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*TREND ALERT: modular building practices

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Franklin & Marshall College chooses LUTRON WIRELESS CONTROLS for ease of installation, minimal disruption to space occupants, and energy efficiency

Simple, scalable, wireless lighting retrofits can help improve the working and learning environment, save energy, and simplify day-to-day facility maintenance. At Franklin & Marshall College in Lancaster, Pennsylvania, a new wireless lighting control solution is saving 55% lighting energy and making it easy to add control locations without the hassle of running new wires.

Rich in Tradition and Committed to the Learning Experience

Franklin & Marshall's campus is peppered with a mix of historic and modern buildings. For the facilities team, those beautiful, historic brick buildings can add a layer of challenge when it comes to facility updates and maintenance. This is just one of the reasons college electrician Pat Henry is so pleased with Lutron's new Vive wireless lighting control solutions, and why the college is working to include Vive as part of the master specification for campus improvements.

"On a campus where some of the buildings date back to 1792, it's just not always feasible to have to fish wires through the walls."
—Pat Henry, Franklin & Marshall College Electrician

Challenge

Lighting and lighting control has come a long way in the last 5 years, with LED technology largely replacing traditional fluorescent lighting fixtures. Renovations in any office, classroom, or dorm almost always include a complete lighting and control upgrade.

The Franklin & Marshall facilities team came to Lutron for a solution that was easy to install with minimal disruption to space occupants, easy to program, and energy efficient. The system they chose had to have timeclock functionality, the ability to load shed, and provide real-time energy savings, all within the college's budget.

Solution

Vive is a new solution for Lutron addressing the need for scalable control that's wireless, easy to install, and simple to program. The college agreed to try it out in an energy retrofit in the College Square administrative offices. Pat Henry was able to install and program the controls while the building was occupied and without outside help.

"We were able to complete the installation and setup in a total of 4 days, working from just 6-8 am. As one of the first Vive projects, Lutron even asked us for feedback on the Vive app, helping us make programming even more intuitive," said Henry.

Occupancy sensors ensure that lights aren't left on when the space is vacant, daylight sensors automatically reduce lighting levels in perimeter offices, and Pico controls provide personal dimming control to space occupants. With the existing fluorescent fixtures, the administrative offices were using 130 KwH during the measured time period. After the lighting and controls retrofit the space is using 60.86 KwH in a comparable time period – a total electricity savings of 55%, which allows the college to redirect those dollars to benefit its students.

Building photos courtesy of Franklin & Marshall College

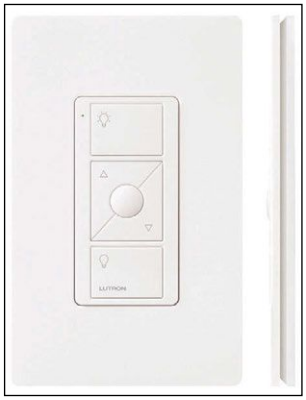
Results

After the success of the College Square installation, and previous experience with stand-alone Lutron wireless controls in Old Main (a building that houses administrative offices, lecture halls, and recital rooms), the Franklin & Marshall facilities team approved Vive solutions for use in a whole-scale renovation of its Keiper Liberal Arts Building.

What else made the Vive wireless solutions stand out? “It just works,” said Pat Henry, “The system is versatile and offers tremendous functionality.” First, he explains, it’s wireless, and that’s an immediate win, “On a campus where some of the buildings date back to 1792, it’s just not always feasible to fish wires through the walls. With Lutron Pico wireless remotes you can put the control wherever you need it, and that’s a huge time and materials saver.” Notably, Keiper was dedicated in the 1930s; Old Main dates back to 1856 and is listed on the National Register of Historic Places.

Henry pointed out that in the Keiper renovation, he was able to put wireless controls at every podium in every classroom, giving professors convenient control of the lights wherever they are. “We can use the right mix of products in every space from open offices, to classrooms, to meeting rooms – it makes product bids, installation, and programming easier and less time consuming.”

Vive is also completely scalable. A space can be programmed as a stand-alone system and tied into a centralized Vive hub down the road, making it easy to adjust any area of lights from a smart phone or tablet.



Lutron's Pico remote, a sleek, versatile wireless device, installs anywhere, on any surface, no wallbox or wiring required.

A more intelligent building is now easier than ever to achieve with Vive Vue management software.

PROJECT UPDATE: Since the initial installation of Vive wireless, Franklin & Marshall College has added Vive Vue management software. Developed with the simple, scalable, wireless building blocks of the Vive system, Vive Vue software now delivers the advanced intelligence necessary for today’s smart buildings.

The facilities team can now control and configure the lights, monitor energy usage over time, analyze, and report on the activity and performance of the lighting system in their buildings.

Vive also integrates seamlessly with BACnet to improve energy efficiency across systems and enhance smart-building performance.

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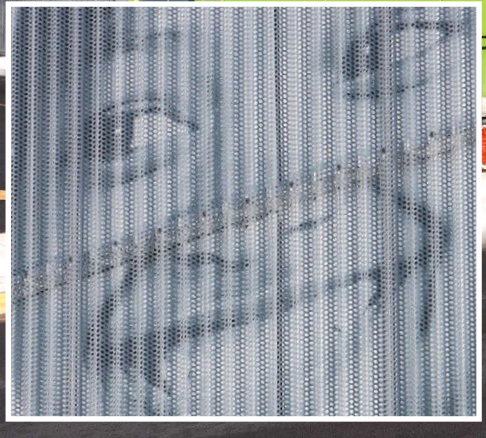

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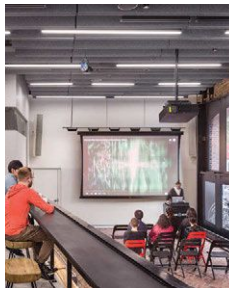
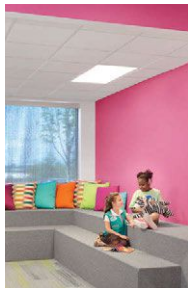
feature projects

ONE SIZE CAN FIT ALL

A former California office building becomes home to three unique high schools.





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PERUSE EDUCATION PROJECTS FROM AROUND THE COUNTRY:

- Gateway Arch Museum, St. Louis
- Lino Tagliapietra Glass Studio, Seattle
- King University, Bristol, Tenn.
- Ouray School, Ouray, Colo.
- Memorial Student Union, DePauw University, Greencastle, Ind.
- Grand Staircase, Natural History Building, University of Illinois Urbana-Champaign
- Alexander II Magnet School, Macon, Ga.
- John Stewart Memorial Library, Wilson College, Chambersburg, Pa.
- Santa Rita Union School District, Salinas, Calif.
- Alfred University's New York State College of Ceramics, Alfred, N.Y.
- Oakdale Joint Unified School District, Oakdale, Calif.
- School of Visual Arts MFA Photography/Video, New York
- Berges Family Girl Scouts Program Center, Maryland Heights, Mo.

cover

COVER PHOTO: **GENSLER / RYAN GOBUTY**

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pointofview

WHAT CAME FIRST: THE CHICKEN OR THE EGG?

I like Facebook for one reason: It allows me to stay in touch with family members and longtime friends who live around the globe. I don't rely on Facebook for news or politics, and I try to avoid reacting to or commenting on—and sometimes even reading—anything that may lead to a political discussion or may be mired in controversy. (I leave the debates for my Twitter feed but that's a story for another day.)

However, on a recent Saturday morning, I couldn't help but comment on a Facebook post made by a former colleague regarding her disdain for self-checkouts. She said she's not getting paid to check her own items and she believes self-checkouts are stealing jobs. My former colleague noted that when only self-checkouts are available, she leaves her items on the self-checkout stand in protest and goes to another store.

My experience tells me self-checkouts are with us out of necessity, not to steal jobs but to fill in for a lack of workers. Twenty years ago, after I graduated from college, I worked at a bank in Cedar Rapids, Iowa, the second largest city in the state and fastest growing at that time. Initially I was a teller, needing to pay my rent while I figured out what I wanted to do with my English degree. Eventually, I was managing the new bank branch opened in a super Walmart. I became friendly with the Walmart day managers who often complained about the no-call, no-show employees in every department, including checkers. In a city with a population of more than 120,000 people, finding reliable employees was a problem for Walmart. I don't imagine it has gotten easier in the years since, so I shared my opinion with my former colleague on her Facebook post.

She and I went back and forth a couple times. I even used my involvement in this industry to underscore my point. I have not gone to a trade show since the 2008 housing crisis in which at least one manufacturer hasn't unveiled a product or tool that assists with installation when fewer laborers are available. The skilled worker shortage is real in our industry, reported by such organizations as the Arlington, Va.-based Associated General Contractors of America and the National Association of Home Builders, Washington, D.C. I soon realized what seemed like a simple dialog on Facebook about what came first—the self-checkouts or fewer workers—could easily become a much deeper discussion about fair wages, immigration and, ultimately, politics. I decided to move on to viewing photos of my college friends' kids and forgot all about this debate until Contributing Editor Robert Nieminen's "Trend Alert" article hit my inbox.

In his article, Nieminen explains modular construction, which according to the National Institute of Building Sciences, Washington, "involves the process of planning, designing, fabricating, transporting and assembling building elements for rapid site assembly to a greater degree of finish than in traditional piecemeal on-site construction." What's driving modular construction? Tom Hardiman, the Charlottesville, Va.-based Modular Building Institute's executive director, says in the article it's the labor shortage, which "is not getting any better—it's getting worse." Hardiman predicts when many 50- and 60-year-old workers retire, "we're going to feel the pain when there's no labor left to build these [buildings]. That day is coming," he warns.

Nieminen's article is a fascinating dive into how technology has begun to change the construction industry, like it has all other industries. He asked his interviews whether modular construction will take jobs away from workers who want to continue constructing buildings the old-fashioned way. Read "Trend Alert", page 100, to see what they said and discover the opportunities modular building practices afford our industry, including retrofits.

I brought up this chicken and egg debate with my husband, Bart. By day Bart is an agricultural lender; by night he co-owns a sports bar in the lake town in which we live. He has had difficulty hiring for the bar, particularly in the kitchen. Bart told me he'd always be willing to pay a higher wage to someone who's reliable and does a good job. He's a good person (why I married him) but neither of us can trust that every business owner feels the way my husband does. There may be some construction company owners (and retailers) who buy the latest tool or products requiring less laborers so they can lay off workers. I guess time will tell how modular construction affects laborers in the construction industry—and whether we'll all be forced to check out our own items when we go to a store.

CORRECTION | On page 34 of our July-August issue, Zoë Zellers should be credited for the write-up about Nassau Veterans Memorial Coliseum, Uniondale, N.Y. The content first appeared on the Hunter Douglas Architectural blog, which can be found at bit.ly/2NuSGJM. The top photo in the print edition mistakenly shows the Target Center, Minneapolis, a different Hunter Douglas Architectural ceiling project. All Nassau Veterans Memorial Coliseum photos on page 34 should be credited to Photographer Richard Cadan. ***retrofit*** apologizes for any confusion these errors may have caused.

Christina Koch

CHRISTINA KOCH
Editorial Director

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CONTRIBUTING WRITERS

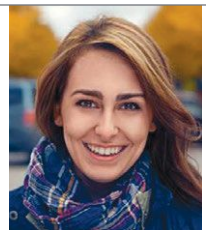
As a KidsBuild! coordinator for New Haven, Conn.-based Svigals + Partners (among other roles), **Katelyn Chapin**, AIA, NCARB, relishes working with school-age children who show an interest in architecture. Created more than two decades ago with the New Haven School Construction Program to educate schoolchildren about how their educational environments were being conceived, built and maintained, KidsBuild! still is inspiring students today. Read about this innovative program in "Business", page 26.

KJ Fields, a Portland, Ore.-based ***retrofit*** contributor, writes our "Cover Story", page 32, about an unlikely structure that was renovated by Gensler's Los Angeles office to provide three high schools for Wiseburn USD students in El Segundo, Calif. The 1981, 360,000-square-foot office building was last occupied by a high-security engineering lab that developed classified planes and weapons systems. Learn what was required to change the facility into unique learning spaces for 1,500 students.

Jim Kelsey, P.E., BEAP, is president of kW Engineering, Oakland, Calif., and chairman of the ASHRAE 211 Committee, which recently oversaw the changes to and release of ASHRAE's Standard 211, Standard for Commercial Building Energy Audits. In "Energy", page 64, Kelsey explains the changes to ASHRAE Audit Levels 1, 2 and 3, which will make it easier to identify useful and practical energy retrofits.

Architect **Gladys Ly-Au Young**, AIA, is a founding principal at Sundberg Kennedy Ly-Au Young Architects, Seattle. With a MSc in Sustainable Design from Carnegie Mellon University, Pittsburgh, she brings a deep commitment to sustainable design to her work, which is showcased in the transformation of Hillcrest Presbyterian Church into Westside School, an independent pre-K through eighth-grade school, in southwest Seattle. Read about how progressive learning spaces were carved out of the existing church in "Transformation", page 68.

Shannon Gedey, AIA, RELi AP, LEED AP BD+C, is an architect in Perkins+Will's Chicago office who employs proven strategies to design delightful, innovative and flexible environments. Gedey demonstrates her acumen in the design of HelloBaby, a play space for parents, caregivers and babies in Chicago's Woodlawn neighborhood. Read about how this space has become a hub for unique family activities in "Transformation", page 76.



Kendra Achenbach, marketing assistant at Ghafari Associates LLC's Grand Rapids, Mich., office, shares the story of the Waters Center, a more than 300,000-square-foot former exhibition space in downtown Grand Rapids. Today it is a viable hub of activity, housing offices, apartments and a hotel. Read about the project in "Mixed Use", page 84.

Nancy Ludwig (left), FAIA, LEED AP, leads Boston-based ICON Architecture Inc.'s creative design staff and multi-million-dollar projects with sensitivity to local and regional contexts. **Janis Mamayek**, AIA, LEED AP, leads the firm's RENEW practice, optimizing value in existing buildings through environmentally conscious design and culturally conscious preservation. In "Multi-family", page 92, the pair writes about the renewal of historic Appleton Mills, a former textile mill in Lowell, Mass., that now provides artists' live/work spaces.

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SMART BUILDING PORTFOLIO MANAGEMENT CONTINUES TO EVOLVE

Technology has revolutionized building management, but even with today's smart buildings, energy managers and data scientists face numerous challenges in managing their portfolios that often include multiple buildings. New technology shows a great deal of promise for providing simpler solutions for accessing, monitoring and comparing HVAC, lighting and other data between buildings.

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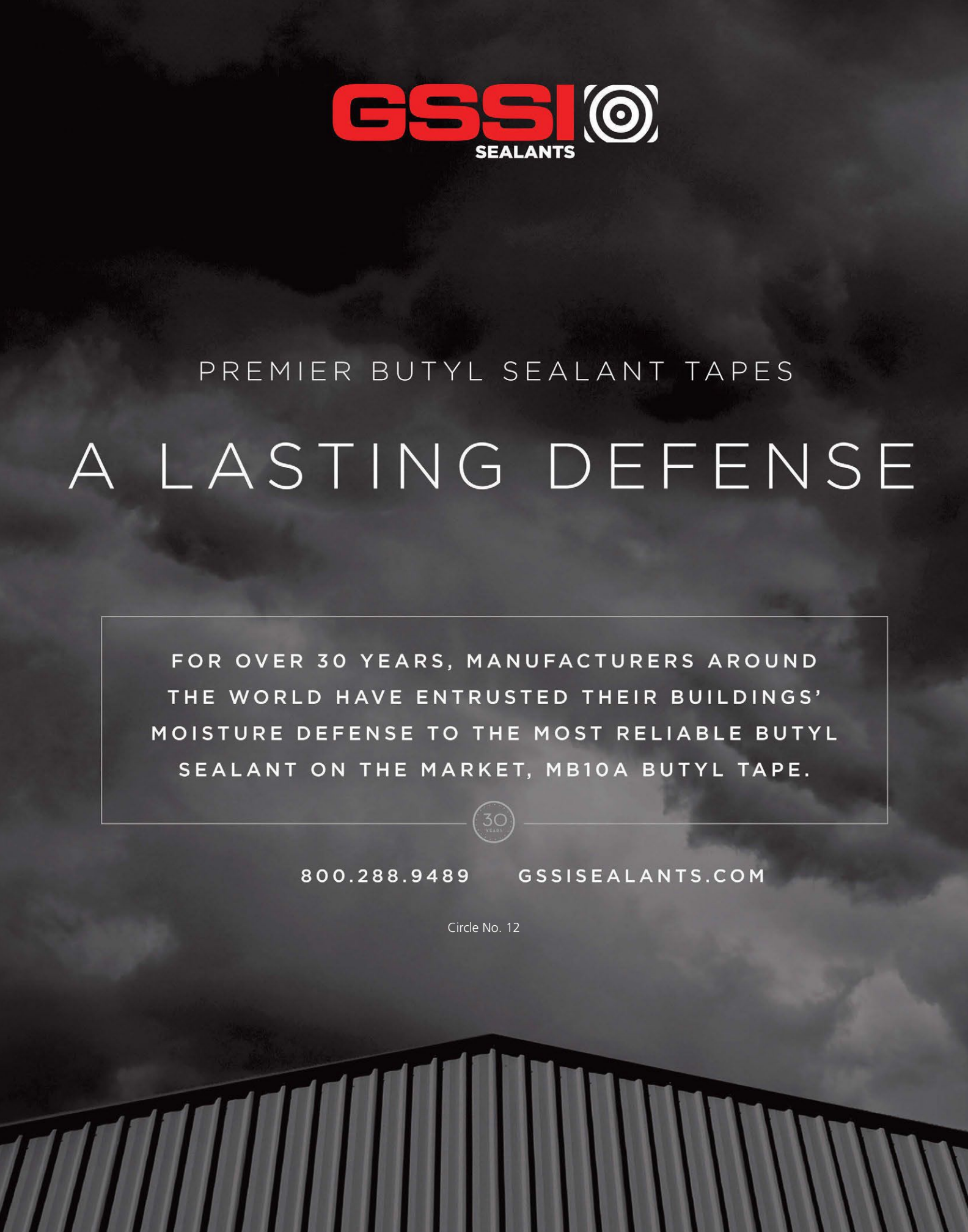
BEHIND-THE-SCENES LOOK AT DRAPER SHADE PRODUCTION

Manufacturer Guidance

Draper invites you to its Spiceland, Ind., facility for an in-person tour; discussions with management; product training; and more. Because not everyone has the ability to travel to Draper's headquarters, the company recently invited a video crew from the television show "Office Spaces: Inside the Blueprint" into its facility to show what goes on behind the scenes in window-shade production.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NIBS, ASTM and RCI Agree to Avoid Duplicating BECx Efforts

The National Institute of Building Sciences, Washington, D.C.; ASTM International, West Conshohocken, Pa.; and RCI Inc., Raleigh, N.C., issued a joint statement July 11 announcing their intent to avoid duplication of efforts relating to their respective building enclosure commissioning (BECx) programs. ¶ NIBS is rolling out a series of new BECx certificate modules as an education component of an agreement with ASTM to create a joint certificate in BECx. The first three two-hour, face-to-face pilot modules were unveiled in April during the fifth BEST Building Enclosure Science & Technology Conference in Philadelphia. A BECx workshop with additional modules is scheduled for Building Innovation 2019: The National Institute of Building Sciences Seventh Annual Conference and Expo in January 2019 in Washington. ¶ Building on that, ASTM will work with NIBS to develop e-learning versions for each module. ASTM will leverage its expertise in multimedia services and provide access to the modules through its online learning management system. ¶ In addition, RCI, in partnership with Orlando, Fla.-based Professional Testing Inc., a certification and examination development company, is developing certifications for the various BECx roles as defined by ASTM. RCI's goal is to develop full-scope certifications for each area to advance the level of quality and standards across the U.S. BECx industry. These certifications will be developed in accordance with accreditation requirements of ISO/IEC 17024: Conformity assessment–General requirements for bodies operating certification of persons. To achieve this objective, RCI has adopted a broad, industrywide collaborative approach to ensure all impacted stakeholders' needs have been taken into consideration. The first step will be to invite industry experts to serve on the Job Task Analysis working groups to be hosted at the University of Wisconsin, Madison, in October. ¶ Learn more by visiting www.nibs.org, www.astm.org and www.rci-online.org.

SURVEY IDENTIFIES INEFFICIENCIES ON CONSTRUCTION SITES

San Francisco-based PlanGrid, a provider of construction productivity software, has shared results from a research report administered in partnership with management consulting firm FMI Corp., Raleigh, N.C. A survey of nearly 600 construction leaders learned how teams spend their time on construction sites, communicate during projects and leverage their technology investments. The survey indicates that time spent on non-optimal activities, such as fixing mistakes, looking for project data and managing conflict resolution, accounts for $177.5 billion in labor costs per year in the U.S. alone. The study also found that rework caused by miscommunication and inaccurate and inaccessible information will cost the U.S. construction industry more than $31 billion in 2018.

Key survey findings include the following:

1. Construction workers lose almost two full working days each week solving avoidable issues and searching for project information.
2. Almost half of all rework is caused by poor communication among project stakeholders and poor project information.
3. Workers are not taking full advantage of mobile devices and IT investments.
4. Technology is expected to improve data management and increase productivity.

"Poor communication among team members and incorrect or inaccessible information that workers need to do their job [are] costing the construction industry tens of billions of dollars annually," says Jay Snyder, FMI technology practice lead. "The majority of industry stakeholders seems to be at a loss for how to remedy these systemic and expensive problems. While construction firms continue to invest in technology, the business-critical issues of communication and data management need more strategic attention than they currently receive."

Download the full report, "Construction Disconnected", at www.plangrid.com/ebook/construction-disconnected.

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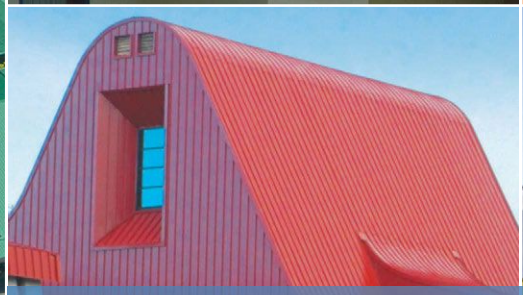

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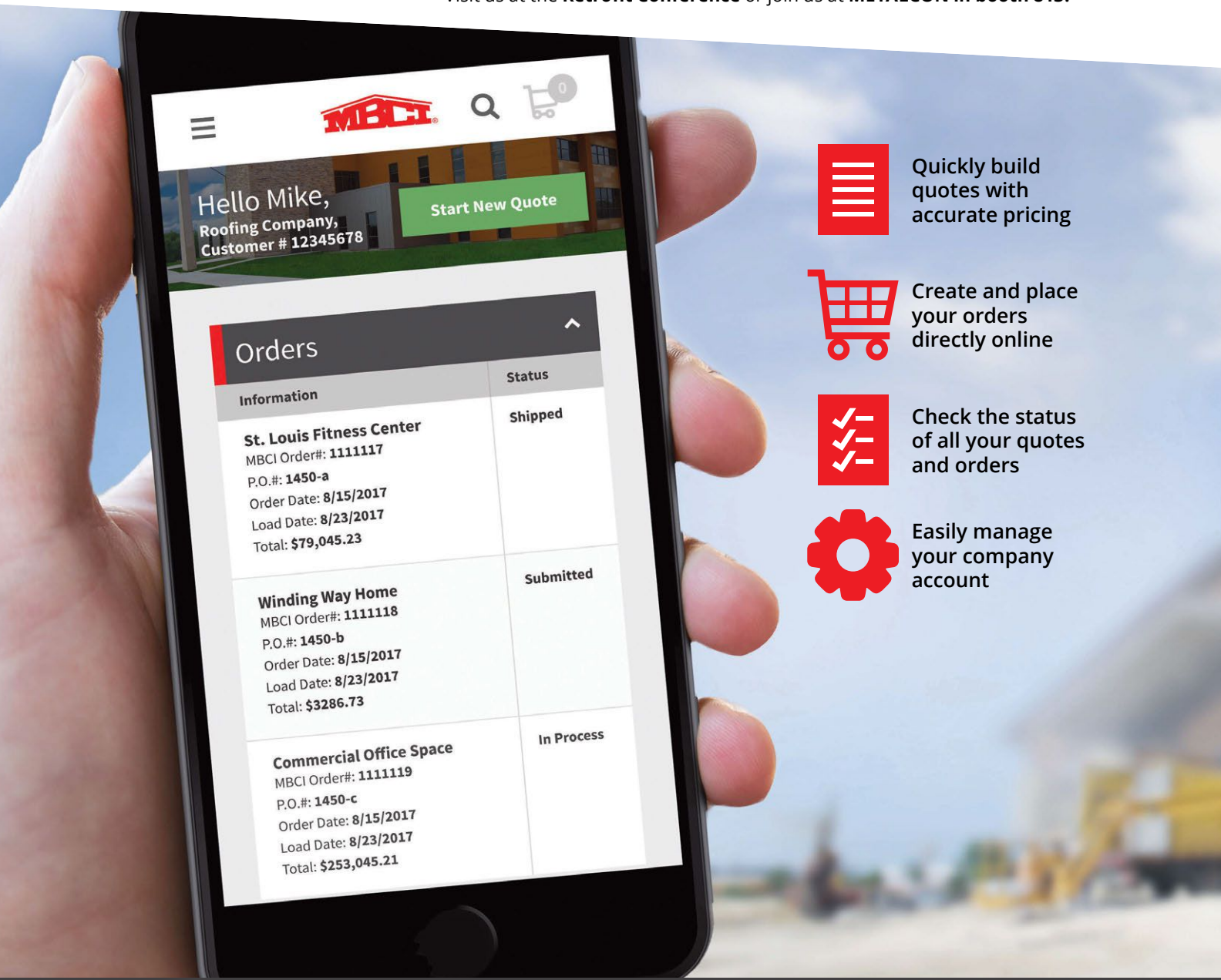


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SCHEDULE

8 A.M.	Onsite Registration/ Check-in
9 A.M.	Welcome and Opening Keynote Speaker: Galina Tachieva, managing partner, DPZ CoDESIGN
10 A.M.	Networking Break in Tabletops Area
10:30 A.M.	Educational Session: Energy-efficient Building Envelope
Noon	Lunch in Tabletops Area
1 P.M.	Educational Session: Retrofitting in Today's Market
2:15 P.M.	Networking Break in Tabletops Area
2:30 P.M.	Afternoon Keynote: Ryan M. Colker, vice president, National Institute of Building Sciences
3:30 P.M.	Educational Session: Resilient Buildings
5-7 P.M.	COCKTAIL RECEPTION in Tabletops Area

KEYNOTE SPEAKERS

OPENING KEYNOTE: Galina Tachieva, managing partner, DPZ CoDESIGN, Miami

With 25 years of expertise in sustainable planning, redevelopment and form-based codes, Galina Tachieva is the author of the *Sprawl Repair Manual*, an award-winning publication by Island Press, which focuses on the retrofit of auto-centric suburban places into complete communities. Tachieva is a CNU Fellow, one of the leaders of the CNU Sprawl Retrofit Initiative, a founding member of the Congress for European Urbanism, certified by the American Institute of Certified Planners (AICP) and a LEED Accredited Professional.

Repair and Prepare Our Suburbs for the 21st Century

We have been building 20th century sprawl in the 21st century. It is time to shift direction. This presentation positions Sprawl Repair as a comprehensive and practical method to transform auto-dependent, single-use places into more complete, economically viable communities. It will show design, regulatory and implementation techniques derived from the "trenches" at all development scales: regional, community, block, building.

The presentation will not only highlight why we should retrofit sprawl, but will also show a practical how, who and when step-by-step path of action forward to a better 'burb. The solutions presented will inspire and equip anyone looking to reimagine suburban development.

AFTERNOON KEYNOTE: Ryan Colker, vice president, National Institute of Building Sciences, Washington, D.C.

Ryan M. Colker leads the institute's efforts to improve the built environment through the collaboration of industry stakeholders from the public and private sectors. He directs the Consultative Council, which develops findings and recommendations on behalf of the entire building community and transmits those recommendations to Congress and administration. He also serves as staff director of the Council on Finance, Insurance and Real Estate; National Council on Building Codes and Standards; Off-Site Construction Council; and the institute's STEM Education Program. He is a recognized expert on emerging issues within the built environment, including resilience, building performance, and off-site construction and speaks and writes frequently on these subjects.

Resilient Existing Buildings Are a Key to Resilient Communities

The vast majority of our building stock in 2030 already exists today. When these buildings were built, they met the needs of their owners, tenants and the surrounding community. However, performance requirements have changed—particularly around safety and security. The structures and communities in harm's way have increased as hazard events become more frequent and more impactful. Our understanding of risks and the measures we can take to address them have drastically improved. We'll explore efforts to advance community resilience through improvements to the existing building stock and how a resilience economy can help drive progress.

EDUCATIONAL SESSIONS

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Each of the three educational sessions will feature a panel of speakers who will present for a total of one hour on the following topics.

SESSION 1 Energy-efficient Building Envelope:

- Understand the diagnostic tools used, the substantial air-leakage reductions possible and the energy savings being realized as more organizations are finding out that neglecting their building enclosures isn't an option.
- Learn about the envelope inspection, specification and repair efforts for three schools: Sewanee University, East Carolina University and Johnston Community College.
- Find out how root causes for moisture intrusion incidents are diagnosed and how different remediation approaches can be taken for buildings.

SESSION 2 Retrofitting in Today's Market:

- Hear from the North Carolina Building Performance Association how leading contractors across the state are overcoming today's challenges and ensure your projects, and your company, are built to perform.
- Learn about Commercial Property Assessed Capital Expenditure (C-PACE), a long-term, self-amortizing form of capital repaid through a special assessment, and how it can be used to upgrade existing buildings, increase seismic or hurricane resiliency, provide tenant improvements, or rehabilitate and reposition historic structures.

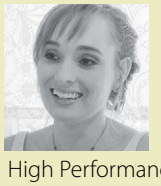
SESSION 3 Resilient Buildings:

- Better understand codes written specifically for existing buildings, including options provided to owners of existing buildings and their designers when making alterations, as well as how these codes provide incentives to owners to keep their buildings current with contemporary safety and construction methods without requiring full compliance with more restrictive and costly codes used for new buildings.
- Learn about the Insurance Institute for Business and Home Safety's extensive full-scale testing and research to provide design and maintenance guidance to increase roof resiliency.
- Discover how to bring high-performance and forward-thinking resiliency measures into your company's building standards and sell the value of doing so to your clients and occupants.

MEET OUR SPEAKERS

Energy-efficient Building Envelope

PHIL WILSON, CxA+BE, BECxP, PEM, director of Building Diagnostics, HICAPS Inc., Greensboro, N.C.



MEGHAN MCDERMOTT, BECxP, CxA+BE, owner, architectural engineer and business manager, High Performance Building Solutions, Charlotte

FRANCIS CONLIN, owner, senior engineer and technical advisor, High Performance Building Solutions, Charlotte

MODERATOR: NATHAN M. GILLETTE, AIA, LEED AP O+M, director of Natura Architectural Consulting LLC, Grand Rapids, Mich., and a ***retrofit*** editorial advisor

Retrofitting in Today's Market:

D. RYAN MILLER, founder and executive director, North Carolina Building Performance Association, Raleigh

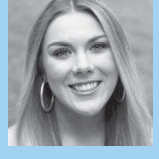
WILL CLARK, vice president of Originations, CleanFund, Sausalito, Calif.

MODERATOR: CHRISTINA KOCH, ***retrofit***'s editorial director

Resilient Buildings:

CINDY L. DAVIS, CBO, deputy director of the Division of Building and Fire Regulations, Virginia Department of Housing and Community Development, Richmond

CHUCK MICCOLIS, vice president, Commercial Lines, Insurance Institute for Business and Home Safety, Tampa, Fla.



ABBY COULTER, commercial buildings and member services specialist, North Carolina Building Performance Association, Raleigh

MODERATOR: MARCIN PAZERA, Ph.D., technical director, Polyisocyanurate Insulation Manufacturers Association, Arlington, Va.

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K-12 BUILDINGS = LEARNING OPPORTUNITIES

Innovative Programs Involve Students in Construction and Community

WRITTEN BY **KATELYN CHAPIN, AIA, NCARB**

An important aspect of any renovation or construction project is community involvement. However, this opportunity for engaging individuals in the design process is often set aside or completely overlooked. It's hard to say why because architects and contractors can benefit from being involved in meaningful ways with local stakeholders and impacted neighbors. Community and client participation helps the project team understand everyone's needs and create designs that best reflect their culture, aspirations and dreams.

For school projects, one way to connect with community is by presenting the design and construction process to teachers and administrators, area residents, and students and their families. Experience shows you can even involve them, tapping into the wealth of creativity found in every individual, including people without any formal design or building experience. As architects and project leaders, we can help unleash that energy in productive and useful ways. At the same time, it removes the shroud of mystery around building and renovation work.

Based on this idea—as well as a desire to help children learn about architecture, engineering and construction—the New Haven, Conn.-based architecture, art and advisory firm Svigals + Partners, in partnership with the New Haven School Construction Program, launched the KidsBuild! program more than two decades ago. KidsBuild! initially emerged as a means to educate primary and secondary schoolchildren about how their educational environments were being conceived, built and maintained. The formal program evolved from a creative engagement process that Svigals + Partners has long employed with project client groups, extending similar ideas to the students anticipating new and renovated facilities of their own.

> Site visits led by design team members can be exciting and fun for students because they inspect and track the construction process.

KidsBuild! Is Born

The ideas behind launching a student engagement program also had roots in the creation of New Haven's first-ever School-Based Building Advisory Committee, or SBBAC, in the mid-1990s. "At the time, there was heightened interest in neighborhood-focused schools," notes New Haven Schools program manager Carolina Cudemus,

(continues on page 28)

PHOTOS: COURTESY SVIGALS + PARTNERS

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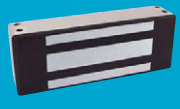
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adding that this trend helped lay the groundwork for community involvement. The SBBACs (one is created for each school building project) had the mission to ensure ample engagement of families, parents, teachers, community and others in the design and construction process behind their proposed school facilities. The committees would also help guide the school building process so it would be deeply based in their neighborhoods and the particular needs of their communities.

"Starting in 1995, these SBBACs gave birth to schools rooted in their neighborhoods and the particular needs of their communities," says Julia McFadden, AIA, an architect and associate principal with Svigals + Partners. "Working on the Edgewood School project, a 48,000-square-foot renovation and expansion of a 1923 existing building that we completed in 1999, our team created a process template that shaped a nearly $2 billion school construction program, and we saw an opportunity in this to expand the involvement of the students themselves."

With interest from the school, parents and the district, the project team developed several lasting and valuable dimensions to KidsBuild!, starting with some basic precepts. These included:

WORKSHOPS // Throughout the design and construction of each school, groups of students from various grade levels participate in a series of workshops that explore the design process. These workshops could offer students of all grade levels the opportunity to collaborate and tap their creativity through hands-on activities and organized site visits.

MIXED AGES // Kids naturally mentor each other. By allowing students in different grades to work together—which typically would not happen—barriers could be broken down and creative potential would flourish. It also could set the stage for mentorships between students to arise.

SUSTAINABILITY AWARENESS // Because KidsBuild! immerses children in the design process and they also learn about and even participate in ongoing building maintenance, they could

become stewards of their own school facilities. This would help them learn to responsibly care for their schools; it exposes younger students to learning about these important values, too. It helps them become better environmental stewards in their own homes, as well, turning off lights when not in the room, closing shades to limit heat gain in the house in warm summer months, recycling and the like.

CAREER AWARENESS // Through interaction with architects, engineers and people in construction trades, students are exposed to career paths they may not have considered. They see the impact they could make in these careers and learn about the educational requirements to get there.

The program was a hit, earning support from teachers, students and their families, as well as local officials and national experts in education. "KidsBuild! is an innovative way to introduce city students to meaningful careers in architecture and construction and also to teach them to be proud of their schools," said New Haven Mayor John DeStefano Jr. in 2008.

KidsBuild! Today

Following the Edgewood School experience, KidsBuild! was introduced in eight Connecticut public schools designed by Svigals + Partners, including Columbus Family Academy in New Haven, the Discovery Magnet School in Bridgeport, Jonathan E. Reed School in Waterbury and the new Sandy Hook School in Newtown.

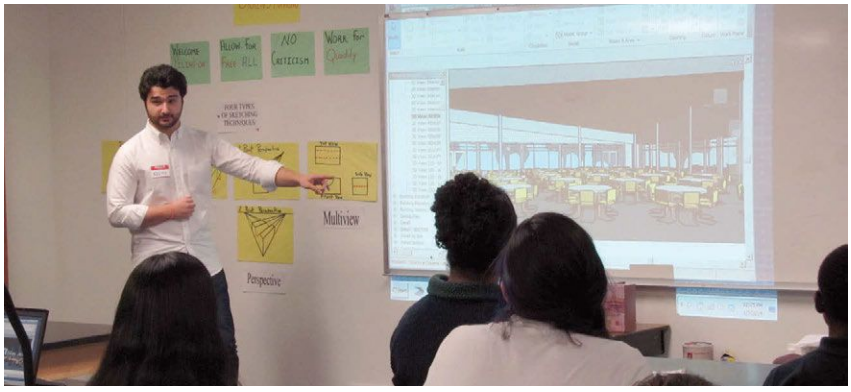
Students from pre-K through seniors in high school in very diverse communities have participated in KidsBuild! programs for magnet schools, arts-based education, early childhood schools and LEED-certified green-building projects. It continues today and is being emulated in other places, too.

KidsBuild! was a central element of the community gathering together to create the new Sandy Hook School, recalls Jay Brotman, AIA, managing principal of Svigals + Partners. The firm's active and inclusive engagement process was initiated through several town institutions and held in multiple forums with officials, governing boards, neighborhood groups, parents, teachers and school administrators. Public brainstorming

PHOTOS: WOODRUFF/BROWN PHOTOGRAPHY, COURTESY SVIGALS + PARTNERS

The Edgewood School renovation and expansion in 1999 helped develop several lasting and valuable dimensions to the KidsBuild! program.

KidsBuild! workshops delve into the architectural design process and specific elements of building engineering. Hands-on activities, such as sketching artwork ideas, building model structures and using surveying equipment, support the lessons.



about the design took place in a series of workshops with engaging activities, resulting in specific ideas for the architectural expression, school layout and even safety features. All ages joined in as the project team employed the KidsBuild! Educational Workshops to teach about the design and construction and to help students create new artwork for their own school.

About a year before, the KidsBuild! program was particularly complementary to the creation of a unique "maker campus" STEM school for New Haven, the Engineering and Science University Magnet School (ESUMS), for grades six through 12. The approach comprised nine workshops over four years engaging about 35 students from various grades each year. Developed with ESUMS Principal Medria Blue-Ellis and two teachers, the workshops delved into the architectural design process and specific elements of building engineering, such as cantilevers and sustainability. It also covered ways to integrate art into the new building and how the adjacent wetlands might affect engineering decisions and construction logistics. A number of hands-on activities supported these lessons, such as sketching artwork ideas, building model structures and using surveying equipment.

PHOTO: ROBERT BENSON PHOTOGRAPHY, COURTESY SVIGALS + PARTNERS

KidsBuild! was a central element of the community gathering together to create the new Sandy Hook School. All ages joined in as the project team employed the KidsBuild! Educational Workshops to teach about the design and construction and to help students create new artwork for their own school.

The KidsBuild! workshops for ESUMS also emphasized what students were learning in their classrooms. Site visits led by design team members can be exciting and fun for students because they inspect and track the construction process. Students learned about groundwater flow, structural engineering, mechanical systems and construction sequences. After a visit to the architecture office, one 11th-grade student said: "After my visit to Svigals + Partners, I was able to understand the amount of work that goes into building our new school. I am more aware of what the future of ESUMS is going to look like and it makes me proud to be part of the process." Several students in KidsBuild! said they were motivated to look into architecture, engineering and construction as possible careers. In fact, Svigals + Partners knows of some students who went into the AEC profession. One actually returned to each KidsBuild! session after graduation to see the final building construction unfold.

"The students and adults alike really appreciated these opportunities created through KidsBuild!," notes Hunter Smith, an ESUMS teacher of math, engineering and science. "We were able to follow along with the project team's work and get exposed to the deep pools of knowledge that each company and each individual brings to the project."

KidsBuild! in Your Community

If you're interested in starting a program like KidsBuild! where you are, New Haven, Conn.-based Svigals + Partners is willing to share its insight and experiences. Call (203) 786-5110 or visit www.svigals.com to learn more.

KidsBuild! also draws on another limitless resource: the creativity and curiosity that naturally comes to children. Our students across the nation deserve more opportunities to tap into their imagination and explore new ideas that occur around them. Yet with today's rigorous curriculum and endless afterschool activities, it's important to make time for even greater enrichment. While the KidsBuild! programs might have influenced a few children to consider future careers in the great big world of building, it definitely captivated the interest and imagination of all who participated.

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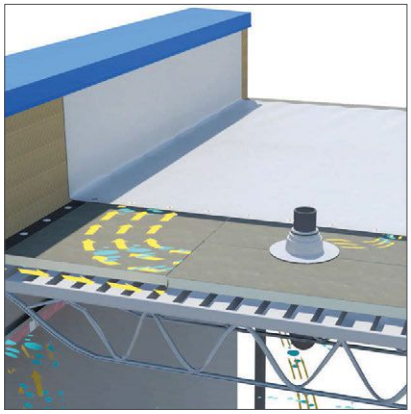

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ONE SIZE CAN FIT ALL

PHOTOS: **GENSLER / RYAN GOBUTY UNLESS OTHERWISE NOTED**

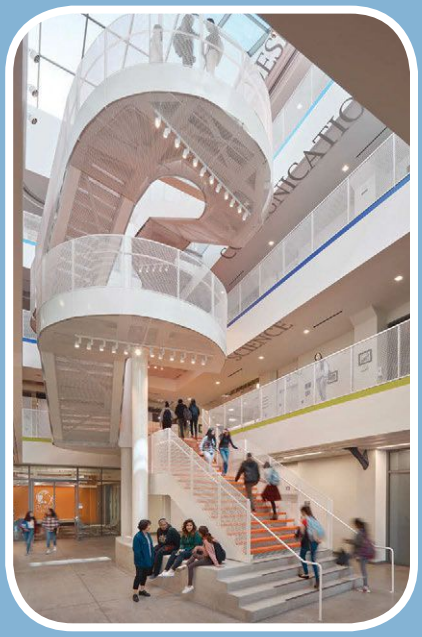
A FORMER CALIFORNIA OFFICE BUILDING BECOMES HOME TO THREE UNIQUE HIGH SCHOOLS

[WRITTEN BY | KJ FIELDS]

Historically, El Segundo, Calif.—a city south of the Los Angeles International Airport and a few miles in from the coastline—was the aerospace heart of the region characterized by U.S. Air Force, aviation and engineering. But companies from Silicon Valley moved south, expanding "Silicon Beach," and El Segundo now booms with internet and technical media presence. Wiseburn Unified School District (Wiseburn USD) serves this area and nearby unincorporated parts of Los Angeles. For many years, Wiseburn USD offered public K-8 education, but when it came time to expand into high school curriculum, Wiseburn USD partnered with Da Vinci independent charter schools to provide three high-school options for Wiseburn USD students.

The district found an unlikely structure to renovate into one space for the three independent high schools: a 1981, 360,000-square-foot, 4-story office building on a 13-acre campus of utilitarian, industrial land. Last occupied in the 1990s by a high-security engineering lab that developed classified planes and weapons systems, the massive building's perimeter was 300 feet on each side with a deep and dark interior. "It was not at all conducive to classrooms and educational space," describes David Herjeczki, design principal in the Los Angeles office of Gensler. Gensler provided architecture and interior design on the project; Herjeczki directed the effort. "But this was a school district with a big dream and a limited budget. Despite the building's challenges, we saw its potential," Herjeczki says.

The building was intended to accommodate a total of 1,500 students from the three combined schools. Each Da Vinci high school has a particular focus: Da Vinci Science (science and engineering), Da Vinci Design (design, art and architecture) and Da Vinci Communication (media and content).



Retrofit Team

ARCHITECT // Gensler, Los Angeles, www.gensler.com

CONTRACTOR // Balfour Beatty Construction, Los Angeles, balfourbeattyus.com

LANDSCAPE DESIGN // Pamela Burton & Co., Santa Monica, Calif., www.pamelaburtonco.com

CIVIL ENGINEERS // KPFF Consulting Engineers, Los Angeles, www.kpff.com

STRUCTURAL ENGINEERS // Saiful Bouquet, Pasadena, Calif., www.saifulbouquet.com

M/E/P // tk1sc, Los Angeles, www.tk1sc.com

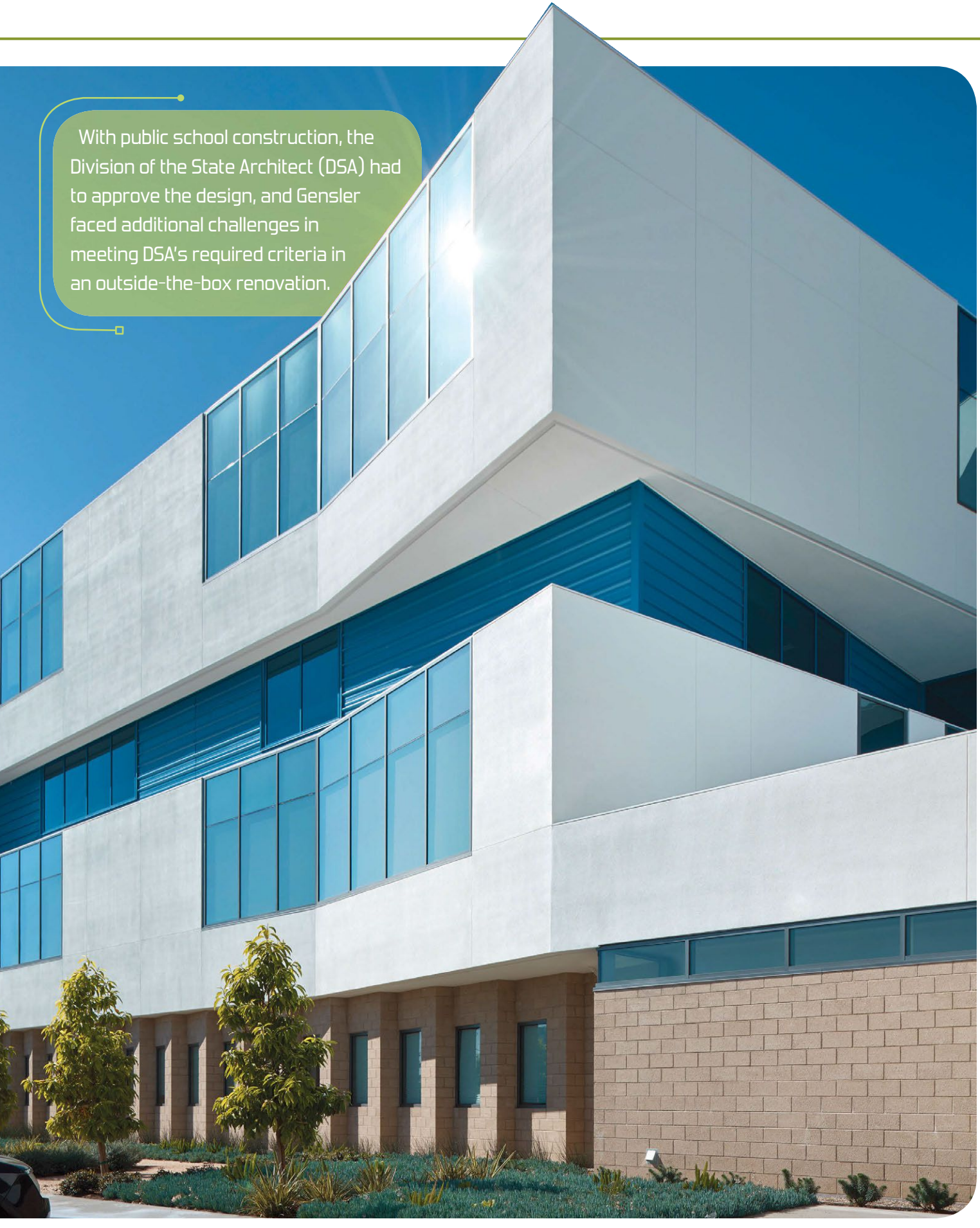
AV/ACOUSTICS // Newson Brown, Santa Monica, newsonacoustics.com

FIRE, LIFE SAFETY // Jensen Hughes, Baltimore, www.jensenhughes.com

COST ESTIMATING // Cumming, Los Angeles, www.ccorpusa.com

EDUCATION PLANNER // New Vista Design, Jamaica Plain, Mass., www.newvistadesign.net

With public school construction, the Division of the State Architect (DSA) had to approve the design, and Gensler faced additional challenges in meeting DSA's required criteria in an outside-the-box renovation.



INSPIRED PARADIGMS

Gensler's team began its design process by becoming acquainted with Da Vinci's educational ideology. Through months of workshops, several prominent factors emerged. "Da Vinci is very innovative. Their 21st-century, project-based learning model shifts away from teacher-centric classrooms and personalizes education to meet students' different learning styles," Herjeczki explains. "We looked at designing spaces that are much more adaptable than typical classrooms, so teachers and students could constantly invent and reinvent their curriculum, which is a part of Da Vinci's philosophical DNA."

Transparency was another key component, so the building needed spaces that gave teens autonomy while providing teachers clear views into the spaces to intervene and guide students if needed.

Maintaining a compact set of 400 to 500 students in each high school helps Da Vinci staff know every student, which enhances its ability to personalize education and keep kids engaged. For Gensler, this meant creating learning spaces at varying sizes and scales to promote a variety of interactions.

"We created four learning clusters of six classrooms around an open, flexible hub and added smaller conference areas that suit 12, eight or four people," Herjeczki notes.

CONVERSION INGENUITY

The building's construction gave the design team a head start for its creative-space allocation. Typical of office developments, the walls were not load-bearing parts of the structure. Without the need to preserve pre-existing partitions, Gensler's team could rethink the building's parameters—inside and out.

"We embraced the industrial nature of the site to some extent, but we tried to humanize it a bit," Herjeczki explains. "We demolished a big portion of the building so it's no longer a monolith right up to the street, and we created a softer,

> We playfully stacked different types of collaboration spaces in the atrium to architecturally emphasize an internal address to each school. We also incorporated the colors and materials associated with each Da Vinci schools' brand, so each floor is unique.
>
> *—David Herjeczki, design principal, Gensler*

The team incorporated the colors and materials associated with each Da Vinci schools' brand to make each floor unique. For example, a hanging wooden ceiling softens a Da Vinci Design room but exposes the building's raw materials to inspire design students. Da Vinci Communication's blue and purple colors are found in the furniture and wall coverings on the third floor. Da Vinci Science's brand emphasizes grids, and the designers played with grids throughout the second floor to define the school's spaces.

articulated edge that brought the building closer to human scale."

In all, the team strategically removed 116,000 square feet of exterior space and reduced the floor plates' size to 52,000 square feet. Daylight is imperative for student wellbeing and enhanced learning, and the team cut an 80- by 40-foot atrium through the structure to bring natural light into the learning spaces and then added floor-to-ceiling perimeter windows.

Each of the three high schools has its own floor in the building and the atrium connects them by offering clear sightlines and an internal staircase for students to access their schools. Community space is on the ground floor of the atrium, as well as a multipurpose room that doubles as a black-box theater; dining area; and after-school program spaces, such as music rooms, performing-arts spaces and an arena for the science students' robot competitions.

The emphasis on open spaces in the building presented acoustic issues, however. In the atrium, Herjeczki says spray-applied acoustically absorptive materials were the key to success. To provide visual transparency but still allow students to focus, the renovation uses thicker glazing than usual in the rooms.

RESPONSIBLE COMPLIANCE

With public school construction, the Division of the State Architect (DSA) had to approve the design, and Gensler faced additional challenges in meeting DSA's required criteria in an outside-the-box renovation. Any building not originally designed under DSA's oversight is classified as a structure that needs to be "rehabilitated." The unusual open plan didn't quite conform to usual school standards either. "There isn't a great deal of interpretation flexibility with the DSA, and it really placed the burden on us to prove strict conformance, from fire safety and emergency egress to structural integrity," Herjeczki notes.

Schools with a high occupancy are required to be designed to a seismic importance factor of 1.25, whereas an office building is built to a factor of 1. The team had to test and augment the building's seismic strength by 25 percent to comply. "Where we added seismic braces, we had to dig out the caisson foundations of the building two at a time, excavating

(continues on page 38)

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PHOTOS: DAVID HERJECZKI

Transforming a high-security office building into a school was a challenge. The team strategically removed 116,000 square feet of exterior space and reduced the floor plates' size to 52,000 square feet. In addition, the team had to test and augment the building's seismic strength by 25 percent. Where the team added seismic braces, caisson foundations of the building had to be dug out two at a time, excavating 20-feet below grade to enlarge them.

Materials

GLAZING // Vitro Architectural Glass, www.vitroglazings.com

CURTAINWALL, WINDOWS AND DOORS // Arcadia Inc., www.arcadiainc.com

MASONRY // Angelus Block Co. Inc., www.angelusblock.com

METAL SIDING // ATAS International Inc., www.atas.com

ACOUSTICAL // International Cellulose Corp., www.spray-on.com

LIGHTING // A-Light, www.alights.com; Delray Lighting Inc., www.delraylighting.com; and Prudential Ltg., www.prulite.com

ACOUSTICAL CEILINGS // Hunter Douglas Architectural, www.hunterdouglasarchitectural.com, and USG, www.usg.com

CARPET // Tandus Centiva, www.tandus-centiva.com

RESILIENT FLOORING // Johnsonite, www.johnsonite.com

FIRE GLAZING // SaftiFirst, safti.com

ACCORDION FIRE DOORS // Won-Door Corp., wondoor.com

WRITABLE PAINT // Idea Paint, www.ideapaint.com

PAINT // Dunn Edwards, www.dunnedwards.com

WALL AND FLOOR TILE // Daltile, www.daltile.com

TACKABLE WALL PANELS // Koroseal, www.koroseal.com

CABINETWORK AND CUSTOM MILLWORK // Stolo Cabinets, www.stolocabinets.com

FURNITURE // Teknion, www.teknion.com

ROOFING // Sika Sarnafil, usa.sarnafil.sika.com

20-feet below grade to enlarge them," Herjeczki recalls.

Another complication was the fact that commercial buildings from the 1980s don't have the detailed documentation DSA would require, so there was inadequate information about how the building was put together. "Our original intent was to reuse more of the existing systems and building enclosures, but we couldn't satisfy the DSA's expectations. In some areas like the west façade that we thought we could keep, it was simpler to tear down and build new," Herjeczki says.

Although the roof was newer, the team also had to tear the roof membrane off to reinforce the deck as part of the seismic upgrade.

SYMBOLS OF SCHOOL SPIRIT

The significant structural retrofits dipped into the project's fixed budget, but designers found multiple ways to support Da Vinci's educational programs and still give the three schools their own identities.

On each of the upper floors, a room projects into the atrium which provides visual cues to identify the three distinct schools in the single building. "We playfully stacked different types of collaboration spaces in the atrium to architecturally emphasize an internal address to each school," Herjeczki explains. "We also incorporated the colors and materials associated with each Da Vinci schools' brand, so each floor is unique."

For example, the material associated with Da Vinci Design is wood, and the collaboration space on the top floor of the atrium is an angular space made of plywood. In another collaboration space, a hanging wooden ceiling softens the room but exposes the building's raw materials to inspire design students. Gensler added light blue and yellow accents throughout the top floor using paint and furniture to reflect the school's brand colors.

Da Vinci Communication's atrium presence is defined by a curvilinear collaboration space, and the school's blue and purple colors are found in the furniture and wall coverings on the third floor. Da Vinci Science's brand emphasizes grids, and the designers played with grids throughout the second floor in treatments like gridded shelving and a ceiling made of metal tiles at different depths. The school's colors of green and silver are evident in its atrium-facing collaboration space.

"Because we couldn't afford to use exotic materials, the spaces have an air of being something hackable and adaptable," Herjeczki remarks. "It long-term future-proofs the project. Twenty years from now as pedagogy continues to evolve, Da Vinci can transform the spaces into whatever it needs them to be."

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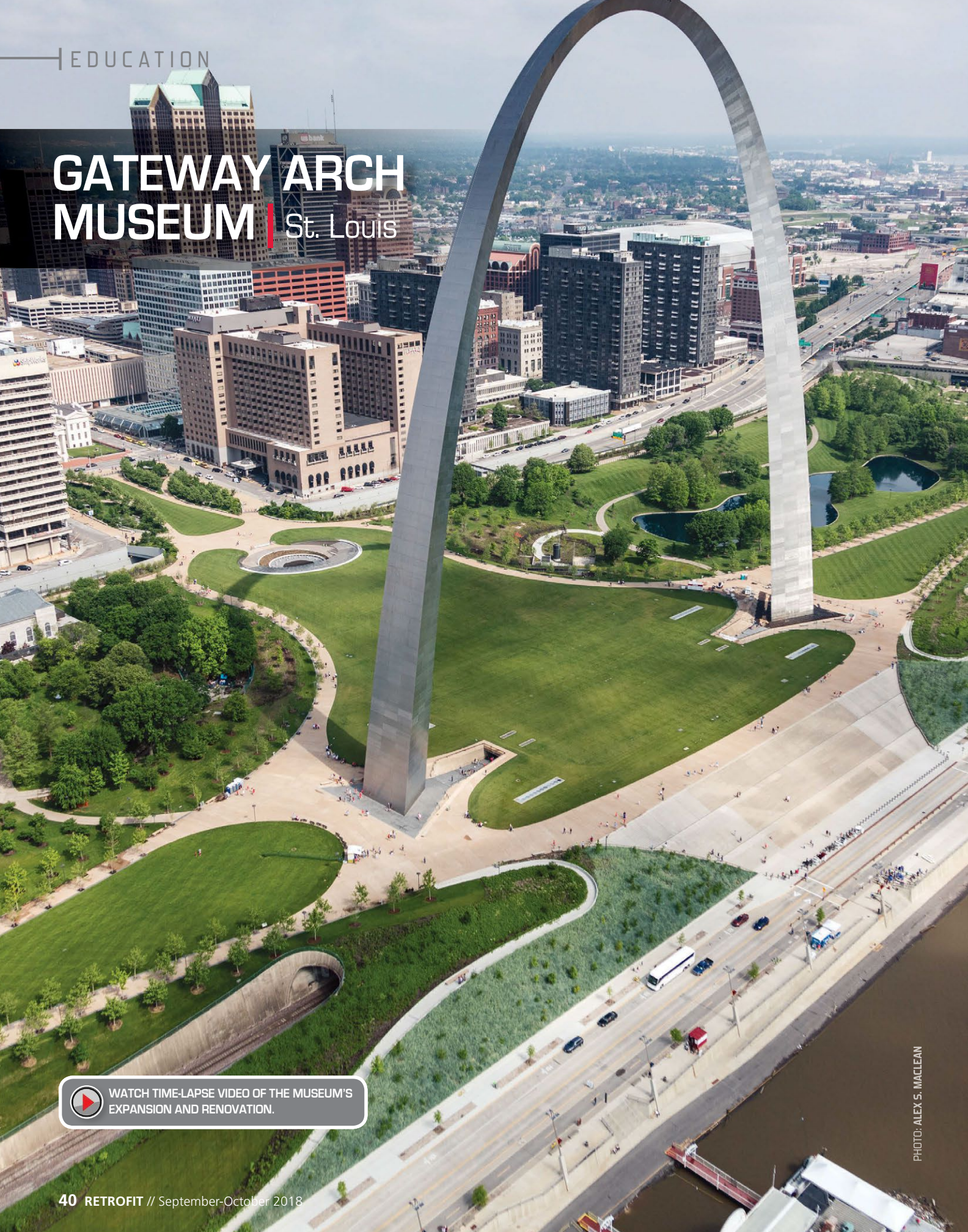
GATEWAY ARCH MUSEUM | St. Louis



WATCH TIME-LAPSE VIDEO OF THE MUSEUM'S EXPANSION AND RENOVATION.

PHOTO: ALEX S. MACLEAN

PHOTOS: NIC LEHOUX

RETROFIT TEAM

ARCHITECTS: Cooper Robertson, New York, www.cooperrobertson.com; James Carpenter Design Associates, New York, www.jcdainc.com; and Trivers Associates Architects, St. Louis, trivers.com
LANDSCAPE ARCHITECT: Michael Van Valkenburgh Associates, Brooklyn, N.Y., www.mvvainc.com
EXHIBITION DESIGN: Haley Sharpe Design Ltd. of London and Toronto, haleysharpe.com

MATERIALS

VEGETATED ROOF ASPHALTIC PROTECTION BOARD: WR Meadows, www.wrmeadows.com
XPS RIGID INSULATION: Dow, www.dow.com
TOILETS AND URINALS: American Standard, www.americanstandard-us.com
FLUSHOMETERS: Sloan, www.sloan.com
INFRARED FAUCETS: Chicago Faucets, www.chicagofaucets.com
KITCHEN FAUCETS AND BARRIER-FREE DRINKING FOUNTAIN: Elkay, www.elkay.com

THE RETROFIT

Located at the base of Eero Saarinen's iconic Arch, within a National Park, the underground museum explores seminal events in American history, such as President Thomas Jefferson's Louisiana Purchase, Lewis and Clark's exploration of North America in 1804, and the role of St. Louis in the settlement of the American West. The museum had suffered from a lack of visibility and needed a more relevant and contemporary narrative.

The new museum occupies a renovated underground space built concurrently with the Arch with a 47,000-square-foot expansion to the west and a new entrance facing the Old Courthouse, site of the landmark 1857 trial of the slave Dred Scott. The majority of the interior of the existing space was reconfigured into new galleries, public amenities and museum staff offices. The original architectural elements of the existing public spaces were preserved, and their distinctive character highlighted with new lighting and other discrete interventions. The addition houses a new public lobby that also serves as a kind of visitor center for the entire park, as well as a great hall with monumental and animated elements that introduce the visitor to major themes to be explored in the galleries.

The new circular stainless-steel and glass entrance refers to the Arch in its materiality and form. It is an arc laid onto the landscape and precisely inserted into the topography, allowing visitors to enter the building through the landscape rather than descending underground. As one enters, the luminous great hall is revealed with views deep into the underground museum's monumentally scaled exhibits, elevating and enlivening the visitor experience while drawing one in.

A giant map of North America floats below the entry hall. Visitors and school groups can land there and walk the path of Lewis and Clark or follow the trails of pioneers migrating west. The map also is designed as a unique space for special events. Beneath the map is a new Education Center that supports the park's programs, which previously had no dedicated space.

One moves down through the hall among screens projecting life-sized videos of wagon trains journeying west across an open and rugged landscape with bison and other natural features of the frontier before entering the galleries.

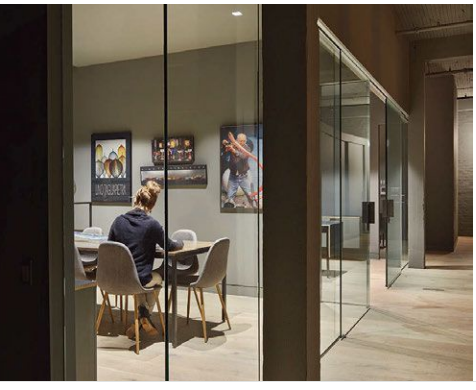
The linear exhibition offers various ways to navigate multiple stories on single and successive visits and merges seamlessly with the trip up the Arch.

The museum is fully accessible for all ages and all abilities. The design is based on Universal Design standards that exceed the legal requirements of the American with Disabilities Act and the federal-mandated Architectural Barriers Act Accessibility Standard.

This project is a key component of the larger plan to connect downtown St. Louis with the park and the Mississippi Riverfront; the underground museum expands toward downtown and opens onto a redesigned public square that now spans over a sunken interstate highway. The new museum and Old Courthouse create an ensemble of buildings of national significance that define a transformed public open space in downtown St. Louis. Taken together with the Arch, this will become a new destination for those interested in architecture and history, contribute to the quality of urban life for residents and drive economic revitalization.

This project is a result of an international competition, "Framing a Modern Masterpiece: The City + The Arch + The River", which was organized by the non-profit Gateway Arch Park Foundation. The $96 million museum is the cultural centerpiece of the overall $380 million comprehensive renewal of the Gateway Arch National Park.

PHOTOS: **GRAHAM BABA ARCHITECTS**



LINO TAGLIAPIETRA GLASS STUDIO | Seattle

RETROFIT TEAM

ARCHITECT, INTERIOR DESIGNER AND LIGHTING DESIGNER: Graham Baba Architects, Seattle, grahambabaarchitects.com
STRUCTURAL ENGINEER: Degenkolb Engineers, Seattle, degenkolb.com
DESIGN-BUILD MECHANICAL ENGINEER: Premier Mechanical, Bothell, Wash., www.premierme.net
DESIGN-BUILD ELECTRICAL ENGINEER: Pinnacle Electric, Redmond, Wash., (206) 546-1332
GENERAL CONTRACTOR: Dovetail, Seattle, www.dovetailgc.com

MATERIALS

The entry is defined by a large wood and steel door that incorporates a modest illuminated cut-steel sign announcing the venue. Inside, the entry opens onto a sloping interior ramp that parallels the studio, which is essentially one large, 6,100-square-foot space. The brick interior has been painted matte gray while floors are made with a subtly bleached white oak. Overhead, a 16-foot-wide by 45-foot-long light monitor floats above the center of the space. Translucent clerestory glazing brings daylight into the space. The underside of the monitor features a curved soffit that softly shapes the daylight that fills the space. The client refers to the light-filled space created by the monitor as the cube. The cube serves as an illuminated volume in which to hang large collections of glass pieces or to feature tall works. Indirect light sources inset into the monitor provide dramatic lighting in the evening. Custom-designed Europly cabinetry and hot-rolled steel and Europly furniture fit out the spaces. The conference table is built from fir beams reclaimed from the building construction. Elemental steel display stands of various heights and steel wall and ceiling mounts support the art.

WOOD AND STEEL DOOR AND CUT-STEEL SIGN: custom by Dovetail, www.dovetailgc.com
PAINT: Sherwin-Williams, www.sherwin-williams.com
WHITE-OAK FLOORS: Garrison Collection, www.garrisoncollection.com
LIGHT-MONITOR AND CLERESTORY GLAZING: Arcadia Inc., www.arcadiainc.com
ELECTRIC LIGHTING: EcoSense Lighting, ecosenselighting.com

THE RETROFIT

Located in a downtown Seattle neighborhood, the studio is dedicated to the display of Lino Tagliapietra's glass art. Tagliapietra's work explores the limits of glass—its form, texture and color. In response to the drama of his work, the space itself becomes an exercise in restraint, a quiet armature and environment in which art becomes the focal point.

Most recently serving as home to an auction company, the studio occupies a 1917, 1-story, masonry and heavy-timber-framed warehouse building, which presents a quiet presence to its urban setting. Support spaces, including a glass-fronted office and conference room, restrooms, kitchenette and storage, round out the functions on the main floor.

Cypress Spring High School | PBK Architects | Cypress, TX

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KING UNIVERSITY | Bristol, Tenn.

PHOTOS: GENERAL SHALE

RETROFIT TEAM

LANDSCAPING CONTRACTOR:
Poor Boy Lawncare & Landscaping, Johnson City, Tenn., poorboylawncare.com

GENERAL CONTRACTOR:
BurWil Construction Co., Bristol, www.burwil.com

MATERIALS

More than 55,000 wire-cut red clay brick pavers were used in the restoration of King University's Oval, an iconic walkway and community space that occupies the heart of the school's main campus. The entrances to King's Chapel, Parks Hall and the E.W. King Library were included as part of the project.

The brick pavers played a key role in maintaining the 19th-century Georgian style of the Oval, which reflects the architectural theme of King University's campus. The walkway, which was first paved with bricks in 1962, had shifted and settled from decades of foot traffic and weathering, creating the need for repair and refurbishment.

"Over time, the Oval had deteriorated from long-term use and weather," says Adam Dennison, owner of Poor Boy Lawncare & Landscaping. "King University wanted the clay brick pavers to not only be durable, but also match the feel of the campus and its surrounding buildings … ."

BRICK PAVER MANUFACTURER:
General Shale, www.generalshale.com

THE RETROFIT

General Shale and Poor Boy Lawncare & Landscaping received an honorable mention in the 2017 Hardscape North America Awards for this restoration project. (Hardscape North America is a New Albany, Ind.-based Interlocking Concrete Pavement Institute event.)

Restoration of King University's Oval took place during a three-month period in the summer of 2015. The new surface does not incorporate the use of mortar, which makes the pathway durable and easy to maintain.

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PHOTOS: S-5!

OURAY SCHOOL

Ouray, Colo.

RETROFIT TEAM

ARCHITECT: RTA Architects, Colorado Springs, Colo., www.rtaarchitects.com
ROOFING CONTRACTOR: Douglass Colony Group Inc., Commerce City, Colo., douglasscolony.com

MATERIALS

The historic school's latest renovation included installation of a new standing-seam metal roof system with a snow guard system to ensure the safety of students, faculty and visitors.

Douglass Colony installed 18,000 square feet of standing-seam metal roofing. The snow guard system selected for the school is ColorGard with a Charcoal Grey insert to match the Una-Clad UC-6, a double-lock standing-seam panel. Approximately 1,600 lineal feet of ColorGard was installed. Depending on the length of the standing-seam metal panel, some sections required two or three rows of ColorGard.

"We wanted a continuous snow guard system, instead of individual plastic pieces that are screwed down through the roof," says Joel Cox, AIA, of RTA Architects. "The ColorGard is attached without penetrating the roof … . There is pedestrian traffic on three sides of the building, so preventing snow and ice from sliding off the roof was obviously important. … We have one row about 1-foot up from the eave, a second row about a quarter way up the roof and another row about midway up the roof, spaced in line with S-5! suggestions."

SNOW GUARD MANUFACTURER: S-5!, www.s-5.com
STANDING-SEAM METAL ROOFING MANUFACTURER: Firestone Building Products Co., firestonebpco.com

THE RETROFIT

The original school, which was built in 1883 when the school district was founded, was destroyed by fire in 1936. A new facility then was constructed adjacent to the original site. Additions were made to the school in the 1970s, '90s and in 2003. After a full assessment in 2014, the existing facilities were found to be structurally safe and worthy of a thorough renovation, including the addition of a standing-seam metal roof that covers the entire building, including the additions.

The project was a two-phase renovation that involved improvements to the 1936 structure. The redesigned facility includes 21st century learning spaces to support modern curriculum delivery and an emphasis on safety for all students and staff. The renovation included south and southeast vestibule additions, security upgrades, new entry steps and windows, HVAC system upgrades, a new fire-alarm system to meet current codes and the addition of a full-building sprinkler system.

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MEMORIAL STUDENT UNION

DePauw University, Greencastle, Ind.

PHOTOS: DANIEL SHOWALTER PHOTOGRAPHY

RETROFIT TEAM

ARCHITECT: Robert A.M. Stern Architects LLP, New York, www.ramsa.com

GENERAL CONTRACTOR: Turner Construction Co., Indianapolis, www.turnerconstruction.com

STRATEGIC DESIGN CONSTRUCTION: Schmidt Associates, Indianapolis, schmidt-arch.com

EXTERIOR CONTRACTOR: JC Ripberger Construction Corp., Zionsville, Ind., www.jcripberger.com

WINDOW DISTRIBUTOR: Kenny Glass Inc., Columbus, Ind., www.kennyglass.com

MATERIALS

Designed in the Georgian style, popular between 1720 and 1830, the Memorial Student Union and several other campus buildings feature steep-angled slate roofs with copper accents, hand-molded red brick, Indiana limestone and painted trim. Ultra Series doors and Majesta windows were key to meeting the campus aesthetics and sustainability goals within the student union's renovation. These same historically appropriate products were installed in a newly constructed dining hall, Hoover Hall, which was built next to the student union. The windows are very large so activity within the buildings is visible and transparent from the surrounding quad and serves to draw students into the buildings.

A custom brickmould was created by the window manufacturer for the student union and Hoover Hall. The historic building and new building also have the same PDLs, glass and finish.

DOOR AND WINDOW MANUFACTURER: Kolbe Windows & Doors, www.kolbewindows.com

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Hoover Hall, DePauw University | Greencastle, IN

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GRAND STAIRCASE, NATURAL HISTORY BUILDING | University of Illinois Urbana-Champaign

RETROFIT TEAM

ARCHITECT: LCM Architects, Chicago, www.lcmarchitects.com

- Richard Lehner, AIA, LEED AP, partner
- Jonathan Lundeen, AIA, LEEP AP, project manager
- Alec Thornton, AIA, project architect
- Todd Douglas, AIA, LEED AP, project architect
- Ewa Kolacz, interior designer

MEP/FP ENGINEER AND TECHNOLOGY CONSULTANT: IMEG, Chicago, www.imegcorp.com

GENERAL CONTRACTOR: Barton Malow, Chicago, www.bartonmalow.com

HISTORIC PRESERVATION CONSULTANT: Harboe Architects PC, Chicago, www.harboearch.com

STAIR FABRICATOR: Heritage Restoration & Design Studio, Peoria, Ill., www.heritagerd.com

MATERIALS

The stairs were custom-designed and -fabricated.

VARNISH: 275 VOC Premium Clear Conversion Varnish from Gemini Coatings, www.gemini-coatings.com

WOOD: solid white oak, quarter sawn

RAILING: The steel and glass guardrail extensions were custom-built to comply with code requirements; the glass was chosen to minimize obstructing the original woodwork.

LOUNGE CHAIRS: Krefeld by Mies Van der Rohe and Risom by Jens Risom, Knoll, www.knoll.com

TABLE: Risom Child's Amoeba by Jens Risom, Knoll

LIGHTING: Sequence pendant from Visa Lighting, www.visalighting.com

THE RETROFIT

Listed on the National Register of Historic Places, the Natural History Building has undergone three building additions since it was built in 1894. The additions created a complex of distinct structural systems and fragmented spaces. Driven by a need to stabilize the structure, there was an opportunity to unify the interior and modernize the building while reviving a historic gem during the $70 million renovation that took place between 2014 and 2017.

Among the beautiful renovations is restoration of the building's grand staircase. The original 1894 structure featured an intricate wood ceiling and symmetrical, ornate stairs from the first through fourth floors. In the 1950s, the north stair was removed to allow the installation of mezzanines and an office. The remaining south stair, though still functional, had suffered in appearance over time.

Discovering the original condition and existence of both stairs was like an archaeological dig. After sifting through historical documents and peeling away layers of physical alterations, the LCM Architects' design team presented the idea of returning the original function of the grand staircase by using historic photographs as reference to restore the existing stair and duplicate the detailed design of the wood to reconstruct its lost companion.

Harboe Associates detailed the historic decorative pattern, devised and detailed the steel under-structure, and coordinated assembly. Harboe Associates also detailed the restoration of the wood ceilings and other historic details.

Heritage Restoration & Design Studio provided superb craftsmanship in restoring the existing stair and producing its match. Each element of the existing staircase was photographed, cataloged and drawn for fabrication.

The resulting stairs are a dramatic overall statement. Entering the building from the north, visitors experience an elegant space where all architectural elements lead to the symmetrical stair. The stains and pattern of the bamboo flooring echo the strong lines of the original dark wood coffered ceiling, which was uncovered during demolition, cleaned and restored.

An unexpected and delightful surprise awaits visitors as they progress to the second level. The intricately carved wooden stairs come alive against a field of light-colored walls and an open, brightly illuminated well. Multiple collaborative zones, defined by different colors and patterns of bamboo flooring, are furnished with classic modern pieces in nature-inspired colors and fabrics with occasional accents of red.

The entire Natural History Building project received a 2018 Heritage Award from the Preservation and Conservation Association, Champaign, Ill.

PHOTOS: SCOTT MCDONALD, GRAY CITY STUDIOS

ALEXANDER II MAGNET SCHOOL | Macon, Ga.

PHOTOS: MCELROY METAL

RETROFIT TEAM

ARCHITECT: Edifice Consulting, Byron, Ga., (478) 954-3971

ROOFING CONTRACTOR: Pittman Waller Roofing, Macon, www.pittmanwaller.com

MATERIALS

Multiple problems, including an aging structure and a failing asphalt roof, led Bibb County Schools representatives to recover the roof of historic Alexander II Magnet School with the 138T symmetrical standing-seam metal roof.

"During an assessment, we discovered that the asphalt shingles were installed with no ventilation and heavy insulation," says Jody Usry, president of Edifice Consulting. "It was designed for metal so with no ventilation, the shingles were burning up. And there was so much expansion and contraction that the nails were backing out in spots. It was decided that the best thing to do was retrofit with metal."

The 138T standing-seam system allows metal roofing to be installed directly over asphalt shingles without an underlayment and without tear-off. The system is designed around the patented clip paired with the company's 138T symmetrical standing-seam panel. Measuring 1 3/8-inches tall, the 138T is a two-piece mechanically seamed metal roof system.

A 3/4-inch airspace combined with vented eave and ridge material provide uninterrupted airflow between the two roofs, known as above sheathing ventilation, or ASV. Testing at Oak Ridge National Laboratory, Oak Ridge, Tenn., demonstrates a free-flowing airspace between a metal roof and shingles can reduce heat transfer by 30 to 50 percent.

Usry notes there were flat roofing areas with an internal gutter that were recovered with new decking and sloped to allow water to flow to an external gutter. Modified bitumen was applied over existing modified bitumen at low-slope areas after thermal scans were done to identify wet insulation. All internal gutters were replaced.

Pittman Waller Roofing installed the modified bitumen and 27,500 square feet of the 138T 24-gauge panels in PVDF Ash Gray. The panels were formed at the McElroy Metal manufacturing facility in Peachtree City, Ga. Because some spots of the decking were sagging, the roofers had to "shim" the roofing with 18-gauge framing.

STANDING-SEAM METAL ROOF SYSTEM MANUFACTURER: McElroy Metal, www.mcelroymetal.com
MODIFIED BITUMEN MANUFACTURER: Johns Manville, www.jm.com

THE RETROFIT

Alexander II Magnet School was completed in 1902. Several significant additions through the years have brought the entire facility up to 41,650 square feet. In June 2000, the school was named to the 11 Most Endangered Historic Places list created by the National Trust for Historic Preservation, Washington, D.C.

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JOHN STEWART MEMORIAL LIBRARY

Wilson College, Chambersburg, Pa.

RETROFIT TEAM

ARCHITECT: Murray Associates Architects PC, Harrisburg, Pa., murrayassoc.com
GLAZING CONTRACTOR: Harrisburg Glass, Shiremanstown, Pa., hbgglass.com
GENERAL CONTRACTOR: Mowery, Mechanicsburg, Pa., rsmowery.com

MATERIALS

Featured on this project are the YCW 750 OG curtainwall, YES 45 TU storefront, medium-stile swing doors and Therma-Shade sunshades.

CURTAINWALL, STOREFRONT, SWING DOORS AND SUNSHADE MANUFACTURER: YKK AP, www.ykkap.com

THE RETROFIT

As part of a $12 million rehab of the existing 1925 library at Wilson College, an outdated addition was razed and replaced. The limestone façade brings together the old and new.

PHOTOS: COURTESY OF YKK AP

SANTA RITA UNION SCHOOL DISTRICT | Salinas, Calif.

RETROFIT TEAM

CONSULTANT: EcoMotion, Los Angeles, ecomotion.us
ENGINEER: Sharp Electronics Corp., Montvale, N.J., www.sharpsmartstorage.com, and Black & Veatch, Overland Park, Kan., www.bv.com
DESIGN-BUILD CONTRACTOR: MBL-energy, San Jose, Calif., www.mbl-energy.com
FINANCIER: Generate Capital, San Francisco, www.generatecapital.com

MATERIALS

Solar power systems and SmartStorage energy-storage systems have been installed at six sites within the Santa Rita Union School District (SRUSD). The systems will provide up to seven hours of power at each school during a grid outage and will offset the school's energy and demand usage, resulting in substantial savings on its utility bills. These multi-campus systems will enable the schools to support the local Salinas community as Powered Emergency Response Centers in the event of disasters that cause prolonged outages.

The intelligent energy-storage solution pairs with solar PV systems to work synergistically, reducing utility costs by pulling power from the SmartStorage batteries rather than from the utility at the times of highest demand, an operation that is well suited for facilities where utility bills are often one of the highest expenses. In the case of a grid outage, software will enable the transition to microgrid operation with only modest disruption to school operations. This capability helps shield the district from grid outages caused by rolling blackouts, brownouts, or severe weather events and minimizes disruptions to the school day for students, parents and faculty.

PHOTOS: SHARP ELECTRONICS CORP.

In total, the SRUSD systems include 1 megawatt of solar PV that is integrated with 1.1 MWh of SmartStorage behind-the-meter energy storage systems.

ENERGY STORAGE SYSTEM MANUFACTURER: Sharp Electronics Corp., www.sharpsmartstorage.com

THE RETROFIT

SRUSD recently hosted a ribbon-cutting at one of its sites facilitated by its consultant, EcoMotion. EcoMotion envisioned the project as a means of getting SRUSD the resiliency that it sought by combining batteries with ubiquitous solar power.

"California school districts face extremely challenging budgeting situations and any reduction in operational expenses can directly translate into money for teachers, books or supplies," says Dr. Shelly Morr, SRUSD's superintendent. "It is also important for our community that schools aren't impacted by events, such as power outages, as this disrupts not just the school day, but parents having to leave work early or scramble to make other arrangements for their children. We're excited to see these clean energy systems implemented on our school campuses."

ALFRED UNIVERSITY'S NEW YORK STATE COLLEGE OF CERAMICS

Alfred, N.Y.

RETROFIT TEAM

ARCHITECT: NBBJ Architecture, Boston, www.nbbj.com
MASON: King Brothers Construction, North Java, N.Y., (585) 535-7526

MATERIALS

NBBJ Architecture was faced with a design challenge at Alfred University's New York State College of Ceramics (NYSCC). A creative concept helped transform an addition to the 1952 McMahon Engineering Building into a work of art with a theme reflective of the ceramics art and science curriculum.

The building would hold the NYSCC's sensitive imaging equipment used in creating ceramic artwork and lab testing engineered ceramics. But the design team at NBBJ envisioned a broader purpose for this space. "Our goal was to give some character to what could have been a simple concrete box," says William Voulgaris, AIA, NBBJ principal and architect. "In trying to be relevant to the ceramic school, we wanted to use an unconventional, forward-thinking material in the design."

The college originally wanted the building to be tiled with actual ceramics, which was impractical because the tiles would not hold up to the weather or normal wear and tear. Instead, NBBJ Architecture specified glazed block, which has the advantages of masonry but with the illusion of ceramic tile. The architects vertically placed Astra-Glaze SW+ in a random pattern. When scored down the center, the product looks like ceramic material. Bold colors add to the illusion.

The units are pre-faced architectural concrete masonry blocks featuring a thermoset glazing compound permanently molded on one or more faces. This exterior is cured and heat-treated to create an impervious surface that repels water and resists mold, is easy to clean and installs in one step. It also is resistant to graffiti and has a four-hour fire rating.

"At first, we were a little concerned about how the glaze facing on the blocks would weather in New York's extreme environment," Voulgaris adds. "However, Echelon representatives showed us some good examples of past performance on other building façades and came up with solutions to help make it easier for the masons to lay the block as designed." The product was used for the entire outer face of the building and for common areas on interior walls.

GLAZED BLOCK MANUFACTURER: Echelon Masonry, www.echelonmasonry.com

PHOTOS: ECHELON MASONRY

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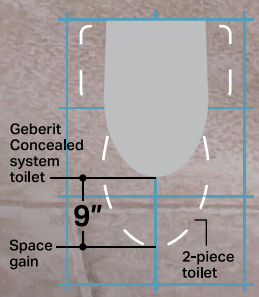

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OAKDALE JOINT UNIFIED SCHOOL DISTRICT | Oakdale, Calif.

RETROFIT TEAM

CONSTRUCTION MANAGEMENT: Oakdale Joint Unified School District, www.ojusd.org

- Dan Casey, director of Maintenance and Operations

ARCHITECT: Pratt Architecture, Modesto, Calif., prattarch.com

- Alisa Cota

INTERIOR DESIGN: Lionakis, Sacramento, Calif., www.lionakis.com

- Bianca Dyke

GENERAL CONTRACTOR: ACME Construction Co. Inc., Modesto, acmeconstruction.com

- Mike Mastagni

MATERIALS

The following materials were used in Fair Oaks and Cloverland elementary schools' library/media centers:

LIGHTING: Finelite (recessed linear lighting), www.finelite.com; Molto Luce (pendant lighting at Fair Oaks), moltoluce lighting.com; Philips Lightolier (can lighting in soffits), www.lightingproducts.philips.com; and Visa Lighting (pendant lighting at Cloverland), www.visalighting.com
CARPET TILE: Mohawk, www.mohawkflooring.com
PAINT: PPG, www.ppgpaints.com
FIBER-REINFORCED LAMINATE WALL PANELS: Nevamar, Panolam Surface Systems, panolam.com/nevamar
TACKABLE WALL PANELS: Anchorage (Cloverland) and FR701 (Fair Oaks), both from Guilford of Maine, www.guilfordofmaine.com
ACOUSTIC CEILING: Ultima Create!, Wood Looks, bamboo veneer finish from Armstrong Ceiling & Wall Solutions, www.armstrongceilings.com
PLASTIC LAMINATE: Pionite, Panolam Surface Systems, panolam.com/pionite, and Wilsonart, www.wilsonart.com

THE RETROFIT

After building new cafeterias at Fair Oaks Elementary and Cloverland Elementary, the schools were left with unused multipurpose rooms. The space at Fair Oaks was 3,600 square feet while Cloverland's room was 2,800 square feet. School district representatives opted to convert these rooms into library/media centers.

"Because we are a pretty rural agricultural community, the color scheme was based on nature with Fair Oaks representing the sky with blues and purples and yellow for the sun. Cloverland was Earth-based with multiple green tints," explains Dan Casey, director of Maintenance and Operations for the school district.

Susan Dyke, the district's chief business officer, worked with Lionakis to find playful but useful furniture for the spaces. For example, ottomans are on wheels and both schools' library/media centers feature amphitheater seating. "The first day the library opened, the amphitheater seating was like a magnet to the students," Casey recalls. "They quickly grabbed a book and went and laid down or sat on the seating." Making the walls graphically interesting and creating curved soffits also adds to the environment.

Both library/media centers were completed in only 66 days.

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SCHOOL OF VISUAL ARTS MFA PHOTOGRAPHY/ VIDEO | New York

RETROFIT TEAM

ARCHITECT: Spacesmith, New York, www.spacesmith.com
STRUCTURAL ENGINEER: Engineering Group Associates, New York, (212) 982-1410
CODE CONSULTANT/EXPEDITOR: Burnham, New York, www.burnhamnationwide.com
SURVEY: ECS Group, Lake Hopatcong, N.J., www.ecs-cadcafm.com
INFORMATION TECHNOLOGY/AUDIOVISUAL: Backhaul Engineering LLC, Fairfield, N.J., www.backhauleng.com
MECHANICAL ENGINEER: EP Engineering LLC, New York, www.epengineering.com
GENERAL CONTRACTOR: DiGiacomo & Son, New York, (212) 704-0750

MATERIALS

The following materials were used in the project:
MOVABLE WALL AND CLERESTORY WINDOWS: Custom made by DiGiacomo & Son, (212) 704-0750
TACKABLE SURFACE AND ACOUSTIC FABRIC-WRAPPED PANELS: Maharam, www.maharam.com
ACOUSTIC PANELS: Robin Reigi Inc., robinreigi.com
PERFORATED METAL: Alpro, www.gordon-inc.com/acoustics/walls/panels
MINERAL FIBER COMPOSITE CEILING: Armstrong Ceiling & Wall Solutions, www.armstrongceilings.com
ACOUSTICALLY RATED DOORS: MegaMet Industries, www.megametusa.com
CEILING-HUNG ACOUSTICAL BAFFLE SYSTEM: Kirei, kireiusa.com

THE RETROFIT

School representatives engaged Spacesmith to renovate their popular MFA Photography program, which occupies the 6,000-square-foot ground floor of a former warehouse building. The project was divided into two phases: the first addressing all classroom, studio, faculty and common spaces; the second, a new multipurpose area connecting the façade to the interior.

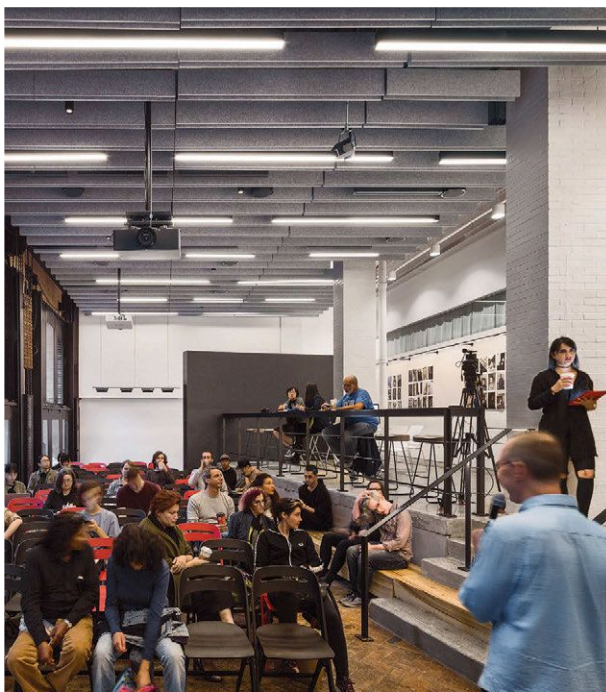
The challenge was to marry high-traffic student areas with accessible, yet private faculty offices, focusing on air, light and sound control. Spacesmith reorganized the program by creating a circulation path that intuitively flows in and out of student hubs and faculty spaces.

At the department entrance off the building's core, circulation splits. One pathway leads to the instruction and production areas, including two acoustically isolated editing rooms and a customized shooting studio. The other path leads to faculty offices separated from noise and activity. Both then meet at the front of the building and pour into the former loading dock located at street level 3-feet below. This unused area created a new programmatic element—a multipurpose meeting and gallery space now visible to the public after opening the façade, which had been sealed for decades. About 2,000 square feet were gained, allowing the program to expand its offerings.

The polished concrete floor of the interior level extends diagonally into the loading dock, creating storage underneath, and is flanked by a freestanding movable wall. With a tackable surface and large industrial hinge, this wall provides pin-up space and can unfold to divide the room in two. Spacesmith highlighted the building's industrial heritage in this space through use of reclaimed wood and blackened steel materials, as well as preservation of the original herringbone brick floor. Reclaimed wood benches on rollers and a small stair connect the upper and lower levels, creating additional seating for events.

Three steel garage doors at the building's façade were replaced with a glass storefront, creating a stronger street presence and allowing natural light into back-of-house spaces through corridors and clerestory windows of offices and classrooms.

PHOTOS: ALEXANDER SEVERIN, COURTESY SPACESMITH




Pipilotti Rist Retrospective at Kunsthaus Zürich

PHOTO: ALISE O'BRIEN PHOTOGRAPHY

BERGES FAMILY GIRL SCOUTS PROGRAM CENTER | Maryland Heights, Mo.

RETROFIT TEAM

DESIGN: Oculus Inc., St. Louis, oculusinc.com
- Lisa Bell-Reim
- Hannah Rohlfing
- Joanne Fields
- Christy Johnson
- Rob Forney

GENERAL CONTRACTOR: McGrath and Associates Inc., St. Louis, www.mcgrathconstruction.com

MATERIALS

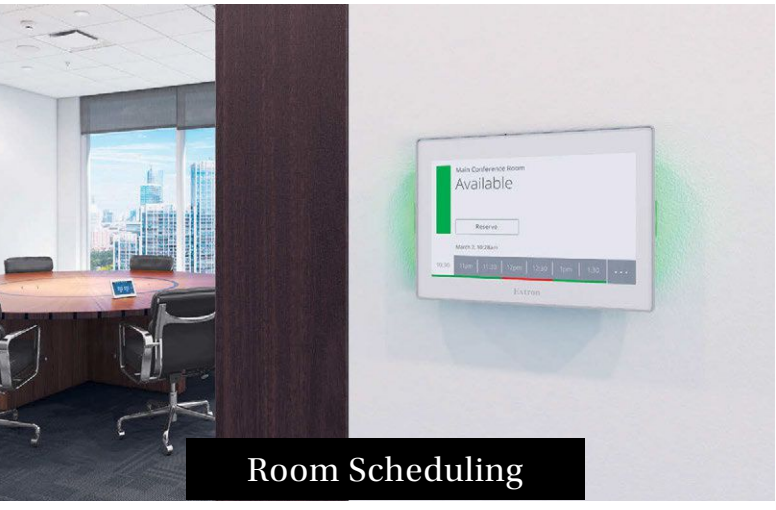
The following materials were used in the project:
CABINETS: Wilsonart, www.wilsonart.com
CAFETERIA FURNITURE: SitOnIt Seating, www.sitonit.net
CARPET: Interface, www.interface.com
CEILINGS: Armstrong Ceiling & Wall Solutions, www.armstrongceilings.com
CERAMIC TILE: Crossville, crossvilleinc.com, and Daltile, www.daltile.com
CLASSROOM FURNITURE: Safco, www.safcoproducts.com
FLOORING: Johnsonite, www.johnsonite.com
LIGHTING AND ACCESSORIES: Focal Point, www.focalpointlights.com
LOUNGE FURNITURE: Knoll, www.knoll.com
MULTIPURPOSE-AREAS FURNITURE: National Public Seating, www.nationalpublicseating.com
OFFICE FURNITURE: Borgo, borgo.com
PAINT/WALLCOVERINGS: Sherwin-Williams, www.sherwin-williams.com

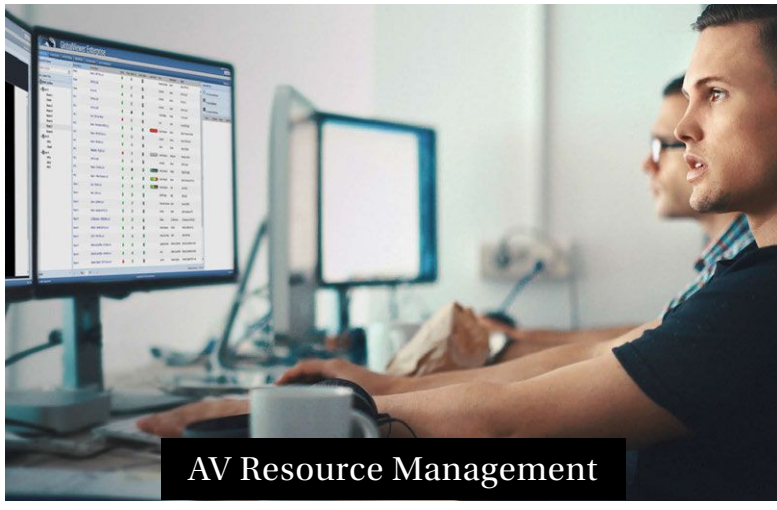
THE RETROFIT

Adjacent to the Girl Scouts of Eastern Missouri's headquarters, the new Berges Family Girl Scouts Program Center is housed in what once was a vacant office. The space now features learning areas, including a science lab, robotics lab, an open learning kitchen, and group/teaming spaces. The expansion invites rural, suburban, and urban girls of all ages and skill levels to interact; take on leadership roles; and participate in premier activities and events, including many delivered through partnerships with businesses and community organizations.

Vibrant pops of color, a seating Keva, suspended round light fixtures, acoustical ceiling "clouds" and a glass feature wall are highlights of the 6,000-square-foot space. Oculus' design team came up with various solutions to keep the project within budget, such as utilizing existing partitions and doors, negotiating discount pricing on finishes and fixtures on behalf of the client, maximizing design impact with paint, working closely with the general contractor for value-engineering concepts, and discussing possibilities of shared restroom counts with code officials.

The center, which has been fully booked since its completion in April 2016, has been awarded the 2018 St. Louis at Home's Architect & Design Awards—Commercial Space Finalist from *St. Louis* magazine and 2017 American School and University Outstanding Design award: Community Use from *American School and University* magazine.





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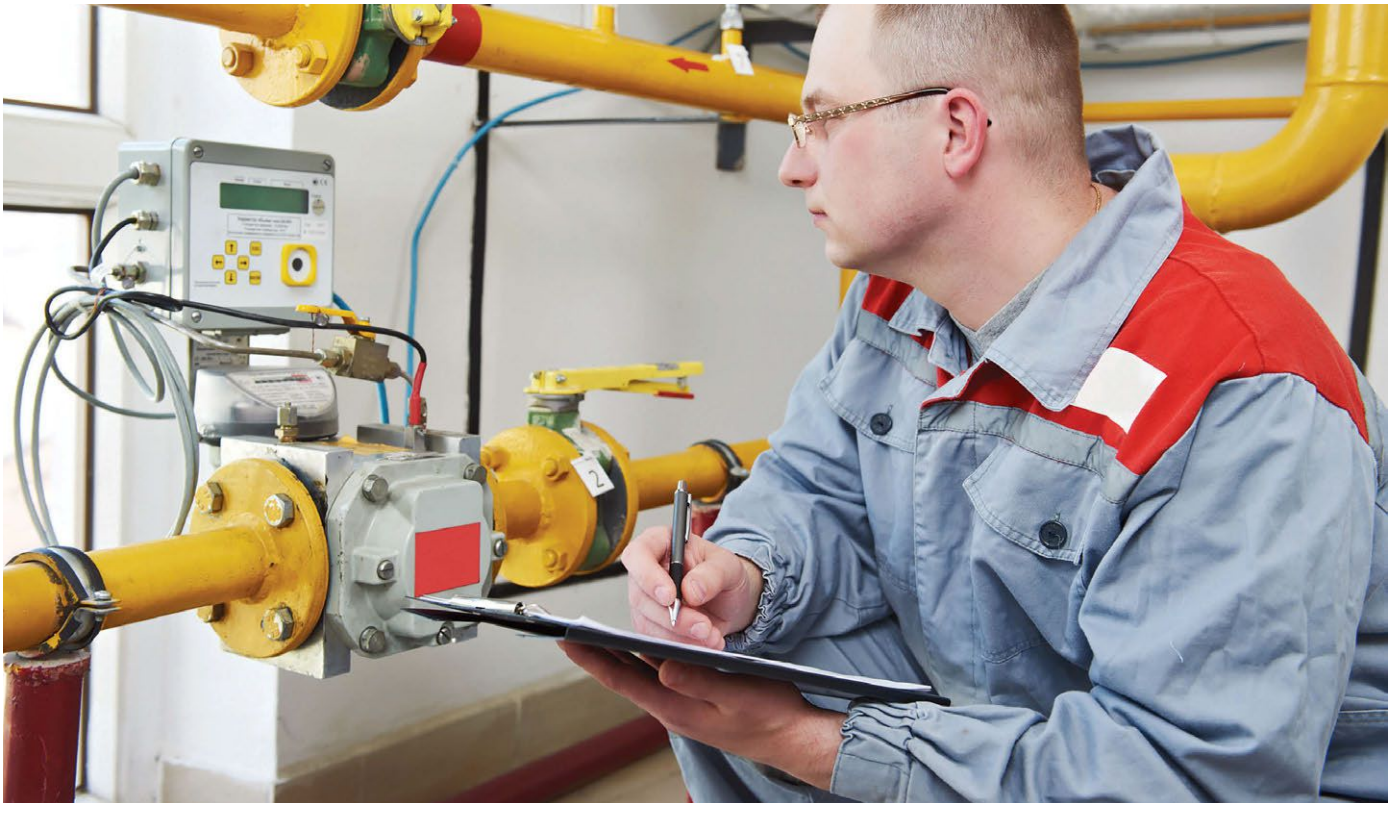
ASHRAE Audit Reboot



Audit Levels 1, 2 and 3 Are Changing; Here's What You Need to Know to Maximize the Success of Your Next Retrofit

WRITTEN BY | **JIM KELSEY, P.E., BEAP**

Energy audits are a cornerstone of retrofit practice and an important first step for assessing potential energy and cost savings in your building. The quality of an audit is vital to identifying useful and practical retrofits. With the release of ASHRAE's Standard 211, Standard for Commercial Building Energy Audits, which has updated ASHRAE Audit Levels 1, 2 and 3, getting the most valuable work product for your next energy retrofit just got easier.

Reasons for the Update

With mandatory energy audit programs increasing around the country, audits are in the spotlight, including their benefits and pitfalls. In cities, like New York and San Francisco, that have adopted these ordinances, there has been an influx of audit requests and many new contractors offering audit services. This has created price pressure on energy audits, resulting in highly variable audit quality.

The decline of audit quality and price pressure is a growing concern resulting, in part, from vendors who have different interpretations of the scope of work. "What is an energy audit?" becomes a critical question. The answer needs to be clearly defined. Otherwise owners can be left comparing prices from very experienced vendors who have led lots of retrofit projects and deliver the entire scope of work versus an inexperienced, low-cost team that spends a short time onsite and delivers a less credible, less complete product.

The idea of three audit levels, originally defined in ASHRAE's Procedures for Commercial Building Energy Audits, has been a victim of its own success. Building owners and regulators have used the concept of ASHRAE Audit Levels 1, 2 and 3. However, few dove into the exact scope of work implied by each level.

The intention behind defining different audit levels was to agree on standardized scopes of varying depths. The problem was that the original publication wasn't written as a standard and left a lot of room for interpretation. That "wiggle room" created

a lot of variation among vendors and their work products.

The release of ASHRAE Standard 211 - 2018 was intended to bring order to the chaos of the energy audit market by giving building owners and policymakers firm guidelines about what to expect from an audit and who should conduct them, eliminating ambiguity. For industry members, it's a means of protection, so our entire field doesn't suffer from a lack of trust rooted in the shoddy workmanship of a few. As a result, the standard defines, in code-enforceable language, exactly what each level entails in terms of procedures and reporting.

Here's a summary of what you need to know whether you're contracting for energy audits or conducting them:

LEVEL 1: SCOPING

Level 1 is all about determining savings potential at the facility. It identifies how a building performs compared to its peers; what savings potential one can address in a quick, low-level effort; and where there are likely energy-saving opportunities to investigate further. It's considered a low-cost first step or sometimes all that is appropriate for a small facility.

WHAT'S CHANGED

Level 1 now is largely qualitative. This level always has been tricky because the prior guidance asked for energy-saving numbers for no- and low-cost measures. It's very hard to maintain the intended limited scope and cost if you start doing calculations. So the standard has made it clear that energy-efficiency recommendations for Level 1 are purely qualitative. Auditors are only required to assign "high", "medium" and "low" to the measure savings, cost and priority.

The only analysis that is required under the new Level 1 definition is to sum up historical energy consumption and benchmark the site. That includes reporting the Energy Use Intensity (EUI in kBTU per square foot per year or MJ per square meter per year) of your building and a peer group of your choosing. This avoids the potential complication (and cost) of assigning numbers to savings, costs and paybacks.

ASHRAE Audit Levels 1, 2 and 3 in Brief

LEVEL 1: A quick (inexpensive) scoping study to estimate the potential for energy savings in a building and how the building compares to peers.

LEVEL 2: What most people expect from an energy audit—site-specific measures with estimates of energy and cost savings. Includes useful background information, such as historical energy consumption and an estimate of the consumption by end use (HVAC, lighting, plug loads, etc.).

LEVEL 3: A more detailed development of measures the owner is interested in pursuing with a deeper level of measurements, calculations and preliminary design elements to reduce uncertainty in savings estimate, refine costs and minimize risk.

LEVEL 2: THE BASIC ENERGY AUDIT

Level 2 is what most people expect when they ask for an energy audit. It requires site-specific recommendations, costs, savings and economics. It also includes important background details that help the owner determine that the auditor:

1) Understands the building.
2) Understands the energy costs at the site.
3) Provides a solid description of recommended measures.

In short, the audit should provide the owner the guidance he or she expects from an energy assessment.

WHAT'S CHANGED

Level 2 now has a quality-control step built in. The reporting forms require the auditor report energy savings as a percent of the base-case energy use of the primary fuel the measure impacts. Essentially, it requires the most basic level of quality control: How do my savings numbers compare to the base-case energy use?

Most well-qualified energy auditors already do some version of this check. This requirement eliminates the worst-offending energy-savings estimates—where the recommendation saves more than the base case uses. The approach also "flags" measures with very high savings estimates as something to double check.

LEVEL 3: TRANSITION TO PROJECT DEVELOPMENT

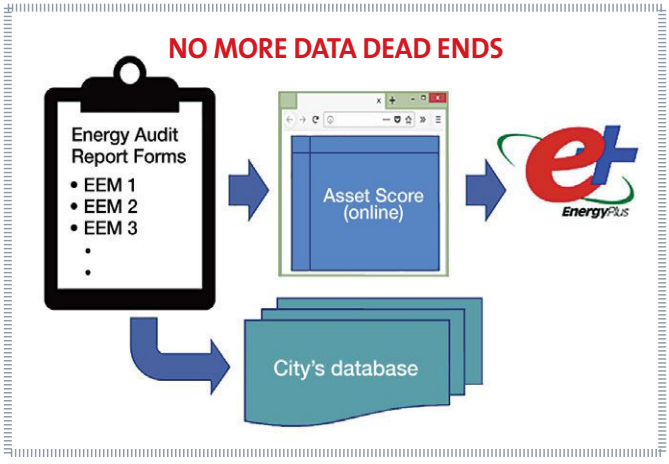
Level 3 is really the beginning of project development and seeks to minimize risks through more thorough analysis and measurement to improve estimated savings and costs. It's expected to run into higher costs. Level 3 generally is not recommended as a first step because it adds real cost to the project being considered. It's a step building owners wouldn't normally take unless they're pretty sure the project looks compelling.

WHAT'S CHANGED

Short answer: not a lot. The main thing is the standard explicitly and clearly defines requirements for items, such as:

- Life-cycle cost analysis.
- Schematic diagrams for proposed retrofits (exception for like-for-like retrofits).
- Detailed measurement or modeling.
- A simple risk assessment for the impact of key assumptions.

The requirement to provide a schematic diagram of the installation is essentially another quality-control check to ensure the proposed project fits the physical requirements of the facility. This step may cause the auditor to ask questions he or she hadn't previously considered carefully, such as "Will the boiler fit through the door?".



Easier Data Transfer

Wouldn't it be great if data were available for analysis, rather than in PDFs and spreadsheets all over the country?

One of the optional parts of the standard that is very exciting is the collaboration with BuildingSync developers (a collaboration among the Washington, D.C.-based U.S. Department of Energy's national energy labs) to facilitate energy audit data transfer between different platforms and applications. (Learn more about BuildingSync at buildingsync.net.) BuildingSync is "a standard language for commercial building energy audit data that software developers can use to exchange data between audit tools." It's important to remember that BuildingSync is a language, not a tool.

> The release of ASHRAE Standard 211 - 2018 was intended to bring order to the chaos of the energy audit market by giving building owners and policymakers firm guidelines about what to expect from an audit ... .

The good folks at the National Renewable Energy Laboratory in Golden, Colo., built a tool to take data from the standard's required forms and interpret it into BuildingSync-compatible code. This enables fast and easy data transfer using tools, like Asset Score, which many cities are using as the reporting platform for mandatory audits. Once you've uploaded your audit data and building characteristics in Asset Score, you then can output some of that data into a draft building model for OpenStudio, the free user interface for EnergyPlus, which replaces the DOE-2 building energy simulation engine. OpenStudio and EnergyPlus also were developed through collaborations between the DOE's national labs, academic institutions and private firms.

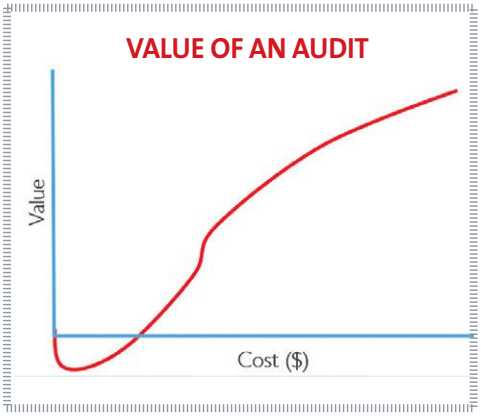
Who Can Conduct Energy Audits?

Virtually everyone providing input to the standard development agreed on one thing: The qualifications of the energy auditor are some of the most important determinants of the value of an energy audit. The problem was nearly everyone had different ideas about who was qualified. If you asked folks who is qualified to conduct energy audits, the answer was, and I'm paraphrasing, "Me".

In the end, the standard defines the qualifications with a balance toward those with engineering expertise, those with demonstrated knowledge and those who practice day to day. Furthermore, the standard relies on DOE's Better Buildings Workforce Guidelines (bit.ly/2mU4Tg5) as an independent evaluator of appropriate certifications for building energy auditors and energy managers. Under ANSI guidelines, ASHRAE couldn't endorse its own Building Energy Assessment Professional (BEAP) certification because others offer similar certifications.

The Cost-to-value Relationship of Energy Audits

Having clearly defined levels, a qualified energy auditor and understanding the cost-to-value relationship is essential to getting what you expect and pay for from an energy audit. The relationship is not a linear one though. In fact, it has a cliff on the low-cost side. In other words, if you pay half as much for an energy audit, you don't get half the value and you might not get any value at all—or worse—negative value, such as costly, poor advice.



That cliff stems from the time your energy auditor spends on the project and his or her skill used to assess the costs and benefits. The new energy-efficient chiller won't halfway fit through the door to the mechanical room; it simply won't fit. In addition, if you knew upfront the retrofit you implemented would only realize half the estimated audit savings and cost twice as much, you likely wouldn't have pursued the project. One surefire way to weed out the inexperienced and invaluable is to ask for redacted sample audit reports that will reveal what you'll really get for your money.

A Good Investment

Whether your city requires energy audits or you're interested in energy and cost-saving retrofits, keep in mind the new energy audit standard with the cost-to-value relationship so you can make the best choice. Sure, for mandatory audits it's appealing to meet the letter of the law with a low-cost bidder and be done. But don't be surprised if your audit report offers no real value. When you are considering the benefits of lowering your operational costs and increasing property value by saving energy, consider paying more for an experienced vendor—one who provides a work product that has real value by identifying low-cost savings opportunities and good investment opportunities that meet your own financial criteria and building needs. In that case, you're likely to find energy savings that more than pay for the difference, and you won't be disappointed.

Order ASHRAE Standard 211 - 2018, Standard for Commercial Building Energy Audits, at bit.ly / 2Kw4NVh.

A PLACE OF THEIR

WRITTEN BY | **GLADYS LY-AU YOUNG, AIA**

Westside School, an independent pre-K through eighth-grade school in southwest Seattle, had never lived in a home of its own. The school instead had adapted to and grown in spaces leased from area public school districts since its 1981 founding. But in 2013, with an ambitious academic and co-curricular program for 360 students in place, and a current lease nearing its expiration date, the school was ready to settle into a permanent home and create a facility designed around collaboration, creativity and community.

With its striking perpendicular arched structures, the Hillcrest Presbyterian Church complex had been nestled in a residential neighborhood near the school since the early 1970s. Two large-volume buildings—the sanctuary and a gym—were connected by a 1-story entry lobby. The 45-foot-tall soaring sanctuary was dramatic but drafty, a cavernous and energy-inefficient facility poorly insulated and expensive to heat for a dwindling congregation. An early childhood education program occupied space in the gym building, providing some daytime life and activity, but the complex sat mostly unused, and the site had become unsafe afterhours.

But Westside School saw in the well-worn church a possibility for rebirth. When the church found an opportunity to co-locate nearby, the school was ready to take on the retrofit of the buildings and create the educational space it needed. The vaulted wood roof structures of the church would be resurrected as a school—the new home for Westside School.

Transforming a Church into a School

As stewards of the next generation, Westside School was committed to reusing the existing church structure as much as possible and minimizing the embodied energy used in new construction. But how does one reinvent two large and drafty structures as a progressive, energy-efficient and modern educational facility?

The challenge involved repurposing the existing nave and gym space comprising the arched perpendicular wings of the church and connecting them with a new entry foyer so the seemingly separate spaces—old and new—could function as a unified school.

The church's wishbone-shaped nave with its 45-foot glulam arches became

OWN

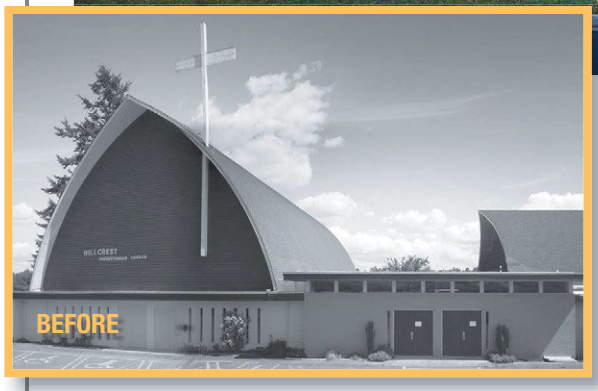
An Independent School Finds Opportunity for Progressive Learning Spaces in a Well-worn Church

the departure point for the design team's imagination. Seattle-based Sundberg Kennedy Ly-Au Young Architects, commonly referred to as SKL, worked with the school community to determine the most effective and cost-efficient way to preserve and adapt the large spaces and arches, as well as accommodate programming functions the school required: classrooms, library, lunchroom, offices and storage, auditorium and gym.

Inserting an educational program into the unique structure involved the reconfiguration of the existing 35,000 square feet comprising the church's three buildings. Demolition stripped the nave building down to its core arched structure, removing flanking structure but preserving the flooring. The existing gym, with its smaller wishbone vault and wood floors, also was preserved. The 1-story entry building was demolished. In both preserved buildings, existing church offices, meeting spaces, daycare rooms and a kitchen were transformed into the classrooms, offices, support space, lunchroom and storage spaces the school

Two levels of new classrooms layered on the front façade help "de-sanctify" the former church, providing a street view that reads "school".

PHOTOS: **BENJAMIN BENSCHNEIDER** unless otherwise noted



In the church's nave, SKL architects advantaged the unique wishbone shell to create large open spaces for new school functions. The glulam beams were cleaned and left exposed to the ground level, serving as the building's visible backbone.

needed. Dark basement hallways and spaces were brightened and lightened.

In the church's nave, SKL architects advantaged the unique wishbone shell to create large open spaces for new school functions. The glulam beams were cleaned and left exposed to the ground level, serving as the building's visible backbone. A new floor was inserted into the nave volume at what had been the choir loft level, providing around 8,500 square feet of classrooms below. The remaining vaulted 35-foot tall space was brightened with skylights and glazing to advantage north/south sun exposure and improve daylighting. Open gathering spaces were created in the 11,000 square feet of large volume area: a 450-person auditorium with rehearsal spaces at one end, an 1,100-square-foot Technology and Literacy Commons (library) and two language learning classrooms at the other. The arched ceiling now provides architectural drama in performing-arts spaces and light-filled open areas for the library.

Wrapping the existing sanctuary building, approximately 20,000 square feet of new space was added, expanding the classroom space. The two levels of classrooms layered on the front façade help "de-sanctify" the former church, providing a street view that reads "school".

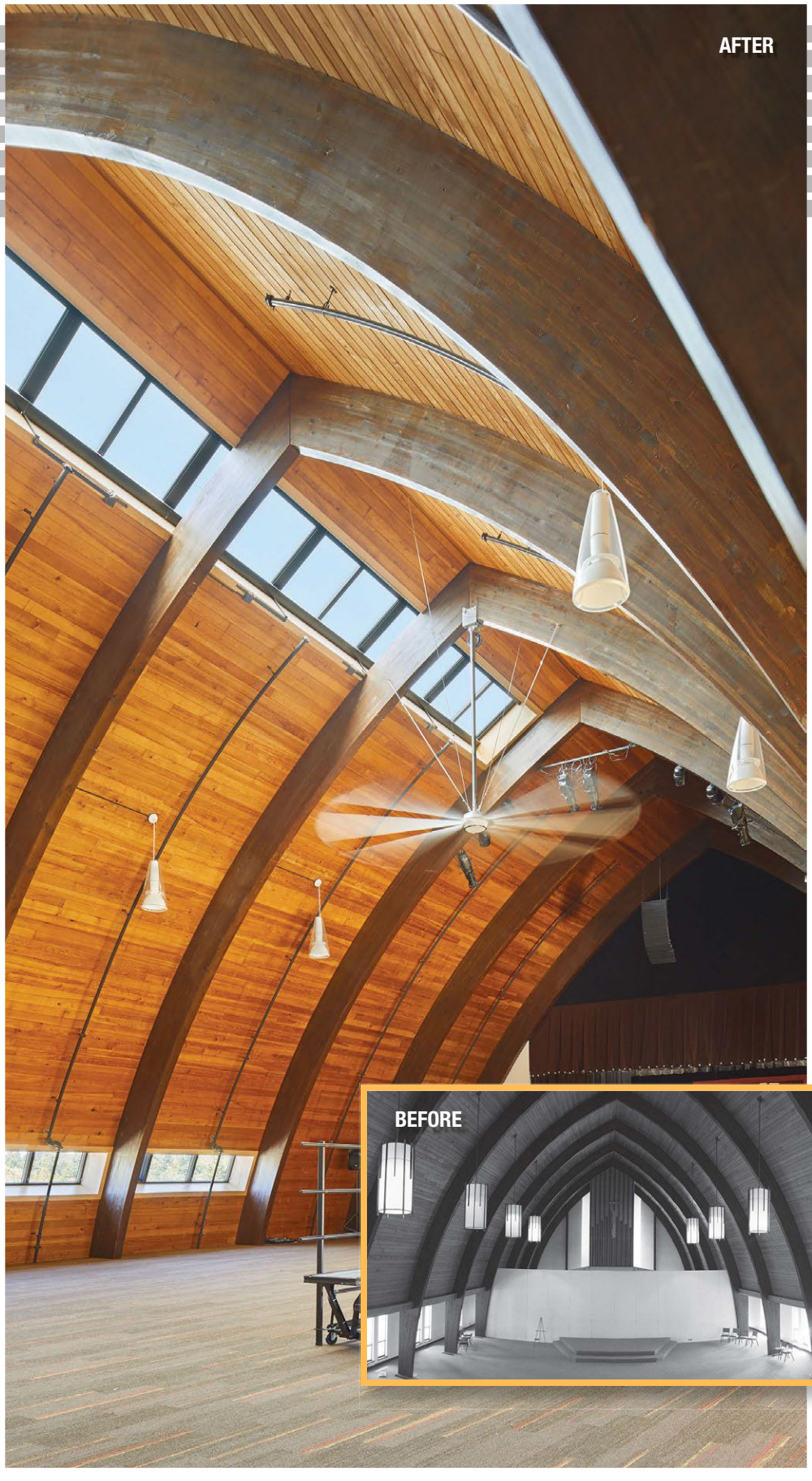
A new central lobby and welcoming point was designed to further redefine the school. The new entry "Commons"—a 2-story glass box—links the two arched wings of the school and serves as the connection nexus: up, down, out, within and through. Upon entry, the transparency of the glass provides a view to the whole building, itself an education in the connection of old to new.

Collaboration, Creativity and Community

A 2007 Washington, D.C.-based U.S. Department of Education survey found that 43 percent of schools in the U.S. see the condition of their buildings as "interfering with the ability of the school to deliver instruction." The effects of such conditions were reported to range from lower student achievement to reduced teacher productivity. Retrofitting and repurposing an old, underutilized building allowed Westside School to create a school building that contributed to the overall academic success of a student.

To design functional spaces at Westside School, SKL's design team brought teachers together to discuss progressive learning environments for better learning outcomes. From those discussions the team set out to optimize functional relationships; for example, putting smaller spaces next to larger spaces so they can overflow as needed. The team also sought to maximize energy efficiency by designing the building to function well, actively and passively.

Twenty-seven large light-filled classrooms house two classes per grade, plus



DURING

↔ Retrofit Team

ARCHITECT // Sundberg Kennedy Ly-Au Young Architects, Seattle, sklarchitects.com

- Gladys Ly-Au Young, principal in charge
- Wing-Yee Leung, project architect
- Rick Sundberg, associate principal
- John Kennedy, associate principal
- Frances Nelson, architectural designer
- Myra Lara, architectural designer
- Nicole Lew, architectural designer and graphics

ENVELOPE DESIGN // RDH, Seattle, www.rdh.com

STRUCTURAL ENGINEER // Quantum Consulting Engineering, Seattle, www.quantumce.com

CIVIL ENGINEER // PACE Engineers, Kirkland, Wash., www.paceengrs.com

MECHANICAL ENGINEER/ENERGY ANALYSIS // Ecotope, Seattle, ecotope.com

LIGHTING // Pacific Lighting System, Kent, Wash., (206) 323-2200

ACOUSTICS // BRC Acoustics & Audiovisual Design, Seattle, www.brcacoustics.com

STAGE (DESIGN-BUILD) // Stagecraft Industries, Seattle, www.stagecraftindustries.com

LANDSCAPE ARCHITECT // Thomas Rengstorf and Associates, Seattle, www.thomasrengstorfassociates.com

GEOTECHNICAL ENGINEER // Terra Associates, Seattle, www.terra-associates.com

CONTRACTOR // Kirtley Cole, Seattle, www.kirtley-cole.com

MECHANICAL DESIGN-BUILD // Emerald Aire, Seattle, www.emeraldaire.com

ELECTRICAL DESIGN-BUILD // Prime Electric, Seattle, www.primeelectric.com

PLUMBING DESIGN-BUILD: Holmberg Co., Seattle, www.holmbergco.com

FIRE SAFETY DESIGN-BUILD // Smith Fire Systems, Fife, Wash., www.smithfire.com

PHOTO: LARA SWIMMER

a middle school program. The wrapping addition combined with existing interior spaces to make larger classrooms and provide additional daylight. Cutting through the classroom spaces, the glulam arches mark the juncture of old and new structures and the divide between active and passive learning spaces. Each classroom is designed with two types of learning space: more traditional formal desk arrangements in the internal (original) structure and flexible learning areas for hands-on, group activities in the outer (new) structure.

At the pre-K and K levels, classrooms are paired and connected to each other; classes can flow back and forth between shared space to facilitate co-teaching (team teaching) and collaborative imagination.

Beyond the classrooms, the architecture provides a range of engaging learning environments. Idea spaces carved into the classrooms and created from corridor space between classrooms provide flexible areas for spontaneous meetings and informal, smaller, group learning shared between classes. Other found spaces—whether a nook under the stairs or a bench tucked behind a screen—encourage interaction, creativity and curiosity for every age group. These design features create flexible collaboration spaces for individuals, pairs or small groups without increasing square footage.

Colors and graphics were developed to make wayfinding intuitive and fun. Colors provide place definition without words. If the walls and carpet are blue, it's the middle school; green denotes the lower school.

The transparency of the classrooms allows other students to see in, creating a sense of shared experience and stirring anticipation in lower grades with a glimpse at what future grades will bring. Student work is displayed throughout the hallways and common areas, as well as in a gallery space on the second level, providing a showcase for students' creativity, as well as creating schoolwide dialog.

As the main entry and welcoming spot for the school, the Commons provides another informal gathering and display space where parents, faculty and students convene and connect. The physical and emotional heart of the school, the sun-filled foyer attracts students and teachers to congregate throughout

(continues on page 74)

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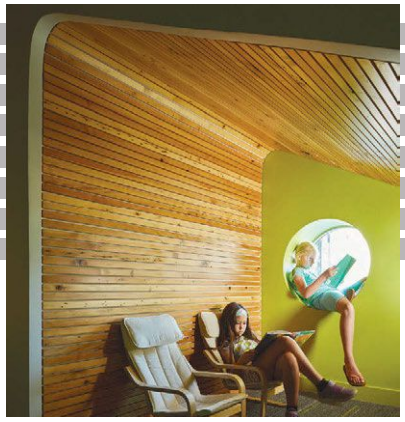


↔ Materials

CLASSROOM WINDOWS // Aluminum Clad from Jeld-Wen, www.jeld-wen.com

MAIN-ENTRY CURTAINWALL // 1600 Curtainwall from Kawneer, www.kawneer.com

SKYLIGHTS // Crystalite Skylights, www.crystaliteinc.com

EXTERIOR CLADDING, BRICKS // Ebony from Mutual Materials, www.mutualmaterials.com

EXTERIOR CLADDING // JamesHardie, www.jameshardie.com

ROOFING, LOW-SLOPE AREAS // SBS Modified Membrane Roofing from Soprema, soprema.us

ROOFING, NAVE AND GYM // SBS Shingles Atlas StormMaster from Atlas Roofing, www.atlasroofing.com

CARPET // Interface, www.interface.com

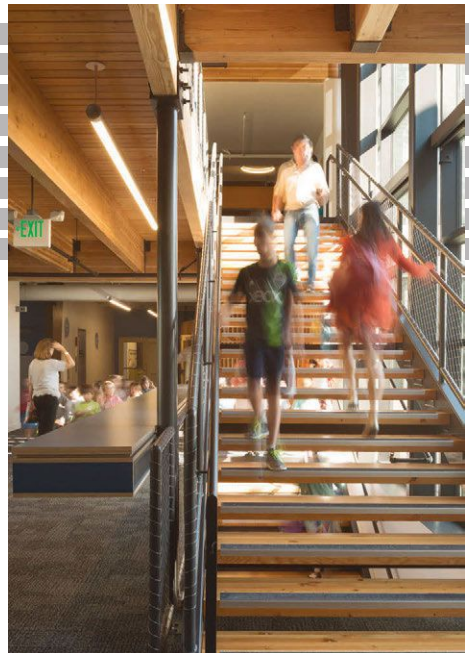
LED LIGHTING // ConTech Lighting, con-techlighting.com; Elite LED Lighting, www.iuseelite.com; Eureka, www.eurekalighting.com; FineLite, www.finelite.com; Inter-Lux, inter-lux.com; Lithonia Lighting, www.lithonia.com; Louis Poulsen, www.louispoulsen.com; Peerless, peerlesslighting.acuitybrands.com; Prudential Ltg., www.prulite.com; Resolute, resoluteonline.com; Vode, vode.com; WAC Lighting, www.waclighting.com; and Winona, winonalighting.acuitybrands.com

HVAC // Big Ass Fans, www.bigassfans.com; Variable Refrigerant Flow from Mitsubishi, www.mitsubishicomfort.com; and Heat Pumps from York, www.york.com

ACOUSTICAL PANEL CEILING SYSTEM // FSorb, www.f-sorb.com

FLOOR ISOLATION MAT // Kinetics Noise Control, kineticsnoise.com

NOISEPROOFING COMPOUND // Green Glue, www.greengluecompany.com



the day. Parents are drawn to gather and linger at the lobby coffee bar when dropping off or picking up their children.

Sustainability

In addition to reusing the structures, wood salvaged from the demolition areas was repurposed in room dividers, desks, benches and stair treads. Reusing existing materials and structure not only kept the square-foot cost down, it contributed to the story of the buildings' history, creating further continuity between old and new.

The 1970s church facility had suffered from outdated systems and energy inefficiencies. With the retrofit, Westside School had an opportunity to adapt state-of-the-art systems for an energy-efficient school building. All aspects of energy savings were looked at in the design, including lighting, daylighting, HVAC, natural ventilation and future PV panel mounting provisions.

New portions of the envelope were built to meet strict Seattle Energy Code requirements, and the majority of the gym and nave roofs and walls were replaced and/or re-insulated.

The philosophy for the mechanical system design was a "Design for Off" approach developed by the team's mechanical designer, Ecotope, Seattle. The Design for Off approach allows equipment to be off most of the time, turning on only to satisfy loads when and where needed. At Westside School, the approach focused on right-sized zonal equipment that can operate independently

from neighboring spaces for heating, cooling and ventilation. Each teacher has control over heating and cooling in his or her classroom. New classrooms feature operable windows to take advantage of Seattle's moderate climate; ceiling fans help evenly distribute the fresh air and provide air movement for improved thermal comfort.

To appropriately orient and size skylights in the nave roof to reduce electric lighting loads in the newly created auditorium and library, the design team consulted with the University of Washington's Integrated Design Lab, an interdisciplinary organization in Seattle providing research-based technical guidance on sustainability measures. Windows throughout were sized "just right" to rely on daylight rather than electric lighting during daylight hours, reducing energy associated with the buildings' LED lighting system.

Westside School now is one of the most energy-efficient schools in the Northwest, created with an extremely small HVAC budget and achieved by concentrating on introducing energy efficiency where it would count the most. First school year building operation achieved a measured EUI of 14 kBtu per square foot per year. The new building is 72 percent more efficient than the former building. The result is a building that easily meets the 2030 Challenge.

By reusing the original church wherever possible—juxtaposing new with old throughout the building—the team created design and environmental opportunities. The project minimized its embodied carbon footprint by not building new where existing structure could be reused, diverting waste from construction and demolition. The transformation of an outdated church facility into a highly efficient 53,000-square-foot school came in at $182 per square foot.

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Circle No. 36

HELLO VIBRANT

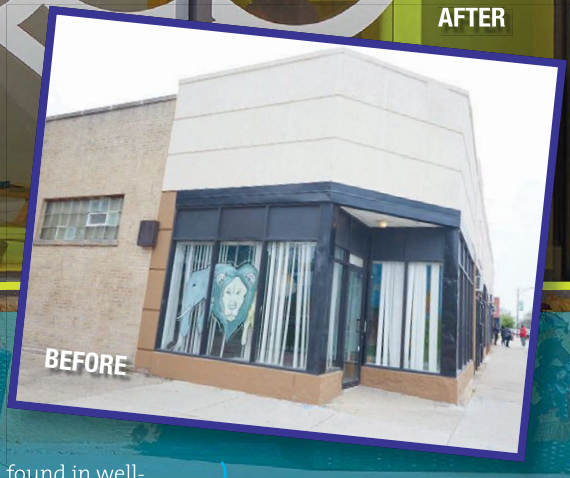
RETROFIT TRANSFORMS AN URBAN STOREFRONT INTO A BRIGHT COMMUNITY PLAY SPACE

WRITTEN BY | SHANNON GEDEY, AIA, RELI AP, LEED AP BD+C

Young children need play to thrive, but the realities of economic disinvestment in Chicago's Woodlawn neighborhood mean that not all children have had access to safe and delightful places to play. Troubled by this inequality, Chicagoan Debbie Frisch founded a not-for-profit organization and set to work renovating a vacant storefront into a 1,000-square-foot indoor community play space. Described as a play desert (a neighborhood lacking in public play spaces), Woodlawn is an ideal location for the new play space Frisch calls "HelloBaby". Architecture firm Perkins+Will, Chicago, provided pro bono design services for the retrofit as part of the firm's Purpose initiative. The initiative seeks to maximize the impact of the firm's volunteer efforts and transform communities by partnering with local non-profit organizations in need of design services. A participant in Public Architecture's 1% Solution, Perkins+Will commits 1 percent of billable hours to pro bono design service. (Learn more at purpose.perkinswill.com.)

The idea for HelloBaby, "a place for you and your baby to play," sprung from Founder and Executive Director Frisch's years of experience as a foster parent. She had observed a pattern of physical and social-emotional developmental delays in even the smallest of her charges and noted how quickly their development could rebound in a play-rich environment. A mother herself, Frisch also had seen how isolating parenting can be—and how much of a difference friendship can make. Seeking to address these needs

hellobaby



for families outside the foster-care system, Frisch envisioned HelloBaby as a community play space with socialization areas for infants, toddlers and caregivers. The space is open to the public at no charge and gives children and parents a place to play together.

INTENTIONAL COLOR

Recognizable from a distance, HelloBaby brings a cheerful splash of color to a formerly drab business corridor dotted with vacant lots. Frisch tapped longtime friend and Graphic Designer Kerry Grady of Grady Campbell Inc., Chicago, for the logo and brand identity. The color palette started with Grady's vision for a simple and timeless brand identity. A parent himself, Grady wanted to create something "more modern and distinctive than traditional pink and blue" and says he drew inspiration from the "simple style of design found in well-designed children's furniture: bright, clean and beautiful."

Anchored by this identity, Pamela Steiner, a Branded Environments designer at Perkins+Will, says she developed ideas for "bringing the colors to life in dimensional and functional

Recognizable from a distance, HelloBaby brings a cheerful splash of color to a formerly drab business corridor dotted with vacant lots in Chicago's Woodlawn neighborhood.

PHOTOS: ANDREWS BRADDY PHOTOGRAPHY, CHICAGO

Flexible furnishings throughout have been key to making caregivers feel welcome. The cozy nook is a favorite spot to relax, chat and wave at passersby in the front window.

ways that would be engaging for children and adults (and the design team, too!)." She expanded the palette to encompass a range of tints for interior applications, including a bank of rainbow-hued laminate toy cubbies. Set against quiet whites and grays, the colors feel vibrant without overwhelming the scale of the space.

NATURE

From the beginning, the team coalesced around a nature theme. Perkins+Will Interior Designer Sunny Ao recalls, "In the visioning session, the clients focused on the importance of nature to children's development." Adds Frisch, "I wanted HelloBaby to be based on something real, so we used nearby Washington Park as our inspiration. HelloBaby reinforces outdoor experiences indoors. I am hopeful this will plant a seed of sustainability in all our guests." Steiner explains, "We didn't want to be prescriptive in our interpretation of nature, but we did want to create an immersive environment that would be a launchpad for play."

Ao proposed vivid green flooring to mimic grass and riff on the green in the brand logo. Incorporating natural elements without going too literal kept the design from becoming cartoonish. Although the existing embossed tin ceiling had been painted sky blue, the team opted for a fresh coat of white paint and new energy-efficient linear light fixtures for a cleaner look. The texture of the tin adds a cool vibe and respects the history of the space, and a smattering of cloud-shaped ceiling baffles modernizes the effect. Frisch describes the clouds as "a subtle but magical touch. They give a focal point for a young child lying on his back; they absorb sound; and they really are the 'bow on top' tying the whole space together."

The nature theme also shaped Steiner's concept for the donor recognition tree, which hosts a bevy of butterflies bearing the names of project supporters. "The donor tree is meant to be a signature piece—visually and emotionally grounding the space," Steiner explains. "We wanted to create an element that was visually appealing and had flexibility as a donor element. The donor tree is meant to be a living-growing element within the space: As HelloBaby's support network grows, so does the tree." In support of nature conservation, the proportions of the donor tree were calibrated to use full sheets of plywood with very little waste.

COZY NOOK

The constraints of the existing space presented a challenging layout at the front, so

(continues on page 80)

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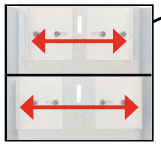

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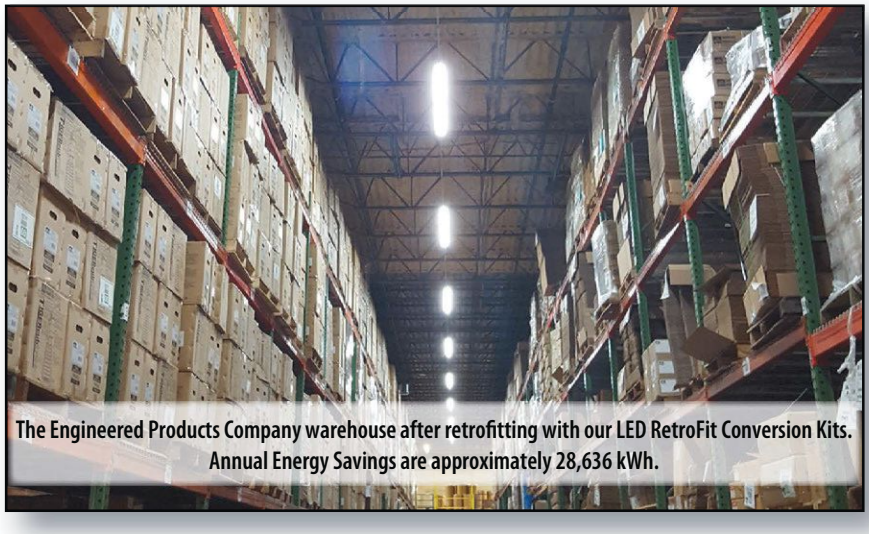

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Circle No. 37

Retrofit Team

ARCHITECT AND INTERIOR DESIGN // Perkins+Will, Chicago, www.perkinswill.com

- Eric Mersmann, AIA, senior interior project manager
- Shannon Gedey, AIA, architect
- Pamela Steiner, Branded Environments designer
- Sunny Ao, interior designer

GENERAL CONTRACTOR // FORGE Design + Builders, Chicago, www.forgedesignbuild.com

CLIENT // Debbie Frisch, founder and executive director of HelloBaby, Chicago, hellobabychgo.org

BRAND IDENTITY // Grady Campbell Inc., Chicago, www.gradycampbell.com

MEP CONSULTANT // Kroeschell Engineering, Chicago, www.kroeschell.com

- PLUMBING/MECHANICAL ENGINEERING: William Bauer and Mike Evensen
- ELECTRICAL ENGINEER: Edward Morrison

the team explored several options for the arrangement of the functional zones. Ao came up with the concept that the client and project team universally preferred, which used this front window space in an inventive way: He envisioned a bold graphic millwork wrap featuring a multifunctional upholstered play platform and integrated toy storage.

Inspired by the idea of a glass aquarium, Ao "wanted to create a showcase in which people outside would enjoy the babies and toddlers. Moreover, it would also carry out a message to the neighborhood that this space is cared for." The cozy nook has become one of the defining graphic elements of the space, as well as a guest and staff favorite.

At the same time, flexible furnishings throughout have been key to making caregivers feel welcome. "The cozy nook is a favorite spot to relax, chat and wave at passersby in the front window," Frisch says. "Although first-time visitors sometimes enter a little shy and nervous, the space is designed to create connection. Stone-shaped lounge seats are easily moved, enabling caregivers to supervise their children while participating in adult conversations. Parents and their children have made friends and had fun so a caregiver, who was perhaps a little reluctant to visit, is eager to return. We are proud to report that 70 percent of our guests are repeat visitors."

SOFT, STRONG, SAFE

Universal appeal, durability and healthfulness were key considerations in the selection of finish materials. Wanting to incorporate soft surfaces inviting to children, the team looked to sustainable, hospital-grade product lines for fabrics and flooring and met with an experienced upholsterer to design upholstered pieces that would be easy to maintain.

Frisch finds that cleanable surfaces allow staff to be gracious about inevitable mishaps. "I really wanted to honor our guests with a beautiful space," she says. "This is a community space and guests take ownership for its upkeep, cleanliness and wellbeing. If a spill or mess occurs—and with kids, that's going to happen—cleanup is quick and easy. Guests aren't made to feel uncomfortable and we can be good hosts."

Mindful of the direct contact children would have with the finishes, concern for children's health dictated a "do no harm" approach to material specifications. The team prioritized low-VOC-content products and avoided chemicals of concern. To improve thermal comfort and energy efficiency, the existing single-pane storefront system was upgraded with the simple but innovative retrofit of a secondary glazing panel within the existing storefront frame.

SURPRISES AND DISCOVERIES

Anticipating the joy of children made it fun to design special surprise elements into the space. Custom vinyl wall graphics of friendly forest animals provide an engaging "I-spy" activity. The wheeled ride-on toy parks in a custom millwork garage under the cozy nook. In the art area, resilient flooring and slate wall panels create a "yes space" where it's fine to get messy and write on the walls. Staff decorates the permanent window tree graphics with seasonal paper cut-outs, adding apples and snow to mark the changing weather. In this way, the space is both consistent and changing, providing stability and interest at each visit.

(continues on page 82)

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Circle No. 38

ADAPTABILITY

Adaptability was built into this pilot renovation to ensure the investment will yield a long life cycle. Contractor Bob Brobson with FORGE Design + Builders, Chicago, worked with Frisch to execute demountable modules in a manageable scale. Brobson advises, "Adding temporary versus permanent elements, such as furniture pieces, art and millwork, not only provide personality and flexibility, but these elements can be relocated" if the not-for-profit outgrows its current space or launches additional locations.

CHALLENGES

Renovating a former daycare into a community space was no easy task. Making the best use of space and meeting accessibility goals entailed a nearly gut retrofit of the interior, as well as repairs and enhancements to the exterior. Challenges posed by the existing plumbing infrastructure sent the team back to the drawing board more than once while the highly unique purpose of the space complicated efforts to narrow down local code requirements.

To encourage creativity and nimbleness, the team tapped a colleague trained in improvisational comedy to facilitate interactive team-building breaks during a planning session. Ao recalls, "HelloBaby was a lot more challenging than comparable projects of this size but I did enjoy working on an unusual project type, which means something great to the community." Trust among team members and passion for the project's meaning sustained the team's energy.

MAKING A DIFFERENCE

In addition to fulfilling its mission of play and community, HelloBaby's flexible open space has quickly become a community hub for family activities, ranging from story hour and book clubs to parent-tot yoga. Social workers love the location for supervised visitation because of the good cross-room visibility and positive setting.

Of the renovation experience, Frisch shares that it has been particularly thrilling to see the design intention come to life. "You can't be it if you can't see it," she says. "The HelloBaby space is transforming lives and reframing experiences. The impact of HelloBaby has exceeded my wildest dreams."

Materials

CLOUD BAFFLES // OWA, www.owa.de
CARPETS // Mohawk, www.mohawkgroup.com, and Interface, www.interface.com
RESILIENT FLOORING // Gerflor, www.gerflorusa.com
PAINT // Benjamin Moore, www.benjaminmoore.com
TILE // Daltile, www.daltile.com
CUSTOM WALL GRAPHICS // Cushing, www.cushingco.com
UPHOLSTERY // Designtex, www.designtex.com
RETROFIT GLAZING // Thermolite RetroWAL, retrowal.com
LAMINATE // Abet Laminati, abetlaminati.com
MICROTHIN SLATE // Interlam Corp., www.interlam-design.com
PLAY STRUCTURE // CedarWorks, www.cedarworks.com
STOOLS // Eastabrooks TreeWorks, www.etsy.com/shop/EastabrooksTreeWorks

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Circle No. 40

HISTORIC CITY BLOCK RENEWED

A Former Exhibition Building in the Furniture City Gains New Life as Offices, Apartments and Hotel Space

WRITTEN BY | KENDRA ACHENBACH

The Waters Center, formerly known as the Waters Building, represents an innovative adaptive reuse of an iconic landmark that occupies an entire city block in downtown Grand Rapids, Mich.

Ghafari Associates LLC's locally based team was tasked with designing its $35 million makeover, which transformed the 120-year-old building—originally conceived as a large-scale furniture exhibition space—into a mixed-use facility. The center now features a 111-room extended stay hotel, 44 market-rate apartments, an office tower, retail space, a shared 2-story lobby and new interior 4-story atrium. This project infuses new life into this quintessential Grand Rapids structure, repurposing its interior to provide modern, diverse functionality without diminishing the historic character of its exterior.

EXTERIOR | The 120-year-old Waters Center offers diverse functionality in downtown Grand Rapids, Mich., without diminishing the historic character of its exterior.

PHOTO: GHAFARI // CONCEPT DESIGN

PHOTO: PEOPLE PLACES & THINGS PHOTOGRAPHICS

RETROFIT TEAM

ARCHITECT // Ghafari Associates LLC, Grand Rapids, Mich., ghafari.com

- Stephen C. Fry, AIA, LEED AP, principal architect
- Jim Ramey, AIA, project architect
- Jacob Staal, project coordinator
- Amanda Benes, project coordinator
- Karen Stauffer, IIDA, LEED AP, senior interior designer
- Carly Visser, senior interior designer
- Deanna Klopcic, interior designer

INTERIOR DESIGN FOR HOTEL // Innvision Hospitality, Griffin, Ga., innvision.net

- Holly Kappes, senior designer
- Wendy Pierce, design and procurement
- Jocelyn Boyarizo, project manager
- Bob Pierce, logistics manager

MECHANICAL ENGINEER // Classic Engineering, Grand Rapids, (616) 742-2810

STRUCTURAL ENGINEER // Teton Designs PLLC, Grand Rapids, www.tetondesignspllc.com

ELECTRICAL ENGINEER // Buist Electric, Byron Center, Mich., buistelectric.com

CIVIL ENGINEER // Medema, VanKooten Associates Inc., Grand Rapids, www.mvkengineering.com

CONSTRUCTION MANAGER // Visser Brothers Inc., Grand Rapids, www.visserbrothers.com

ACOUSTIC CONSULTANT // ABD Engineering and Design, Grand Rapids, www.abdengineering.com

Reinvention

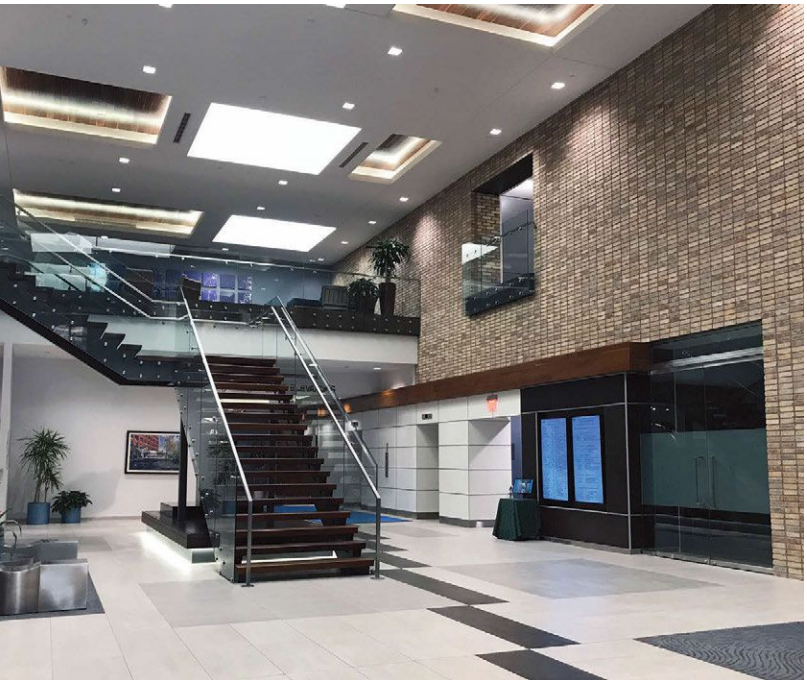
Originally built in 1898, the building stands as a tribute to Grand Rapids' rich legacy as "Furniture City". With its central location and proximity to the Grand River, Grand Rapids was once a hotbed for the production of raw lumber and, eventually, more refined wood products, including furniture. The Waters Building was constructed in direct response to the growing volume of furniture manufacturers traveling to the area for exhibitions. At the time, it was the largest building in the world dedicated to furniture exposition. At 6 stories, the Waters Building had the capacity to display products from numerous manufacturers in one central location and quickly solidified Grand Rapids' Furniture City status.

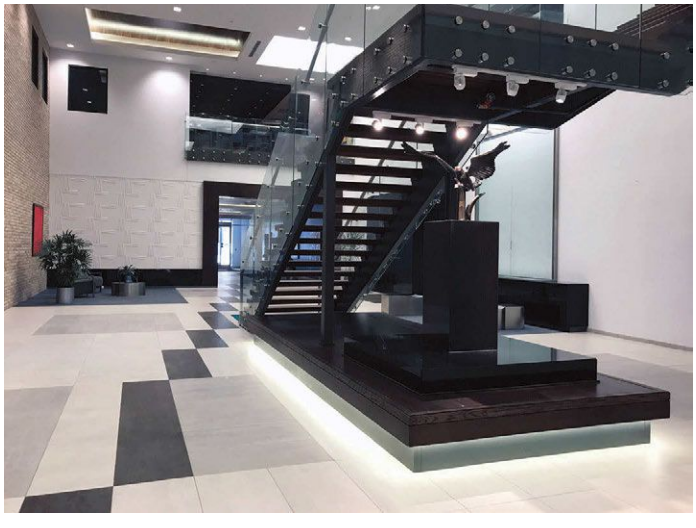
By the 1950s, the furniture industry had moved south because of Grand Rapids' eventual deforestation, and the Waters Building entered its second era when it was converted into office space. In 2013, the building entered its third era when it was purchased by Edmark Development Co. and Visser Brothers Inc., both of Grand Rapids. By this point, the building had been suffering from low occupancy, and its new owners decided to reduce the office areas and use the space for other purposes. They sought to capitalize on the building's central location in Grand Rapids' business district to attract and retain tenants and renamed the building the Waters Center to signal the diversification of its amenities and occupants. Ghafari Associates was challenged with blending the existing character of the century-old building with contemporary amenities and details, striking a deliberate balance between old and new.

In total, the project involved the extensive transformation of 300,000 square feet of space. The renovated north tower houses office space and apartments that feature exposed brick and existing hardwood floors (many of which had been covered by new flooring materials over the years). The walls and floors were maintained to uphold some of the original character of the historic building. The loft-style apartment units include high-end features, such as quartz surfaces and walnut cabinetry, that contrast nicely with the original building structure. The units that do not face the street look out over the internal atrium, which provides all units with natural light (which was not previously the case with these internal spaces). The Ghafari Associates team also was involved in the design of several office spaces for tenants, including Baker Holtz, Goebel Insurance and Spectrum Health.

The south tower was renovated into a beautiful and contemporary Hilton Homewood Suites Hotel. Ghafari Associates provided architectural services for the hotel

PHOTOS: GHAFARI // CONCEPT DESIGN





LOBBY | Originally one floor, the central entrance lobby was opened up to create a larger 2-story lobby with a grand staircase that connects to the hotel check-in and concierge. The expanded central lobby services the north and south towers for hotel guests, office users and apartment residents.

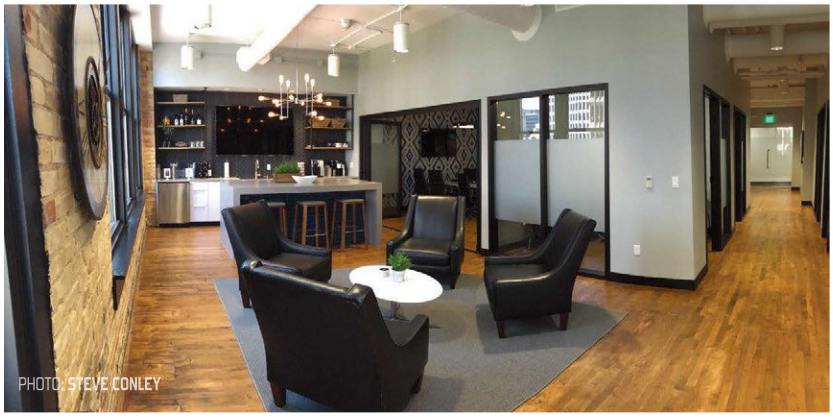


PHOTO: STEVE CONLEY

PHOTOS: GHAFARI // CONCEPT DESIGN

PHOTO: MICHAEL BUCK

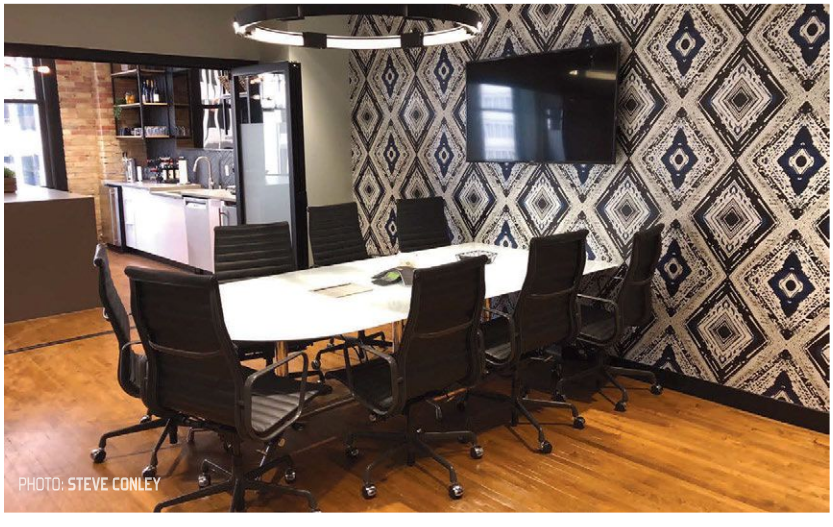
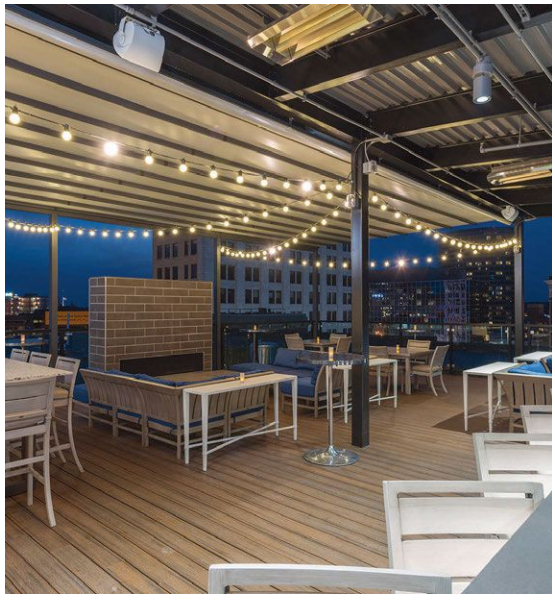


PHOTO: STEVE CONLEY

OFFICES | The major interior renovations successfully reactivated an underutilized building, offering more than 20 leasable high-end office spaces.

APARTMENTS | The loft-style apartment units include high-end features, such as quartz surfaces and walnut cabinetry, that contrast nicely with the original building structure.



PHOTOS: **PEOPLE PLACES & THINGS PHOTOGRAPHICS**

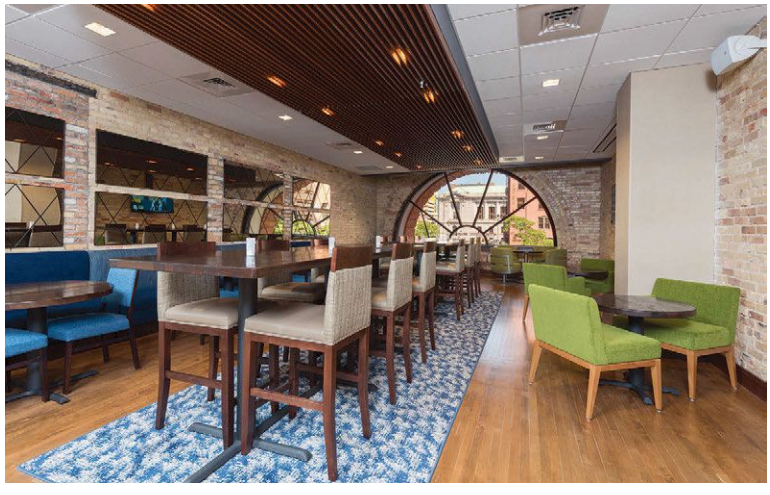
and interior design services in the core spaces of the building. Hilton selected Griffin, Ga.-based Innvision Hospitality to coordinate the hotel interiors, including the rooms and mezzanine restaurant. The design team utilized water-inspired imagery and furniture-manufacturing concepts to pay tribute to the building's historic past within Grand Rapids. These extended-stay rooms feel more like urban apartments with exposed brick and timber and existing hardwood floors alongside every modern amenity desired by today's travelers.

Changes

The existing building previously had infill lobby floors that connected two towers on six levels. These internal lobbies were removed at several floor levels to create the multistory interior atrium space. Originally one floor, the central entrance lobby was opened up to create a larger 2-story lobby with a grand staircase that connects to the hotel check-in and concierge. The expanded central lobby services the north and south towers for hotel guests, office users and apartment residents. The second floor of the main lobby also offers a mezzanine bar and restaurant. Two rooftop lounge spaces—one servicing hotel guests and the other a private retreat for the apartment residents—were also included in the renovation.

Although the building was in good structural condition, the adaptive reuse project presented a number of challenges related to the age and condition of the existing building. Because few improvements had been made to the building in the previous 15 years, the existing tenants were left scattered throughout, making office leasing inefficient. The sequence of the project presented another challenge. Half the existing tenants

(continues on page 90)



HOTEL | The extended-stay hotel looks more like an urban apartment building with exposed brick and timber and existing hardwood floors. A rooftop lounge servicing hotel guests tops off the hotel's amenities.

MATERIALS

CARPET // Archeologic Collection from Atlas,www.atlascarpetmills.com, and Diffuse from Shaw Contract, www.shawcontract.com

FLOOR TILE // Mark Collection from Atlas Concorde, www.atlasconcorde.com

WALLCOVERING // Vycon from MDC Wallcoverings, www.mdcwall.com, and Traverse from Maharam, www.maharam.com

WALL TILE // Progetto from Lea Ceramiche, www.ceramichelea.it/en, and Ona from Porcelanosa, www.porcelanosa-usa.com

WATER FEATURE // Rock'N Crab Aquatics, www.rockncrab.com

WOOD STAIR // Brazilian Walnut Stair Treads

LED LIGHTING // Cree, www.cree.com

BOILER // Lochinvar, www.lochinvar.com

HEAT PUMP // ClimateMaster, www.climatemaster.com

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were to remain, so it was necessary to relocate them to new spaces before construction could begin on the new hotel space.

Conveniently, one of the owners of the project—Visser Brothers—also was the contractor, allowing the design and construction document processes to be completed in very close collaboration with the construction team. The production schedule was planned to allow the owner to budget and construct the spaces with minimal disruption to the tenants. The project met the owners' schedule and completed their goal of providing upgraded leasable spaces while allowing them to maintain their existing tenants.

Hotel and apartment walls and floor structures had to meet acoustical requirements of today's building codes. Special treatments were designed by Ghafari Associates to isolate sound between apartment floors and offices. In addition, there are a couple masonry walls in the building, so the design team incorporated these as the separation walls between the office and hotel spaces where possible. The team also had the existing floor/ceiling assembly tested by ABD Engineering and Design, Grand Rapids, which determined the assembly would meet code requirements, so it was largely left intact.

Because of the building's age and usage change, a new HVAC system was installed. Boilers with a cooling tower and a heat-pump system now provide comfort for the hotel, offices and apartments. The former mechanical room was moved from the basement to an area on the roof.

All new LED lighting has been installed in the office tower and shared lobby. A new EPDM roof and entrance canopy were incorporated. The hotel roof deck includes an outdoor café and bar. A portion of the roof is a "live roof" to improve the view from the decks. Other than cleaning and minor restoration, the exterior brick and windows remained intact.

Heavy-timber floor joists that were removed to create the lobby were repurposed as large planter features within the newly created atrium space. Brick was saved and reused to create the new window openings in the atrium.

Ultimately, the major interior renovations successfully reactivated an underutilized building, offering more leasable high-end office space, a thoughtful balance between historic architectural elements and new contemporary amenities, as well as modern streamlined interiors. Together with the owners and a team of consultants, Ghafari Associates was able to successfully produce more than 20 new office-tenant spaces, the hotel, apartments and rooftop decks. The original building storefronts from the 1950s remain intact, along with the original wood plank flooring, exposed brick and a few original coal chutes. The Waters Center is again a viable hub in downtown Grand Rapids, a proud tribute to the city's past and bright future.

WATERS CENTER SCHEDULE

Demo began in September 2014 for the first tenant relocation (Baker Holtz). The apartments opened December 2015, and the project was complete when the hotel opened in July 2016.

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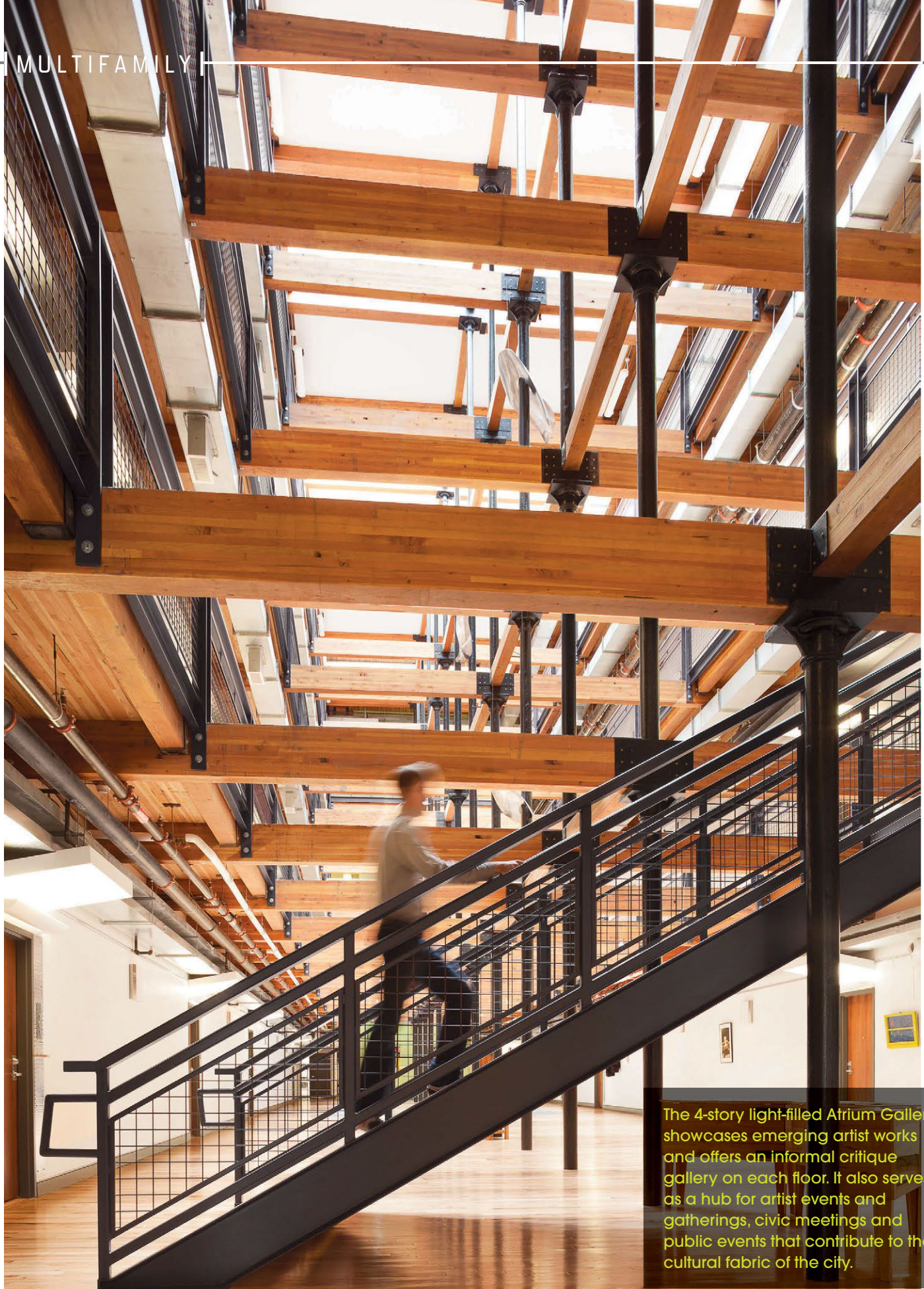


The 4-story light-filled Atrium Gallery showcases emerging artist works and offers an informal critique gallery on each floor. It also serves as a hub for artist events and gatherings, civic meetings and public events that contribute to the cultural fabric of the city.

PHOTOS: TRENT BELL

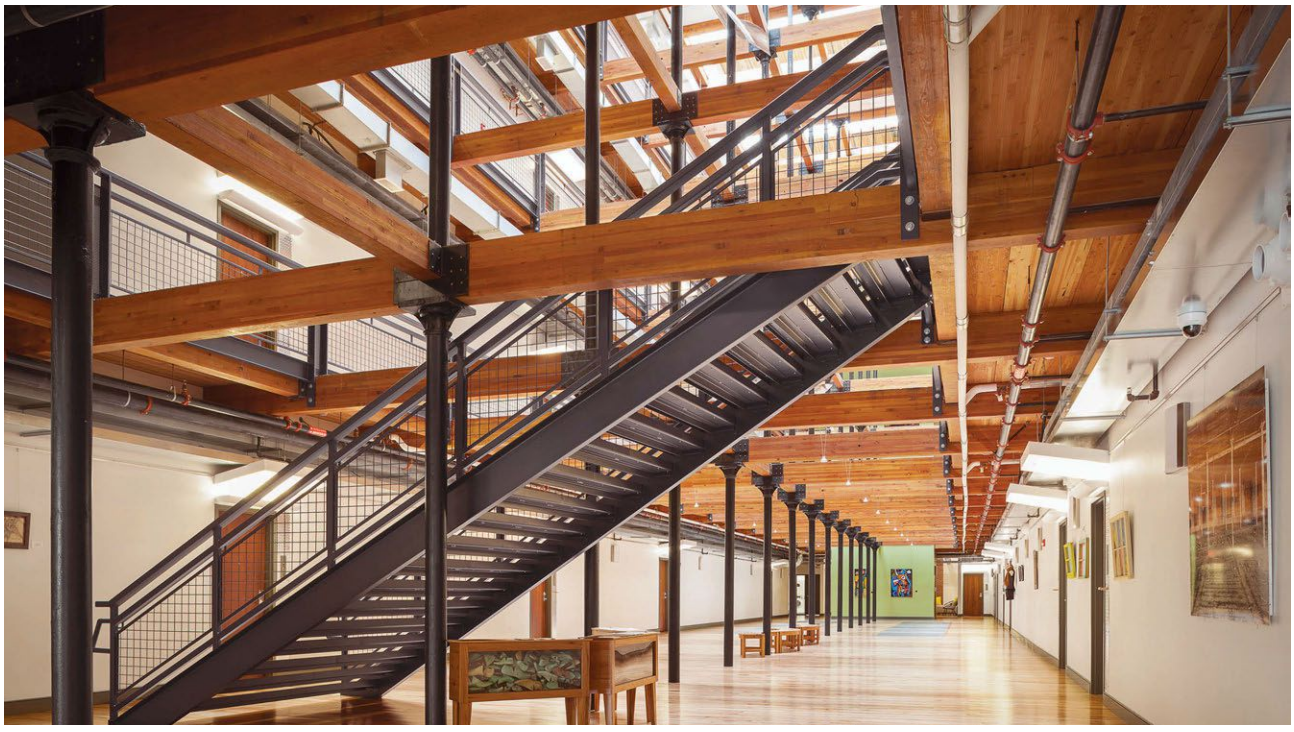
MAKER Space

Former Textile Mill Now Houses Artists and Showcases Their Work

WRITTEN BY | **NANCY LUDWIG, FAIA, LEED AP, AND JANIS MAMAYEK, AIA, LEED AP**

Converging the preservation and sustainability movements, Boston-based ICON Architecture Inc.'s RENEW practice is committed to optimizing inherent value in existing buildings through environmentally conscious design and culturally conscious preservation. While rooted in history, this approach looks to serve the future in developing high-performance sustainable environments. The renewal of the historic Appleton Mills, a former textile mill in Lowell, Mass., is representative of the application of this old/new comprehensive style, making the old new and relevant again.

Today, the artist live/work lofts at Appleton Mills have expanded the burgeoning artist community in Lowell, offering loft homes with broad floor plates and high ceilings scaled to encourage a variety of art formats, as well as a gallery to showcase artists' work.



The building's exterior design successfully mixes old and new, preserving historic materials and forms where possible and introducing new elements, establishing an aesthetic that echoes the mill's storied past. Its northern segment features renovated brick walls with new small-paned glazing refitted into original openings. The southern section incorporates corrugated metal panels and zinc shingles with large storefront windows, punctuating façades with painted galvanized steel canopies.

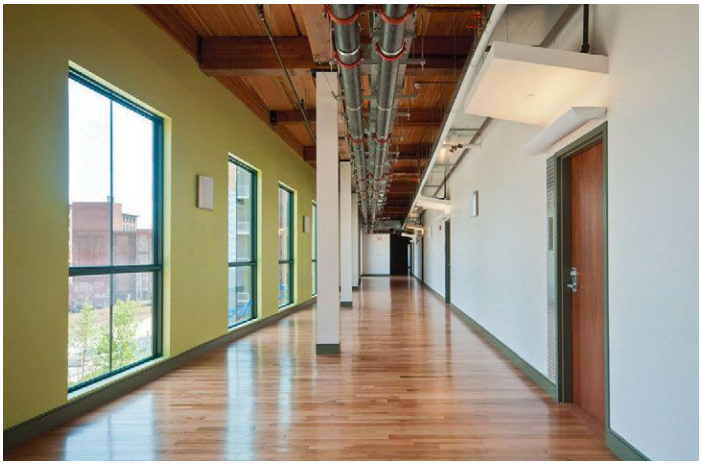
Restoring Appleton Mills

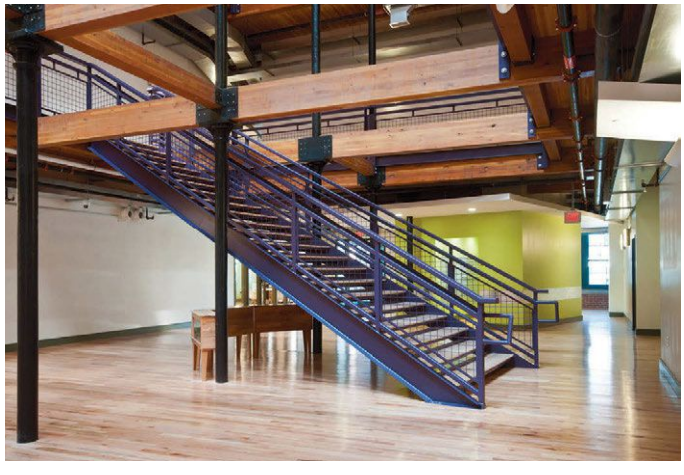
For many years, the remains of Appleton Mills stood prominently at the center of the Hamilton Canal District (HCD), a manmade island bounded by the canals that once powered former industries. (See "Creation of the Hamilton Canal District", page 98, for more information about Lowell's history and renaissance.) Several vacant and ominous buildings lined the canals and set a negative tone for visitors to the city and its National Historical Park.

Given that there was an emerging artists community in Lowell, this mill environment seemed to offer a unique setting for an artists' village. The design and development team toured local artist facilities and met with invested artists to assess the best program for moving the project forward. Reusing Appleton Mills, which is one building composed of several different parts connected on the upper levels, for live/work would allow the most open, flexible floor plans, revealing as much as possible of the original structure and mill character. The idea to create "maker space" also harkened back to the original building's use as a textile mill.

When design was initiated, the structure was unsafe from years of neglect; it had not been inhabited for 20 years. A recent fire devastated the top floor, and the roof had collapsed. Deconstruction of the entire interior structural support and floor system had to be undertaken with 5-story-tall steel "K-braces" temporarily installed to hold the extant masonry walls in place. The original steel and cast-iron columns and beams were numbered as they were removed, so they could be reinstalled in their same position when the interior was rebuilt. New wood planks thick enough to qualify for heavy-timber construction were imported from Canada. These planks now form the floor and ceiling of the corridors. Their rich color and texture add warmth to the interior spaces.

Work surrounding the building uncovered a number of interesting finds from the mill's past. For example, the remains of the hydropower system that once powered the building was discovered. The turbine has been left in place and may ultimately be interpreted as an exhibit in the landscape. The water raceways that were found below grade were made of wood and still intact because of their position underwater. A safe discovered in the former Counting House had to be removed; however, the transaction windows where mill workers picked up their pay were incorporated into a new unit.





The design team consulted with local artists to develop loft layouts. In addition, oversized elevators, doorways and hallways allow for transportation of supplies and artwork.

Working closely with the U.S. National Park Service, Washington, D.C., and the Lowell Historic Commission to maintain the exterior walls, the design combined sensitive infill with contemporary additions. The building's exterior design successfully mixes old and new, preserving historic materials and forms where possible and introducing new elements of artistically textured metal shingles and corrugated metal, establishing an aesthetic that echoes the mill's storied past. Its northern segment features renovated brick walls with new small-paned glazing refitted into original openings while the southern section incorporates the new language of corrugated metal panels and zinc shingles with large storefront windows, punctuating façades with painted galvanized steel canopies. New decks are tucked behind frames that recall mill hoistways. The materials and forms create an edgy residential vibe, drawn from the former industrial aesthetic.

The existing inefficient, wide floor plates of the former mill building created a design challenge; even with deep units, a broad central space was left over on each floor. Rather than fill this floor area back in, the design team chose to leave it open, celebrate the structure and highlight this gathering space with broad skylights at the roof. Now known as the Atrium Gallery, the 4-story light-filled space showcases emerging artist works and offers an informal critique gallery on each floor. It also serves as a hub for artist events and gatherings, civic meetings and public events that contribute to the cultural fabric of the city.

A "Call for Artists" competition for the permanent art installation that would highlight the Atrium Gallery drew many submissions. The installed piece draws visitors' eyes up to a floating sculpture suspended from the rafters, creating a dynamic environment that constantly changes as light moves through the space.

(continues on page 98)

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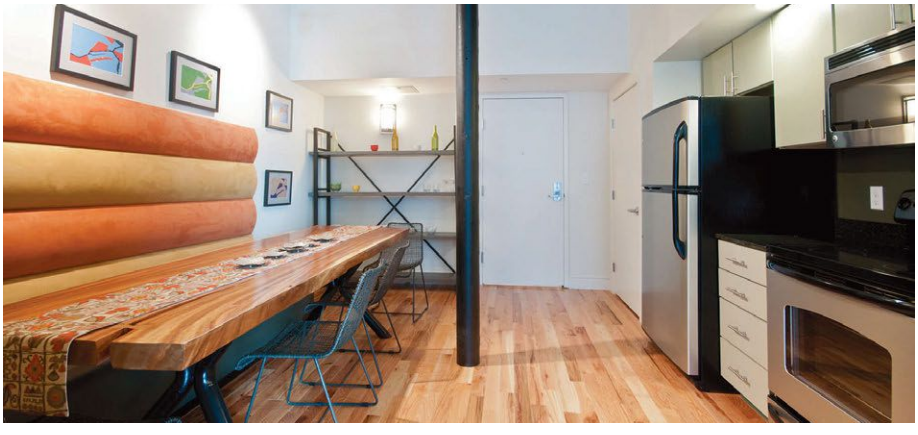

The patterning evokes the feeling of a moving river with subtle bends and curves to link the four levels of the atrium space. The Atrium Gallery is surrounded by additional amenity spaces, including a community lounge; social laundry; fitness center; rooftop terrace, featuring a green roof; and collaborative raw workshop space. The common laundry was designed to be a space for social interaction with tables and chairs and large windows looking out into the atrium. A phone app that signals when the machines have completed their cycle allows

Creation of the Hamilton Canal District

The city of Lowell, Mass., flourished in the 1880s, led by visionary merchants who harnessed the water power of Pawtucket Falls for manufacturing. Francis Cabot Lowell, the city's namesake, built a leading-edge manufacturing complex woven among the world's most extensive waterpower system at that time. Textile manufacturing brought entrepreneurs and immigrants, spawning development of a richly textured downtown. By the turn of the century, however, competition in other New England communities limited Lowell's expansion, leading to a decline in business and prosperity that continued well into the 20th century.

The mills and canals, however, were built to last. In 1978, public entities established The Lowell Plan and Lowell National Historic Park, spurring economic vitality and transforming Lowell into a "living history" venue of worldwide renown. Historic mills have been adapted for new uses; the unique canal system has been preserved; and interpretive arts pop up throughout the city. Creation of the Downtown Lowell Arts District in 1998 spurred a renaissance of arts and cultural institutions; a minor league baseball team and park, new arena, professional regional theater company, and numerous restaurant and arts venues emerged. These days, Lowell attracts more than 650,000 visitors per year.

Situated amidst this unique historic canal system, the 15-acre Hamilton Canal District (HCD) is being revitalized as a new transit-oriented, mixed-use neighborhood engaging Massachusetts' creative economy. Its visual centerpiece is a stunning waterfall, controlled by the Swamp Locks at the confluence of four canals. Located within a short walk to the MBTA Commuter Rail Gallagher Terminal and linked with an expanded historic Trolley system, the development engages LEED Neighborhood Development principles. The adaptive reuse of the HCD historic mills will combine with more than 1 million square feet

residents to engage with the surrounding amenity areas, as well.

Live/Work

With a focus on maintaining affordability for artists, the 214,000-square-foot adaptive reuse created 126 live/work units of affordable housing with a preference for artists. The team developed guidelines and a peer-review portfolio program to determine residents' eligibility for these sought-after apartments. Current artist residents in the building range from fine artists and photographers to culinary artists, musicians and dancers.

The design team consulted with local artists to develop loft layouts. Unit types range from open lofts where a kitchen/bathroom pod subdivides spaces to "Live/Sell" layouts at the ground level where residents can roll up wide garage-like doors to open their studios for view from a terrace that recalls the mill's former loading dock. Oversized elevators, doorways and hallways allow for transportation of supplies and artwork. All lighting and appliances were selected for energy efficiency.

The building and courtyard engage an outdoor, contemporary mill yard interpretation, creating a community core on the central "island" of the HCD. The mill yard hosts resident events and provides a venue for an annual folk-music festival. In the landscape, angled walkways mark historic mill worker paths and tipped granite benches recall fallen buildings. Former canal-crossing bridges that brought millworkers into the mill have been restored and a remnant steel frame of a historic overhead bridge has been incorporated as a "ghosted" memory. A linear fountain traces the location of the historic canal raceway that drew water to the mill power system.

The building was fully occupied just a few months after completion. Its success re-establishes the historic mill's legacy into the next century and acknowledges that it is more than just a building. It's about relationships and an overall appreciation and pride of place, ensuring the character and connections of its past are preserved and renewed with new programs, new technology and new advocates to serve the future. Appleton Mills' artist residents, visitors and the city of Lowell benefit from maintaining critical parts of this built context within the HCD and upholding the value of existing viable and historic structures. Appleton Mills has become a wonderful opportunity for those who make art and for those who truly appreciate it.

A commitment to optimizing value in existing building assets is clear in the environmentally conscious design and culturally conscious preservation of this historic mill. By reflecting on what works and responding to cultural forces, the RENEW team rethinks the current reality of each building. This socially responsible approach proudly sustains a collective story that is revealed and celebrated in the structure's resiliency.

Relevance is restored as it is renewed.

of new construction to create public parks, 750 units of housing, 55,000 square feet of retail space and 425,000 square feet of commercial/office space. The multiphase development, envisioned via multiple community design charrettes, will be built out over 20 years.

With a focus on restoring Lowell's pre-eminent position in Massachusetts' "creative economy", development is well underway with the completion of new canal-crossing bridges, which connect a pedestrian-oriented street network that capitalizes on views of the canals and historic locks. The former Freudenberg Wovens Mill (now known as 110 Canal) has become home to the University of Massachusetts Lowell (UML) Fabric Discovery Center, re-establishing Lowell as a center of textiles research and technology. The building also houses UML's Innovation Hub, Massachusetts Medical Device Development Labs, and the New England Robotics Validation and Experimentation Center—all designed by ICON Architecture Inc., Boston.

Adjacent to the canal locks, construction is underway on a new leading-edge, highly sustainable, net-zero-energy courthouse. New construction for retail and additional housing is planned to begin in spring 2019.

RETROFIT TEAM

ARCHITECT // ICON Architecture Inc., Boston, www.iconarch.com
- Nancy Ludwig, principal in charge
- Kevin O'Neil, project manager

CIVIL ENGINEERS // Meridian Associates, Beverly, Mass., www.meridianassoc.com

LANDSCAPE ARCHITECTURE // Copley Wolff Design Group, Boston, www.copley-wolff.com

STRUCTURAL ENGINEER // Souza, True and Partners Inc., Waltham, Mass., www.souzatrue.com

M/E/P ENGINEER // R.W. Sullivan Engineering, Boston, www.rwsullivan.com

CONTRACTOR // CWC Builders, Newton, Mass., (617) 965-2800

HISTORIC // Epsilon Associates Inc., Maynard, Mass., www.epsilonassociates.com

ART CONSULTANT // Kim Radochia, Boston, kimradochia.com

OWNER // Trinity Financial, Boston, www.trinityfinancial.com

MATERIALS

WOOD FLOORING // Hardwoods from Shaw, www.shawfloors.com

RESILIENT FLOORING // Footnotes Sheet Vinyl from Tarkett, www.tarkett.com

PAINT // EcoSpec from Benjamin Moore, www.benjaminmoore.com

WINDOWS // Series 9150 and 1900 from Peerless, www.peerlessproducts.com

SKYLIGHTS // Wasco, www.wascoproducts.com

WOOD DOORS // Mohawk Flush Doors from Masonite, www.masonite.com

DOOR HARDWARE // Hager, www.hagerco.com

APPLIANCES // GE, www.geappliances.com

WINDOW BLINDS // Heritage 2-inch Aluminum Horizontal Blinds from Bali, www.baliblinds.com

GREEN ROOF // Carlisle SynTec, www.carlislesyntec.com

GARAGE DOORS // Overhead Door Co., www.overheaddoor.com

ZINC SHINGLES // VMZinc, www.vmzinc-us.com

CORRUGATED METAL // Morin, bit.ly/2LKpSR6

STOREFRONT WINDOWS // Vistawall, vistawall.ae

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WRITTEN BY | ROBERT NIEMINEN

PHOTO: SCOTT WEBB FOR UNSPLASH

MODULAR BUILDING

Practices Are Changing the Construction Industry; Here's What Facility Executives Need to Know

When most people hear the word "*modular*" with respect to buildings, they often mistakenly picture cheaply built mobile homes sitting atop flatbed trucks cruising down the highway. In other words, modular is regarded as somewhat of a four-letter word.

But modular construction practices aren't equivalent to manufactured homes, and the industry in North America is finally waking up to the fact.

"We're starting to see it trickle down, and I think we're finally changing the 'M' word," says Ken Semler, president and CEO of offsite construction company Express Modular, Martinsburg, W.Va. "That's the problem with modular—everybody's confused it with mobile or manufactured for a lot of years, and I think the internet's kind of been our best friend. People are doing the research and finding out we're not what they thought we were."

So, if it's not mobile homes, what is it?

By way of definition, modular or offsite construction "involves the process of planning, designing, fabricating, transporting and assembling building elements for rapid site assembly to a greater degree of finish than in traditional piecemeal on-site construction," according to the National Institute of Building Sciences (NIBS) Off-Site Construction Council, Washington, D.C. Additionally, NIBS notes the modular industry consists of two, distinct industry segments: re-locatable modular, referring to temporary structures for short-term use, and permanent modular construction (PMC), which is prefabricated single or multi-story whole building solutions in deliverable module sections.

According to the Modular Building Institute (MBI), Charlottesville, Va., though PMC has been flourishing for a decade or more in Europe, it still is an emerging market in North America. However, a 2011 Sage report described PMC as "the stealth division of the nation's construction industry." At that time, PMC accounted for roughly $2 billion in annual revenues in the U.S. and Canada. "The industry has since emerged from the shadows," an MBI white paper suggests. To be sure, PMC firms earned roughly $3.3 billion in gross revenues in 2016—a 61.8 percent increase from 2015.

Given the growth and prevalence of this trend, what does modular offer over traditional construction practices, and what are the opportunities for existing building retrofits? Read on.

An Outdated Construction Paradigm

Why the sudden surge in modular construction? There are a couple major drivers toward the modular construction trend, including skyrocketing construction costs and inefficiencies. But the biggest concern according to experts is the labor pool.

"You can't go to a construction conference, meeting, seminar, webinar and not hear about labor shortage, and so that's been the biggest driver [for modular construction]," Semler explains.

Tom Hardiman, MBI's executive director, agrees, noting after the recession, many construction workers left the industry and didn't return. Further, he says the labor situation "is not getting any better—it's getting worse." Hardiman predicts when many of these 50- and 60-year-old workers retire, "we're going to feel the pain when

> "ANYONE WHO'S AN OWNER OR DEVELOPER THAT'S NOT TAKING A HARD LOOK AT MODULAR DEVELOPMENT BEING BUILT IN FACTORIES VERSUS SITE BUILD—I DON'T WANT TO SAY THAT THEY'RE IGNORANT—BUT HOW COULD YOU NOT TAKE A LOOK AT THIS CONCEPT AND RECOGNIZE [ITS VALUE] COMPARED TO WHAT YOU'RE CURRENTLY DOING?"
>
> *—Steven Bolos, president, Katerra Renovations*

View modular insulated wall panels being attached to a building's façade in this short video.

PHOTOS: **ENERGIESPRONG**

there's no labor left to build these [buildings]. That day is coming," he warns.

When it does, it will be far more difficult to address the problems with traditional construction practices, which have scarcely changed since the late 1800s and early 1900s, according to Steven Bolos, president of Renovations for technology-driven offsite construction company Katerra, Menlo Park, Calif. Bolos suggests a historical photo of a construction worker putting nails into a wall and one from a construction site today look strikingly similar because the industry is lagging behind the times. "It hasn't changed," he says. But with respect to modular construction, he notes, "This is a true evolution of change in the construction industry, of which a lot of the other parts of the world have already been there."

Hardiman echoes those comments, suggesting the industry is among the last to stick to its old ways of doing things. "Technology has advanced and driven virtually every other industry, and we're still clinging to [the practice of] shipping materials to the site and get a bunch of guys with a bunch of hammers and put it together—and it's not going to work," he says. Hardiman points out the U.S. is nearly a decade behind other developed countries that have embraced modular construction, "and we're still making up excuses as to why we don't want to go down this path."

Benefits of Building Offsite

The fact is, offsite construction practices represent a more industrialized and efficient way of approaching building projects with inherent benefits that cannot be ignored much longer. Past and ongoing research comparing the benefits of offsite construction versus traditional onsite construction has proven that modular is advantageous, according to NIBS. Benefits of offsite practices include:

- shorter construction schedules.
- greater degree of predictability in cost.
- reduced material waste.
- reduced carbon emissions caused by transportation to and from the site associated with onsite construction.
- reduced site disturbance.
- an increase in safety and security of laborers and trade equipment.

"Speed is one of the biggest reasons for growth on the commercial side," Semler says. "Projects get done faster because it takes about a third less time because construction happens simultaneously—it's happening in a factory simultaneously with the site preparation, so immediately upon a foundation being in place, modules can be scheduled to be there and start being placed."

Bolos adds offsite construction improves efficiency and saves valuable time in scheduling, "and time equates to money to the building owners and the developers."

Although some may question whether modular construction will threaten the job market, Hardiman suggests the opposite is true. "Modular factories offer a more stable, less seasonal work environment, which is also much safer," he says. "The fact that entire building projects can be 50 to 90 percent completed in a factory-controlled setting—including framing, electrical, plumbing, drywall, painting—is very appealing to general contractors struggling to find consistent subs."

Existing Building Challenges and Opportunities

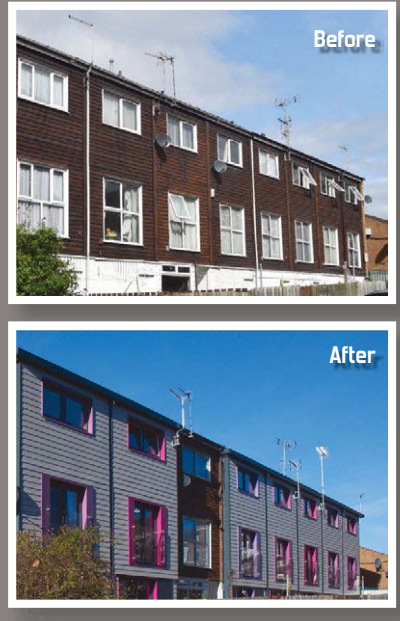
The business case for offsite building is evident for new-construction projects. Existing buildings, on the other hand, face limitations but there are ample opportunities to capitalize on modular construction for retrofits, as well.

Perhaps the most obvious scenario is with additions and expansions that build off a structure outward or upward with additional floors. Hardiman says MBI has seen many successful examples of modular additions to existing buildings, including schools, health-care facilities and office complexes. "Of course, it's best when the original building is designed and constructed with the idea of future expansion in mind," he points out.

Semler suggests tying in modular building pods to an existing structure is simply a matter of keeping measurements in mind, noting the differences in construction between them. For example, he points out modules are self-contained units with their own structural integrity, each with their own ceilings and floors, so floor transitions are particularly important. "Other than that, I really don't see any issues—it's just designing it and stacking. It's literally like stacking Legos," he says.

Another attractive option for retrofitting is installing prefabricated bathroom pods into existing buildings or prefabricated, insulated wall panels or even elevator shafts that attach to a building's façade, according to Hardiman. "I could see those [examples] really being more appropriate for more of a retrofit situation than maybe a full 3-D module," he says.

For large companies, like Katerra's Renovation division, the opportunity for retrofitting isn't necessarily in structural modifications but in materials for interiors. Leveraging its size and purchasing power in the modular construction market, the company wants to be the largest turnkey provider of material sourcing for renovation projects, according to Bolos. Whether it's lighting, plumbing, countertops, cabinets, hardware, doors or flooring, Bolos says Katerra is able to negotiate deals with



Prefabricated wall panels installed on an existing multifamily building were designed to make the building energy-efficient, warm and desirable to tenants.

Katerra offers a **pre-fabricated** closet program for existing apartments and condo buildings. Leveraging its size and purchasing power in the modular construction market, the company wants to be the largest turnkey provider of material sourcing for renovation projects.

factories—or in some cases purchase the manufacturing facilities—to bring products to projects at a much lower price point while ensuring high-quality materials.

"Right now, the biggest bang for the buck that I think we're driving beyond the price is that we are out there soliciting creative and innovative items and products that haven't even reached the marketplace yet," Bolos says. "Because we're so large, reaching out to vendors and providers that … now we're bringing things to the market that most of the property owners haven't even seen yet. That's on the development side, new construction, as well as renovation."

That being said, existing structures do restrict what can be done with offsite construction. For example, can modules 12 feet by 40 feet or longer be brought into an existing building? "I think for retrofitting, it would certainly be a case-by-case determination. But if there is a desire to minimize onsite disturbances or a need for quicker construction completion, modular may make a great deal of sense," Hardiman says.

According to Semler, another big challenge is a perceived limitation in design. He says not many architects are familiar with modular construction practices yet, and it's not being taught in schools so construction professionals don't know how to design buildings and products that optimize the use of modules into the process. "As this is gaining more popularity, people are learning, but it's kind of an on-the-job training process," Semler explains. As a result, adoption among architects and building owners is slow. "If project owners don't know about it, it's foreign and you get trapped in the same cycle. You do what you know, not what possibilities are," he adds.

Regardless of whether modular construction seems viable at this point, change is coming to the industry—and those that want to remain competitive ought to give this trend another look. As Bolos concludes: "Anyone who's an owner or developer that's not taking a hard look at modular development being built in factories versus site build—I don't want to say that they're ignorant—but how could you not take a look at this concept and recognize [its value] compared to what you're currently doing?"

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Circle No. 47

SCREEN ROLLS OUT OF SIGHT WHEN WINDOW IS CLOSED

Pella Corp. has gone back into its history to debut the Integrated Rolscreen, a concealed, retractable screen that moves seamlessly with the sash of double- and single-hung windows. The Rolscreen retractable screen, which was introduced when the company was founded nearly 100 years ago, automatically appears when the window is opened and rolls out of sight when closed. The design features high-strength magnets that keep the screen in place and a self-correcting feature that quickly re-threads the screen material if needed. Tested in extreme conditions to deliver performance, the Integrated Rolscreen is backed by Pella's 10-year transferrable limited warranty. The Integrated Rolscreen, which appears at both the lower sash and the upper sash of double-hung windows and appears at the lower sash of single-hung windows, is initially available on Pella Architect Series Reserve double- and single-hung windows with plans to expand into other product lines in 2019.

View the Integrated Rolscreen in action via a short video.

www.pro.pella.com // Circle No. 48

FIRE-PROTECTION PORTFOLIO LAUNCHES WITH 35 SKUs

Zurn Industries LLC has released its Fire Protection portfolio, which includes backflow preventers, fire valves, shut-off valves, pressure-relief valves, automatic control valves and in-building risers. Zurn offers 35 new SKUs this first launch, including additional fire valves (hose valves and restricting hose valves), test and drain valves, additional shut-off valves (powerball butterfly valve) and commercial risers. Zurn has been providing fire-protection solutions since 1971, now manufacturing solutions across more than seven fire-protection categories. All products are inspected and backed by warranty. The manufacturer will continue to roll out new fire-protection products and parts throughout the year and into 2019.

zurn.com // Circle No. 49

DURABLE DECKING, CLADDING PRODUCTS ARE REAL WOOD

Drift from Thermory offers the increasingly popular look and texture of reclaimed-wood decking and cladding. The product utilizes thermally modified spruce, pine or ash for consistent quality and stability and offers Class 1 durability (25-plus years) for resistance to rot and decay. Produced in Estonia, the thermal-modification process uses only heat and steam to create real-wood products that combine durability and moisture resistance without sacrificing strength. Drift decking, which is available in dimensions of 5/4 by 6 inches and 1 by 6 inches in lengths of 6 to 16 feet, features solid and grooved profiles for installation via a proprietary hidden fastening system. Drift cladding, which comes in seven silver/gray color options and dimensions of 1 by 6 inches and 1 by 8 inches in lengths of 6 to 16 feet, is designed for a blind fastener installation.

www.thermoryusa.com // Circle No. 50

CREATE PRIVACY OR TRANSPARENCY ON DEMAND

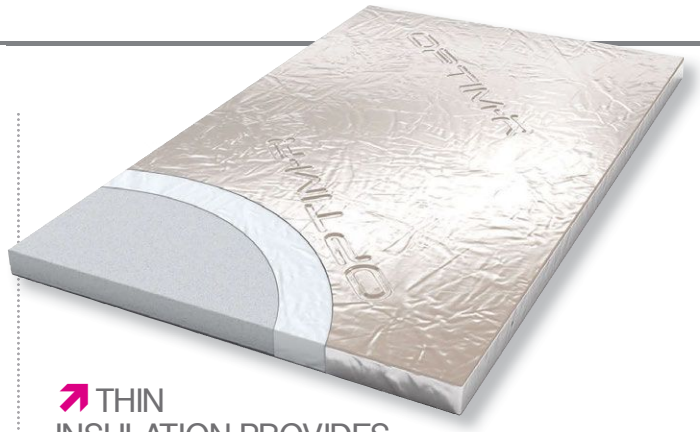
NanaWall Systems has made available its NanaWall WhiteOUT glass wall system that provides visual privacy or transparency on demand. At the touch of a button, the opacity allows it to be used as a whiteboard or projection screen for maximum space efficiency. When not in use, the glass panels can be stacked remotely out of sight to allow for flexible connectivity of spaces. NanaWall also has unveiled NanaWall 3D Visual Studio, a cloud-based design tool that provides architects with an interactive solution to visualize and animate their design using NanaWall Single Track Sliding glass walls. The tool renders and emails consolidated CAD and PDF files of design drawings, making it easy to incorporate the system into a project.

nanawall.com // Circle No. 51

PRECISELY CONTROL COATINGS' MIL THICKNESS

The Wooster Brush Co. has added a green, 16-millimeter roller gauge to extend its product line. These tools make a challenging application—controlling mil thickness—more precise. Their design helps with spreading, gauging, and backrolling roof and floor coatings, epoxies, urethanes, anti-skid floor toppings, metallic finishes and vapor barriers. The four roller gauges in the line are color-coded to the different mil-thickness depths they're designed to achieve; the colors are yellow, 4 millimeter; red, 12 millimeter; green, 16 millimeter; and blue, 22 millimeter. Wooster-exclusive roller gauges are recommended for use with 3/16-inch nap Wooster roller covers; using different nap-height covers will provide varying results.

www.woosterbrush.com // Circle No. 52



THIN INSULATION PROVIDES HIGH R-VALUE

Kingspan Insulation has debuted OPTIM-R next-generation insulation for roof systems. The insulation comprises rigid vacuum insulation panels with a microporous core, which is evacuated, encased and sealed in a thin, gas-tight envelope. The high level of thermal efficiency—up to R-28 on 1 inch and R-57 on 2 inches using calculated edge thermal-resistance properties—combined with minimal thickness, provides a solution for applications where a lack of construction space or depth is an issue.

www.kingspaninsulation.us // Circle No. 53

OPEN-CELL SPRAY FOAM ELIMINATES AIR INFILTRATION

Icynene-Lapolla has introduced its Lapolla FOAM-LOK 450 Spray Polyurethane Foam Insulation. An open-cell solution for attics and cavity walls, over metal and other critical insulation areas, FOAM-LOK 450 eliminates air infiltration. The installed costs in many circumstances are cost-competitive with traditional insulations and can potentially offer a return on investment through reduced energy consumption. Additional product benefits include noise attenuation, durability and moisture control. The product adheres to framing members and substrates and can be used to fill stud-wall construction in a single application. Additionally, it conforms to the AC 377 End Use Configuration Criteria, meeting building-code requirements for use with no additional ignition barrier required.

www.icynene.com, www.lapolla.com // Circle No. 54

CLOSET SYSTEM IS UPSCALE

ClosetMaid LLC has introduced 27th Avenue, a premium suite of textured wood styles, soft-touch finishes and hardware for modern residences that require upscale personalization. Three muted woodgrains—Washed White, Natural Blonde and Modern Gray—are embossed to provide a tactile experience. New solid finishes—Timeless Taupe and Clean Slate—have a matte appearance that is soft to the touch. The collection offers three premium door and drawer-front styles—Modern, Traditional 5-panel, and Shaker 5-Panel—to coordinate with multiple design preferences. New glass knobs and contemporary drawer pulls add a finishing touch. 27th Avenue also includes two new island tops: Calcutta Marble and Black Alicante. Manufactured using 3/4-inch industrial-grade engineered wood, the system's features span soft-close, full-extension glide drawers to fitted jewelry trays and complementary accessories.

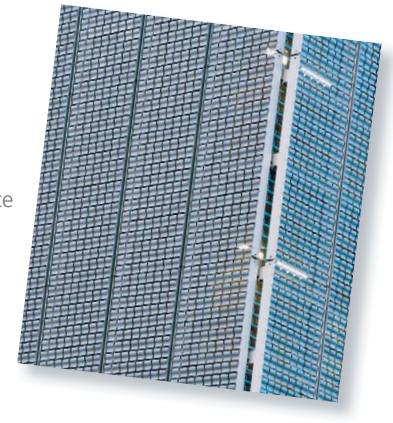
www.closetmaidpro.com // Circle No. 55

IMPROVE LIGHTING AND AESTHETICS IN SPACES WITH HIGH CEILINGS

Columbia Lighting's Peloton High Performance High Bay is designed for gymnasiums, warehouses and light-industrial working environments that require improved aesthetics. Peloton features an uplight option from 1,000 to 4,000 lumens to eliminate the "cave effect" and alleviate contrast concerns that ultimately lead to decreased light uniformity. Wide and Narrow distribution options are available for open area and aisle applications, and visual comfort can be enhanced with a broad selection of lens options. Peloton has been certified to the UL 924 emergency lighting standard, which sets minimum lighting levels and overriding controls in emergency mode to light the path of egress in the event of an emergency. The DesignLights Consortium-qualified Peloton offers a 177 lumen per watt high-efficacy option and 8,000 to 60,000 lumen packages, enabling lighting specifiers to use a single fixture to achieve a unified look and feel in facilities with a range of ceiling heights.

bit.ly/2McQhqV // Circle No. 56

FAÇADE SYSTEM CREATES LOOK OF ROLLING WAVES



KINETICWALL Dynamic Façade system from Exterior Technologies Inc. adds movement to building enclosures and wall systems with flappers attached to stainless-steel rods. The panels react to wind currents, creating the look of rolling waves across the wall system. KINETICWALL is structurally designed to withstand hurricane-force winds and torrential rainfall, yet it is light enough to enable easy installation, natural ventilation and visibility from the inside. It can be specified with square or curved polycarbonate, glass, aluminum or steel flappers, in different sizes. The metal framing and standard 6-inch flappers may be finished in a broad choice of finish types and colors and can be recycled at the end of their useful life. The spacers between the flappers remove the chance for collateral noise. Depending on the choice of flapper material, the KINETICWALL system also manages unwanted solar heat gain inside the building.

extechinc.com // Circle No. 57

TRANSFORM INTERIOR WINDOWS INTO PRIVACY SCREENS, INTERACTIVE DISPLAYS AND MORE

Avery Dennison has introduced its Vela Dynamic Display System, which enables interior windows to be instantly transformed into privacy screens, erasable whiteboards or interactive displays. It works by placing a thin, transparent film over glass panes. When switched on, Vela offers transparency and clarity. When off, the technology transforms a glass pane into a frosted opaque surface to provide privacy. In retail environments, the technology can turn any window into a high-definition TV screen, allowing retailers to syndicate messages across multiple locations or broadcast store-specific advertisements and media-elevating customer engagement. The Vela film is designed with a Pressure Sensitive PS adhesive on one side for a wet application and a Scratch Resistant SR Coating on the other side to ensure scratch-free installation and maintenance. Available in custom shapes and sizes, Vela can be applied to any interior window.

www.averydennison.com // Circle No. 58

DOOR OPENINGS CAN WITHSTAND FOUR-MINUTE PHYSICAL ATTACK

ASSA ABLOY has partnered with School Guard Glass to develop complete attack-resistant door openings that comply with the 5-aa10 test standards recommended by the FBI's Active Shooter Report. These Attack-Resistant Openings are economically designed using hollow metal door and frame construction with accompanying ASSA ABLOY hardware. The openings are rigorously tested to ensure they can withstand an intense four-minute physical attack with the use of hand tools and after being shot 60 times with 7.62 NATO rounds. Although the door or glass may not stop a bullet from penetrating the opening, the attack-resistant door assembly will remain intact so as to prevent an attacker from breaching the opening.

Watch a demonstration of the Attack-Resistant Openings.

www.assaabloy.com // Circle No. 60

GLASS INSULATES LIKE A WALL

Using a vacuum between two panes of glass that prevents heat from escaping to the outside, Guardian Vacuum IG provides thermal insulation with an R-value of up to 12 for 8-millimeter thickness. Because Guardian Vacuum IG uses tempered glass, the product is suitable for use in commercial buildings. Performance is enhanced by pairing Guardian Vacuum IG with Guardian SunGuard coated glass to create a hybrid, low-E glass product that delivers the light transmission, reflectivity and color needed for new construction and retrofits. In addition, noise reduction exceeds that of a typical insulating glass unit.

guardianglass.com // Circle No. 61

The first application of Guardian Vacuum IG is a retrofit at Sherzer Hall at Eastern Michigan University, Ypsilanti. The planning and design team have reported the installation has had an immediate impact.

DURABLE FLOORING IS OFFERED IN NATURAL AND VIVID SHADES

Altro Cantata offers 16 soft-look flooring shades ranging from subtle, natural options to vivid colors, allowing designers to achieve their desired tones without appearing too industrial. Although its finish is smooth, the floor can handle medium to heavy traffic. A damp subfloor poses no threat; Altro Cantata solutions can be installed at up to 97 percent internal relative humidity. Easy cleaning and maintenance will ensure the shades continue to look great and the flooring is durable throughout its lifetime.

www.altro.com // Circle No. 64

Learn more about DESIGNFlex Ceiling Systems via a short video.

CHANGE CEILINGS WITH SHAPE, COLOR AND TEXTURE OPTIONS

With the introduction of DESIGNFlex Ceiling Systems, Armstrong Ceiling Solutions is giving architects and designers the freedom to reinvent their ceilings by mixing and matching different panel shapes, sizes, colors and textures in orders as small as one carton that can be ready for shipment to the job site in three weeks. DESIGNFlex Ceiling Systems include smooth-textured Calla and Lyra panels, fine-textured Ultima and Optima panels, and smooth-textured MetalWorks panels. These products are available in new DESIGNFlex Shapes, including triangles, parallelograms and trapezoids. Squares and rectangles also are available in made-to-order sizes for these and a myriad of other ceiling textures. In addition, Calla and Lyra Shapes, squares and rectangles are available in any color. An online DESIGNFlex Pattern Gallery features dozens of patterns and color palettes, as well as details about panels, suspension systems, trim and accessories. Complete installation instructions and suggestions for integrating lighting and diffusers into ceilings also are included.

armstrongceilings.com/designflex, armstrongceilings.com/patterngallery // Circle No. 65

AD INDEX

SEPTEMBER-OCTOBER 2018

A DAY AT THE ZOO

Special Events Space Meets Sustainability Goals

When the Lilly Endowment granted the Indianapolis Zoo $10 million in 2015, it came with a couple conditions. The grant needed to benefit the zoo's long-term sustainability goals and it had to create a standalone feature to attract and engage visitors that could be transformed for special events. Zoo representatives reached out to RATIO Architects, Indianapolis, to create the Bicentennial Pavilion and Promenade, an open-air special events space that embodies sustainability in every aspect of its design.

It was vital for the pavilion to function year-round for concerts, picnics and more, as well as be a centerpiece for the zoo to aid in visitor circulation. The pavilion, which opened in spring 2017, houses 11 canopies that feature 12,770 square feet of the U-Lite low-slope canopy system.

The canopies vary in height to increase air circulation along the promenade and are comprised mainly of natural material to resemble a lush rainforest. Each canopy utilizes a combination of clear and ice-white glazing panels to provide a balance of diffused and direct light to the ground below to benefit patrons and existing plant life.

Zoo representatives wanted a system that would properly filter rainwater through to the ground rather than to the sewage system. While reviewing different products, RATIO Architects found this to be a challenge given the limitations of other systems. "The other companies we spoke to weren't able to achieve the types of goals we had," explains Andrew Heilman of RATIO Architects.

RATIO Architects' solution relied on the U-Lite system's ability to effectively channel water to the drainage system where it would then be collected from the individual pods by the weathered steel structure and moved to the plant life below the canopies. "Because the design of the panel is turned up at the end on all four sides of each pod, there are no moisture problems and water can efficiently drain," Heilman notes. "The edge detail of the polycarbonate was a huge detail that other companies just couldn't accommodate."

All pathways within the zoo connect to the pavilion's central placement, making it well-suited for an improved natural flow through the zoo. "The previous layout was essentially a maze that was confusing for visitors," Heilman adds. "This structure has cleaned up the circulation space around the zoo by making more accessible paths that all tie together; now when you visit, it's practically a guarantee that you'll visit the pavilion at some point."

The Bicentennial Pavilion and Promenade currently is home to the zoo's newest bird exhibition, Magnificent Macaws.

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