January | February 2012

CONCRETE MASONRY DESIGNS

NCMA/ICPI Design Award Winners

Designing Concrete Masonry Safe Rooms for New and Existing Homes

SRWs Provide a Solid Solution for Lake Erie Cliff Erosion Problems

ICON EXPO

The Evolution of Concrete Masonry

AIA Continuing Education Learning Program

NCMA CRASH COURSE WEBINARS

February 1, 2012

Is it a Workmanship or Production Issue?

Speaker: Mike Maroney

Knowing how to assess and address common field problems can be the difference between a highly successful and profitable job; and wishing the other guy won the bid. This course will review commonly encountered field problems and introduce attendees to a systematic approach of determining whether these issues are the result of product deficiencies or stem from workmanship defects. Recognizing that everyone's common goal is to quickly and efficiently resolve field issues to minimize project disruptions, course attendees will be introduced to a step-by-step process to getting projects back on track at minimal impact. Cost: $20.

For more information and to register, please visit the *Professional Development* section of www.ncma.org.

March 7, 2012

How to Design a Concrete Masonry Structure in 20 Minutes

Speaker: Jason Thompson

Description: To address the evolving problems associated with complicated and often confusing requirements of contemporary building codes, The Masonry Society created a new design standard, Direct Design Handbook for Masonry Structures (TMS 403), with one principal objective: make masonry design simple. Engineers, architects, building code officials, producers, and contractors – anyone engaged in concrete masonry construction needs to have this document at ready reference to ensure their next project safely and economically meets the requirements of the International Building Code. Course attendees will save time and money on their next concrete masonry project by employing the easy to follow approach – and International Building Code approved method – contained within the direct design standard. For a limited time, The Masonry Society is also offering a special discount price for the direct design standard for those attending this session. Cost: $20.

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CONCRETE MASONRY DESIGNS

January | February 2012

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.

Concrete Masonry Designs is published bi-monthly by the National Concrete Masonry Association (NCMA), and distributed to advance and support the concrete masonry and hardscape industry and public interest.

NATIONAL CONCRETE MASONRY ASSOCIATION
Sustainable Concrete Products for Structures and Hardscapes

Send address corrections and subscription inquiries to:
NCMA Sales and Marketing Department
13750 Sunrise Valley Drive
Herndon, VA 20171-4662
703-713-1900
Fax 703-713-1910
www.ncma.org

Publisher:
Robert D. Thomas

Editor:
Mary Arntson-Terrell, mterrell@ncma.org

Associate Editors:
Dennis W. Graber, P.E.
Gabriela Mariscal

Advertising:
Heidi Weiss, hweiss@ncma.org

STATE OF CALIFORNIA DEPARTMENT OF GENERAL SERVICES, CENTRAL UTILITY PLANT

PROJECT LOCATION
Sacramento, California

ARCHITECT
Nacht and Lewis Architects
Sacramento, California

MASONRY CONTRACTOR
SW Mertz Masonry Specialists
Winters, California

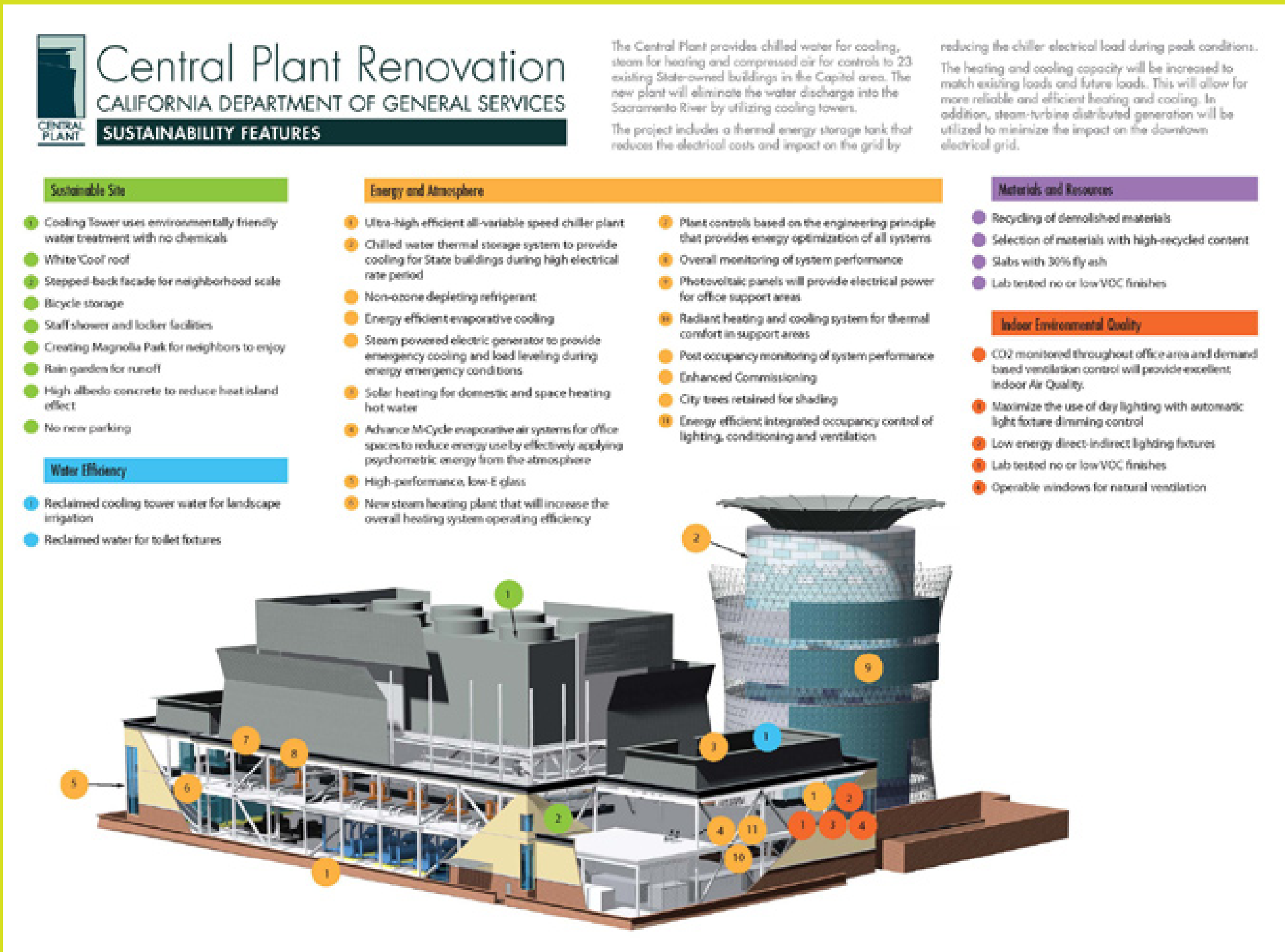
BLOCK PRODUCER
Basalite Concrete Products, LLC
Dixon, California

PHOTOGRAPHY
Ed Asmus Photography

Sacramento, California's capital, is the oldest incorporated city in the state. Its rich and vibrant history goes back to 1849. The city is currently the core cultural and economic engine of a four-county metropolitan area exceeding 2.1 million residents. The city's economy is broadly based, although government is by far the largest employer with 25 percent of California's 471,000 government employees. Transportation is a large sector along with information technology, leisure and hospitality, professional and business services, higher education, health services and research, and construction.

Sacramento also has plans to promote a more sustainable city over the next 30 years. The city has set policy guidelines for everything from the physical boundaries of the city to its economic growth and physical development for future development and preservation of resources.

Sacremento's environmental consciousness lead to Michael Parrott's, AIA, LEED AP, design of the new Department of General Services, Central Utility Plant. The 5,000,000 square-foot building (465,000 square meters) houses 20,000 employees in 23 buildings.



"The prime directives were to provide safe, reliable and efficient heating and cooling systems," said Parrott. "The design was required to respect character and functions of the existing downtown neighbors." The building also needed to be progressive aesthetically, yet complement the existing downtown Sacramento area, which included residential areas within blocks of the plant. The Central plant provides chilled water for cooling, steam for heating and compressed air for controls to 23 existing State-owned buildings in the area. The new plant eliminates water discharge into the Sacramento River by utilizing cooling towers.

A monolithic concrete masonry block was chosen as the cladding material as it effectively met the design requirements. "Because of the plant's location, we chose concrete masonry for its durability and sound control," said Parrott. "The tan units are 24-inch by 16-inch (610 mm x 496 mm) with a polished face and anti-graffiti coating. The concrete masonry gives the plant an appearance that is civic in stature and highly textured, relating to adjacent residential." A smaller four-inch (102 mm) unit provides banding to break the scale of the large walls. CMD

The Design Award Jury found the following sustainability elements outstanding

- **Cooling tower uses environmentally friendly water treatment with no chemicals**
- **Reclaim cooling tower water for landscape irrigation**
- **Reclaimed water for toilet fixtures**
- **Photovoltaic panels will provide electrical power for office support areas**
- **CO2 monitored throughout office areas and demand based ventilation control will provide excellent Indoor Air Quality**
- **Slabs with 30 percent fly-ash**

NCMA/ICPI DESIGN AWARD WINNER

UNIVERSITY OF HAWAII CENTER FOR MICROBIAL OCEANOGRAPHY

PROJECT LOCATION
Honolulu, Hawaii

ARCHITECT:
Group 70 International, Inc.
Honolulu, Hawaii

MASONRY CONTRACTOR
Ono Construction
Kapolei, Hawaii

BLOCK PRODUCER
Tileco, Inc.
Kapolei, Hawaii

PHOTOGRAPHY
Franzen Photography

"This building showcases concrete masonry at its best," said the Design Award jury. "It is an excellent example of using concrete masonry as a primary building component, yet allowing other materials to take the stage as well."

Completed in October 2010, the Center for Microbial Oceanography: Research and Education (C-MORE) on the University of Hawaii at Mānoa is located on the north end of the university campus. The university desired a building that would provide a new direction attitude towards research. The design team saw an opportunity for C-MORE to be become a center for communication, a gathering place for collaboration and a model for sustainability.

As a global research information center working across disciplines, C-MORE brings together teams of experts – scientists, educators, and community members – who usually have little opportunity to interact, facilitating the creation and dissemination of a new understanding of the critically important role of marine microbes in global habitability.

Therefore, the University recognized it was time to bring a state-of-the-art building to campus. The building houses a 7500-square-foot (697 square meters) research laboratory, 4800 square feet (566 square meters) of administrative offices, an 1800-square-foot (167 square meters) conference room, and an additional 9200 square feet

(855 square meters) of support and mechanical space.

According to architect Charles Kaneshiro of Group 70 International, C-MORE sought to be a new model of sustainability for the university; to make a statement that a quality research facility and environmentally conscience design are not mutually exclusive.

As an island state in the Pacific Ocean, Hawaii has very few natural resources. The vast majority of all building products are imported from the mainland United States. Sustainability in terms of building materials remains a challenge for all projects. However, there is one building resource that Hawaii has an abundance of – volcanic rock. The volcanoes on the island have produced and continue to produce basalt and volcanic cinder in a variety of colors.

At C-MORE, they attempted to maximize the utilization of regional materials. All the exterior walls are comprised of ground-face, polished concrete masonry units. Except for the cement, these units are created from material entirely from Hawaii: basalt, limestone and volcanic cinder. As this was the first application of this block in Hawaii, Kaneshiro worked directly with the manufacturer in developing the five block colors used randomly throughout the walls. The colors – garnet, pepper, kahlua, cocoa and outback – add texture and creativity to the building. "The colors of the walls blend well together, yet contrast the blue and silver colors of the other building materials nicely," noted the Design Awards jury. CMD

HERITAGE HALL-WALTER D. EHLERS SENIOR AND COMMUNITY CENTER

PROJECT LOCATION
Buena Park, California

ARCHITECT
Robert R. Coffee Architect + Associates
Newport Beach, California

MASONRY CONTRACTOR
Winegarder Masonry, Inc.
Yucaipa, CA

BLOCK PRODUCER
ORCO Block Company, Inc.
Stanton, CA

PHOTOGRAPHY
RMA Photography

Located along Knott Avenue in Buena Park, California, the Walter D. Ehlers Senior and Community Center is a collection of buildings sitting in a park-like setting surrounded on three sides by streets and a residential neighborhood. The existing buildings are organized along an exterior covered pedestrian walkway that bisects the open courtyard between the community center building, built in 1971 and the senior center building built in 1983, and originally led to a parking lot at the back of the site. The new, single-story building is situated at the back of the site and now acts as the terminus of the pedestrian walkway. The main building entry and gallery/lobby visually continue the "look" of the pedestrian walkway and are organized so they can be seen from the parking lot accessed from both of the side streets surrounding the site.

Designed to function as the primary meeting and social space for the City of Buena Park, the new 9,250 square-foot (860 square-meter) Heritage Hall is designed to create a centralized destination and focal point for the campus of buildings comprising the Walter D. Ehlers Senior and Community Center. The Center's simple massing and composition are used to compliment the architecture of the existing buildings and to give the Heritage Hall a prominent visual identity.

According to the Design Award jury, "The architectural design of this building is very clean with no materials competing for attention." The building is organized along a linear gallery and lobby articulated by a marching colonnade of plaster columns supporting laminated wood trusses. The 6,500 square-foot (604 square meter) main "social hall" is comprised of concrete masonry and is de-

tailed with the use of alternating courses of 4-inch (102-mm) precision and 8-inch (203-mm) split-face block in warm grey with red and black aggregate. “The block was used to build the walls of the multi-purpose room and to distinguish it as a distinct volume, hence, one of the walls is a partial interior wall. The material functions well as either an interior or exterior material,” said Robert Coffee, AIA.

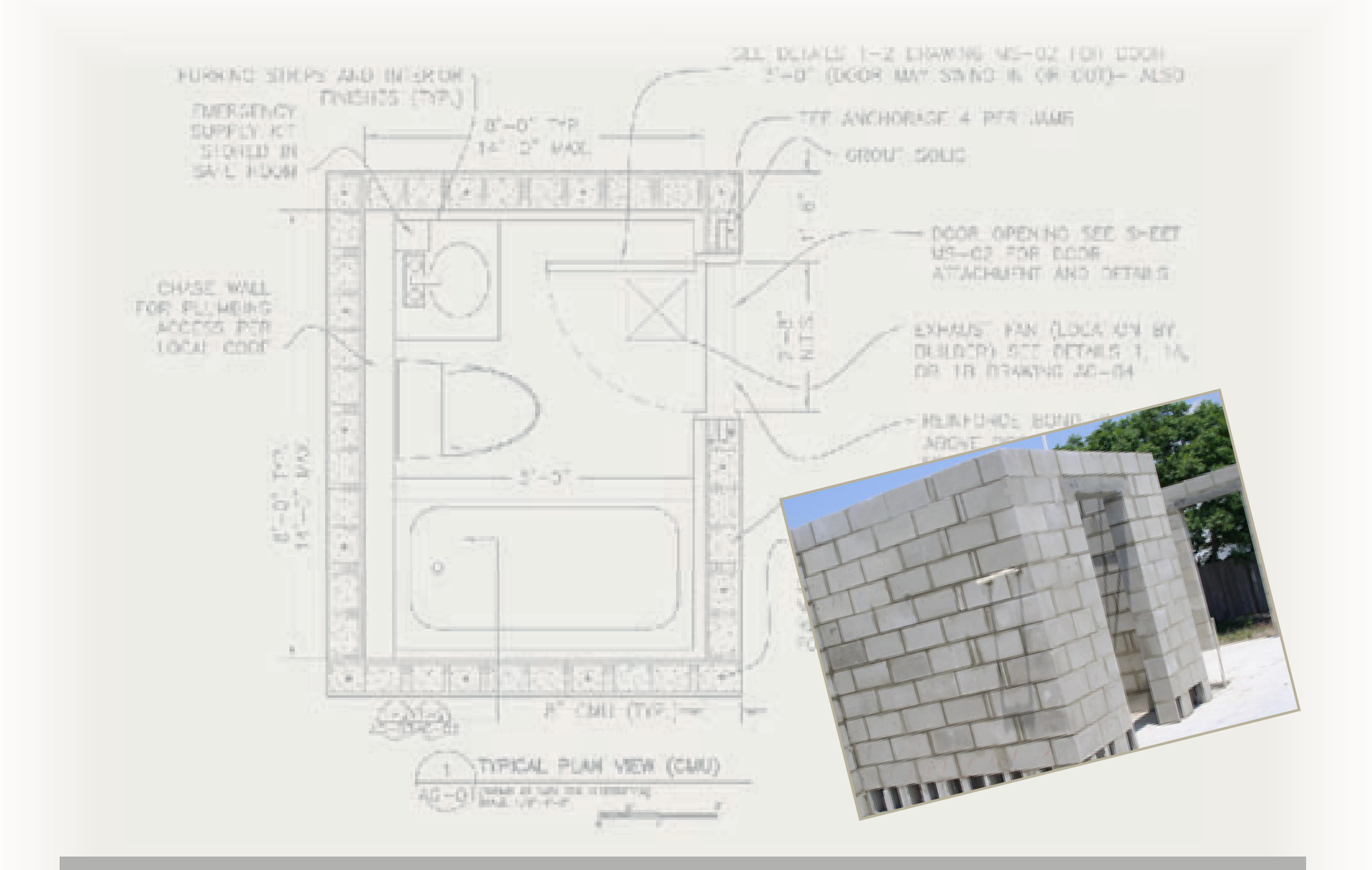
This multi-purpose space includes a catering kitchen, a raised platform/stage, has full audio-visual capabilities and is designed to accommodate 370 people in a banquet table arrangement and 600 people in a theatre style sitting arrangement. For smaller functions, the large room can be subdivided into smaller activity rooms by an electronically controlled moveable partition.

“Concrete masonry was specifically chosen for this project for its sustainable properties, long-term durability, cost- and energy-efficiency, and the opportunities it presented for texture and color, said Coffee. “The block was fully grouted with rebar. In some cases the block is loadbearing and in other cases it is not.”

Used in combination with wood and plaster, the masonry allowed for a strong architectural statement that clearly defined the building’s organization and reinforced the architect’s goal of allowing the building detail to be expressed in how the building is constructed.

The Design Award jury agreed, “Although the smooth and split-face lines of masonry cover the vast majority of the building’s surface, it does not dominate the subtle shades of the complementary wood and metal elements. “ A similar philosophy was used in expressing the structural connections of the wood trusses. Essentially the building utilizes the same building materials of the earlier buildings but in a more honest and decorative manner.

In addition, the building’s design allowed for daylighting and natural materials to give the building a contemporary yet timeless feeling. The building is oriented east-west to minimize the west exposure and to maximize the southern exposure, taking optimal advantage of the sun for daylighting. The gallery space is protected by a large overhang designed to protect the space from direct sunlight while providing ample daylight to the main circulation space. CMD



DESIGNING CONCRETE MASONRY SAFE ROOMS FOR NEW AND EXISTING HOMES

Extreme windstorms, such as the hurricanes and tornadoes seen in recent years, can pose a serious threat to buildings and their occupants. Hurricanes and tornadoes produce wind pressures and generate flying debris at much higher levels than most residential buildings are designed to protect against. Hence, these storms require residents to either evacuate the area or seek protection in dedicated shelters.

With features such as safe rooms built into designs, consumers can have a home that will provide security for just a little bit more money than a home without a safe room. Why not build safer?

CONCRETE MASONRY SHELTERS

A typical concrete masonry storm shelter design is shown in Figure 1. Several concrete masonry systems have been successfully tested to withstand a 15 lb (6.8 kg) 2 x 4 (39 x 89 mm) propelled at 100 mph (45 m/s) (ref. 1,4,5). Solidly grouted 8-in (203 mm). concrete masonry walls with No. 5 (#16 M)reinforcement at 48 in. (1219 mm) on center, with one horizontal No. 5 (#16 M) min. at the top of the wall and in the footing or bottom of the wall, can withstand these conditions. All weight classes of concrete masonry meet the strength and impact-resistance requirements. The engineer can use the masonry weight in the shelter design to resist overturning. Regardless of the concrete masonry density, the weight of the grouted masonry assembly provides increased overturning resistance compared to low-mass systems.

A ceiling system using 7-in. (178-mm)deep bottom chord bearing steel joists infilled with concrete masonry units and grout to a nominal 8-in. (203-mm)depth was also tested and found to withstand the 15 lb 2 x 4 at 67 mph (608 kg 38 x 89 mm at 30 m/s) protocol (ref. 1). No. 4 (M #13) reinforcing bars were placed perpendicular to the joists, at 8 in. (203 mm) on center. (see Figure 2 for a typical Shelter Wall/Ceiling Connection.)

RESIDENTIAL SAFE ROOMS

An in-home safe room provides an area where occupants can safely shelter during a high wind event. In flood prone areas, the shelter must not be built where it can be flooded. The shelter should be accessible from all areas of the house and should be free of clutter to provide immediate shelter.

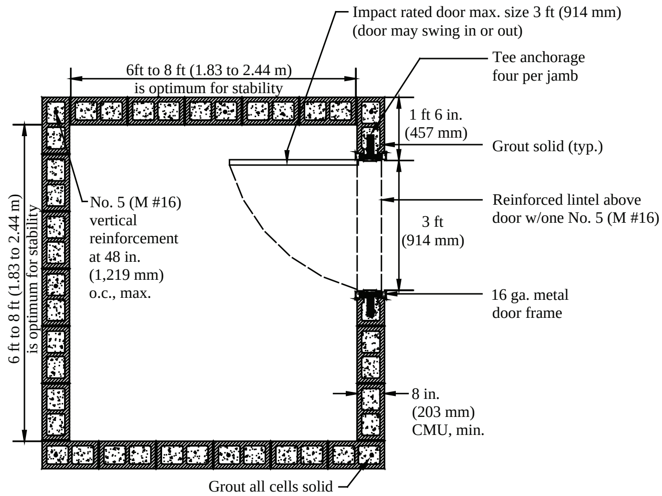


Figure 1

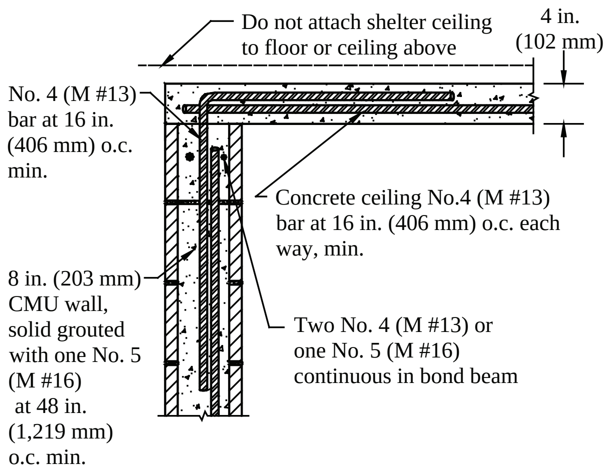


Figure 2

FEMA (ref. 2) suggests a basement, an interior room on the first floor on a foundation extending to the ground or on top of a concrete slab-on-grade foundation or garage floor as good locations for an in-home shelter.

Below-ground safe rooms provide the greatest protection, as long as they are designed to remain dry during the heavy rains that often accompany severe windstorms. When shelters are located below grade, the soil surrounding the walls can be considered as protection from flying debris during a high wind event, as long as the wall is completely below grade and soil extends at least 3 ft (914 mm) away from the wall, with a slope no greater than two inches per foot for that 3 ft (914 mm) distance. When these conditions are met, the walls do not need to meet the missile impact requirements described above. Below-grade ceilings must have a minimum of 12-in. (305 mm)of soil cover to be exempt from the impact testing requirements.

Sections of either interior or exterior residence walls that are used as walls of the safe room must be separated from the structure of the residence so that failure of the residence, which is designed for a much lower loading, will not result in a failure of the safe room. Shelter walls and ceilings must be able to withstand impact from flying debris.

The result of recent testing (ref. 1, 2, 4, 5) has improved the economy of constructing retrofits. Previously, a concrete masonry storm shelter would have required a large dedicated foundation. Research confirms, however, that considering the weight of fully grouted concrete masonry, a large foundation is not required to adequately resist the uplift and overturning forces making safe rooms easy to install in new and existing homes.

BUILDING CODES & SAFE ROOMS

The *ICC-500, Standard on the Design and Construction of Storm Shelter*s, provides design and construction requirements for hurricane and tornado shelters.

General design considerations for storm shelters include:

- adequate wall and roof anchorage to resist overturning and uplift,
- walls and ceiling, as well as openings such as doors and windows, must withstand design wind pressures and resist penetration by windborne objects and falling debris, and
- connections between building elements must be strong enough to resist the design wind loads. Figure 2 shows a typical detail for connecting a concrete roof slab to concrete masonry shelter walls, using reinforcing bars to provide adequate load transfer.

ICC-500 allows concrete masonry storm shelters to be constructed within one and two family dwellings on existing slabs on grade without a dedicated foundation, under the following conditions:

- the calculated soil pressure under the slab supporting the storm shelter walls does not exceed 2,000 psf (95.8 kPa) for design loads other than the design storm events and 3,000 psf (143.6 kPa) for design storm shelter events,
- at a minimum, the storm shelter is anchored to the slab at each corner of the structure and on each side of the doorway opening (see Figure 4), and
- the ICC-500 slab reinforcement requirements are waived if the slab dead load is not required to resist overturning.

CMU REINFORCEMENT SCHEDULE

DIMENSIONS	CMU THICKNESS	WALL GROUTING AND REINFORCEMENT	CONCRETE ROOF OPTIONS SLAB THICKNESS AND REINFORCEMENT
8"X8"X8"	6"	FULLY GROUTED CELLS WITH #4 VERTICAL REINFORCEMENT @ 16" O.C. AND AT EVERY OPENING AND EACH CORNER	4" THICK CONCRETE ROOF SLAB REINFORCED WITH #4 BARS EACH WAY @ 12" O.C.
8"X8"X8"	8"	FULLY GROUTED CELLS WITH #5 VERTICAL REINFORCEMENT @ 48" O.C. AND AT EVERY OPENING AND EACH CORNER	4" THICK CONCRETE ROOF SLAB REINFORCED WITH #4 BARS EACH WAY @ 12" O.C.
14"X14"X8"	8"	FULLY GROUTED CELLS WITH #6 VERTICAL REINFORCEMENT @ 40" O.C. AND AT EVERY OPENING AND EACH CORNER ALTERNATIVE REINFORCEMENT : FULLY GROUTED CELLS WITH #5 VERTICAL REINFORCEMENT @ 32" O.C. AND AT EVERY OPENING AND EACH CORNER	6" THICK CONCRETE ROOF SLAB REINFORCED WITH #4 BARS EACH WAY @ 18" O.C.

TABLE NOTE:
VERTICAL REINFORCEMENT SHALL TERMINATE IN BOND BEAM WITH A STANFORD HOOK. IF CEILING SYSTEM IS A REINFORCED CONCRETE SLAB, A SEPARATE BOND BEAM IS NOT REQUIRED. GROUT WALLS SOLID AS PER NOTES.

CMU Reinforcement Schedule from *Taking Shelter from the Storm: FEMA 320*

Special consideration must be given when retrofitting a shelter into an existing home. Figures 3 through 5 illustrate typical details for connecting shelter elements to an existing basement wall.

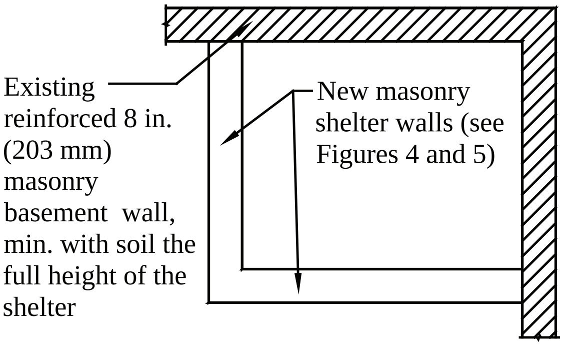
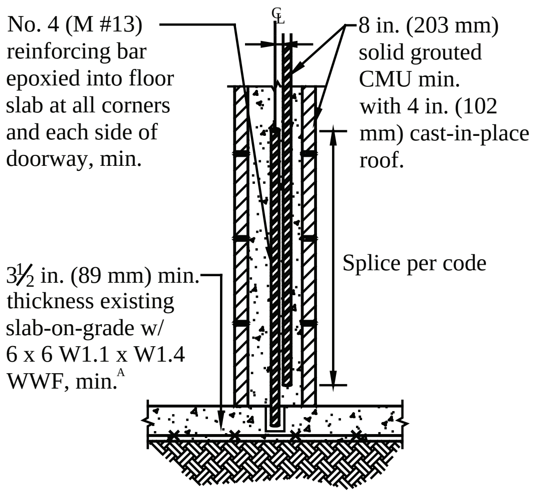
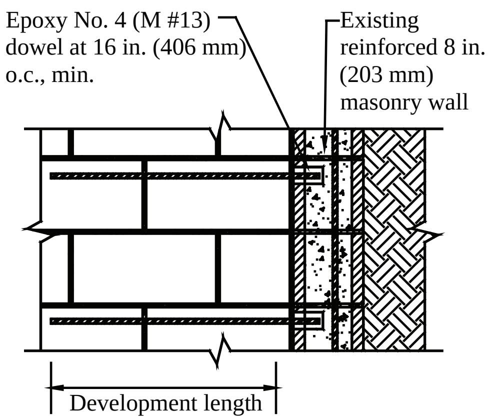


Figure 3



A This slab reinforcement is not required when the slab dead load is not required to resist overturning.

Figure 4



Note: Top of shelter must not be above grade level

Figure 5

READY FOR THE WORST

ICC-500 (ref. 1) is a consensus standard in accordance with the ANSI (American National Standards Institute) process and is referenced in both International Building Code and the International Residential Code. Representatives of FEMA and their consultants served on the ICC-500 committee. After completion of the ICC-500 in 2008 FEMA revised their FEMA 320 publication (ref. 3) as well as their FEMA 361 publication "Design and Construction Guidance for Community Safe Rooms" to align closely with ICC-500 with a few exceptions. See reference 5 prepared by FEMA staff and consultants which summarizes the requirements of all these documents in regard to concrete masonry.

For tornado prone areas, the highest design wind speed prescribed by ICC-500 is 250 mph (112 m/s). Corresponding walls and ceilings must withstand impact from a 15 lb (6.8 kg) wooden 2 x 4, propelled at 100 mph (45 m/s) and 67 mph (30 m/s), respectively.

For hurricane shelters, the highest design wind speed in ICC-500 is 237 mph (106 m/s) (with the exception of Guam, which has a design hurricane wind speed of 256 mph (115 m/s). In addition, walls subject to this 237 mph (106 m/s) design wind speed must be capable of withstanding impact from a 9 lb (4.1 kg) wooden 2 x 4 propelled at 100 mph (45 m/s). Ceilings and other horizontal surfaces must withstand impact from the same projectile propelled a 25 mph (11 m/s). All above designs wind speeds are per the ASCE 7-05 Standsrd (ref. 6) (3 second gust).

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3. Taking Shelter From the Storm: Building a Safe Room for Your Home or Small Business, FEMA 320. Federal Emergency Management Agency, 2008.
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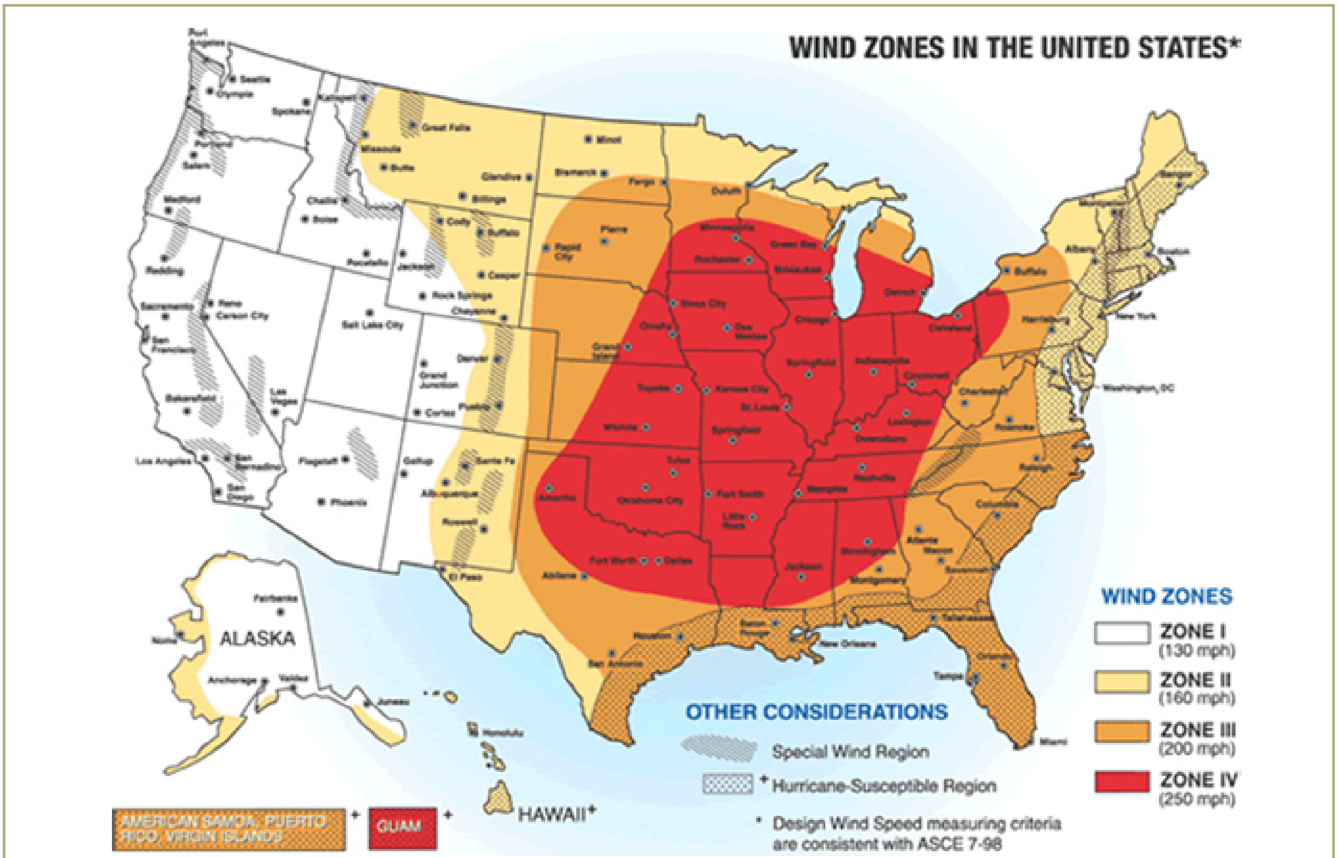
6. "Minimum Design Loads for Buildings and Other Structures", ASCE 7-05. American Society of Civil Engineers, 2055.

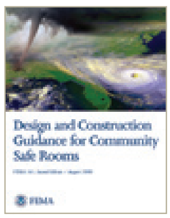


Wind zone map shows how the frequency and strength of extreme windstorms vary across the United States. Wind speeds in Zone IV (red), where the risk of extreme windstorms is greatest, can be as high as 250 miles per hour (ref. 3)

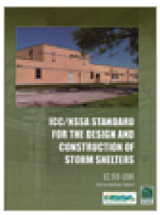
SAFE ROOM DESIGN RESOURCES

Concrete Masonry Hurricane and Tornado Shelters, TEK 5-14 - Provides a summary of the requirements for concrete masonry shelters according the ICC-500 Standard on the Design and Construction of Storm Shelters. (National Concrete Masonry Association, 2008)

Taking Shelter from the Storm: Building a Safe Room For Your Home or Small Business, FEMA 320 - Provides safe room designs that will show you and your builder/contractor how to construct a safe room for your home or small business. Design options include safe rooms located in the basement, in the garage, or in an interior room of a new home or small business building. Complete plans and specifications for a residential concrete masonry safe room included. It includes the results of research that has been underway for more than 30 years, by Texas Tech University's Wind Science and Engineering (WISE; formerly known as the Wind Engineering Research Center or WERC) and other wind engineering research facilities, on the effects of extreme winds on buildings. The safe room designs presented in this publication meet or exceed all tornado and hurricane design criteria of the ICC-500 for both the tornado and hurricane hazards. (Federal Emergency Management Agency, 2008)



Design and Construction Guidance for Community Safe Rooms, FEMA 361 - This document presents important information about the design and construction of community safe rooms that will provide protection during tornado and hurricane events. (Federal Emergency Management Agency, 2008)



Standard for the Design and Construction of Storm Shelters, ICC 500 - The ICC-500 successfully took many of the design and performance criteria presented in the earlier editions of FEMA's safe room publications, updated them, and codified them through the consensus standard process. (International Code Council and National Storm Shelter Association, 2008) Note that NCMA members may purchase this and other ICC documents at the ICC member discounted price. CMD

ALABAMA SAFE ROOM WITHSTANDS EF-4 TORNADO

The master bedroom closet was the only thing left standing in the pile of debris in the Tuscaloosa neighborhood after the tornadoes ravaged the area in late April.

The front of the home before the tornado.

The rear addition is where the safe room was located

William Blakeney grew up in Tuscaloosa County and is well aware of the effects of disasters in the area. In an effort to prepare for disasters like the tornadoes in mid and late April 2011, he built a safe room in his grandparents' home. Although they weren't home when the storms devastated the area, the only portion of their home left standing was the solid grouted reinforced concrete masonry multipurpose safe room.

Blakeney and his construction company had built a few safe rooms in the past, mainly in their family members' homes. While not built according to the design criteria of Federal Emergency Management Agency's publication *FEMA 320*,*Taking Shelter from the Storm: Building a Safe Room For Your Home or Small Business*, this safe room was able to withstand the strong winds of the EF-4 tornado that ravaged the area.

FEMA 320 includes construction plans and cost estimates for building individual safe rooms. A safe room, built according to the standards outlined in FEMA 320, in a home or small business provides "near-absolute protection" for its occupants.

"We were not familiar with FEMA specifications, but we had built a few safe rooms," said Blakeney. "I was actually at the office and used the safe room we had built there when the tornado came through."

April's storms claimed over 40 lives in Tuscaloosa and left more than 2,000 residents homeless. The area experiences tornadoes early spring and late fall each year, but never as severe as those on April 2011.

"Tornadoes usually hit the southern or northern parts of the town," said Blakeney about the recent events. His family had lived in Tuscaloosa County for more than 71 years. "In my time, we've never seen one come through the area like that!"

The home was recently renovated so his grandparents could move from the outskirts of the city and live closer to other relatives. In the additional wing, the master bedroom closet was the perfect location to reinforce as the safe room.

"They had a basement in their old home and that made them feel secure," said Blakeney. "Here, they had nothing."

Safe rooms provide homeowners, like Blakeney's grandparents, relief during times where they have to quickly seek shelter. Should homeowners decide to build a safe room in their new or existing home, FEMA 320 provides examples of proper installation techniques and designs. Safe rooms built to FEMA 320 standards have saved the lives of people affected by events like the one that destroyed many areas of Alabama.

"We just think it is a great investment for the sense of security," Blakeney added. "We will be building more in the future using FEMA 320."

Building safe rooms according to FEMA specifications helps ensure that they will be able to withstand high winds and provide the ultimate protection. Not building according to FEMA specifications is risky and increases the likelihood of the safe room not providing the needed protection. For additional information, contact the FEMA Safe Room Help Line at 866-222-3580 or at saferoom@dhs.gov. The help line provides information on where to go for assistance regarding hazard mitigation grants and other grant funding, project eligibility, and guidelines for safe room construction. FEMA's safe room web site (http://www.fema.gov/plan/prevent/saferoom) is another source of information. CMD

SOURCE: Federal Emergency Management Agency

SRWs Provide a Solid Solution for Lake Erie Cliff Erosion Problems

Segmental retaining walls (SRWs) have been called upon to solve a lot of erosion problems. But few have been as complex or unique as keeping a towering cliff from crumbling into Lake Erie outside of Cleveland.

A home built about 20 feet (6 meters) back from the cliff face was endangered because the cliff face was eroding away and the homeowner was slowly losing his lakefront real estate. The top 8 to 10 feet (2.4 to 3 meters) of the cliff is pure topsoil, Greg Norton, owner of NCS Construction Services, explains. Beneath that is about 5 feet (1.5 meters) of solid clay, which turns to shale as you go deeper.

"The softer shale flakes off but it gets harder as you go deeper. The lake eats away at the base of the cliff, but it's the groundwater at the top that does most of the destruction. First the soil, then the clay washes away and then large pieces of rock."

There was little room for geogrid, so the project engineer determined that anchor bolts could be used to secure the geogrid to the bluff. Using a 2.5-inch (64-mm)drill bit, holes were drilled 6 to 7 (1.8 to 2.1 meters)feet into the cliff face and anchor bolts cemented into the borings. Then a steel bar was attached to the anchor bolts and the geogrid attached to the steel bar to secure the wall to the cliff face.

PROJECT LOCATION
Shore of Lake Erie, OH

DESIGNER
Andrassy Engineering
Bay Village, OH

CONTRACTOR
NCS Construction
Brunswick, OH

SRW LICENSOR
Versa-lok

SRW PRODUCER
4D/Schuster's
Sheffield Village, OH

The existing seawall was used as the footing. The concrete wall extends upward for 17 feet (5.2 meters) and an 18-inch (457-mm) cap on top rests on a ledge chiseled out of the cliff face. The SRW unit wall rests on top of the cap.

Once the footing was completed, a series of three decks was built that jutted out from the cliff and was connected to a pier on the water by zig-zagging stairways. The retaining wall was built behind the deck/stairway structure.

The wall begins at about 13 feet (4 meters) above the water level. It's 65 feet (20 meters) wide and 27 feet (8.2 meters) tall and was built in three tiers with a slight curve.

"That allowed us to follow the bluff face," Andrassy explains. "The nature of the bluff face was such that the lower two-thirds were very steep, nearly vertical. The rock transitions to soil at the top, so it starts to fall back. That allowed us to bench into the existing face, so each segment has its own footing."

About 3,000 SRW units in a blended pattern of 80 percent brown and 20 percent gray were used. A special conveyer belt system was designed to lower the units down the cliff face one by one; a chute alongside the conveyer was used to transport the backfill aggregate.

"The higher we went with the wall, we had to adjust our system of transport," says Andrassy. "We had a little innovation going on. Everyone got a good workout. No matter how good you are at moving it, that's a lot of block."

"With its flexible system, SRW units were perfect for the application," says Norton. "[The wall] looks awesome." CMD

DIRECT ANCHORAGE DESIGN

In some retaining wall applications, sufficient space does not exist behind the face units to allow excavation and subsequent placement of geosynthetic reinforcement. In these applications, a direct-anchorage retaining wall system is a more aesthetically pleasing and less costly alternative to the conventional cast-in-place concrete that would often be used in such situations.

Direct anchorage consists of an anchor (e.g., soil nail) installed into the ground and connected to galvanized steel beams (walers) placed within the horizontal cavity in the SRW units, which were specifically designed to accommodate them.

Each steel beam spans two adjacent anchors, transferring the load from the segmental retaining wall units to the anchors. The space between the excavated face and the SRW units is filled with free-draining aggregate.

In addition to transferring stresses from the retained soil to the SRW units, the fill is selected to provide drainage between the excavated surface and the wall face. Since the SRW units are not mortared, but interlocked, hydrostatic pressure is released through the joints in the units as well as the drain outlets typically placed along the bottom of the wall.

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CONCRETE MASONRY VENEERS

TEK 3-6C
Construction (2012)

INTRODUCTION

In addition to its structural use or as the exterior wythe of composite and noncomposite walls, concrete brick and architectural facing units are also used as veneer over various backing surfaces. The variety of surface textures, colors, and patterns available makes concrete masonry a versatile and popular exterior facing material. Architectural units such as split-face, scored, fluted, ground face, and slump are available in a variety of colors and sizes to complement virtually any architectural style.

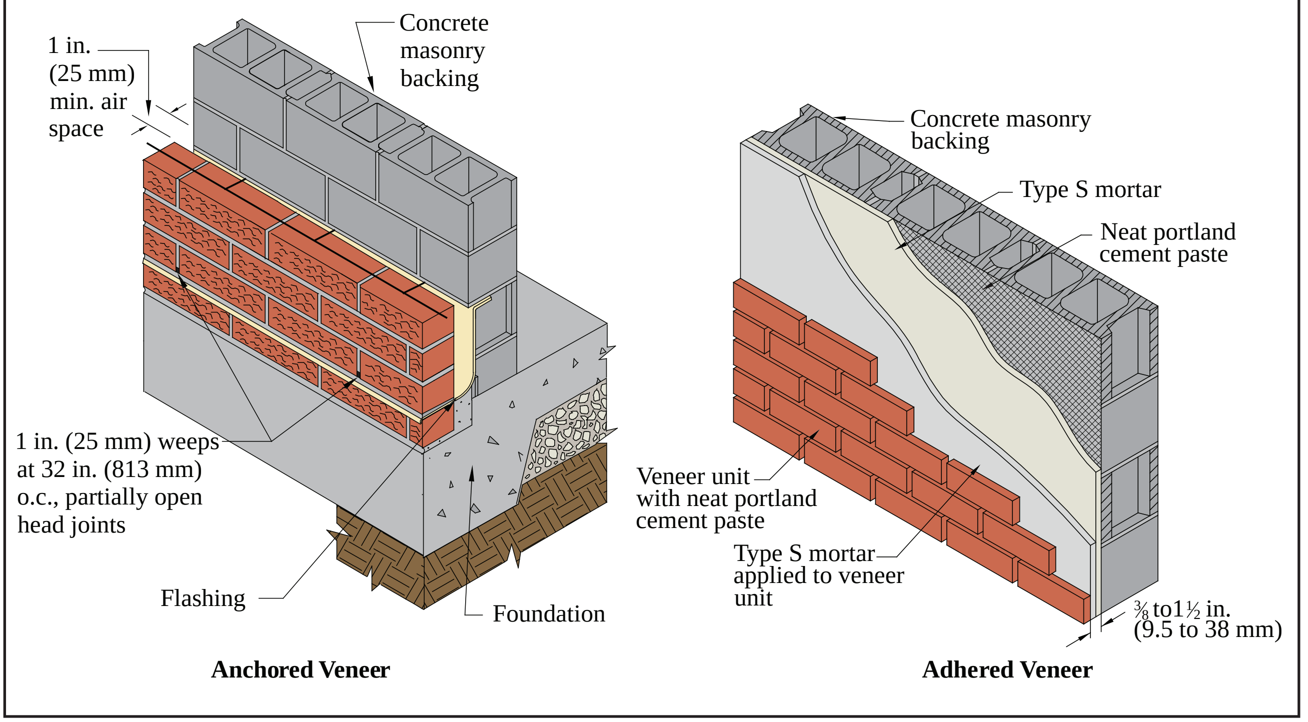


Figure 1—Types of Veneer
Note: For clarity, not all construction elements are shown. See TEK 5-1B (ref. 1) for full construction details

Related TEK:
5-1B, 10-4, 12-1B,
16-4A, 19-4A, 19-5A

Keywords: adhered veneer, anchored veneer, anchors, cavity walls, joint reinforcement, moisture control, multi-wythe walls, steel lintel detail, veneer, wall ties

VENEER—DESIGN CONSIDERATIONS

Veneer is a nonstructural facing of brick, stone, concrete masonry or other masonry material securely attached to a wall or backing. Veneers provide the exterior wall finish and transfer out-of-plane loads directly to the backing, but they are not considered to add to the load-resisting capacity of the wall system. Backing material may be masonry, concrete, wood studs or steel studs.

There are basically two types of veneer—anchored veneer and adhered veneer. They differ by the method used to attach the veneer to the backing, as illustrated in Figure 1. Unless otherwise noted, veneer requirements are those contained in the *International Building Code* (IBC) and *Building Code Requirements for Masonry Structures* (refs. 2, 3).

For the purposes of design, veneer is assumed to support no load other than its own weight. The backing must be designed to support the lateral and in some instances the vertical loads imposed by the veneer in addition to the design loads on the wall, since it is assumed the veneer does not add to the strength of the wall.

Masonry veneers are typically designed using prescriptive code requirements that have been developed based on judgement and successful performance. The prescriptive requirements relate to size and spacing of anchors and methods of attachment, and are described in the following sections. The assembly can be designed as a noncomposite cavity wall where the out-of-plane loads are distributed to the two wythes in proportion to their relative stiffness. Design criteria are provided in IBC Chapter 16 as well as in TEK 16-4A, *Design of Concrete Masonry Noncomposite (Cavity) Walls,* (ref. 4).

In addition to structural requirements, differential movement between the veneer and its supports must be accommodated. Movement may be caused by temperature changes, moisture-volume changes, or deflection. In concrete masonry, control joints and horizontal joint reinforcement effectively relieve stresses and accommodate small movements. For veneer, control joints should generally be placed in the veneer at the same locations as those in the backing, although recommended control joint spacing can be adjusted up or down based on local experience, the aesthetic requirements of the project, or as required to prevent excessive cracking. See TEK 10-4, *Crack Control for Concrete Brick and Other Concrete Masonry Veneers* (ref. 5), for further information.

For exterior veneer, water penetration into the cavity is anticipated. Therefore, the backing system must be designed and detailed to resist water penetration and prevent water from entering the building. Flashing and weeps in the veneer collect any water that penetrates the veneer and redirects it to the exterior. Partially open head joints are one preferred type of weep. They should be at least 1 in. (25 mm) high and spaced not more than 32 in. (813 mm) on center. If necessary, insects can be thwarted by inserting stainless steel wool into the opening or by using proprietary screens. For anchored veneer, open weeps can also serve as vents, allowing air circulation in the cavity to speed the rate of drying. Additional vents may be installed at the tops of walls to further increase air circulation. More detailed information is contained in TEK 5-1B, *Concrete Masonry Veneer Details,* TEK 19-4A, *Flashing Strategies for Concrete Masonry Walls*, and TEK 19-5A, *Flashing Details for Concrete Masonry Walls* (refs. 1, 6, 7).

ANCHORED VENEER

Anchored veneer is veneer which is supported laterally by the backing and supported vertically by the foundation or other structural elements. Anchors are used to secure the veneer and to transfer loads to the backing. Anchors and supports must be noncombustible and corrosion-resistant.

The following prescriptive criteria apply to anchored veneer in areas with velocity pressures, q_z, up to 40 psf (1.92 kPa). Modified prescriptive criteria is available for areas with q_z greater than 40 psf (1.92 kPa) but not exceeding 55 psf (2.63 kPa) with a building mean roof height up to 60 ft (18.3 m). These modified provisions are presented in the section *High Wind Areas*. In areas where q_z exceeds 55 psf (2.63 kPa), the veneer must be designed using engineering philosophies, and the following prescriptive requirements may not be used.

In areas where seismic activity is a factor, anchored veneer and its attachments must meet additional requirements to assure adequate performance in the event of an earthquake. See the section *Seismic Design Categories C and Higher* for details.

Masonry units used for anchored veneer must be at least $2\ ^{5}/_{8}$ in. (67 mm) thick.

A 1 in. (25 mm) minimum air space must be maintained between the anchored veneer and backing to facilitate drainage. A 1 in. (25 mm) air space is considered appropriate if special precautions are taken to keep the air space clean (such as beveling the mortar bed away from the cavity). Otherwise, a 2 in. (51 mm) air space is preferred. As an alternative, proprietary insulating drainage products can be used.

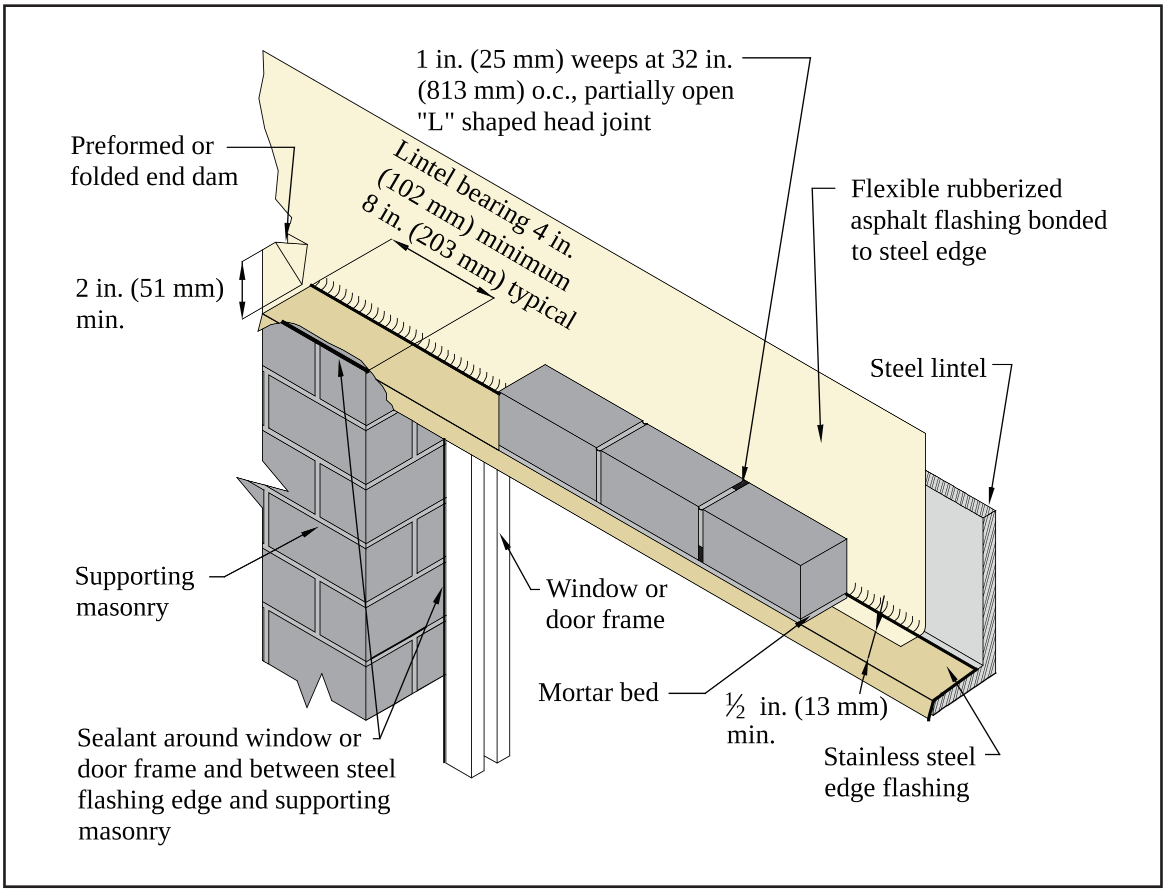


Figure 2—Steel Lintel Flashing Detail (ref. 8)
(backing not shown for clarity)

The maximum distance between the inside face of the veneer and the outside face of the backing is limited to 4 $^1/_2$ in. (114 mm), except for corrugated anchors used with wood backing, where the maximum distance is 1 in. (25 mm).

When anchored veneer is used as an interior finish supported on wood framing, the veneer weight is limited to 40 lb/ft^2 (195 kg/m^2).

Deflection Criteria

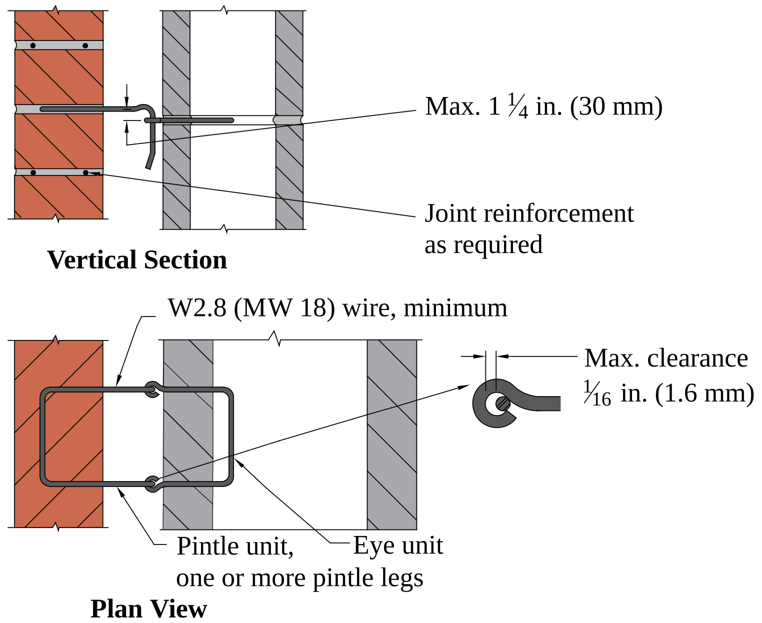
Deflection of the backing should be considered when using masonry veneer, in order to control crack width in the veneer and provide veneer stability. This is primarily a concern when masonry veneer is used over a wood or steel stud backing. *Building Code Requirements for Masonry Structures*, however, does not prescribe a deflection limit for the backing. Rather, the commentary presents various recommendations for deflection limits.

For anchored veneer, Chapter 16 of the *International Building Code* requires a deflection limit of *l*/240 for exterior walls and interior partitions with masonry veneer.

Support of Anchored Veneer

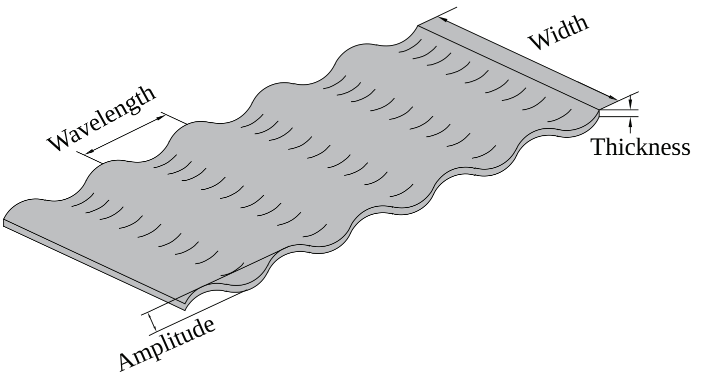
The height and length of the veneered area is typically not limited by building code requirements. The exception is when anchored veneer is applied over frame construction. For wood stud backup, veneer height is limited to 30 ft (9.14 m) (height at plate) or 38 ft (11.58 m) (height at gable). Similarly, masonry veneer over steel stud backing must be supported by steel shelf angles or other noncombustible construction for each story above the first 30 ft (9.14 m) (height at plate) or 38 ft (11.58 m) (height at gable). This support does not necessarily have to occur at the floor height, for example it can be provided at a window head or other convenient location.

Exterior anchored veneer is permitted to be supported



Note that the 2011 MSJC Code (ref. 3) specifies that pintle units may have only one pintle leg. This is a change from previous versions of the code, which required two pintle legs.

Figure 3—Adjustable Anchors



Minimum width = $^7/_8$ in. (22 mm)
Minimum thickness = 0.03 in. (22 gage, 0.80 mm)
Wavelength = 0.3 - 0.5 in. (7.6 - 13 mm)
Amplitude = 0.06 - 0.10 in. (1.5 - 2.5 mm)
Min. embedment in mortar or grout = 1 $^1/_2$ in. (38 mm)
Min. cover to the outside face = $^5/_8$ in. (16 mm)

Figure 4—Corrugated Sheet Metal Anchor Requirements

on wood construction under the following conditions:

- the veneer has an installed weight of 40 psf (195 kg/m^2) or less,
- the veneer has a maximum height of 12 ft (3.7 m),
- a vertical movement joint in the veneer is used to isolate the veneer supported on wood construction from that supported by the foundation,
- masonry is designed and constructed so that the masonry is not in direct contact with the wood, and
- the horizontally spanning member supporting the masonry veneer is designed to limit deflection due to unfactored dead plus live loads to *l*/600 or 0.3 in. (7.5 mm).

Over openings, the veneer must be supported by noncombustible lintels or supports attached to noncombustible framing, as shown in Figure 2.

The following requirements assume that the veneer is laid in running bond. When other bond patterns are used, the veneer is required to have joint reinforcement spaced no more than 18 in. (457 mm) on center vertically. The joint reinforcement need only be one wire, with a minimum size of W1.7 (MW11).

Anchors

Veneers may generally be anchored to the backing using sheet metal anchors, wire anchors, joint reinforcement or adjustable anchors, although building codes may restrict the use of some anchors. Corrugated sheet metal anchors are permitted with masonry veneer attached to wood backing only. Requirements for the most common anchor types are summarized in Figures 3 through 5 and Table 1. As an alternative, adjustable anchors of equivalent strength and stiffness may be used. Cavity drips are not permitted. See TEK 12-1B, *Anchors and Ties for Masonry*, (ref. 9) for detailed information on anchor materials and requirements.

Attachment to Backing

When masonry veneer is anchored to wood backing, each anchor is attached to the backing with a corrosion-resistant 8d common nail, or a fastener with equivalent or greater pullout strength. For proper

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ENERGY CODE COMPLIANCE USING COMCHECK™

TEK 6-4B
Energy & IAQ (2012)

INTRODUCTION

COM*check*™ (ref. 1) is software developed by the U.S. Department of Energy specifically for demonstrating compliance with nationally recognized energy codes. Versions are available for download (for various software platforms) as well as for online use. Using the tradeoff compliance method allowed by energy codes, such as COM*check* software, may provide more design flexibility when compared to prescriptive table requirements. For example, parameters such as fenestration area can be increased above the prescriptive limitations, and the additional energy demand offset by adjusting fenestration characteristics and/or increasing roof or wall insulation levels. In addition, once the basic building description has been entered into the program and saved, design changes and/or the building location can be quickly modified, and compliance immediately redetermined. COM*check* has another advantage in that various national and state energy codes and energy standards are included within the program, making it easy for designers who work in several states to be able to use the same compliance tool for many different project locations.

After the building data is entered, COM*check* indicates the percentage by which the proposed building envelope passes or fails the chosen energy code requirements. The program can be downloaded free of charge from: http://www.energycodes.gov/comcheck/download.stm. It is advisable to also review the known problems in COM*check*, which are documented on this same site.

This TEK provides a basic overview of the program as well as some guidance on concrete masonry building envelope compliance.

APPLICABILITY

COM*check* enables the user to choose the code and year for compliance. This is a critical first step, as energy code requirements can be significantly different from one edition of the code to the next. If unknown, the local building department can provide this information. Currently, the following codes are included:

- the *International Energy Conservation Code* (ref. 2), IECC (2000, 2001, 2003, 2004, 2006 and 2009 editions),
- ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings* (ref. 3) (2001 2004, 2007 and 2010 editions), and
- state energy codes for New York, North Carolina, Oregon and Vermont, as well as for Puerto Rico.

COM*check* is applicable to all buildings other than low-rise residential, i.e., most commercial, industrial, hotels and educational buildings as well as residential buildings over three stories in height. For low-rise residential buildings, the program RES*check*™ (ref. 4) can be downloaded from http://www.energycodes.gov/rescheck/download.stm.

BUILDING ENVELOPE COMPLIANCE

After choosing the appropriate code, the *Project* screen is used to enter the building location (which determines climate) and the building use category, such as school, office or restaurant (which determines the internal heat loads, such as lighting loads). The building's gross floor area is also entered on the *Project* screen. Note that for multistory buildings, the total area of all floors is entered, while for single story buildings, the gross floor area is generally equal to roof area. The user can also add descriptive text about the building, client and location.

After the basic information has been entered, the user

Related TEK:
6-1B, 6-2B, 6-5A,
6-11A, 6-16A

Keywords: building envelope, code compliance, COM*check*, energy codes, energy efficiency, software

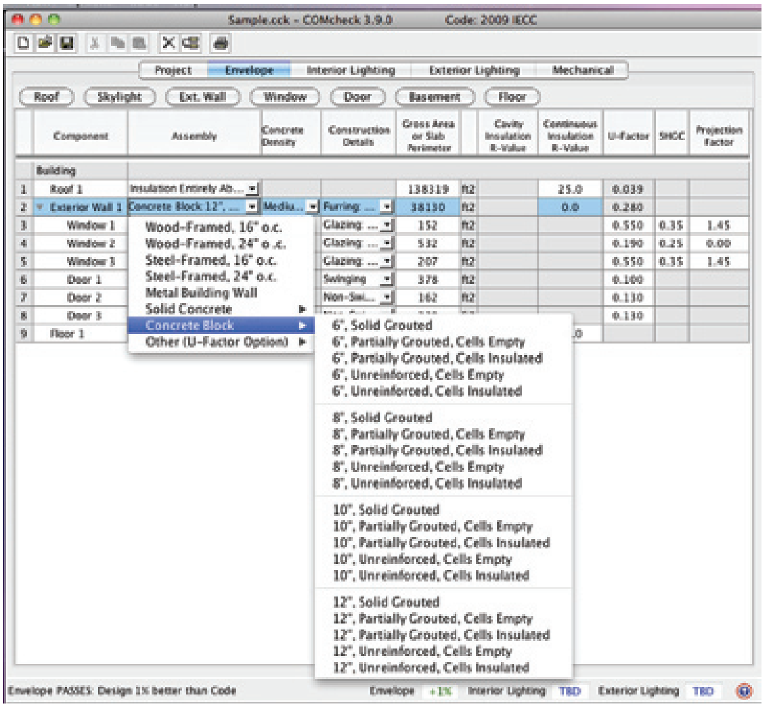

Figure 1—COM*check* Building Envelope Compliance Screen Showing Drop-Down Menu for Above Grade Concrete Masonry Walls

chooses the *Envelope* tab to display the envelope compliance screen (see Figure 1). Building envelope data input for COM*check* is straightforward. The user describes the building envelope, component by component, either from a series of drop-down menus or from user-entered data.

Individual envelope elements (roof, skylight, exterior wall, etc.) are chosen from the row above the data table. Then, the table is populated with a description of each element: the element size, R-values or U-factors to describe the steady-state resistance to heat transfer, and solar heat gain coefficient (SHGC) for windows.

When the building envelope has been completely described, the software combines this input with the weather data embedded in the program to perform a location-specific analysis.

The output is a pass/fail rating (in the lower left-hand corner of the screen), along with an indication of how close the proposed building is to meeting the specified code requirements. In Figure 1, the proposed building exceeds the minimum code requirements by 1%. This percentage can help the designer understand the building envelope's sensitivity to various design changes and help optimize building components.

If the program returns *Fails*, one or more envelope parameters can be quickly modified and compliance immediately redetermined. Thus, the user can choose from various ways to improve the envelope performance, whether it be in the roof insulation, high-performance glazing or wall performance, based on the economics of the products involved and on other project goals or restrictions.

Above-Grade Concrete Masonry Walls

Figure 1 shows the above-grade concrete masonry wall options within COM*check* that can be used to demonstrate compliance with the 2009 IECC. Note that the specific walls listed may vary somewhat with the code chosen for compliance.

COM*check* contains a database of precalculated thermal properties for various systems. As a result, once the user chooses a concrete block wall construction, the program applies an associated R-value and, for masonry walls, a heat storage capacity describing the wall's thermal mass. Figure 1 shows that COM*check* includes various single wythe concrete masonry walls, with or without insulation in the ungrouted cells, as follows:

- *Concrete Block, Solid Grouted* applies to fully grouted masonry walls. The R-value of any insulation installed between furring should be entered under the *Cavity Insulation R-Value* column, while the R-value of continuous insulation should be entered under the *Continuous Insulation R-Value* column.
- *Concrete Block, Partially Grouted, Cells Empty* applies to masonry with at least 50% of the masonry cells free of grout or cells that are grouted no more than 32 in.

(813 mm) o.c. vertically and 48 in. (1,219 mm) o.c. horizontally, and with no insulation in the ungrouted cells. Similar to solid masonry, the R-value of any insulation installed between furring should be entered under the *Cavity Insulation R-Value* column, while the R-value of continuous insulation should be entered under the *Continuous Insulation R-Value* column.

- *Concrete Block, Partially Grouted, Cells Insulated* applies to masonry with at least 50% of the masonry cells free of grout (see Table 1) or cells that are grouted no more than 32 in. (813 mm) o.c. vertically and 48 in. (1,219 mm) o.c. horizontally, and with insulation in the ungrouted cells. Masonry core insulation is typically molded polystyrene inserts, expanded perlite or vermiculite granular fills or foams (see *Insulating Concrete Masonry Walls*, TEK 6-11A (ref. 5), for more information on insulating concrete masonry walls). Although the R-value of this cell insulation is already accounted for in the program and need not be entered by the user, note that the U-factor included in COM*check* for cell-insulated concrete masonry is conservative. Often, the actual wall U-factor will be lower (i.e., R-value will be higher) than that reflected in the program. In these cases, the user can enter their own wall performance data (see below). Additional insulation installed on the interior or exterior side of the masonry, such as EIFS or insulation between furring, should be entered separately in the *Continuous Insulation R-Value* or *Cavity Insulation R-Value* column, respectively.
- *Concrete Block, Unreinforced, Cells Empty* applies to masonry without reinforcement and without insulation in the ungrouted cells. Although by definition these walls do not include reinforcement, up to 50% of the masonry cells are permitted to be grout-filled.
- *Concrete Block, Unreinforced, Cells Insulated* applies to masonry without reinforcement and with insulation in the cells.

In some cases, the concrete masonry wall being used for the project is significantly different from those listed in the program (see refs. 6 and 7 for R-values of concrete masonry walls). For example, a variety of special unit shapes have been developed to increase energy efficiency. These units often have reduced web areas to reduce heat loss due to thermal bridging through the webs. Even conventional concrete masonry units may have significantly better thermal performance than that assumed in COM*check*, because the thermal values in COM*check* for concrete masonry are conservative for many walls. R-values in the COM*check* database for concrete masonry with insulated cells are based on loose fill insulation, which has a relatively low R-value per inch of thickness. In addition, partially grouted walls are assumed to be grouted at 32 in. (813 mm) o.c. vertically *and* 48 in. (1,219 mm) o.c. horizontally.

Buildings with masonry walls utilizing better-performing cell insulation systems, special unit shapes and/or less grout can demonstrate compliance by using the *Other* option from the exterior wall pull-down menu.

Note that when the *Other* and *Mass* options are chosen, the screen displays a new column for heat capacity (which allows COM*check* to distinguish masonry wall requirements from frame wall requirements when determining compliance). When custom data is entered using this option, the user enters both the overall U-factor of the wall (including all insulation and finish materials) as well as the wall heat capacity (see TEK 6-16A , *Heat Capacity (HC) Values for Concrete Masonry Walls*, ref. 8).

When the building's exterior is constructed of more than one type of construction (one story is masonry and another is frame, for example), each construction type should be entered into the program as a separate wall. When all above grade exterior walls are the same construction, they can be entered into the program as a single wall, unless the optional wall orientation option is selected.

Choosing *Orientation* from the *Options* tab on the main program menu bar allows the user to enter solar orientation (north, east, south or west) for each exterior wall, and displays this information in an additional column on the *Envelope* screen. When *Orientation* is not selected, the building envelope assemblies are assumed to be equally distributed. Therefore, compliance results may be slightly different. Selecting *Orientation* may be an advantage when fenestration for the proposed building has been located to maximize energy efficiency (see *Passive Solar Design*, TEK 6-5A (ref. 9), for more detailed information).

Multi-Wythe Masonry Walls

Only single wythe masonry walls are explicitly included in the COM*check* drop-down menus. When using multi-wythe walls, such as a masonry cavity wall, the user has two options. The first is to select the backup masonry wythe from *COMcheck*'s drop-down menu, and enter the R-value of the cavity insulation under *Continuous Insulation R-Value*, which effectively ignores the masonry veneer. The second option is to determine the overall wall U-factor and heat capacity of the cavity wall (using TEKs 6-1B, *R-values of Multi-Wythe Concrete Masonry Walls* (ref. 7), and 6-16A or other data) and enter this data under the *Other* wall option described above.

Concrete Masonry Basement Walls

The masonry wall types in COM*check* for basement walls are the same as those listed for above grade walls, and data entry is similar. In addition to gross wall area and continuous or cavity insulation R-values, for basement walls the user also enters the basement wall height and the depth below grade (i.e., average grade level to the depth of the basement floor). This information allows the program to account for basement walls that are partially above grade.

Additional Mandatory Requirements

In addition to passing COM*check*'s envelope criteria, there is a list of mandatory requirements that must be met. To access the mandatory requirements, choose *View* then *Mandatory Requirements* from the main program menu. After choosing the applicable code, the program displays a list of items that must be accomplished.

For the building envelope, these mandatory requirements include:

- installation of insulation: ensuring that insulation is installed without large gaps, without being compressed, and that blown-in insulation is installed to the specified density, to help ensure that the rated R-value is achieved,
- fenestration and doors: certified to meet air leakage requirements, and
- air leakage: requires sealing, caulking, gasketing and/or weather-stripping at joints and penetrations to minimize energy losses and the associated moisture migration due to air leakage through the envelope.

LIGHTING AND MECHANICAL COMPLIANCE

In COM*check*, the mechanical, lighting and envelope compliance are independent of each other (i.e., improved HVAC performance cannot be used to help offset lighting or envelope requirements, for example). The lighting input has a similar format to the envelope, with various lighting fixture types, and drop-down menus for the ballast, number of lamps, wattage per fixture, etc. Similar to the envelope compliance, any combination of lighting components can be used, as long as the total meets the lighting budget for the proposed building. The mandatory lighting requirements primarily cover lighting controls and exterior lighting requirements.

Mechanical compliance for COM*check* is different from the envelope and lighting. The mechanical section generates a list of mandatory requirements based on the list of mechanical components input by the user. So, rather than producing a pass or fail message, the program generates a checklist of requirements that must be met.

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9. *Passive Solar Design*, TEK 6-5A. National Concrete Masonry Association, 2006.

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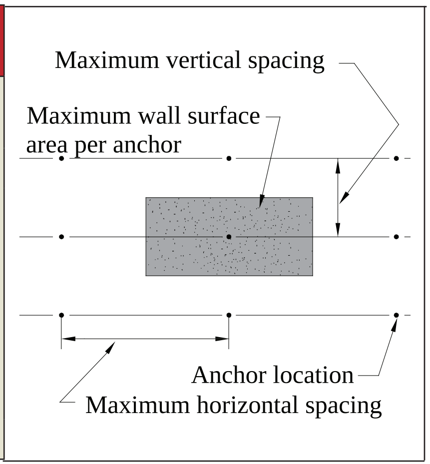
Table 1—Anchor Type and Spacing Requirements (ref. 2, 3)[A, B]

Backing:	Anchor type:	Max. wall surface area, ft² (m²):	Maximum anchor spacing:
Masonry	wire, adjustable, or joint reinforcement	2.67 (0.25)	32 in. (813 mm) o.c. horizontally and 25 in. (635 mm) vertically, but not to exceed the maximum wall surface area.
Concrete	adjustable	2.67 (0.25)	
Wood stud	adjustable two-piece, anchors of wire size W1.7 (MW11), or 22 gage (0.80 mm) corrugated sheet metal	2.67 (0.25)	
	all other anchors	3.5 (0.33)	
Steel stud	adjustable	2.67 (0.25)	



[A] Around openings larger than 16 in. (406 mm) in either dimension, space anchors around perimeter of opening at a maximum of 3 ft (0.91 m) on center, and place anchors within 12 in. (305 mm) of opening.

[B] Modified provisions are available for high wind areas and seismic areas. See the sections *High Wind Areas* and *Seismic Design Categories C and Higher* for details.

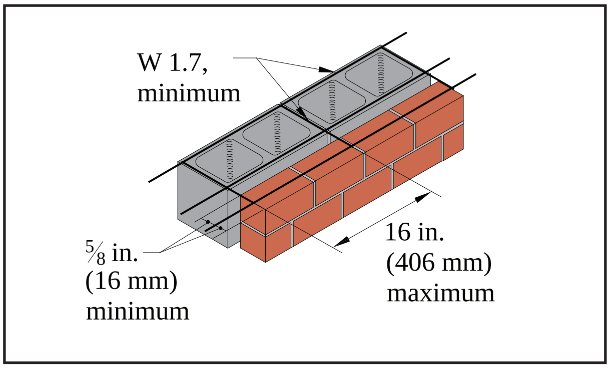


Figure 5—Requirements for Joint Reinforcement Used to Anchor Veneer

fastening of corrugated sheet metal anchors, the nail or fastener must be located within 1/2 in. (13 mm) of the 90° bend in the anchor. The exterior sheathing must be either water resistant with taped joints or be protected with a water-resistant membrane, such as building paper ship-lapped a minimum of 6 in. (152 mm) at seams, to protect the backing from any water which may penetrate the veneer.

When masonry veneer is anchored to steel backing, adjustable anchors must be used to attach the veneer. Each anchor is attached with corrosion-resistant screws that have a minimum nominal shank diameter of 0.19 in. (4.8 mm), or an anchor with equivalent pullout strength. Cold-formed steel framing must be corrosion resistant and should have a minimum base metal thickness of 0.043 in. (1.1 mm). Sheathing requirements are the same as those for wood stud backing.

Masonry veneer anchored to masonry backing may be attached using wire anchors, adjustable anchors or joint reinforcement. Veneer anchored to a concrete backing must be attached with adjustable anchors.

Anchor Placement

When typical ties and anchors are properly embedded in mortar or grout, mortar pullout or pushout will not usually be the controlling mode of failure. For this reason, connectors must be embedded at least 1 1/2 in. (38 mm) into a mortar bed of solid units, and the mortar bed joint must be at least twice the thickness of the embedded anchor. The required embedment of unit ties in hollow masonry is such that the tie must extend completely across the hollow units (Figure 6). Proper embedment can be easily attained with the use of prefabricated assemblies of joint reinforcement and unit ties. Because of the magnitude of loads on anchors, it is recommended that they be embedded in filled cores of hollow units. To save mortar, screens can be placed under the anchor and 1 to 2 in. (25 to 51 mm) of mortar can be built up into the core of the block above the anchor (Figure 7).

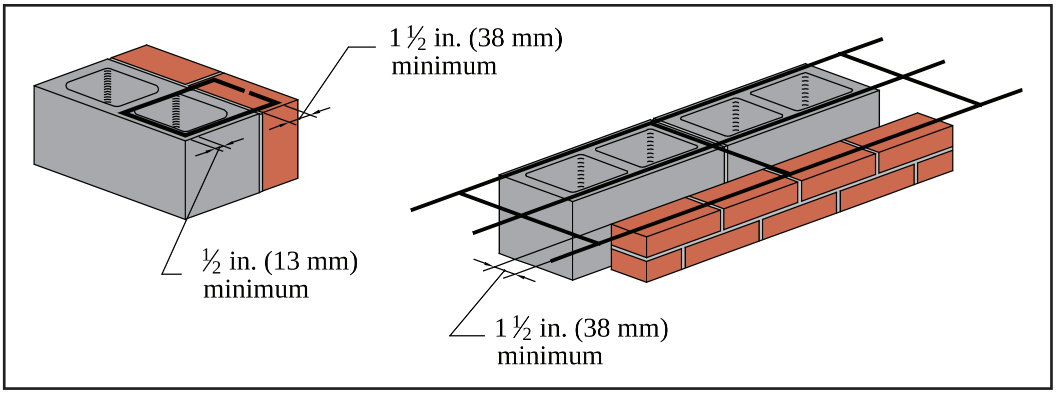


Figure 6—Minimum Embedment of Joint Reinforcement and Wire Ties

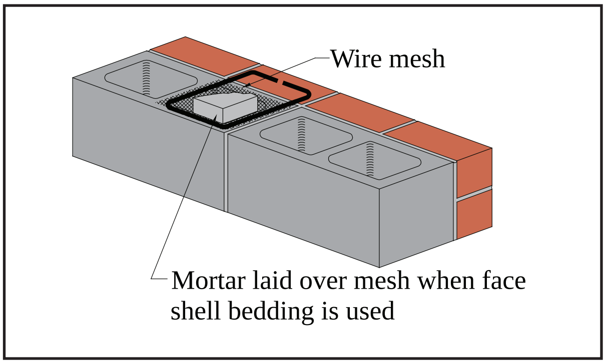


Figure 7—Use of Mesh to Facilitate Embedment of Anchor in Mortar

High Wind Areas

In areas with q_z greater than 40 psf (1.92 kPa) but not exceeding 55 psf (2.63 kPa) with a building mean roof height up to 60 ft (18.3 m), the following modified prescriptive provisions may be used.

The modified prescriptive provisions are:

- the maximum wall area supported by each anchor must be reduced to 70% of the value listed in Table 1,
- anchor spacing is reduced to a maximum of 18 in. (457 mm), both vertically and horizontally, and
- around openings larger than 16 in. (406 mm) in either direction, anchors must be placed within 12 in. (305 mm) of the opening and spaced at 24 in. (610 mm) on center or less.

In areas where q_z exceeds 55 psf (2.63 kPa), the veneer must be designed using engineering philosophies.

Seismic Design Categories C and Higher

To improve veneer performance under seismic loading in Seismic Design Category (SDC) C, the sides and top of the veneer must be isolated from the structure, so that vertical and lateral seismic forces are not transferred to the veneer. This reduces accidental loading and allows more building deflection without causing damage to the veneer.

In SDC D, in addition to this isolation, the maximum wall area supported by each anchor must be reduced to 75% of the value listed in Table 1, although the maximum spacings are unchanged. In addition, when the veneer is anchored to wood backing, the veneer anchor must be attached to the wood using a corrosion-resistant 8d ring-shank nail, a No. 10 corrosion-resistant screw with a minimum nominal shank diameter of 0.190 in. (4.8 mm), or with a fastener having equivalent or greater pullout strength.

In SDC E and F, the requirements listed above for SDC C and D must be met, as well as the additional requirements listed here. The weight of each story of anchored veneer must be supported independently of other stories to help limit the size of potentially damaged areas. In addition, to improve veneer ductility the veneer must have continuous W1.7 (MW11) single wire joint reinforcement at 18 in. (457 mm) o.c. or less vertically, with a mechanical attachment to the anchors, such as clips or hooks.

ADHERED VENEER

Conventional adhered veneer is veneer secured and supported through adhesion with a bonding material applied over a backing that both meets required deflection limits and provides for necessary adhesion. When applied to a masonry or concrete backing, the veneer may be applied directly to the backing substrate using layers of neat cement paste and Type S mortar, as illustrated in Figure 1. When applied over steel or wood framing, the adhered masonry veneer is applied to a metal lath and portland cement plaster backing placed against the sheathing element and attached to the stud framing members.

Alternative design of adhered veneer is permitted under the *International Building Code* when in compliance with *Building Code Requirements for Masonry Structures* (MSJC), where the requirements of unit adhesion (shear stress > 50 psi, 345 kPa) are met, out-of-plane curvature of the backing is limited to prevent the veneer from separating from the backing, and freeze thaw cycling, water penetration, and air and water vapor transmission are considered. Although the MSJC does not stipulate a deflection limit to control out-of-plane curvature, the Tile Council of America limits the deflection of backing supporting ceramic tiles to $l/360$ (ref. 11). Similarly, IBC Chapter 16 (for engineered design) requires a deflection limit of $l/360$ for exterior walls and interior partitions with plaster or stucco, which would be similar to an adhered veneer application.

Proprietary polymer-fortified adhesive mortars exist that meet the adhesion requirements and are used as a mortar setting bed to adhere the masonry veneers directly to a masonry or concrete backing, or to a lath and plaster backing system over wood or steel studs.

In addition, several proprietary systems are available to aid in placement of adhered masonry veneer on suitable exterior or interior substrates. These typically take the form of galvanized steel support panels that are mechanically anchored to a masonry or concrete backing, or placed against the sheathing element and attached to stud framing members. These products essentially take the place of the metal lath in the adhered veneer application. The metal panels contain support tabs and other features to facilitate the veneer application, carry the dead load of the veneer, and improve bonding of the veneer to the panel. In some cases, metal panel systems provide drainage or air flow channels as well. In lieu of mortar, construction adhesives having a shear bond strength greater than 50 psi (345 kPa) are used to bond the masonry veneer to the panel and masonry pointing mortar is used to fill the joint space between the masonry units. Installation using these products should follow manufacturer's instructions.

Masonry units used in this application are limited to $2^5/_8$ in. (67 mm) thickness, 36 in. (914 mm) in any face dimension, 5 ft^2 (0.46 m^2) in total face area and 15 lb/ft^2 (73 kg/m^2) weight. In addition, the *International Building Code* (ref. 4) stipulates: a minimum thickness of 0.25 in. (6.3 mm) for weather-exposed adhered masonry veneer; and, for adhered masonry veneers used on interior walls, a maximum weight of 20 lb/ft^2 (97 kg/m^2).

When an interior adhered veneer is supported by wood construction, the wood supporting member must be designed for a maximum deflection of $^1/_{600}$ of its span.

Adhered veneer and its backing must also be designed to either:

- have sufficient bond to withstand a shearing stress of 50 psi (345 kPa) based on the gross unit surface area when tested in accordance with ASTM C482, *Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste* (ref. 10), or
- be installed according to the following:
  - A paste of neat portland cement is brushed on the backing and on the back of the veneer unit immediately prior to applying the mortar coat. This neat cement coating provides a good bonding surface for the mortar.
  - Type S mortar is then applied to the backing and to each veneer unit in a layer slightly thicker than $^3/_8$ in. (9.5 mm). Sufficient mortar should be used so that a slight excess is forced out the edges of the units.
  - The units are then tapped into place to eliminate voids between the units and the backing which could reduce bond. The resulting thickness of mortar between the backing and veneer must be between $^3/_8$ and $1^1/_4$ in. (9.5 and 32 mm).
  - Mortar joints are tooled with a round jointer when the mortar is thumbprint hard.

When applied to exterior stud walls, the IBC requires adhered masonry veneer to include a screed or flashing at the foundation. In addition, minimum clearances must be maintained between the bottom of the adhered veneer and paved areas, adjacent walking surfaces and the earth.

Backing materials for adhered veneer must be continuous and moisture-resistant (wood or steel frame backing with adhered veneer must be backed with a solid water repellent sheathing). Backing may be masonry, concrete, metal lath and portland cement plaster applied to masonry, concrete, steel framing or wood framing. Note that care must be taken to limit deflection of the backing, which can cause veneer cracking or loss of adhesion, when adhered masonry veneer is used on steel frame or wood frame backing. The surface of the backing material must be capable of securing and supporting the imposed loads of the veneer. Materials that affect bond, such as dirt, grease, oil, or paint (except portland cement paint) need to be cleaned off the backing surface prior to adhering the veneer.

NOTATIONS:

l = clear span between supports, in. (mm)

q_z = velocity pressure evaluated at height z above ground, in.-lb/ft^2 (kPa)

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NCMA Annual Convention and ICON EXPO CPU Education Schedule

(AS OF 1/26/12)

TUESDAY, FEBRUARY 28

1:00pm – 5:00pm	NCMA Executive Committee Meetings

WEDNESDAY, FEBRUARY 29

8:00am – 9:30am	Foundation Program Review Committee
8:00am – 9:00am	Environmental Health and Safety Task Group
8:00am – Noon	Masonry Technical Committee
8:30am – 10:00am	SRW Contractor Subcommittee
9:00am – 11:30am	NCMA Spouse Welcome Breakfast & Book Talk
9:30am – 10:30am	Safety Awards Program Task Group
10:00am – 11:30am	Foundation Investment/Finance Committee
10:00am – 11:30am	SRW Marketing Subcommittee
10:30am – Noon	Associate Member Division Board
1:00pm – 2:00pm	Foundation National Endowment Council
1:00pm – 2:30pm	Education and Training Committee
1:15pm – 4:30pm	NCMA Spouse/Guest Winter Park Scenic/ Peterbrooke Tour
1:30pm – 3:00pm	NCMA Small Business/Family Business Forum
2:30pm – 4:30pm	SRW Technical Subcommittee
2:30pm – 4:30pm	Foundation Board of Trustees
3:00pm – 4:30pm	NCMA Product Development and Creative Concepts Forum
4:30pm – 6:00pm	NCMA Town Hall Meeting
6:00pm – 7:00pm	NCMA Member Networking Reception

THURSDAY, MARCH 1

7:00am – 8:00am	NCMA Industry Challenge Networking Breakfast
7:00am – 8:00am	Council Past Chairmen of the Board
8:00am – 9:30am	SRW and Hardscape Products Committee
8:00am – 9:30am	Government Affairs Committee
8:00am – 9:30am	Masonry Marketing Subcommittee
8:00am – 6:00pm	NCMA SRW Installer Course
9:30am – 10:00am	PAC Committee
9:30am – 10:30am	Membership Recruitment Committee
10:00am – 11:30am	Masonry Committee
10:30am – 11:30am	Membership Dues & Bylaws Committee
12:00pm – 1:30pm	NCMA Industry Business Luncheon
1:00pm – 3:00pm	ICON EXPO CPU Education:
1:00pm – 2:00pm	Architectural Design with Cast Stone
2:00pm – 3:00pm	•Introduction to Green Building and the International Green Building Code •Selling Permeable Interlocking Concrete Pavements Against Competitive Systems •Overview of New ASTM C90 Web Requirements •Leadership Styles of Men and Women – Embrace the Differences and Capitalize on Gender Strengths •ISO 14000 Environment Management and Masonry Cast Stone Connections
3:30pm – 8:30pm	Grand Opening Reception on Exhibit Floor
5:00pm – 6:00pm	HOT (Hands-On Training – Show Floor)

FRIDAY, MARCH 2

7:00am – 8:00pm	NCMA Networking Breakfast
7:00am – Noon	ICON EXPO CPU Education – Plant Operation Boot Camp
8:00am – Noon	Executive Committee
8:00am – 9:00am	ICON EXPO CPU Education: •Green Building Rating Systems (LEED) •Surviving an OSHA or EPA Inspection •Mastering Virtual Teams
8:00am – Noon	First Aid and CPR
9:00an – 10:30am	NCMA Spouse/Guest Breakfast
9:15am – 11:30am	ICON EXPO CPU Education:
9:15am – 10:15am	ICON EXPO CPU Education: •Managing Stormwater Runoff •Positioning Products for IGCC Application •Leveraging ASTM C90 Performance Requirements •Health in the Workplace: Silica; and Ergonomic Considerations
9:30am – 4:30pm	NCMA SRW Design Seminar
10:30am – 11:30am	ICON EXPO CPU Education: •Social Media •Recycled Materials – Do's and Don'ts Strategies for Sustainable Production: How Green Practices and Green Products can Transform Your Business •Understanding Production System Variations and Strategies for Improvement
Noon – 6:00pm	Exhibits Open
1:00pm – 2:00pm	HOT (Hands-On Training – Show Floor)
1:30pm – 4:30pm	NCMA Spouse Tour, Albin Polasek Museum & Sculpture Gardens
3:30pm – 4:30pm	HOT (Hands-On Training – Show Floor)
4:00 pm - 5:00 pm	NCMA Japanese Concrete Masonry Producers Association
6:00pm – 7:00pm	NCMA Political Fundraiser
6:30pm – 7:30pm	NCMA PAC Reception
7:30 pm – 9:30 pm	NCMA/ICPI Safety Awards & Design Awards of Excellence Dinner and CSI Design Awards

SATURDAY, MARCH 3

6:30am – 11:00am	NCMA/ICPI Block & Paver Plant Tour
11:00am – 3:00pm	Exhibits Open
1:00pm – 5:00pm	Optional Tour: Airboat Adventures at Old Florida Fish Camp
3:00pm – 5:00pm	NCMA Board of Directors Meeting
3:00pm – 6:00pm	NCMA/ICPI CPU Education – Plant Operation Boot Camp

DON'T MISS THESE NCMA OPTIONAL EVENTS

NCMA SMALL BUSINESS/FAMILY BUSINESS FORUM

Wednesdesay, February 29 – 1:30pm – 3:00 pm

This highly popular Forum addresses common issues and ideas, and provides networking opportunity among peers to solve problems facing small or family-owned companies. The agenda is open and topics addressed are based on those of interest to the attendees. Past Forum topics have ranged from legal issues, social media, and advocacy, to finance and technology. Come and expand your knowledge, meet with your peers, and grow your company. All NCMA members and registered guests with an interest in small business or family business are encouraged to attend!

NCMA PDCC FORUM

Wednesdesay, February 29 – 3:00 pm – 4:00 pm

Concrete masonry and hardscape producers always enjoy this bi-annual event where they have the opportunity to discover great new products! This PDCC Forum features the following presentations:

- True Mortar
- The PaveDrain System
- Omni Block

NCMA INDUSTRY BUSINESS LUNCHEON

Thursday, March 1– Noon – 1:30 pm

Cost: $55 members / $65 non-members

Join your peers this biannual event with networking, an update on association business by NCMA Chairman Don Gordon, as well as a presentation on one of today's hot industry topics. Speaker Ed Sullivan, vice president and chief economist for the Portland Cement Association will highlight current economic indicators and provide insight into the construction industry. You don't want to miss this popular event.

Special thanks to our generous event sponsors: ACM Chemistries Inc. and CCMPA.

NCMA POLITICAL FUNDRAISER

Friday, March 2 – 6:00 pm – 7:00 pm

At almost every Annual Convention and Midyear Meeting, the NCMA Political Action Committee (NCMA PAC) has hosted a political fundraiser for a member of Congress that has demonstrated a real interest in supporting the concrete masonry industry on Capitol Hill. Past honorees include Senators Susan Collins (R-ME), Ken Salazar (D-CO), and Evan Bayh (D-IN). Join us for a festive gathering and personal appearance of a Member of Congress who has been very helpful to NCMA in promoting the concrete masonry industry's Check-Off bill. A personal or PAC contribution will be required for admittance.

NCMA PAC FUNDRAISER

Friday, March 2 – 6:30 pm – 7:30 pm

Then walk across the hall and join fellow politically astute members at NCMA's gala PAC Fundraiser. This fun-filled event is the most important fundraising component of NCMA's annual drive to support the PAC by raising vital funds to support its program of giving to candidates that advocate for our industry on Capitol Hill. In this year when NCMA is so heavily engaged in bringing our Check-Off bill to completion, it is particularly important that the NCMA PAC replenish its coffers for supporting candidates with which NCMA has close ties in support of the important Check-Off initiative. Your registration fee for this event is used for this purpose. Door prizes are a major draw of the event, and again we will provide drawings for many door prizes.

NCMA/ICPI SAFETY AWARDS AND DESIGN AWARDS OF EXCELLENCE EVENT

Friday, March 2 — 7:30 pm – 9:30 pm

Cost: $85 members / $100 nonmembers

The winners of the NCMA/ICPI Design Awards of Excellence Event in masonry design and construction as well as the winners of the annual NCMA/ICPI Safety Awards will be honored at this ever popular annual event. The Cast Stone Institute (CSI) will also present their Design Awards at this event.

NCMA/ICPI BLOCK AND PAVER PLANT TOUR

Saturday, March 3 — 6:30 am – 11:00 am

Cost: $55 members / $155 nonmembers

Attendees of the Block and Paver Plant Tour will enjoy a continental breakfast before heading out to visit three plants located in the Orlando area including A-1 Block, Bedrock Industries and Tarmac. A-1 Block produces hardscape products and architectural block. Their fully automated plant features in-line splitting of standard products plus a specialty off-line splitter for wall veneer products. Bedrock Industries is a modern state of the art facility manufacturing both masonry and paver products. They feature a storage yard using close to five acres of pavers specially made to handle the heavy trucks. There is also a Bedrock ready-mix plant onsite as well. Tarmac is a dual line facility producing a variety of concrete units. During the tour they will be producing Pave Drain units using a core puller on one machine and standard units on another.

AIRBOAT ADVENTURE AT OLD FLORIDA FISH CAMP

Saturday, March 3 — 1:00 pm – 5:00 pm

Cost: $180 members / $200 nonmembers

The day's experiences will start on the bus ride to the Tosohatchee Florida Trail, an eco-system that borders a marsh, and a Tour Guide will narrate to your guests' en-route. The certified eco-guides will take you on a short 30 minute walk into the heart of this pristine wilderness before you are transferred to a 100 year old outpost, a turn-of-the-century fish camp. At fish camp, guests will enjoy a sampling of alligator tail and a cold beverage. Afterwards, you will board an airboat to ride the American Heritage River. Each airboat has its own guide and a Coast Guard licensed boat captain. Learn about the fresh water eco-system, alligators, and the many creatures that call this habitat home. This is an easy adventure without the dirt or danger. The ambiance of the fish camp and the natural beauty of Florida will make this outing memorable.

WIN $5,000 CASH! BUY YOUR RAFFLE TICKET AT THE SHOW!

On Saturday, March 3, one lucky winner will be announced for the Raffle being held at The Precast Show featuring ICON EXPO in Orlando, Florida. The grand prize is $5,000 in cash. Tickets will be on sale on the show floor during show hours Thursday – Saturday, with the drawing being held at the conclusion of the show. Tickets are $50 each, or at a discount for five or more. Ticket sales benefit the Education and Research Foundations of the National Concrete Masonry Association and the National Precast Concrete Association.

Special thanks to our generous sponsors: Basalite Concrete Products, Midwest Block & Brick, Hess Machinery, Besser.

ICON EXPO CPU EDUCATION SESSIONS

THURSDAY, MARCH 1	Industry Challenge Networking Breakfast 7:00 am – 8:00 am	Economic Status and Forecasting					
	1:00 pm	Architectitural Design with Cast Stone					
	2:00 pm	Introduction to Green Building and the International Green Building Code	Selling Permeable Interlocking Concrete Pavements Against Competitive Systems	Overview of New ASTM C90 Web Requirements	Leadership Styles of Men and Women — Embrace the Differences and Capitalize on Gender Strengths	ISO 14000 Environment Management and Masonry	Cast Stone Connections
FRIDAY, MARCH 2	Education Networking Breakfast 7:00 am – 8:00 am	Getting People on Baord — Unlocking the Power of Influence					
	7:00 am						**NCMA/ICPI CPU Education Bootcamp** 7:00 am – 12:00 pm • Continental Breakfast • Operations Overview and Introductory Presentation • Materials • Mixing and batching • Production • Curing • Handling • Splitting and Treating • Cubing
	8:00 am	Green Building Rating Systems (LEED)	Surviving an OSHA or EPA Inspection	Mastering Virtural Teams		First Aid & CPR	
	9:15 am	Managing Stormwater Runoff	Positioning Products for IGCC Application	Leveraging ASTM C90 Performance Requirements	Health in the Workplace: Silica; and Ergonomic Considerations		
	10:30 am	Social Media	Recycled Materials—Do's and Don'ts	Strategies for Sustainable Production: How Green Practices and Green Products can Transform Your Business	Understanding Production System Variations and Strategies for Improvement		
SATURDAY, MARCH 3	6:30 am – 11:00 am						NCMA/ ICPI Block and Paver Plant Tour
	3:00 pm – 6:00 pm						**NCMA/ICPI CPU Education Bootcamp** Round Table Discussion • ASTM C90 • Graduation Ceremony and Networking Reception • Reduced web production variables & considerations

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What: First Annual Production BOOT CAMP

Why: Learn what's new! New techniques, how to run your plant more efficiently and increase product quality, form relationships with peers from across the country

When:

Friday, March 2:

7:00 am – 12:00 pm	Breakfast and Boot Camp
12:00 pm – 6:00 pm	Attend The Precast Show featuring ICON EXPO to see what's new

Saturday, March 3

6:30 am – 11:00 am	Breakfast, NCMA/ICPI Plant & Paver Tour and meet with industry suppliers
11:00 am – 3:00 pm	Attend The Precast Show featuring ICON EXPO to see what's new and meet with industry suppliers
3:00 pm – 6:00 pm	Roundtable discussions; Topics include: New ASTM C90 Production of units with reduced web thicknesses; Networking Reception and Graduation.

Register for Icon Expo at www.iconexpo.org

LEFT: A group of block industry pioneers gather in 1933 to view the latest in block machinery. BELOW: The iconic shape of a typical concrete masonry unit.

THE EVOLUTION OF CONCRETE MASONRY

In 2010 while catching up on some circa 1930s Popeye cartoons with my (then) 3 year-old daughter, she made the astute observation that Bluto had selected "concrete masonry" in an attempt to slow down a spinach-juiced Popeye saving Olive Oyl from imminent peril. I had two reactions. The first being that of fatherly pride; whereby my young daughter not only noticed, but focused on the (albeit unconventional) use of concrete masonry amongst all the other distractions and excitement playing out before her. (Admittedly, such knowledge is foregone in my house.) The second was the realization that the iconic shape of a block, gray, consisting of two open cells and three webs, was as immediately recognizable today as it was nearly 80 years ago when this cartoon debuted.

So how was it that the concrete masonry industry converged on this 'standard' unit configuration nearly a century ago? Among many factors it was driven by the need to maintain interchangeable and modular units, address production and handling limitations, allow units to be laid with one hand, vertically align cells for the placement of grout and reinforcement, ensure structural stability well before engineering analysis was commonplace, or most likely a combination of all these traits as well as many others. Certainly there are examples of proprietary and non-proprietary unit configurations that exist today to meet specific market needs, such as open-ended units used on the West Coast to accommodate heavy reinforcing detailing and reduced-web units used in combination with insulation to increase the energy efficiency of the assembly. Yet the 'standard' two cell, three web unit configuration has prevailed.

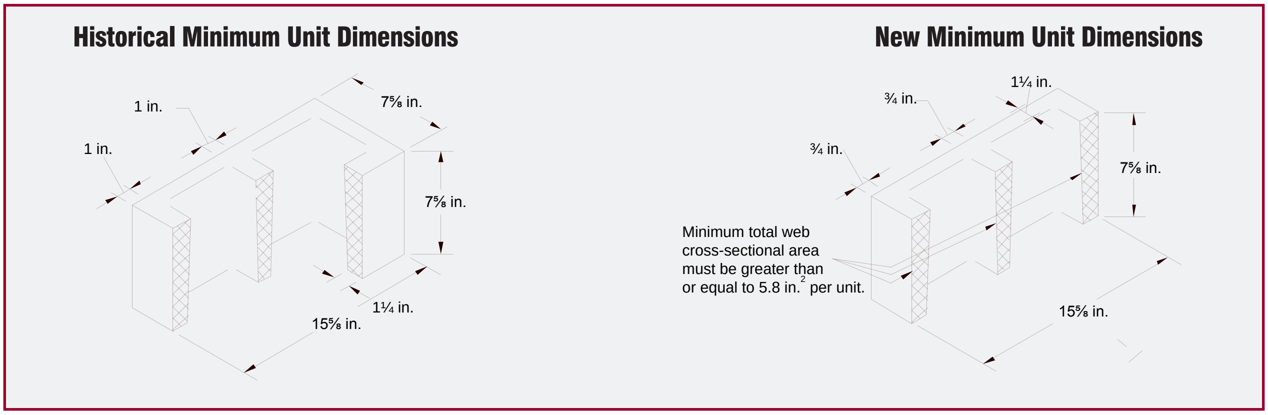
But why? What makes this single unit configuration the go-to choice for a nearly limitless number of applications across the globe? In discussing this question with producers, mason contractors, and designers I was surprised by the response I often received, which basically boiled down to: "Because this is what ASTM requires." Contrary to this common misconception, ASTM does not contain, and has never contained, requirements for unit configuration. ASTM C90 for loadbearing concrete masonry units has historically included minimum thickness requirements for face shells and webs as well as a minimum requirement for the total equivalent web thickness – but never has this standard included requirements for how the webs of a unit are configured. Unit configuration – specifically how and where the webs of a unit are located – is market driven.

It was this realization that prompted NCMA's Masonry Technical Subcommittee to discuss alternative web configuration strategies in early 2011 and to identify benefits that could be realized by revisiting this century-old icon. As a result of these discussions a series of changes was proposed to modify the minimum web requirements in ASTM C90, Standard Specification for Loadbearing Concrete Masonry Units, to provide more explicit flexibility in unit configurations to meet continuously evolving market demands. In December of 2011 these changes were approved by ASTM and a new version of ASTM C90 is available.

In a nutshell these changes modify the web requirements in ASTM C90 in three significant ways:

1. The equivalent web thickness, which is the sum of the individual web thicknesses per foot of block length, has been removed.
2. The minimum thickness of each web cannot be less than ¾ inch (19 mm).
3. The total minimum cross-sectional area of the webs connecting the face shells of the unit cannot be less than 6.5 in.^{2}/ft^2 (45,140 mm^2/m^2), which translates to 5.8 in.^{2} (40,280 mm^2) for a unit with 8 by 16 inch (203 by 406 mm) nominal face dimensions.

With these changes now in place, the question on every-



one's mind is "What's next?" How quickly will the industry (producers, contractors, and designers alike) adapt to and adopt this new flexibility into the marketplace? What factors will drive the use of one particular unit configuration over another? What impact, if any, does this change have on how concrete masonry is constructed or how it is designed for fire, sound, energy, water penetration, or structural loads? These questions, and likely many others, will continue to be debated in the months and years to come as each region and market application settles in on a unit configuration that best fits their needs. While this transition unfolds, I offer the following insights and predictions; each of which is certainly open to debate.

The immediate impact of these changes to ASTM C90 is somewhat nuanced, but important nonetheless. Currently there are a myriad of units commonly used that have web configurations that do not comply with the old ASTM C90 requirements, but would comply with the new ASTM C90 requirements. Examples include open-ended units such as H-block and A-block, which although these units have been used successfully in structural loadbearing applications for years they are essentially limited to grouted and reinforced applications to address the reduced webs provided by these units. Hence, while I foresee no immediate shift in the increased or decreased use of specialty configuration units, I do see reduced confusion in the field as to whether these units can be used in loadbearing applications.

In the short term I suspect the changes to unit configurations will initially be subtle, but tangible. For example, under the old ASTM C90 web requirements a standard 8 inch (203 mm) unit is manufactured with three webs each measuring nominally 1 inch (25 mm) in thickness. By reducing the thickness of these three webs to ¾ inch (19 mm) each, as would be permitted under the new ASTM C90 web requirements, a slight material and weight savings can be realized. Not much for an individual unit, but for a facility that produces 1 million units in a year this savings can add up to more than 620 cubic yards (475 cubic meters) and 2 million pounds (900 Mg) of material. Virtually identical unit configuration, yet with real, significant savings that will yield a unit that is more sustainable and cost effective to produce, easier to transport, and lighter to install.

Looking even further ahead into the future, the real challenges facing the industry will be to offer cost effective solutions to meet continuously increasing energy efficiency requirements imposed by building codes. In my opinion, this is where the flexibility in unit configurations available under the new ASTM C90 requirements can be the most beneficial when coupled with innovation and creativity. Because the webs of concrete masonry units are the paths by which heat transfers across the assembly, we can realize potential increases in energy efficiency for single wythe R-values 2 to 3 times higher by simply removing material from the web. Where and how we move forward with these options is yet to be determined, but will be a central theme of discussion at NCMA's upcoming Annual meetings in Orlando as we identify new design resources to develop, pending revisions to design codes and standards, and tools to educate the entire industry on how to successfully manufacture, install, test, and design using unit configurations that may not yet exist in the marketplace.

Re-engineering the iconic concrete masonry unit to use less material, be more energy efficient, and maintain its inherent structural, fire safety, sound abatement, and durable characteristics isn't without its challenges, but I am convinced this industry is ready to take these challenges on in supplying the marketplace with the next generation block.

JASON THOMPSON is Vice President of Engineering for the National Concrete Masonry Association. His area of expertise is concrete industry equipment and codes & standards. He is involved in developing technical publications on design and construction of masonry structures and providing seminars and lectures. Jason is active in the development of building codes and standards on design, construction, testing, and QA provisions for masonry structures. He received his Bachelor of Science Degree in Civil Engineering and Master of Science in Structural Engineering from Washington State University. He invites everyone to share their thoughts and insights with him as to what your crystal ball tells you the future holds for the concrete masonry industry. He can be reached at jthompson@ncma.org or 703-713-1900.

ASSOCIATION NEWS

NCMA SCHOOLS TO BE REFORMATTED FOR WEBINAR DELIVERY

Work on the 2012 education courses and certification programs schedule is in progress. As many of these programs as possible are being converted to a webinar delivery system. Sessions will be recorded so that they may be accessed at any time by the student. This will make the programs more convenient by requiring less time out of the office and will eliminate travel costs. The first programs to be converted are:

- Block and Landscape Products Sales & Customer Service Representative Course
- NCMA Technical Sales Training Course
- AIA/CES Provider Training Program
- SRW Train-the-Trainer Level I
- SRW Trainer Advanced

Details and information, when finalized, will be published in future e-News Briefs and posted in the Professional Development section of the NCMA website.

ENVIRONMENTAL HEALTH & SAFETY TASK GROUP SEEKS MEMBER INPUT FOR 2012

The NCMA Environmental Health & Safety Task Group is soliciting input from NCMA members on key regulatory health, safety and environmental issues to target for 2012. "As the federal government involves itself more and more in the EH&S realm, it is crucial that the task group hear real-time input from producers to guide NCMA's focus, and to better serve our membership," Chairman Bob Stewart said on a recent conference call to plan the upcoming year. "We want to hear from members before we meet in Orlando. Better yet, we invite everyone to roll up their sleeves and join our meeting." The agenda will include updates on regulatory issues like fly ash, silica, I2P2 and the new GHS/MSDS system upgrade, as well as grassroots reports on safety and education training programs. Reader input to the task group should be directed to Bob Stewart.

NEW ENGINEER JOINS NCMA STAFF

Tyler Witthuhn started with NCMA on Jan. 3 as project engineer. He joins NCMA after completing his bachelor's degree in civil engineering from Washington State University in Pullman, Wash. Witthuhn grew up on the east side of Washington and has been a Cougar all his life, but is looking forward to the transition to North Virginia. He is excited to work here at the NCMA offices, and to meet NCMA members as he has the opportunity to work with them. Witthuhn's focus will be to help advance the association's mission, goals and objectives while working with both the engineering department and the laboratory. His energy, personality and skill set fit in well with NCMA.

NEW NCMA AIA/CES POWERPOINT PRESENTATIONS AVAILABLE

NCMA AIA/CES PowerPoint presentations are now available, and existing presentations have been updated. NCMA AIA/CES Facilitators are allowed to give these presentations and award

NEW MEMBERS

NEW ASSOCIATE MEMBERS

- **Concrete Results Inc**., Southlake, Texas, Mark Muratore, CEO, 931-614-4167, mark@concrete-results.com, www.concrete-results.com. Recruited by: NCMA staff. Concrete Results is a leader in providing total solutions for manufacturers of concrete products. Providing direction in sales, product specification, production, equipment, molds and innovative licensed products all focused on pavers, wetcast, precast, stone veneer, pipe and concrete block.
- **cf Foam Inc.**, Knoxville, Tenn., Richard Porter, president, 865-588-4465, Richard@cfifoam.com, www.cfifoam.com. Recruited by: Lee McClinton, Block USA. cfiFOAM products are a two-part foam system that combine a unique spray-dried polymeric resin with a foaming catalyst to produce a "dry" foam. When combined with compressed air using specialized equipment, the foam insulation flows throughout the wall filling any irregular voids and hard-to-reach spaces, resulting in a building that is well-insulated, quiet and energy efficient. All cfiFOAM products are Class I Fire-Rated and have been tested by certified laboratories to comply with all international building codes.

If you do business with a company that is not a member, let's recruit them. Contact Membership Manager Heidi Weiss at hweiss@ncma.org.

continuing education units to architects on behalf of NCMA using NCMA's provider number. As of Jan. 1, the new presentations must be used per AIA requirements to award proper CEU credit. For more information on becoming an NCMA Facilitator see the AIA/CES Provider Training Program section of this website for prerequisite qualifications and how to become an AIA NCMA/CES Facilitator. Versions of these presentations are also available for sale to those individuals who would like to give the presentations without offering AIA/CES units or have their own provider number and want to register the programs themselves. For additional information contact Director of Technical Publications Dennis Graber or Brittaney Thompson.

WHY MASONRY? ADVERTISEMENT AVAILABLE

The Concrete Masonry Association of California & Nevada encourages NCMA members to use the current "Why Masonry" ad on websites, publications, e mails, bulletins and newsletters. Please contact Kurt Siggard, kurt@cmacn.org, or visit www.whymasonry.org for more information.

JOHN SORRELL ELECTED TO ARCHITECT BOARD

Alabama Concrete Industries Association (ACIA) director John Sorrell has been elected to serve on the state American Institute of Architects Board. John will serve in the role of Professional Affiliate Director beginning in 2012 and serve a one year term. The ACIA places a high priority on supporting the Alabama state chapter of AIA as well as other local chapters. The association regularly sponsors the group's events.

GOVERNMENT AFFAIRS NEWS

CONGRESSMAN SHIMKUS INTROTRANSPORTATION BILL REMAINS A PRIORITY IN THE HOUSE, SENATE

The House Transportation and Infrastructure Committee plans to mark up its surface transportation bill in the first week of February, meaning that it hopes to have a draft bill completed by the end of January. Speaker of the House John Boehner has indicated that he wants the bill to pass the House by President's Day. This timetable may be unrealistic because of the tens of billions of dollars in pay-fors that still need to be worked out, as well as rumors that the House bill would amend state apportionment formulas set under the last surface bill, which would create debate among "donor" and "donee" states. Senate Majority Leader Harry Reid has also prioritized the transportation bill to the top of the Senate's 2012 agenda, but the Senate Commerce, Science and Transportation Committee, which reported out a series of bills that will be added to the surface bill's safety title, has problems with portions related to freight that have drawn several holds. In addition, the Senate Finance Committee still has not made public the offsets needed for the bill, and the Banking, Housing and Urban Affairs Committee is still working on its piece of the bill dealing with transit.

INDUSTRY NEWS

Southern pine 2x4 design values downgraded

The American Lumber Standard Committee, a quasi-government agency authorized to set grading standards for lumber used in construction, approved a reduction of about 30 percent in design values for 2x4's made of southern pine effective June 1. The dramatic action is in response to recommendations made in October by the Southern Pine Inspection Bureau following an investigation that determined that the rating methods used by lumber mills were not producing product capable of meeting the previous design values. The reduction only applies to visually-graded 2x4's of southern pine and does not apply to other board sizes yet, nor southern pine that is machine graded, nor lumber made from other trees. However, additional planned testing may result in further future revisions. The Forest Economic Advisors had estimated that the changes could create a potential demand loss of 1 to 2.5 billion board feet of southern pine. The approved changes represent a scaled-down compromise from the original SPIB recommendations based on concerns raised about their potential far-reaching impacts to homebuilders and the wood industry. The ALSC said in their decision, "All design professionals are advised in the strongest terms by the board to evaluate this information in formulating their designs in the interim period." For more information, visit www.alsc.org.

IN MEMORIAM

ROB SHOULDICE

Rob Shouldice of Shouldice Designer Stone, Shallow Lake, Ontario, Canada, passed away at the age of 65 Dec. 23, 2011. Rob joined the company in 1962 and learned all phases of operation from the ground up, including operations, transportation, office and administration. Rob married June Shouldice (Ackert) in 1970, and she worked shoulder to shoulder with Rob at Shouldice Cement Products Limited. Rob became president and owner of Shouldice Cement Products Limited in 1978. Rob experimented with processes to make designer stone, adding value to the basic blocks. In 2012, Rob would have celebrated his fiftieth year in the concrete block and stone industry. During that time he was an active member of NCMA, serving on several committees as well as the Executive Committee and the board of directors. Rob was a generous supporter of the NCMA Education and Research Foundation. A celebration of life and block truck funeral procession was held Dec. 29, 2011.

NCMA Technical Resources and Support

NCMA professional engineering staff provides industry expertise and technical support for members and the design community. NCMA also develops, publishes, markets and maintains publications and software packages highlighting the correct and efficient design as well as detailing and construction of concrete masonry and hardscape products. The popular TEK Series is a compilation of over 130 technical topics—over 500 pages of information on estimating concrete masonry, loadbearing wall design, grouts and mortars, and segmental retaining walls, among many other subjects.

Visit www.NCMA.org for more information

A Magazine Archive is Available at www.ncma.org

Have You Taken Advantage of all the resources available on the NCMA web site?

- e-TEK
- Bookstore
- Design Resources
- TEK Technical Information
- Research Reports
- Metric Design Guidelines
- Energy Code Options for CMU
- Sustainability Information
- Technical Services
- Technical Publications Database
- Fire and Acoustics
- Design Awards Program
- Marketing Resources
- Articles for Print and Radio
- Camera Ready Artwork
- Fire Safety Materials
- Mold Materials
- Print Ads
- Safety Resources
- eSafetyLine Software
- Opportunities/Leads
- Helpful Links
- Fire Safety Associations
- Mold Resources
- Workforce Development

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Marketplace

AIA Continuing Education Learning Program

Learning Units Reporting Form

AIA Questions (Circle the correct answer)

1. Advantages of concrete masonry safe rooms include:
   a. It does not have to be designed in accordance with any standards or codes
   b. It can be built on an existing slab on grade without having to remove part of the slab to install a large foundation normally required for safe rooms
   c. In many cases there is adequate weight available in a grouted masonry assembly to resist overturning of the safe room
   d. b and c above.

2. Which of the following publications are consensus standards that can be referenced by building codes
   a. FEMA 320
   b. FEMA 361
   c. ICC-500
   d. All of the above
   e. a and b above only

3. The inherent physical characteristics of properly constructed, reinforced concrete masonry make it ideal to withstand wind-induced pressures and windborne debris impacts in safe rooms
   a. True
   b. False.

4. Concrete masonry safe rooms for tornadoes according to ICC-500 require that
   a. All the cells of the masonry units be solid grouted
   b. Every cell of the masonry units contain reinforcing steel
   c. The concrete masonry walls be no more that 6’-8” (2 m) tall.
   d. a and b above.

5. Tornado safe rooms are designed to resist the impact of a 2x4 (38 x 89 mm) missile of the following mass and velocity
   a. 9 lbs, 80 mph (4.1 kg, 36 mps)
   b. 9 lbs, 128 mph (4.1 kg, 57 mps)
   c. 15 lbs, 100 mph (6.8 kg, 45 mps)
   d. 15 lbs, 250 mph (6.8 kg, 112 mps)

6. FEMA 320 contains design criteria and guidance is to be used for community shelters.
   a. True
   b. False.

7. Connections between building elements must be strong enough to resist the design loads
   a. True
   b. False.

8. Segmental Retaining Walls (SRWs) cannot be constructed unless there is adequate for excavation to install geogrid soil reinforcement
   a. True
   b. False.

9. The most feasible alternative for installing a segmental retaining wall when there is little room behind the wall to excavate and place geogrid is:
   a. Temporarily remove the structure above the wall and replace it after constructing the retaining wall
   b. Use a whaling harpoon to shoot anchors and cable deep into the soil to provide anchorage for the SRWs.
   c. Drill anchors into the soil to provide the anchorage for the SRWs.

10. The direct anchorage SRW system is a more aesthetically pleasing and less costly alternative to conventional cast-in-place concrete than would normally be used in that situation.
    a. True
    b. False

To receive one learning unit, read “Designing Concrete Masonry Safe Rooms for New and Existing Homes”, “SRWs Provide a Solid Solution”, and complete the questions on this page. Return this form to the National Concrete Masonry Association.

Return forms before December 2012 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:
AIA CES, National Concrete Masonry Association,
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.

January | February 2012

AIA Member Information:

Name

Address

City State/Province Zip Code

Phone Fax

E-mail ID Number

I certify that the above information is true and accurate to the best of my knowledge. I have complied with the AIA Continuing Education Guidelines.

Signature Date

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

CONCRETE MASONRY DESIGNS

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