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See article on page 24.

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(703) 684-0300
Fax: (703) 236-4600
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Learn more about the 2025 Summer MSR, July 16-18, at The Pfister Hotel in Milwaukee, Wis., by visiting csiresources.org/csi-msr/upcoming/summer **CS**

How I Earned My CCCA: A Conversation with Jarrod Mann, FCSI, CCCA, CDT

Sometimes, another person's story can motivate us to take a bold step. That's why we're sharing our spotlight on Jarrod Mann, a seasoned architectural engineer who has leveraged the power of CSI certification to enhance his professional practice.

His journey is a testament to the impact of professional certification on both personal growth and industry expertise.

Here, Mann discusses his passion for the built environment and his journey toward achieving the Certified Construction Contract Administration (CCCA) certification.

Tell us about your career and why you chose to work in this industry. Why did you decide to earn a CSI certification?

I love the built environment and understanding how and why it was built. I have felt this way for as long as I can remember, and that's the simplest explanation for why I chose to work in this industry. I've been a practicing architectural engineer for nearly 25 years focused on building systems. I currently lead the MEP Engineering team for my company.

The education and knowledge that are integral to CSI's certifications fill a crucial gap that exists in the formal education and degree programs of most A/E design professionals. Most architects and engineers end up learning a bit more about this through study for licensure but mostly learn it "on the fly" through doing the job. That kind of learning tends to include gaps in knowledge and a lot of "that's the way we've always done it" explanations. Learning the right things to do and why we do them in the project delivery and construction administration spaces is the best reason to earn a CSI certification.

How did you study or prepare for the certification exam?

For my recent CCCA exam, I utilized all the CSI materials available to study. I joined a CCCA study group organized through the CCCA community page on the CSI website and participated in weekly sessions that walked through and reviewed each chapter of the CCCA Practice Guide. I also used CCCA study flashcards that were shared with our study group. I found the flashcards and study questions to be most valuable in studying, as they allowed me to determine what areas I was not as strong in so I could focus my study efforts on those areas.

The exam process itself was simple, and based on conversations I had with others after taking it, I think that if you are well-prepared for it, there is more than enough time to complete it.

How has earning your CCCA certification informed how you approach new projects, especially when developing, administering, and enforcing construction documentation? What has been the biggest change?

Having been a practicing engineer for a long time, I can't say the certifications or the knowledge gained radically changed how I approach projects. However, they have prompted me to improve some of my processes and documentation and to shed some of the poor practices of the past.

Probably the biggest change that I continue to work on implementing is to not take anything for granted but always go back to the source—the contract documents—for guidance in situations that come up or when questions are asked.

Keeping the contract documents front and center throughout a project's life, both through writing them and administering them, leads to better project delivery. Period.

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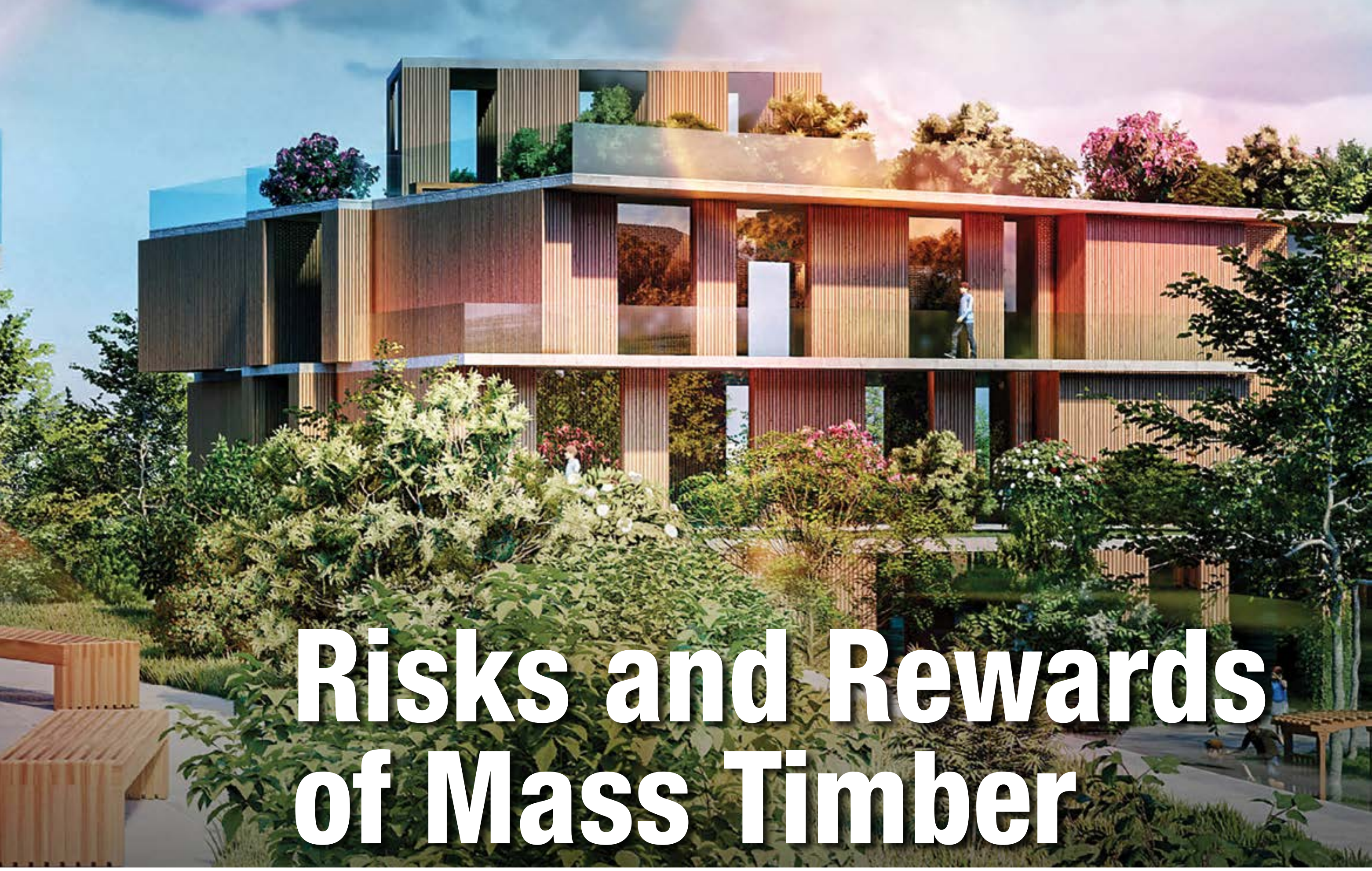


Risks and Rewards of Mass Timber

By Donald Koppy, CSI, CCS, AIA, NCARB, Casey McDonald, B.S., EIT, and Tom Jaleski, ICC

Photos courtesy RDH Building Sciences

AS THE DESIGN AND CONSTRUCTION INDUSTRY SHIFTS TOWARD MORE ECO-CONSCIOUS BUILDING SYSTEMS, MASS TIMBER HAS BECOME A PROMINENT ELEMENT IN THIS NEW DIRECTION. MANY LEADING ARCHITECTURAL FIRMS CURRENTLY FAVOR IT AND THE WOOD INDUSTRY IS ACTIVELY PROMOTING IT.

While wood construction has never disappeared, its use as heavy timber in large buildings was easily replaced by steel and concrete in the last two centuries. With its rediscovery, it is important to remember why it originally lost its place in large building construction and, more importantly, how to overcome those shortcomings to ensure a successful project.

There are three main reasons why mass timber lost out to other materials:

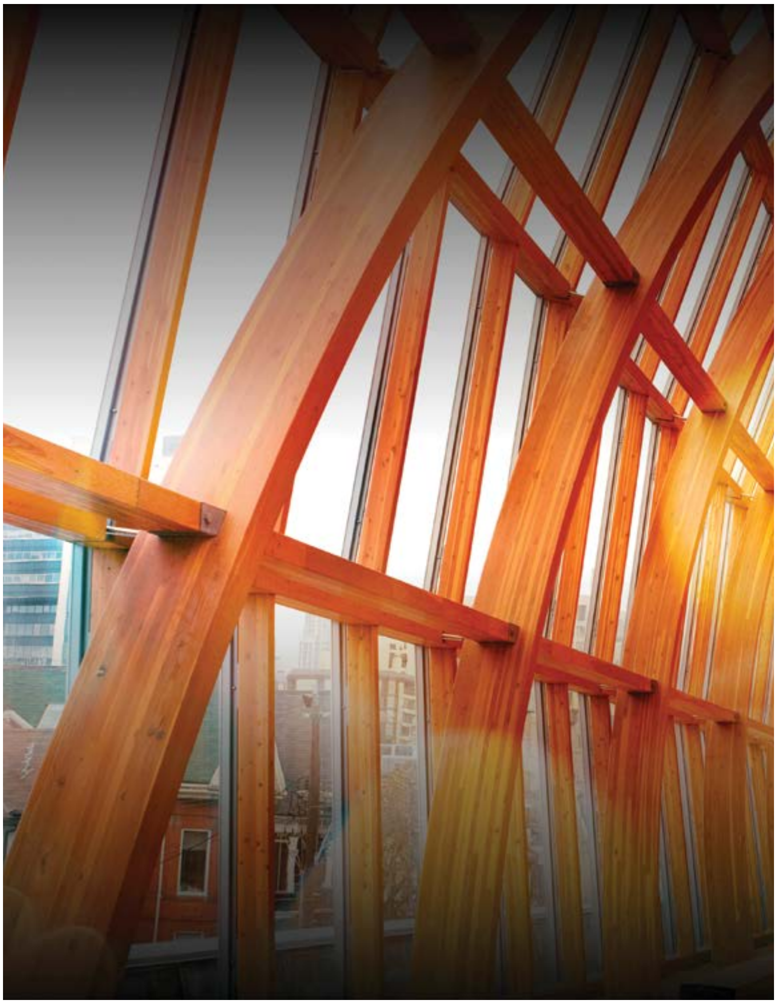
Moisture

During its construction, a mass timber structure is exposed to weather and can remain exposed for a very long time. The wood species used in mass timber are classified as "softwood," which are hygroscopic, meaning they absorb water and can also lose water. This causes mass timber to swell and shrink, often warping as it does so. Given continuous exposure to relatively small amounts of liquid water or high humidity, softwood will grow mold, rot, and decay.[1] (Many types of mushrooms grow on decaying wood.) That condition can now be counteracted only by adding representative chemicals to the natural product, which mass timber manufacturers do not use due to incompatibility with their fabrication processes.

In addition, sealers and vapor-permeable membranes are needed to protect mass timber components from weather-related water exposure during construction. However, even with the addition of these products, the need to monitor and maintain the wood's moisture content extends well beyond the construction period and throughout the building's lifecycle.

Combustion

Wood is combustible, which means it readily burns. So, exposure to fire, if not thick enough, can completely release the wood's sequestered carbon into the atmosphere with some residue ash. If thick



Top: Mass timber includes more than just walls, roofs, and floors.

Right: Protection from weather during construction is critical for successful mass timber projects

enough, mass timber will not only char but also produce vast quantities of smoke, which is the main cause of death in most building fires. Although the structure may remain standing, repairing charred structural members could exceed the cost of replacing the building.[2] Fire suppression/protection systems are required for most facilities. Mass timber producers currently do not use fire-treated wood for the same reason they do not use preservatives. That capacity might be counteracted in the future, but only by adding additional chemicals to the natural product, which mass timber producers currently do not use.

Staining

While the exposed wood of mass timber can be beautiful, construction activities easily stain it, and some stains are very difficult to remove. This makes its installation more of an art compared to other structural materials.

To put it more bluntly, "If someone invented wood today, it would never be approved as a building material."[3]

Due to these and other minor reasons, wood, in the form of heavy timber, was basically abandoned for the structural construction of large commercial and institutional buildings, with a preference for steel and concrete. Once the building was fully enclosed and conditioned, wood was reintroduced as part of the building's interior design. Even so, most of this reintroduced wood was in the form of hardwoods, and the only softwoods were primarily concealed and either pressure-treated or fire-treated to protect from its shortcomings.

The new wood

As a response to climate change concerns, improving availability, speed of construction, and biophilic considerations, wood in "mass timber construction" is being quickly re-evaluated for such buildings' structures. Its implementation has moved beyond the few pioneering designers, manufacturers, and constructors and into the mainstream with much excitement and fanfare.

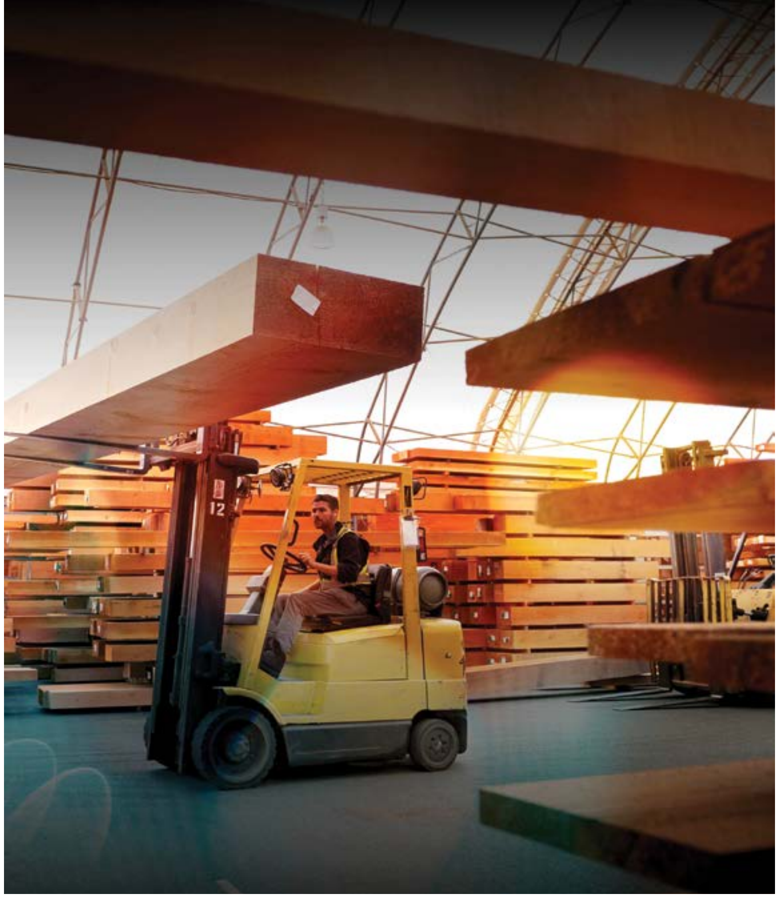
The question remains: Is mass timber construction ready to be adopted by the entire design and construction industry? Some see the construction of mass timber projects and harken back to images of barn-raising by low-tech and sometimes religiously no-tech constructors. It all seems simple and easy to build, but with today's technological advancements in construction, it should now be a piece of cake.

However, as noted previously, the properties of softwood have not changed. Similar to solid sections of heavy timber, the major components of the mass timber family include cross-laminated timber (CLT), dowel-laminated timber (DLT), nail-laminated timber (NLT), and mass plywood panels (MPP), which use a combination of smaller sections of wood and adhesives or fasteners to create larger sections to provide strength and dimensional stability. However, they are all composed of softwoods.

While early buildings constructed by previous generations may have featured heavy timber post-and-beam structures, they lacked fire-rated floors, roofs, and wall systems comparable to those found in modern mass timber projects. Additionally, many of these structures were built using hardwoods rather than softwoods.

They also did not enclose air-conditioned spaces for human inhabitation. Both the softwood heavy timber of old and today's mass timber remain hygroscopic and combustible. (Note: Neither preservative-treated nor fire-retardant-treated wood is currently used in mass timber panels.)

While softwood is not a new structural material, its use in today's design of mass timber buildings should be considered new. The number of designers and constructors using mass timber is quickly growing; however, very few are well-experienced with the nuances of the system's means and methods.



Mass timber is being re-evaluated for large-scale construction, offering eco-conscious benefits while requiring consideration of moisture, fire, and construction methods.

Concerns with means and methods

One part of the construction industry that most architects and engineers do not specify is the means and methods of construction. They cannot be blamed, as back in 1909, the American Institute of Architects (AIA) Owner-Architect agreement first excluded designers from the responsibility, and their professional liability insurers reminded them of this at the start of every policy period. Since insurance coverage is a must in today's construction industry, both architects and engineers must avoid actions that could render them uninsured.

However, a major concern with mass timber pertains to the means and methods: mass timber is exposed to elements and usually for a longer duration than any other materials that have the same type of reactions to the changes in weather/moisture. Rainwater seeping between joints, wall openings, and protrusions can flow from floor to floor and even into wall systems. Seepage through wall system joints can run vertically and horizontally, causing multiple problems for other trades. This moisture causes the wood to swell and shrink, and it can then warp as it tries to dry out. Protection systems and methods that are not vapor-permeable can cause more harm than good, especially when encapsulating moisture in permanent weather barriers and roofing, leading to mold and rot.

It is equally important to consider the methods used to stabilize the indoor environment once the building is enclosed. Expecting an inexperienced constructor to understand all these nuances and protect mass timber components is quite the ask, and specifications for mass timber, like most construction products, state little about how the product should be protected from the elements, rather just that it should be protected. This potentially crosses into specifying "means and methods" that could be uninsurable.

Pioneers versus settlers

The initial mass timber design and construct pioneers did their research and planning to have a successful outcome, avoiding swelling, shrinking, warping, rot, decay, mold, and mushrooms.

The settlers following these pioneers must address these concerns with equal proactivity. Mass timber is in a remarkably similar place as exterior insulation and finish systems (EIFS) was in the North American construction industry during the early 1980s. Though proven in Europe, there are few standards to reference when specifying, with no defined MasterFormat

Mass timber construction offers speed and sustainability but requires moisture protection and coordination to prevent warping, rot, and other challenges.

name or section number. Manufacturers provide various levels of services and types of products to designers and constructors. Implementing mass timber and its environmental benefits should succeed for all involved, unlike the unfortunate decline in reputation that EIFS experienced.

Fortunately, the technical information on mass timber has been proactively addressed by the leaders in the subject. Organizations such as WoodWorks, RDH, and Mass Timber Group have provided extensive open-source and free documentation on the many technical aspects to consider when designing and constructing with mass timber. Additionally, building codes are being quickly updated to address mass timber in multiple construction types.

Despite extensive research on this subject, no CSI three-part formatted guide specification section currently addresses all the concerns associated with the various types of mass timber. The linked Section 06 17 10—Mass Timber is recommended as a starting point for designers and constructors to use confidently when using mass timber in their projects.

Additional considerations

Since not all conditions can be covered in a specification guide, the following should be addressed in one's design documentation:

- Mass timber construction has unique regulations related to fire resistance, height restrictions, and seismic requirements. Construction and design novices must research regulations to ensure they are meeting these requirements.
- Mass timber is noted for its greater speed in construction (+/-25 percent) and subsequent reduced labor compared to traditional construction. That speed assists in limiting moisture exposure.
- While this is a given, verify mass timber can be used per the building code's construction type, especially exterior wall systems.
- There are currently a few UL-rated top-of-wall (TOW) firestopping systems for the underside of mass timber floors/roofs above. Verify the firestopping manufacturer's engineering judgments are acceptable to the authorities having jurisdiction (AHJ).
- Structural design of mass timber is prevalently performed by the manufacturer, requiring close coordination with the building's other structural component engineering. Connections from mass timber structures to other structural framing systems require close coordination between engineers of record.
- The thickness of components can vary from manufacturer to manufacturer. Consider this when detailing and dimensioning mass timber components for competitive bids.
- Provisions and materials used for moisture protection of components can vary from manufacturer to manufacturer.
- Close coordination of exposed-to-view conduits, pipes, ducts, and wiring is required, especially when openings are needed in mass timber components. Consider visible routing of wiring and connections of low-voltage fixtures.
- The "wood" components may include multiple species of trees and various grades. It is essential to ensure the aesthetics match the intended vision.
- Less than 13 percent of forests in the Unite States have certifications from the Forest Stewardship

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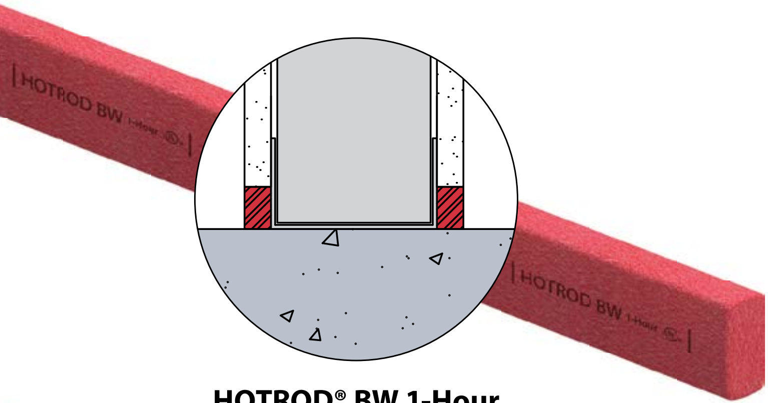

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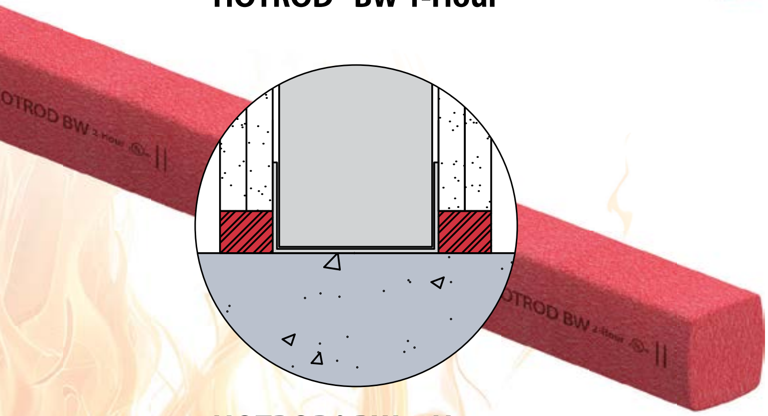

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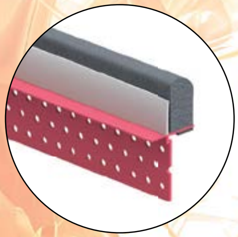

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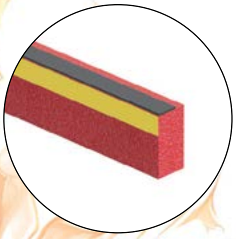

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Council, the Sustainable Forestry Initiative, or the American Tree Farm Systems.[4] Verify the manufacturer uses wood only from certified forests.

- When specifying mass timber, although it may appear to have similarities, consider separate specification sections for Heavy Timber, Laminated Veneer Lumber, Wood I-Joists, Rim Boards, Shop-Fabricated Wood Roof and Floor Trusses, and Glue-Laminated Beams and Columns.
- AXA/XL Insurance's "Risk considerations in mass timber construction" guideline identifies additional risks to be addressed when using mass timber.
- As with any wood construction, fire protection responsibilities exist during construction. Contractors/owners are required to provide active fire protection systems during construction per Chapter 33 of the *International Fire Code* (*IFC*). Codes, however, are evolving quickly to address the nuances of mass timber construction.
- Fire protection system design: Fire flow requirements from Chapter 5 of the *IFC* should be provided based on Appendix B for a Type IV building. Tall mass-timber buildings, Type IV-A, may use provisions for Type I and II buildings with the approval of the AHJ.

This three-part Guide Specification, 061710-mass-timber-guide,[5] is a collaborative effort between RDH Building Sciences Inc., Jensen Hughes, and Mead & Hunt. It is available for free use on any mass timber project to support the proper implementation of mass timber construction. **CS**

Notes

[1] Refer to *A Method to Characterize Biological Degradation Of Mass Timber Connections* (2020) by Sinha, Udele, Cappellazzi, and Morrell.

[2] See *Structural Repair of Fire-Damaged Glulam Timber* by Chorlton, B., Gales, J. York University. American Society of Civil Engineers.

[3] Review BSI-023: *Wood Is Good . . . But Strange* by Lstiburek, Joseph, Building Sciences Inc.

[4] Refer to *Certified Forests*, by M. Alvarez, U.S. Endowment for Forestry & Communities (2019).

[5] See meadhunt.com/wp-content/uploads/061710-mass-timber-guide.pdf

ADDITIONAL **INFORMATION**

Authors

With 40-plus years in design management, Don Koppy, CSI, CCS, AIA, NCARB, is a master construction specifier/architect who has led major construction projects nationwide. A licensed architect in 10 states, a Certified Construction Specifier, and NCARB-certified, he has excelled in roles from project director to BIM manager. His expertise ensures coordinated designs, guiding designers in product selection, detailing, and specifications.

Casey McDonald, B.S., EIT, is an associate and senior project manager at RDH Building Science. With expertise in curtain wall design, cross-laminated timber (CLT), and mass timber research, he specializes in custom unitized assemblies and pre-panelized approaches. He also conducts thermal and hygrothermal analysis and presents on various building science topics.

Tom Jaleski, ICC, is a director and managing principal at Jensen Hughes with more than 30 years of experience working with regulatory agencies. He has authored code appeals, alternates, and variances to resolve complex issues, ensuring safety while reducing costs. An expert in accessibility, fire science, egress, and predictive planning, he specializes in high-rise, healthcare, residential, and commercial facilities.

Key Takeaways

Mass timber is gaining popularity as an eco-friendly building material, yet its reemergence in the construction industry comes with challenges. Historically, mass timber was replaced by steel and concrete due to issues such as moisture, combustion, and staining. While advancements have been made, these concerns persist, requiring careful consideration during design and construction. Proper protection, fire resistance, and coordination among project stakeholders are crucial for successful implementation. The industry must also stay updated on evolving regulations and standards to ensure mass timber's benefits are fully realized in modern construction.

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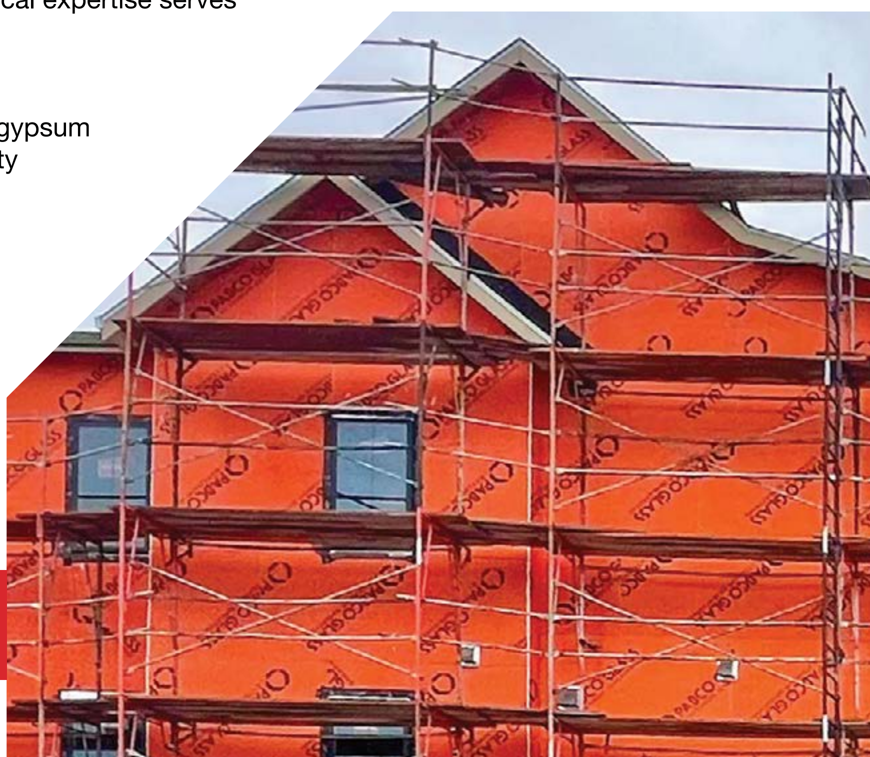

Specifying Low Embodied Carbon Steel Framing

By Adam Shoemaker, CSI, CDT, LEED AP BD+C

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IN DECEMBER 2021, THE UNITED STATES PLACED A FEDERAL EMPHASIS ON CLIMATE-FRIENDLY CONSTRUCTION MATERIALS BY IMPLEMENTING THE BUY CLEAN INITIATIVE. THIS INITIATIVE LEVERAGES THE U.S. GOVERNMENT'S PURCHASING POWER TO HELP SPUR "A LARGE AND STABLE DEMAND SIGNAL TO THE MARKETPLACE" FOR AMERICAN-MADE PRODUCTS WITH LOWER EMBODIED EMISSIONS IN THE MANUFACTURING SECTOR, WHICH ACCOUNTS FOR NEARLY ONE-THIRD OF THE NATION'S TOTAL GREENHOUSE GAS (GHG).[1]

In 2022, the effort was strengthened by the *Inflation Reduction Act* (*IRA*), which provided more than $4 billion to federal agencies, including the General Services Administration (GSA), to source climate-friendly materials on federally funded construction projects. As of writing, much of the funding related to low-embodied carbon projects has already been disbursed, but it is unclear how future funding may be impacted.

The U.S. is not the only country cracking down on embodied emissions. France, Switzerland, and the Nordic countries have led the charge with similar programs that require mandatory embodied carbon calculations.[2] Canada also took action in 2022 with its "Standard on Embodied Carbon in Construction," which requires disclosing and reducing the carbon footprint of structural materials in major construction projects.[3]

Since the onset of these efforts, terms such as "low embodied carbon" have grown more commonplace in the construction sector. According to the Environmental Protection Agency (EPA), low embodied carbon steel products "have less climate impact associated with mining, manufacturing, and transportation." Essentially, this term correlates to a product's greenhouse gas emissions, measured across its entire supply chain.

Steel production has historically been a significant source of carbon emissions.[4] However, growing awareness of the lower embodied carbon in steel from electric arc furnaces drives a shift towards this more sustainable production method.

How production differs for low embodied carbon steel

Steelmaking is a multi-step process with varying methods and production routes. Each choice along the way, from raw materials to manufacturing processes, influences the sustainability of the final product. Ultimately, how the steel is sourced and produced determines whether it will qualify as low embodied carbon steel framing. The World Steel Association

Government-supported initiatives, such as Buy Clean, are just the tip of the sustainability iceberg.

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has a comprehensive breakdown of the steelmaking process,[5] categorizing it into seven basic steps: raw materials, raw materials preparation, ironmaking, steelmaking, semi-finished products, hot-rolled products, and finishing operations.

Raw materials

The journey toward a sustainable steel product begins at the raw materials stage. Using recycled steel at this early juncture sets a benchmark for low embodied carbon by effectively bypassing several energy-intensive processes. New steel is conventionally made via the basic oxygen furnace (BOF). This relies on iron ore, which necessitates mining, transportation, raw material preparation, and ironmaking—each step contributing significantly to embodied carbon emissions. In contrast, recycled steel, predominantly used in an electric arc furnace (EAF), enters the steelmaking phase after being sorted, generally circumventing the raw materials preparation and ironmaking steps. This fundamental shift in raw material sourcing underscores the pivotal role recycling plays in decarbonizing the steel industry and establishes a greener foundation from the outset.

Raw materials preparation

The raw materials are then processed to optimize suitability for subsequent ironmaking or steelmaking processes. Iron ore headed to a BOF mill must undergo extensive preparation, including processes to enhance the iron content and remove impurities, as well as crushing and grinding the ore into smaller, uniform pieces. By contrast, EAF mills using recycled steel typically demand less extensive sorting and sizing preparation before the material is charged into the furnace.

Ironmaking

In this step, iron ore is transformed into molten iron using a blast furnace. Iron ore, coke (derived from coal), and limestone are heated, with coke acting as fuel and reducing agent. Limestone removes impurities such as slag. Notably, this step applies only to the BOF route; the EAF route completely bypasses this energy-intensive stage.

Steelmaking

In the steelmaking process, molten iron, derived from ironmaking or recycled steel, is transformed into steel. In BOF mills, oxygen is blown into the BOF to reduce the carbon content of the molten iron and remove impurities, resulting in steel. EAF mills, on the other hand, use electrical energy, sometimes supplemented with oxygen injection, to melt scrap steel and adjust its chemical composition by adding alloys.

Semi-finished products, hot-rolled products, and finishing operations

Steel is cast into a semi-finished shape, such as slabs, billets, or blooms. It is then hot-rolled into various products, including rebar, coils, structural shapes, etc. Several finishing procedures can then occur, including painting, galvanizing, and cold rolling, to further reduce the thickness of a hot-rolled plate or coil product. After this final step, the steel is shipped to companies such as steel framing manufacturers, where it is formed into end-use products.

In most cases, LEC steel is made with high percentages of recycled content and processed at an EAF mill, resulting in up to 30 percent less embodied carbon than steels using different raw material inputs. LEC steel framing has the proper data to back this up, including environmental product declarations (EPDs), life cycle assessments (LCAs) and more.[6]

It is worth noting that while a low embodied carbon perspective would have all steel ideally coming from EAF mills, BOF mills do still have a benefit in today's market. There is currently not enough steel being recycled to supply the total

When specifying low embodied carbon (LEC) steel, look for readily available third-party environmental product declarations (EPDs), life cycle assessments (LCAs), or even EPD optimization reports that compare the LEC product against a baseline product.

Photos courtesy ClarkDietrich

market demand for new steel products,[7] and maintaining a balance between EAF and BOF sources supports a resilient supply chain, help mitigate price volatility, and allow for quick and flexible adaptations to demands.

BOF mills are also exploring many ways to produce more sustainable steel, such as hydrogen-based direct reduced iron (DRI); carbon capture, utilization, and storage (CCUS); electric smelting furnace (ESF); oxygen-enriched blowing; and increased scrap utilization, to name a few.[8]

Specifying LEC steel

According to the Office of the Federal Chief Sustainability Officer, U.S. manufacturing accounts for nearly one-third of the country's total greenhouse gas emissions, and half of those emissions come from asphalt, concrete, glass, and steel production.[9] In 2023, the GSA launched a pilot program to test new requirements for LEC construction materials in 11 initial *IRA*-funded projects, focusing on those four key materials. To date, the GSA has seen an increase of more than 17,000 new EPDs in the four material categories (including more than 5,000 during the six-month trial program alone), indicating the industry is following suit with the new push for increased transparency and lower emissions. Following the pilot's success, the GSA announced $2.51 billion in funding for more than 150 projects across the U.S. that meet its LEC material requirements.[10] Projects that use LEC steel verified by a third-party Type III EPD qualify for funding from the GSA.[11]

The federal government is not the only agency encouraging the use of LEC materials. The initiative has flourished at the state level as well. Through the Federal-State Buy Clean Partnership—which currently includes 13 states: California, Colorado, Hawaii, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Oregon, and Washington[12]—LEC materials are also being prioritized in state-funded projects.

California is taking things a step further, becoming the first state to mandate a reduction in embodied carbon emissions as part of its building code. Effective July 2024, the code change offers three paths to meet the new standards for commercial buildings of more than 9,290 m^2 (100,000 sf) and schools of more than 4,645 m^2 (50,000 sf). According to the U.S. Green Building Council, "The first calls for the reuse of at least 45% of an existing structure, the second requires the use of materials (steel, glass, mineral wool, and concrete)[13] that fall within specified emission limits, and the third is a performance-based compliance path that allows the use of a whole building life cycle assessment analysis."[14]

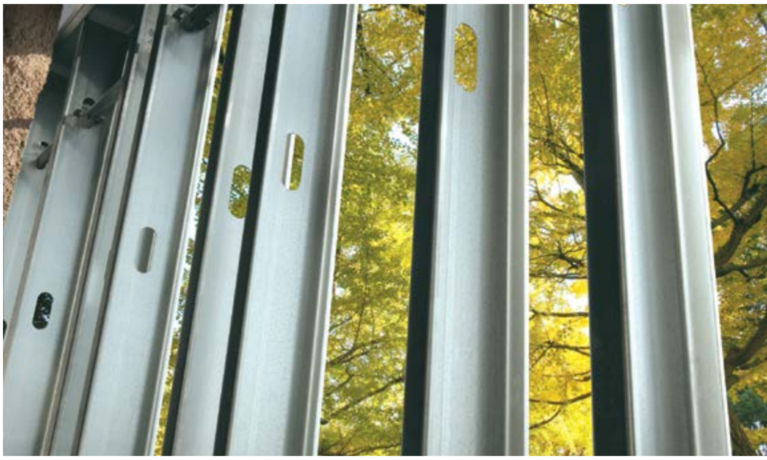
Accreditation programs such as LEED also support products with environmental transparency and lower embodied carbon. In LEED v4.1, for example, building teams can earn up to two points under the "Material and Resources Credit: EPDs." To earn these points, teams must achieve one or more of the following options: Option 1—Environmental Product Declaration (1 point), or Option 2—Embodied Carbon/LCA Optimization (1 point). Option 1 requires that a project include at least 20 different products from at least five different manufacturers that meet certain disclosure criteria. Option 2 requires that projects include at least five products from at least three manufacturers that have a compliant embodied carbon optimization report or action plan separate from the LCA or EPD.[15]

In achieving these LEED credits, it is important to understand the distinction between LEED "points" and "products." Various environmental disclosures contribute differently toward the required product count. For instance, an LCA, a Product-Specific Type III EPD (not third-party certified), or an Industry-Wide Type III EPD each count as "one whole product."

Meanwhile, a third-party certified Product-Specific Type III EPD counts as "1.5 products" toward the required total. Under Option 2, products with demonstrated reductions in Global Warming Potential (GWP) can be weighted differently. For example, a single product with a 20 percent or greater reduction in GWP and at least a five percent reduction in two additional impact categories may count as two products toward the five-product requirement.

In addition to understanding how different environmental disclosures contribute toward product counts, the EPD credit specifically aims to promote the use of products with available lifecycle information that demonstrate environmentally, economically, and socially preferable impacts. It rewards project teams for selecting products from manufacturers with verified environmental improvements.

Demand for LEC building materials is higher than ever. Specifiers should be aware of legislative actions and code changes that emphasize such products and which manufacturers are adapting to these new standards. For instance, only a handful of products on the market meet the criteria for the embodied carbon/lifecycle analysis optimization point ("Option 2") under LEED v4.1's MR Credit: EPDs. (As of writing, there is only one steel framing manufacturer with the data available to help achieve credit for this option.) Therefore, specifiers may need to source strategically to meet specific accreditations or standards requirements.



Projects that use low embodied carbon (LEC) steel verified by a third-party Type III environmental product declaration (EPD) qualify for funding from the General Services Administration (GSA), which has announced $2 billion in support for more than 150 projects that meet its LEC material requirements.

Luckily, with the growing demand for LEC steel, it is easier to specify than before. At least one manufacturer offers LEC steel framing products with a nationwide footprint, and others may additionally serve smaller geographic regions. When specifying LEC steel, look for readily available third-party EPDs, LCAs, or EPD optimization reports that compare the LEC product

Demand for low embodied carbon (LEC) building materials is higher than ever, and specifiers need to remain aware not only of legislative actions and code changes that place an emphasis on such products, but also of which manufacturers are adapting to these new standards.

against a baseline product. Some manufacturers even have a dedicated sustainability platform to make finding product environmental data simple and streamlined. The EPA has also announced a new label program for LEC construction materials, which, when in effect, will identify "clean" products and list them in a centralized, public registry to make sourcing and purchasing LEC materials easier.[16]

Many groups are also dedicated to educating about and advocating for reducing embodied carbon within the construction industry. For years, the Carbon Leadership Forum has worked to transform the building sector by "radically reduc[ing] the greenhouse gas emissions attributed to materials (also known as embodied carbon) used in buildings and infrastructure."[17] In 2019, the group issued a challenge that "all structural engineers shall understand, reduce, and ultimately eliminate embodied carbon in their projects by 2050." As a result, SE 2050, or Structural Engineers 2050 Commitment Program, formed, "designed to ensure substantive embodied carbon reductions in the design and construction of structural systems by the collective structural engineering profession."[18] Both of these groups are examples of industry professionals collaborating for the mission of reducing embodied carbon in buildings and materials. Closely following groups like these can help specifiers and building teams stay informed on the latest carbon reduction policies, regulations, or updates from manufacturers.

When incorporating low-embodied carbon cold-formed steel framing into construction projects, specifiers might be unsure where to specify it in their documents. This is a common question, and for good reason. While LEC requirements can appear in various sections, it is recommended to focus on these three key areas:

- Sustainable Design Requirements—01 81 13: This section is a natural fit for LEC, as it directly addresses environmentally conscious building practices.
- Cold-Formed Metal Framing—05 40 00: Since this section deals specifically with cold-formed steel, including LEC requirements here ensures they are seen by those directly involved with the framing process.
- Non-Structural Metal Framing—09 22 16: If the LEC steel is primarily for non-structural applications, this section is the most relevant.

Referencing the GSA *IRA* Limits for Low Embodied Carbon Steel Cold-Formed and Galvanized products[19] provides a standardized baseline for everyone involved. This avoids confusion and ensures everyone is on the same page regarding these evolving standards. For ease of use, place LEC requirements directly within sections 05 40 00 or 09 22 16 to ensure project teams sourcing and installing the steel products see the requirements clearly without having to delve into the broader sustainable design section.

Looking forward

The surge of government-supported initiatives, such as Buy Clean, is just the tip of the sustainability revolution iceberg for the building sector. As more programs increase the demand for lower embodied carbon materials, steel mills and manufacturers should strive to continue to evolve their practices to better address the need for less carbon-intensive processes.

Improvements in the industry can already be seen. Following the GSA's six-month LEC pilot program, the agency has published program updates, including that "the steel industry has shown substantial improvement, with average GWPs (emissions per unit of product) dropping in most of GSA's steel product subcategories, including hot-rolled sections and cold-formed galvanized steel." Published in June 2024, the update went on to recognize that "two major U.S. manufacturers of steel have also published their first-ever EPDs, or are currently in the process of doing so. Both companies have said their action was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motivated by the Federal Buy Clean leadership." This shows that the market has already evolved tremendously.

Seeing these improvements in the manufacturing processes for materials such as asphalt, concrete, glass, and steel is incredibly encouraging. It is imperative to continue innovating and moving forward. The betterment of the built environment and beyond demands nothing less. **CS**

Notes

[1] To learn more, visit sustainability.gov/buyclean

[2] To learn more about carbon regulations, visit preoptima.com/the-carbon-source/embodied-carbon-regulations

[3] Review the standard on embodied carbon at tbs-sct.canada.ca/pol/doc-eng.aspx?id=32742

[4] See steel's environmental impact and next steps at globalefficiencyintel.com/steel-climate-impact-international-benchmarking-energy-co2-intensities

[5] Check out this interactive infographic at worldsteel.org/about-steel/steelmaking-process/

[6] Refer to ClarkDietrich's LEC-EPD LCA Optimization Assessment at clarkdietrich.com/sites/default/files/media/documents/ClarkDietrich%20LEC-EPD%20LCA%20Optimization%20Assessment.pdf

[7] Read "What is Steel" by the World Steel Association at worldsteel.org/about-steel/what-is-steel/#:~:text=Most%20steel%20products%20remain%20in,BOF%20and%20EAF%20production%20methods

[8] Review "Climate Action: worldsteel member initiatives" from the World Steel Association at worldsteel.org/climate-action/climate-member-initiatives/

[9] See note 1.

[10] Learn more at www.gsa.gov/real-estate/gsa-properties/inflation-reduction-act/lec-program-details/program-updates/lec-pilot-fact-sheet-archived-version

[11] See the requirements for asphalt, concrete, glass, and steel at www.gsa.gov/real-estate/gsa-properties/inflation-reduction-act/lec-program-details/material-requirements

[12] Read more about the principles of the partnership at www.sustainability.gov/pdfs/federal-state-partnership-principles.pdf

[13] Review the document Revision Record for the State Of California—Supplement, July 1, 2024 at iccsafe.org/wp-content/uploads/errata_central/2022-CA_Green_July24-Supp_COMPLETE.pdf

[14] See California's code update at www.usgbc.org/articles/california-code-update-aims-reduce-embodied-carbon

[15] Review the full LEEDv4.1 criteria guide at build.usgbc.org/bd+c_guide

[16] Refer to the Environmental Protection Agency's (EPA's) label program at www.epa.gov/greenerproducts/label-program-low-embodied-carbon-construction-materials

[17] To learn more, see the Carbon Leadership Forum at carbonleadershipforum.org/

[18] Learn more about SE 2050 by visiting se2050.org/

[19] Refer to the following document at www.gsa.gov/system/files/Steel%20-%20GSA%20IRA%20Low%20Embodied%20Carbon%20Requirements%20%28Dec.%202023%29_508.pdf

ADDITIONAL **INFORMATION**

Author

Adam Shoemaker is the director of corporate sustainability for ClarkDietrich, North America's largest manufacturer of cold-formed steel framing. He is a LEED AP BD+C and CDT-certified professional with expertise in navigating the complexities of sustainability, building codes, and green building programs for the construction industry. He can be reached at adam.

Key Takeaways

The push for sustainable construction materials is accelerating worldwide, driven by initiatives such as the Buy Clean program, strengthened by the *Inflation Reduction Act* (*IRA*), which promotes low-embodied carbon (LEC) materials. Steel, a major contributor to embodied emissions, is undergoing a transformation through the adoption of electric arc furnaces (EAF) and the use of recycled materials. Countries such as Canada, France, and the Nordic nations are enforcing stricter embodied carbon standards, while California leads the U.S. with building code updates. As demand for LEC materials grows, specifiers and manufacturers must adapt, leveraging environmental product declarations (EPDs) and evolving production methods to meet sustainability goals.

MasterFormat No.

05 40 00—Cold-Formed Metal Framing
09 22 16—Non-Structural Metal Framing

UniFormat No.

B2010—Exterior Walls

Keywords

Division 05, 09
Environmental product declarations (EPDs)
Low embodied carbon steel
Life cycle assessments (LCAs)
Low embodied carbon (LEC)
Steel framing
Sustainable construction

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The Case for Metal and Stone Wool in Sustainable Building Design

By Rachel Berkin

Photo by Randy Hoepner Photography

DESIGNING NEW BUILDS IS MORE CHALLENGING THAN EVER BEFORE. PROJECT OWNERS DEMAND THAT ARCHITECTS AND DESIGNERS SELECT MORE SUSTAINABLE MATERIALS, WHETHER A COMPANY IS CONSTRUCTING A MULTIFAMILY RESIDENTIAL, COMMERCIAL, OR INDUSTRIAL BUILDING. WHEN SPECIFYING CEILING TILE AND PANEL SYSTEMS, THOSE MATERIALS ALSO NEED TO MEET THE REQUIRED ACOUSTIC PERFORMANCE GOALS AND, IN A PERFECT WORLD, SUPPORT THE DESIGN VISION SIMULTANEOUSLY.

With a variety of options available for ceiling systems in the marketplace, how does one choose the right product? Two material types, in particular, can offer designers and architects significant benefits in terms of acoustical and sustainability requirements: metal and stone wool.

Metal performs, protects, and provides design flexibility

Metal offers performance, durability, and flexibility. Due to its properties, aluminum in particular does not need additional treatments to resist high heat or high humidity in environments. Most options are also highly corrosion-resistant, increasing their longevity.

Another advantage of metal, which designers and specifiers sometimes overlook, is it can be modified to meet the acoustical requirements for a variety of buildings. Meeting these requirements is vital as it assists with managing noise control for factors such as privacy and speech intelligibility.

When designing metal ceiling panels with smaller perforations, they can be machined so building occupants cannot see them from about five to ten feet away. No matter the size of the perforations, these spaces allow sound to travel through the metal surface.

“The backs of the panels can be covered with an acoustical fabric, which offers two advantages. The fabric absorbs a portion of sound energy coming through the panels while, in the case of large perforations, making it so people cannot see through the panels," says Gary Madaras, acoustic specialist at Rockfon. "If a building owner requires extremely high sound absorption, this requirement can be met by adding a fibrous pad backer on top of ceiling panels."

"The addition of acoustical backers on metal ceiling panels offers upwards of a 0.95 noise reduction coefficient (NRC)," he adds.

Metal ceiling panels can also be installed with a combination of perforated and non-perforated panels if there are areas of a room where a designer prefers to have sound reverberate, such as near stages during conferences where they might want a speaker's voice to project further.

Another advantage of metal ceiling panels is they can be manufactured in various finishes, offering designers and architects flexibility. For people looking for a wood finish, many metal panels are produced using a baked-on coating that gives the metal woodgrain design options. The benefits of adding wood or other natural materials to a space are well-known, including bringing the feeling of being outside indoors; those benefits can also be achieved using a wood-like metal product that is more durable and less vulnerable to humidity.

Metal ceiling products are offered in snap-in, lay-in, torsion spring, and hook-on options, all using grid-based suspension systems, making installation straightforward for builders. Builders are typically accustomed to using these types of systems to install ceiling tiles, panels, and planks.

Stone wool for sustainability

More architects and designers are raising the bar, demanding product transparency and easy access to information to meet sustainability targets. Stone wool ceilings feature superior sound absorption, fire resistance, humidity resistance, durability, and low environmental impact.

"We take one of the Earth's most abundant bedrocks, basalt, and perfect it. There is no need for added antimicrobials or fire-retardants because the source material has inherent fire and humidity-resistant properties. Stone wool ceiling tiles are a great choice for creating a healthy and safe indoor environment as it does not support the growth of mold, fungi, or bacteria," explains Nadia Tagashova, senior product manager for stone wool portfolio at Rockfon.

"Stone wool is a very efficient absorber compared to other material selections that are not necessarily fibrous," Madaras explains. "It is the fibers and structure of stone wool that make it a very efficient sound absorber over other material choices. For example, stone wool ceiling panels typically have high NRC ratings between 0.80 and 0.95 even at standard ceiling panel thickness of 5/8, 3/4, and 1 in. [15.8, 19, and 25.4 mm] allowing to absorb more sound."

Another key advantage of stone wool is its highlighted ability to be endlessly recycled. It does not degrade over time and has a 30-year warranty, allowing it to be recycled repeatedly without compromising product quality.

Properly designed acoustics are important for safety in healthcare environments, where optimal noise control enhances patient privacy, supports clear communication, and improves overall wellbeing.
Photo by Crest Photography

Safety education

Meeting the acoustical requirements of a building has always been considered a health and safety factor.

"Acoustics affect health, safety, and welfare," says Madaras. "Noise leads to stress, increased blood pressure, muscle tension, and voice fatigue, making it a crucial aspect of indoor environmental quality."

The American Institute of Architects (AIA) uses continuing education credits to educate and standardize acoustic performance to enhance the well-being of building occupants. A study in the Iranian Journal of Public Health also highlights the effects of noise on workers.

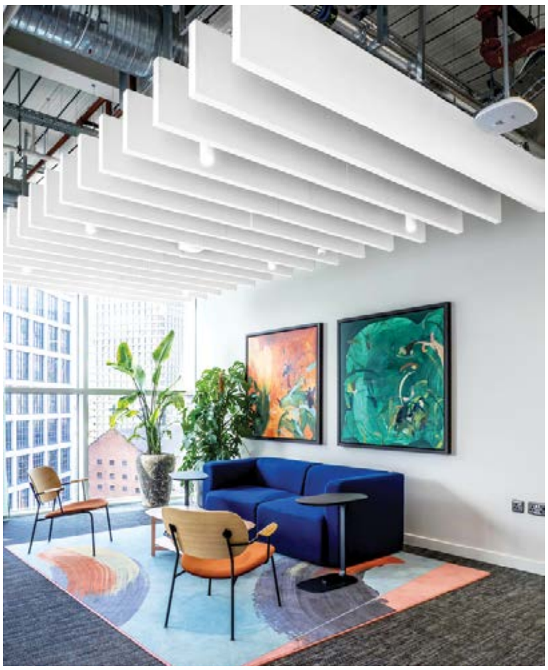
Ensuring a building has the optimal acoustics can be vital in some applications for the health and safety of building occupants. One example is in a hospital environment. Hospitals rely on optimal acoustics to protect patient privacy, enhance speech clarity (especially in crises or emergencies), and support seamless communication among employees in various spaces.

Greater design flexibility to meet aesthetic vision

In the not-so-distant past, architects' and interior designers' visions for a building's interior dictated

Architects and designers can experience the best of both worlds—performance and aesthetics—with ceiling systems that enhance acoustics while complementing the overall design vision.

Photos courtesy Rockfon



Ceiling systems designed with advanced acoustical materials enhance noise control, creating comfortable and visually appealing environments in modern spaces.

the type of material to be specified. Thanks to evolving technologies and applications, this is no longer the case.

Over the decades, manufacturers have developed perforated metals that look like wood and perforated metals that can be solid, clean white panels. Now, the visual aesthetic no longer necessarily determines the acoustic performance.

Architects and designers can experience the best of both worlds: performance and aesthetics. Products available in a variety of forms, shapes, colors, and finishes can widen design possibilities and help achieve a designer's vision and performance goals.

"In healthcare, alarm fatigue impacts clinical staff. Nurses on long shifts face constant medical alarms, and without proper acoustics, they struggle to localize them, risking a wrong direction in response. In emergencies, clear audio instructions can be a matter of life or death," Madaras explains.

Properly designed acoustics are important for safety in school environments. Poor acoustics may hinder the understanding of critical messages, affecting immediate safety responses.

Certifying sustainability

Architects today are redefining what it means to create a lasting impact. By using industry-recognized certifications and standards, professionals can ensure their projects have low embodied carbon, are resource-conscious, and are healthy for occupants. When designers and architects specify building products for projects, they must seek as much information as possible about each product, ensuring that third-party certifications validate any sustainability claims.

Highlighting specific, measurable, and science-backed benefits is a best practice that promotes transparency, builds trust, and strengthens sustainability claims. Product certifications relevant to stone wool ceiling tiles include GREENGUARD Gold Certification, which tests for volatile organic compounds (VOCs). All stone wool ceiling tiles achieve this credential. The industry relies on environmental product declarations (EPDs) to understand the overall impact of a product on the environment over its entire lifecycle, from extraction to disposal. Both health product declarations (HPDs), administered by the HPD Collaborative, and Declare Labels, administered by the Living Future, are essential tools for architects and designers who want to focus on material health and transparency in projects.

Various third-party building standards address each of these product certifications, including LEED, WELL, and the Living Building Challenge. LEED v4.1 is a holistic certification focusing on reducing a building's environmental footprint across categories such as energy efficiency and water while encouraging using materials with third-party certifications. LEED is administered through the United States Green Building Council (USGBC) and Canada Green Building Council (CAGBC) in Canada.

Other certifications, such as WELL v2, focus on the impact of buildings on people in concepts such as air, materials, and sound. The Living Building Challenge v4.1 emphasizes human and environmental health through its energy, water, and materials petals while incorporating beauty and equity.

Third-party building standards such as these set the benchmark for sustainability targets. Stone wool can achieve optimal acoustics while maintaining low embodied carbon impacts and have published transparency labels with HPD and Declare.

Ultimately, selecting a sustainable and durable product is the cornerstone of achieving performance goals. It is more than a choice; it is a commitment to longevity, efficiency, and building better.

Case study: Kaiser Permanente, Mission Bay Medical Offices

Located in one of the fastest-growing live-work neighborhoods in San Francisco, Calif., the Kaiser Permanente houses more than 100 doctors' offices and healthcare professionals, including physicians, nurses, technicians, and administrative staff.

When constructed, the nine-story, 20,624-m^2 (222,000-sf) building met the highest environmental and sustainable building standards, including LEED Gold certification through the USGBC new construction rating system, thanks in part to stone wool ceiling panels.

To reach the architect and design team's goals for optimizing acoustics, aesthetics, and sustainable design, stone wool, and metal ceiling systems made a great choice. Both of these ceiling systems are easy to clean, resist water and moisture, and prevent mold, mildew, and harmful microorganisms—helping to create a healthier indoor environment, especially for those with sensitive immune systems. Acoustic enhancements and perforations allow these metal panels to provide excellent sound absorption, as high as 0.90 noise reduction coefficient (NRC), and, in turn, provide privacy for patients and their families.

The building became part of a new wave of Kaiser Permanente medical offices designed to enhance the care experience by using technology and space to make getting medical care easier, more convenient, and focused on choice. **CS**

Perforated metal ceiling panels can enhance acoustics in large spaces such as airports, reducing noise levels while maintaining a sleek aesthetic.

ADDITIONAL **INFORMATION**

Author

Rachel Berkin is the senior sustainability manager at Rockfon, where she spearheads the integration and execution of sustainability initiatives. Her focus is on healthy materials, carbon management, and performance optimization for stone wool and metal ceilings. With years of experience in the manufacturing sector, she is dedicated to advancing sustainable practices, serving as the Mindful Materials manufacturing engagement group chair. Berkin holds a master's degree in environmental policy and sustainability management.

Key Takeaways

Selecting the right ceiling materials is crucial for balancing sustainability, acoustics, and aesthetics in modern buildings. Metal and stone wool ceiling systems offer key benefits. Metal ceilings provide durability, fire and humidity resistance, and design flexibility. Perforated panels with acoustic backers enhance noise control, while woodgrain finishes offer a natural look with added durability. Stone wool ceilings, made from basalt rock, deliver superior sound absorption, fire resistance, and recyclability. With high noise reduction coefficients (NRC), they support healthier indoor environments and sustainability certifications such as LEED and WELL. Proper acoustics are vital for safety, especially in healthcare and education. Case studies, such as Kaiser Permanente's Mission Bay Medical Offices, showcase how combining metal and stone wool ceilings optimizes performance, aesthetics, and environmental impact.

MasterFormat No.

09 50 00–Ceilings
09 51 00–Acoustical Ceilings
09 54 00–Specialty Ceilings

UniFormat No.

C30–Interior Finishes
C3030–Ceiling Finishes
C303090–Specialty Ceilings

Keywords

Division 09
Acoustics
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Metal panels
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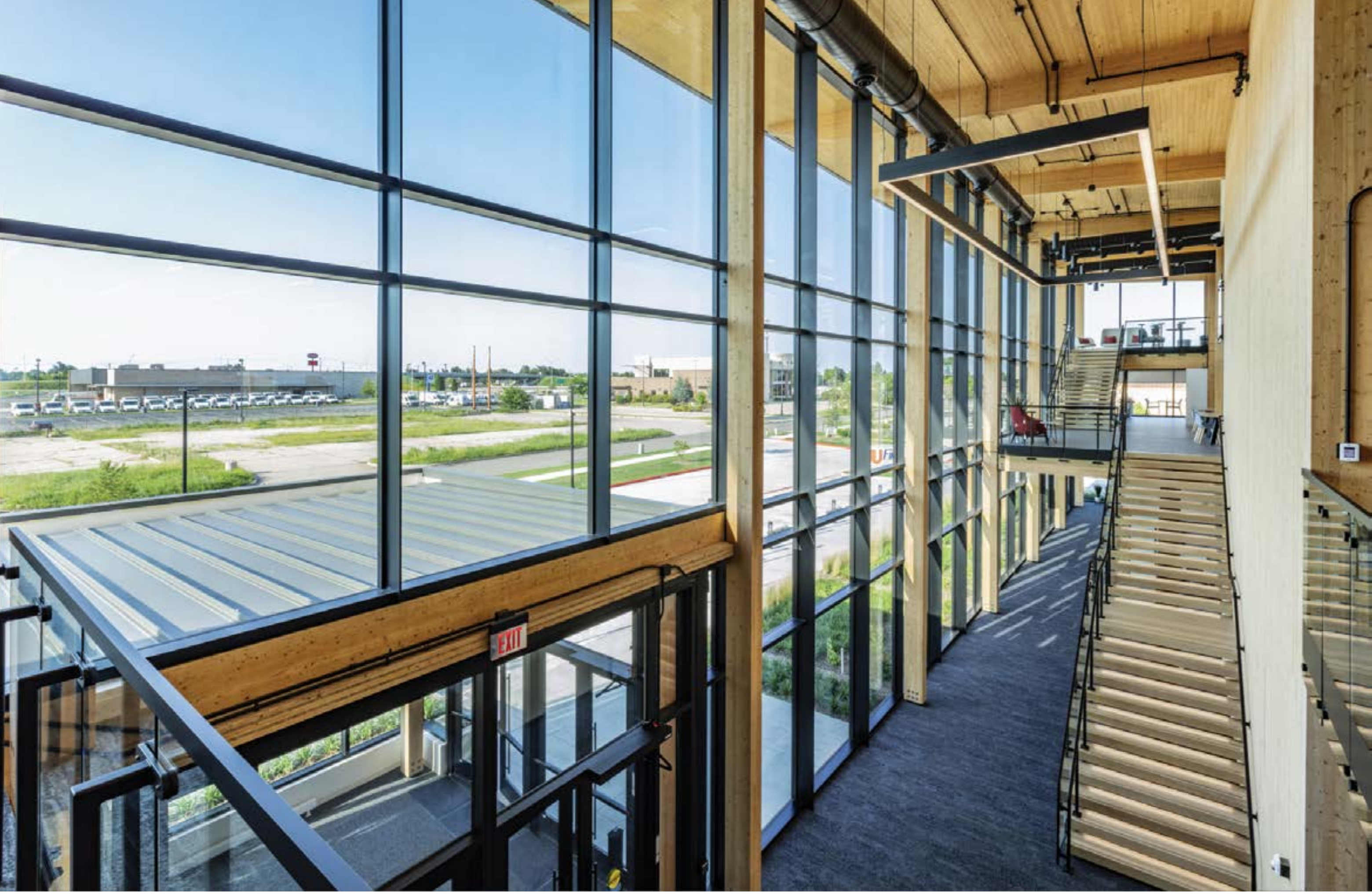
Stone wool
Sustainability



Steel Curtain Walls

Revolutionizing Facades

By Chuck Knickerbocker

Photo ©Simon Hurst Photography/courtesy Technical Glass Products (TGP)

GLAZING SYSTEMS ARE SIGNIFICANT IN CONNECTING INTERIOR SPACES TO THE OUTDOORS, MAKING THEM A POPULAR OPTION FOR TODAY'S SLEEK AND MODERN BUILDING FACADES. THEIR ABILITY TO TRANSFER DAYLIGHT ALSO MAKES THEM BENEFICIAL FOR INTERIOR APPLICATIONS. WHILE NATURALLY HERALDED FOR THESE ATTRIBUTES, GLAZING SYSTEMS ARE INCREASINGLY REQUIRED TO DO MORE AS SUSTAINABLE CONSTRUCTION AND ENERGY EFFICIENCY TAKE CENTER STAGE.

As a result, building and design professionals are turning to high-performance building envelopes to reduce operational carbon. Glass and framing manufacturers have developed products that improve U-values, reduce solar heat gain, and enhance thermal performance to meet this demand.

With an ever-growing array of options available, building and design professionals might be challenged with selecting materials and systems that balance visual appeal with performance. To ease their process, this two-part series will delve into the performance of two beneficial glazing systems—steel curtain wall and channel glass, starting with the former.

Steel the show by solving design challenges

Building and design professionals frequently use curtain walls to create monumental building entrances, providing beautiful views of the outdoors and natural lighting for spaces inside. Given the prominent role glass plays in achieving these goals, it

is easy to see why much of the conversation centers on the glass itself. However, despite glass having a significantly larger area in a curtain wall, the framing is key in helping establish numerous design and performance outcomes. After all, the material and size of the framing significantly impact a curtain wall's structural strength.

Consider aluminum—the historical framing material for curtain walls. The material is lightweight, versatile, and more corrosion-resistant than traditional steel framing, which is beneficial, considering parts of the U.S. are subject to freezing winters and heavy snowfall.

However, with Young's modulus € of approximately 69 million kPa (10 million psi), aluminum may not be able to support the required loads associated with high-performance glazing simply due to their size, thickness, and/or weight. Likewise, increasing the free span size may lead to thicker and bulkier frame profiles than is desirable to ensure structural integrity. Unfortunately, larger frame profiles limit the total area of glazing possible.

As often happens in building construction, materials used in the past have metamorphosed into other variations of themselves, regaining popularity, as they did with wood and stone. This is now happening with steel, making it a viable alternative to aluminum for curtain wall framing systems.

Advanced technology offers weather sealing and moisture protection

Steel is an inherently stronger material than aluminum, with Young's modulus € of approximately 207 million kPa (29 million psi). As a stronger material, it can support larger free spans at various locations throughout (not just at the podium level) of a building's design.

Despite its strength advantage, the design-build sector preferred corrosion-resistant materials such as aluminum over steel since it could not withstand corrosion catalysts such as moisture and air.

However, today's steel framing can be combined with innovative technology to eliminate any concern regarding corrosion. The material can be powder- or wet-coated to match the desired color scheme, using any coating suitable for architecturally exposed structural steel (AESS). The author recommends designers and specifiers approach coating manufacturers or suppliers about using specific coatings on steel if there are any questions. Building professionals can also use exterior caps or interior back mullions from stainless steel to match other building elements and suit local climate requirements. Manufacturers also provide high anti-corrosion protections, such as double-sided pre-galvanization, coated with a durable primer and finished with color to enhance weather protection.

While these protective mechanisms are beneficial, some manufacturers now offer gaskets that isolate the water and prevent it from coming into contact with the steel components. In such systems, a continuous gasket, typically made from extruded silicone, fills the gap between curtain wall components and keeps water off the tops of insulated glass units (IGUs). The water is directed to the verticals, which it is then weeped out of the glazing

Understanding steel's performance capabilities, designers for the First United Bank's regional headquarters specified floor-to-ceiling glazing systems to create uninhibited sightlines and fill the corporate office with daylight.

Photo ©Simon Hurst Photography/courtesy Technical Glass Products (TGP)

Steel curtain walls enable expansive glazing areas, allowing buildings such as the Dallas Center for Performing Arts to maximize daylight and provide unobstructed views of the city skyline.

By utilizing steel curtain walls, the Dallas Center for Performing Arts achieves expansive glazing, enhancing daylighting, energy efficiency, and architectural elegance.

Photos courtesy Technical Glass Products (TGP)

systems. The glazing pocket is also free of metal, supporting condensation resistance.

To further ensure protection, installers seal the lapped gasket joints at horizontal-to-vertical connections to any prevent water intrusion to the steel back members and interior occupied spaces. Another benefit of using steel systems is that do not require zone damming at each glazed lite to manage water flow, unlike aluminum pressure plate systems. However, the full gasketing fabrication method without zone damming still provides a water penetration resistance of 718 Pa (15 psf) or more, meeting ASTM E331, *Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*.

Modern techniques and installation systems have improved steel curtain wall assemblies, ensuring they effectively protect against dynamic and static water penetration, which helps reduce the risk of corrosion. These overlaps and specific joint treatments also provide a layered barrier to help maintain air tightness within the envelope.

Manufacturing advantages help use steel's strength

Beyond corrosion concerns, traditional steel framing members were not as adaptable to different designs, preventing their widespread use as a primary material. Modern steel fabrication techniques today overcome these challenges, resulting in previously unimagined aesthetic possibilities for curtain walls. For instance, in the cold-roll forming process, flat steel sheets or continuous coils undergo a series of rolling operations to achieve project-specific profiles. This process enables the creation of complex shapes and larger sections from thin-gauge carbon or even stainless steel, with thickness ranging from 24-gauge 0.60 mm (0.02 in.) to 6 mm (0.23 in.).

Further, laser cutting and welding processes provide even greater flexibility. These processes involve taking long, flat carbon or stainless plates with lengths ranging from 11.8 to 15 m (38 to 49 ft) and thicknesses up to 38 mm (1.5 in.), and cutting them into bars or strips of the necessary width for

Steel framing members can be specified with powder- or wet-coated to match the desired color scheme and to protect against corrosion.

shaping. Once cut, these bars are assembled into the desired shapes (rectangles, channels, T's, angles, square tubes, and I-beams), and the joints are welded using lasers. This method allows steel profiles to meet custom width and depth requirements and, in turn, enables curtain wall system depths to be tailored per specific project specifications. Unlike traditional steel forming methods, the laser cutting/welding process allows these profiles to have sharp corners 0.5 mm (0.02 in.) rather than rounded ones, allowing teams to create corner joints with no visible weld beads or fasteners.

These steel formation processes also allow for the development of larger sections of thin-gauge carbon or stainless material with longer member lengths. Steel is much more versatile when shaped or formed in this advanced manner. Combining design flexibility with strength makes enduring and expansive glazing facades possible.

Narrow yet stronger framing system

In addition to production techniques, steel's material properties offer specifiers significant advantages over conventional materials in large curtain wall designs. Using Young's modulus € numbers earlier, steel is approximately three times stiffer than aluminum. Steel framing systems can better resist deformation and deflection under wind and other loads. Consequently, the stiffness of steel allows framing profiles to be much narrower in width and depth than aluminum's for the same load specifications.

For example, if building and design professionals aim to meet design criteria for a typical two-story curtain wall, steel frames can accommodate a 45 x 146 mm (1.75 x 5.75 in.) profile. In contrast, aluminum would require a 64 x 200 mm (2.5 x 8 in.) profile. The profile size of an aluminum frame in such a case would be 25 to 50 percent larger than a steel framing system. The leaner steel profile does not compromise material strength and allows design teams to build more expansive curtain walls with larger glazing areas.

Greater glazing spans with fewer supports

Due to their strength, steel profiles can also support much larger glass panes than what is possible with aluminum. Moreover, the cold roll-formed and laser-welded steel processes help capitalize on steel's strength and bolster its ability to handle a greater wind load. This enables building and design teams to achieve larger free spans and daylight openings between framing members without additional supporting members. For example, consider a 6 m (20 ft) long steel or extruded aluminum mullion with the same cross-sectional properties, using 1.4 Pa (30 psf) in a 1.5 m (5 ft) module as the design load (discounting allowable deflection limits momentarily). In this scenario, an aluminum mullion deflects 111.6 mm (4.4 in.), whereas a steel mullion deflects about 38.51 mm (1.5 in.).

These properties allow building and design professionals to use smaller system shapes to realize larger free spans and glass lites, facilitating uninterrupted outside views and greater illumination for interior spaces.

Thinner frame profiles have a smaller surface area for the sun to move across during the day, resulting in smaller shadow projections. Understanding steel's performance capabilities, designers for the First United Bank's regional headquarters in Moore, Okla., specified floor-to-ceiling glazing systems. The curtain walls helped them create uninhibited sightlines and fill the corporate office with daylight.

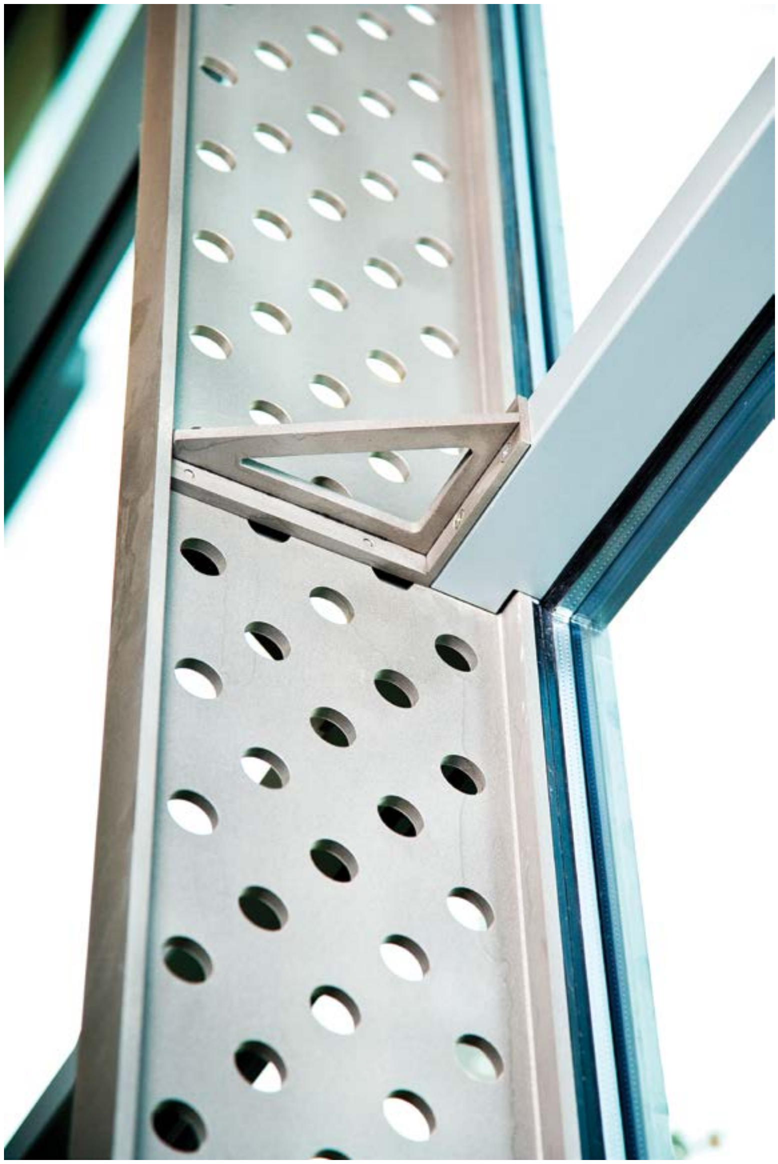
Prioritizing designs with energy efficiency

Steel's ability to increase glazing spans and areas is one of the simplest ways for building and design professionals to maximize daylight area in building design. However, this can make a building more vulnerable to heat transfer, posing a challenge to attaining energy efficiency. While pairing framing systems with glazing solutions such as low-emissivity (low-e) coatings improve center-of-glass (COG) thermal values, they may still be susceptible to summer heat gain and winter heat loss.

Many building and design professionals have preferred thermally broken aluminum frames in predominantly subarctic climates. Incorporating thermal breaks (*i.e.* separations between the inner and outer frames) can help reduce the heat flow associated with the material's high thermal conductivity (approximately 118 Btus per hour). However, thermally broken aluminum frames are not the only high-performance alternative available to North American professionals.

Thermally efficient glazing systems

Steel's thermal conductivity is approximately 74 percent less than aluminum (*i.e.* approximately 32,7000 joule [31 BTUs/hr]). This is equivalent to that of thermally broken aluminum frames. Moreover, some advanced steel frames do not require a traditional thermal break due to profile designs. Steel frames without a thermal break require less metal to support the glazing than traditional aluminum frames. Therefore, they reduce and resist heat transfer. The computer simulations were conducted on steel curtain wall systems according to the National Fenestration Rating Council's (NFRC's) 100 Procedure for Determining Fenestration Product U-factors. These simulations used 25.4 mm (1 in.) insulating glass units (IGUs) with clear low-e coatings. The results showed the combined system achieved U-values of 1.65–2.21 watts per square meter and Kelvin (W/m^2.K) 0.29-0.39 Btu per hour per square foot per degree Fahrenheit (Btu/h·sf·F) (depending on the glass), significantly surpassing the thermal performance of many aluminum curtain walls.



Advanced manufacturing techniques allow steel profiles to be formed into precise project-specific shapes.

Steel supports high-performance glazing

To further mitigate heat transfer in curtain walls, building and design teams often turn to double- and triple-glazed systems and/or a variety of glass thicknesses to help balance natural light admission with energy costs. In similar scenarios, traditional framing systems might struggle to support these configurations due to their size and loads, requiring either a reduction in glass lite dimensions or free spans (which would increase the metal area).

Steel's inherent strength allows it to support heavy triple- and quadruple-glazed units, with glazing infills up to 76 mm (3 in.) thick and weights up to 112.3 kg/m^2 (23 lb/sf). This easily surpasses a triple-glazed unit's thickness of 45 mm (1.7 in.) and weight of 48.8 kg/m (10 lb/sf), helping bolster a building's thermal efficiency with ease. Underscoring this point, in NFRC 100 computer simulations of steel frame materials with IGUs comprised of clear glass

With three-times the stiffness of aluminum, thinner steel profiles will deflect significantly less and can be specified in taller curtain walls.

and non-gassed airspace plus triple glazing, recorded U-values as low as 1.078 W/m^2.K (0.19 Btu/h·sf·F). However, it is important to note these are approximate values only. Actual values will vary depending on specific glass and framing combinations per project requirements.

Mitigating airtight leakage

Modern steel curtain walls can mitigate air penetration infiltration, which can be especially beneficial in cold climates. There are two factors at play here. Firstly, steel's coefficient of thermal expansion is about 12 x 10-6 meters per meter per degree Celsius (m/m C), which is much closer to that of glass (9) and concrete (10) than aluminum's coefficient of 23.6. Similar expansion rates to neighboring materials reduce the strain on one material in case of temperature fluctuations. For example, when there is a high-temperature differential between the framing material and the supporting structure, the components will expand or contract differently, creating gaps in the envelope and causing air leakage. The compatibility of the physical properties between framing materials is also crucial to minimizing risks of sealant failure and other instances that affect thermal performance.

Secondly, when paired with the full gasketing, modern steel curtain walls promise almost no air penetration. When tested (per ASTM E283/E283M, *Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen*) with a pressure differential of 30.47 kg/m^2 (6.24 lb/sf), a steel curtain wall's air leakage has been consistently measured at 0.05 L/s•m^2 (0.01 cfm/sf) or less of wall area. These factors enhance energy performance in steel-framed curtain walls, supporting sustainability goals.

The gasketing on the front of the steel frames plays a role in isolating steel from coming in contact with any air that may be present in the glazing channel, further mitigating infiltration. Together with perimeter detailing around the curtain walls or windows and select infill panels (glass, metal panels etc.), the steel-framed curtain wall can have an almost impenetrable air and water barrier. Naturally, tighter systems that prevent heat transfer are better at keeping conditioned air inside a building while not allowing untreated exterior air into building interiors. The process lowers loads on mechanical systems that do not need to work as hard to heat or cool interior spaces, improving energy efficiency. In doing so, steel-framed curtain walls support a project and team's sustainability goals.

Sustainability considerations and LEED ratings

Steel curtain walls help building and design teams meet sustainability goals and various LEED requirements by optimizing energy performance and contributing to daylight and views.

With steel-framed curtain walls, green building professionals can earn points in the "Energy and Atmosphere" category by optimizing energy performance beyond standard requirements. Since high efficiency glazing systems may improve building performance and reduce excess load on the HVAC systems, they can mitigate excessive energy use. Steel's lower thermal conductivity than aluminum also decreases energy demands by reducing heat transfer between inside and outside.

Steel frames can also help earn points in the "Indoor Environmental Quality (EQ)" category, which aims to connect occupants with the outdoors, reinforce circadian rhythms, and reduce electrical lighting use by introducing daylight. There are three methods to accomplish this goal. The initial method involves conducting yearly computer simulations to determine spatial daylight autonomy and average spatial daylight autonomy, with a minimum value of 40 percent. The second option requires computer simulations for illuminance during the equinox, while the third option involves directly measuring illuminance. The second and third options have a minimum threshold of 55 percent for regularly occupied spaces.

Since steel mullions support large free spans, they assist building and design teams in meeting daylight goals. Steel mullions come in various sizes and shapes, such as box, I-beams, and T-shapes. Compared to aluminum, steel T-shapes are thinner, effectively allowing better light penetration deep into building interiors by increasing the glazing size and reducing shadows to improve the quality of space. Larger glazing areas also offer better unobstructed and quality views, which can earn more LEED points in a category that seeks at least 75 percent of all regularly occupied floor areas to have a clear view of the outdoors through vision glazing. These factors make steel a compelling choice for environmentally conscious projects to maximize energy efficiency and advance sustainability goals.

In addition to evaluating the operational carbon of the building envelope to make strides toward a more sustainable construction practice, professionals are also examining the embedded energy and recyclable content within metal frames. Among available options, primary steel manufacturing consumes 2,800 kg (6,173 lb) of CO2 equivalent per tonne (kgCO2e/tonne), while aluminum has an embodied carbon rate of around 8,300 kg (18,298 lb) CO2e/tonne. Both these materials are 100 percent recyclable. However, recycled content in steel frames typically ranges between 15 to 25 percent, whereas using about 30 percent of recycled aluminum in framing profiles is possible. One of the reasons for this low recyclable content is that the global supply of scrap steel and aluminum (low carbon feedstock) is limited, albeit to a different extent.

Looking beyond design and performance

When specifying curtain walls, professionals often consider the design potential and performance, the installation complexity, value for money, and long-term maintenance. Steel curtain walls are typically designed as stick wall systems, where fabricated and finished parts are shipped to the site for direct installation. Once the frame is in place, glaziers install the glazing. That said, it is also possible to unitize steel frames to a minimal extent, although it is less common when compared to aluminum extrusions. This is because the heavier weight of steel profiles requires stronger connections if assembled before installation. Plus, shipping unitized steel frames is not recommended over great distances due to the vibration the framing is subject to in transit. Adding to the complexity, pre-glazing steel-framed unitized wall assemblies before field installation can negate the functionality of the single-glazing gasket on the face of the framing member. As a result, the installation process would require a field-applied wet seal between units, fundamentally negating the desired "unitized" approach.

Steel's strength supports heavier glazing and enables light-filled spaces to meet sustainability objectives.

Whether using a partly unitized or stick system, steel-framed curtain wall installation can be beneficial when evaluating total costs. Although steel framing generally runs 20 to 25 percent higher than aluminum frames with the same spacing, this difference can be easily offset by steel's ability to support larger lites. When looking at the larger picture, steel frames enable less framing members to be fabricated and erected, and can mean fewer field connections to the structure that have to be installed. A study found that increasing vertical mullion spacing from 1.2 m (4 ft) on center (OC) to 1.5 m (5 ft) and 1.8 m (6 ft) OC, reduced framing costs by 15 to 20 percent at each interval. While these values do not include erection costs, there are clear advantages in that regard as well. For example, a 9.144 m (30 ft) column spacing typically requires six 1.5 m (5 ft) modules or five 1.8 m (6 ft) modules. This means at least one less vertical component to purchase, fabricate, ship, and install, along with one fewer module of horizontals to furnish and install, thus reducing the number of glass lites to install. These reductions facilitate labor savings and offset field installation costs.

Additionally, efficient field installation directly impacts long-term maintenance. Precise installation of the continuous gasket mentioned above is crucial to preventing air and water infiltration through a steel curtain wall system. Reduced exposure to elements can reduce maintenance requirements and prolong the service life of the glazing system. For projects exposed to high-speed winds, where air tightness is a concern, installers can use pressure plates as a two-line resistance strategy for air and water penetration resistance. In these systems, the pressure plates hold the lites in place and help maintain adequate pressure on the glass, gaskets and framing. This creates efficient seals that resist air and water penetration, enhancing a curtain wall's performance and reducing the need for intensive maintenance over the long term.

The balancing act

As building and design teams increasingly seek high-performance system solutions, specifying steel-framed curtain walls can help them address performance priorities without sacrificing visual appeal. After all, the exterior defines a building's appearance.

To achieve the best of both worlds, it is crucial to consider how steel curtain walls fit within the overall building enclosure. This involves evaluating how a specific system interacts with perimeter details and surrounding materials, examining anchorage details, and verifying deflection to ensure structural integrity. Ironing out these details early in the design and specification process, through collaboration with steel framing manufacturers, can result in precise fabrication and seamless installation.

Moreover, consulting and adhering to the manufacturer or supplier's installation guidelines is crucial for optimal performance. Assuming standard practices may lead to improper installation, particularly regarding air and water integrity, and could void the manufacturer's warranty. Fortunately, many manufacturers offer design and installation support, which can help ensure enhanced energy efficiency and the enduring beauty of curtain walls for years to come. **CS**

ADDITIONAL **INFORMATION**

Author

Chuck Knickerbocker is the curtain wall manager for Technical Glass Products (TGP), a supplier of fire-rated glass and framing systems and specialty architectural glazing products. With more than 40 years of curtain wall experience, Knickerbocker has successfully worked with numerous architects, building owners, and subcontractors from schematic design development through installation.

Key Takeaways

As sustainability and energy efficiency become priorities, a growing demand for high-performance building envelopes is growing. This series examines the use of steel curtain walls in architecture, which are favored for creating striking entrances and optimizing natural lighting. Steel's superior strength allows for larger spans and smaller frame profiles, and recent advancements have improved its weather sealing and moisture protection.

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Sight and Sound

Enhancing Light and Acoustics with Flooring Contractors

By David Gross

Photo courtesy Beaumont Health

NATURAL LIGHT SOURCES AND COMFORTABLE ACOUSTICS HAVE BECOME HALLMARKS OF WELL-DESIGNED MODERN SPACES, PROMOTING HEALTH AND WELLBEING, SUSTAINABILITY, AND AESTHETIC APPEAL. TO ACHIEVE OPTIMAL LIGHT AND SOUND EFFECTS, DESIGNERS ACCOUNT FOR MANY ELEMENTS, ANTICIPATING HOW THEY WILL ALL INTERACT WHEN ASSEMBLED IN ONE SPACE. IN VIRTUALLY EVERY PROJECT, FLOORING IS THE ONE ELEMENT THAT OFTEN HAS AN OUTSIZED IMPACT.

Typically representing the largest surface area of continuous material in an interior design, flooring products—and the level of expertise with which they are installed—are key choices for projects where natural light and acoustics are priorities. As such, specifying a certified flooring contractor is imperative to ensure proper installation of the flooring material and its long-term performance. To fully appreciate the role of a certified flooring contractor, it is essential to understand how their expertise enhances natural light and acoustics. Here is a closer look at some skills they bring to the floor.

Avoiding glaring errors

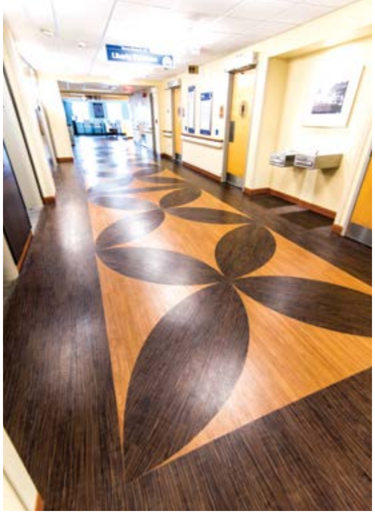
Architects and designers often prioritize natural light in their projects because it enhances the aesthetic and functional aspects of a space while improving energy efficiency. As an aesthetic element, natural light can create a warm, inviting atmosphere and highlight textures, colors, and architectural features. It adds depth and dimension that artificial lighting often cannot achieve. Natural light also fosters a sense of openness and outdoor connection, which can be especially appealing in urban environments where green spaces are limited. Studies indicate exposure to natural light improves mood, productivity, and mental health while reducing eye strain in workspaces.

Natural light also offers energy savings. By maximizing natural light sources and limiting artificial lighting, architects and designers can help lower a building's energy use and HVAC loads and support Green Building Standards. Natural light sources align with sustainability goals and certification programs (such as LEED) that prioritize energy efficiency and occupant wellbeing. When using natural light, designers pay careful attention to window placement and orientation, precisely positioning windows, skylights, and light wells to optimize illumination throughout the day.

Flooring is important in creating these effects and gaining these efficiencies by reflecting and intensifying light or absorbing and lessening its intensity. In spaces where natural light is a central feature, designers must carefully select flooring materials, assessing how the natural light interacts with different surfaces. For instance, surfaces such as polished tiles, glossy vinyl, and light-colored flooring are highly reflective and will brighten a space. Conversely, matte and dark surfaces such as carpets, dark

At the Ann Arbor Veterans Rehabilitation Clinic, flooring contractors expertly installed 2,879 m^2 (31,000 sf) of intricate, high-performance flooring. Blending durability with thoughtful aesthetics, the design enhances wayfinding, acoustics, and natural light, creating a welcoming, healing environment for veterans.

Photos courtesy Veterans Affairs Michigan Rehabilitation Clinic



The flooring contractors brought the Ann Arbor Veterans Rehabilitation Clinic's vision to life with expertly installed flooring that balances safety, durability, and design. Thoughtfully integrated patterns aid navigation, while acoustically optimized materials and natural light reflections create a calm, restorative atmosphere for veterans.

Bringing nature indoors: The 1,858-m^2 (20,000-sf) Florence and Richard McBrien Pediatric Neuroscience Center at Beaumont Hospital in Royal Oak, Mich., features animal-inspired decor.

Photo courtesy Beaumont Health

tiles, and darker woods absorb light, creating a dimmer atmosphere. Flooring choices can also influence the perceived size of a room. Lighter floors create a sense of spaciousness, while darker floors provide a more intimate feel.

One of the biggest challenges for flooring contractors working in areas with abundant natural light is managing the reflectivity and glare that accompany certain materials, such as concrete and ceramic tiles. In these applications, natural light can showcase a stunningly flawless installation, but only if the installation is, in fact, flawless. However, the challenge for the contractor is that natural light can also highlight every imperfection, leaving no room for even the smallest error.

An experienced contractor will start with impeccable subfloor preparation to deliver near-perfect results. A flat, smooth, and clean subfloor is essential, as any imperfection will be magnified in natural light. Other key installation strategies a certified installer will employ include:

- Seaming—Regardless of the flooring material, a knowledgeable contractor will position seams perpendicular to the natural light source whenever possible to draw less attention to the eye. Conversely, if seams are parallel to the light source, the light will emphasize the seam, and the slightest deviation from a perfectly straight line or level surface will become a focal point.
- Leveling: Leveling is critical when installing materials such as luxury vinyl tile (LVT) or ceramic tile. Without consistency and precision, "ledging" can occur. Ledging refers to the shadows cast by any sections of flooring that sit slightly higher than their neighbors. In a large, open, naturally lit space, ledging draws attention to these unsightly irregularities.
- Polishing—While some degree of shine is often desired with hard flooring materials, it can easily cross into excessive glare and reflectivity without proper care. Intense glare from sunlight can be blinding to occupants, and mirror-like surfaces can be unwanted or, at worst, create privacy concerns. To achieve a desirable level of reflectivity and shine, experienced contractors work with architects, designers, and specifiers to calibrate polished finishes using a scale from matte to highly polished. Well-calibrated polishing of materials such as concrete and ceramic tile can even be used to earn green building credits by enhancing natural light and reducing the need for artificial illumination.

The complexity of working with natural light underscores the need for an experienced, certified flooring contractor who understands its unique challenges. From subfloor preparation to strategic seaming, precise leveling, and controlled polishing, each step requires meticulous attention to detail to ensure the flooring enhances rather than detracts from overall lighting effects.

Sounding off

In both residential and commercial spaces, managing sound is critical for creating environments that are functional, comfortable,

At the intersection of infection control, acoustics, and natural light, flooring contractors ensure healthcare floors enhance safety and comfort. By minimizing contaminants, reducing noise, and optimizing light reflection, these expertly installed surfaces create a cleaner, calmer environment for healing.

Photos courtesy INSTALL Flooring

and suited to their intended purpose. Whether minimizing footfall noise in a multifamily residence, reducing echo in an open office, or protecting privacy in a healthcare setting, flooring plays a pivotal role in controlling sound transmission and absorption. In every case, achieving optimal acoustics requires more than just selecting the right materials; it also requires expertise in how those materials are installed.

Certified flooring contractors possess a unique skill set, combining technical knowledge of flooring materials with specialized installation techniques to address the intricate relationship between flooring and acoustics. These professionals understand the nuances of soundproofing underlayments, the acoustic qualities of different flooring materials, and other advanced products designed to reduce noise transmission and enhance sound quality. Examples of soundproofing underlayments installers may choose from include:

- Rubber—Made from recycled rubber, these underlayments provide excellent impact noise reduction by absorbing vibrations and sound energy before they travel through the subfloor. They are durable, moisture-resistant, and suitable for various flooring types, including hardwood, tile, and laminate.
- Cork—Cork's cellular structure naturally absorbs sound and prevents it from transferring to adjacent spaces. It also offers thermal insulation, making it a dual-purpose solution. Cork underlayments are often used under hardwood and laminate flooring.
- Foam—Made from polyethylene or polypropylene, foam underlayments reduce sound by creating a cushioning layer that minimizes impact noise such as footfalls. Foam is commonly used under laminate or engineered wood floors. For improved performance, some foam options are enhanced with an additional sound barrier layer.
- Felt—Comprising recycled fibers such as jute or synthetic materials, felt underlayments are dense and provide excellent sound absorption. Felt is often used with hardwood or engineered wood flooring to reduce impact and airborne noise.
- Acoustic mats—Typically made from rubber or synthetic materials, acoustic mats are placed beneath the flooring to act as a vibration barrier. They are especially effective under tile or stone flooring, where hard surfaces can amplify sound.
- Mass-loaded vinyl (MLV)—MLV is a dense, flexible material underlayment that blocks airborne noise. It can be combined with other underlayment types to enhance soundproofing for virtually any flooring material.

When appropriately matched with flooring material and properly installed, underlayments help create quieter, more comfortable environments by absorbing impact noise and reducing airborne sound transmission.

One environment that is particularly sensitive to sound control is healthcare. For example, hospitals have diverse flooring requirements absorption on the function of each space. In areas such as check-in/check-out, lobbies, and waiting rooms, sound dampening and absorption are often accomplished with soft flooring, most commonly carpet. Sound control in these areas helps protect patient confidentiality by limiting voice travel. It also contributes to creating a quieter, more calming environment.

Comparatively, patient treatment areas have different priorities. Harder, more durable materials such as LVT are necessary for rigorous sanitation practices and patient and equipment mobility. In hallways and patient rooms, flooring must be easy to clean and provide a smooth surface for rolling equipment, such as gurneys, wheelchairs, and carts. While sound management remains important, it must be balanced with other priorities such as safety, hygiene, and ease of movement. Flooring contractors who work in healthcare must follow specific protocols, and many complete Infection Control Risk Assessment (ICRA) training to learn these specialized skills. For specifiers, an ICRA-certified contractor is a strong indicator of expertise in meeting these unique requirements.

In commercial spaces (*e.g.* educational facilities, fitness centers, and corporate environments), designers can choose flooring materials that meet their aesthetic and acoustic needs. Popular flooring materials that offer both color and style choices and acoustic enhancements include:

Top: The new Florence and Richard McBrien Pediatric Neuroscience Center expands to 25 exam rooms with child-friendly decor and durable, high-performance flooring.

Photo courtesy Beaumont Health

Right: The flooring contractors enhanced healing at Nemours Alfred I. duPont Hospital with advanced flooring, soothing acoustics, and natural light. Pictured is a patient room.

Photo courtesy Nemours/ Alfred I. DuPont Hospital

- Carpet and carpet tiles for occupant comfort, sound absorption, and design flexibility. Carpet products are ideal for quieting spaces (*e.g.* reading areas and theater aisles).
- Cork for its eco-friendly, naturally resilient qualities and sound absorption. Cork is perfect for quiet zones in libraries and backstage areas in theaters.
- Rubber offers exceptional durability, effective noise reduction, and a non-slip surface, and it is well-suited for high-traffic, heavy-use spaces such as fitness and recreation facilities.
- LVT with acoustic backing can deliver the look of harder materials such as wood or stone with sound-dampening properties, making it a versatile choice for corporate and retail spaces.
- Felt and textile flooring provide the softness of carpet with modern design aesthetics and excellent sound absorption, making them popular for creating unique spaces.

Delivering the desired look, performance, and acoustic effect of a flooring material requires a technical understanding of how the chosen material responds to sound. It also requires expertise in subfloor preparation and installation techniques specific to each material.

Perfect harmony

Many features of well-designed spaces create successful natural light and acoustic effects, but flooring plays one of the most significant roles. By specifying a certified flooring contractor, building professionals know that installation will be executed with technical expertise and attention to detail. These experts can also recommend renewable materials and innovative solutions supporting sustainability initiatives, including helping projects qualify for green building credits. With the right team, designers can fully optimize a space's aesthetic and functional potential. **CS**

ADDITIONAL **INFORMATION**

Author

David Gross is the executive director of INSTALL, the leading organization for floorcovering installation training and certification in North America at INSTALLFloors.org. Prior to this role, Gross was a full-time instructor for the Eastern Atlantic States Carpenter's Apprenticeship Training Fund, where he achieved Level III Advanced Instructor Certification. He holds a bachelor's degree in economics, an MBA, and is a BCSP Certified Safety Professional, with more than 30 years of hands-on floor installation experience.

Key Takeaways

Integrating abundant natural light in modern architecture has become a hallmark of well-designed spaces, promoting health, sustainability, and aesthetic appeal. However, to fully capitalize on these benefits, flooring materials must be carefully specified to address key considerations such as glare and acoustics. This article explores the critical role flooring plays in enhancing spaces with natural light by focusing on materials with low-glare finishes to prevent visual discomfort and maintain design integrity. Additionally, it delves into solutions for subfloor preparation and flooring materials that reduce sound transmission, sound, creating acoustically comfortable environments in both residential and commercial applications.

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Keywords

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Acoustic treatment	Lighting

Down to Earth Detailing

Kenneth Itle, AIA, is an architect and associate principal with Wiss, Janney, Elstner Associates (WJE) in Northbrook, Illinois, specializing in historic preservation. He can be reached at kitle@wje.com.

When designing and constructing a building facade, the base of wall detail can be a particular source of difficulty. At this location, the work of different designers and different trades must come together to provide a durable and functional whole. Two recent projects exhibited facade assemblies that performed very well over the height of the building but which failed at the portion closest to grade.

As one example, a log cabin was constructed less than ten years ago in a southern state for interpretive purposes. In keeping with historic prototypes, no roof gutter is present, and precipitation drips freely from the roof edge to grade below. The new structure is supported on a concrete foundation, and concrete pavers are used to provide a pedestrian walkway directly adjacent to the exterior wall on one side. For much of the perimeter, the concrete foundation protects the logs at the base of the wall from rising damp, and the soil is graded away from the walls, providing a durable assembly. However, the logs on the walkway side are exposed to water that splashes back from the concrete pavers (Figure 1). The frequent wetting led to premature deterioration of the logs at the base of this wall.

Figure 1

This newly built log cabin experienced premature deterioration where water splashes back from concrete pavers adjacent to the wall.

Photos courtesy Wiss, Janney, Elstner Associates (WJE)

In another project, the limestone veneer of an office building facade continued down to grade, with a concrete sidewalk directly adjacent. Due to the slope of the site, water was channeled toward the building and down the length of the facade. After years of exposure to splashed rainwater and deicing salts, the course of masonry closest to grade had discolored and eroded, although the rest of the masonry was intact (Figure 2).

Figure 2

While most of this limestone facade has performed very well, the course of stone near grade has experienced severe staining and erosion from moisture and deicing salts.

In both of these projects, adjustments to the detail where the building wall met grade could have mitigated the observed deterioration. If rain will be shed near the base of the wall from a roof or ledge above (as in the log cabin project), consideration should be given to including a trench drain, free-draining gravel, or similar details that minimize splashing and quickly remove water from the base of the wall. Where pavements cannot be held back from the wall (as in the office building project), they must be sloped away from the wall to prevent water from collecting against the facade.

For many buildings, the design of this critical transition will involve coordination among multiple disciplines, including architects, landscape architects, and civil engineers. Designers need to consider a range of moisture sources that could affect the base of wall, including precipitation, water in soil, surface runoff, and water deflected by hard surfaces. Material selections that work well for the majority of the facade may need to be reconsidered for the transition at grade. Base of wall flashing details that are effective at one condition, such as a planting bed, may not function adjacent to pavement. As seen in these two very different examples, details at the base of the wall may be easily overlooked and if not well resolved, can contribute significantly to deterioration. **CS**