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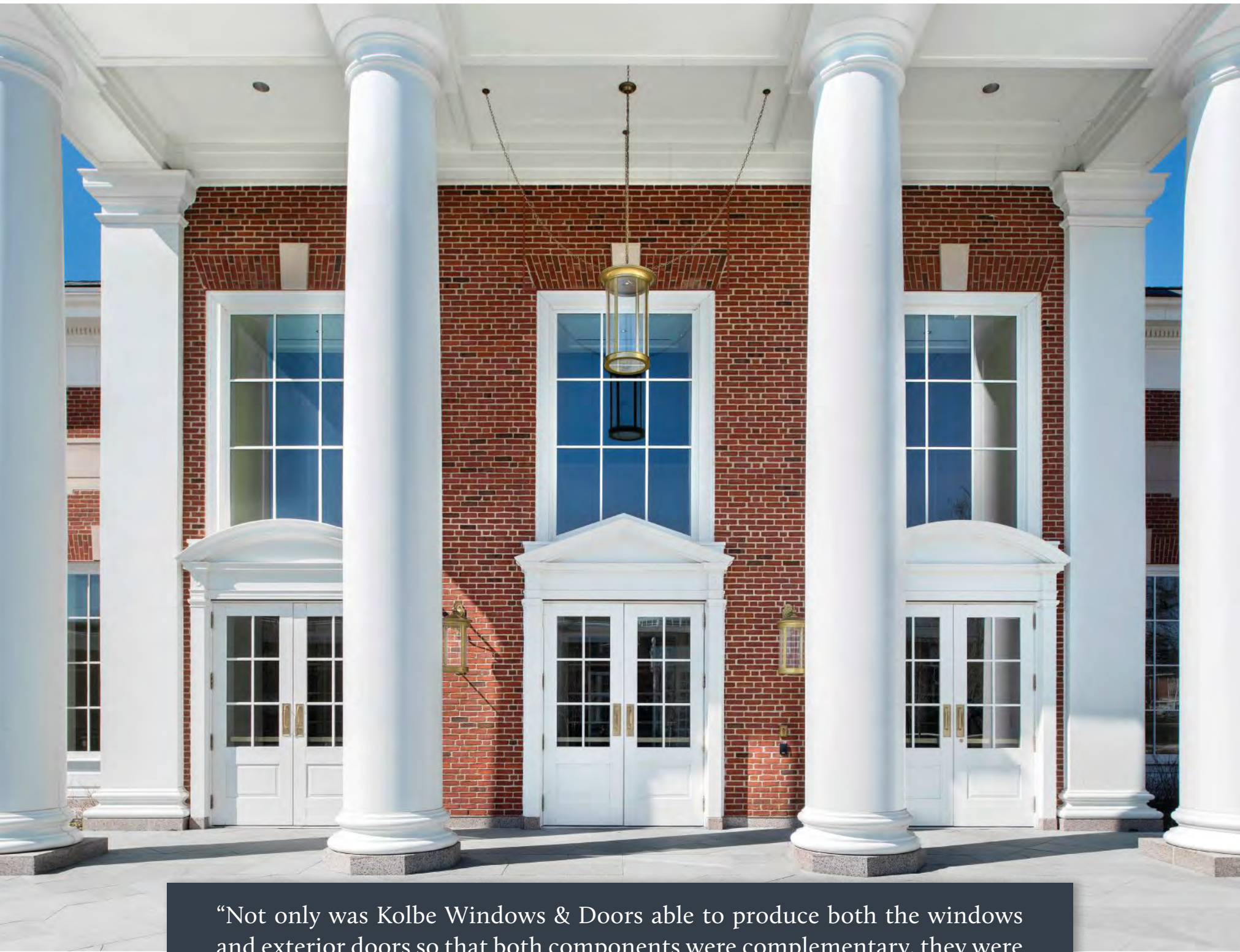

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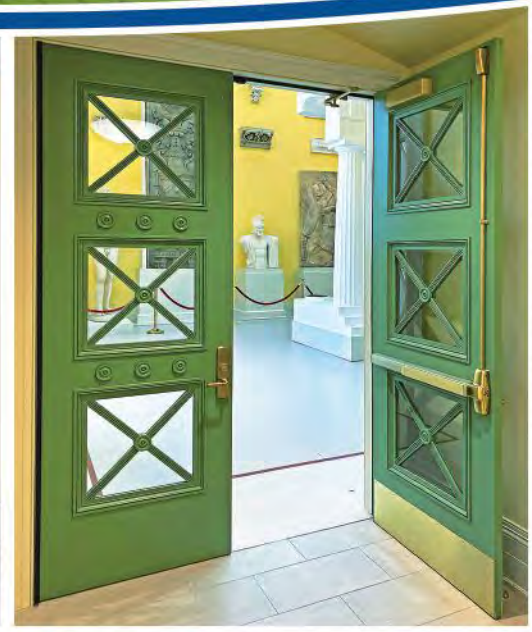

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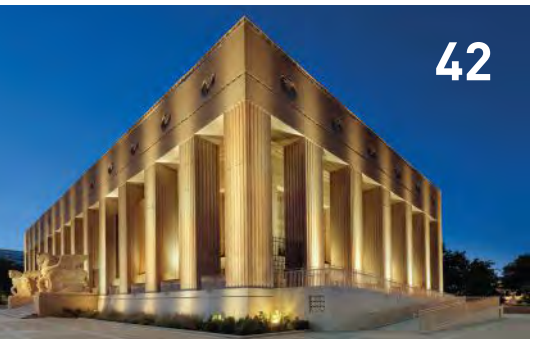

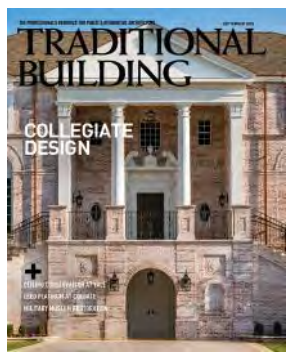

ON THE COVER

Michael G. Imber designs a traditional building at the University of Arkansas.

Photograph courtesy Rett Peek and Louis Curtis

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Traditional Building® (ISSN #0898-0824) (USPS #000-049) is published February, April, May, June, August, September, October and December by Active Interest Media. The known office of publication is located at 5720 Flatiron Parkway, Boulder, CO 80301. The editorial office is located at 5720 Flatiron Parkway, Boulder, CO 80301. Periodicals Postage paid at Boulder, Co, and other offices. **POSTMASTER:** Send address changes to Traditional Building, P.O. Box 3000 Denville, NJ 07835-9965.

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Traditional Building (ISSN # 0898-0284) is published February, April, May, June, August, September, October and December by Active Interest Media, 5720 Flatiron Parkway, Boulder, CO 80301.

Subscription rate to professionals in architecture, interior design, construction and landscape design in the U.S. and possessions: $48/yr. (8 issues). Not available outside the U.S. postal system.

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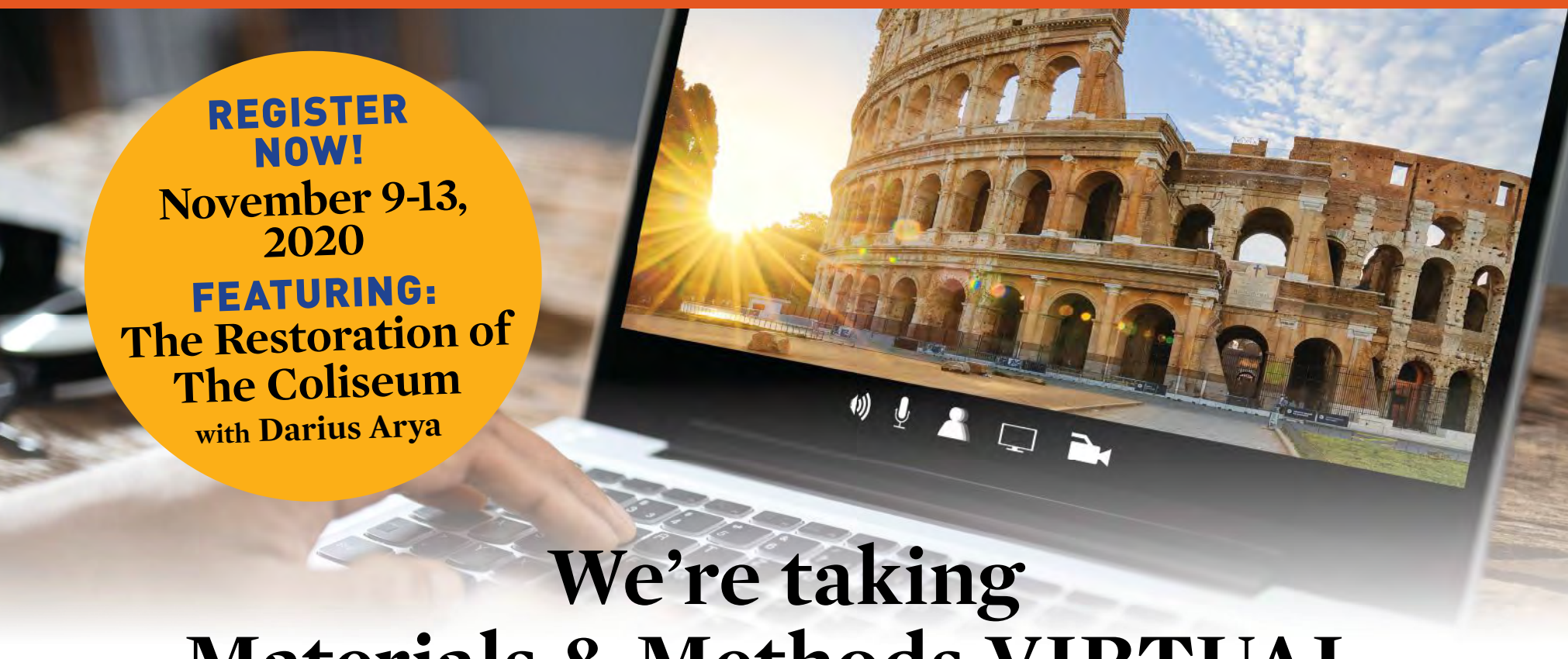

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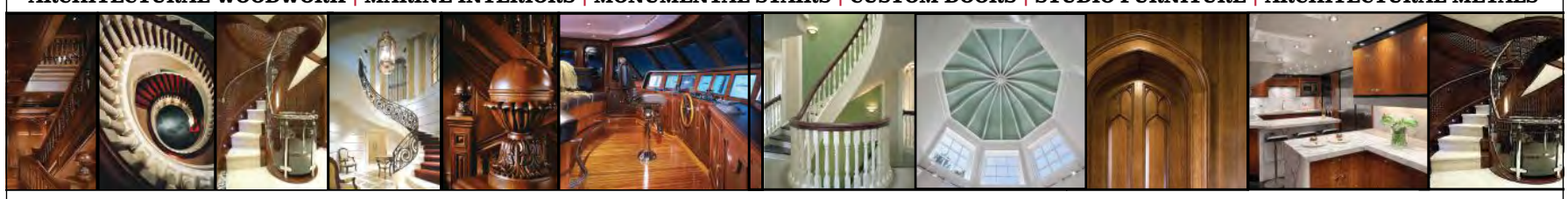

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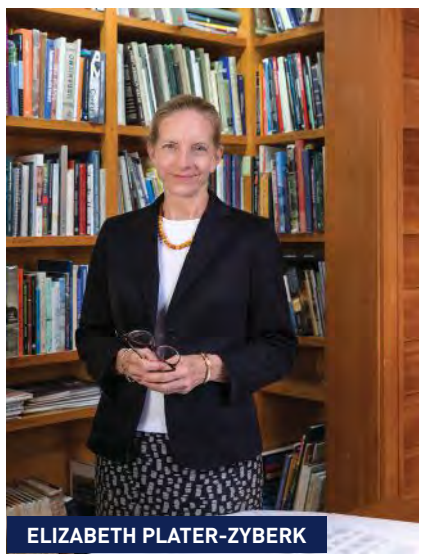
INTERVIEWED BY ERICA FIRPO

Photo courtesy of DPZ

Master Class

Building change, an interview with Elizabeth Plater-Zyberk.



ELIZABETH PLATER-ZYBERK

Photo by Silvia Ros

Navigating cities and reconfiguring spaces has always been part of Elizabeth Plater-Zyberk's world. Growing up on Philadelphia's Main Line, Elizabeth had a front seat to the city's transit situation as she commuted by train and bus to high school in Overbrook daily, and building restorations, and renovations were casual table talk at home.

"I was lucky to have a father who was an architect. Both my father and my uncle were architects. I would see his pencil drawings on the drafting table in his room that were the Pennsylvania farmhouses that he was restoring and renovating for people, these old, old farmhouses that I remember for their beauty," shares Plater-Zyberk. With an eye on architecture since her childhood, Plater-Zyberk was the first woman undergraduate at Princeton University and she would continue with a Masters at Yale School of Architecture.

It was the early 1970s, and nobody was interested in looking back at architecture historically. But at Yale, Plater-Zyberk was captivated by architectural historian Vincent Scully's conversations on "the diminished circumstances of early colonial America" and she began reminiscing on those farmhouses her father was renovating back in the day.

"My generation engaged with that [architectural history]. People were reexamining history influenced by Robert Venturi's book, *Complexity and Contradiction in Architecture*, and Jane Jacob's, *The Death and Life of Great American Cities,* among others. There was this aura that history was an interesting resource. It was the beginning of discovery."

Mix in a 1970s magic and you've got the start of a movement. Or better yet, a whole new city. By the 80s, Plater-Zyberk and husband Andres Duany teamed up for DPZ, and were leading the way with New Urbanism, a prescient urban design movement promoting social and environmental sustainability through architecture and urban planning.

"There were several of us who were aware that we had projects that were in fact placemaking projects, often starting out with housing and understanding that you could arrange the buildings in such a way that you would make a public space or some kind of shared benefit for all of the housing units," tells Plater-Zyberk. It was these placemaking and subsequent conversations about changing growth polices and suburban sprawl while rediscovering history that led them to Seaside, Florida, a new urbanism town immortalized on the silver screen in 1998 *The Truman Show.* And thus, the Congress on New Urbanism was created, now nearly a 30-year-old national organization espousing principals that promote urban planning change from the region to the neighborhood to street and block details all focused on sustainable, healthier living.

Today, Plater-Zyberk, FAIA, LEED AP is in Miami, where she is director of the Master of Urban Design Program and the Malcolm Matheson Distinguished Professor of Architecture at University of Miami. We sat down with her to find out more about what inspires her.

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Photo by Carlos Morales

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1 ***Who are some of your inspirations or your mentors?***

Princeton was very Corbusian and the library reserve shelf was relatively small. And Le Corbusier, Mies, and Alto were the main intellectual resources. But there were a lot of great faculty including Kenneth Frampton who was there at the time and Michael Graves. It was the age of the New York Five.

There were very few [female] role models, so to speak, but that's changed. Today, I think one needs to point to Zaha Hadid as a stellar example of someone who dedicated herself to her work in the profession and to her standing in the public eye. Jeanne Gang, of course, is another one, the Chicago architect who's very prominent. And Daniela Voith is really a marvelous architect. She has had a very interesting practice of some groundbreaking buildings as well as traditional and restoration architecture.

2 ***What would you say to young women that are interested in architecture?***

I would say go for it! I've always thought it was the kind of field that you could step in and out of if you wanted to spend time on a family. There's so many different routes that you can take. There's not one route that pigeonholes your path. That said, clearly, there are still a lot of challenges, as you don't see women in the top ranks a lot.

3 ***How do you see new urbanism for the future? And in particular, the recent surge of reinvestment in smaller towns and sustainability?***

The New Urbanism has helped many of those smaller places revive, with a reappreciation of their public spaces, their historic buildings, and so on. And so they're in a sense prepared to receive refugees and retreaters from higher density places. And it's probably

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This townhouse court building type has become a staple in DPZ charrettes where providing vehicular access along a greenway or water frontage is impractical or costly. Lining a private Coral Gables golf course on one side, this 2.5-acre collection of rowhouse compounds caused a stir when first built due to its picturesque architecture with sculptural Dutch-Caribbean parapets. Yet the unique look was contextual, given the City's historic themed villages from the 1920s.

a healthier economy, to be distributed, to have people and employment distributed in that way.

4 What are your five favorite Florida buildings or buildings that must be seen, or types of architecture?

Well, you know, it's funny that you should ask that because I am writing the introduction to an issue of the Classicist that's on Florida, and so I've been thinking about our buildings a lot. To answer your question I can think of the buildings that in some way influence me.

- Española Way "Both sides of the street were developed by the same developer and architects. It's not a replica, one side of the other, but it's very much a cohesive whole in the Mediterranean style. It's absolutely charming, and so illustrates that idea that a building doesn't need to stand out by itself as an object, but can be part of an ensemble. The buildings on the two sides of the street, though varied, are very conscious of their relationship to each other."

- The Villages in Coral Gables, (historic villages of different architectural styles: Chinese, French, Dutch South African, Florida Pioneer, Italian). "These small groupings of houses have an incredible character and sense of place, generated by the style of the buildings and, their unified relationship to the street. The Harvard Business School used to say that the three most important factors for real estate success were location, location, location. Well, these places prove that it's really design, design, design."

- Biltmore Hotel - Its courtyard is one of the most magical places to be.

- The Old Miami Courthouse, designed by Kiehnel and Elliott. The carved pieces of a classical facade that are made out of coral rock with shell deposits that add an additional kind of richness to that traditional and dignified facade.

- Miami Beach Art Deco District
  All the buildings share a kind of language, a similar language, but each one has its own individuality, and each gives delight on its own. The fact that you can walk by many of them in a unified area, and see how they all work together is a rare experience."

"It's what Aldo Rossi referred to in "The Analogous City," that essentially cities only give you moments of delight. The very special places are moments within a larger context that may be less inspiring, but they are valuable for that. And also because they enable us to imagine making places like that, too." ~ EPZ

Photos courtesy of DPZ

BY GORDON BOCK

Restoring and upgrading the historic Supreme Court chandelier became a centerpiece of Wyoming State Capital project, only one of some 800 fixtures.

Historic Lighting Restoration Brightens Wyoming Capitol

Original fixtures now shine with state-of-the-art LED technology.

Upgrading historic lighting can present a paradox. How best to boost performance to the latest standards for light output and energy efficiency while keeping fixture design unchanged from decades ago? It's been going on a long time—gasoliers got wired soon after electricity became the dominant illuminant—and the rehabilitation and restoration of the 1888 Wyoming State Capitol offers a contemporary case in point.

Completed in 2019, the extensive $300 million project included renovating nearly 800 light fixtures by Crenshaw Lighting of Floyd, Virginia. "Over the years we've worked on the Virginia and Minnesota State Capitols," says chief executive officer Patrick Daley, "but all of them had other types of lighting applications. For this state house to be entirely modernized with solid-state LEDs really exemplifies what that technology can accomplish in a historic envelope."

It wasn't long ago that upgrading historic lighting meant trying to pack compact fluorescent lamps and their components into 100-year-old fixtures. "We've come a long way from those days," says Daley, noting that their work was not simply retrofitting incandescent sockets either. He adds that excellent partners, J.E. Dunn Construction, construction manager, and Gary Steffy Lighting Design, lighting designer, were vital. "The big challenge in a project like this is raising light levels in a space to modern standards, without changing the number of fixtures or the aesthetics of the existing fixtures—or creating a 'glare bomb'".

First widely seen in the 1970s as the dimly glowing ruby displays of indicator lamps and digital clocks, light emitting diodes (LEDs) have grown exponentially in the last few years. Basically, a two-terminal semiconductor that emits light when carrying current, LEDs were at first restricted to the color red and had limited light output—one might say you sometimes needed a light to see them.

By the 2000s, however, advances in diode types and coatings improved the range of possible colors as well as their light output. Most recently, chip-on-board (COB) technology has allowed manufacturers to mount multiple LEDS (nine or more) to a single substrate, typically a plastic or metal circuit board, to comprise an individual module. When these modules are built to a specific application, they are often called solid-state LEDS.

Compared to separately mounted LEDS, a COB LED module carries more light sources in the same or less space with the advantage of looking more like a single light source and with more output per square inch. This leads to efficiency on several levels, explains Kevin Page, design engineer at Crenshaw. "Typically, if you're comparing a COB LED to a conventional incandescent socket, your overall diameter is about the same, but your height completely goes away. COBs are less than 1/8 of an inch tall, but they're about nine to 12 times as bright." What's more, that increase in output does not come at the expense of energy. "On this project, we're running in the realm of 160 to 220 lumens (a measure of light) per watt, depending upon the fixture. By

Photo courtesy of Wyoming Capitol Square - Girt Communications

comparison a standard incandescent fixture runs about 10 to 15 lumens per watt."

Page adds that, as far as output, the Wyoming State Capitol fixtures are all right on the leading edge of what can be done. Explains Daley, "Kevin made estimates about where we started—a benchmark of probably 1 foot-candle (one lumen per square foot of light intensity)—and now we have a lower limit of 30 foot-candles. Plus, there are spaces that need even more for television so there are a lot of applications that come into it."

What's more, if maximum light output is not desired, the technology is dimmable. "The standard we used for this project is 5 percent dimming," says Page. "Some fixtures are less than that, even 1 percent, but every fixture was at least 5 percent." Daley points out that COB technology allows far greater control than other technologies, and features like dimming and color tuning are far easier to accomplish. "Some people worry about flicker," adds Page, "but it's all flicker free."

All sounds perfect for retrofitting historic fixtures but, as ever, there's the real world to deal with. "The big issue that comes with putting in these COB LEDs is they're so much more efficient but, because they also have much lower maximum running temperatures, you have to keep them a lot cooler." This requires modifications in the fixture, he explains, "such as adding aluminum heat sinks (heat exchangers) so that the LEDS operate at an acceptable temperature.

One of the other big benefits of COB says Daley is the potential for remote access to the drivers (power supplies). "For instance, instead of a maintenance person having to climb up to the fixture, in some cases we are able to set it up so that they can go to a closet and change out a driver without ever having to get on a lift."

"Part of the reason we're capable of results so close to the leading edge of technology is we have a lab at our facilities where we can get in components, test them, then go back to the design team about reasonable operating ranges for the technology," says Daley. At Crenshaw, however, that approach is not just for new technology. For instance, a large scope of the work in the Wyoming Capitol project was reproducing complex pieces of cast glass. "Since that's not a very common product anymore, we actually have our own glass studio in-house." He says generally the goal of a project is to restore a fixture to as close to original as possible. "We'll research and identify what is was, and the methodology in its construction, then we'll fabricate a replication in a method similar to what they would have had originally."

Going back to lighting upgrades, Daley recalls with amusement a discussion several years back about using solid-state LEDS in historical applications. "A bunch of my colleagues noted that they didn't think LED was ready for prime time yet." On the contrary, the technology has clearly opened up a bright new future.

GORDON BOCK *is an architectural historian, instructor, and speaker through gordonbock.com.*

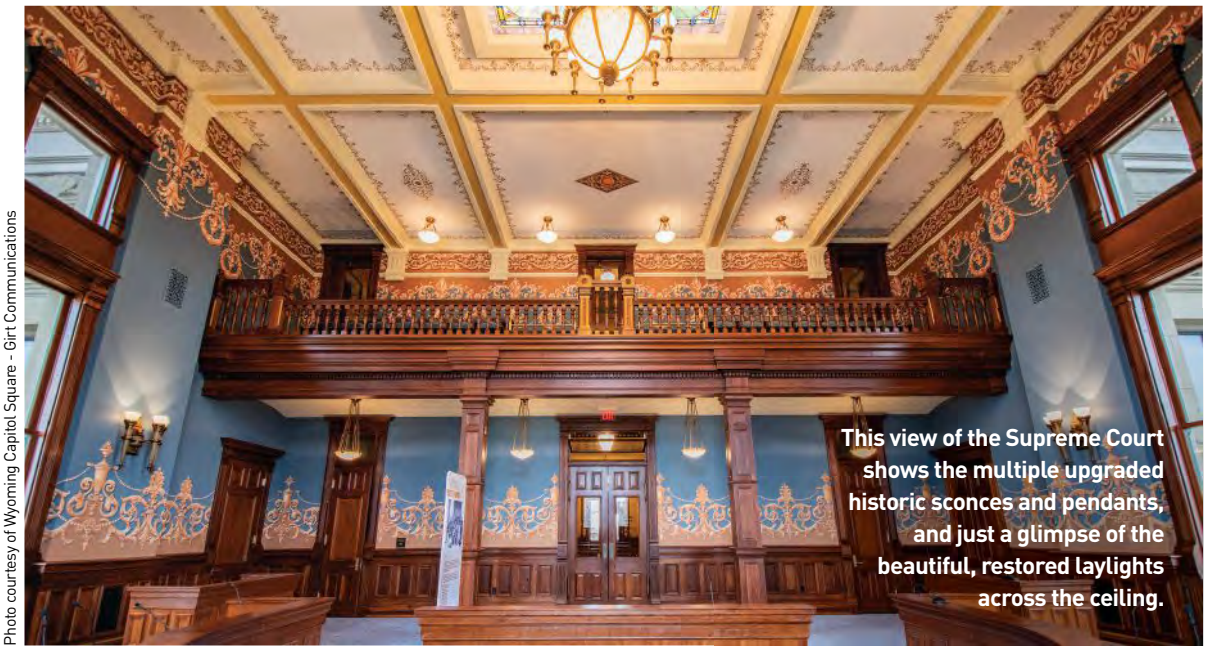
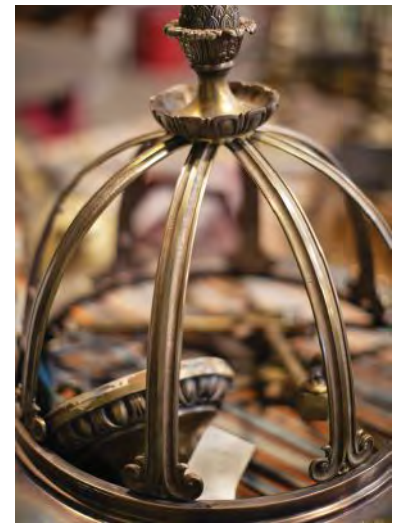


Photo courtesy of Wyoming Capitol Square - Girt Communications

This view of the Supreme Court shows the multiple upgraded historic sconces and pendants, and just a glimpse of the beautiful, restored laylights across the ceiling.

CLOCKWISE FROM RIGHT Besides the electrical upgrades, the Wyoming State Capitol called for cleaning and replicating intricate brass castings—stock-in-trade at Crenshaw. • The trick to retrofitting historic fixtures with modern electrics is hiding the components without altering the appearance of parts, which can often be very small. • Replacing complicated cast glass parts was another part of the project. Crenshaw maintains its own glass studio and artisans just for this purpose. • Ironically, the superior quality of today's glass makes reproducing the appearance of historic glass parts—which often had imperfections—a bit of a challenge. • The bowl of this ceiling fixture hides a nest of eight COB LED units, each composed of multiple LEDs. Note the rings of finned heat sinks for cooling.

Photos right & below courtesy of Crenshaw Lighting



BY SUSAN D. TURNER

Colorful revivalist mansion outside Chicago by Liederbach & Graham Architects.

Eric Piasecki/OTTO photo

Sensational Slate Roofs

These gray slabs have been protecting roofs for centuries—we take an in-depth look at this building material.

Slate has been used as a roofing material in North America for hundreds of years —many of which could be in service for many years more. Although, slate roofs can be repaired through known traditional techniques, it's important to understand the entirety of the slate roof, both material and craftsmanship, to determine whether to repair or replace.

CHARACTERISTICS AND USES

Slate is a metamorphic rock, which is highly dense and striated. It is formed in the ground from sediment compressed under extremely high pressure. It is commonly used for roofing, but is also versatile for floor tiles, black boards, wall finishes, and countertops. When installed properly on a building, quality slate can last more than a 100 years.

ASSESSING SLATE ROOFS

Given that slate roofs are steep and brittle, it is best to execute assessments from a lift to avoid walking on the surface. If that is not possible due to site conditions, enlisting in assistance from a qualified slate contractor to provide access with slater's ladders will prevent accidental damage in the process of investigation.

Slate roofs typically fail in one of four ways: 1. When being installed, the nails could be set too tightly, leading to cracked slates; or 2. the nails could be set too loosely, leading to the nail head punching a hole through the upper slate. 3. Typically, roof leaks do not occur on the field of the roof, but at a change in condition, such as at a valley, ridge, rake, eave, or intersection with another plane (chimney or dormer). 4. These leaks are typically failure of the flashing detail and not the slate. Over the long term, the slate can weather, due to long term exposure to sun, salt air, and acid rain. Impurities such as calcite and iron sulfides within the slate react with temperature and moisture fluctuations, forming calcium sulfate, or gypsum. Gypsum is larger volumetrically than other minerals in the stone, and its expansion fractures the striations, causing delamination, also showing up in what is known as a "gypsum smile." This will form late in the life of the roof (75 to 200 years), or earlier if a poor-quality slate was used. ***(fig. 1)***

To fully assess an existing roof, remove several slates to observe the underlayment, the deck, the slating nails, and the back side of the slates. The removed slates illustrate the head lap, or the amount that the tile above overlaps the tile two courses down. Similarly, it indicates the exposure, or the amount of slate which is visible past the edge of the slate above. Removing slates will also permit a quick field test to determine the soundness of a slate: Balance the removed slate on three fingers of one hand, while lightly striking it like a bell. If it rings, it is sound. If it is more like a "thunk," it is junk. ***(fig. 2)***

Visual inspection of the underside of deck will permit identification of areas of rot requiring deck repair required during reroofing. Further, observations in the attic areas will establish construction of the roof to identify the scope of demolition and the current insulation method to permit calculation of the dew point. Once known, an approach to accommodate the National Energy Code for thermal insulation can be developed.

INSTALLING A ROOF

To maintain cultural landscapes over time in concert with these natural changes, a comprehensive treatment approach must deal with both the natural and cultural resources in parallel. The conservation approach will dictate the treatments needed. Treatments approaches can include: a) a conservation approach and treatment plan, b) a management plan and management philosophy, c) a strategy for ongoing maintenance, and d) a record of treatment and future research recommendations.

Slates roofs are very heavy and can weigh ten pounds per square foot for ¼" slate, when the weight of the slate, underlayment and flashings are included. If the plan is to place a slate roof

Photo courtesy National Slate Association

FIGURE 1

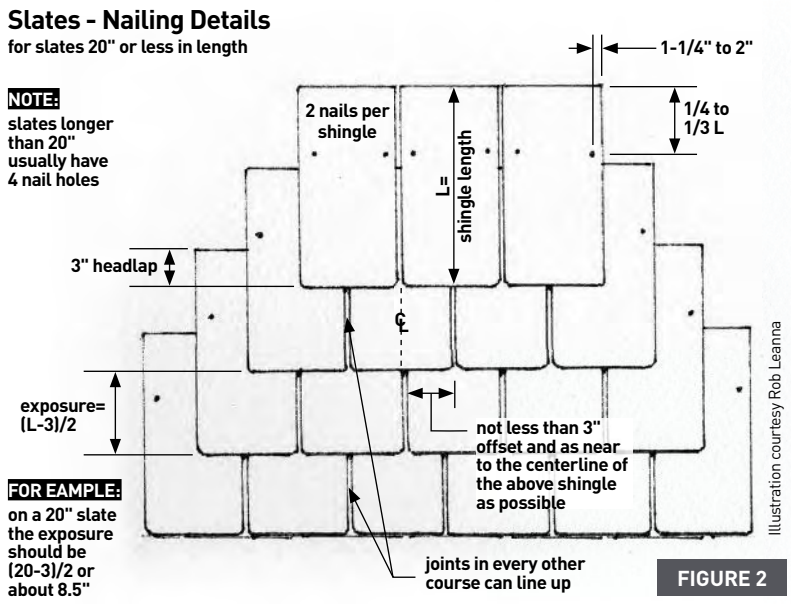


Illustration courtesy Rob Leanna

FIGURE 2

FIGURE 1 Slates with "Gypsum smile", delamination, holes due to high set nails, and cracks due to overtightened slates or impact damage.

FIGURE 2 Slates Nailing Details

FIGURE 3 Vertical application of colored, "fish scale" shaped slates.

on a building, which has never had one, structurally assess the size and condition of the rafters, to confirm that the existing structure can support the weight. If it is not, consult a structural engineer to design improvements to increase the load capacity.

Traditionally, slate roofs did not use an ice and water shield. Many clients desire this belt-and-suspenders design. This is acceptable for applications where the impermeable membrane does not form an air/vapor barrier at an unfortunate location where condensation will occur, which can lead to rot of the deck, or freeze/thaw causing damage to substrates such as concrete. Limit this self-adhering membrane to just the valleys, rakes, and eaves to avoid this. If you choose to install the ice and water shield over the entire field, a heavy roofing felt is necessary to permit repair of individual slates broken by careless workers, hail, or fallen tree limbs.

Regardless of the presence or absence of an adhered underlayment, heavy roof felt should be installed over the entire roof. After the felt layer, begin at the eave with a starter course, over which is installed the first slate. Individual slates are laid in rows along the roof. The entire field will be covered in slates lapped to form a weatherproof barrier of two layers of slate. Slates should have a side lap of a minimum of 3". Slates work best for roofs with a pitch greater than 4:12 and as steep as 20:12. It also works for vertical applications. The lower the slope, the greater the head lap required, and the more quickly it will weather. ***(fig. 3)***

SLATE SPECIFYING

First and foremost, the slate quality rating is the most important consideration. Slate rated as S1 quality is the best, as defined by ASTM C-406. Testing uses about 20 slate samples to undergo three separate tests to achieve its grade: C121 for water absorption, C217 for weather resistance, and C120 for flexure testing. Specify recent testing of the slates, as the

Synthetic Versus True Slate

Clients frequently suggest "synthetic slate," which are formed rubber or plastic units to resemble slate. When considering this substitution, the characteristics should be carefully assessed. Some criteria follow:

COST – Synthetic slate requires less up-front capital cost. As a percent of the roof replacement, is not significant when one considers labor, and materials for underlayment, flashing, and ridge materials etc. (based on pricing a large roof replacement in synthetic as an alternate for a client).

DURABILITY – Based on reviewed manufacturer's warrantees, a 50-year warrantee may be obtained, and this pertains only to manufacturing defects. It is typically ten years for wind, UV, or hail damage. While both achieve Class 4 rating for impact, genuine slate can be an unfading type, while other have limited fading over time. Genuine slate has an in-service record of 100 to 200 years, while most manufacturers of synthetic slates have been manufacturing for fewer than 20 years.

LIFE CYCLE COST - Slate is less costly over its lifetime than synthetic since it is two to four times more durable than synthetic. You would replace that same roof two to four times over a 200-year period, leading to a much larger carbon footprint and embodied energy loss. The concept of synthetic slate being 'green' is based on their ability to recycle the deteriorated units, but how do those tiles get to the appropriate recycling facility, and at what cost. Slates can be reused in some cases, can be crushed for garden path applications or used as clean backfill, reusing the material with less energy input.

TEMPERATURES - Thermal fluctuations and improper storage can result in curling of synthetic slates and the voids around edges will permit water ingress. Genuine slates are temperature stable and can be installed at any temperature.

FIRE RATING – Genuine slates are rated Class A roof coverings. In the presence of heat, they remain stable. While synthetic tiles are also Class A, they will melt when exposed to fire from adjacent structures.

INSTALLATION – The labor involved in installation is similar, other than the speed at which genuine slates are transported to the roof. The ease of cutting is attractive for the benefit of using unskilled labor. A skilled slater can cut and finish the edge quickly, while a cut edge of a synthetic tile cannot be left visible.

WEIGHT – if the roof was never designed for the weight of a genuine slate roof, then synthetic slates could be an economical answer to the cost of a structural reinforcement of the existing structure.

It is up to the designer to determine what the best solution will be for their project.

Photo courtesy North Country Slate

FIGURE 3

FIGURE 5

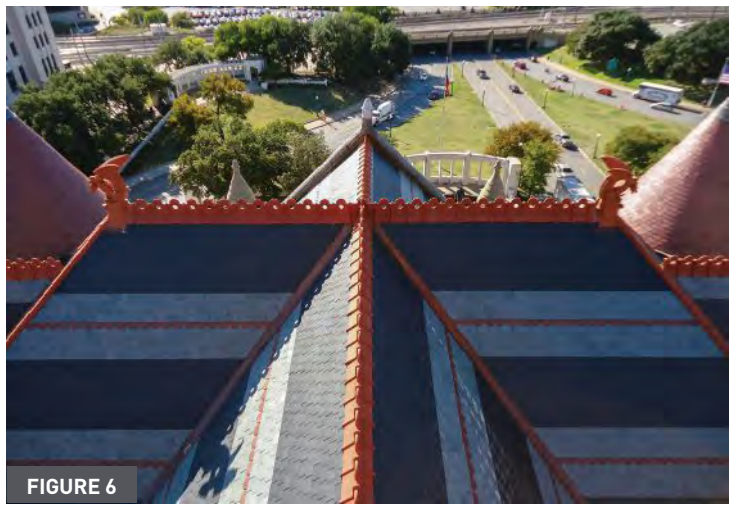


FIGURE 6

FIGURE 7

Figures 5, 6, 7 courtesy North Country Slate

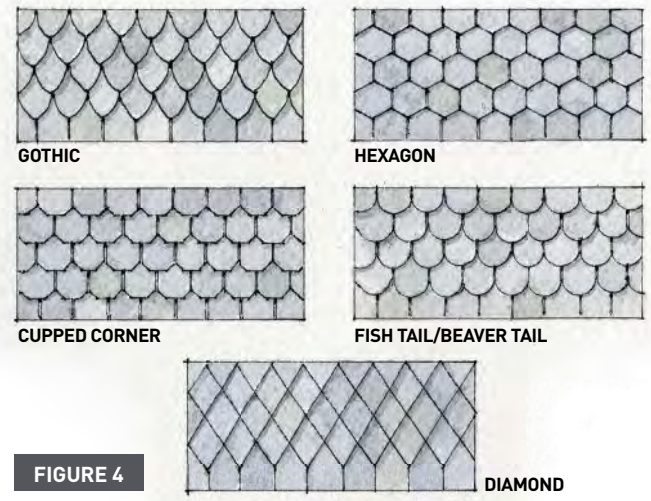


FIGURE 4

FIGURE 4 Slate Roof Patterns

FIGURE 5 Multicolored slate on steeply sloped roof with terne coated copper ridges and flashings.

FIGURE 6 Multicolored, shaped slate roof with terracotta ridges, hips and valleys.

FIGURE 7 Multicolored, shaped slate roof with pattern.

quality of slate will vary, depending on how far into the quarry they have excavated.

If the building is historic, selecting the same color, shape, thickness, and size will be important to match. Research could determine where the original slate originated. Even if known, the quarry could be "quarried out" and the slate is no longer available. It is best to select color from samples and compare them to unweathered portions of the existing slate. ***(fig. 4)***

Slates can be shaped into every manner of thickness, shape and style. Standard thickness is 1/4"- 3/8" but can be ordered as thick as 1". Slate thicknesses will vary +/- 1/16". Depending on the application, they can be gradated size, cut to shape, or selected with less variation in thickness.

Secondly, when specifying the installation of the slate, ensure requirements for bidders to be qualified in the installation of slate, with at least five projects of a similar size and complexity. Inexperience with setting slates will hasten a roof failure more quickly than any other aspect of the installation. Approved site mock-ups off the wall, retained through construction, are important to reinforce the methods and craftsmanship required, in order to have a completed roof that will last as long as the slate.

SOURCING

Slate is formed from sedimentary rock which was put under great pressure. In North America, it is quarried in Quebec, Maine, Vermont, New York, Pennsylvania, and Virginia. While slates can come from China, India, Brazil, and Spain, the testing protocols and quality control overseas are not consistent with those in North America.

DETAILING

As can be seen in most photographs of slate roofs, the ridges, hips, valleys, and gutters are design features, as well as critical locations to control water. With historic building, these elements can be built of pressed metal, copper, terne coated copper, terracotta, or slate. It is best to repair historic materials, even if modifications to the details need to be made for better performance. Replication of elements such as ridge cresting, medallions, or finials should be fabricated of the same material, if the original is too deteriorated for effective repair.

There is a higher likelihood that a faulty detail will cause a leak before slate failure. Examine the existing details during rain events, to assess their effectiveness in shedding and directing water. The design of these details must be carefully resolved, and the installation supervised, to ensure that lapping of flashing sections is well executed, and details are followed. Good design guides for these details, in addition to the National Slate Association's (slateassociation.org) guide, are Copper.org's Architecture Design Handbook, and SMACNA.org's Architectural Sheet Metal Manual. ***(figs. 5, 6, 7)***

LESSONS LEARNED

Know what you are specifying.
The difference between an S1 (75+ years) and an S3 (20-40 years) is not detectable by visual observation. Specify field testing of material arriving on site. Follow up on timely testing to ensure that the specified quality is received, and that it is coming from the specified quarry. Shipments of slate whose quality has not been verified through successful testing should not be installed.

Use only prequalified contractors.
Site observation is of utmost importance. While using a qualified contractor will support a successful project, verification of installation of the details will prevent premature leaks.

Bibliography

www.traditionalroofing.com
An excellent website of current and archival articles on slate roofing.

slateassociation.org
The National Slate Association, the industry's website with various articles, and also where to find the Slate Roofs Design and Installation Manual among other resources.

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Illustration courtesy Rob Leanna

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CASE STUDY

BY GORDON BOCK

Robinson House Rehabilitation

A building with a storied past gets a new lease on life as a gallery and tourist center in Virginia.

What do you do with a historically important house that has served diverse roles over nearly 200 years, but struggles to fit into the very surroundings it created? "Robinson House didn't really want to be another art gallery, but it did want to have public function," observes Steven Blashfield, AIA, LEED AP and principal at Glavé & Holmes Architecture in Richmond, Virginia. "For 20 years it was vacant and used for storage, until we rehabilitated the building and brought it back to life."

Indeed, one might say many lives. When first built in the late 1820s by banker Anthony Robinson Jr., the house sat on about 160 acres in the rural outskirts of Richmond. "Robinson passed away in 1861, and his wife kept on with the property until her son sold the house in the 1880s to an organization developing a home for disabled war veterans." As the last soldiers passed on, the commonwealth acquired the property starting in the 1930s. "When plans evolved to build the Virginia Museum of Fine Arts (VMFA), it made sense to put it on this greenspace now in the center of the city." Then through the 1950s the building housed the Virginia Institute for Scientific Research, a Cold War-era laboratory, and afterwards offices and storage.

The Robinson House might have hibernated away as a depository if not for a series of nearby improvements. "In 2010, the VMFA embarked on a sizeable expansion of their facility," explains Blashfield, "and in the process of a lot of landscaping, they actually lowered the grade around Robinson House so that it now sat raised on what looked like a plinth of land." With the formerly separated house now in the midst of 360 degrees of activity, there seemed a need to convert the building into something with more function that also recognized its historical importance for the site. "However, the VMFA didn't really want to put art in the space, because it did not have art-type mechanical systems and, from a security standpoint, they didn't want their high-value art objects away from the museum proper."

So they decided on two solutions. One part has became the Richmond Region Tourism Center, where visitors can get information about tourism opportunities. "The first floor includes a permanent gallery that tells the history of the site, how it evolved from the Robinson family to the soldiers' home to a museum, so visitors can understand the context." He says since the building is load-bearing masonry with brick exterior walls, there's none of the art collection in the Robinson House; it's more like a history museum. "We would have had to do lots of work inside to really bring it up to a collections-oriented environment with, for example, humidity control. So just bringing out the history of the

Photos by Virginia Hamrick Photography

The long history of the Robinson House is integrally connected to the establishment of the Virginia Museum of Fine Arts, one of the premier art museums in the U.S.

The relationship between the Robinson House and the main entry to the museum places the building in a position of prominence, so it was important to consider how any expansion would be viewed from all sides.

A new permanent gallery on the first floor tells the complex story of the Robinson House from its start as a residence to a convalescent home for Civil War soldiers and finally as a part of the VMFA.

building didn't really require that level."

To make it all work, however, did require adding 3,200-square-foot to the back of the 7,600-square-foot house. "As you can imagine, when you convert a house to a public space, you need accessibility," explains Blashfield. "We had to create two means of egress and vertical access for people within the building. The addition is largely a circulation structure with a new elevator and a new stairway that allows us to use all three floors to their full capacity."

Nonetheless, it's about more than codes and communication. "We really wanted to do something that reconnects the house to the ground and transitions it more into the public realm. So, the addition steps down off the back to the site while retaining the historic character of the original house and façade." In fact, he notes that the addition continues partly like a porch. "It's new circulation off the back that is enclosed with shutters, similar to how a lot of historic homes look, but in a little more contemporary way."

While the historic exterior remained fairly intact, the house's interim use as offices had lost some historic fabric on the interior. "On a lot of these projects, we take a research-based approach, mapping throughout the space to identify what is actually significant and original to the house." Most of the historic elements that still exist are on the first floor. "We rehabilitated some original mantelpieces, and we kept the historic staircase, so even though it's not outfitted like a historic home, to visitors it feels like a historic home."

Though they had to replace basically all mechanicals, this allowed upgrading the HVAC to a new VRF (variable refrigerant flow) system. "It has small, individual units in different rooms," he explains, "that allowed us to really integrate with less change to the interior." Up-front costs are a little more, but it avoided hiding big pieces of equipment outside in an enclosure, where there's 360-degree visibility. "We try really hard to make these kinds of things as invisible as possible, because we want the history to be the significant portion of the experience."

GORDON BOCK *is an architectural historian, instructor, and speaker through gordonbock.com.*

Photos by Virginia Hamrick Photography

JUDY L. HAYWARD

From the Ground Up and the Top Down

Energy conserving techniques for older buildings.

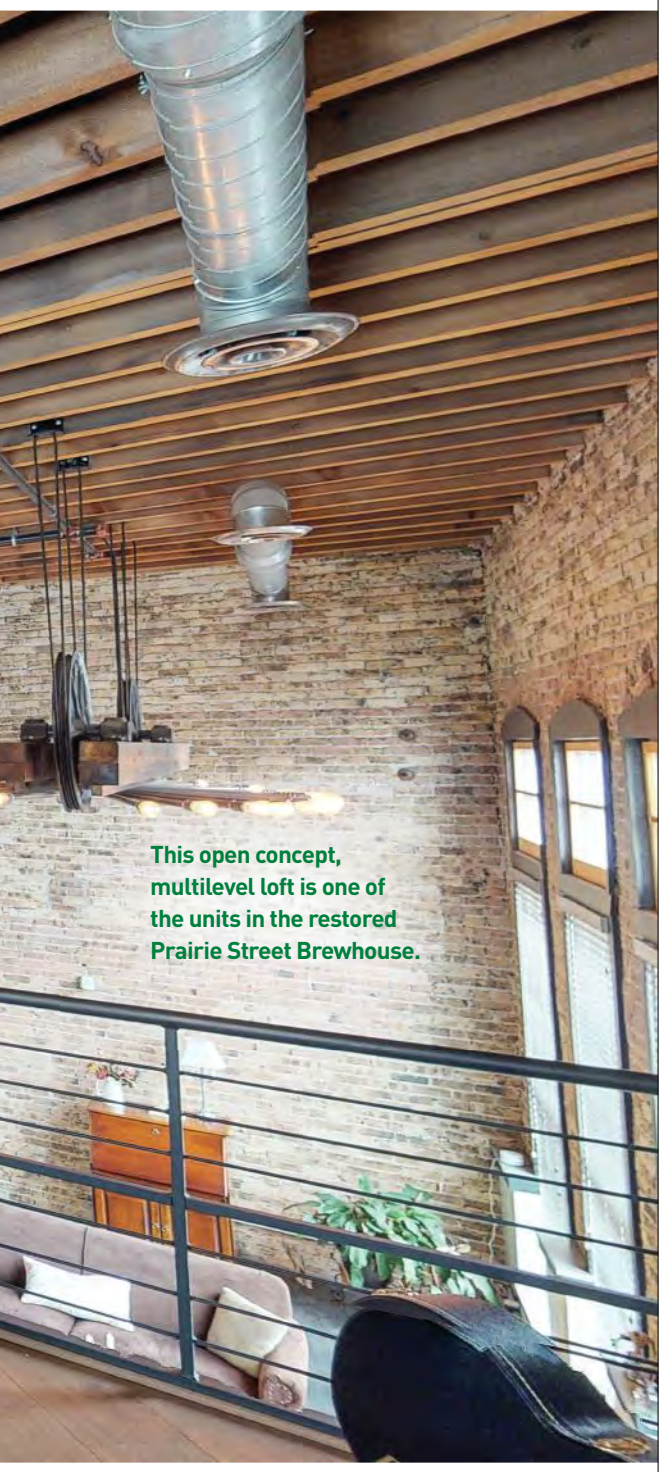
The Prairie Street Brewhouse is a remarkable multi-use building on the banks of the Rock River in downtown Rockford, Illinois. Gary W. Anderson, AIA, served as the architect for this 2015 award-winning project that combines a microbrewery, banquet center, and restaurant with offices on the second floor and luxury lofts on the third and fifth floors. The brewhouse comprises 81,000 square feet in the historic Peacock Brewery built in 1857 by English émigré Jonathan Peacock, with seven subsequent additions up until 1920. There have been only four owners in its 163-year history with a temporary closure during Prohibition, but today the site is thriving again with an innovative, adaptive reuse project that qualified for federal and state historic tax credits.

Anderson noted that in the past decade, the City of Rockford has made an intentional effort to get people back into the downtown. The reuse of upper levels for office and housing has gone hand in hand with a revival of restaurants, retail, and riverfront vitality for this city of 150,000 people. What he describes is not so much a story of which came first, but how the mixed-use approach is revitalizing this downtown by bringing people and activity side by side. He says downtown is now as busy on early Saturday mornings as it is during business hours and nighttime recreation. The active presence of people among the renovated structures has changed everything. Anderson even moved his office into the second floor of the brewhouse and became an owner/investor.

Anderson says the results of the geothermal system are even better than he expected. “The biggest hurdle was getting city officials to believe the technology would work,” he says. “This was a complicated project that needed to provide comfort 24-7 for a variety of users on multi-levels. Even on a morning when the temperature outside was flirting with 30 below zero, the building was comfortable. And now with the pandemic, more tenants have opened windows and doors for ventilation, and yet the air conditioning provided by the geothermal system is still working just fine.”

Anderson explains the technical specs of the system and how it was integrated into this industrial giant. “The goal was to reduce energy consumption with an open loop geothermal system. Two 100-foot wells were drilled to reach a shallow aquifer directly below the adjacent river. The pump and dump system is well within the EPA temperature limits of returning the water to the river. It is important to note that the pumps have variable speed drives, and they may only operate 50 to 60 percent in a 24-hour period depending on outdoor temperatures. Balancing the building loads of a mixed-use building have added to the economic return. All the building

Photo by Gary W. Anderson Architects



This open concept, multilevel loft is one of the units in the restored Prairie Street Brewhouse.

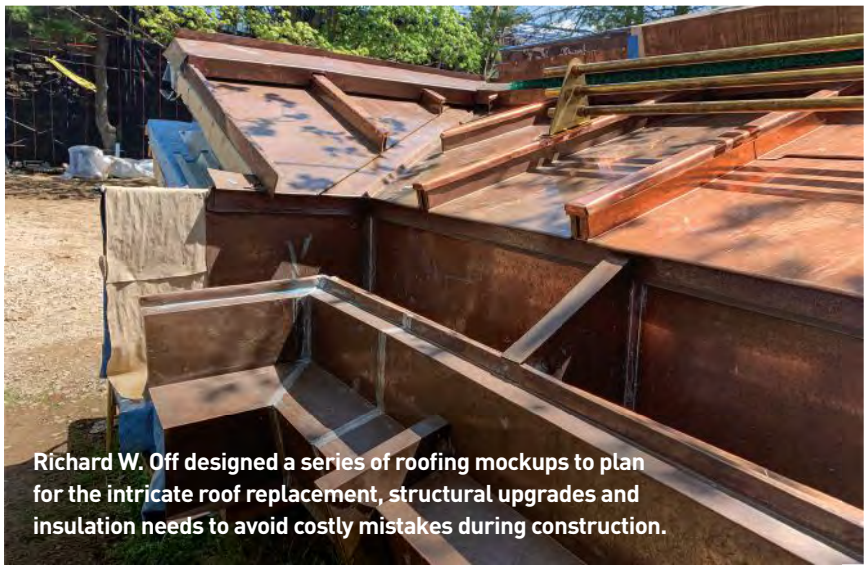
refrigeration for the restaurants and brewery are on the geo system. The energy costs on a square-foot basis for the past five years have been 60 percent less than a conventional system. The initial installation costs for the open loop system were nearly the same as a conventional system."

FROM THE TOP DOWN: INSULATED ROOFING

A good roof is still the best defense against the elements, and combining one with a sound insulating strategy can become the best offense in mitigating heat loss.

Lupton Hall on the campus of Farmingdale State College in Farmingdale, New York, on Long Island was designed by Max O. Urbahn in 1945. Today the

An open loop geothermal system now heats and cools the 167-year-old Prairie Street Brewhouse in Rockford, IL.



Richard W. Off designed a series of roofing mockups to plan for the intricate roof replacement, structural upgrades and insulation needs to avoid costly mistakes during construction.

Photo by Richard W. Off, Hoffmann Architects, Inc.

80,000-square-foot, brick and stone building houses the architecture program, construction management studies, and related building technology programs. It was designed with Prairie School features including a roof with a large overhang and contemporary interpretations of clerestory windows. And while the building is not listed on the National Register, the college wanted to keep the historic character of the roof shape—arguably its most character-defining feature. The roof had been plagued with leaks, ice dams, and icicle formations at the perimeter, and there were no gutters or downspouts to divert water away from the building. They were concerned about heat loss through the uninsulated roof. The college commissioned Hoffmann Architects from New York to conduct a thorough building evaluation.

The existing attic space could not easily accommodate continuous insulation, so some increase in the thickness of the roof would be required for a new ventilated and insulated roof assembly secured to the top of the existing roof structure. Architect Richard Off, AIA, noted that the existing framing was in remarkably good condition, consisting of steel rafters with concrete decking. Even the paint was still sound after nearly 75 years of service. The applicable energy code requires improved R-value performance, so the decision was made to install a new, 11-inch-thick assembly to accommodate mineral wool insulation, provide an uninterrupted air cavity, and allow a new nailing surface for underlayment and copper installation. Mineral wool would not be damaged by moisture that might enter the cavity and offers some fire protection of the framing for the new assembly. The new air cavity extends from the eaves to the newly ventilated roof ridge to keep the roof cool and help prevent ice dams from forming. To achieve this continuous ventilated and insulated assembly, a portion of the roof's eave structure was removed and reconstructed. If this had not been done, the roof overhang would have increased from just over two feet to nearly four, and Off and his team from Hoffmann Architects felt this would alter the appearance of the roof too much. Reconstruction of the eave also allowed for the installation of a new built-in gutter and downspout system to properly address drainage.

There were significant structural challenges. Additional weight was a concern and was addressed by using lightweight galvanized steel framing positively secured to the existing steel structure with stainless steel bolts to reduce the likelihood of thermal bridging and condensation in the new roof assembly. This was done in lieu of heavier fire-treated wood framing, which also allowed insulation batts to be placed more closely and continuously. This new metal framing ensured the new fire-treated sheathing/nailer boards were properly supported and appropriately anchored against high uplift loads found on Long Island, and also allowed for the installation of a brass snow guard system to protect gutters and adjacent paved areas, against potential snow and ice accumulations at the roof. Off explained that "Installing this new framing and increased roof assembly thickness became especially complex around the roof's existing chevron-shaped dormers, louvered hip

Photo by Michael Smith

ends, and reconstructed eaves and ventilated ridges; however, producing a series of large freestanding mockups of the replacement system during the submittal process allowed the design and construction team to resolve detailing concerns without making costly and irreversible mistakes in the field."

Given that the existing roof is not currently insulated and has a thin existing assembly with multiple thermal bridges, this copper roof replacement and assembly and structural retrofit not only addresses leaks, drainage, and mitigates winter problems but should also increase the annual energy savings for both heating and cooling, and should help reduce overall operating costs for the building.

JUDY L. HAYWARD *is executive director of Historic Windsor Inc. and the Preservation Education Institute. She serves as education director for the Traditional Building Conferences Series and Online Education Program. She blogs and writes this* "Techniques" *column regularly for* Traditional Building. *She specializes in the development of educational programs for builders, architects, and tradespeople. She can be reached at peihwi@gmail.com or 802.674.6752.*

BY NANCY A. RUHLING

Robert A.M. Stern Architects designs The Guild, part of the Courier Square project in Charleston, South Carolina. The eight-story loft-style brick apartment building recalls the industrial character of early 20th-century warehouses in the area with expansive metal windows.

Photo courtesy of Peter Aaron / OTTO for Robert A. M. Stern Architects

Made of Steel

Metal windows, the soul of America's historic commercial and civic structures, provide a peek into the past. Here are some of the companies that specialize in recreating these views of bygone eras.

GRAHAM ARCHITECTURAL PRODUCTS

GRAHAMWINDOWS.COM

Founded more than a half century ago, Graham Architectural Products designs and manufactures thermally broken custom architectural-grade windows at its 300,000-square-foot factory in York, Pennsylvania.

"We've done projects all over the country," says director of marketing Jim Eisenbeis. "We are known not only for our historic replication windows but also for our service—we have extensive experience working with historic approval agencies."

The company, which offers a variety of window styles ranging from casement to double hung, offers over 12,000 window shapes.

Graham Architectural Products designed and manufactured the eight miles of multi-pane ribbon replica windows that define the Starrett-Lehigh Building in Manhattan, an iconic modernist structure that was built in 1931 and covers a full city block.

Eisenbeis notes that there are nearly 5,000 separate openings at Starrett-Lehigh. "At 2.3 million square feet, it's larger than the Empire State Building," he says. "We're using the window originally designed for that project—the SR6700—in other projects."

The company also supplied windows for St. Louis' Old Cathedral, America's first cathedral west of the Mississippi River; Yonkers City Hall, a century-old building in New York State; and the St. Louis University Museum of Art, a Missouri institution since 1900.

Photos courtesy of Graham Architectural Products

LEFT Yonkers City Hall in New York, which opened in the early 1900s, features replica windows by Graham Architectural Products.

BELOW, LEFT Hope's Windows created 58-foot-tall solid hot-rolled steel windows covering a combined surface of 16,700 square feet for the Chapel of the Resurrection at Valparaiso University.

BELOW The 14,000-square-foot John Deere Pavilion, the world's largest agricultural museum, features floor-to-ceiling expanses of Hope's Windows' hot-rolled steel windows and doors.

Photo by Jon Hendricks/Valparaiso University

Photo by IMG_INK

HOPE'S WINDOWS

HOPESWINDOWS.COM

For more than century, Hope's Windows has been handcrafting solid hot-rolled steel and bronze windows and doors.

The family-owned company manufactures the custom doors and windows in its 400,000-square-foot plant in Jamestown, New York.

"We are the largest domestic fabricator of steel windows and doors with corporate offices and production located in western New York," says Brian Whalen, vice president-sales. "Our team of dedicated employees has unparalleled experience with guiding product design in concert with domestic code."

The company's windows are in a variety of venues around the country, including at Fenway Park, home of the Boston Red Sox; the Chapel of the Resurrection at Valparaiso University; the Philadelphia Museum of Art; the George W. Bush Presidential Library and Museum; and Frank Lloyd Wright's Fallingwater.

Hope's Windows encourages clients to visit its factory as part of the research process. "'Steel' has been globally marketed and may lead to the assumption that all products are the same," Whalen says. "Like 'wood,' many variables exist that separate the premium products from those of lesser quality and material. There are multiple steel raw material choices in today's market—hot-rolled, cold-rolled, hybrid—all affecting aesthetics, performance, cost and lifecycle of the finished product."

ST. CLOUD WINDOW
STCLOUDWINDOW.COM

Based in Sauk Rapids, Minnesota, St. Cloud Window offers custom aluminum windows for commercial buildings and landmark properties that are architecturally and historically significant.

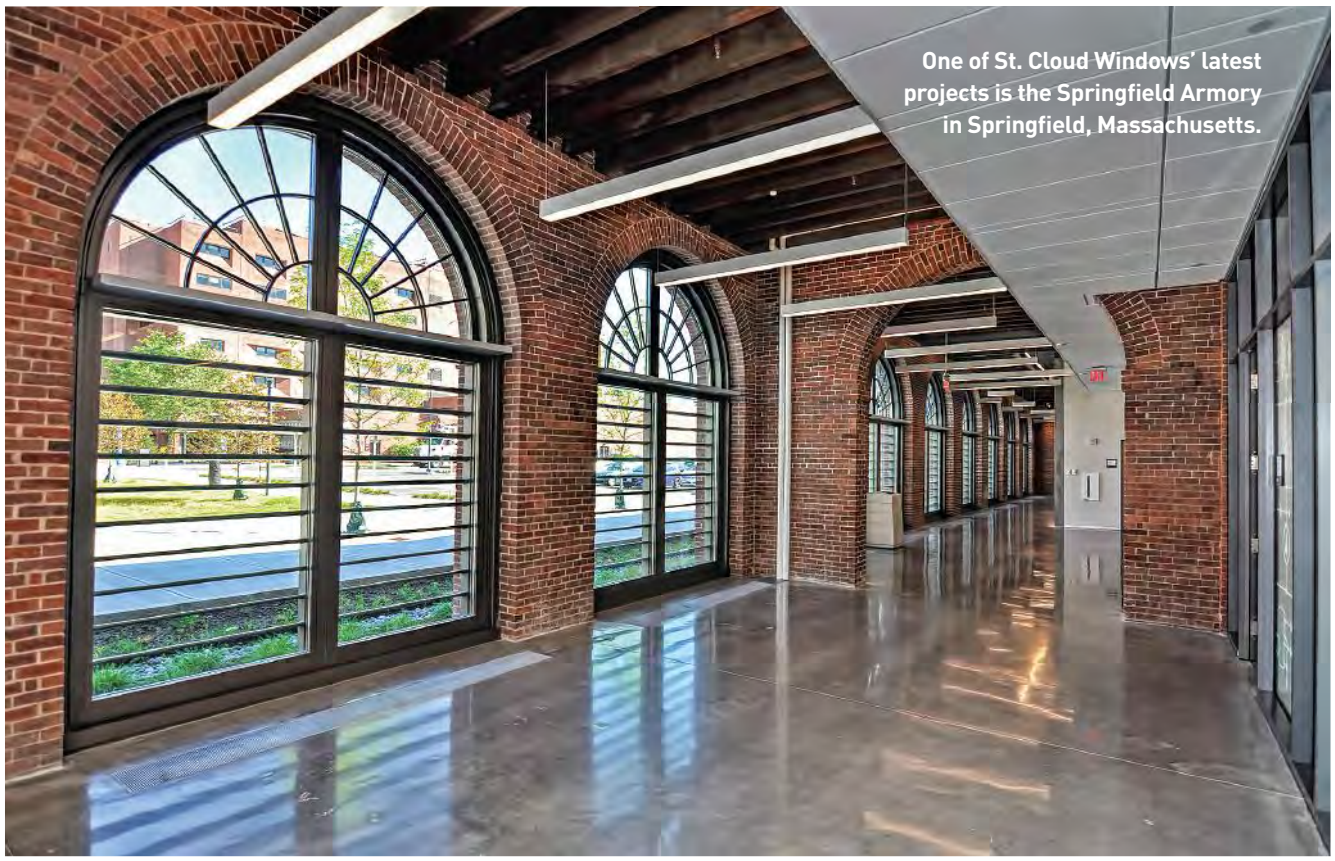
Established in 1952, the company, which is owned by five sisters, designs and manufacturers historically accurate aluminum windows, as well as sliding glass doors, terrace doors, and acoustically rated curtain walls in its 34,000-square-foot factory, which employs 44 people.

"We can replicate just about any historical architectural feature you desire," says president Casey Mahon. "The common denominator for all of our work is looking for historical features peculiar to each product."

He notes that the company frequently uses 3-D printing during product development, which saves not only time but also money.

St. Cloud Window has done a variety of projects around the country. It supplied the aluminum windows for Minneapolis' Midtown Exchange, a 1928 commercial/retail building; Springfield Armory, an 1895 Gothic Revival structure in Springfield, Massachusetts; and Foshay Tower, a 1929 Art Deco skyscraper in Minneapolis that's modeled after the Washington Monument.

"Our level of services distinguishes us," Mahon says. "Each new contract has a dedicated project manager who works with the architect's team from design through installation because old buildings have their own menu of problems."



One of St. Cloud Windows' latest projects is the Springfield Armory in Springfield, Massachusetts.

Left & below photos courtesy of St. Cloud Window

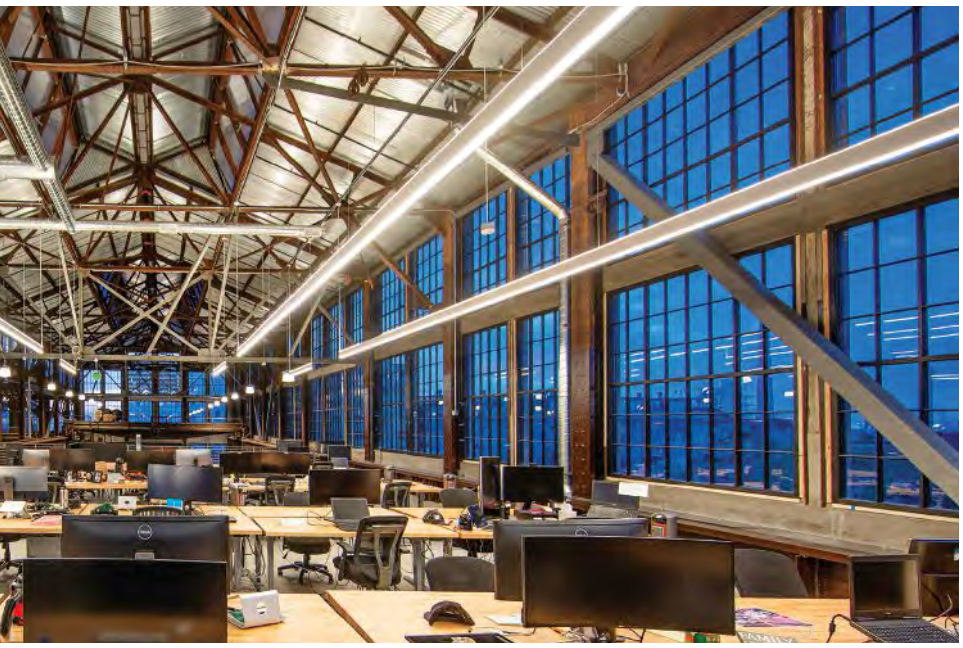
Minneapolis' Midtown Exchange, built in 1928, features aluminum windows by St. Cloud Window.

WINCO WINDOW CO.
WINCOWINDOW.COM

St. Louis-based Winco Window Co. has been designing and engineering customized architectural aluminum windows for projects that require historic replicas for more than a century.

The family-owned company, which is the preferred provider for the National Park Service and state historical agencies, employs sustainable manufacturing processes and uses recycled materials, many of them locally sourced, to make historic replication windows. It also applies a naturally occurring, ecologically friendly anodized finish that's more durable than paint.

Winco has designed and made windows for a variety of historical preservation projects around the country,



Left & above photos by Billy Hustace Photography

including those for two buildings at San Francisco's Pier 70, which is on the National Register of Historic Places.

For that award-winning project, Winco engineers created unique shapes to match the profiles of the original windows and made a 16-foot mock-up on site. The company has also made windows for Washington University in St. Louis, the University of Alabama, and the Uber headquarters in San Francisco.

Marketing Coordinator Katherine Hahn says the company continues to push the envelope. "We pioneer innovative solutions for today's most challenging issues," she says. "We make noise-reducing windows designed to improve acoustical performance as well as blast- and impact-resistant windows to withstand explosions, hurricanes and tornadoes."

ABOVE & TOP Winco Window Co. designed and made the windows for two buildings at San Francisco's Pier 70, which is on the National Register of Historic Places.

Additional Resources

CRITTALL WINDOWS
crittall-windows.com

DYNAMIC ARCHITECTURAL WINDOWS AND DOORS
dynamicwindows.com

OPTIMUM WINDOW MANUFACTURING
optimumwindow.com

REBCO rebcoinc.com

SKYLINE WINDOWS
skylinewindows.com

PROJECT Benton Hall
ARCHITECT Robert A.M. Stern Architects

HISTORICAL PRECEDENCE

With Benton Hall, Robert A.M. Stern Architects both respects and adds to Colgate University's centuries-old architectural heritage.

The new 16,600-square-foot LEED-Platinum home of Colgate University's Center for Career Services is clad in locally-quarried bluestone with robust cast-stone ornament, taking cues from the campus's Romanesque 19th-century buildings.

MEETS SUSTAINABLE DESIGN

BY KILEY JACQUES | PHOTOGRAPHY BY PETER AARON / OTTO (UNLESS OTHERWISE NOTED)

LEFT Scored panels of cast stone resemble individual blocks of limestone.

RIGHT The rough-faced cast stone used for the archway includes four different impressions installed in a random pattern to present a naturally variegated appearance.

BELOW Stone-clad façades with large windows where appropriate contribute to the building's airtight envelope, which meets Passive House standards.

Colgate University in Hamilton, New York, recently celebrated its bicentennial. Perhaps there is no better time to introduce a new, sustainably designed building to its campus—one set to stand for another 200 years. Plans for Benton Hall, which houses Colgate's Center for Career Services, had gone through a few iterations before principals Preston Gumberich and Graham Wyatt of Robert A.M. Stern Architects took charge of the project.

The earliest of the campus's buildings dates from 1827. It and buildings that followed are traditional in the vernacular of upstate New York during its Erie Canal heyday, clad in locally quarried bluestone with limestone trim and slate roofs, embodying what Gumberich calls an "elegantly stoic character" with an almost singular ornamental focus on entryways. Among the campus's late 19th-century buildings, a few have rich Romanesque detailing. Gumberich shares this: "The campus administration was instrumental in the design—the president, Brian Casey, wrote his dissertation on 'The Romantic Campus and the American College from 1880 to 1940,' exploring what historic campuses meant to students and alumni of that period. He thought the design needed to reflect Colgate's heritage," says the architect. "President Casey, who is impressively thoughtful and well informed, directed our attention to Colgate's Romanesque," adds Graham Wyatt. "When we are asked to add a building to an existing campus, we approach it much as we would a commission to add to an existing building. For Benton Hall, our design is rational and efficient, on the model of the campus's historic buildings."

The new 16,600-square-foot hall sits on the northeast corner of Academic Quad, occupying what had been, according to Gumberich, a "vacant corner in a most prominent location." The building is positioned to allow "breathing space" around it, establishing a commanding presence and providing views of the bucolic landscape from within. Split- and-seam-faced Llenroc bluestone quarried in nearby Ithaca clads the majority of the facade, while cast stone, simulating limestone, was used for the Romanesque pilasters, colonettes, buttresses, horizontal banding, and entry arch. "We viewed the use of cast stone over limestone as an advantage because it allowed us to implement ornamental detailing that we might not otherwise have been able to afford with real stone carved by hand," Gumberich explains; the emphasis was on achieving the best value for every dollar spent. Of special note are the jointing patterns, which create the illusion of individual blocks of limestone, when in truth, they are cast-stone panels scored with faux joints. This was one of a few strategies developed to keep the project budget on track.

Adapting to the steep site, the design puts the arched campus entry close to the grade of the upper quad, while the visitors' entry is a full story below, conveniently close to Oak Drive, a main campus-access road. In terms of the building's functionality, two office suites occupy the ground floor—the operations suite and the employer relations suite, designed for on-campus interviews; those rooms are clustered around a multifunctional space that opens to the main corridor. One set of stairs accesses the second level, which includes the Career Commons, , a large flexibly-furnished media presentation room, and a seminar room.

Many of the interiors are distinguished with quarter-sawn white oak paneling; but the ceiling moldings represent another cost-savings innovation. The original design called for glass-fiber reinforced gypsum, but the team worked with a plaster fabricator, using stock moldings to build a layered effect on the coffered ceiling. "It was a great success," says Gumberich. "It's beautiful and economical, and the contractor praised its ease of installation." He notes, too, that plaster's ability to resist temperature variations (unlike wood) makes it an exceptionally durable material for this application. Similarly, real granite was used for the flooring because of its capacity to hold up against decades, perhaps centuries, of near-constant pedestrian wear.

Sustainable design is a core principle at Colgate. It is the first university in New York State to achieve carbon

OPPOSITE The white oak-paneled lobby greets students entering from the campus's Academic Quad.

LEFT The upper gallery, lined on one side with French doors that open into the Career Commons, connects the upper lobby to the building's stair hall.

ABOVE Large windows open the Career Commons to daylight and views.

The paneled stair hall connects career services above with employer interview rooms below.

required to be, at minimum, LEED Silver–certified. The design team wanted to push it further; they made Passive House certification the goal. Measures taken to this end include: an airtight building envelope, confirmed by blower-door testing, comprising six-inch exterior EPS rigid foam, as well as mineral wool batts inserted within the stud cavities for an R-36 wall assembly that includes CompacFoam (with an R-value of nearly 4 per inch) for blocking to prevent thermal bridging; a roof of 12-inch-thick structural insulated panels (SIPs); an energy recovery ventilation (ERV) unit; low-flow plumbing fixtures; LED lighting with occupancy and light-level sensors; and on-site stormwater management, among others.

The building's transparency is on full display in the light-flooded upper-level gallery, with its views of the campus and distant landscape. The idea was to include biophilic design elements, with windows as large as possible—typically at odds with Passive House standards. To meet the criteria, the team specified aluminum-clad European white oak windows by Makrowin, sourced from European Architectural Supply. The triple-glazed, thermally broken units have an R-value of nearly 8, as compared to R-3 or R-4, at best, for standard aluminum insulated windows.

Despite all efforts, the project did not earn Passive House certification due to the building's orientation and its relationship to adjacent buildings and the nearby quad, which was paramount. Nonetheless, the building performs at Passive House levels. "We achieved a Passive House building envelope without a budget premium, and the building has already demonstrated a significant reduction in energy use that will pay dividends for decades to come," says Wyatt. (According to building envelope consultant Terry Brennan of Camroden Associates, Benton Hall has a 59 percent cost savings in energy consumption compared to a baseline design.) Notably, the building did achieve LEED Platinum certification.

Asked for final thoughts, Gumberich expresses gratitude for Colgate's commitment to sustainable development and "its simultaneous dedication to design that reinforces the remarkable history and beauty of its campus, proving that sustainability and style are not at odds with one another."

For his part, Wyatt adds: "Every campus has a prevailing architectural character—often several strains, with one or another dearest to the hearts of the campus community—as well as underlying organizational principles, that we, as architects, study in ways that go beyond what those who occupy the campus may be conscious of. I feel we owe it to each campus to carry forward, rather than disrupt, the character that their institution values most." Benton Hall stands as a testament to their success.

KEY SUPPLIERS

LEAD DESIGN FIRM
Robert A.M. Stern Architects

GENERAL CONTRACTOR
Hayner Hoyt Corp.

CIVIL ENGINEER
Delta Engineers

STRUCTURAL ENGINEER
Thornton Tomasetti

MASONRY CONTRACTOR
Remlap Construction

ADDITIONAL SUPPLIERS

Eggers Industries

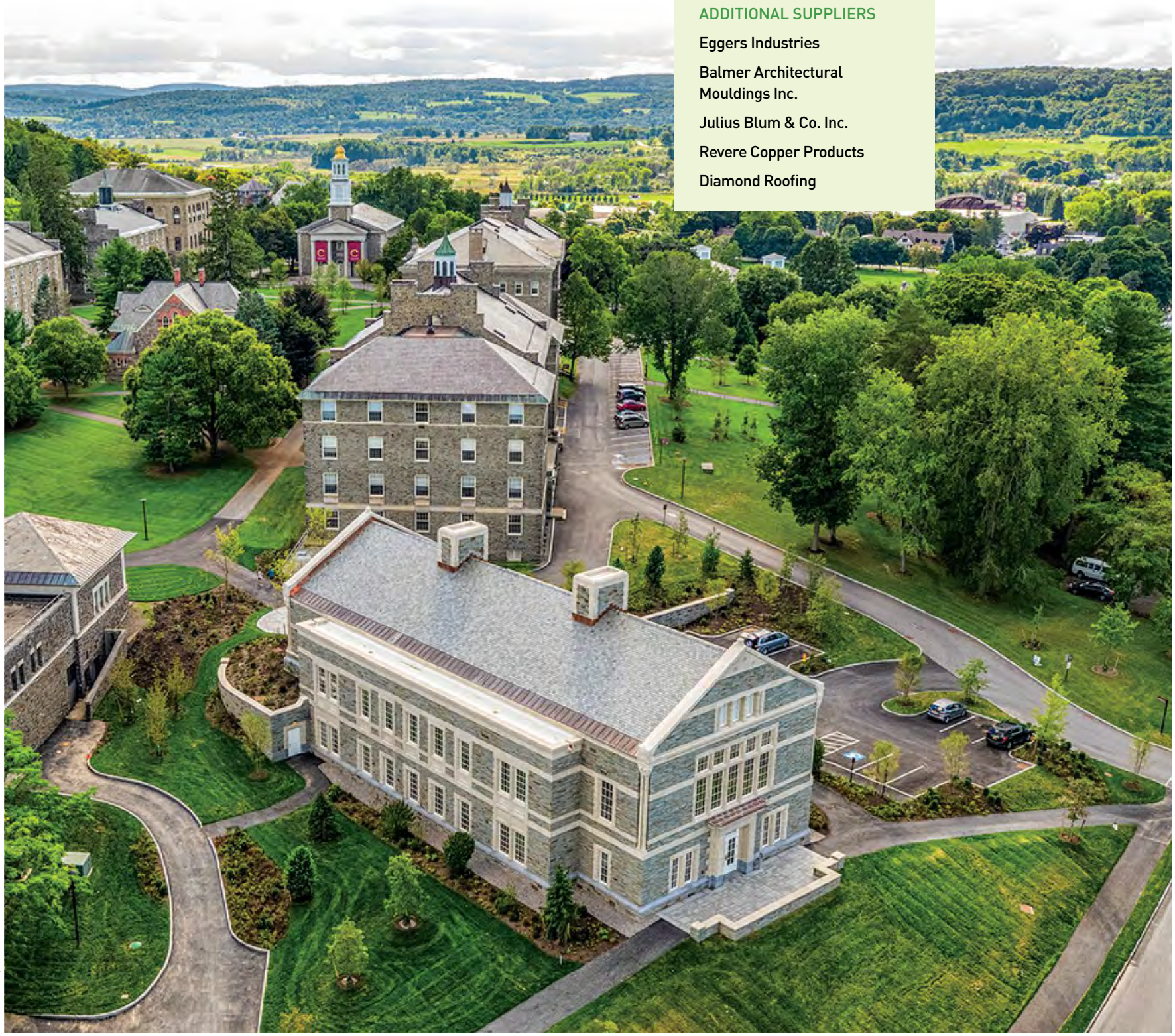
Balmer Architectural Mouldings Inc.

Julius Blum & Co. Inc.

Revere Copper Products

Diamond Roofing

Benton Hall negotiates the 30-foot change in grade between the campus's upper Academic Quad and the visitors' entrance from Oak Drive below.

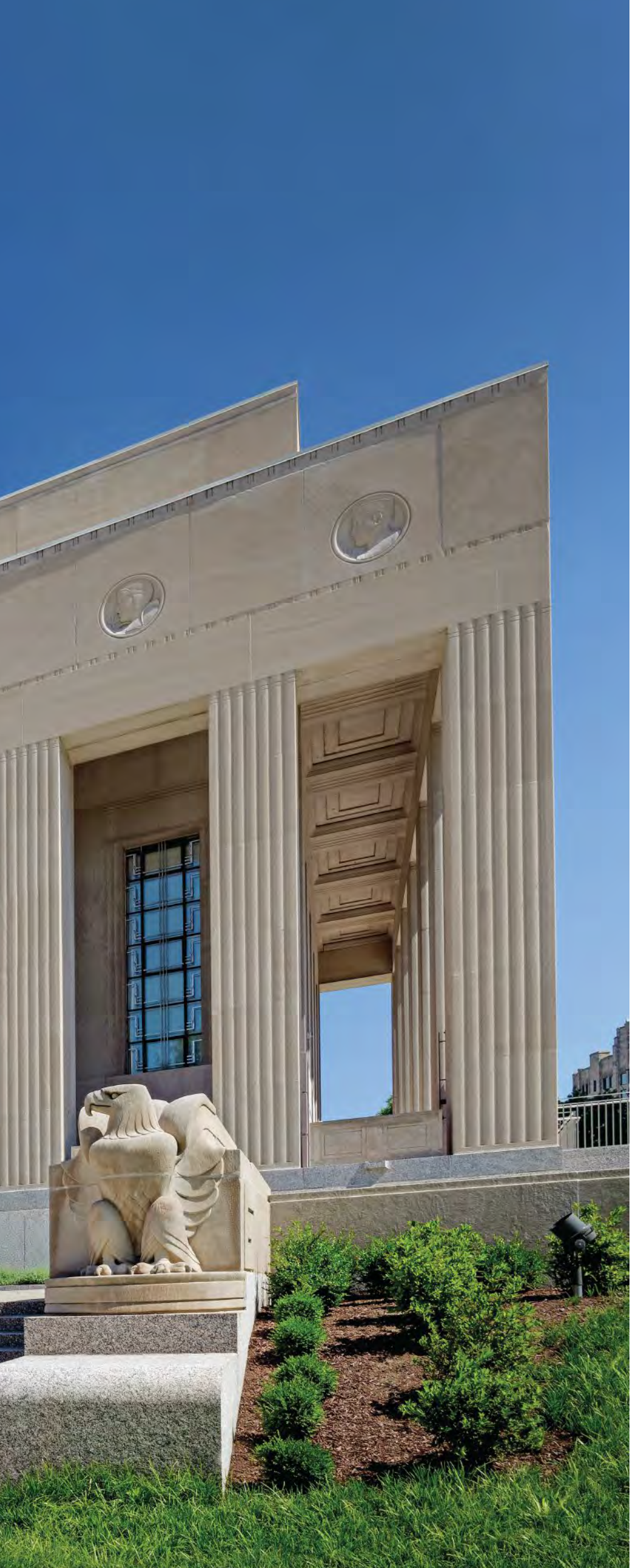


Dave Revette photo

PROJECT Soldiers Memorial Military Museum

ARCHITECT Mackey Mitchell Architects

Having suffered from years of neglect, Soldiers Memorial in St. Louis underwent a $30 million restoration to increase accessibility and provide a state-of-the-art museum experience deserving of this important Missouri landmark.



MILITARY HISTORY

St. Louis Soldiers Memorial Military Museum restoration

BY VICTORIA ABBOTT RICCARDI

PHOTOGRAPHY BY GAYLE BABCOCK

The City of St. Louis experienced a chest-swelling moment when it opened the Soldiers Memorial Military Museum on Memorial Day in 1938 to honor soldiers from St. Louis who had lost their lives during World War I. It was a magnificent, 38,000-square-foot, stripped-down classical tribute of limestone and granite occupying a full city block with four Walker Hancock sculptures representing figures of Courage, Loyalty, Sacrifice, and Vision standing with their winged horses by the north and south steps of the building.

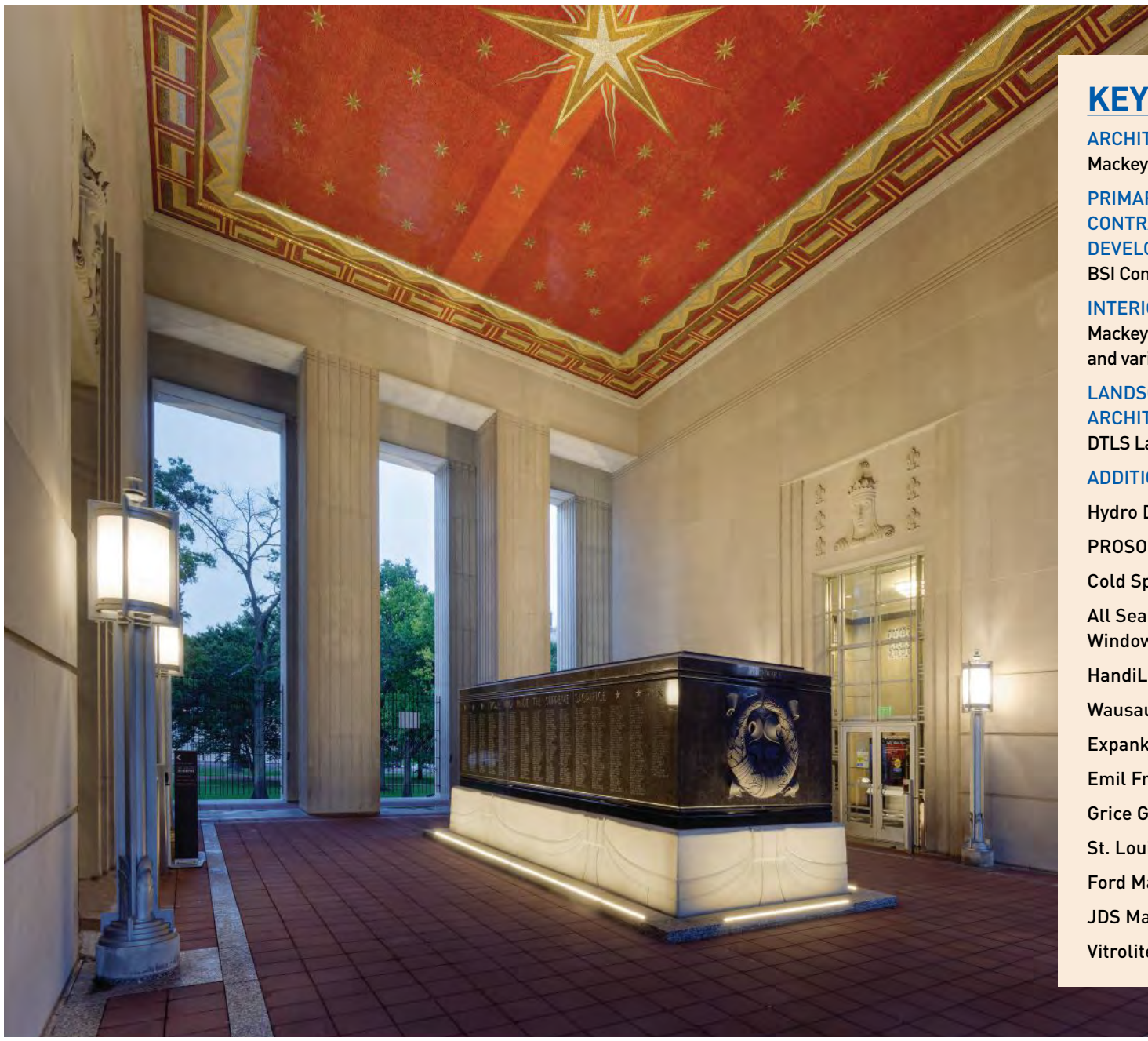
Over the years, however, the memorial fell into disrepair due to weather damage and failing mechanics. The original radiant heating system was still in place and many pipes had sprung leaks, causing damage particularly in the basement, where artifacts like uniforms, newspapers, and photographs had been stored. The cooling system consisted of mere ceiling fans and the building, even by 2,000 was inaccessible for people with disabilities. To add insult to injury, the Court of Honor, a memorial erected in 1948 for St. Louis soldiers who died World War II, had become more of a space to hold public events, like concerts. Thus, in 2010, community member Gene Mackey of Mackey Mitchell Architects decided to take action.

"After witnessing all the deferred maintenance over the years," notes architect Erik Biggs of Mackey Mitchell Architects, "Gene rounded up some potential donors and flew them to the National World War I Museum and Memorial in Kansas City and said, 'This is what we could have.'" The trip resulted in enough donations to fund a $30 million restoration, which Mackey Mitchell Architects began in December 2014 with the help of the Missouri Historical Society (who now operates the memorial) and Gallagher & Associates, which specializes in planning and designing museums, exhibits and visitor attractions.

OPPOSITE Inside the building, the original elevator was restored inside the West Passage.

LEFT The exhibit halls feature restored terrazzo floors, plaster ceilings, and light fixtures. Window shades over the original aluminum windows feature local soldiers and contribute to the story told through the new exhibits.

ABOVE Original Art Deco exhibit cases were restored and incorporated into the new exhibits.



KEY SUPPLIERS

ARCHITECTURE FIRM
Mackey Mitchell Architects

PRIMARY BUILDING CONTRACTOR/BUILDER/ DEVELOPER
BSI Constructors

INTERIOR DESIGN FIRM
Mackey Mitchell Architects and various contractors

LANDSCAPE ARCHITECTURE FIRM
DTLS Landscape Architecture

ADDITIONAL SUPPLIERS

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Cold Spring

All Seasons Architectural Windows Mfg.

HandiLift

Wausau Tile

Expanko Resilient Flooring

Emil Frei & Associates

Grice Group Architects

St. Louis Antique Lighting Co.

Ford Marble & Tile, Inc.

JDS Masonry, Inc.

Vitrolite Specialist

"Every effort was made to maintain the architectural and historic integrity of the building while also bringing the 1938 structure up to contemporary museum standards," says Mark Sundlov, Soldiers Memorial division director. "The lower level of the museum [the basement], previously closed for public use, was gutted and renovated for a rotating gallery space and new restrooms. Further renovations include the addition of a museum-quality heating, cooling and air conditioning system (HVAC)—a first for the building—as well as new electrical wiring, a fire suppression system, and a state-of-the-art security system."

"The biggest challenge was getting into the existing marble clad walls," says Biggs, the project architect, to install the new HVAC system. Beyond that, Biggs and his team helped the memorial meet Americans with Disabilities Act compliance for the first time in its history with such additions as power-assist automatic openers at entrances and into main exhibit galleries, elevators, and external entry ramps. Other renovations included replacing missing red glass tesserae and gold smalti in the first-floor loggia's Gold Star Mosaic ceiling dedicated to mothers of the fallen St. Louis soldiers. Galleries received new exhibit cases, storm windows were added to the original Art Deco aluminum windows, and throughout the building the Art Deco lighting was refurbished and relamped for LEED light sources. In fact, says Sundlov, "by using environmentally friendly construction materials, such as cork flooring, reusing materials wherever possible, including the granite steps, marble walls, and the original restroom Vitrolite panels, recycling waste, and adding an electric vehicle charging station on the north side of the building, the memorial ended up being Gold LEED-certified."

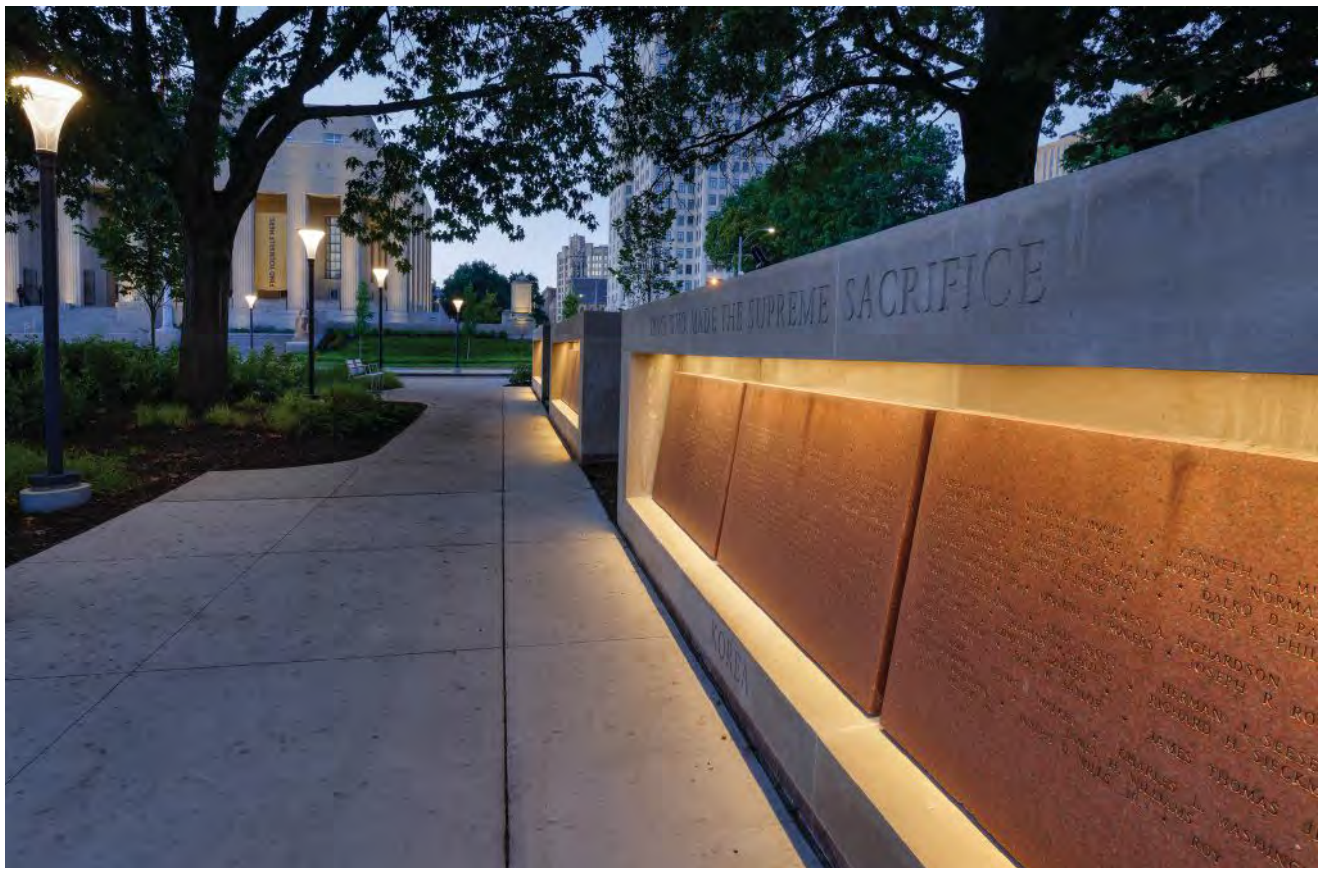
Outside the building the four sculptures, blackened over time, were brought back to their original luster. New landscaping helped improve traffic flow around the memorial and better connect it to the Court of Honor (designed by Gene Mackey's father), which received its own refurbishment. In addition to a new memorial walk with plaques recognizing those St. Louis soldiers who died in conflicts from World War 11 to today, a reflecting pool and fountain were installed to buffer traffic noise and promote contemplation.

"In the first year of operation following the renovation [completed in November 2018], we saw attendance numbers near 40,000 visitors," says Sundlov. "This number wasn't imaginable prior to the restoration. At best, the museum saw a few thousand visitors annually." Now, beyond serving as a memorial, The Soldiers Memorial Military Museum shares the history of the United States in conflict through a St. Louis lens with added room for educational programs, lectures and discussions about the past. There's even enough space to hold military ceremonies related to promotions, retirements, and change of command.

"The building is not that different from what it was originally designed to do," says Biggs, which is a good thing. "The idea was to energize the space, bring it back to relevance, and give it a lot more respect."

"The restoration of this historically and culturally important building in the St. Louis community has brought a great deal of pride to not only those directly involved but also in the community at large," says Sundlov, "who feels deeply grateful to the private donors that enabled the restoration, the Missouri Historical Society for directing the restoration, and the multiple professionals, like the architects at Mackey Mitchell, that made it all a reality."

mohistory.org/memorial



OPPOSITE The original granite cenotaph located in the loggia features the inscribed names of 1,075 St. Louisans who died in World War I. The original ceiling mosaic was carefully restored.

LEFT New memorial walls were installed in the Court of Honor to prominently display names of those St. Louisans who gave their lives in wars since World War II.

ABOVE New lighting shines up each column to accentuate the strong architecture and height of the building at night.

CONSERVATOR John Canning & Co.

FINE-ARTS CONSERVATOR
Gianfranco Pocobene Studios

Photos by Brian Rose

art lesson

John Canning & Co. restores Yale's Sterling Memorial Library's ceiling.

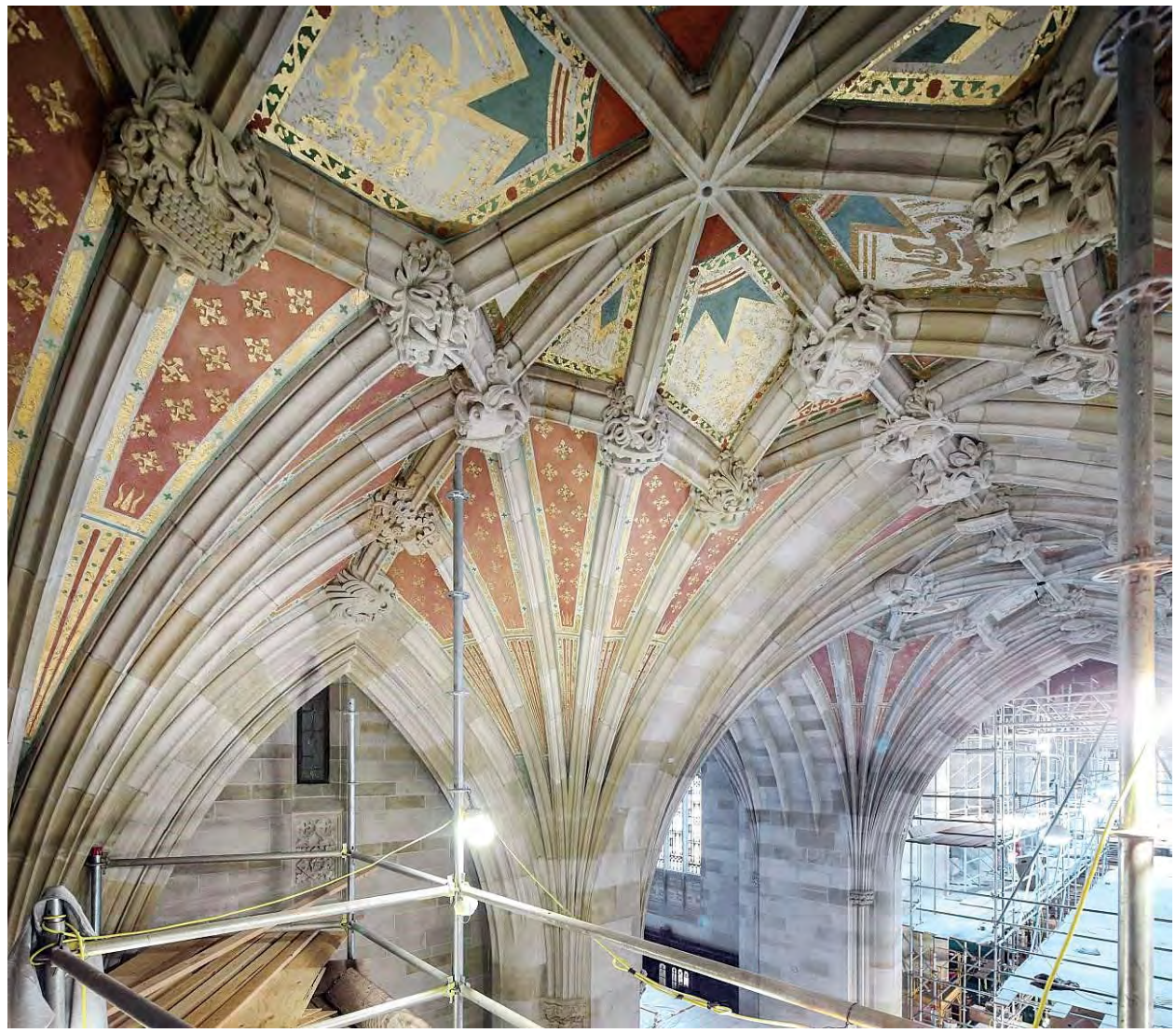
BY NANCY A. RUHLING | PHOTOGRAPHY BY JOHN CANNING & CO. (UNLESS OTHERWISE NOTED)

OPPOSITE The library's decorative finishes, restored.

ABOVE The completed south aisle.

OPPOSITE The library's Alma Mater mural after conservation treatment.

BELOW The completed ceiling restoration in the crossing.



With its 60-foot ceiling, cloisters, 3,000 clerestory-style stained-glass windows, side chapels, and altar-like circulation desk, Yale's Sterling Memorial Library stands as a visual testament to the cathedral of knowledge—and to the work of architect James Gamble Rogers.

Completed in 1930, the ornately ornamented library, the university's largest and sited in the heart of the Central Campus, was part of the 1924 master plan devised by architect Rogers, Class of 1889, and is one of 19 buildings he designed and erected over that next decade that would establish Yale's Collegiate Gothic architectural identity.

Named for its benefactor, New York City lawyer and 1864 alumnus John William Sterling, the iconic towered library, whose layout is in the cruciform style, houses more than 2.5 million books on 16 floors of stacks.

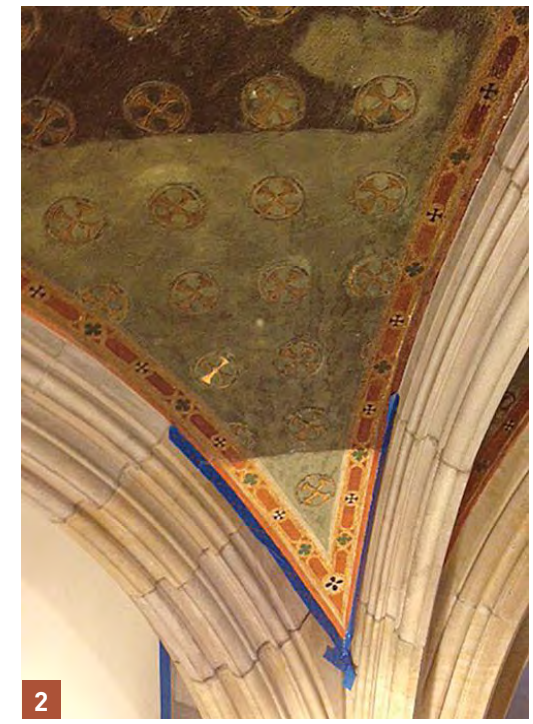
Over the last 40 years, architectural conservator and restoration contractor John Canning & Co. of Cheshire, Connecticut, has been commissioned not only to do a variety of restoration and replication work on the library but also on a number of Rogers' other historic buildings on the university's New Haven, Connecticut campus.

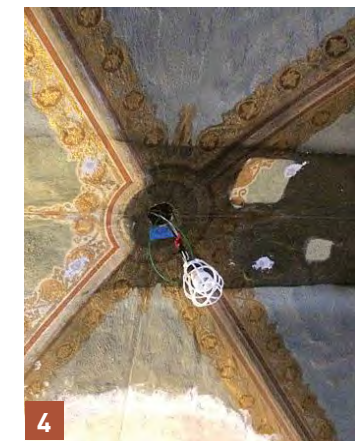
For the latest commission, John Canning & Co. restored and conserved the Sterling Memorial Library's ceiling, woodwork, and the its Alma Mater mural.

"I've worked on most of Rogers' buildings at Yale," says John Canning, one of the principals of the firm that he established in 1978. "In order to properly conserve or restore decorative finishes and artwork, one must understand the original materials and method of execution prior to commencing the work."

In this case, that meant drawing upon his vast knowledge of the techniques employed by Rogers, who, inspired by the century's old buildings of Oxford and Cambridge universities, wanted his structures to look as

LEFT: Photo by Brian Rose





1. John Canning & Co. developed conservation treatment for James Gamble Roger's heterogenous finishes.
2. John Canning & Co. performed conservation cleaning tests on the library's ceiling.
3. In Yale's Sterling Library, James Gamble Rogers specified lead came windows that were purposely broken and repaired with 15th century techniques per his specifications to appear old. He used mismatched colored glass to draw attention to the repairs.
4. In the north aisle, a fluorescent light was removed to reveal the original color scheme encapsulated above the fixture.
5. Cleaning and conservation tests at the nave ceiling were part of the process used by John Canning and Co.

though they had stood for hundreds of years.

"Rogers did things like put cracks in windows and repaired them using mismatched stained glass and 15th-century techniques to draw attention to their artificial age," Canning says. "He also ground down stair treads to make them look as though they were worn down by generations of use, and his painted decoration effects begin with his treatment for textured plaster substrate so they look like they are set in old plaster. In this time, he was roundly criticized by his peers for being too theatrical. They had a lack of understanding of what he was trying to do."

The Canning team developed a custom aqueous solution to clean the textured and decoratively painted plaster ceiling and bas-relief ornament, including gilded crosses with bars.

"This was a challenge because we had to find a way to uniformly clean everything, including the crevices, which in some cases were half an inch or more deep," Canning says. "Rogers' technique not only added age but drama, movement, and interest."

Canning's team applied a neutral pH solution in a gel form or a poultice, allowing it to dwell for 15 minutes to draw everything to the surface, which was then carefully cleared with water.

"We did the same thing when we were called in to help restore the Sky Mural in New York City's Grand Central Station," Canning says.

Re-creating the original color scheme at the north aisle ceilings was not as straightforward as following a single paint sample, which revealed only one hue.

"Every finish that Rogers used was a multi-colored wash of oil paints," Canning says. "Coupled with the textured plaster, this gave the effect of aged tempera paint. When the eye puts them together, it creates a color with a feeling of great movement. Generally, he used two to five colors, especially on walls, and scumbled or blended them in an irregular fashion."

With the removal of a six-foot-long 1950s fluorescent lighting fixture in the groined vault ceiling, an encapsulated area of the original finishes was revealed. The heterogeneous effect intended by Rogers was created with the combined irregularities of multicolored washes and textured and relief plaster. Once studied, the design was replicated in the same fashion.

The library's woodwork, parts of which had water damage, was conserved and restored to an earlier finish, however, not to the same specifications of Rogers' original design.

Rogers' original specifications for the woodwork throughout the library described quartered white oak panels that were hand planed to show plane marks then treated with caustic soda, which Canning says, naturally accelerates the aging process. Rottenstone, which is essentially limestone, was applied to achieve a chalky look. After the wood was shellacked, unbuffed beeswax was rubbed on as a protective coating.

The finish, Canning adds, was not meant to be shiny. "The original furniture of the library was finished in the same way," he adds.

The library's Alma Mater mural, by Eugene Savage, was conserved and cleaned under the direction of Gianfranco Pocobene, whose eponymous studio is in Malden, Massachusetts.

The mural, set in the back wall, features allegorical figures representing her academic schools.

"I love seeing how the library would have looked originally," Canning says. "You can see all the colors, techniques and decorations. On a very bright day, it looks brilliant under natural light. Everyone thinks it is because of the new lighting systems, and that does help, but it's really all because we replicated Rogers' techniques."

Working at Sterling Memorial Library again was "kind of like being a kid in a candy factory," Canning adds. "I'm delighted that I got the chance to pay homage to James Gamble Rogers' original intention."

PROJECT Phi Mu House
ARCHITECT Michael G. Imber Architects
ARCHITECT OF RECORD Core Architects

SISTER ACT

Michael G. Imber designs a Georgian-inspired building at the University of Arkansas.

BY NANCY A. RUHLING | PHOTOGRAPHY BY RETT PEEK AND LOUIS CURTIS

The Phi Mu house, which is on a prominent corner, is on a 20-degree slope.

TOP Phi Mu Fraternity's new sorority house at the University of Arkansas, designed by Michael G. Imber Architects, presents graceful proportions and traditional detailing.

ABOVE Plaster lunettes, which feature an unfurled fan of peacock feathers and an arched wave motif, give a feminine flare to the south façade.

When The Faithful Sisters of Phi Mu, the second oldest female fraternity in America, decided to build at new sorority house on the University of Arkansas campus, they wanted to select a site and a style that would reflect their storied place in history.

"The goal of both parties—the university and the sorority—was to add a traditional building of lasting quality," says architect Michael G. Imber, FAIA, whose eponymous firm is based in San Antonio, Texas. "Our design is one of southern precedents with English influences."

Imber and his team, which included project manager Mac White and assistant project manager Jim Lenahan, designed a 30,800-square-foot classical building that references Georgian estates that inspired the architectural traditions of sorority houses and the work of the English architect Sir Edwin Lutyens and the Italian Renaissance architect Andrea Palladio.

"This was a new paradigm for the university," Imber says. "The other sorority houses on campus are more builder-designed."

The team chose the Corinthian and Ionic Orders not only to reflect the sorority's Greek roots but also because they are seen as delicate, refined, and feminine—more than appropriate for the image of a society of young women.

The three-level building, which is on a corner lot on a prime piece of property in fraternity row facing the university's main gates, features sleeping quarters for 85 sorority members, a house director's suite, a commercial kitchen, a dining room that seats 200, and a chapter room that seats 350.

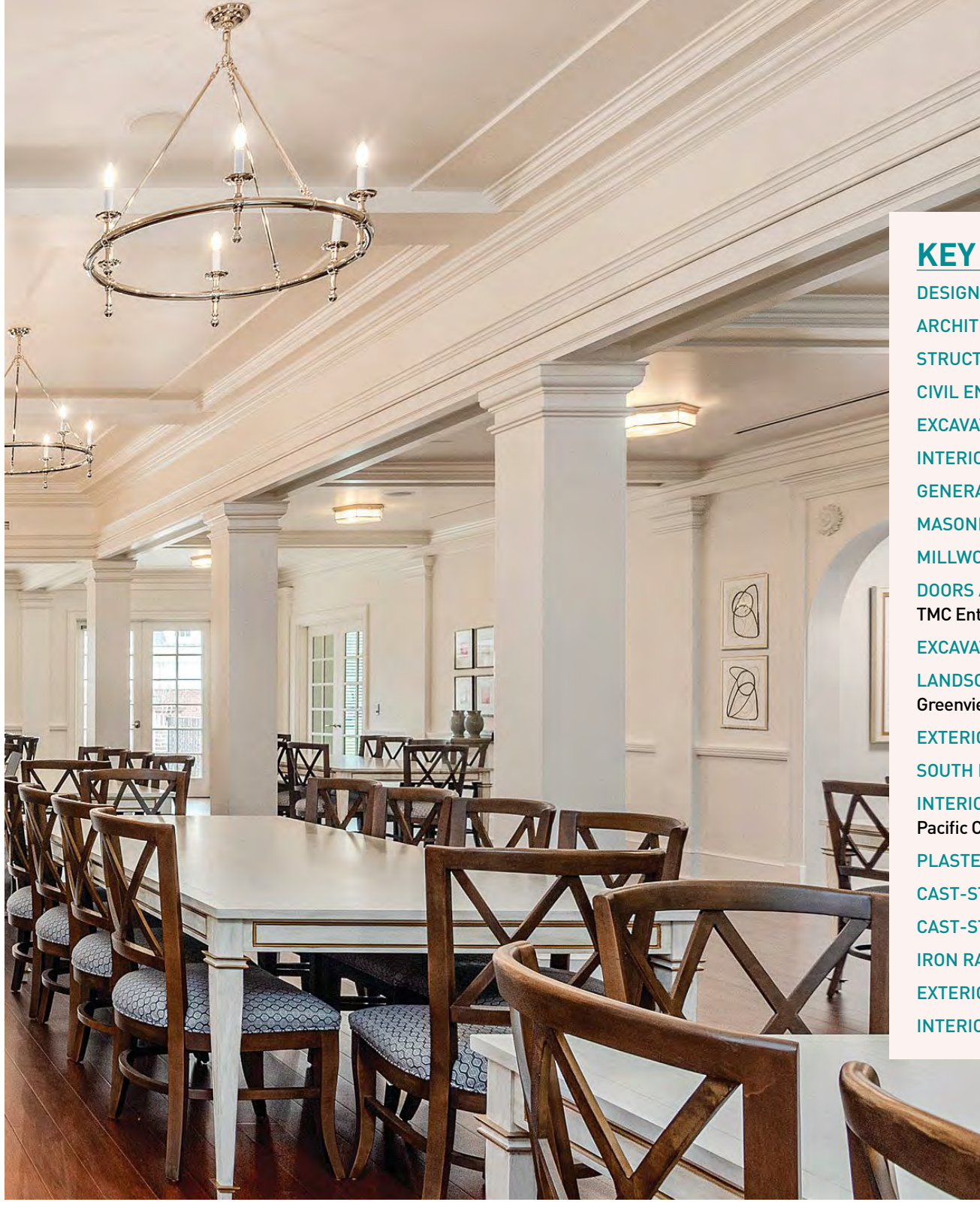
"It was a complex program in terms of uses and functionality," says Imber, adding that the building's massing was broken down into "more intimately scaled elements in separate blocks" that look as though they were added over time, a design conceit that also allowed the more functional spaces to be tucked out of sight under the building's main level.

The two-story entry portico, which is in a Palladian style, consists of a pediment, engaged corner pieces, and freestanding round Corinthian columns whose capitals originated in ancient Athens' Tower of the Winds, which is considered the world's first meteorological station.

Ionic columns, a swan-neck pediment, and a pineapple finial over the main entry door create a graceful and welcoming portal. "Again, we felt it was important to use a more feminine order here," he says. "The Ionic Order is thin

Roman Ionic column screens are set within apsidal bays flanking the entry foyer and stair hall.

Harper Howey Interiors introduced traditional furnishings for the living spaces.



KEY SUPPLIERS

DESIGN ARCHITECT Michael G. Imber Architects

ARCHITECT OF RECORD Core Architects

STRUCTURAL ENGINEERING Bernhard

CIVIL ENGINEERING/LANDSCAPE DCI

EXCAVATION/SITEWORK Garrett Construction

INTERIOR DESIGN Harper Howey Interiors

GENERAL CONTRACTOR CDI Contractors

MASONRY Tri Point Masonry

MILLWORK, PANELING TRIM Trimco

DOORS AND WINDOWS
TMC Enterprises; Pella Windows

EXCAVATION/SITEWORK Garret Construction

LANDSCAPING
Greenview Lawns, Second Nature Landscape

EXTERIOR BRICK Acme Brick

SOUTH PORTICO Chadsworth Columns

INTERIOR AND EXTERIOR COLUMNS
Pacific Columns

PLASTER LUNETTES Decorators Supply Corp.

CAST-STONE PAVERS Peacock Pavers

CAST-STONE TREADS Conway Precast

IRON RAILINGS Julius Blum & Co.

EXTERIOR TRIM James Hardie

INTERIOR TRIM White River Hardwoods

and graceful in proportion."

The most dramatic feature of the façade is the sweeping horseshoe staircase, which is as much a product of necessity as it is of aesthetics.

This frames the lower-level brick entry loggia leading to the Chapter Room and is accessed via a "fornix" motif, a triumphal vaulted passage dating back to ancient Rome, which at Phi Mu is flanked by elliptical brick niches.

A striking design feature, the exterior staircase allows the sorority to gather all its members annually in front of their house in a graceful manner.

"The site slopes over 20 feet vertically, which was not an easy scenario," Imber says. "But we decided to make lemons into lemonade. There was a major need for a place where all the girls could get together for a photo shoot; the multi-level staircase became a big stage set."

The exterior is made of red brick from Acme Brick, a foundry in Fort Smith, Arkansas, that has been in production for more than a century.

"Our office has not had a lot of experience with brick, and we saw this an opportunity to celebrate and be expressive with the material," Imber says. "We selected it for its hand-crafted qualities. It has a rougher surface than normal, and there's an irregularity among the bricks so each is truly unique. We also used special brick shapes and traditional detailing."

A mortar wash, applied by hand, created a white textured effect similar to that of the campus' historic Carnall Hall, which is down the street, and provides a subtle reminder of the sorority's signature colors—rose and white.

The interior layout and details of the Phi Mu house also are classical in approach. The entry foyer features honed marble floors in a checkerboard pattern of soft grey and white; Ionic columns and a denticulated entablature with Greek fretwork dentils.

A sweeping semi-circular stair soars to a vaulted second story, which is partially open to below, giving the space a light and airy feel.

The foyer is flanked by a formal living room and parlor that are defined by gracious windows, classical moldings, picture rails, and wainscoting.

The dining room, which is in the center of the house, offers easy access from all directions and spaces, including the commercial kitchen and weekend kitchen. It flows outdoors to the dining terrace, which provides views of the campus and space to locate mechanical equipment out of sight.

Interior and exterior details also relate to Phi Mu, which was established in 1852 to foster the lifetime development of women. The sorority's signature motif, the quatrefoil, is represented in the façade's brickwork, ceiling medallions, lighting fixtures, and a special staircase window.

Imber, whose team has received numerous kudos for the project, says the greatest compliment came from an unexpected source.

"When I walked by the Phi Mu Fraternity building after it was completed, I saw a group of students taking photos there," he says. "They had no idea who I was, but they said, 'Isn't this building just off the hook?' I told them I thought it certainly was. It was exciting connecting with a whole new generation."

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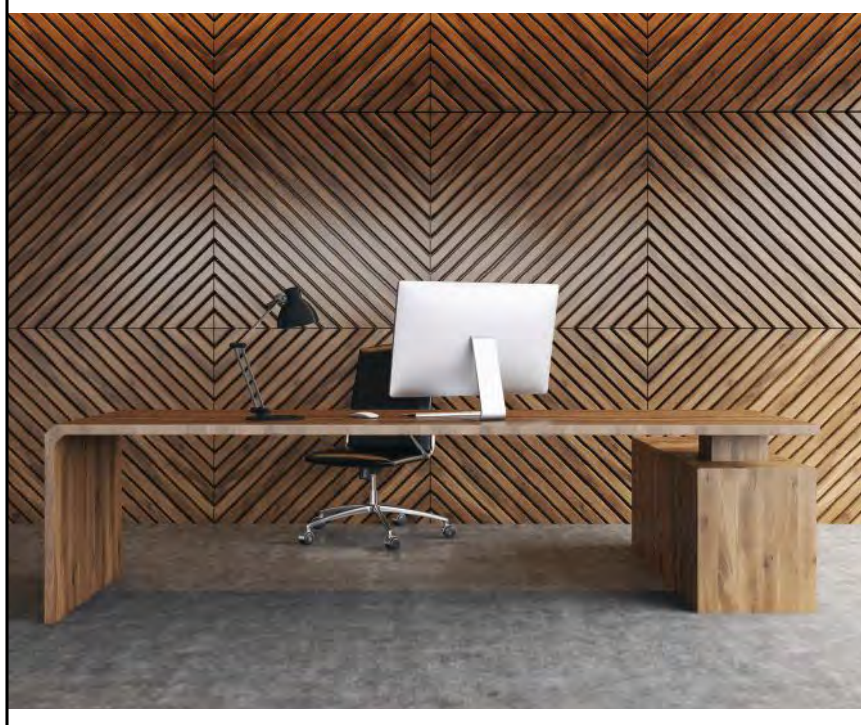

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A new survey conducted by the ICAA Washington Mid Atlantic chapter takes the temperature on its members' current industry.

News

Brooklyn Bridge Redesign Competition

The competition features virtual showdown and online voting.

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Lead Fallout From Notre Dame Fire was Likely Overlooked

A ton of lead dust may have been deposited near the cathedral.

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Statues in Urbanism, Again

The statues of Confederates that are targets of revised judgments about their subjects often occupy important places in our urbanism, which calls attention to the importance of urbanism in what we build.

Peter Miller

The State of Things

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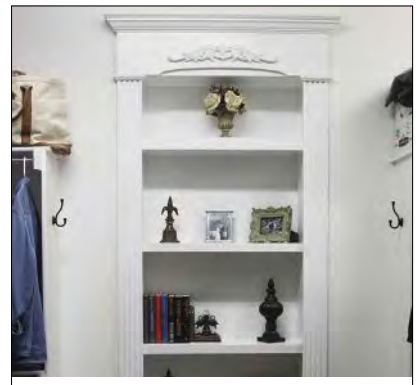

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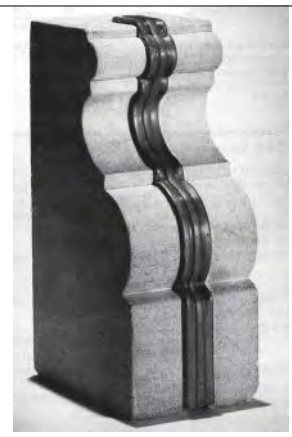

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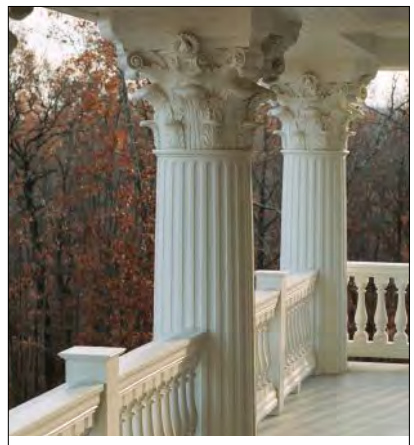

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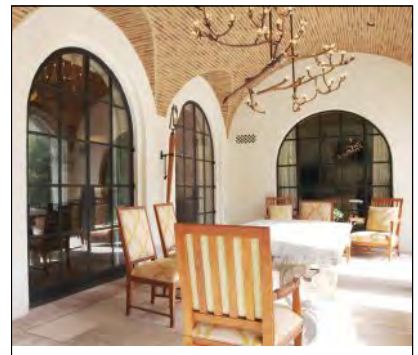

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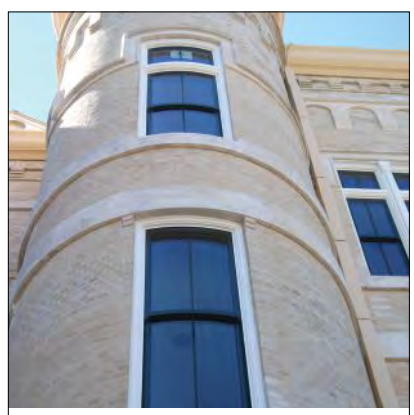

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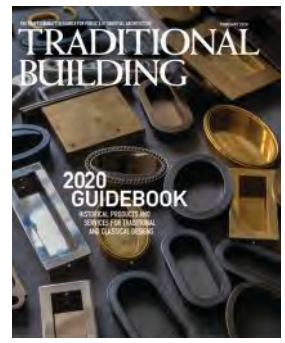

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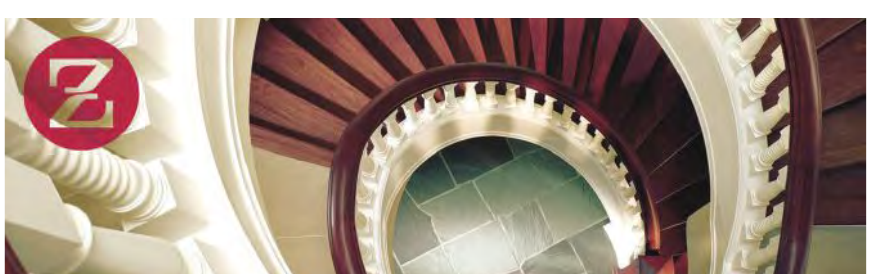

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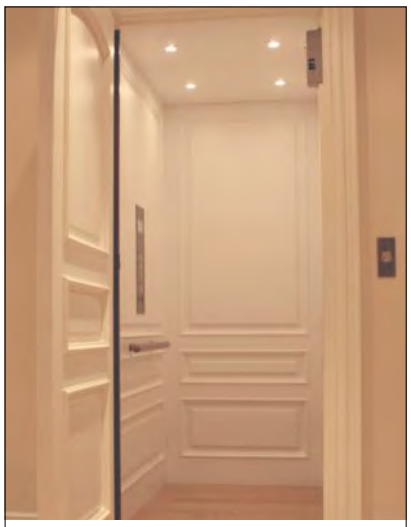

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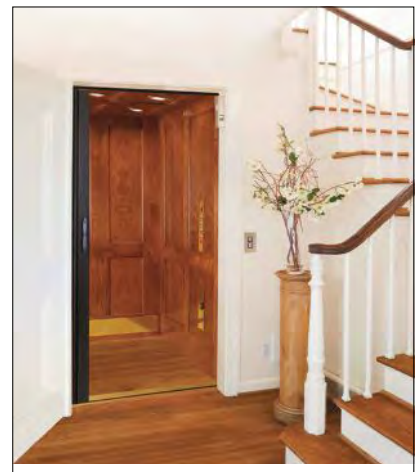

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www.tinman.com
Houston, TX 77074
Manufacturer of pressed-tin ceiling & wall panels: tin-plated steel has shiny silver finish, can be painted with oil-based paint; 3-, 6-, 12- & 24-in. patterns ranging from Art Deco to Victorian; easy-to-install 2x4-ft. sheets.

DECORATORS SUPPLY CORP.
800-792-2093; Fax: 773-847-6357
www.decoratorssupply.com
Chicago, IL 60609
Manufacturer of classic architectural elements: 13,000 appliqués for woodwork, furniture & walls; plaster crowns, ceiling medallions, ceilings, niches & swags; 900 sizes of column capitals, plaster capitals, corbels & columns; 15 styles of traditional wood mantels; Classically inspired grilles; since 1883.

HOUSE OF ANTIQUE HARDWARE
888-223-2545; Fax: 503-233-1312
www.houseofantiquehardware.com
Portland, OR 97232
Manufacturer & supplier of vintage reproduction door, window, shutter, cabinet & furniture hardware & accessories: Federal, Victorian, Colonial Revival, Craftsman & Deco styles; lighting fixtures, push-button switches & plates; bathroom accessories; registers & grilles.

SEE OUR AD ON PAGE 75.

JP WEAVER COMPANY
818-500-1740; Fax: 818-500-1798
www.jpweaver.com
Glendale, CA 91201
Over 8,000 types of molded ornaments cast from carvings. Products are pliable and will contour and self-bond to any sealed surface such as mirror, plaster, drywall, wood, metal, ceramic. Scaled-design books (1/4 in. = 1 in. scale).

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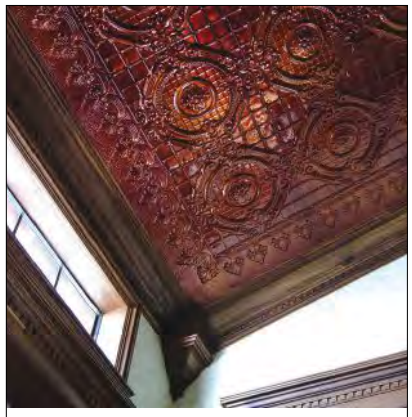
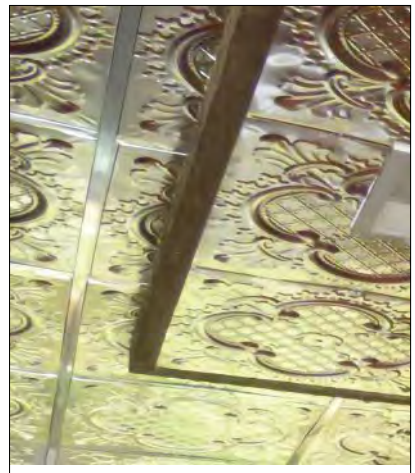


M-BOSS, INC.
866-886-2677; Fax: 216-641-7387
www.mbossinc.com
Cleveland, OH 44105
Manufacturer of tin ceilings, cornices & moldings: more than 200 patterns, array of finishes; panels nail to wood substrates or lay into suspension grids; molded resin medallions, cornice & corbels also available.ications & custom.



METALCEILINGEXPRESS
941-723-2288; Fax: 941-729-1470
www.metalceilingexpress.com
Palmetto, FL 34221
Manufacturer of ceilings: ornamental; decorative painting & faux finishes; architectural, standard & custom sheet metal.

NIKO CONTRACTING CO., INC.
412-687-1517; Fax: 412-687-7969
www.nikocontracting.com
Pittsburgh, PA 15213
Custom fabricator & contractor of sheet metal & roofing: slate, tile & other roofing; storefronts, cornices, cupolas, domes, steeples, snow guards & leader heads; copper, lead-coated copper, zinc & stainless steel; metal ceilings.

SEE OUR AD ON PAGE 25.

PACIFIC REGISTER COMPANY
805-487-7500
www.pacificregisterco.com
Oxnard, CA 93033
Manufacturer of registers: metal, wood & stone; many historic styles; accessories. Custom metal ceiling panels, overlay panels, more.

W.F. NORMAN CORP.
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www.wfnorman.com
Nevada, MO 64772
Manufacturer of sheet-metal ornament: hundreds of stock designs; cornices, moldings, brackets, pressed-metal ceilings, roofing, siding, finials & more; zinc, copper & lead-coated copper; duplication from samples or drawings.

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www.ballandball.com
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Fabricator of historical lighting: chandeliers, sconces, pendants, lanterns & table lamps; Early American & Turn of the Century styles; antique & salvaged originals, new designs, custom work & reproductions; stair handrails; restoration services.
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DEEP LANDING WORKSHOP
877-778-4042; Fax: 410-778-4070
www.deeplandingworkshop.com
Chestertown, MD 21620
Manufacturer of custom lighting fixtures: chandeliers, sconces, pendants & lanterns; new designs, historic reproductions & custom work; handcrafted in wood, tin, brass or copper; glass, mica or alabaster shades.
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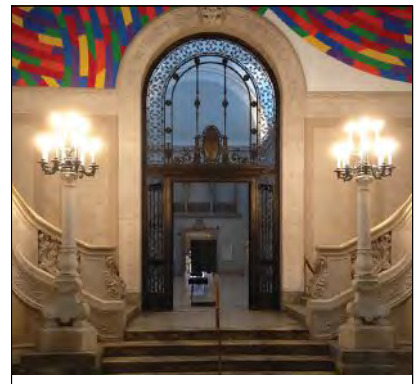

GRAND LIGHT
800-922-1469; Fax: 203-828-6307
www.grandlight.com
Seymour, CT 06483
Restorer of historic lighting fixtures & manufacturer of custom lighting fixtures: metal fabrication, glass fabrication, metal finishing, polishing, painting, welding, abrasive blasting; historical replication & reproduction.
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HERITAGE METALWORKS
610-518-3999; Fax: 610-518-7264
www.hmwpa.com
Downingtown, PA 19335
Foundry, blacksmith shop and custom metal fabricator offering historically accurate and custom-designed lighting, architectural hardware, and designer-envisioned metalwork including interior and exterior gates & railings.
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HISTORICAL ARTS & CASTING
800-225-1414; Fax: 801-280-2493
www.historicalarts.com
West Jordan, UT 84081
Designer & custom fabricator of ornamental metalwork: doors, windows, hardware, stairs, balustrades, registers, fences, lighting, gutters, columns, weathervanes, snow guards, cupolas, planters, fireplace tools & more; iron, bronze, aluminum & steel; restoration services.
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HOUSE OF ANTIQUE HARDWARE
888-223-2545; Fax: 503-233-1312
www.houseofantiquehardware.com
Portland, OR 97232
Manufacturer & supplier of vintage reproduction door, window, shutter, cabinet & furniture hardware & accessories: Federal, Victorian, Colonial Revival, Craftsman & Deco styles; lighting fixtures, push-button switches & plates; bathroom accessories; registers & grilles.
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RAMBUSCH LIGHTING CO.
201-333-2525; Fax: 201-860-9999
www.rambusch.com
Jersey City, NJ 07304
Designer & fabricator of custom & engineered lighting for 100 years: for churches & public spaces; conservation & replication of lighting fixtures.

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805-962-5119; Fax: 805-966-9529
www.stevenhandelmanstudios.com
Santa Barbara, CA 93103

Manufacturer of hand-forged traditional lighting, grilles & fireplace accessories: many types & styles of lighting & grilles; fireplace screens, grates & inserts; historic reproduction & restoration services.

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VINTAGE HARDWARE & LIGHTING

360-379-9030; Fax: 360-379-9029
www.vintagehardware.com
Port Townsend, WA 98368

Supplier of door hardware, window hardware: window locks & sash lifts; drapery hardware; bathroom accessories; reproduction lighting; weathervanes.

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WIEMANN METALCRAFT

918-592-1700; Fax: 918-592-2385
www.wmcraft.com
Tulsa, OK 74107

Designer, fabricator, finisher & installer of fine quality custom ornamental metalwork: railings, fences, gates, custom, hot-rolled steel doors & windows, lighting, grilles, bronze & aluminum entry doors; all cast- & wrought-metal alloys, finishes & architectural styles; since 1940.

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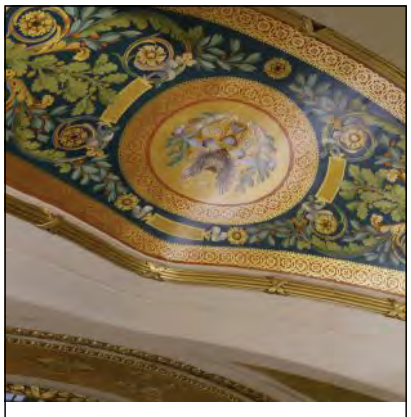

CONRAD SCHMITT STUDIOS
800-969-3033; Fax: 262-786-9036
www.conradschmitt.com
New Berlin, WI 53151
Creator, conservator & restorer of decorative painting: stained & art glass; ornamental plaster work & ceilings; gilding; murals, mosaics & statuary; for public & religious buildings; since 1889.
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EVERGREENE ARCHITECTURAL ARTS, INC.
212-244-2800; Fax: 212-244-6204
www.evergreene.com
Brooklyn, NY 11232
Since 1978, EverGreene Architectural Arts has provided award-winning design and fabrication, conservation and restoration services for many for the world's most significant buildings and objects. Expertise includes: murals, decorative painting, gilding, plaster, wood, metal, stone, mosaics, new design, conservation, restoration, ecclesiastical, institutional, public, commercial projects; offices in Brooklyn, Chicago, Washington DC & Los Angeles.
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917-796-1447
www.foregroundconservation.com
Chatham, NY 12037
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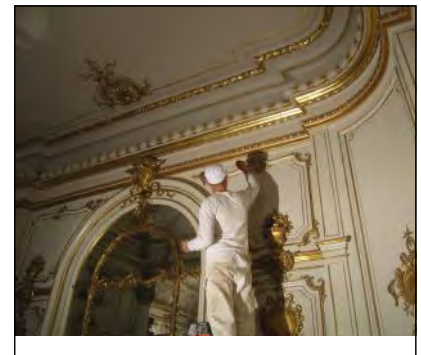

JOHN CANNING CONSERVATION & PAINTING STUDIOS
203-272-9868; Fax: 203-272-9879
www.JohnCanningCo.com
Cheshire, CT 06410
Restorer, conserver & designer of decorative finishes, ornamental plaster & wood: historic paint analysis; plaster consolidation & stabilization; decorative paint, murals, interior & exterior gilding, wood graining, metal & stone cleaning.
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GLASS DOMES & SKYLIGHTS

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www.customskylights.com
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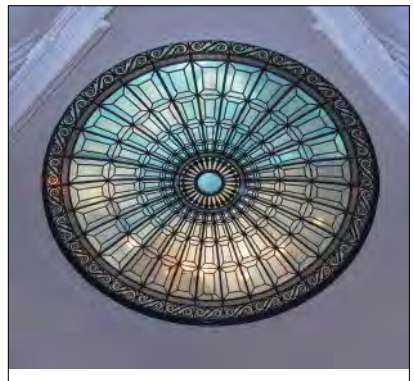

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www.historicalarts.com
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RENAISSANCE CONSERVATORIES
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www.renaissanceconservatories.com
Leola, PA 17540
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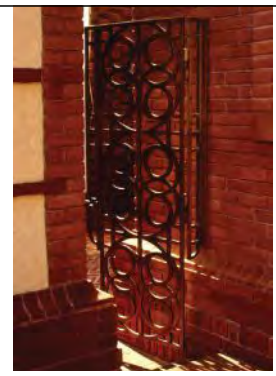

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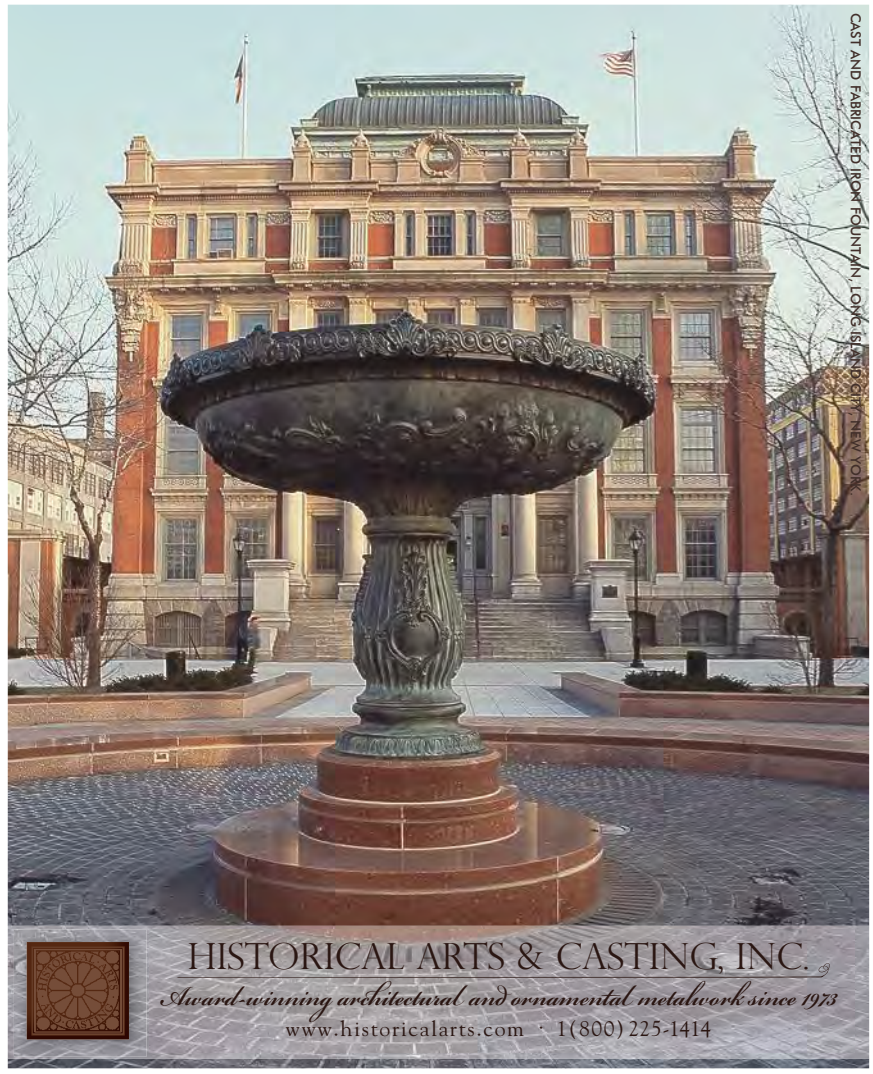

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www.houseofantiquehardware.com
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610-518-3999; Fax: 610-518-7264
www.hmwpa.com
Downingtown, PA 19335
Foundry, blacksmith shop and custom metal fabricator offering historically accurate and custom-designed lighting, architectural hardware, and designer-envisioned metalwork including interior and exterior gates & railings.

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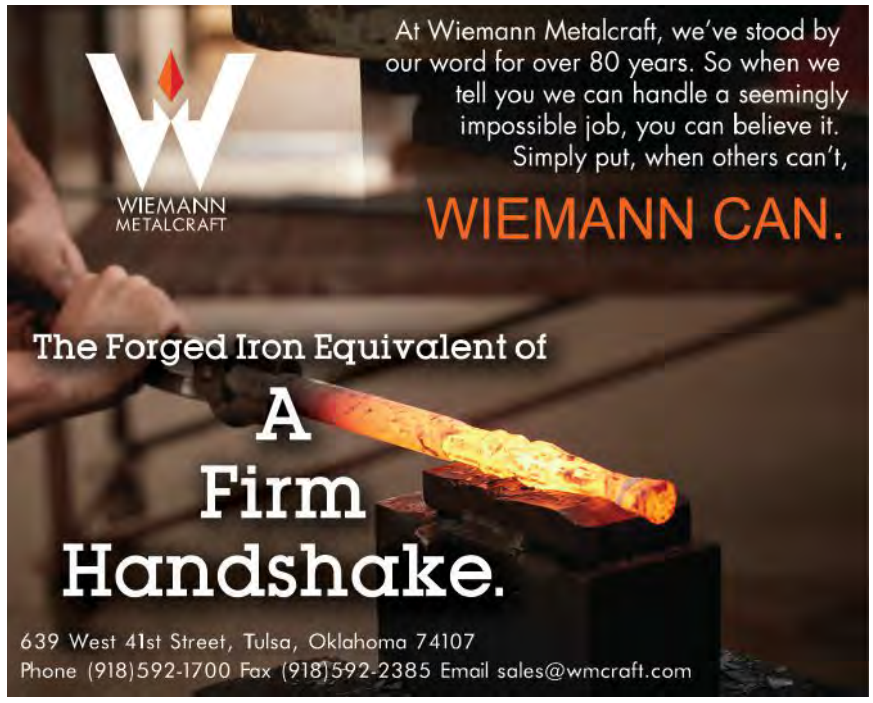

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www.robinsoniron.com
Alexander City, AL 35010
Designer & installer of custom metalwork: fountains, columns, fences, doors, railings, sculpture, benches, grilles, cresting, street lighting & gazebos; wrought iron/steel, aluminum, bronze & cast iron; historical restoration.

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WIEMANN METALCRAFT
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www.wmcraft.com
Tulsa, OK 74107
Designer, fabricator, finisher & installer of fine quality custom ornamental metalwork: railings, fences, gates, custom, hot-rolled steel doors & windows, lighting, grilles, bronze & aluminum entry doors; all cast- & wrought-metal alloys, finishes & architectural styles; since 1940.

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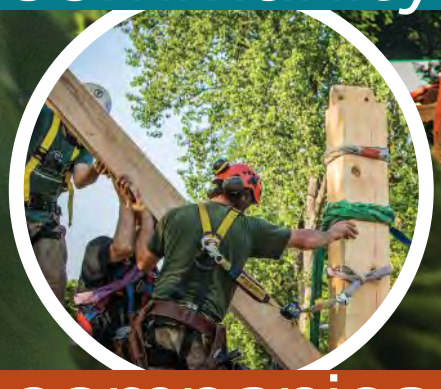

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