress to address the complicated greenhouse gas regulation issue. The bill's supporters claim that decisions regarding clean coal and the Nation's energy future must be put into the hands of elected representatives rather than a federal agency.

Using authority to regulate "pollutants" under the Clean Air Act, EPA seeks to impose new permitting restrictions on greenhouse gases that could effectively stop new construction on industrial projects for at least two years. The EPA regulation of greenhouse gas emissions would most certainly raise the cost of all forms of energy, including coal, electricity and gasoline. Additionally, if EPA is successful in implementing its greenhouse gas agenda, it will likely frustrate American manufacturing and may eventually close down a number of plants, which, in turn, will result in even higher levels of unemployment. Moreover, if the EPA was allowed to regulate greenhouse gas emissions, this would create a controversial legal precedent of leaving for regulation what should be left to legislation.

Passage of the bill would prevent EPA from regulating pollution from large factories and utilities starting in January. Although it is unclear whether this proposal will be actively considered in the lame duck session, it is very likely that next year Sen. Rockefeller will reintroduce this proposal next year.

Infrastructure

HIGHWAY BILL REAUTHORIZATION—BIPARTISANSHIP STILL WORKS HERE

Due to a lack of agreement with respect to funding and because of other unresolved issues, including extension of the tax cuts implemented under the Bush administration, Congress is unlikely to pass a long-term reauthorization of the federal highway program during the lame-duck session. However, the current authorization of the program, which is set to expire on December 31, will probably be extended at least for several months into 2011.

Last year the reauthorization of the federal highway program was delayed because the fuel tax, which has not been increased since 1993, did not derive enough revenue to fund highway needs as cars and trucks continued getting more efficient. Moreover, in the last two years, Congress was forced to take billions of dollars from general revenues to prevent the Highway Trust Fund's insolvency. Rep. James Oberstar (D-Minn.), chairman of the House Transportation and Infrastructure Committee, who will be replaced in January by Rep. John Mica (R-Fla.), have been trying to persuade his fellow congressmen to obtain financing for his $450 billion six-year reauthorization proposal, but the required tax increase was opposed by many of his colleagues and by the Obama administration.

Although 18 out of 45 Democrats on the House Transportation and Infrastructure Committee lost their elections and will be replaced, it appears that the passage of long-term reauthorization of the federal highway program remains a critical priority. Rep. Mica stated in the beginning of this year that there might be a possibility of getting a reauthorization bill passed in the first half of 2011. He noted that this would be feasible if the federal highway program was funded by something other than a fuel tax increase

Immigration Reform

A PERMANENT SOLUTION REMAINS ELUSIVE

The victory of the Republican party in the midterm elections will most likely reorient immigration policies towards enforcement and combating illegal immigration as opposed to expanding visa categories that would place legal immigration in due order. Advocacy groups likely to have influence in the new Congress, such as the Federation for American Immigration Reform, have declared that the immigration policy should be transformed so that it puts interests of Americans first, suggesting that this would mean strict enforcement of immigration laws and reduction of overall levels of immigration. Thus, comprehensive immigration reform regulating options for legal entry to the United States is at this point in question.

Conclusion

The new Congress will bring new challenges and opportunities for NCMA and its member companies, as it will for other competing industries. From changes to the health care reform bill to new tax regimes and regulatory proposals to new infrastructure projects, Washington will continue to have a huge effect on businesses and the choices they will make. There will be legislative opportunities to add value, a more directed focus to benefit small business, and a greater awareness of the limitations of government. The Republican House of Representatives can be expected to emphasize the importance of restoring a better balance between government and the private sector. CMD

ASSOCIATION NEWS

JOINT ACI/TMS 122 COMMITTEE FORMED TO UPDATE EXISTING ENERGY GUIDE

The American Concrete Institute (ACI) extended an invitation to The Masonry Society (TMS) to join forces with its Committee 122 to create a joint committee. TMS has accepted and in so doing, the name of the committee was changed from "Thermal Properties" to "Energy Efficiency of Concrete and Masonry Systems". The joint committee met last month at the ACI Fall Convention in Pittsburgh and is updating the current ACI 122 publication *Guide to Thermal Properties of Concrete and Masonry Systems*. The committee also is considering preparing new standards that may be referenced in building energy performance codes and standards.

During the convention the committee also sponsored a session entitled "Energy Conservation for Greener Buildings" to educate and update industry on current trends in codes and standards related to the thermal performance of concrete and concrete masonry buildings. The session was well attended and provided excellent information for the joint ACI/TMS 122 Committee. For more information contact Dennis Graber at dgraber@ncma.org.

A BOARD OF DIRECTORS ELECTIONS

Congratulations are extended to the following newly elected board members:

- Region I; **Barry Diller**, Nitterhouse Masonry Products, Chambersburg, PA, and **Keith May**, Peerless Block & Brick Company, St. Albans, WV.
- Region II; **Michael Carlson**, CEMEX, West Palm Beach, FL.
- Region III; **Carol Lee**, Lee Brick & Block, Bowling Green, KY and **Kent Wade**, Ruby Concrete Company, Madisonville, KY.
- Region IV; **R.G. Atwood**, Featherlite Building Products, Round Rock, TX and **Paul Valentine**, Oldcastle Architectural, Inc, Atlanta, GA.
- Region V; **Wade Ficklin**, Oldcastle Architectural-West, Phoenix, AZ and **Dennis Hite**, CEMEX, Henderson, NV.
- Region VI; **Bruce Dick**, Expocrete Concrete Products Limited, Saskatoon, SK and **Gary Belisle**, Group Permacon, Ville D'Anjou, PQ.

ASSOCIATE MEMBER DIVISION BOARD ELECTION

Congratulations are also extended to the following individuals who are newly elected to the Associate Member Division Board:

- **Marshall Brown**, ACM Chemistries, Norcross, GA;
- **Mike Mueller**, TEKA North America, Chesapeake, VA
- **Dave Sharp**, Columbia Machine, Vancouver, WA.

They will each serve a four-year term.

NCMA/ICPI SAFETY AWARDS PROGRAM 2010 ENTRY FORMS NOW AVAILABLE!

The **Safety Awards Program** recognizes safety-conscious Producer and Associate Members of the National Concrete Masonry Association (NCMA) and the Interlocking Concrete Pavement Institute (ICPI), as evidenced by exemplary safety records. Since the program's inception, participation has grown steadily to more than 100 entries last year. The **2010 Safety Awards** will be presented during the 2011 Annual Convention and International Concrete Exposition (ICON EXPO), held in conjunction with the CONEXPO-CON/AGG tradeshow in Las Vegas, March 22-26. Award recipients will also be recognized in *Concrete Masonry Designs* and in other trade publications. For more information and the entry form, go to the NCMA website, www.ncma.org, and look for 2010 Safety Awards page in the "Resources" section.

CANADIAN LEVY FUNDS HARD AT WORK

Professors at McMaster University, which houses the largest masonry-research team in North America, were recently recognized as the ASTM 2010 Alan H. Yorkdale award winners for the best peer-reviewed masonry paper published in the English language. The paper, written by Shedid, M.T., El-

IN MEMORIAM

ANTHONY FIZZANO, JR.

Anthony A. Fizzano Jr. "Tony" of Newtown Square, Pa., formerly of Ridley Township, passed away Nov. 15. Tony was a Vietnam veteran and was president of Fizzano Bros. Concrete Products Inc. Tony was an active member of NCMA—serving on the Foundation Committee, the Foundation Board of Trustees, the Government Affairs Committee, the Dues Committee and more. Tony was a Cornerstone member of the NCMA Foundation. The deepest sympathy is extended to the entire Fizzano family, friends and coworkers.

Dakhakhni, W. W. and R.G. Drysdale is titled, Alternative Strategies to Enhance the Seismic Performance of Reinforced Concrete-Block Shear Wall Systems and was first published in the American Society of Civil Engineers (ASCE) Journal of Structural Engineering. McMaster has been able to reach these high levels with continuous funding from the Canadian Concrete Masonry Producers Association's (CCMPA) levy fund for research and Natural Sciences and Engineering Research Council of Canada (NSERC) students. A mini-block machine worth $220,000 was donated to McMaster so that research can be undertaken. The professors thank the members for their support, saying "without this investment in McMaster, we would have never been able to reach the status we are at right now as the largest masonry research group in North America and to be awarded the prestigious award. On behalf of all my students, I sincerely thank all the members of CCMPA for your continuous support." Contact the Canadian Concrete Masonry Producers Association for more information (information@ccmpa.ca).

GOVERNMENT AFFAIRS

NCMA RESPONDS TO EPA'S PROPOSED RULE ON FLY ASH

NCMA has submitted a formal response in general opposition to the Environmental Protection Agency's (EPA's) notice of proposed rulemaking on coal combustion residuals (CCRs)—"fly ash" to our industry—from electric utilities.

NCMA's response culminated more than two years of advocacy by NCMA and other concrete industry association partners that matched rising intransigence on the part of

ONTARIO MASONRY DESIGN AWARDS

On Saturday, November 20th, The Ontario Masonry Contractors Association held its Inaugural Masonry Design Awards Gala recognizing engineers, architects, owners and masonry contractors for substantial, imaginative and creative uses of masonry in building design and construction. The event attended by more then 300 people was held at the majestic Liberty Grand, one of Ontario's masonry masterpieces built in 1929, in Toronto, Canada. This was a two-tiered competition, Regional and Provincial, with 11 Regional categories and 14 Provincial categories. Winners from the Regional awards were elevated to finalists for the Provincial level. The Canadian Concrete Masonry Producers Association was a proud Major Sponsor. The funds used for this sponsorship were directly from the Industry Levy Fund collected to promote the use of Masonry as the preferred construction material of choice. Log on to www.ontariomasonrydesignawards.com for more information

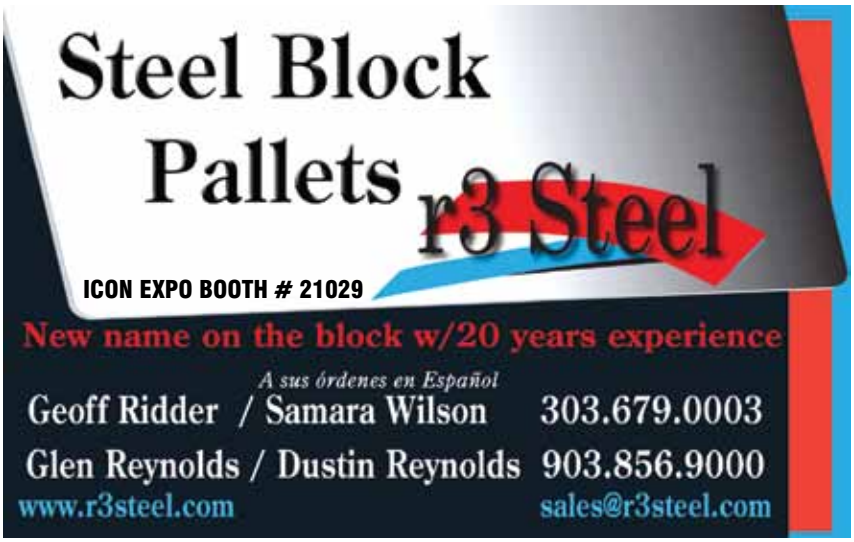
EPA as a well intended effort to regulate the disposal of coal combustion waste in the light of a recent environmental disaster in Tennessee shifted from improving containment design to a thinly veiled attack on the use of coal in the production of electricity.

Specifically, EPA proposed two options to address the disposal of CCRs from America's electric utilities. Under the first option, EPA would reverse its 1993 and 2000 regulatory determinations that CCRs were non-hazardous wastes and list them as "special wastes" regulated under subtitle C of the Resource Conservation and Recovery Act (RCRA). Under the second option proposed, EPA would leave the non-hazardous determinations in place and regulate disposal as non-hazardous under subtitle D of RCRA.

NCMA, and every other known concrete related association, responded in support of the schedule D option. Fly ash is an important component of durable, lightweight concrete masonry. True, fly ash is not used in all concrete masonry, but the performance of enough of our product benefits from this important recycled material that the potential loss of business to other non-concrete industries would be a serious blow to NCMA members, and an even possibly fatal one to the use of fly ash for high strength concrete in modern construction design.

Dozens of factors supported our position, but NCMA cited the most important in the letter. The chief ones were detrimental stigma – the fear of possible legal exposure by customers could lead to wholesale abandonment of fly ash concrete (especially if the material is dropped or negatively footnoted in building codes)—and loss of jobs in our industry from a potentially staggering loss of business. Others included infrastructural harm—the use of lesser performing alternate materials; non-applicability of EPA's approach —this is a containment issue, nota material issue; and over-reaction by EPA—penalizing the use of an important, safe construction material.

"This rule, in either form, makes no sense to our industry, America, and even the environment. EPA misses the mark by turning up the regulatory screws on the use of a safe material," said Bob Thomas, NCMA President, "instead of focusing on containment design that endangers the environment and clearly needs to be better regulated. It is improper to penalize an inert material like fly ash that is so beneficial to America's infrastructure. We hope that our comments will dissuade EPA from over-regulating with this rule." CMD



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AIA Continuing Education Learning Program

Learning Units Reporting Form

AIA Questions (Circle the correct answer)

1. Are there unique code requirements in different localities for fences or handrails?
   a. Yes
   b. No
2. Augering or driving through backfilled geogrid after wall construction is generally suggested
   a. True
   b. False
3. Fences and guardrails can be installed on top of or close behind the SRW units.
   a. Yes
   b. No
4. Traffic barriers do not require special design considerations.
   a. True
   b. False
5. What is NCMA recommendation for compaction equipment close to the face of the SRW facing?
   a. There isn't a special recommendation
   b. Only smaller, hand operated equipment is recommended within 3 ft (1 m) of the face of the wall.
   c. Large compactor equipment can be used for all the SRW construction.
6. What is the maximum recommended lift height to compact Reinforced soil on SRW constructions?
   a. There isn't special recommendations
   b. 4 in.
   c. 8 in.
7. What are the most common densities recommended on SRW constructions?
   a. 95% of the Proctor standard dry density
   b. 98 % of the Proctor standard dry density
   c. A to B
   d. There aren't special recommendations
8. Gravel fill can be any coarse material as long as the fine fraction is not more than 35%.
   a. True
   b. False
9. What erosion protection measures where provided on the Landel Residence project (page 9)?
   a. Riprap at the toe of the wall
   b. Increased embedment
   c. Nothing
   d. A and B
10. Is the SRW designer typically responsible for providing water conditions such as scour depths, water flow velocities and the details on an SRW design?
    a. Yes
    b. No

CONTINUING EDUCATION AIA

To receive one learning unit, read "SRW Flood Proofing in Kilkenny Drive" and "Hardscape North America SRW Award Winners", and complete the questions on this page. Return this form to the National Concrete Masonry Association.

Return forms before December 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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13750 Sunrise Valley Drive,
Herndon, VA 20171-4662,
or fax to NCMA at 703-713-1910.

If you have questions, please contact NCMA at 703-713-1900.

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