Your Sneak Peek:
A preview of papers from the upcoming BEST3 Conference
Cladding wasn’t meant to stand up to climate all by itself. Buildings need StoEnergy Guard advanced cavity wall system to protect from the inside out. This integrated system of products delivers wall protection technology that works seamlessly under many cladding types, all while meeting the latest code requirements for energy efficiency and moisture control.

StoEnergy Guard

stocorp.com/stoenergyguard
Selection tip for continuous insulation (ci):

It shouldn’t burn!

Unlike rigid foam, non-combustible Thermafiber RainBarrier® provides thermal AND fire protection in rain screen/cavity wall construction.

LIFE SAFETY
RainBarrier insulation remains intact at 2,080°F, even after 5 hours of testing. (Rigid foam melts at 300°F.)

SUSTAINABILITY
RainBarrier is made of 70% to 90% recycled materials. (Rigid foam includes no more than 40% recycled content.)

ENERGY EFFICIENCY
RainBarrier provides equal or better R-value (up to 4.2/inch) for less than the price of rigid foam and contributes to 33 LEED® credits.

To learn more about Thermafiber RainBarrier:
Contact your field representative.
Call 1-888-634-2371.

Thermafiber RainBarrier is available in light or dark fiber to help camouflage the insulation in open-joint systems (or ventilated façades).
AIA/CES module for Enclosures and Cladding\textsuperscript{1} says:

“A continuous air barrier...... must seamlessly connect to the lowest slab on grade, foundation, and roof. This requires compatible materials and close coordination among the trades.”

“Of the many different connection points, one that requires the most careful detailing and is most often subject to failure, is the interface between the air/moisture membrane and window openings, curtain walls, or storefront framing edges.”

\textsuperscript{1} Enclousres and Cladding AIA/CES Module, www.BDCnetwork.com/EnclosuresAndCladding

Polyguard has compiled a comprehensive book, \textit{Integrated Building Envelope™ Handbook – Connections with Exterior Wall Assemblies}. This handbook (available to the design community at www.polyguardproducts.com/aac) describes the all important tie-in connections using isometric drawings and installation text.

“Missed Connections”- installation errors and omissions - are the major cause of breaches in otherwise airtight and water resistant building envelopes. Our handbook, in combination with our unique and patented products, address decades of observed failures caused by incompatible materials, incomplete and/or omitted design details, and lack of coordinating installation guidelines.

It’s not just about good air barriers and flashings. It’s about compatible, inexpensive, easy to install and single source end dams, cants, corner boots, corner flashing kits, drips, counters, thru wall and pan flashings, flared termination strips, horizontal and pan weeps, bottom and top vents, rain screens and pressure equalizing rain screens. AND it’s about clear and simple drawings, details, and instructions.

Work with Polyguard.
We’re the ones with the connections.

\textbf{VENEER WINDOW HEADS}

- 1 Detail
- 7 Isometrics with instructions
- Uses: Drips, Couplers, Counters, Cant, Flashing, Termination Strips, End Dams, Horizontal Weep

Innovation based. Employee owned. Expect more.

\textbf{Polyguard}

Phone: (1) 615.217.6061  www.polyguardproducts.com
Features:

11 Eliminating the Potential for Air and Moisture Infiltration in Stucco Façades at the Window-Wall Interface

17 Electronically Tintable Glass as an Architectural Enabler

23 Dynamic Exterior Wall Systems for Solid Masonry Walls in Humidified Buildings

27 Thermal Insulation Systems of the Future

Messages:

7 Message from Institute President Henry L. Green

9 Message from BETEC Chairman Wagdy Anis

Industry Updates:

31 BEC Corner

36 Buyer’s Guide
With Pilkington Optiwhite™ and Pilkington OptiView™, the possibilities are endless.

No matter how ambitious your latest projects may be, whatever you have in mind you should have Pilkington Special Applications Glass in mind too. Pilkington Optiwhite™ is so versatile it can be specified for a surprisingly wide range of applications. Our extra-clear, low-iron float glass is virtually colorless and has excellent light transmission, making it the ideal choice for applications where glass edges are visible or where transparency and purity of color are desired. Pilkington OptiView™ has anti-reflective and UV blocking properties which make it perfect for any display, showroom or storefront applications. Pilkington OptiView™ blocks more than 99 percent of transmitted UV to protect interiors and content. It also minimizes visible light reflectance to less than 2 percent compared to clear glass.

www.pilkington.com/na • email BuildingProducts.PNA@nsg.com • Call 800.221.0444
AS THE YEAR WINDS DOWN (IÛªM WRITING this column in mid-December) and the cold days of January approach, this may be the best time to think about how important enclosures are. With spring not too far in the offing, this issue of the Journal of Building Enclosure Design allows us to preview the next installment in discussions on building enclosures. The Building Enclosure Science & Technology (BEST) 3 Conference is right around the corner. As we learned at BEST2, this conference offers excellent examples to review and lessons to learn. BEST3 provides a unique opportunity to continue our discussion and to learn from colleaguesÛª field experiences and other ways to improve building enclosure innovation. Articles in this issue are just a sample of the discussions and lessons scheduled for the upcoming BEST3, to be held April 2-4, 2012, in Atlanta, Georgia.

At the recent Building Enclosure Technology and Environment Council (BETEC) Symposium held at the National Institute of Building Sciences Annual Meeting in December 2011, BETEC discussed High R-Value Walls and Field Studies and the importance they have on our built environment and the development of good codes. This discussion should be continued at BEST3. We want to thank the National Association of Home Builders (NAHB) and the NAHB Research Center for their support, and Craig Drumheller for pulling together speakers who discussed the various challenges and solutions for use of foam plastic insulation in buildings. The event was extremely well attended and got rave reviews.

At the Annual Meeting, I engaged the BETEC Board of Direction in a conversation on how we advance the discussion of resilience in our building stock. I asked that BETEC also consider working on a symposium for the next Annual Meeting in 2013. This educational opportunity provides the platform for a continued discussion on the improvement of building envelopes and the importance they serve in assuring resilient buildings and communities. More information on the 2013 Annual Meeting will be forth coming over the next several months. A save-the-date reminder is also included in this edition of the magazine.

On the subject of codes, the National Building Enclosure Council and BETEC are examining current code provisions of the International Building Code to determine if current standards are appropriate or need to be revised in light of the evidence that walls perform well and do not demonstrate a hazard as has been suggested in the current code for certain materials. This work is just the initial start of what is hoped to be an ongoing effort by BETEC to examine codes and to improve on the technical content of the codes based on experience and data that will support the code for expected building envelope performance. The combined knowledge and experience of BETEC and other members of the building community could provide a sound basis for examination as well as recommendations to improve code content that result in building envelopes that serve the functions for advancing the high performance of buildings, not only in terms of enclosure protection from moisture and air infiltration but also as it relates to assuring the envelope performs in hazard conditions such as high wind events.

In September, the Institute entered into a renewed Memorandum of Agreement with the American Institute of Architects (AIA) for the development and support of local Building Enclosure Councils (BECs). I have invited AIA representatives to participate in the upcoming BEST3 Conference in the opening plenary session to offer their views on how we can collaborate to improve the work of the local BECs and our work nationally in the science of building enclosures.

BEST3 will provide an opportunity for attendees to exchange ideas, learn new techniques and explore the current research being conducted to address the many issues surrounding building enclosures. I hope to see you at BEST3 in Atlanta, April 2-4, 2012.

Henry L. Green, Hon. AIA
President
National Institute of Building Sciences
Insulating Solutions for High Performance Curtain Wall Systems

- Fire Resistant
- Stable Long-Term Thermal Resistance
- Sound Absorbent
- Water Repellent
- Environmentally Sustainable

800.265.6878
www.roxul.com

BEDR (Building Envelope Designed with Roxul)
The Building Enclosure Councils in the United States have expressed their grave concerns nationally on the questionable direction that the IBC has taken regarding this issue, the millions of dollars already spent on consultants and testing, and the spiraling need for testing that is hitting an already suffering construction industry.

The increase in stringency is not backed by statistical data on fire loss and is therefore unwarranted. The Building Enclosure Councils in the United States have expressed their grave concerns nationally on the questionable direction that the IBC has taken regarding this issue, the millions of dollars already spent on consultants and testing, and the spiraling need for testing that is hitting an already suffering construction industry. The issue has been brought up to the Institute Board for help and action.

On another note, BETEC is changing. The BETEC Visioning Committee has expressed the need for change commensurate with the challenges of the future. There will be potential intensification in BETEC’s activities, accompanied by changes to its structure, its bylaws, and its goals and finances (which is hopefully a good thing). So stay tuned as BETEC reinvents itself over the next six months, and hopefully YOU will get involved!

Wagdy Anis, FAIA, LEED-AP
Chairman, BETEC
Wiss, Janney, Elstner Associates, Inc.

---

**Your Ticket to the BEST Conference Ever**

**Join us for:**

3 Days

3 Tracks: Energy Efficiency, Whole Building, and Fenestration

18 Sessions

75 Technical Presentations

Continuing Education Units (CEUs)

Exhibits and more . . .

Sponsored by the National Institute of Building Sciences and the Building Enclosure Council-Atlanta

---

**REGISTER TODAY AT:** www.thebestconference.org
Join the Glazing Big Leagues.

Register today.

www.glassweek.com
Eliminating the Potential for Air and Moisture Infiltration in Stucco Façades at the Window-Wall Interface

By Peter Poirier and Bill Hooper

FUNCTIONAL PERFORMANCE AT THE window-wall interface in stucco façades has a significant effect on overall building envelope system performance. While building envelope materials, design and construction have exhibited a number of improvements in recent years—including increasingly stringent code requirements, along with the general acceptance of air barriers and vapor protection, and the introduction of whole building envelope commissioning—the window-wall interface continues to be a problem.

In 2008, the Western Construction Consultant Association (WESTCON) set out to test commercially available flashing systems for a standard storefront window in a stucco application. Their results were presented at RCI, Inc.’s 2009 Building Envelope Technology Symposium.1 The WESTCON study began with a literature review that revealed that there is limited guidance available for flashing aluminum storefront windows that lack attachment flanges. Of the six assemblies tested, two were considered successful while the others leaked. Based upon the fact that the majority of the assemblies tested experienced problems, a team was assembled to investigate how the connection around the window and/or wall assembly within a stucco façade could be modified to improve leak-free performance. The process began by determining what testing would be required to confirm components incorporated in the design would be compatible and what standards must be met.

A description of product and independent laboratory testing for air infiltration, water-resistance and structural performance as well as vapor permeance and testing protocols will be reviewed during our presentation at the BEST3 Conference.2 It is summarized here. The presentation includes the evaluation of the ability of drift joints in the test assembly to meet seismic performance requirements by using a modified American Architectural Manufacturers Association (AAMA) racking test with testing showing little difference in air exfiltration and air infiltration rates before and after the racking test.

Stucco façades have problems with proper sealing and flashing window or wall systems within the stucco cladding. The window-wall interface can compromise the integrity of the stucco cladding. A logical solution to remedy these issues is the development of pre-engineered transition assemblies, comprised of finished aluminum and silicone materials, which are assembled and attached to the window and wall assemblies to ensure a durable connection and seal capable of absorbing dynamic movement and windloading stresses without pulling apart (FIGURE 1). The potential benefits are numerous: reduction or elimination of problems currently faced at the window-wall interface; the ability for the designer to specify one transition assembly flexible enough to be placed in many different locations and under different climactic conditions; and the ability to provide continuity and compatibility of performance layers between

---

**Figure 1.** Pre-engineered transition assemblies ensure a durable connection and seal.
adjoining components/assemblies in a structurally sound and durable manner.

Stucco façades, as shown in FIGURE 2, are comprised of a cementitious coating that is made up of three layers: a scratch coat, a brown coat and a top finish coat, all of which are applied over a building paper with a metal lath embedded for structural reinforcement, covering the structure’s sheathing. The building paper’s function is to create a drainage plane behind the plaster, while the two layers of paper rely on flashing moisture to the bottom of the wall. Fasteners used in mounting the plaster’s casing bead (J-molding) and metal lath penetrate the building paper as shown in FIGURE 3, allowing air/moisture access. The building paper is designed to flash moisture; however, air pressure differential can draw in air and moisture through these penetrations.

**DEFINED WALL PERFORMANCE STANDARDS**

A typical laboratory test standard for wall performance would be ASTM E331, *Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*. Since a large percentage of stucco wall construction is done in California, particular attention was given to West Coast standards where the original WESTCON testing was conducted. The 2010 *California Building Code* goes beyond basic requirements by extending exposures from 15 minutes to 2 hours.

The *California Building Code, Section 1403 Performance Requirements*:  

2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.

2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1,219 mm by 2,438 mm) in size.

2.3. Exterior wall envelope assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (psf) (0.297 kN/m²).

2.4.1. Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of two hours.

Many states currently are mandating air barriers in their building codes. As a result, the team felt the test assembly should also comply with ASHRAE 90.1-2010, which establishes 0.2 L/s.m² at 75 Pa (0.04 cfm/ft² at 1.57 lbf/ft²) as the maximum allowable assembly air leakage as tested in accordance to ASTM E2357 procedures. This test method requires two 8 ft. by 8 ft. test specimens to be constructed for comparison. One is an opaque wall (specimen 1), while the second (specimen 2) has prescribed window, pipe, ductwork and electrical-box penetrations.

**DEFINED COMPONENT PERFORMANCE STANDARDS**

Plaster façades are required to use two layers of Grade D 60-minute building paper as an isolation sheet between the plaster and wall sheathing. The following tests were conducted to confirm compatibility with this wall component.

**Stain/adhesion testing**

A three-month stain/adhesion evaluation test was conducted using a silicone extrusion with silicone sealant in direct contact with a Grade D building paper. The test specimens were conditioned at
100°F (38°C) and 100 percent relative humidity (RH). Test specimens were evaluated for adhesion and compatibility every month for three months. The test specimens showed no change in adhesion and no staining (color change) to the silicone sealant or silicone extrusion.

For the next test the exterior sheathing was coated with a fluid-applied synthetic vapor-permeable air barrier. The coating was applied at 70 wet mils and cured to a thickness of 35 mils. A film thickness gauge is used to check the coating thickness. Once cured (less than 24 hours), the surface provides a clean durable surface for the bonding of the silicone extrusion in the transition assembly to the surface with silicone sealant.

The Grade D building paper was placed as a single or double sheet on top of the dry or wet coating in a horizontal position. A common pre-mix concrete was used as the “stucco” and applied on top of the building paper to a 0.5 in. (1.27 cm.) thickness. Each assembly was then cured for 7 days at 75°F (24°C) and ~50 percent RH. The wet air barrier membrane exhibited good adhesion to a single layer of the building paper. The cured coating exhibited a very small amount of adhesion to the building paper due to its uneven nature, adhering primarily at the high points. This confirmed the building paper will act as an isolation sheet to create a drainage plane between the plaster and the air barrier membrane.

The fluid-applied synthetic vapor-permeable air barrier coating was tested in accordance with ASTM D 1970-09 procedures for self-sealability. The test assembly was modified by applying a fluid-applied synthetic vapor-permeable air barrier applied over an exterior gypsum board and allowed to cure. Mechanical fasteners used to support the metal lath, J-channel and staples for the building paper, were driven into and through the assembly. After the sealant was allowed to cure, deionized water was used to cover the fasteners and the assembly was placed in a refrigeration unit for three days. No water leakage was detected within the assembly.

The window-wall connection

For the window penetration in the test specimen, a center-glazed storefront system was chosen. This was the first time an actual window unit was used as a test specimen for an ASTM E 23574 test.

When installing a storefront system in a typical stucco façade, the exterior sealant bead is bonded to the metal casing (J-channel) around the rough opening. As noted in WESTCON’s testing, moisture can migrate behind the plaster coating and casing bead thus bypassing the exterior sealant. Flashing techniques can reduce and potentially prevent moisture from gaining access around the window penetration but are not designed to prevent air infiltration.

To allow a connection to be made behind the stucco coating, as shown in FIGURE 4, a continuous snap-in pocket filler was utilized in the storefront system. This filler allowed a metal adaptor to be mechanically attached to the prefabricated window unit. Once the unit was properly positioned and shimmed in the rough opening, silicone sealant was applied along the adaptor and window frame. The silicone extrusion was inserted into the adaptor and the excess sealant under the short leg of the silicone extrusion bonded the leg to the window frame and was able to seal the metal-to-metal gap. The silicone extrusion was able to span the rough opening joint like a window frame nailing flange but was flexible too, to span the gap unsupported to seal the window unit to the air barrier coating.

The window frame was factory fabricated and sealed. The ends of the vertical mullions were sealed with backer rod and silicone sealant. This allowed the metal adaptor to span over the end of the vertical mullion at the head condition to provide a bonding surface for the silicone extrusion.

This window system was sealed into a typical sill pan with end caps and the sill pan was sealed to the rough opening with silicone sealant. The metal adaptor was stopped short of the sill pan end cap. The dart of the silicone extrusion was removed to allow the gasket to be adhered to the sill.

These assemblies could not only eliminate problems currently faced at the window-wall interface but enable the designer to specify one transition assembly flexible enough to be placed in many different locations based upon the configuration of the window or wall system and under different climactic conditions.
pan’s end cap and sealant bead under the sill pan.

Prior to installing the .25 in. (.64 cm.) monolithic glass, measurements were taken of the glazing pockets and glass thickness. The top load ethylene propylene diene monomer (EPDM) gaskets were installed on either side of the glazing pocket to allow the insertion of the edge pressure gauge to measure the lip seal pressure of these gaskets. Based upon the measured glass thickness, the gaskets obtained an instantaneous edge pressure reading of ~4 pli. No silicone sealant was used as corner seals in this instance to help reduce the infiltration of air and water as would generally be recommended.

After seismic performance testing, the test specimen was tested in accordance with ASTM E 331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference of 300 Pa (6.24 psf) infiltration for 2 hours with no water infiltration. Some fasteners missed the structural support and the fluid-applied synthetic vapor-permeable air barrier coating sealed these from the exterior.

After the water test, specimen 2 was retested for air infiltration. Then the test specimen 2, along with the opaque specimen 1, were tested in accordance with ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies. The test results for specimen 2 are contained in TABLES 1 TO 4.

The assembly configured and tested by the team performed at a level far superior to ASHRAE and Air Barrier Association of America (ABAA) standards requirements for an air barrier system. This assembly achieved these results even though it went beyond the normal specimen design to include a real-world-window (dry glazed with no sealant) and drift joint, which was subjected to simulated seismic racking.

The two test specimens will be joined with a door and another wall to create a small out-building with a roof for long-term exposure. After a period of time, the structure will be dismantled and the walls retested for comparison. Prior to the out-building construction, specimen 2 (with window) was retested in accordance with ASTM E331 @ 600 Pa (12.5 psf) for

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Total Leakage (cfm)</th>
<th>Tare (cfm)</th>
<th>Specimen Leakage (cfm)</th>
<th>Leakage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Pa (0.52 psf)</td>
<td>0.058</td>
<td>0</td>
<td>0.058</td>
<td>0.005</td>
</tr>
<tr>
<td>50 Pa (1.04 psf)</td>
<td>0.098</td>
<td>0</td>
<td>0.098</td>
<td>0.008</td>
</tr>
<tr>
<td>75 Pa (1.57 psf)</td>
<td>0.144</td>
<td>0</td>
<td>0.144</td>
<td>0.011</td>
</tr>
<tr>
<td>100 Pa (2.09 psf)</td>
<td>0.168</td>
<td>0</td>
<td>0.168</td>
<td>0.013</td>
</tr>
<tr>
<td>150 Pa (3.13 psf)</td>
<td>0.229</td>
<td>0</td>
<td>0.229</td>
<td>0.018</td>
</tr>
<tr>
<td>250 Pa (5.22 psf)</td>
<td>0.339</td>
<td>0</td>
<td>0.339</td>
<td>0.027</td>
</tr>
<tr>
<td>300 Pa (6.27 psf)</td>
<td>0.397</td>
<td>0</td>
<td>0.397</td>
<td>0.031</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Total Leakage (cfm)</th>
<th>Tare (cfm)</th>
<th>Specimen Leakage (cfm)</th>
<th>Leakage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Pa (0.52 psf)</td>
<td>0.072</td>
<td>0</td>
<td>0.072</td>
<td>0.006</td>
</tr>
<tr>
<td>50 Pa (1.04 psf)</td>
<td>0.102</td>
<td>0</td>
<td>0.102</td>
<td>0.008</td>
</tr>
<tr>
<td>75 Pa (1.57 psf)</td>
<td>0.139</td>
<td>0</td>
<td>0.139</td>
<td>0.011</td>
</tr>
<tr>
<td>100 Pa (2.09 psf)</td>
<td>0.179</td>
<td>0</td>
<td>0.179</td>
<td>0.014</td>
</tr>
<tr>
<td>150 Pa (3.13 psf)</td>
<td>0.249</td>
<td>0</td>
<td>0.249</td>
<td>0.020</td>
</tr>
<tr>
<td>250 Pa (5.22 psf)</td>
<td>0.331</td>
<td>0</td>
<td>0.331</td>
<td>0.026</td>
</tr>
<tr>
<td>300 Pa (6.27 psf)</td>
<td>0.381</td>
<td>0</td>
<td>0.381</td>
<td>0.030</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Total Leakage (cfm)</th>
<th>Tare (cfm)</th>
<th>Specimen Leakage (cfm)</th>
<th>Leakage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Pa (0.52 psf)</td>
<td>0.068</td>
<td>0</td>
<td>0.068</td>
<td>0.005</td>
</tr>
<tr>
<td>50 Pa (1.04 psf)</td>
<td>0.124</td>
<td>0</td>
<td>0.124</td>
<td>0.010</td>
</tr>
<tr>
<td>75 Pa (1.57 psf)</td>
<td>0.162</td>
<td>0</td>
<td>0.162</td>
<td>0.013</td>
</tr>
<tr>
<td>100 Pa (2.09 psf)</td>
<td>0.197</td>
<td>0</td>
<td>0.197</td>
<td>0.016</td>
</tr>
<tr>
<td>150 Pa (3.13 psf)</td>
<td>0.275</td>
<td>0</td>
<td>0.275</td>
<td>0.022</td>
</tr>
<tr>
<td>250 Pa (5.22 psf)</td>
<td>0.419</td>
<td>0</td>
<td>0.419</td>
<td>0.033</td>
</tr>
<tr>
<td>300 Pa (6.27 psf)</td>
<td>0.467</td>
<td>0</td>
<td>0.467</td>
<td>0.037</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Total Leakage (cfm)</th>
<th>Tare (cfm)</th>
<th>Specimen Leakage (cfm)</th>
<th>Leakage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Pa (0.52 psf)</td>
<td>0.064</td>
<td>0</td>
<td>0.064</td>
<td>0.005</td>
</tr>
<tr>
<td>50 Pa (1.04 psf)</td>
<td>0.122</td>
<td>0</td>
<td>0.122</td>
<td>0.010</td>
</tr>
<tr>
<td>75 Pa (1.57 psf)</td>
<td>0.170</td>
<td>0</td>
<td>0.170</td>
<td>0.013</td>
</tr>
<tr>
<td>100 Pa (2.09 psf)</td>
<td>0.211</td>
<td>0</td>
<td>0.211</td>
<td>0.017</td>
</tr>
<tr>
<td>150 Pa (3.13 psf)</td>
<td>0.259</td>
<td>0</td>
<td>0.259</td>
<td>0.021</td>
</tr>
<tr>
<td>250 Pa (5.22 psf)</td>
<td>0.423</td>
<td>0</td>
<td>0.423</td>
<td>0.034</td>
</tr>
<tr>
<td>300 Pa (6.27 psf)</td>
<td>0.459</td>
<td>0</td>
<td>0.459</td>
<td>0.036</td>
</tr>
</tbody>
</table>
15 minutes with no water leakage, which surpasses the storefront manufacturer’s minimum performance requirements.

CONCLUSION

The development of pre-engineered transition assemblies which were flexible, durable, could simplify the detailing and that could provide clear proof of a secure bond was key to the design of a leak-free, airtight wall assembly. These assemblies could not only eliminate problems currently faced at the window-wall interface but enable the designer to specify one transition assembly flexible enough to be placed in many different locations based upon the configuration of the window or wall system and under different climatic conditions.

When used in conjunction with a compatible air barrier system, they could also ensure continuity and compatibility of performance layers between adjoining components/assemblies in a structurally sound and durable manner for a wall assembly that could meet today’s most stringent standards and those anticipated in the future.

This wall assembly was put to all of today’s tests and beyond. The results surpassed expectations, providing a solution that eliminates trial and error, uncertainty and interpretation on the job while providing critical data that will enable the design team to make sound decisions and provide long-term sustainability.

Peter Poirier is the Technical Director of Tremco Building Envelope Solutions. Bill Hooper is the Research & Development Manager for Kawneer Company, Inc.

REFERENCES

1. Presentation by the Western Construction Consultant Association (WESTCON) at RCI Inc’s 2009 Building Envelope Technology Symposium, October 26-27, in San Diego, CA.
2. Eliminating the Potential for Air and Moisture Infiltration in Stucco Façades at the Window-Wall Interface, to be presented at the BEST3 Conference, April 2-4, 2012, Atlanta, GA.
Airtightness Testing

NOT JUST FOR HOMES ANYMORE

Airtightness testing of homes has been around for more than 20 years. Various energy programs and fluctuating energy bills have provided homeowners an incentive to improve the airtightness of their homes. Energy tax credits can also be received by the homeowner but only if the house airtightness has been verified that it is less leaky after remodeling than before.

Efforts to make commercial buildings more energy efficient in the US has only recently been incorporated into various “green” initiatives. Tests of commercial buildings show that they tend to be more leaky than the average house, based on air leakage per square foot of surface area. That means that commercial buildings are less energy efficient than the average house.

To measure the actual airtightness of a large building means more air is needed to maintain a reasonable test pressure. The Energy Conservatory, a leader in airtightness testing, has kits available to directly measure more than 18,000 cubic feet per minute of air leakage. Multiple kits and fans can be used simultaneously to generate more air for accurate and reliable measurements of air leakage for testing before and after retrofitting.

For more information on multi-fan systems, contact:
The Energy Conservatory
612-827-1117 or visit our website at www.energyconservatory.com

Where’s the Leak?

What’s the best way to: measure the airtightness level of building envelopes; diagnose and demonstrate air leakage problems; estimate natural infiltration rates and efficiency losses from building air leakage; certify construction integrity?

For more than 20 years, the Minneapolis Blower Door™ has been recognized as the best designed and supported airtightness testing system in the world. The Minneapolis Blower Door is the system of choice for utility programs, energy raters, HVAC contractors, builders, insulation contractors and weatherization professionals.

FEATURES:
- Precision Engineered, Calibrated Fan
- Accurate, Powerful 2 Channel Digital Pressure and Flow Gauge
- Lightweight, Durable Aluminum Door Frame and Fabric Panel

Download product pdfs at
www.energyconservatory.com 612.827.1117

Diagnostic Tools to Measure Building Performance

The ENERGY CONSERVATORY
By Helen Sanders, PhD and Louis Podbelski, AIA, CSI

WILL EVER-MORE STRINGENT ENERGY CODES MEAN THAT highly glazed buildings are a thing of the past? Will architectural design freedom using glass be constrained as we move towards net-zero energy buildings? In an environment of ever-increasing building energy performance goals, constraining the amount of glass area in buildings is being widely debated (Wilson 2010, Shuttleworth 2008). Indeed, in both Europe and North America, we are seeing an increasing trend to reduce window to wall ratio in new building energy codes and standards through either increasing stringency for insulation values and whole building energy efficiency targets (The Building Regulations, Part L, 2010) or through additional specific window area limits (IECC 2012).

However, glass is a key architectural design tool and is ubiquitous in buildings today because of the design flexibility it provides and the positive impact that natural daylight and the connection with the outdoors have on people’s health and well-being. Constraining the amount of glass that can be used certainly puts limitations on an architect’s design freedom. It is also true that too much glass or glass in the wrong location on the building can cause uncomfortable glare and heat for the occupants, as well as a large air conditioning load.

Moreover, because we live in a dynamic environment that changes season by season, day by day, and hour by hour, a traditional “static” building envelope cannot respond effectively to these ever-changing conditions, even if glass is strategically placed around the façade and overhangs are employed. As a result, a static envelope is increasingly becoming a constraint when balancing architectural design with occupant comfort and the rising demands of energy efficiency.

The U.S. Department of Energy (DOE) has identified three key façade elements required in order to achieve net-zero energy commercial buildings (Arasteh et al., 2006): low U-factor fenestration (reduce conductive losses); dynamic solar control (admit or block solar heat gain and light as needed); and integrated façades in which dimmable lighting controls are used in combination with fenestration, light redirecting strategies (such as light shelves) and dynamic glare control systems (such as automated blinds/shades or dynamic glass) to offset electric lighting with natural daylighting.

Dynamic solar control can be achieved with mechanical moveable louver systems or Venetian blinds integrated into double skin curtain walls. Such systems are popular in Europe. Alternatively, electronically tintable glass (also known as electrochromic or EC glass) can be used to provide variable solar control and variable glare control as part of the integrated façade. EC glass can, at the touch of a button or command from a building automation system, modulate its solar heat gain coefficient (SHGC) and visible light transmission over a wide range, stopping anywhere in between (see FIGURE 1 for an example of the performance of an EC product).

By achieving a visible light transmission as low as two percent in the tinted state, EC glass provides the ability to block uncomfortable glare while maintaining the view to the outside, unlike the mechanical alternatives which block or obstruct the view. The ability to modulate the SHGC also provides the designer with controllable heat and light. The amount of light and heat coming into the space is tuned depending on the exterior environmental conditions and the needs of the occupants. By dynamically controlling the light and heat flow, significantly more energy savings can be captured than when using a static façade solution, as well as providing enhanced occupant comfort with maintained exterior views. In fact, the use of EC glass provides an architect with the ability to design with more glass without energy penalty.

According to DOE estimates, if all windows in commercial buildings in the United States were replaced today with highly insulated fenestration with integrated dynamic solar control and daylighting controls, $35 billion annually could be saved (Arasteh et al., 2006). In fact, by itself, dynamic glass could save 0.8 Quads annually over the current static window baseline. Dynamic solar control saves energy in all climate zones by providing passive solar gains during heating seasons, minimizing cooling loads during cooling seasons and providing maximum daylight harvesting potential, replacing electric lights with natural light in all seasons.

Through a series of case studies, we will explore how dynamic glass can be used to provide architects with a tool that can expand design possibilities for the use of glass in a climate of ever-increasing energy codes and enable the creation of exceptionally energy-efficient and comfortable daylit spaces that would otherwise not be possible.

Figure 1. Graph of visible light transmission (Tvis) versus solar heat gain coefficient (SHGC). This chart shows the heat gain and light transmission range of a high-performance EC product compared with some examples of standard static glass.
ENABLING OTHER SUSTAINABLE DESIGN STRATEGIES: HVAC FREE DESIGN

The first case study is illustrated in FIGURES 2 AND 3, which show exterior and interior images respectively of a two-story atrium space at Chabot College Student Services Center in Hayward, California, which has been glazed with EC glass. This highly glazed space faces south and west in a cooling dominated climate zone and as such presents significant challenges for glare and heat gain control.

Furthermore, as part of the energy efficiency strategy to meet the U.S Green Building Council’s LEED certification, the architect created this atrium as a heating, ventilation and air conditioning (HVAC)-free, naturally ventilated space, implementing a novel natural air cooling and heating strategy. The temperature of the atrium is controlled by radiant heating and cooling in the concrete slab, combined with roof and ceiling air scoops to provide natural air flow.

Implementation of EC glass gave the architect sufficient range of solar control that he was able to implement his design strategy without needing to reduce the glazed area in the space. In fact, the architect, Phil Newsome from tBP Architecture, is quoted as saying that the natural ventilation technology implemented in this project would not have been possible without the use of dynamic glass. “This revolutionary dynamic glass controls the amount of sunlight entering the two-story space. As a result it has become an architectural enabler that has allowed us to create an HVAC-free space.”

The EC glass is automatically controlled in three zones through the building automation system based on temperature control points with manual override, providing glare control for the occupants of the private office spaces on the second floor as well as a comfortable temperature in the atrium.

Chemeketa Health Sciences Center has been designed by SRG Partnership and the Energy Studies in Buildings Laboratory at the University of Oregon to provide a completely daylit two-story space with no requirement for electric lighting during the day and with only natural ventilation for cooling. With skylights covering 30 percent of the roof area, achieving a naturally ventilated space was very challenging because of the difficulty of controlling the amount of light and the heat admitted by the glass. However, in this design EC glass is used in the skylights to provide dynamic control over the light and heat entering the space based on the exterior conditions and facilitating the design concept. The unique daylighting design (FIGURES 4, 5), with light reflectors under the skylights, provides uniform distribution of the light into both top and bottom floors and eliminates hot spots. As with the previous example, the use of EC glass in this project has enabled the use of a sustainable design concept that provides a fully natural daylit space without the need for mechanical cooling.

Figure 2. EC glass installed in the Student Services Center at Chabot College, Hayward, California (exterior view). This is an example of how EC glass can provide additional design freedom to architects. In this case the use of EC glass enabled the use of a natural ventilation system while maintaining a fully glazed south and west facing atrium.

Figure 3. Interior view of the EC glass installed in the Student Services Center at Chabot College. The glass can be tinted to control the amount of solar heat entering the space to allow effective use of the natural ventilation system.

Figure 4. Schematic showing the daylighting and natural ventilation design for the two-story Chemeketa Health Sciences Center. EC glass is used in the skylights to control the amount of light and heat entering the building.
ENABLING GREATER ARCHITECTURAL FREEDOM

Dehority Hall at Ball State University in Indiana features a large skylight (~150 sq.m, or 1,600 sq. ft.) with clerestory glazing around the perimeter (FIGURE 6). Converted from an open central courtyard into an enclosed space, the university wanted to preserve the open feel of the space and to create a general purpose area serving as a lounge, entryway and a venue for large group audio visual presentations.

Working in the background using light sensors, the EC glass solution in this application provides variable levels of tint in order to maintain a constant user-determined light level in the space. This automatic control can be manually overridden to, for example, fully tint the glass when darkening the room for presentations or when full glare control is required.

When considering solutions for the heat and light control problem that they knew they would have, the architects, Schmidt Associates, investigated alternative options involving mechanical shading solutions. According to design architect, Ryan Benson, EC glass was a more eco-friendly and aesthetically pleasing alternative to using conventional skylights and architectural controls such as shades, exterior fins or louvers. It enabled him to incorporate more glass into the project without compromising energy efficiency and a view to the natural outdoors.

He said, “Students perform better with daylighting and views. EC glass was the best option for the Ball State project because it enabled us to maximize natural light and a view to the outdoors, while creating a space that’s thermally and visually comfortable for the students inside.”

In addition, Gary Canaday, Ball State’s Manager of Campus Construction, Facilities Planning and Management, noted that, “We previously had regular glass skylights but blinding glare and heat was a problem. We looked at installing mechanized shades and blinds but that option was not attractive and would have created on-going maintenance issues. EC glass controls the sunlight and heat that enters and leaves the building, reducing our energy use while enhancing and increasing students’ use of the space.”

Based on user feedback, it is clear that the provision of a comfortable space that met both the open feel design intent and the full range of occupant needs would not have been possible without the use of EC glass.

The use of EC glass provides an architect with the ability to design with more glass without energy penalty.

The fourth case study illustrates how increased design freedom can be provided by using EC glass in a religious facility. Increasingly, churches are becoming multi-use spaces and religious services are multi-media in nature. While there is a need to bring more natural light into these types of buildings, there is also a need for darkening the space for presentations as well as controlling the heat and glare caused by increased daylight at other times.

At Immanuel Bible Church in Virginia, the architect implemented EC glass in the large amount of clerestory glazing in order to be able provide as much natural daylight as deep into the building.
building as possible, yet control the heat and, as needed, darken
the space for audio visual presentations (FIGURE 7). The panes
are controlled in groups (or zones) according to orientation and
their height/position on the elevation.

LOUVER FREE FAÇADE DESIGN SOLUTION

The final case study illustrates how EC glass can provide
more architectural design freedom and a more elegant façade
solution relative to conventional mechanical dynamic solar
control alternatives. FIGURE 8 shows the application of EC
glass integrated into a full building façade in the Siemens Wind
Turbine Facility in Hutchinson, Kansas. It is the largest instal-
lation of EC glass in the world today. The original renderings of
this building design showed the use of automatically controlled
external horizontal louvers spanning between columnar ele-
ments on the façade, which were to provide dynamic solar con-
trol for the façade.

After investigating alternative options, the architects de-
cided to specify electronically tintable glass for a number of
reasons. Firstly, on an initial upfront cost basis, the EC solution
was less expensive than the mechanical louver system origi-
nally envisioned and secondly, there would be no additional
maintenance costs. Moreover, the EC glass also presented a
more elegant façade solution, which provided a clean look to
the building with unobstructed views to the outside.

The ability to zone the glass on the façade and to variably tint
the glass between the fully clear and fully tinted states allows
for different control strategies for private offices compared to
multi-use spaces such as the cafeteria, entryway and meeting areas. The EC control system is connected to the Siemens building management system. Based on whether the building is occupied or not, the EC glass can be switched to either optimize for energy efficiency or for occupant comfort.

**SUMMARY**

The five case studies described in this article clearly demonstrate why EC glass can be considered an architectural enabler. Electronically tintable glass can provide the architect with more design flexibility and the ability to use more glass in the face of ever more stringent building codes as well as facilitating the use of other sustainable technologies. Together, this supports the movement towards zero energy buildings.

Today, even though manufacturing economies of scale are not yet leveraged, EC systems are comparable in cost, and, in an increasing number of cases, are lower in cost than today’s conventional solutions, which combine high-performance static low-e glass, interior and exterior mechanical shading and larger HVAC capacity. This is especially true when comparing the EC glass solution to one with automated mechanical shading systems. With a static envelope system, the building owner also has the potential reduction in productivity due to comfort issues and, worst of all, the loss of the primary reason we put windows in a building in the first place—to see out.

Moreover, with the advent of high volume manufacturing scale and the efficiencies afforded by the use of large area magnetron sputtering, the manufacturing costs of the EC glass solution are being driven increasingly lower and lower. In a similar way to the advancement of low-e products over the past 20 years, electronically tintable glass will evolve in terms of price reduction, performance enhancements and breadth of product range, thus driving increasing market adoption until ultimately EC products will become the de-facto standard for building envelopes.

Helen Sanders, PhD, is Vice President of Technical Business Development, and Lou Podbelski, AIA, CSI, is Vice President of Architectural Solutions for SAGE Electrochromics, in Faribault, Minnesota.

The authors would like to thank SRG Architects and Energy Studies in Buildings Laboratory at the University of Oregon for the use of their graphics; Phil Newsome from tBP Architecture for providing commentary on his use of EC glass in his atrium design at Chabot College; and to Ryan Benson (Schmidt & Associates) and Gary Canaday (Ball State University) for their feedback on the design and use of EC at Ball State University. We would also like to acknowledge the entire team at SAGE Electrochromics, Inc., with out whose hard work and commitment none of these case studies would have been realized.

**REFERENCES**


International Energy Conservation Code (ICC). 2012. Published by ICC. This code has reduced the allowable maximum window to wall ratio from 40 to 30 percent compared to IECC 2009. Up to 40 percent WWR is still allowed if dimmable lighting controls are used.


Judd Allen Group specializes in helping our clients achieve the highest level of quality, design, and energy efficiency by focusing on exterior envelope assessments, thermal analysis, & design recommendations that comprise many exterior components, such as waterproofing, masonry, window/curtain wall installation, metal panels, rain screen & many other exterior envelope materials. We pride ourselves in being up-to-date with all exterior materials and methods to help guide our clients with attention to efficiency and aesthetics.
Dynamic Exterior Wall Systems for Solid Masonry Walls in Humidified Buildings

By Sean M. O’Brien, P.E., and Vince Cammalleri

THE CHALLENGES OF “MODERNIZING” SOLID MASONRY buildings are well understood for typical buildings but less so for humidified buildings, especially those in cold climates. The conversion of existing, often historically-significant buildings into climate-controlled museum spaces is a fairly common theme in renovation projects.

Designing a new museum building is challenging but an even greater challenge lies in converting an existing building into a museum space. Existing constraints in renovation projects often complicate wall design and detailing conditions that could otherwise be simply resolved in new building design. The special case of converting a solid masonry-walled structure into a museum brings further challenges, as simply adding insulation and vapor control layers can actually lead to more problems than they solve.

Our BEST 3 paper, synopsized here, reviews the challenges of maintaining museum environments in solid masonry buildings and presents effective solutions based on the authors’ experience. It discusses specialized “dynamic wall systems” that couple the building enclosure with the mechanical system as a means of thermal and moisture control. Practical examples of the implementation of these systems will be presented.

SOLID MASONRY CHALLENGES

Unlike contemporary lightweight walls, in traditional solid masonry construction the walls themselves form both the structure and the enclosure of the building, with no true separation between dry and wet zones. Rather than acting as barriers to heat, air and moisture, masonry walls act more like buffers, allowing for slow heating, cooling, wetting and drying in response to changing environmental conditions.

While uninsulated solid masonry buildings have been in use for centuries and have clearly passed the test of time in most respects, subjecting these walls to high interior humidity levels can result in a range of problems, including condensation on interior surfaces, concealed moisture damage within the masonry, or visible damage or efflorescence/staining on exterior surfaces.

The risk of wall damage depends on the type and condition of the masonry. Hard-fired, exterior brick that can withstand direct exposure to rain and freezing temperatures is unlikely to be affected by increased interior humidity levels. Conversely, relatively weak materials such as face-bedded sandstone or common brick can be significantly affected by increased interior moisture levels.

While the seemingly obvious strategy of adding insulation and air/vapor barriers to solid masonry walls to accommodate higher interior humidity levels is simple in concept, in practice those materials can end up causing more problems than they solve. Interfering with the ability of masonry walls to breathe and dry to the interior can lead to moisture retention within the masonry as well as interior finish materials. Adding interior insulation reduces heat flow into the masonry wall and subjects the interior portion of the wall to a new range of temperatures. With enough insulation in a cold enough climate, the interior portion of the masonry will experience freeze/thaw conditions.

Older (for example, pre-1900) solid masonry walls used durable stone or more thoroughly fired brick as the exterior wythe due to the need for weathering resistance and weaker, common brick, for interior/backup wythes. Common brick has sufficient strength to support the wall but is less resistant to weathering.

The use of common brick diminished as extruded terracotta block and concrete masonry units—both of which are more durable than common brick—became more popular as backup materials. The reduced durability of common brick was generally not a problem because the inner wythes were protected from extreme events by the outer wythes, and were warmed from the interior during cold weather due to the lack of interior insulation (for example, inner wythes were exposed directly to the interior).

With the addition of insulation and a vapor retarder, the retained moisture and freeze-thaw cycling discussed above can lead to accelerated freeze-thaw damage to wall materials, particularly materials like common brick that were never intended for such exposure. Even if breathable insulations are used and vapor retarders omitted, some risk still exists since the elevated interior moisture levels in a museum space will eventually result in higher moisture contents in the masonry wall materials.

In most cases, adding air/vapor-permeable insulation, such as fiberglass or mineral wool, to the interior of a masonry wall increases the risk of condensation on the back of the masonry, which is now kept colder by the insulation but may not be fully isolated from moist interior air.

When considering the performance of solid masonry walls in museums, designers must keep in mind that due to the relatively low insulating value of the walls—a typical, 3-wythe brick masonry wall has an RSI-value of approximately RSI-0.5 (R2.8)—anything hung on the exterior walls essentially becomes “coupled” to the wall performance.

Since temperature drop across a layer in a wall assembly is proportional to the total thermal resistance of the layer compared to the total assembly resistance, adding a wood framed painting with a resistance of RSI-0.2 (R-1.1) means that over 25 percent of the temperature drop in the system will occur across the painting. This produces an effective drop in the...
surface temperature of the wall behind and around the painting (FIGURE 1). While the drop in temperature around wall hangings can be enough to cause condensation by itself (since the wall surfaces drop below the interior dew point), hangings such as thick oil paintings or anything with a plastic or glass facing also act as strong vapor retarders, increasing the risk of condensation and moisture accumulation on the walls regardless of their surface temperature. Even in the absence of condensation, the temperature drop across and moisture flows through these interior hangings can produce localized fluctuations in temperature and relative humidity (RH) levels that are not acceptable for the artwork being displayed. These fluctuating conditions can lead to induced mechanical stresses in hygroscopic materials and, consequently, accelerated degradation. Shelving containing artifacts or other forms of storage or display will be subjected to similar conditions, creating temperature and vapor gradients across their thickness due to their inherent insulating value and moisture resistance.

**DYNAMIC WALL SYSTEMS**

An ideal design for a masonry wall system in a museum should prevent condensation and moisture accumulation within the masonry while providing a stable environment for collections placed against the wall. This requires that the design control airflow and prevent moist air exfiltration, keeping the interior masonry warm (both above the interior dew point and above freezing), and preventing damage to, or localized temperature and moisture gradients around, artwork that may be hung on the exterior walls. To accomplish all of these goals, an active system is necessary.

**Design**

A wall system design that has been used successfully on multiple projects essentially turns the exterior walls into return air plenums that are integrated with the mechanical systems. The first component is an air barrier installed over the existing masonry. The air barrier, which must be a vapor permeable material, limits airflow through the masonry wall and consequently limits air exchange between the exterior and interior.

For masonry walls, a coat of cement plaster is often sufficient to improve the airtightness of the wall. Depending on the applicable code, plaster, as a noncombustible material, may be the only option since the vent space may qualify as a return air plenum, precluding the use of materials without the required flame spread/smoke development ratings.

A vented space is then constructed inboard of the wall, with interior finishes facing the room/space. The entire vented space is connected to a return air plenum which feeds back to the mechanical system. The key component of the system is a calibrated or adjustable restrictor plate at the base of the wall which allows for negative pressure to be maintained in the interstitial wall cavity (FIGURE 2).

In typical operation, the mechanical system delivers conditioned air to the room space, maintaining the space at a positive pressure to prevent outside contaminants from entering. Room air is drawn through the restrictor plates, which create a pressure drop. The plates are calibrated so that the pressure in the vent space is lower than the exterior ambient air pressure. In this arrangement, the room operates under positive pressure to prevent bulk air entry at doors, while the vented wall cavity is operated under negative pressure to prevent humid air exfiltration through the walls.

This is the primary defense against moisture-related damage to the walls; the air barrier is installed to prevent air from leaving but also to limit the amount of exterior air that enters the wall cavity that would need to be treated/conditioned. Air that does enter through the exterior walls is immediately drawn through the vent space and returned to the mechanical system. This is where it is treated and filtered before being delivered back to the space (eliminating any potential contaminants which may have entered the space via the airstream).

The movement of air across the interior of the masonry wall has the benefit of delivering more heat to the masonry than still air, thereby raising interior surface temperatures of the masonry. This can be critical in extremely cold climates where condensation on the masonry itself is a risk. The system design must take into account the velocity of the airstream as well as the wall height so that temperatures on the masonry are maintained above the dew point for the full height of the walls.

Similarly, the moving airstream will evaporate moisture from the masonry walls and return it to the mechanical system for removal, providing redundancy in the event of excessive wetting of the masonry or incidental water leakage through the walls.
By removing heat and moisture loads from the exterior walls directly, before those loads can affect the space, the dynamic wall provides the additional benefit of maintaining relatively constant conditions on the interior finish wall. This wall can be used to hang paintings or other artwork since temperature and moisture conditions are nearly the same on both sides of the wall regardless of the temperature and moisture conditions in the masonry.

To this end, a continuous sheet of plywood installed over the studs is useful for providing flexibility to the owner for artwork display (for example, they are not limited to hanging at stud locations only). The dynamic wall essentially de-couples the interior finishes and hangings from the masonry wall, allowing museums greater flexibility in planning their displays and providing a more stable microclimate around the artwork (FIGURE 3).

Construction
The simplest construction of a dynamic wall is that of an archive space with no windows and minimal aesthetic requirements. In this case, restrictor plates at the base of the wall can be left exposed and ductwork at the top of the wall does not need to be concealed.

Finished spaces with windows present an additional challenge for vented wall designs, as the windows create significant interruptions in the flow of air across the masonry walls. Failure to properly direct airflow around windows can lead to dead spots within the walls where condensation can develop, especially in colder climates where wall surface temperatures are critical. While computational fluid dynamic (CFD) simulations can be used as a design tool, testing and evaluation of field-constructed mock-ups are essential as they provide a clear indication of performance.

Testing
The complexity of ventilated wall systems often makes field testing a basic requirement for the project. Testing can range from simple airflow balancing to comprehensive pressure measurements and monitoring of temperature and RH levels within the system. Monitoring surface temperatures on the existing masonry during cold weather is one of the best indicators of performance since condensation risk can be directly evaluated. Monitoring of surface temperatures and ambient conditions in the vented space can be useful in identifying dead spots in the system where additional airflow is needed, or where specific components to divert or deflect air within the vent space must be added (FIGURE 4 AND FIGURE 5).

SUMMARY
Creating humidified environments within existing solid masonry buildings poses some unique design challenges, particularly when the building is intended for use as a museum. A balance between the preservation of the building and its contents can be achieved with a dynamic wall system. This design approach essentially decouples the interior environment from the exterior wall by introducing a vented cavity that is coupled with the building’s mechanical system. This allows the wall to accommodate the stringent demands that humidification and pressurization places on the building enclosure while providing a safe, stable environment for the artwork in the building. When properly designed and implemented, dynamic walls serve the dual purpose of preserving and protecting the existing masonry and the building contents placed along its side.

Sean M. O’Brien, P.E., LEED-AP, is an Associate Principal at Simpson Gumpertz & Heger Inc., New York City. Vince Cammalieri, AIA, is a Senior Principal at Simpson Gumpertz & Heger Inc., New York City.

FURTHER READING
SAVE THE DATE

BUILDING INNOVATION 2013

January 7-10, 2013
Washington Marriott at Metro Center
Washington, D.C.

IMPROVING RESILIENCY through HIGH PERFORMANCE

Be there for four impactful days as the Institute focuses on Improving Resiliency through High Performance during this first in a series of annual events that will present informative programming from all of the Institute’s councils, committees and projects and feature the following:

- The buildingSMART alliance™ Conference
- FEDCon® – The Market Outlook on Federal Construction
- The Building Enclosure Technology and Environment Council (BETEC) Symposium
- The Multihazard Mitigation Council (MMG) Symposium
- Innovative technology demonstrations, including COBie, SPie and other information exchanges

And much more!

Witness the Institute’s impact on the industry, interact with industry experts and innovators, gain a wealth of information through educational programs, earn CEUs, share your expertise and experiences and participate in advancements toward a better built environment.

Sign up to receive updates and more information at:

www.nibs.org/conference

Sponsorship Opportunities Available

National Institute of Building Sciences: An Authoritative Source of Innovative Solutions for the Built Environment
DURING THE BEST1 (2008) AND BEST2 (2010) Conferences, a shift in the design paradigm that requires a systems approach to build ecologically correct, durable, energy-efficient enclosures that contribute to a good indoor environment became evident. A systems approach leads to airtight and highly insulated enclosures that allow drying to the outside. The emergence of new, moisture-breathable, no-crack renderings that we called eco-wrap, which fall between strong and rigid cement-based plasters on one end of the spectrum and flexible and thinner than 3/16th inch exterior insulation finishing system (EIFS) lamina on the other end, was highlighted.

The BEST 3 paper previewed here connects all these concepts into one thermal insulation system of the future that links building physics with current practice and recognizes the need for new exterior insulation systems that are suitable for both new buildings and existing building retrofits.

EFFICIENCY FACTOR FOR THERMAL INSULATION

This paper focuses on thermal performance of assemblies. It starts with a concept of thermal insulation efficiency that compares the nominal and the average U-values for an assembly. (The U-value is the inverse of R-value, which means a ratio of the average thermal resistance of the assembly to the nominal R-value is obtained as the sum of thermal resistance of all components, or measured in a cross-section with one dimensional heat flow through the thermal insulation).

To illustrate the significance of this concept, without performing calculations, we can use an article by Sandin (1990), where external and internal insulation is added to a one and a half brick wide wall as illustrated in TABLE 1. The results illustrate the effect of a thermal bridge typical for masonry construction, with bounding temperatures of 24.8°F (-4°C) and 68°F (20°C) and a height of 9.2 ft. (2.8 m.) for the wall.

<table>
<thead>
<tr>
<th>Drawing</th>
<th>Description</th>
<th>Additional Flux</th>
<th>U-value excl. thermal bridge</th>
<th>U-value incl. thermal bridge</th>
<th>Temperature decrease due to thermal bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case A</td>
<td>Flooring joined wood frame wall</td>
<td>0.16</td>
<td>0.28</td>
<td>0.38</td>
<td>17.6 → 15.4</td>
</tr>
<tr>
<td>Case B</td>
<td>Interior thermal insulation of 1 1/2 brick wall</td>
<td>0.17</td>
<td>0.30</td>
<td>0.38</td>
<td>17.9 → 12.6</td>
</tr>
<tr>
<td>Case C</td>
<td>Exterior thermal insulation of 1 1/2 brick wall</td>
<td>0.005</td>
<td>0.30</td>
<td>0.30</td>
<td>17.9 → 17.9</td>
</tr>
</tbody>
</table>

Table 1. Additional heat flux U-values “without” and “with thermal bridge”, and temperatures “without” and “with thermal bridge” (termed here as “temperature decrease due to thermal bridge”) measured in the corner between the wall and concrete floor in a typical masonry construction, quoted from Sandin (1990).
the EIFS went through polymer-modified to polymer-based thin lamina. **FIGURE 1** shows thermal upgrade of a Vermont high school, which was completed in Fall 2009 where expanded polystyrene was replaced by SPF.

**FIRE AND MOISTURE PROTECTION**

While the building renovation shown in **FIGURES 1, 2 AND 3** may be considered a step forward in the design of better cladding systems, it is still far from the optimum because it needs to address both fire protection and the ability to remove moisture from building enclosures to avoid growth of mold, which remain as two chief concerns for existing buildings.

To this end, one may introduce another layer of fibrous thermal insulation separated by an air gap. The materials used in the second layer are either stone wool (Rockwool) or another type of mineral fiber insulation boards manufactured with a significant fraction of vertically oriented fibers, or wood-fiber insulation boards (see Bomberg and Chrenka, 2010). The first solution may be preferred for highrise buildings that typically require a noncombustible cladding system, while the second solution may offer better durability of the cladding system for low and midrise claddings.

From a building physics point of view, one material may satisfy both hygroscopic and fire performance requirements. This is where eco-fiber insulation is introduced to achieve both improved hygrothermal and fire performance by using a mixture of different fibers, manmade as well as natural. For the optimal cladding assembly, we need, however, light and durable three-coat plaster

instead of heavy cement board or brick veneer, which would have required thermal bridges for support. Expanded polystyrene insulation can be replaced with polyurethane foam if you have the technology for removing the skin from the sprayed polyurethane foam.

**CORRECT HYGROTHERMAL DESIGN IS THE KEY**

A correct hygrothermal design for stucco mixes is the first step to ensure durable performance of stucco-clad walls. As they have evolved, the drying ability of stucco claddings has been reduced by a factor of 10-100. Current stucco will become wetter and stay wet over prolonged periods of time. Add to that the fact that new polymer-based water-resistant board (WRB) products have much higher permeance than asphalt-impregnated Kraft paper and under certain environmental conditions, increases the rate of moisture transport from wet stucco to oriented strand board (OSB).

In exposures with prevailing solar radiation in the winter and only one layer of polymeric WRB (plastic wrap) with a permeance of 80-100 perms, the OSB sheathing may become wet and decay. Under these conditions, the use of a water vapor-tight finishing layer in stucco may be detrimental to the durability of walls.

The proposed insulation system uses two continuous layers of thermal insulation (closed cell polyurethane foam and the eco-fiber layer). The latter also needs to be protected from the effects of weather, and eco-wrap fulfills this function. The correct design of stucco requires that each layer toward the outside has lower stiffness (to avoid warping) and increased water vapor permeance to accelerate drying. While previously this was achieved by changes in porosity, we have shown that adequate hygric properties can be independent of the density and stucco composition. Because we also are specifying moisture permeable (breathing) walls, we are calling for this layer to be ecologically designed wrap, eco-wrap, not stucco or plaster.

While wood-based rigid boards have acoustic and thermal properties similar to those of loose-fill cellulose, are
moisture-breathable (typical water vapor permeance is about 15 perms), are volatile organic compound (VOC)-free and provide a sustainable alternative to glass-fiber technology, they can complement mineral fiber technology in roofing, flooring and other applications where compressive strength is required.

PUTTING THE PROPOSED INSULATION SYSTEM TOGETHER

This system will be placed on the exterior and will include two continuous layers of thermal insulation separated by an air gap. The first layer is a poured or sprayed polyurethane foam that provides heat, air and moisture control. The second layer is either wood or mineral fiber insulation or, as previously mentioned, a new multi-fiber eco-fiber material with climatic plaster (eco-wrap). This provides rain protection and accelerated drying.

The optimal system has a 3 to 9 mm wide air gap, functions as an accelerator for removal of incidental water and provides a unique system of water removal after flood events. The insulation system can also be integrated with the heating, ventilation and air conditioning (HVAC) system to enhance energy efficiency in mixed climates. (It is important to point out that the popular name of “drainage cavity” can be misleading; in a well-designed wall, there is no water to drain. The cavity serves to accelerate drying by convection.)

A NOTE OF CAUTION

Evaluation of performance of such systems can be difficult, particularly in North America, where testing favors the laboratory rating of materials instead of the field performance of materials as assemblies. Some materials that have been used for centuries, such as plaster, do not have a test method to evaluate crack resistance. Materials of the future, such as spray polyurethane foam, do not have a dimensional stability test for defining performance under field conditions. And while there is an ASTM test method of rating for selected environmental effects, such as high or low temperature or moisture condensation, it does not account for strains or effects of thermal gradients acting on the material.

Unfortunately, it may take several years to develop this kind of optimal insulation system because there is little research and development support from federal or state sources for small companies to evaluate the performance of novel systems. This is in stark contrast to 20 to 30 years ago, when North America was the undisputed leader in the new technology development for housing.

Mark Bomberg is a research professor of civil engineering at the University of Toronto, in Ontario, Canada, and in the Architecture Department at Southeast University, Nanjing, China. Marcin Pazera is a Senior Research and Development Associate, CENTRIA, Moon Township, Pennsylvania. Robert Aird is President of Robert Aird Inc., Frederick, Maryland.

The authors wish to thank those who shared data and opinions on historic, traditional and modern plasters: Dr. Margaret Thomson, Chemical Lime Company, Nevada; Dr. Rudi Plagge Dresden Technical University, Germany; and Dr. Donald Onysko, DMO Associates, Ontario, Canada. Discussion with Dr. D.W. Yarbrough is also gratefully acknowledged.
air barrier
abaa
association of america

THE COMPLETE RESOURCE FOR AIR BARRIER EDUCATION AND TECHNICAL INFORMATION.

AIR BARRIERS CONTRIBUTE TO:
- Durable Buildings
- Significant Energy Savings
- Green Buildings (LEED Rated)
- Air Quality and Indoor Comfort

SPECIFY THE ABAA AIR BARRIER QUALITY ASSURANCE PROGRAM
Build it Right, the first time.

www.airbarrier.org

FOR MORE INFORMATION VISIT OUR WEB SITE OR EMAIL US: abaa@airbarrier.org
BEC Corner

AUSTIN
By Keith Simon, AIA, LEED-AP, Beck Architecture LLC; BEC-Austin Chair

Building Enclosure Council (BEC)-Austin has been focusing on speakers and presentations to provide a core curriculum of subjects (thanks go to BEC-Portland for the suggestion) regarding the fundamentals of heat, air, vapor and moisture transport, as well as envelope commissioning and design considerations.

In response to a need to address fenestration more specifically, our December meeting was called Advances in Window Technology and it consisted of a series of four short presentations. That, coupled with the BEC National webinar on National Fenestration Rating Council (NFRC) ratings and our January presentation on daylighting fundamentals, will provide a solid overview of fenestration concerns.

Other topics we will address in 2012 include roofing systems, spray foam insulation and vapor control strategies specific to a hot and humid climate. We will also have a WUFI® workshop, a high-performance detailing symposium and an air barrier round table.

BOSTON
By Richard Keleher, AIA, CSI, LEED-AP; Richard Keleher Architect; Boston-BEC Co-Chair

The Boston-BEC continues to meet monthly (except for August and December) for one and a half to two hours at the Boston Society of Architects’ headquarters in Boston’s financial district. Recent presentations included Combustible Materials in Exterior Walls by Brian Kuhn; Review of the BEC Air Barrier Challenge by Chris Semmelink; Window Systems by Michael Lewis; Understanding the HERS Index by Matthew Root; Deep Energy Retrofit of a Sears Roebuck House by Betsy Pettit; Basic Curtain Wall – Lessons Learned by Michael Lewis; and Principles of Façade Design by Karol Kazmierczak. There is always spirited discussions with our presenters.

BEC-Boston has worked on several projects this year. The council prepared another Building Enclosure Award program, the second of which was presented in January 2012. The award goes to the building that best demonstrates innovation in design through the craft, science and engineering of high-performance building enclosures in New England.

The council also created an Air Barrier Challenge, wherein nine teams constructed their own window flashing on a wall with a window opening and a window to be installed, which were provided by the BEC. The walls with windows installed were tested for air and water leakage at Architectural Testing’s Chelmsford, Massachusetts, facility. An article was written and published online, with a slide show: www.architects.org/news/buildingenclosure-council-air-barrier-challenge.

After several years of gathering photo permissions, the Romp Through the History of Daylighting presentation is almost ready for public use.

The council is beginning a study of the impact of the Massachusetts Energy Code on the energy efficiency of buildings. We hope to look at energy consumption within a group of sample buildings and to conduct airtightness testing.

Upcoming meetings will focus on Falling Ice and Snow, Daylighting Provisions in the International Code Council (ICC), and The Whole Building Air Leakage Research Project.

Learn more at www.bec-boston.org.

CHARLESTON
By Whitney E. Okon, Applied Building Sciences; BEC-Charleston Past Chair

BEC-Charleston enjoyed a technically rich sixth year of bringing building enclosure science and technology to our hot and humid state; we held nine programs in 2011. We enjoyed presentations entitled Exterior Masonry Wall Assemblies – The State of the Art, by Michael Hatzinikolas of the Canadian Masonry Research Institute (CMRI); Mortar: Things You Should Know About Masonry Mortar But Were Misled or Just Afraid to Ask, by Mike Edison of Edisson Coatings, Inc.; and 90 Million Years of Building Science: Lessons From the Honey Bee/South Carolina Energy Code, by Chris Mathis of Mathis Consulting Company.

BEC-Charleston is proud to announce the completion of our Net-Zero Energy House (NZEH) in Mount Pleasant, South Carolina! Our partners, East Cooper Habitat for Humanity and the East Cooper Rotary Club, as well as local media and community volunteers, were in attendance for the ribbon cutting ceremony on December 9, 2011. This project has taken over two years to complete. Now the four person family who is living there will be able to provide energy performance data, which is needed for further study and research.

Final blower door results indicate that the 1,300 sq. ft., 3 bedroom home is meeting its air tightness goals with a total leakage of 16.5 sq. in., LBL ELA at 4Pa. The energy dashboard is currently logging and analyzing the data from all circuits, including major systems such as solar hot water, photovoltaics and the geothermal heat pump. We anticipate the addition of the net metering panel currently installed will provide a metric for on-site power production. In our hot and humid climate zone, we are hopeful that this project will provide our local and regional construction community the opportunity to learn and exchange knowledge. For more information on our NZEH: www.facebook.com/pages/BEC-RotaryNet-Zero-Energy-Habitat-for-Humanity-House/115275105215606.

BEC-Charleston recently named its 2012 Board at the annual planning retreat. Congratulations to Wayne Butler, our new chair! For additional information please contact myself or Wayne Butler, by visiting www.bec-charleston.org.

CHICAGO
By Richard E. Fencl; AIA, CSI, LEED-AP, Gensler; BEC-Chicago Chair

BEC-Chicago is welcoming new officers to our Board of Directors for 2012. Kevin Kalata, Wiss, Janney, Elstner Associates, Inc. (WJE), will become the new chairperson. I will remain on the Board of Directors as past chairperson. Sarah
Flock, Raths, Raths & Johnson, Inc. (RRJ), has been elected vice chair/chair elect. Elizabeth Cassin (WJE) is returning in her capacity as secretary, having been reelected. Kenneth Lies (RRJ) will remain BEC-Chicago’s treasurer.

BEC-Chicago is raising money to improve our current website design, making it more member interactive as well as a portal for all things envelope. The development site can be viewed at http://dev.bec-chicago.org. Goldin Media is the website developer.

The September 2011 meeting was an evening event (chairperson’s event) starting with a period of fellowship and colleague interaction, followed by a presentation on the current advancement of fuel cell technology in buildings. Keith Spitznagel of Logan Energy presented both a history of fuel cell development as well as the current state of development. Mechanical, electrical and plumbing (MEP) firms from the Chicago area, including Environment Systems Design, Inc.; KJWW Engineering Consultants; Arup Inc.; Cosentini Associates; Tetra Tech, Inc.; dbHMS; and McGuire Engineers, sponsored the event.

Lerch Bates presented an in-depth look at façade access and maintenance for our October meeting.

In November, Steven Nadler from HDR, Inc. facilitated a contractor panel discussion involving representatives from several prominent midwestern contracting organizations. This session included opinions from contractors and BEC members on the interaction between architects and contractors with respect to façade design, detailing, mock-up testing and field coordination.

The December meeting involved a roofing discussion focused on environmental responsibility, energy concerns and increased regulations. This translates for designers into what could arguably be considered a more restricted approach to roof design. Presenters were Joseph Godfryt and Richard Koziol, from WJE.

Programs scheduled for 2012 include a presentation on carbon cast precast concrete, switchable glass and a focused program on brick veneer ties.

Meetings are held on the second Friday of the month, at the offices of Gensler in Chicago, 11 East Madison Street.

Membership of our local council has doubled in the past year. We are now 120 members strong and still growing.

**DALLAS**

*By Dudley McFarquhar, PhD, P.E., McFarquhar Group, Inc.; Dallas-BEC Chair*

We are thrilled that BEC-Dallas is once again active based on a lively reboot event held this past September. Our guest speaker, Dr. Maria Spinu, a member of the ASHRAE 90.1 Committee and Envelope subcommittee, provided the presentation *Building Enclosure Design with Continuous Air Barriers* to a roomful of attendees. The enthusiastic feedback we received during and after the event was a clear sign that the Dallas construction community is excited to have an active BEC chapter.

Our Executive Committee and co-chairs are already at work promoting the chapter’s 2012 lecture series *Dynamic Dallas: Innovative Building Enclosure Design*. These talks will focus on some of the area’s newer buildings and the related design details/approach/construction behind their respective building enclosures.

Our kickoff in February 2012 will feature members from the design team at Morphosis Architects (a firm based in California), who will discuss the unique enclosure for the Perot Museum of Nature and Science, slated to open in 2013. Other events planned include a presentation from the design team for the Winspear Opera House, a flashing rodeo and an event focusing on ASHRAE 90.1.

With construction in the Dallas metro area currently experiencing growth, it’s timely to energize the chapter and further engage the community in disseminating information.

**GREATER DETROIT**

*By Brian J. Tognetti, RA, CCCA; BEC-Greater Detroit Program Committee*

In 2011, BEC-Greater Detroit (BEC-GD) once again offered numerous engaging technical seminars regarding various aspects of the building envelope. These regularly scheduled, one-hour presentations provide cutting-edge building science focused on guidance for building owners, facility managers, architects, engineers, construction managers, contractors, material suppliers/fabricators and other interested parties located in Michigan and our neighboring regional Midwest states.

BEC-GD schedules six one-hour programs throughout the year, all starting at 4:30 p.m. at the Birmingham Conference Center located at 31301 Evergreen Road in Beverly Hills, Michigan. Prior to the start of each presentation, the attendees have the opportunity to share current project issues, discuss challenging situations and partake in general professional camaraderie by networking with the collective expertise of the group.

These BEC-GD meetings have averaged approximately 60 or more attendees per meeting, and when also considering our Annual Symposium, the BEC-GD has truly embraced continuing education by providing an overall contact hour-to-date tally exceeding 3,600 hours!

In October, the BEC-GD hosted its third all-day Annual Symposium in Livonia, Michigan. Over 215 attendees from the Midwest region benefited from a distinguished panel of nationally recognized experts in the field of building enclosure research, investigation, assessment and execution. This year’s symposium, entitled *Understanding Hygrothermal Performance*, was presented by Robert Kudder, William Rose, Chris Mathis and Joe Lstiburek. As with our past symposiums, the cost to attend for the day was very reasonable at $50, which included lunch, snacks and beverages throughout the event. This is an exceptional value considering the technical topics, quality of speakers, venue and networking opportunity.

For additional information regarding the BEC-GD, visit our website at www.bec-gd.org. For specific program information, contact our Programs Committee Chairperson, Andrew Dunlap (313-442-8186 or andrew.dunlap@smithgroup.com). For program sponsorship opportunities, please contact Dan Zechmeister (248-663-0415 or dan@mim-online.org).

**KANSAS CITY**

*By David Herron, herron + partners; BEC-Kansas City Chair*

Last year was a successful year for BEC-Kansas City. We were able to host
MINNESOTA
By Judd Peterson, AIA; BEC-Minnesota Chair

Since our last meeting in Washington, D.C., Henry Green, President of the National Institute of Building Sciences, Ryan Colker, Director of the Consultant Council/ Presidential Advisor, and I are following up with Minnesota Senator Al Franken to discuss Institute initiatives for the nation’s infrastructure and construction programs for energy efficiency. We are seeking a Republican senator who would have an interest in a bi-partisan, co-chair position with Senator Franken on an Institute Senate Caucus for High Performance Buildings.

In Minnesota, we are continuing with wide ranging presenters. We helped sponsor Joe Lstiburek’s presentation, Thick as a Brick, at the at the 2011 American Institute of Architects (AIA) Minnesota Annual Convention. One of our BEC-Minnesota Board members, Jim Larson of Building Solutions, Inc., participated with John Cook of HGA Architects at the AIA Minnesota Convention, illustrating the design detailing process and explaining how practical, technical priorities are addressed.

Robert Dazel with Dryvit discussed thermal bridging, actual R-value in framed wall construction, current and future energy code requirements for framed wall assembly insulation and continuous exterior insulation.

Craig Hinrichs of the Midwest Masonry Promotion Council presented Masonry Cavity Walls, Inside and Out, describing the design of a masonry cavity wall. Chris Bupp of Hohmann & Barnard, manufacturers of masonry accessories, was available to show samples of the latest flashing technology.

Dan Handeen and Lucas Alm of the Center for Sustainable Building Research at the University of Minnesota, discussed their research for the U.S. Department of Energy’s (DoE) Solar Decathlon competition. They showed the University of Minnesota’s Zero Energy entrant. Learn more at www.solardecathlon.umn.edu.

Jim Andersen of BASF discussed spray foam insulation on the interior side of existing brick masonry and the effect the spray foam will have on moisture within the brick, as well as the risk of freeze/thaw spalling. Gord Cooke, building scientist and IAQ specialist with Building Knowledge, Inc., was present to discuss the impact of moisture, temperature and high-performance insulation on exterior masonry walls.

NORTH CAROLINA
By W. Blake Talbott, AIA, NCARB, IFMA, CSI, ASTM, NIBS, AAMA, BBH Design; and Rita Ray, WJE; BEC-Research Triangle Co-Chairs

The Building Enclosure Council-Research Triangle (BEC-RT) is excited to have completed the 2011 calendar year after the foundation of our local chapter last spring. Our registered membership currently totals well over 100 local industry professionals, including a variety of architects, engineers (structural and mechanical), facility managers, owners, educators, manufacturers and others.

BEC-RT hosted two full-day educational seminars in 2011. Chris Mathis, Mathis Consulting Company, discussed residential and commercial North Carolina energy code in May and Dr. Joseph Lstiburek, Building Science Corporation, presented on the principles of enclosure design, vapor diffusion, air flow, roof/attic ventilation and mechanical systems in September. Thanks to the RCI, Incorporated, Carolina Chapter for co-sponsoring the seminar with Dr. Lstiburek and for providing RCI Learning Credits for this event.

BEC-RT also hosted regular monthly meetings with presentations by Kevin Turner, The Freelon Group, on Building Envelope 101; Fiona Aldous, WJE, on Building Enclosures: From Concepts to Commissioning; Jeff Erdly, Masonry Preservation Services, Inc., on Flashing and its Importance in All Buildings and Joint Sealant in Exterior Walls: Proper Design and Execution; and W. Blake Talbott, BBH Design, on 21st Century Building Enclosure Institutional Detailing.

BEC-RT is approved to provide AIA Continuing Education System (AIA/CES) learning units and, at the request of several members, we are in the process of coordinating with the U.S. Green Building Council, North Carolina Triangle to provide AIA/Leadership in Energy and Environmental Design (LEED) credits for a selection of our 2012 presentations.


For more information on membership or upcoming events, contact chair Blake Talbott, BBH Design (btalbott@bbhdesign.com), or vice-chair Rita Ray, WJE (rray@wje.com).

PHILADELPHIA
By Joseph DeAngelis, AIA, LEED-AP, TBS Services; Philadelphia-BEC Co-Chair

In October 2011, the Philadelphia Building Enclosure Council (Philly-BEC) put on a symposium about fenestration as a continuation of the topic presented during the September webinar National Fenestration Rating Council’s Certification Program for Commercial Fenestration. Three topics were presented and illustrated in detail by each presenter. Optimizing Performance in Commercial Fenestration covered structural thermal barriers for aluminum window framing and warm-edge spacer technology for insulating glass. Energy Efficient Glazing focused on how the environmental and economic benefits of Low-E glass are quantified and the energy impact of various Low-E coated glass through simulation modeling. Lastly, Ensuring Compliance of Fenestration with Today’s Energy Codes and Green Standards...
concentrated on how to use performance results based on NFRC sizes and project specific sizes, and achieving sustainable performance with aluminum commercial fenestration by pre-qualifying thermal performance for a project.

The symposium was a departure from our typical event, which occurs at noon the second Tuesday of each month. It provided three continuing education units (CEUs) and was offered from 8:00 a.m. to noon. We are happy to report that it was well attended and very well received. Thanks to the generosity of our sponsors, AZON USA, PPG Industries and YKK. With the success of this event, Philly-BEC will continue to look for opportunities to provide venues that can augment and bolster our regular monthly meetings.

We are in the process of soliciting sponsors to develop this year's agenda.

PORTLAND

By David C. Young, P.E., RDH Building Sciences, Inc.; Portland-BEC Chair

The 2011-2012 Portland-BEC seminar program is in full swing. We started 2011 with two back-to-back panel forum programs, each with a local developer, a general contractor and an architect. The theme each panel discussed was based on the value of building enclosure consultants in the design and construction process. The conversations were very lively, informative and positive.

Other presentations included, Application of Spray Foam Insulation, Optimizing Performance in Commercial Fenestration, Continuous Insulation and Rainscreen Precast. We also have two building tours in the planning stage and, of course, Portland BEC’s first full day symposium. Portland’s Spring Building Enclosure Symposium, scheduled for June 2012, is geared toward air barriers and air barrier testing, a hot topic as Seattle now has requirements for air barrier testing and we expect other jurisdictions will be soon to follow.

We continue to develop our Portland-BEC website using Google applications and now have an online form for new member applications. Check out www.portlandbec.org. If you have any feedback on our website, we’d be pleased to receive it.

SEATTLE

By Roxanne Navrides, Seattle Housing Authority; SeaBEC Chair

Our calendar of meetings this season includes topics such as air barriers, systems maintenance, historic preservation and foam insulation. Our kick-off meeting in September 2011 featured Mark LaLiberte on Innovation and the Building Enclosure. Our November meeting was a plant tour of Hartung Glass, thankfully well attended considering both a rain storm and the Occupy Seattle protesters impeding traffic that evening.

We are changing calendar years and our current membership is already around 75. We invite students and retirees to join for free, and AIA members are half price at $30. Many of our members are not working in this economy and we encourage them to attend without paying to continue networking and learning at our monthly meetings. We have almost 350 names on our e-mail list, including architects, contractors, materials suppliers, forensic specialists, an attorney or two, and people who own or manage properties.

Our Board of Directors rotated this summer; Peter Ryan of WJE is now treasurer; Robin Kotulka of OAC Services, Inc. continues as secretary; Clint Shaw of CWS Manufacturers is now in charge of communications and public relations; Sam Packard of RDH Group is membership chair; Jeff Dideon of Architectural Testing is education chair; and Joel Thornburg of Tatley Grund, Inc. is vice president. Dave Bates of OAC Services, Inc. continues to advise and participate as our original president and seasoned veteran, while I’ve taken the helm as the current president.

Our meetings are held third Thursdays monthly (except July and August) and we invite you to join us as our guest. Please extend this invitation to your BEC members and friends. Information is on our website at www.seabec.org.

WASHINGTON, D.C.

By Juli Szabo, AET, WJE; BEC-D.C. Co-Chair

I am excited to be co-chairing BEC-Washington, along with Brad Carpenter, in 2012. We look forward to an exciting year!

I am an associate in the Washington, D.C. office of WJE. My education and experience has been focused in the field of building science and I have specialized in building envelope problem solving for over nine years. This includes the design of new building enclosures, as well as forensic investigation, rehabilitation, maintenance and litigation support on existing buildings.

Bradford S. Carpenter, PE, LEED-AP BD+C, is a senior project manager in the Building Technology Division of the Washington, D.C. office of Simpson Gumpertz & Heger (SGH). He is a licensed professional engineer in Washington, D.C., Virginia and Maryland, who is experienced in the design, investigation and rehabilitation of building enclosure systems of contemporary and historic structures.

We are looking forward to re-establishing our monthly programs with presentations and the introduction of round table discussions. Contact myself (jszabo@wje.com) or Brad (bscarpenter@sgh.com) with any questions you may have!

WISCONSIN

By Brian Stoik, The Boldt Company; BEC-WI Co-Chair

The 2011-2012 year finds BEC-Wisconsin (BEC-WI) starting its fourth year of educational programs. Once again, we are utilizing a webinar format, allowing us to reach out to professionals across the entire state. We have already had three excellent presentations including: Seals: What Types for Where? by Don Menee; Energy Modeling for LEED by Gregg Achtenhagen; and Topics in Low-Slope Roofing by Thomas M. Gernetzke.

Presentations coming up include PV Curtainwall by Nick Bagatelas in February and our annual full-day seminar on March 15, featuring Dr. John Straube of Building Science Corporation. We also continue to hold our meetings the third Thursday of the month, starting at 3:00 p.m.

BEC-WI continues to work with other groups in our area such as AIA-Milwaukee; the Construction Specifications Institute; the new local RCI, Incorporated chapter; and local universities to promote the education of building science. Visit our website, www.bec-wi.org, for more information on upcoming topics and a link to our open registration for the March Seminar with Dr. Straube.
DURABLE. ADAPTABLE. ENERGY EFFICIENT.
AND YOU THOUGHT IT JUST LOOKED GOOD.

A high performing masonry enclosure starts with the right brick. Endicott Brick and Thin Brick helps you create the perfect wall with a veneer that provides the maximum efficiency with unmatched aesthetics. Choose Endicott and you'll build your wall right. And you can choose from unique colors found nowhere else.

Endicott makes it easy to specify, with a wide range of sizes and special shapes. And our industry-leading BIM models make it easy to see your vision come to life.

For the name of your nearest Endicott distributor, or to request samples, literature and BIM models, visit us online and talk to us today.

Endicott Clay Products Co./Endicott Tile LLC  ·  P.O. Box 17  ·  Fairbury, Nebraska USA 68352  ·  402-729-3315  ·  endicott@endicott.com
Buyer's Guide

Air and Vapor Barriers
Hohmann & Barnard, Inc. ..................19, 20

Below Grade Water and Containment Barrier
Polyguard ............................................4

Building Information Modeling
Endicott.............................................35

Building Enclosure Consultants
Construction Consulting......................36
The Facade Group...............................21

Building Sciences and Restoration Consultants
Read Jones Christofferson....................15

Consulting, Commissioning, Engineering, Testing, Certification and Inspections
Architectural Testing.............................OBC

Diagnostic Tools
The Energy Conservatory......................16

Government
Homeowner Protection Office..................37

Industrial Glass Supplier
NSG – Pilkington....................................6
PPG Industries.....................................38, IBC

Jag Architecture
Judd Allen Group.................................22

Masonry
Endicott.............................................35

Masonry Anchoring Systems
Hohmann & Barnard, Inc. .....................19, 20

Masonry Products
Hohmann & Barnard, Inc. .....................19, 20

Mineral Wool Insulation
Roxul, Inc.............................................8

Non-Combustible Rain Barrier Manufacturer
Thermafiber, Inc....................................3

Roofing
Duro-Last Roofing, Inc.........................29

Structural Engineering, Design and Consultants
WJE......................................................36

Water Intrusion Test Equipment and Training
The RM Group, LLC...............................15

Water Proofing
Sto Corp...........................................IFC

Offering Exterior Enclosure Commissioning Services

WJE | ENGINEERS ARCHITECTS MATERIALS SCIENTISTS
800.345.3199

Wiss, Janney, Elstner Associates, Inc. www.wje.com

CONSTRUCTION CONSULTING INTERNATIONAL

CCI standard services include:
• New Construction Design Peer Review and QC Inspections
• Building Envelope Condition Survey for Due Diligence, Maintenance Budget, and Water Penetration
• Remediation Design, Project Management, and QC Inspections
• Forensic Investigation Reports, Deposition, and Trial Testimony
• Storm Damage Analysis and Restoration Management
• Borescope Inspection of Wall Cavities
• Davit and Tieback OSHA Testing and Certification
• On-Site ASTM Standard Curtain Wall and Window Leak Testing

Bryan S. Stevens, CSI
President
George L. Blackburn III, AIA
Consulting Manager
Andy Wilson
Laboratory Manager

1601 Luna Road
Carrollton, TX 75006
phone 972-242-0556
fax 972-245-6047
www.sunited.com
gblackburn@sunited.com
Enhance the Quality of Wood-Frame Residential Construction

The Building Enclosure Design Guide – Wood-Frame Multi-Unit Residential Buildings is the industry’s most widely accepted reference guide on building enclosures. It’s an invaluable resource for builders, designers, architects, engineers and educators in British Columbia and in other jurisdictions across North America.

This comprehensive 290-page illustrated Guide:

- Outlines design and construction best practices
- Explores building enclosure performance issues and solutions
- Presents design guidelines for assemblies, details, components and materials
- Covers energy provisions for the building enclosure
- Addresses maintenance and renewal planning over the service life of the building enclosure

Visit the online store of the Homeowner Protection Office’s website to learn more about the Guide or to purchase a printed copy.

www.hpo.bc.ca
Toll-free: 1-800-407-7757
Email: hpo@hpo.bc.ca

BRITISH COLUMBIA

Homeowner Protection Office
Branch of BC Housing
New Solarban® R100 solar control, low-e glass.
A better glass for a better environment.
Clean lines. Clean look. Clean conscience. It’s a lot to expect from an ordinary piece of glass. Then again, Solarban® R100 solar control, low-e glass is about as far from ordinary as you get — thanks to a Solar Heat Gain Coefficient of .23 and a neutral-reflective appearance that lets your building put its best face forward. And you’ll really be surprised by the extraordinary energy savings you can expect with Solarban R100 glass. To get your copy of the white paper, go to ppgideascapes.com/SBr100.
The industry’s leader in comprehensive building envelope testing now offers NFPA 285!

Our new state-of-the-science fire testing facility continues to add a steadily expanding list of testing capabilities. Bring new products to market faster and safer. And enjoy the confidence that comes with knowing your products are backed by the company with more than three decades of testing, certification and inspection expertise. Call today to learn more!