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Fall 2019

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Harbor Habitat For Humanity

Firm Management: Business Planning:
A Blueprint for Your Firm's Future

Balcony Design – IBC Changes and
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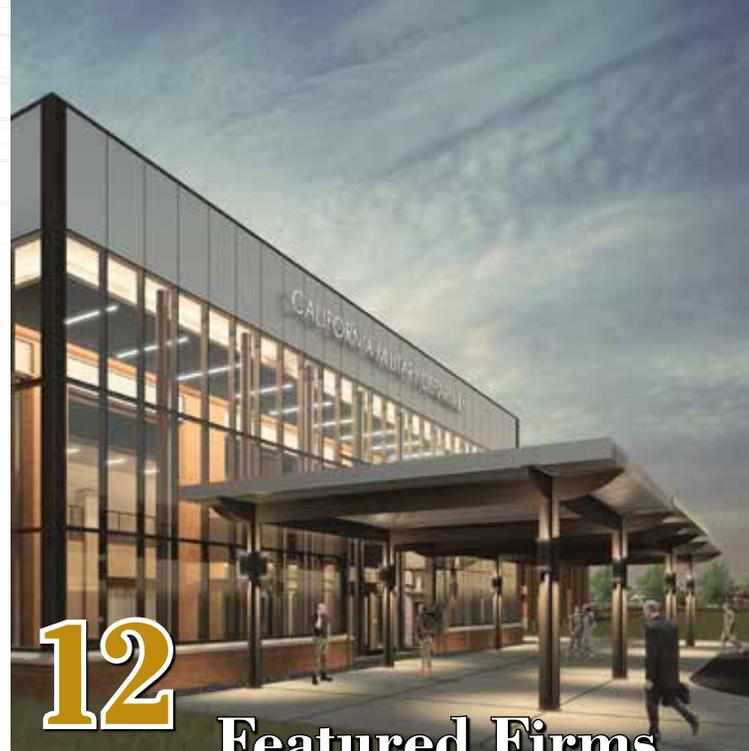
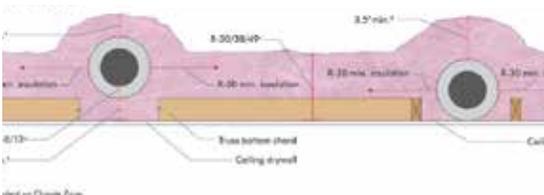
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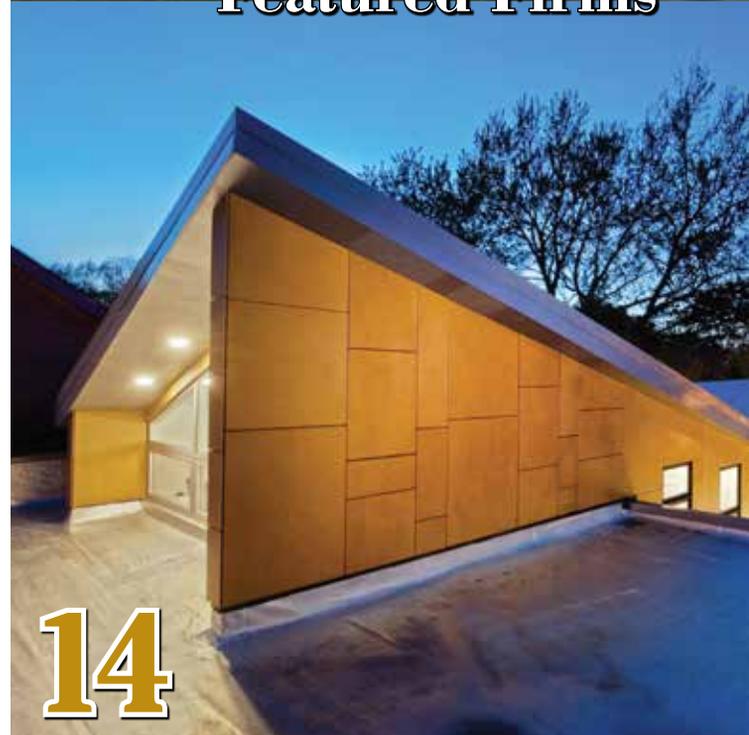
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*Cover Photo: Project: The Johnson Center for Science and Community Life, Stantec Architecture, Inc.
Photo credit: Mark Ballogg, ©BalloggPhoto.com*



Not rain, nor heat, could stop the fun at the annual ALA Golf Outing, June 28th in Algonquin, IL. We are pleased it was so well-attended, that we had many generous sponsors, and that so many members and guests filled the dining room for a buffet dinner and awards presentation. Make a note today to look for our 'Save the Date' for next June.

Speaking of enjoyable opportunities, our personal and professional lives were enriched at the ALA tour and culinary experience at Taliesin on August 15th. We toured Frank Lloyd Wright's home, studio, the school, stopping for a farm to table lunch on the grounds of Tan-y-deri marveling at the views of the 800-acre estate. Clearly, as professionals, we continue to expand our technical and creative expertise... however, let's always remember the value in getting away from our desks and actively seeking a healthy work/life balance.

Another ALA event is highlighted in this LA issue and is not to be missed: the July 31st participation at the Habitat for Humanity home in Benton Harbor. PLEASE read all about it here, and kudos to those who gave of themselves that day and have 'made a difference' for years to come.

Other noteworthy ALA items:

Design Awards

- Boards have been turned in
- Friday, September 13, Judging
- Monday, October 28, Design Awards Dinner, evening before ALA Conference. Emcee - Stephen Chung, host of TV's "Cool Spaces: Best of New Architecture"

21st Annual ALA Midwest Architectural Conference

- Tuesday, October 29, 2019, Drury Lane, Oak Brook, IL
- 17 seminars to choose from, earning as many as 6 learning units in one day
- Keynote Speaker: Blair Payson, Principal Olson Kundig. He has worked on the Century Project for the Space Needle, The Bill and Melinda Gates Foundation Visitor Center, as well as a new art park in Sacramento and museum projects in Hawaii and London, to mention a few projects.

Student Merit Awards

- 27 winners, congratulations! See their biographies in this issue
- 17 schools/universities represented

Enjoy each of the articles and tune into the ads in this Fall issue. There are many great opportunities to connect with what's happening in the architectural world and build relationships with the people who help sponsor our publication. Have a great fall season, and we'll see you October 29th in Oak Brook. 



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A Hand Up, Not a Hand Out

BY: MICHELLE RUMSA, ALA, RA

ALA Southwest Michigan and Illinois chapter members and guests had the honor of participating in a collaborative effort of exterior sheathing and blocking installation on a new home with Harbor Habitat for Humanity in Benton Harbor, Michigan on July 31, 2019. Our volunteers came together as a group of strangers, spent the day working hard side-by-side, and parted as friends who shared a common goal of making a difference in the life of someone by giving them a hand up.

The mission of Harbor Habitat for Humanity, as beautifully stated by executive director Erin Hudson, is to provide a “hand up, not a hand out” for those who need housing. Families and individuals in need of decent, affordable housing apply for homeownership with their local Habitat for Humanity.

Each local Habitat’s family selection committee selects homeowners based on three criteria:

- The applicant’s level of need.
- Their willingness to partner with Habitat.
- Their ability to repay a mortgage through an affordable payment plan.

As part of their willingness to partner, Habitat’s homebuyers invest three hundred hours of their own labor with 150 hours working alongside volunteers and other Habitat homeowners to build homes and 150 hours of life training skills such as maintaining a steady job, how to balance a budget, home ownership responsibilities and repairs and understanding taxes, insurance and community participation.

Organized by the ALA Southwest Michigan Chapter we would like to give a big shout out to the staff of Harbor Habitat for Humanity, those

who transform lives every day: Erin Hudson, Executive Director; Brenda Butler, Volunteer Coordinator; Bruce Banghart and Aaron Parker, Site Supervisors; and our own ALA volunteers from Tromp Architects, La Grange, Illinois; La Mantia Design and Remodeling, Hinsdale Illinois; Tera Architects, Benton Harbor Michigan and Edgewater Resources, St Joseph, Michigan.

Habitat for Humanity brings people together to build homes, communities and hope. Michelle M Rumsa, RA, ALA is an architect with Edgewater Resources in St Joseph, Michigan. 





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Business Planning: A Blueprint for Your Firm's Future

BY: RENA KLEIN, FAIA, AND EMILY HALL OF CHARRETTE VENTURE GROUP

As an architect, the first thing that you need to know about business planning is that the process is similar to designing a building. It is a blueprint for the future success of your firm. Without a plan, how can you coordinate all of the elements and timing required to get to your desired result? How can you navigate an unpredictable business environment?

The answer lies in starting with a plan that represents your firm's future vision now and then engaging with that plan frequently. Typically, business plans will look out over a five-year time frame. The goal is to create a living document that can evolve as new opportunities and challenges arise. In order to keep this planning process dynamic (as opposed to creating a document that sits on the shelf), developing an action plan for the near-term is also necessary, along with a check on progress toward stated goals. That can happen quarterly and during an annual strategic planning process.

The primary elements of a strategic business plan are purpose, finance,

marketing and business development, and operations. In this article we'll review what is involved in each of these areas of focus.

DESIGN YOUR FIRM

Purpose: "Why does your firm exist?"

All other aspects of a business plan are sourced from defining the primary purpose of your firm, which answers the question, "Why does your firm exist?" Purpose is expressed in mission, vision, and core values, as well as differentiators and market position.

Creating a clear mission statement requires you to think about why you are in business, who your clients are, and what unique talents and skills you

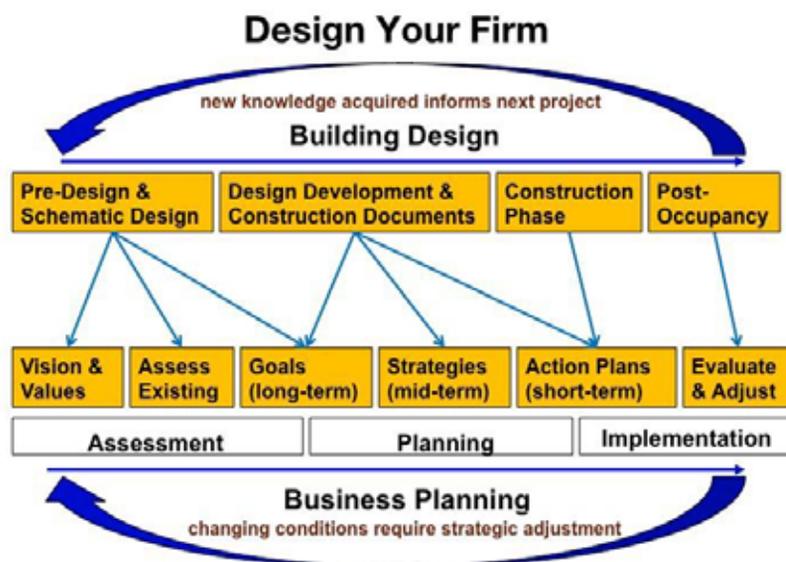
bring to serve them. Vision is about your aspirations and imagination of what the firm can be now and in the future. Core values speak to what is most important to your firm culture, which is critical to authentic formulation of mission, vision, goals, and action plans. At Charrette Venture Group, we have observed that firms whose leadership and staff agree on their purpose are consistently more successful in executing all other aspects of business planning.

Here are examples of mission statements from two of Charrette Venture Group's partner firms:

THE UP STUDIO, LONG ISLAND CITY, NY

THE UP STUDIO is a full-service architecture, interior, and brand design studio that enhances people's lives through concept-driven work. Our projects are customized to our clients' needs, site specific, and rooted in a thoughtful design strategy.

We believe that every design has a story to tell. To tell that story, we employ a multidisciplinary approach that combines broad ideas, diligent organization, and innovative tools, presented within a coherent narrative. We are passionate about this process and look forward to sharing it with you.



LIVING SHELTER ARCHITECTURE, ISSAQUAH, WA

*Living Shelter Architects is committed to providing innovative **design solutions for healthy and resilient homes, small businesses that share our values, and mission-driven organizations.***

*We are dedicated to positively impacting the **people and communities** we serve through **inspired place-based design, influenced by nature and guided by pattern language.** Our team believes that ongoing collaboration is key to achieving **cost-effective, resilient design** and we strive to remain **open and intuitive listeners** as we work toward making **sustainable design accessible to all.***

Finance: “How will your firm make a profit?”

A financial plan answers the question, “how will your firm make a profit?” While concerns about profitability may not be high on the list for many architects, businesses need to make money beyond paying the bills and providing market rate salaries for owners and staff. Profit allows a firm to take advantage of new opportunities and technologies, engage in marketing and sales initiatives, plan firm growth and stability, and create a “rainy day fund” to protect against future cash shortfalls.

A business plan should include a financial Pro Forma, typically looking out five years. These financial plans can become the basis of annual financial goals and should be reviewed and revised on an annual basis.

Pro Forma are basically budgets that outline expectations for revenue, expenses, and profit over a given period of time. Five-year Pro Forma for design firms are often based on growth in the number of people working at a firm, coupled with assumptions about revenue and expense per person. If a firm has been in business for a while, these assumptions can be based on actual

	Year 1	Year 2	Year 3	Year 4	Year 5
Size of Firm (FTE)	6	7	7	9	10
Net Revenue Forecast	\$718,362	\$861,588	\$861,588	\$1,120,392	\$1,235,988
Direct Labor Forecast	\$261,500	\$312,500	\$312,500	\$399,700	\$435,700
Overhead Expense Forecast	\$400,095	\$478,125	\$478,125	\$611,541	\$666,621
Profit Forecast	\$56,767	\$70,963	\$70,963	\$109,151	\$133,667
Profit Rate	7.9%	8.2%	8.2%	9.7%	10.8%
NOR per FTE	\$119,727	\$123,084	\$123,084	\$124,488	\$123,598

past performance. For a start-up, a Pro Forma can be developed by conducting research on basic business expenses in your area, including salaries. Financial scenarios can then be developed that include revenue forecasts, which are based on the number of people (actual FTEs - full-time equivalents) in the firm each year. In most parts of the United States, for most small firms, revenue per person can be estimated at around \$120,000 per person.

SAMPLE FIVE-YEAR FINANCIAL PRO FORMA

Action plans for achieving financial goals include:

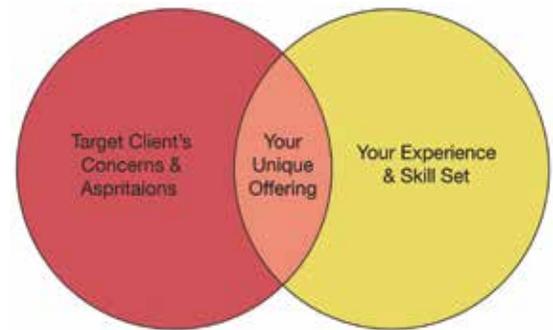
- Annual Profit Plan showing goals for net revenue and staffing
- Annual Budget including payroll, marketing, and general expenses
- Quarterly Review of Key Financial Indicators including utilization rates, break-even rates, billable ratio, and current ratio

Marketing and Business Development (Sales): “How will your firm bring in work?”

The marketing and business development plan answers the question, “How will your firm bring in work?” For many firms in today’s economy, work seems to flow in without apparent effort. However, to position your firm to thrive when the inevitable downturn comes, giving attention now to marketing and relationship-nurturing

is essential. Aspects of marketing and sales planning include defining target markets, doing market research to identify opportunities, developing ideal client personas, and understanding the connection between client needs and the unique value that you provide.

It is also important to understand the difference between, and the complementary nature of, marketing and business development. Marketing activities are meant to increase awareness of your brand and attract new leads to the top of your sales funnel. Business development (sales) activities are meant to move opportunities through the sales pipeline eventually resulting in acquiring projects. Each requires different tactics and discrete focus.



KNOW YOUR VALUE PROPOSITION

Marketing Activities Can Include:

- Branding
- Print Collateral

- Website
- Social Media
- Signage
- E-Blasts
- Press Placement
- Advertising
- Event Sponsorship
- Awards
- Competitions
- Thought Leadership

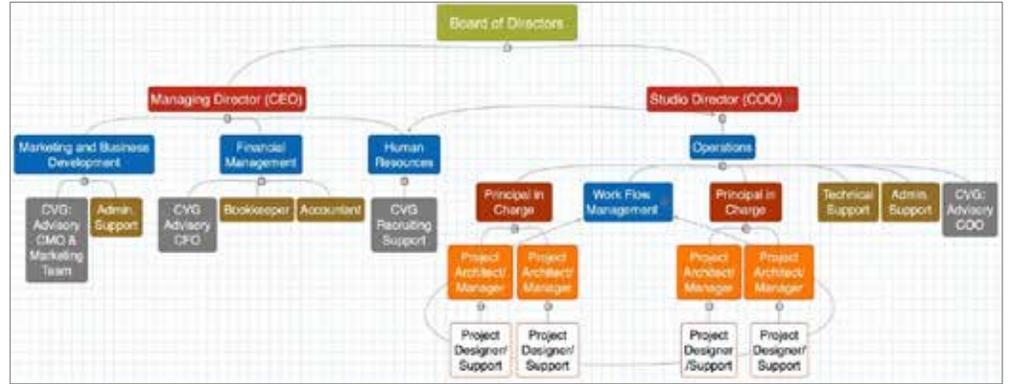
Business Development (Sales)

Activities Can Include:

- Networking Events
- Initial Consultations
- Proposal Preparation
- Project Interviews
- Civic Volunteering / Board Commitments
- Taking People to Lunch / Coffee
- Remembering your Conversations
- Following-Up
- Connecting People to Each Other and Providing Value
- Asking for Referrals

Operations: “How will you execute the mission?”

In a business plan, the operations section answers the question, “How will you execute the mission?” This involves thinking about organizational design – *who* is responsible for what? Who has authority to make what decisions? How is accountability enforced? How does project delivery flow from phase to phase and from person to person? Operations plans will often include an organizational design diagram and an outline of roles for firm



leadership and management, along with clearly articulating authority and responsibility.

SAMPLE ORGANIZATIONAL DESIGN

In a project-based environment, operations also involve project management systems. How are projects tracked against budget and schedule? How are clients managed? How can a culture of attention to project profitability, as well as design excellence be instilled? Who is responsible for managing the project managers? Operations plans will outline project-based roles and responsibilities, including those of Principal-in-Charge, Studio Manager, Project Architect/Manager, and other project team members.

The role of administrative support should also be considered in an operations plan. By the time a firm has grown to five or six, there should be administrative support, which might be in the form of a remote

bookkeeper and a part-time office manager. Some firm owners find it beneficial to have administrative support at start up, or soon after. The goal is to free firm owners from work that can be done by others and support principals to focus on strengthening client relationships, business development and other tasks that only principals can do.

Conclusion

Business planning is an essential tool whether you are starting a firm, growing or stabilizing an existing firm, or contemplating transition to new leadership. Planning your business should be a regular part of your practice. It requires merging strategic thinking with creative visioning and pragmatic action plans. Creating a business plan and updating it regularly will enable you to have a unified and consistent focus toward achievable goals. You wouldn't recommend building something without a plan. Applying similar thinking to shape

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To learn more, attend Charrette Venture Group's session on business planning at the 2019 Association of Licensed Architects Conference. We'll walk through the above concepts in greater detail, and there will be ample time for questions at the presentation and opportunity to talk with us individually during the conference. We look forward to seeing you there!

Rena M Klein, FAIA is VP of Investment Partnerships, and Emily Hall is VP of Marketing, at Charrette Venture Group. We help small design firms become stronger businesses. 

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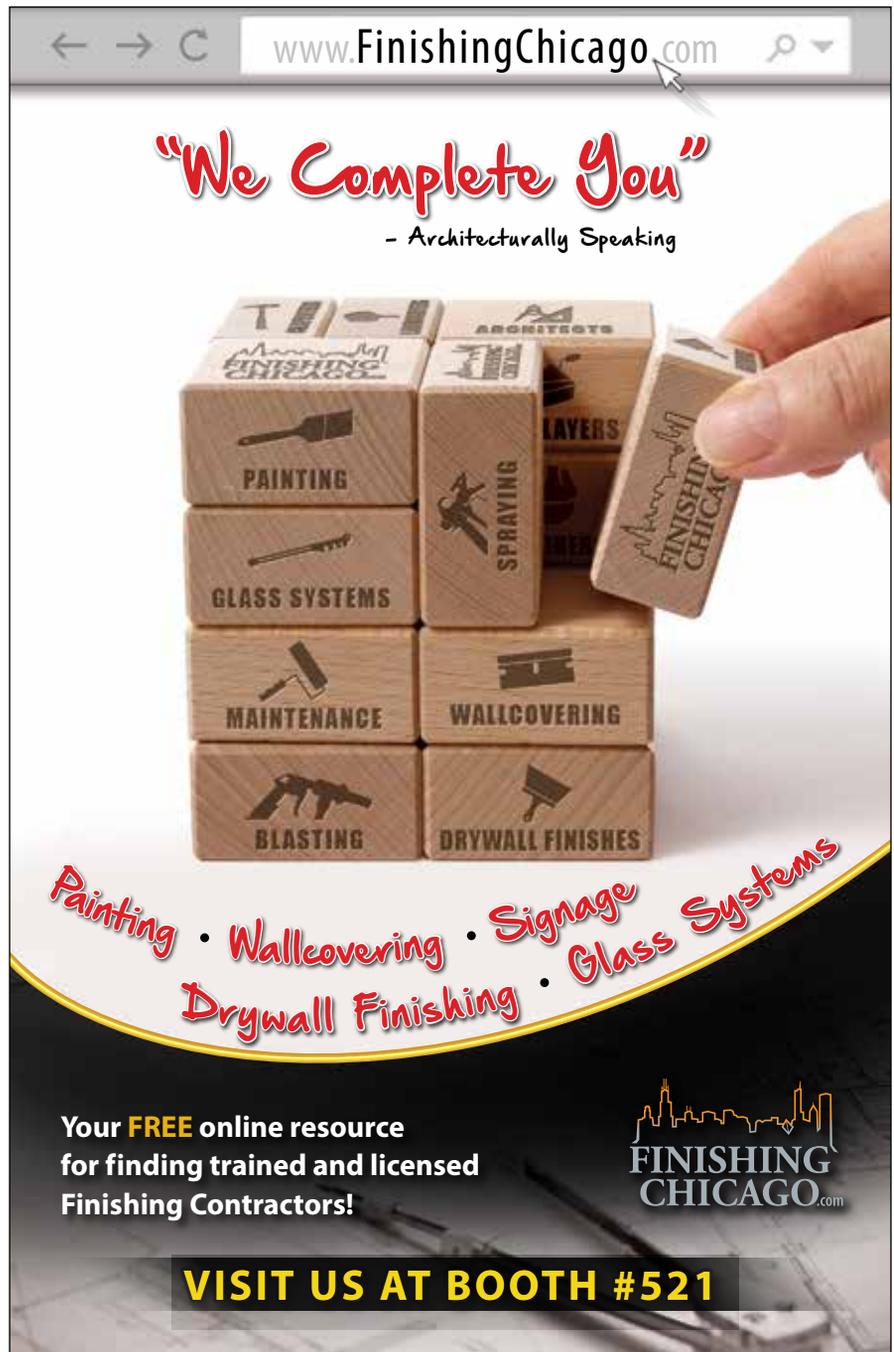
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Rena M. Klein, FAIA is a nationally recognized expert in small firm practice, having served as executive editor of AIA's The Architect's Handbook of Professional Practice, 15th edition (Wiley 2013) and as past-chair of the national Advisory Group for the AIA Practice Management Knowledge Community. At CVG she advises partner firms on all aspects of financial management and operations. With 20 years of experience as the owner of a small architecture firm, and over 10 years as a consultant and educator, Rena brings a special understanding of design firms managed by entrepreneurial architects. She has served as an adjunct professor at various universities teaching professional practice, ethics, project management, and leadership to students of architecture. Rena received her Bachelors in Architecture from the University of Oregon and her Masters in Management and Organizational Development from Antioch University in Seattle. Rena is based in Albuquerque, New Mexico.

Emily Hall

VP of Marketing
Charrette Venture Group
emily@charrettevg.com
Emily brings over 18 years of architectural marketing experience to CVG, with a focus on discovering a firm's authentic personality and using it to drive strategy. She served for over six years as Senior Associate and Director of Marketing and New Business Development at Union

Studio Architecture & Community Design and for nine years at Durkee, Brown, Viveiros & Werenfels Architects, both architectural firms in Providence, Rhode Island that have experienced significant growth. She received a Master in Business Administration from the University of Rhode Island, a Master of Industrial Design from Rhode Island School of Design, and a Bachelor of Arts from Colorado College.



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WORKPLACE



North Park University Johnson Center

The Johnson Center for Science and Community Life is the capstone of twenty years of campus planning and development and focuses on the quality of science-related education programs. Its central location on campus also offers the opportunity of a much needed social setting for bringing students and faculty together. This project is among the first higher education tri-party IPD Agreements used in the Chicago area and is LEED Gold Certified.

Confidential Technology Client

As this technology company continues to expand in Chicago's Fulton Market District, they found themselves in need of not only more workspace, but additional conference facilities to host training sessions. Their worldwide offices are each distinctive from one another and, while reflective of the company's overall identity, each office is representative of the uniqueness of each location. This project was the first project in the world to achieve WELL Building, LEED v4 Silver Certification, and Living Building Challenge Petal Certification.

Communities are fundamental. Whether around the corner or across the globe, they provide a foundation, a sense of place and of belonging. That's why at Stantec, we always **design with community in mind**. We care about the communities we serve – because they're our communities too. We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe. 

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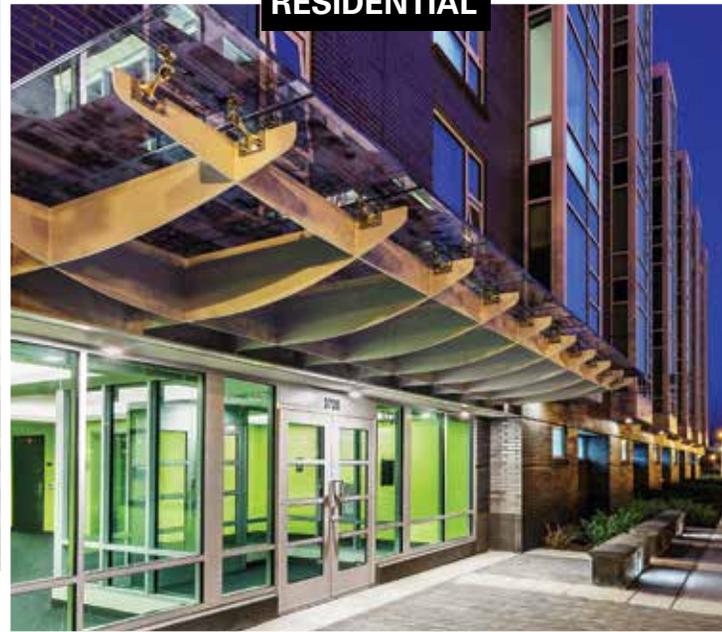
HOSPITALITY



Hotel Zachary

The Hotel Zachary is part of the multi-phase, multi-year historic renovation of Wrigley field in Chicago. The hotel is inserted into a vibrant urban neighborhood that is diverse in its commercial and residential use, and a year-round social gathering space.

RESIDENTIAL



Park Boulevard

This five-story, 80-unit mixed-income rental apartment building presents a playful facade on Chicago's South State Street. It features large bay windows, covered parking, a rooftop terrace, and floor-to-ceiling windows at the ground level to illuminate office and tenant recreation space.

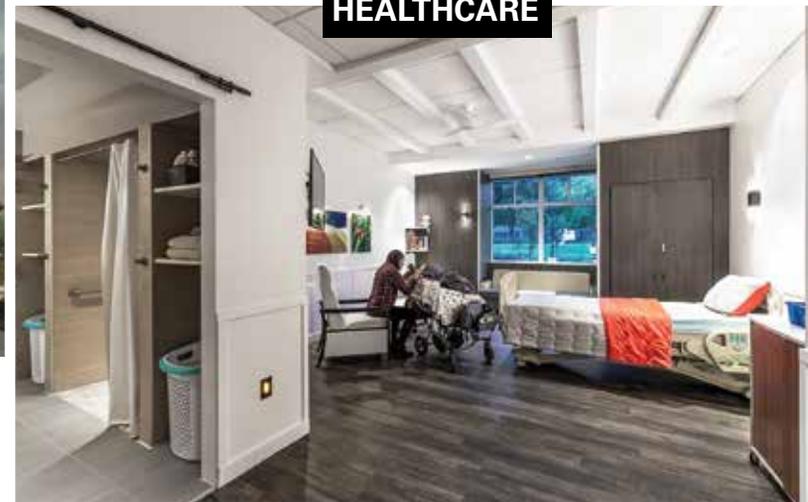
CIVIC



California Military Department

The goal of this project is to be more than a typical military facility, but be seen as more of a corporate headquarters with an open and friendly public entrance. This project is targeting LEED Gold Certification and is one of the first large scale Zero Net Energy projects legislated by the State of California.

HEALTHCARE



Almost Home Kids

Children who are chronically ill need a comfortable place to live while they transition between the hospital and home. The mission of this facility is to provide short-term transitional care in a home-like setting to children with complicated health needs, training for their families, and respite care. Ultimately the goal is for children to live comfortably with their families at home. Almost Home Kids has served over 1,000 children who have chronic medical complexities.

RETAIL



Salvatore Ferragamo

This 8,600 SF retail project includes the ground floor renovation and an expansion of the second floor of this Chicago North Michigan Avenue retail space. The new construction includes a two-story exterior façade, an ornamental stair connecting the second floor and ground floor.



Level is a collaborative of architects and creative thinkers designing to improve lives at work, at home, and at play. Michael Wilkinson and Greg Gibson founded Level based on their 15 year working relationship, which capitalizes on their combined strengths: quality design, attention to detail, innovative spirit, and absolute accountability. Level is passionate about using every commission to manifest clients' vision in a creative, inspirational, and economically viable design solution. 



The Henry - Chicago, IL

This 38,200 SF, 38-unit apartment building consists of one and two-bedroom units, a roof deck and indoor lounge, and ground floor retail space. The massing articulated by the different materials and the irregularly shaped property works to reinforce the concept that the site is comprised of a collection of smaller buildings.

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PHOTOGRAPHY: TRISHA KOENIG



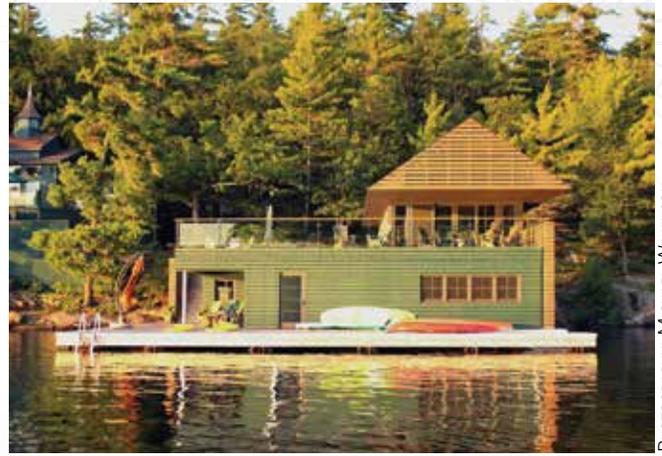
PHOTOGRAPHY: TRISHA KOENIG

Cornelia Loft - Chicago, IL

This former manufacturing building was converted into a residence for a family of four. The house is organized around an internal courtyard which provides a focal point from the living spaces and allows natural light to reach every room.



PHOTOGRAPHY: MICHAEL WILKINSON



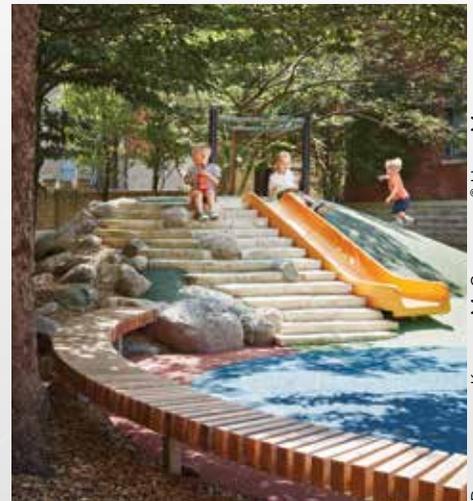
PHOTOGRAPHY: MICHAEL WILKINSON

Lake Muskoka Boathouse - Horseshoe Island in Lake Muskoka, ON, Canada

Our design solution for this boathouse and summer home was to abstract and modernize the traditional gabled Muskoka boathouse typology by extending the roof 15' to create a covered porch, adding a continuous band of ribbon windows and doors, and exposing the steel structure.



PHOTOGRAPHY: KENDALL McCAUGHERTY © HALL+MERRICK



PHOTOGRAPHY: KENDALL McCAUGHERTY © HALL+MERRICK

Latin School Play Garden - Chicago, IL

This play garden, occupying the grounds of a former mansion, follows Reggio Emilia principles, an approach towards early childhood education that encourages children to construct their own learning through play and exchange with each other, as well as the teacher.



RENDERING: MICHAEL WILKINSON



RENDERING: MICHAEL WILKINSON

Between the Lines - 4540 North Ravenswood, Chicago, IL

A nine-unit apartment building with ground floor commercial space, this project was designed by Level and developed by Michael Wilkinson. Situated between two train lines, a scrim of perforated corrugated metal defines the balconies and adds an element of privacy, as well as architectural layering to the façade.

Balcony Design – IBC Changes and Wood Durability Considerations

BY: FRANK WOESTE, P.E., Ph.D. AND DON BENDER, P.E., Ph.D.

Wood construction for “mixed-use” has always been popular in the western US, and is growing in popularity throughout the country due to favorable cost, availability, ease of construction, thermal performance, less embodied energy, and carbon sequestration. All building materials have advantages and disadvantages, and wood is no different. For example, wood is susceptible to deterioration from moisture exposure, but this risk can be mitigated through proper design and detailing.

Buildings such as the one shown in Figure 1 often include balconies as shown in the background. Cantilevered balconies have limited structural redundancy and have exposure to weather that requires special attention by design professionals, related contractors, permitting and inspection department, and maintenance by owners in-service. Figure 2 shows a different example of balcony framing for an apartment building constructed in 2018.

Balconies can add considerable value but require special attention to ensure public safety. A case in point – on June 16, 2015, a balcony on a wood-framed apartment building collapsed, causing *six fatalities* and injuring at least *seven* others, precipitating *emergency* changes to the 2016 California Building Code, effective January 30, 2017, and motivated changes to the 2018 IBC that address waterproofing measures and “special inspections” during construction.

Lessons learned from the Berkeley tragedy include:

- Balconies have limited structural redundancy so special attention to design, construction, material selection and inspection are critical.
- Moisture usually finds a way into enclosed spaces, so there needs to be a way for moisture to exit the spaces.
- Periodic inspections are needed to ensure the integrity of the balcony structure. Some means of access is needed to inspect the enclosed space (e.g. removable access panel).

The objectives of this article are to alert design and construction professionals as to changes in the 2018 IBC that address occupant safety of wood-frame balconies, and to provide guidance on improving balcony safety through durable material selection and considerations for in-service inspections.

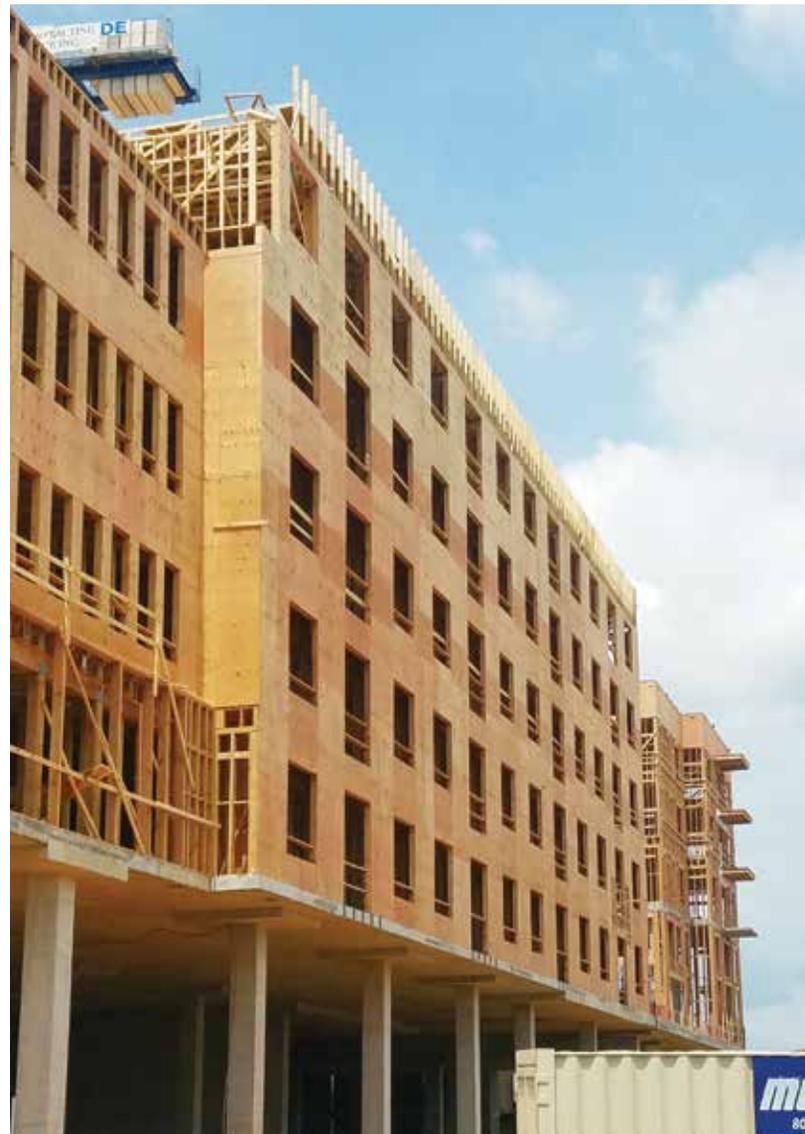


Figure 1. Example mixed-use podium wood-construction utilizing structural concrete for the first floor and wood-framing for the upper five floors. (Courtesy of Construction Science and Engineering, Inc.)



Figure 2. Example of balcony framing with untreated lumber with the framing enclosed. Note that the covering does not allow for ventilation of the enclosed space, nor does it have a removable access panel for periodic inspection. The guards are not yet installed, although these too require careful consideration to carry guard loads given in IBC 1607.8 Loads on handrails, guards, grab bars and seats.

2018 IBC change – Impervious Moisture Barrier System

The new code requires an “impervious moisture barrier system” when the wood structural framing is “exposed to the weather, such as concrete or masonry slabs,” as an alternative to preservative-treated or naturally durable wood. 2018 IBC Section 2304.12.2.5 follows (change indicated by underline):

“IBC 2304.12.2.5 Supporting members for permeable floors and roofs. Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative treated wood unless separated from such floors or roofs by an impervious moisture barrier. The impervious moisture barrier system protecting the structure supporting floors shall provide positive drainage of water that infiltrates the moisture-permeable floor topping.” (Underline indicates change.)

Positive Drainage. One critically important element for protecting untreated structural framing is the requirement for the “impervious moisture barrier system” to have “positive drainage” of water that infiltrates the “floor topping.” This change makes sense since hard surfaces can form cracks in-service and allow the passage of water by gravity and capillary action. Without the use of an impervious moisture barrier system that *includes* a “drainage mat component,” water that infiltrates the moisture-permeable floor topping can “back up” above the lower surface of the waterproofing system, creating hydrostatic pressure and back flow/migration of water.

Impervious Moisture Barrier System. The key word is “system” as the system required per the 2018 IBC to have “shall provide positive drainage of water that infiltrates the moisture-permeable floor topping.” A 2016 publication by Joseph Lstiburek, Ph.D., P.Eng. reviewed the issues involved and presented excellent stepwise details of a system installation that incorporates a “drainage mat” above the “waterproof membrane.”

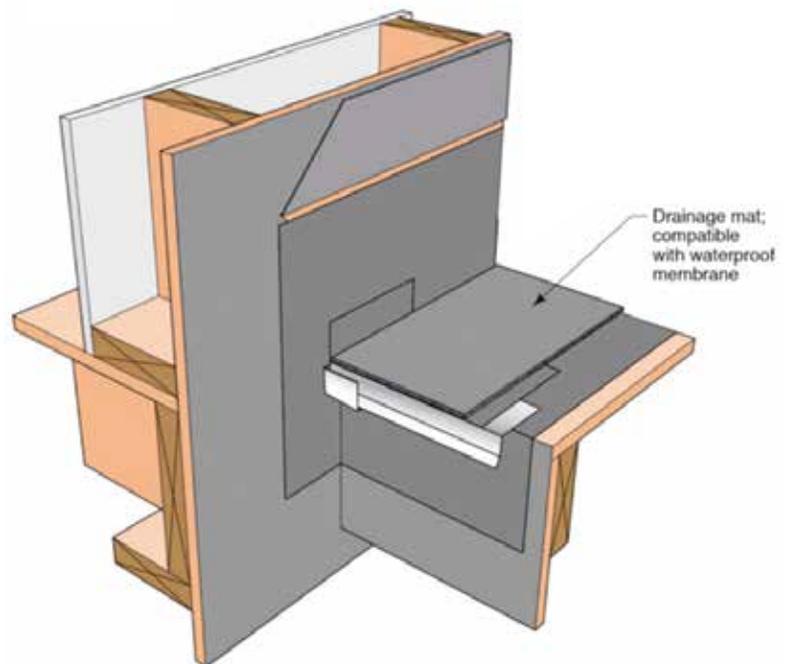


Figure 3. Source: BSI-093: All Decked Out by Joseph Lstiburek (Building Science Corporation) www.buildingscience.com/documents/building-science-insights-newsletters/bsi-093-all-decked-out

Dr. Lstiburek’s publication and details merit careful study by the design and construction professionals as the integrity of the wood framing is conditioned on the proper installation of a waterproofing system that meets the requirements of IBC 2304.12.2.5.

Commentary on “Impervious Moisture Barriers.” In our experience, it is entirely possible that moisture will find a way into the enclosed balcony space, as no barrier system is perfect. As such, it is important to provide a way for the moisture to exit the space. Next, we will cover another IBC change that calls for “free cross-ventilation.” Finally, given the limited structural redundancy of balconies, designers should consider using preservative-treated wood even for the case of impervious moisture barriers. Later in this paper, we give guidance on durable wood selection and fasteners.

Discussion of Durable Wood Options

Naturally durable wood versus preservative-treated wood. The IBC allows for both options, but practically speaking, preservative-treated wood is a better choice for balcony framing.

The IBC defines “naturally durable wood” as the heartwood of decay resistant species except for the occasional piece with corner sapwood, provided 90 percent or more of the

width of each side on which it occurs is heartwood. Decay resistant species listed include: redwood, cedar, black locust and black walnut.

The reason for the 90% “heartwood” requirement is that “sapwood” of species listed is not decay resistant. From the **2010 USDA Wood Handbook**, “Untreated sapwood of essentially all species has low resistance to decay and usually has a short service life under conditions favoring decay.” Visit www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr190.pdf for more information on wood as an engineering material.

We have never seen black locust or black walnut used in building framing, so we examine the remaining choices. Redwood and cedar (with the stated heartwood requirements) generally have lower design values and are more expensive than other common framing lumber choices. These species are good choices for lower structural demand applications such as deck boards, where the natural beauty of the wood is left exposed. However, for balcony framing, we favor PT lumber that has been treated and certified according to the specifications in *IBC 2303.1.9 Preservative-treated wood*.

Preservative-treated (PT) wood. The proper and adequate specification of PT wood requires a knowledge and use

Table 1. AWPA U1-16 Use categories that make reference to service conditions: “non-critical components,” “critical components,” and “difficult replacement.”

AWPA U1-16 Table 2-1 Use Category	Service Condition	
	Reference to Non-critical, or Critical Component?	Reference to Difficult Replacement?
UC3B Above Ground	Footnote 1 directs reader to UC4A given below.	Footnote 1 directs reader to UC4A given below.
UC4A Ground Contact General Use (Commodity Specification A only)	Yes “Non-critical components (Includes above ground applications with ground contact type hazards or that are critical or hard to replace)	Yes (Includes above ground applications with ground contact type hazards or that are critical or <u>hard to replace</u>) (Underline for emphasis.)
UC4B Ground Contact Heavy Duty	Yes	Yes
UC4C Ground Contact Extreme Duty	Yes “Critical structural components”	No

of the 2018 IBC, Chapter 35 Referenced Standard for PT Wood: *AWPA U1–16: USE CATEGORY SYSTEM: User Specification for Treated Wood*. As discussed next, a PT wood specification such as “all balcony framing lumber shall be PT wood” by a project designer is extremely vague and not sufficient for balcony framing that is critical for life safety.

Referring to *AWPA U1-16*, Table 2.1 Service Conditions for Use Category Designations review of the table for “Above Ground” and “Ground Contact” yields ten *Use Categories* and *Service Conditions*. In Table 1, the *Use Categories* are tabulated with reference to whether or not the *Service Condition* applies to “critical components” or could involve a “difficult replacement.”

Our interpretation of Table 1 leads to the conclusion that while a balcony is clearly “Above Ground” based on the elevation of the balcony framing, the application of PT structural wood-framing per the *AWPA U1-16* Standard is “Ground Contact” UC4A, 4B, or 4C. The choice of UC4A, 4B, or 4C is the responsibility of the design professional and should be clearly stated in the construction documents to enable the general and framing contractors to use the proper preservative treatment.

The most recent version of the code-referenced *AWPA U1-19* Standard Excerpt can be downloaded from this site: www.awpa.com/standards/U1excerpt.pdf.

PT structural composite lumber. Structural composite lumber (SCL), which includes laminated veneer lumber (LVL), parallel strand lumber (PSL), laminated strand lumber (LSL) and oriented strand lumber (OSL), are engineered wood composites with excellent engineering properties. However, other than Parallam Plus PSL, we are not aware of any SCL that is treated to decay protection levels above *AWPA Use Category UC2*.

Fasteners in PT wood. Some of the chemical formulations in wood preservatives can accelerate corrosion of fasteners and flashing. IBC 2304.5 specifies requirements for zinc-coated and stainless-steel fasteners and connectors in contact with PT wood. Simpson Strong-Tie provides excellent information about corrosion risks and solutions at their site: www.strongtie.com/products/product-use-information/corrosion-information

2018 IBC Change – Enclosed Balcony Framing must be Ventilated

The 2018 IBC has a new provision requiring ventilation of enclosed balcony framing as follows:

“2304.12.2.6 Ventilation beneath balcony or elevated walking surfaces. Enclosed framing in exterior balconies and elevated walking surfaces that are exposed to rain,

snow or drainage from irrigation shall be provided with openings that provide a net free cross-ventilation area not less than 1/150 of the area of each separate space.”

This addition to the code guards against the accumulation of water vapor (for any reason) through natural drying. Balcony ventilation openings should be visible to an inspector, and the inspector should report if they are not present or are deficient. In addition, we recommend that the ventilation covers, or some other access panel, be removable to allow for periodic inspections.

A Special Case – Open Framed Cantilevered Balconies

PT wood framing for balconies that rely solely on cantilever beams for structural support as depicted in Figure 4 is not recommended due to several structural and in-service issues. We are not aware of any method to inspect or determine the structural integrity of the cantilevered joist section embedded in the wall. It should be noted that even “early decay,” not visible or detectable by physical means, significantly reduces the strength properties of wood. In addition, the water trapping joints/surfaces created by the entry of the framing into the wall cavity creates a decay hazard as it is very difficult to prevent the movement of moisture into the contact areas between the joists and masonry wall.



Figure 4. Balcony with cantilevered joists extending through masonry wall. The deck surface is pervious.

Summary Recommendations

We believe the impervious moisture barrier system option is a “best practice” for balconies when coupled with ventilation per 2018 IBC 2304.12.2.6 and Special Inspection of the “manufacturer’s installation instructions” specified by the design professional and contained in the Construction Documents. In addition, we recommend using UC4A, UC4B, or UC4C PT wood (and appropriately protected fasteners) even though an impervious moisture barrier system is used, and we recommend access panels that facilitate periodic inspections. This redundant protection against decay is appropriate given the limited structural redundancy of a cantilever balcony system, and the importance for life safety.

In the words of the late Professor Stan Suddarth (Purdue Univ.), the focus of the impervious moisture barrier system option is to protect wood framing from decay by the most fundamental way: “Keep wood dry. Don’t let wood get wet. Keep water away from wood.” If installed properly, the life of the wood framing is only limited by the service life of the impervious moisture barrier system.

We recognize that Special Inspections of the “manufacturer’s installation instructions are not part of the new IBC, only given in the **2018 IBC Chapter 1 Scope and Administration** and thus may not be adopted by states and local jurisdictions when the IBC is officially adopted. The inspection provisions follow:

“[A]107.2.5 Exterior balconies and elevated walking surfaces. Where balconies or other elevated walking surfaces are exposed to water from direct or blowing rain, snow, or irrigation, and the structural framing is protected by an impervious moisture barrier, the *construction documents* shall include details for all elements of the impervious moisture barrier system. The *construction documents* shall include manufacturer’s installation instructions.”

“[A]110.3.6 Weather-exposed balcony and walking surface waterproofing. Where balconies or other

elevated walking surfaces are exposed to water from direct or blowing rain, snow or irrigation, and the structural framing is protected by an impervious moisture barrier, all elements of the impervious moisture barrier system shall not be concealed until inspected and *approved*.

Exception: Where *special inspections* are provided in accordance with Section 1705.1.1, Item 3.”

Conclusions

We view the new balcony code provisions to be an opportunity to proactively address the safety and reliability of balconies in-service. As such:

- In the interest of public safety, design professionals are encouraged to adopt the new 2018 balcony provisions before they are adopted by the governing jurisdiction or state code.
- At a minimum, we believe that owners of new construction projects should be advised of the “balcony safety issue”, the new IBC provisions that address water-related issues, and the need for periodic inspections to ensure the balcony framing is being protected from moisture conditions that can compromise structural integrity. 

About the Authors

Frank Woeste, P.E., Ph.D., is Professor Emeritus, Virginia Tech, and frequently consults with the public, design professionals, contractors, building code officials on various aspects of engineered wood construction and residential construction, including decks and balconies. Frank, along with his colleagues, continues to offer continuing education programs at Virginia Tech annually. (email: fwoeste@vt.edu)

Don Bender, P.E., Ph.D., is Weyerhaeuser Professor of Civil Engineering and Director of the Composite Materials & Engineering Center at WSU-Pullman. He is an expert in testing, design and construction of timber structures. Don teaches university and outreach courses in structural engineering and is active in national building code and standards development. (email: bender@wsu.edu)

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Test Questions - Balcony Design

- Cantilevered balconies:
 - Have limited structural redundancy
 - Are exposed to weather
 - Require special attention in design, permitting, construction, inspection, & maintenance
 - All of the above
- Enclosed balcony framing does not allow for natural ventilation that allows for moisture to exit the space, nor does it allow access for in-service inspections.
 - True
 - False
- Following the Berkeley balcony tragedy, changes were made to the 2018 IBC, specifically addressing:
 - Waterproofing measures
 - 'Special inspections' during construction
 - Limits on the occupancy of rental properties
 - A & B only
- Positive drainage requires:
 - A drainage mat component
 - Moisture permeable floor topping for 'back up' only
 - Passage of water by gravity and capillary action
- The key to a successful Impervious Moisture Barrier system is to have positive drainage of water that may infiltrate the floor topping due to cracks that can form in-service.
 - True
 - False
- A recommendation that balcony framing lumber "shall be preservative-treated" is too vague. Pressure-treated balcony framing can be clearly specified in the construction documents by the following:
 - Balcony framing lumber shall be preservative-treated with brush-on wood stain
 - Balcony framing lumber shall be preservative-treated with primer and paint
 - After review of the latest edition of AWPA U1 (www.awpa.com/standards/U1excerpt.pdf) and selecting a "Ground Contact" Use Category, balcony framing lumber can be clearly specified in the construction documents.
- Open framed cantilevered balconies are preferred because the exposed framing can be easily inspected for possible decay.
 - True
 - False
- The authors recommend _____ should be visible to an inspector and the inspector should report if they are not present or deficient.
 - Enclosed framing
 - Fasteners in PT wood
 - Ventilation openings
- While more expensive than preservative-treated wood, "naturally durable wood" can be used for balcony framing provided 90% of the cross-section is sapwood.
 - True
 - False
- Along with proper materials and design, _____ is critical to the safety and longevity of the wood framing of each balcony.
 - Waterproofing
 - Proper installation
 - Access panels
 - All of the above

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Measuring Up to Steeple Remediation

BY: TIMOTHY M. CROWE, ALA, FAPT, SE, PE, WISS, JANNEY, ELSTNER ASSOCIATES, INC.

Prior *Second Chances* articles have reviewed both structural and material characteristics in buildings and remediation challenges that can arise. In this article, church spires and steeples are discussed. As with any assembly, considering the materials involved is imperative to develop appropriate remediation strategies to extend the serviceable life of these structures. When working on steeples and bell towers, investigations can expose unsuspected deterioration or impaired conditions that are otherwise concealed from the owners or maintenance staff. Like many roofs and building claddings, these assemblies are frequently only viewed from a distance, and regular maintenance is not always performed due to challenges accessing these elements.

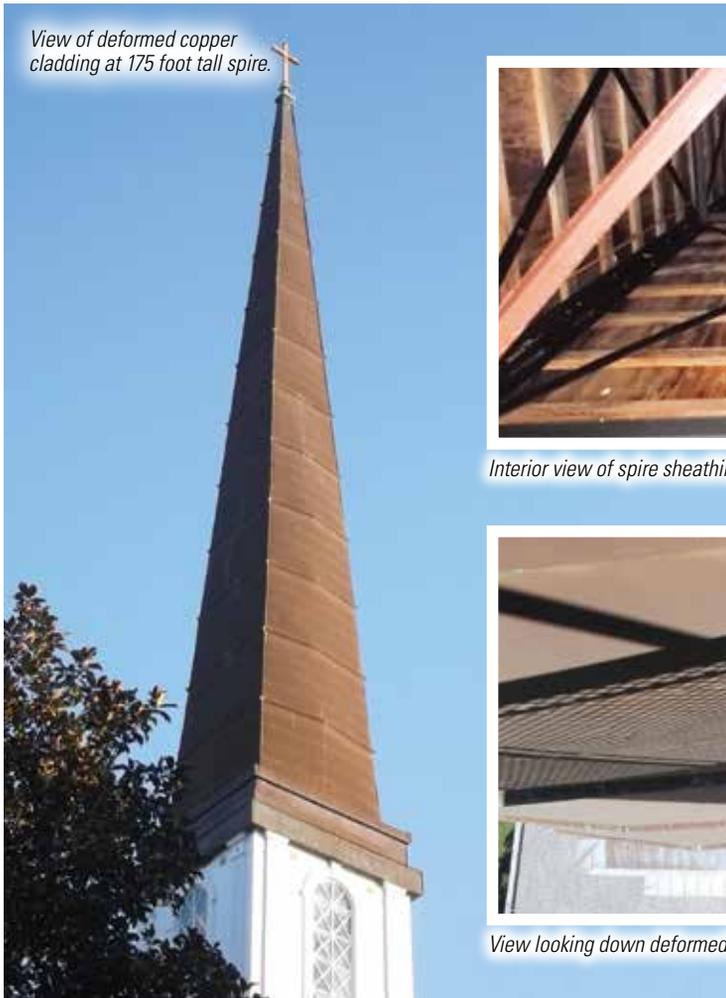
Thus, proper care is frequently postponed until bigger issues emerge. So, when assessments are implemented, the opportunity must be seized to get appropriate information to develop remediation

strategies and educate owners regarding regular maintenance needs. Three bell towers are briefly discussed below that represent different challenges and corrective actions that were not initially apparent.

Metal Clad Bell Tower in Summerville, South Carolina

A 175-foot tall bell tower in Summerville experienced recurring distress, raising the church's

View of deformed copper cladding at 175 foot tall spire.



Interior view of spire sheathing construction around the braced steel framing.



View looking down deformed spire cladding from crane basket.

concerns regarding copper cladding on the pyramidal spire above the tower belfry. The distress was initially attributed to hurricane activity along the coast, but closer examination revealed other factors as well. This structure, built in 1976, required spire cladding repairs address wind damage caused by Hurricane Hugo in 1989. In 2003, similar but less extensive distress was reported and patches at copper tears and failed attachments were installed. In 2018, spire cladding concerns were again raised and the damage was suggested to have been the result of Hurricane Matthew (October of 2016 event). However, Matthew only resulted in winds of approximately 50 to 60 mph and gusts of 70 mph in the vicinity of the tower. This results in approximately 50 percent of the wind loading required by the 1976

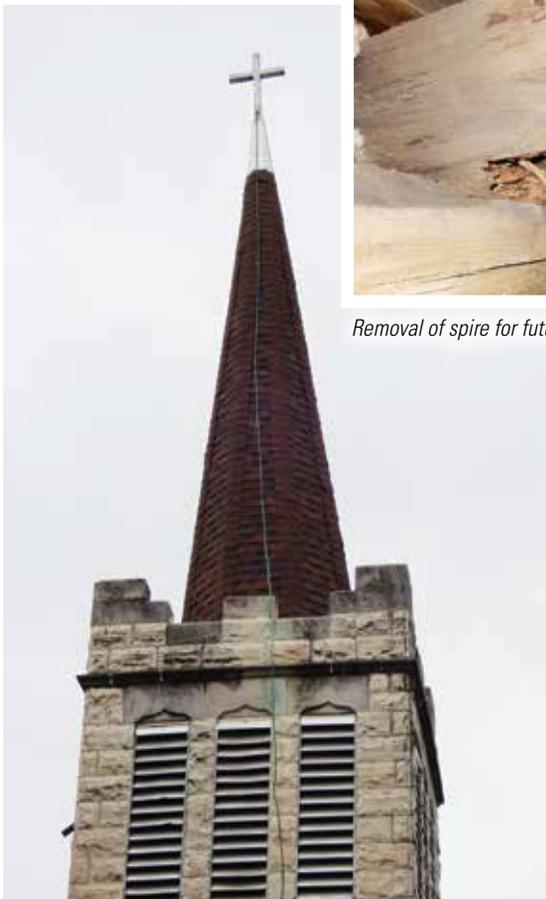
codes. Thus, other contributing factors were suspected.

Structural assessments revealed that the spire's braced steel armature could resist code wind loads. However, plywood sheathing supported by 2x4 wood members secured to the corners of the steel frame comprised the copper-cladding substrate, and was too flexible. When negative wind pressures pulled on the cladding, this sheathing assembly was vulnerable to significant deflections with even moderate wind loads. Deflections resulted in crimping of the metal and the copper sheets experienced tears and deformations. Further inspection revealed that the copper had been installed over the plywood without underlayment. The lack of an underlayment subjected the plywood to moisture from recurring condensation on the inside face of the

copper when dew-point temperatures are experienced — a frequent occurrence in the southeast United States region. Wet plywood reduced pull-out capacities of the cladding fasteners and promotes rot, further weakening cladding support. Thus, repairs that include a stiffer sheathing support and a properly detailed underlayment were recommended with cladding remediation.

1895 Spire in Lemont, Illinois

The Lemont church tower and belfry is a stone masonry structure with a wood framed spire built around 1895, and is 90 feet tall. The spire is clad with asphalt shingles and adorned with a metal cross. Concerns regarding apparent decay at the belfry roof framing prompted our inspection. Our investigation revealed that advanced decay of the timber framing led to member crushing and



Partial view of leaning spire at 1895 church in Lemont.



Removal of spire for future restoration.



View of crushed and decayed timber.

corresponding leaning of the spire. Though the stick-framed spire generally remained intact, the extent of framing decay demonstrated that moisture infiltration had been ongoing at its base. Support deterioration and spire displacement posed significant safety concerns regarding whether the spire may collapse under even moderate wind loads.

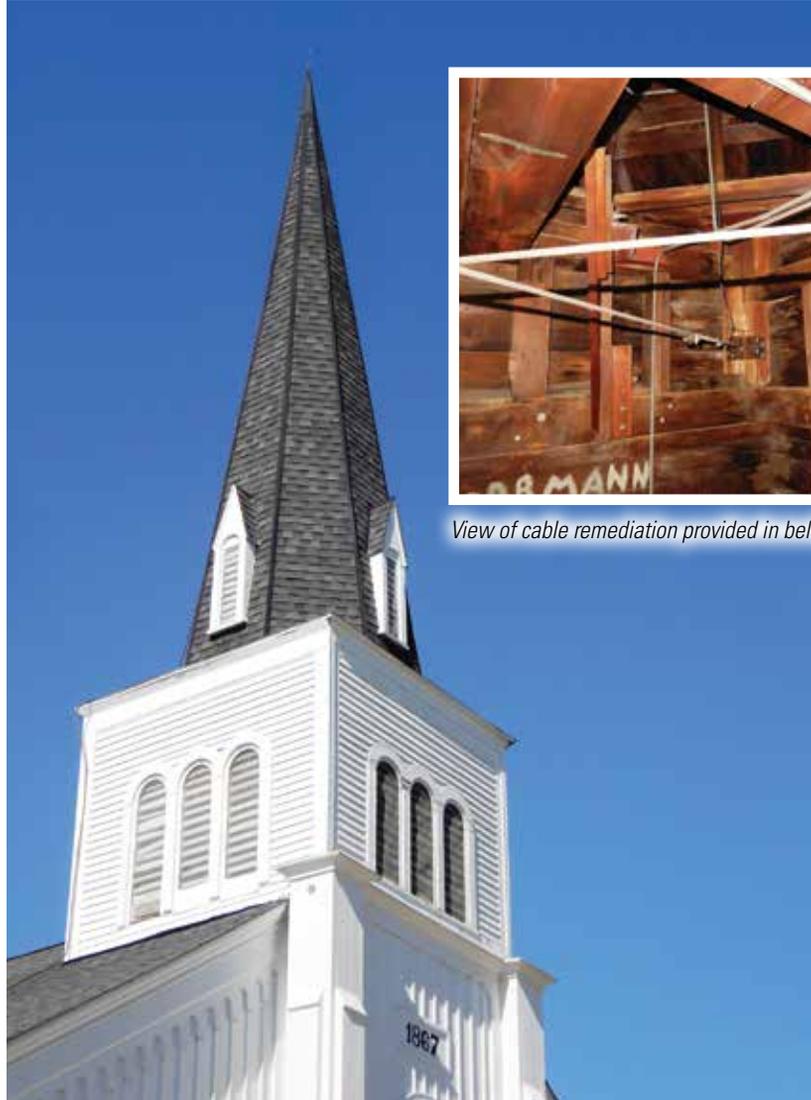
Temporary stabilization was not practical as shoring systems would have hampered church functions, obstructed future repair implementation, and was costly. Thus, the objective was to develop a strategy to immediately remove and salvage the spire for future restoration.

Temporary roof details were also prepared to enclose and protect the belfry until restoration work could be performed. Removal work included the extraction of rotted timbers and bell-ringing mechanisms. Detaching the spire revealed that the sole anchorage of the 35-foot tall wood cone was a single 1/2-inch diameter bolt through the spire mast and a strap to the decayed framing. Consequently, all parties involved were very relieved when this element was safely secured to the ground. Modifications of this spire attachment along with enhanced water management at the spire base will be necessary as part of the restoration effort.

1867 Bell Tower Restoration in Crystal Lake, Illinois

The Crystal Lake tower and belfry is a timber assembly centrally located at the front of the Gothic Revival church.

The tower structure has mortise and tenon joinery that encloses the belfry and has a stick-framed octagonal spire above clad with asphalt shingles. Water infiltration



View of cable remediation provided in belfry.

Partial view of 1867 bell tower from the exterior.

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occurring near the tower base and belfry, and apparent water staining and framing distress within the belfry prompted further review and assessment. We examined the bell tower and provided remediation recommendations. Our inspection revealed areas of decay within this framing, though conditions were generally dry when measured with a moisture meter. Past structural repairs and apparent reinforcing efforts were noted. Steel straps and cables were installed that secured opposing corner posts as an apparent measure to enhance lateral stability of the framing as a number of timber knee-braces were no longer intact. Supplemental framing, steel straps, and angles had also been secured to the spire framing that were somewhat irregular, but generally appeared intact. Other more recent plank-sheathing was observed that was reportedly part of cladding repairs from 1957. An interior sheet metal roof at the belfry floor was in poor condition and vulnerable to moisture that could bypass wood louvers at the belfry walls. Irregularity in the cladding near the base of the belfry and open seams within metal flashings were also observed from the exterior.

The tower was dry, well ventilated, and generally intact. However; damaged framing members and missing bracing components had impaired the structure's ability to resist lateral loads. Though the steel cable installations may have been performed to help correct framing deficiencies, structural analyses revealed the cables lack the necessary stiffness to effectively resolve load paths. Consequently, the structure was vulnerable to lateral movement when subjected to moderate wind events. These movements damaged to the exterior wood cladding, created flashing system breaches and introduced paths for moisture infiltration.

Recommended repairs included properly reinforcing the structure to provide a reliable load paths against wind loads, replace the metal roofing within the belfry, and repair belfry louvers and affected cladding. Further examination of the spire roofing was also recommended so that asphalt shingle issues and flashing be corrected as appropriate.

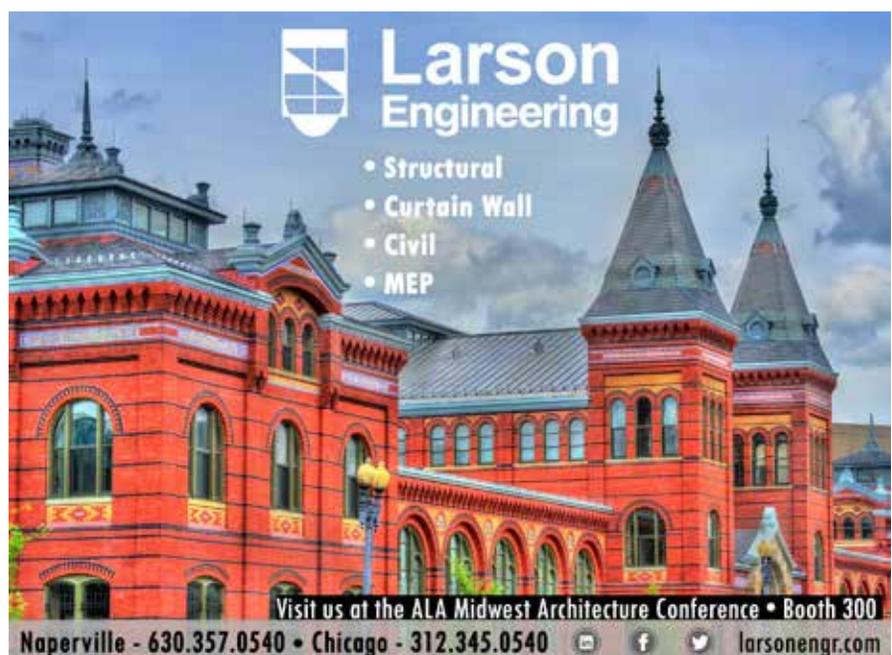
Summary

Spire and bell tower structures, like other building systems, necessitate a methodical approach that considers both material and environmental conditions for their assessment and repair. These structures experience extremes in wind forces, temperature, and moisture resulting from seasonal changes. Temperature ranges and humidity (particularly with metal and/or non-porous cladding) results in additional moisture sources that need to be accounted for. Also, as demonstrated in the copper clad spire above, the rigidity of the cladding substrates need to be compatible with the cladding attachment systems.

Regular inspections are an important part of tower maintenance. Though

older structures may produce challenges in completing these tasks, it remains vital that proper assessments be performed with attention to water management systems included. During inspections, structural considerations and awareness of material behaviors is vital when identifying sources of distress and developing remediation strategies. When assessments are scheduled, critical information must be captured to get a complete picture of the issues at hand. These structures must be evaluated by a knowledgeable professional familiar with these constructions who can develop meaningful repair strategies to extend the serviceability of these elements. 

Timothy Crowe, ALA, FAPT, SE, PE, is an Associate Principal with *Wiss, Janney, Elstner Associates, Inc. (WJE)* in Northbrook, Illinois, with over thirty years of experience in analysis, investigation, and repair of archaic and contemporary structures. Mr. Crowe is Co-chair of the Association for Preservation Technology International (APT) Preservation Engineering Technical Committee. He can be reached at tcrowe@wje.com.



2019 Student Merit Awards

The Association of Licensed Architects congratulates the following students for their academic excellence, numerous awards, honors, and significant achievements in the schools of architecture. We believe these winners will be assets to the profession of architecture in the future and continue to excel in their education and professional pursuits.

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Michel Al Najm
Miami University
Master of Architecture

Michel Al Najm is originally from Damascus, Syria and studied architecture for three years at Damascus University until his family immigrated to Canada to escape the war in Syria. He completed his degree in 2016 from St. Clair College in Windsor, Ontario, with a 3.95 GPA. Michel is on target to graduate at Miami U in the spring of 2019. He was the recipient of a Gensler Diversity scholarship and internship last year. After graduation he plans to work for a few years before getting his PHD.

Brianna Barr
Ball State University
B.Arch (professional)

Brianna has an exemplary (top) academic record (3.9971) in the undergrad program, and is a community service-oriented student.

Phil Breckler
University of Notre Dame
Master of Architecture

Phil Breckler received his undergraduate degree in architecture from Ball State University and is currently designing the St. Thomas More Newman Center in Columbus, OH, for his master's thesis at Notre Dame University.

Beatrice DeCastro
Harper College
Architectural Studies

As a student, Beatrice is highly motivated and pursues excellence in her assignments and project work. She consistently seeks to learn both from successes and errors, and is an engaged member of her classes. Her future goals include transfer to an accredited professional degree program and ultimate licensure.

Deniz Demir
Illinois Institute of Technology
Bachelor of Architecture

Deniz has a 3.9 cumulative grade point average and made the Dean's List for 9 semesters. She is the recipient of the Dwight T. Black Scholarship and Edson and Fleeta Danforth Endowed Scholarship and a Cloud Scholar Mentor.

Daniel Englund
Judson University
Masters of Architecture

Julian Gonzales
University of Illinois at Chicago
Bachelor of Science in Architecture

Julian will finish the Bachelor of Science program as one of the top students in the School of Architecture. He has held an internship through the school's internship co-op program at Juan G. Moreno Architects since summer 2018. He also works in the school's Print Lab and has been involved in Architecture student programming.

Rui Guo
Washington University in St. Louis
Master of Architecture, Master of Landscape Architecture

Jonathan Gutello
College of DuPage
Pre-Architecture AAS

Jon is an outstanding student. He excels in every class. He is extremely intelligent, disciplined and motivated. His work is always thoughtful, complete and conceptually well-developed. Though Jon is one of our younger students he is more mature than most. He is able to deal with whatever issues he faces and stay focused and enthusiastic. He is the first person every student wants to be partnered with, or to have in their group. We are lucky to have had him in our program.

Ashley Hemmen
Southern Illinois University
Masters of Architecture

Ashley graduated in May of 2018 with a Bachelors' Degree in Architectural Studies from SIU. She graduated at the top of her class academically, with a 4.0 grade point average. She also served as the AIAS Chapter Vice President and SIU PCI Student Chapter President. She is a member of the Tau Sigma Delta Honor Society. Ashley is currently earning her Masters of Architecture at SIU and plans to graduate in August of 2019. Her goal is to become a licensed architect and work in an architecture firm.

Bayleigh Hetrick
Bowling Green State University
Masters of Architecture

Bayleigh Hetrick is a top graduate student known for her forward-looking perspective on architecture and her skill in modeling design solutions. She is always willing to help others and makes exemplary contribution to a healthy studio culture. She plans to become a licensed architect.

Mistika Jimenez
Joilet Junior College
Associates of Architectural Studies

Mistika graduates this May and plans to transfer to U of I in Champaign. Here is a statement from Mistika: "I aspire my architecture to be an emotional interaction. I believe Architecture is an enduring physical and psychological experience based on a concept. I design for simplicity and efficiency, keeping in mind the human emotion I seek to have in my architecture. Not only is it important for me to be satisfied with an idea, but the stimulation and affect it has on others is what I do it for."

Victoria Kospin
Triton College
AAS Architecture

Victoria very quickly emerged as one of the most talented students in our program. Her sense of design and understanding of the thought process and details involved is excellent, and superbly executed in her projects. Victoria works at an Architecture firm while attending school, is a PTK Honor Society member, and a leader of the Architecture Club. She mentors other students, always with a positive attitude. Victoria will transfer this fall to continue her Architecture studies.

Joojin (Deborah) Lee
Judson University
Bachelor of Arts in Architecture

Joojin (Deborah) graduated from Judson University Spring 2019 with the highest honor and currently working as an architectural intern at Lake Flato Architects. She plans on returning for Graduate School in a year or two to continue pursuing her goal to become an architect.

Meagan Ley
Drury University
Masters of Architecture

Emma Mappes
Ball State University
M.Arch (Professional)

Emma has exemplary academics, program support, community outreach, and professional potential. Her goal is to become a licensed architect.

Tim Mehta
Southern Illinois University
Architecture

In 2017, Tim came to SIU having already achieved a Bachelor of Science in Mechanical Engineering from the University of Kentucky and 10+ years of engineering experience in power generation. Tim is classified as an undergraduate as a senior with degree. Tim has excelled in all architectural classes and has already been accepted into the Master of Architecture program beginning summer, 2019. Upon graduation in 2020, Tim aims to join an architectural firm seeking his Architectural License.

Harrison Moxey
Andrews University
M.Arch

Sophie Olund
Washington University in St. Louis
Bachelor of Science in Architecture

Sophie earned her Bachelor of Science in Architecture with Minors in Design and Anthropology from Washington University in St. Louis. After graduating magna cum laude, she is currently working for Lazor/Office Architectural Design in St. Paul, Minnesota.

Nicole Rusk
Miami University
Bachelor of Arts in Architecture

Nicole is a graduating senior from the Ohio region. During her years here, she became the youngest Certified Passive House Consultant in the country, passing her exam during her second year in college. She has plans to attend graduate school in the fall.

Sarah Shavonne Barry
Bowling Green State University
Bachelor of Science in Architecture

Sarah Barry, a top undergraduate student, is known for her investigation into the many roles and functions of the architect, and to generate interesting design inventions. She is always willing to help others and makes outstanding contribution to a healthy design studio. Her plans include the pursuit of an advanced degree in architecture as well as to become a licensed architect.

Jessica Sherlock
University of Wisconsin-Milwaukee
M.Arch

Jessica is a highly skilled architecture student achieving one of the highest GPAs in our M. Arch program. She has served as a Teaching Assistant for Contemporary Criticism and Law & Practice classes demonstrating her versatility as a student. She is well respected by her peers and contributes to the culture of the school through her engaged community research. Jessica is well-deserving of this award.

Cynthia Sigler
University of Notre Dame
Bachelor of Architecture

Cynthia Sigler is currently designing a new Market Hall for downtown South Bend, IN, as her fifth-year thesis project. She has interned in Chicago and hopes to return there upon graduation.

Junghyo Woo
Illinois Institute of Technology
Master of Architecture

Junghyo has a 4.0 cumulative grade point average. She is recipient of the AIA Chicago Student Award in 2018, received the 2019 Schiff Foundation Fellowship for Architecture and the 2018 Chicago Women in Architecture Award (1st place).

Logan Wyse
Ferris State University
Bachelor of Science in Architecture and Sustainability

Logan has earned his Bachelors of Science in Architecture and Sustainability at Ferris State University. He has had the opportunity to work on a number of projects and have even had one congressionally recognized by the State of Michigan. He plans to continue on his Masters of Architecture at Kendall College in the fall.

Andreina Yopez
University of Illinois at Chicago
Master of Architecture

Andreina will finish the Master of Architecture program in the top of 2019 cohort. Her work has been featured in the School's Year End Show and Portfolio Day programs multiple times, and in 2018, her project "A House for Horizontal Living" won the Adrian Smith Prize, the Susan Nealy Award, and the Faculty Choice Prize. 

A Brief Lesson on Buried Ducts

BY: MATT BROWN, CGP, APA – THE ENGINEERED WOOD ASSOCIATION

The 2018 International Residential Code (IRC) and the International Energy Conservation Code (IECC) offer new provisions for HVAC duct design within ventilated attic spaces. These provisions will increase the options for architects who are working to meet the requirements of the energy code using the performance path or Energy Rating Index (ERI) method of compliance.

The energy codes address all major components and systems in a structure, including building envelope, mechanical systems, service water heating, lighting and air infiltration. Compliance with the energy code has primarily been driven by a prescriptive method, until recently. The new options with the performance path method use energy modeling to demonstrate how the building as a whole uses equal or less energy than a home built to the prescriptive path.

The performance path allows architects and builders to maintain their preferred building specifications for structural design and comply with energy code requirements using energy-neutral alternatives for energy performance.

In addition to buried ducts in ventilated attic spaces, additional examples include attic insulation, tight air leakage rate (air sealing), efficient wall construction, insulated foundation walls, energy-efficient heating, ventilation and air conditioning (HVAC) systems.

Two Provisions, Three Methods

In the first provision for HVAC ducts, when ducts in ventilated attic spaces are “deeply buried” they can be considered to be insulated to an effective R-25 value for energy modeling

purposes. Under the second provision, the ducts within a ventilated attic space can be modeled as being in conditioned space, provided additional criteria are met.

To meet the 2018 IRC and IECC installation criteria for ducts buried in insulation, heating and cooling system ducts within ventilated attics must be installed in accordance with one of the three methods, dependent on specific climate zone requirements.

Method 1: Partially buried ducts

R-Value = Minimum

Figure 1 illustrates ducts partially embedded in attic insulation, ducts resting on top of truss or rafter chords and ducts resting between truss chords.

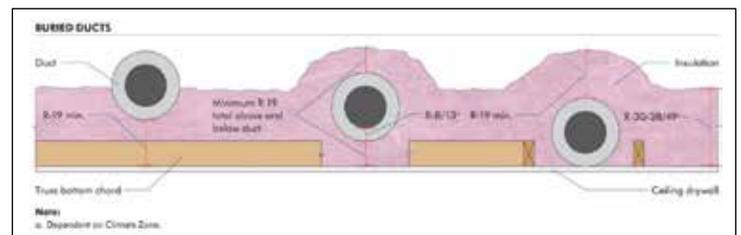


Figure 1.

Estimated Impacts in the Energy Rating Index Score						
Roof systems — radiant barrier and buried ducts						
IECC Climate Zones	2	3	4	5	6	7
Radiant Barrier Roof Sheathing ¹	-3	-3	-2	NR	NR	NR
Deeply Buried Ducts ^{1,2}	-2	-2	-1	-1	-1	-1
Ducts Considered in Conditioned Space ^{1,2,3}	-7	-7	-6	-7	-7	-7

Notes:

1. Calculated assuming 80% ducts in vented attics in climate zones 2 and 3, and 30% ducts in vented attics in climate zones 4 through 7. Values can vary depending on the size and type of the HVAC system used. For houses with 100% ducts in vented attics, energy performance will show greater benefit.
2. For more information on these provisions, see 2018 IECC Sections R403.3.6 and R403.3.7.
3. Duct considered in conditioned space (Section R403.3.7) also require the air handler to be located within conditioned space (not in the attic). This permits the attic ducts to be modeled as being in conditioned space, provided all requirements are met.

Figure 4.

Method 2: Deeply buried ducts

R-Value = Effective R-25*

Figure 2 illustrates ducts that are “deeply buried” in attic insulation.

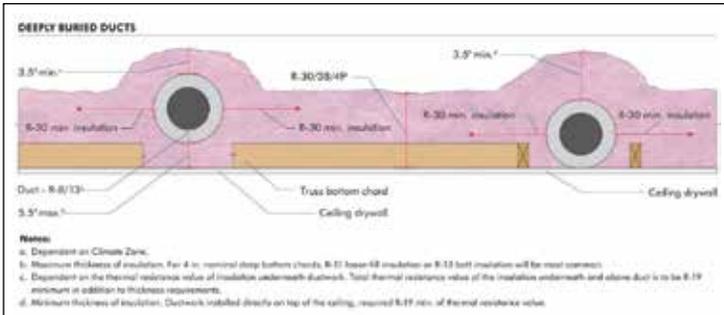


Figure 2.

Method 3: Ducts in conditioned space

R-Value = Minimum+*

Figure 3 illustrates ducts considered to be in a conditioned space.

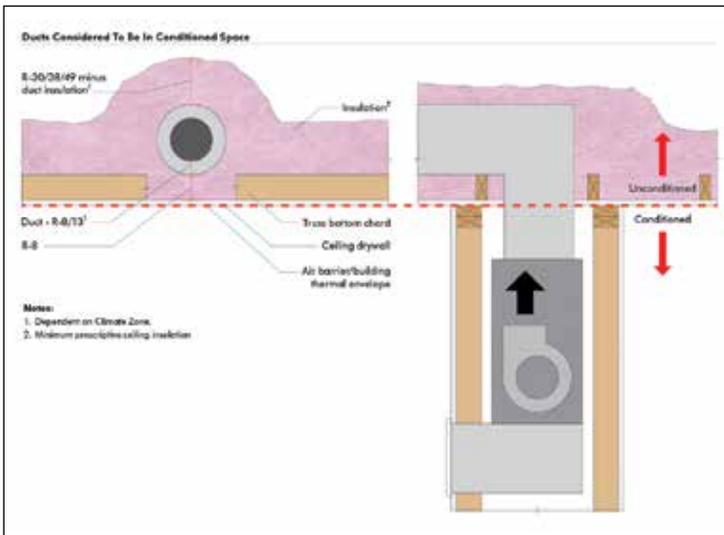


Figure 3.

Added benefits of radiant barrier sheathing

Radiant barrier roof sheathing absorbs solar energy and heat. In the summers, when the sun heats the roof, the roof assembly absorbs the solar energy and heat. When the roof assembly’s temperature exceeds the ambient temperature within the attic, heat from the roof assembly is transferred into the attic. Similarly, when ventilated attic ambient air is cooler than the air inside the building envelope, heat from the conditioned space transfers through the ceiling assembly and into the attic. A radiant barrier on the

underside of the roof deck helps maintain the ambient temperature in attics.

Radiant barrier roof sheathing panels are most effective in warmer climates, but can also be used in colder climates. For climates where heating is the dominant consideration, the energy savings is less than in warmer, cooling dominated climates. Table 1 identifies the estimated impacts in the ERI score for radiant barrier and buried duct energy performance options.

Conclusion

The 2018 IECC delivers more flexibility for meeting the performance pathways of the energy code, including Deeply Buried Ducts and Ducts Considered in Conditioned Space. These options can reduce energy use, and when radiant barrier panels are added, further reduce the radiant heat gains in homes. Architects will have met code requirements and their clients will be pleased with cooler homes, lower utility bills, improved energy efficiency, and a more comfortable indoor environment. For more information on the performance path or to download *The Performance Path to Energy Code to Compliance* (Form R505), visit www.apawood.org/energy-efficiency.

*Criteria must be met to meet the stated R-value.



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