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THE COATINGS DEBATE
SMP vs. PVDF

Metal's Expanding Role in Design

Benefits of Composite Cladding

Comparing SPF Insulation Options

The official magazine of Construction Specifications Canada

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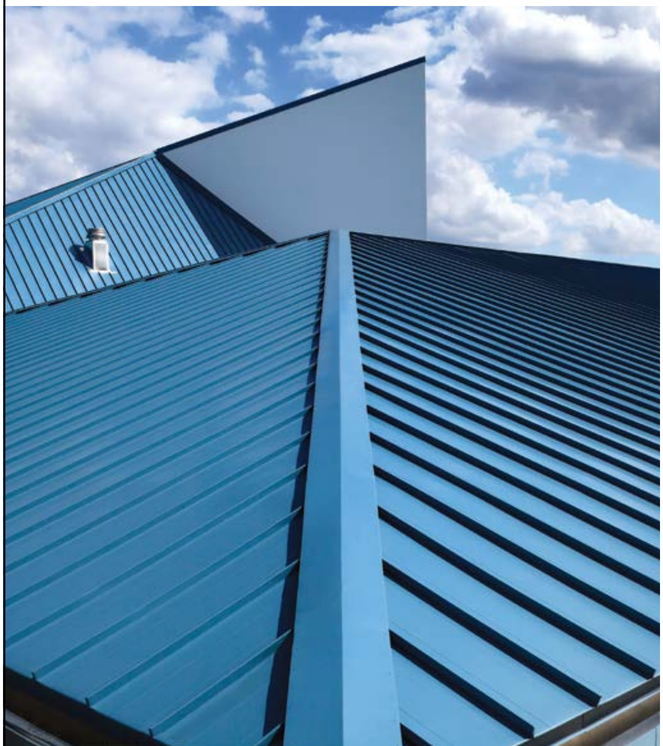

Selecting a finish for metal panels means balancing durability, appearance, and warranty coverage. Silicone-modified polyester (SMP) delivers a tough, scratch-resistant surface and versatile gloss options, while polyvinylidene fluoride (PVDF) offers exceptional colour and gloss retention in coastal, industrial, and high-UV environments. Learn how performance ratings, exposure conditions, and warranty limitations can guide coating choices for roofing, cladding, facades, and windows and doors across building projects with confidence.

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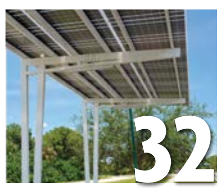

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SMP vs. PVDF for Metal Panels

Which is Superior?

By Brent Fletcher

PHOTOS COURTESY AKZONOBEL

Understanding the coatings best suited for metal panel projects involves considering critical factors related to the coating's performance and warranty. This article delves into the differences between silicone-modified polyester (SMP) and polyvinylidene fluoride (PVDF) coatings, providing insights to help inform decision-making when selecting coatings for upcoming metal panel projects.

SMP-based coatings

SMP is a silicone-modified or siliconized polyester coating system for application in metal building products. SMP resin systems are typically blended with high-quality pigments, UV additives, and a proprietary resin blend to achieve excellent colour and gloss retention, as well as excellent weather resistance. With extensive research and performance testing, SMP-based coatings have been formulated and

AAMA 2603, 2604, and 2605 use a mix of accelerated and real-world testing in the harsh South Florida environment to evaluate coatings.

refined over decades, and today's SMP coatings are much closer to the durability of PVDF. SMP offers more gloss options and textured finishes than PVDF coating systems, and it shows slightly different colour fade on medium- and dark-coloured surfaces. The coating can begin to chalk and fade slightly more quickly than PVDF coatings, especially when bright or dark colours are used in extreme conditions. However, lighter colours are inherently better at deflecting UV rays, making SMP a viable option. Once cured, SMP is tougher than PVDF and offers excellent scratch resistance, helping reduce corrosion of exposed metal over the life of the building.

PVDF-based coatings

PVDF is a very stable fluoropolymer used in high-performance, highly durable exterior paint finishes. It was discovered more than 60 years ago by DuPont scientists, who created Teflon, most commonly used in non-stick cookware. Fluoropolymers are the most chemically inert of all polymers. PVDF's strength comes at the molecular level. Its carbon-fluorine bonds produce one of the strongest chemical bonds in polymers, and the molecule's spiral shape is structurally very stable. These thermoplastic polymers soften upon heating and harden upon cooling. This process is repeatable, making them flexible during coil and extrusion manufacturing. The unique molecular structure of these polymers accounts for their well-known performance. PVDF remains stable in most chemical environments at high temperatures and is highly durable in extreme weather conditions.

AAMA specifications in extrusion coatings

To help decide which coating is suitable for any given environment, it is worth considering the Fenestration and Glazing Industry Alliance (FGIA) performance ratings, which use three AAMA specification codes. These specifications, AAMA 2603, 2604, and 2605, use a combination of accelerated and real-world environmental testing to evaluate coating performance. While tested in the United States, these standards apply across North America.

PVDF coatings are often still primarily selected when sourcing materials for coastal environments.

A quality coating system will retain its original colour over the life of the structure.

AAMA 2603, *Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels,* is primarily used for interior facades, retail point-of-sale areas, or commercial storefronts in shopping malls. Typically, high-solid polyester and acrylic coatings meet the requirements of AAMA 2603. They are not exposed to harsh weather conditions, so the need for exceptional performance in outdoor weather is unnecessary.

The AAMA 2604, *Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix),* performance specification aligns well with systems designed with SMP resins. These coatings can cost more than standard polyesters yet are five times more protective. Their weathering performance over five years is equivalent to that of ordinary polyesters over one year. SMP coatings are often applied to storefronts, windows, doors, and low-rise curtain walls. Although the specification is for five years, they are usually accompanied by a 10-year guarantee.

The toughest specification, AAMA 2605, *Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix),* requires 10-year South Florida testing for colour retention, chalk resistance, and gloss retention. AAMA 2605 is most commonly associated with the performance properties achieved with 70 per cent PVDF coatings. This makes PVDF coatings ideal for use in any environmental conditions to protect exterior curtain walls, facades, windows, and doors of buildings, stadiums, and high-value residences. These polymers provide long-lasting protection for buildings' structural and esthetic qualities and often come with 20-year warranty coverage.

Selecting the right coating system

PVDF is particularly effective at providing long-lasting protection for vivid and dark colours. A choice of bright colours is restricted, though, if a two-coat rather than a three-coat system is used. The PVDF coating's flexibility supports the construction of metal building components.

However, this flexible coating can be relatively soft and more susceptible to scratching and

marring than other systems. With white coatings, more metal marking occurs than with other, tougher coating systems. Careful handling in production helps avoid these issues.

PVDFs are particularly suited for severe weather environments such as industrial sites with higher concentrations of acid rain and chemical pollutants; coastal areas with saltwater spray from the ocean; or climates with extreme heat, UV sunlight, and moisture or humidity.

Coating selection can vary by project. SMPs are a good substitute in environments such as parts of Canada where PVDF may not be needed. With recent advancements in technology, SMP coatings will perform well in these areas and other extreme environments, including coastal and mountainous regions with temperature swings, heavy rainfall, hail, and snow. Although these environments might be considered extreme, SMP's toughness will withstand them well.

Both PVDF and SMP coatings are well-suited for metal roofing and metal cladding applications. Due to their lower prices and harder final finish, SMP coatings are often the preferred alternative for warehouses, industrial storage, agricultural structures, and other non-monumental commercial buildings. SMP coatings work well in all but the most extreme environments. PVDF coatings are often still

It is critical to select appropriate substrates and ensure coaters are following best practices for surface preparation, pretreatment, and application.

Lighter colours are inherently better at deflecting UV rays.

primarily selected for coastal environments and areas with intense sunlight, as well as for heavy industrial areas with chemical pollutants.

Warranty coverage

A good warranty will cover the following areas:

- Film integrity—A quality coating system will maintain film integrity throughout the structure's life. The film integrity aspect of a paint warranty ensures that the paint maintains adhesion to the substrate. The coating will not peel, flake, or otherwise lose adhesion. This is measured in time (years).
- Colour retention—A quality coating system will retain its original colour over the life of the structure. Colour fade results from chemical breakdown of a coating's base resins and pigments, which appear as a visible loss of colour. Reported as a Delta E in Hunter units, colour retention signifies the maximum colour change (fade) over a specified number of years. In this case, a lower number is best.
- Washed versus unwashed panels—Apparent discolouration of the coating may occur when it has been exposed to dirt-laden atmospheres for long periods. A good cleaning will generally restore the appearance of these coatings.
- Chalk resistance—A quality coating system will maintain chalk resistance throughout the structure's life. Decomposition of the coating film caused by UV rays, moisture, or heat (or any combination of the three) results in chalk-like residue on the building's surface. The residue is transferred to a soft fabric by rubbing the coated surface and assessed visually against photographic standards, in accordance with ASTM D4214, *Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.*

What is not covered

It is important to understand what is outside the scope of common coating warranties. Some common non-warrantable situations include, but are not limited to:

- Coating film breaches caused by installation scratches, abrasions, or hard impacts.
- Damage caused by moisture entrapment, including moisture trapped between bundles or during transit.
- Substrate corrosion, including failure or damage resulting from under-film corrosion or edge corrosion.
- Coatings that are not applied in accordance with specified application procedures and film thickness requirements.
- Mixing or combining different coating systems.
- Other situations that fall outside the conditions and requirements outlined in the coating warranty.

Brent Fletcher is the regional product marketing manager for coil and extrusion coatings Americas at AkzoNobel.

Composite Cladding

Sustainability, Performance, and a Growing Global Market

By Thomas Gooch

PHOTOS COURTESY FIBERON

Sustainability is no longer just a values statement. It is a business strategy. According to the 2025 CEO Study from the United Nations Global Compact and Accenture, which surveyed nearly 2,000 chief executives across 128 countries, 88 per cent of CEOs say the business case for sustainability is stronger today than it was five years ago, and 99 per cent plan to maintain or increase their sustainability commitments in the years ahead.[1]

This shift is especially visible in the building industry, where sustainability has long been a priority. In green building construction, product sustainability manifests in many ways, from material makeup and manufacturing processes to end-of-life care and durability (the longer a material lasts, the fewer new products will need to be produced).

When specifying exterior cladding or building envelope materials, building professionals have many options: wood, engineered cladding products, stucco, and brick and stone masonry, among others. Wood-plastic composite (WPC) has evolved from a niche alternative into a mainstream building material. With its sustainability credentials, performance advantages, and design versatility, it is easy to understand why.

Sustainability of composite cladding

From its material makeup through the manufacturing process to its performance

trim, door frames, lumber, or cabinet pieces that would otherwise be discarded. Through these recycling efforts, manufacturers of composite decking and cladding products can prevent more than 1 million trees from being cut down each year. This is equivalent to about 15,000 football fields of healthy forests preserved annually.[2] Further, the manufacturing process of WPCs avoids using rainforest species, thus protecting endangered trees and reducing deforestation. Although WPCs can include any wood species, maple, pine, and oak are among the most frequently used. This selection not only leverages more abundant and sustainably sourced wood but also ensures the final products support environmental conservation efforts.

The plastic in composite cladding is derived from milk jugs, shampoo bottles, grocery bags, laundry detergent containers, and other recycled packaging materials. The average family uses approximately 1,500 plastic bags each year, with each bag being used for an average of just 12 minutes.[3] If not recycled, these plastic bags likely end up in landfills or the ocean, where they could remain for up to 1,000 years.[4] That said, it is this same resistance to decomposing that helps make composite cladding last such a long time. As many as 2,000 plastic bags can be used to manufacture a single WPC board, meaning one manufacturer can recycle an average of 45 million kg (100 million lbs) of plastic each year. That is the weight of approximately 227 Boeing 747s.

and lifecycle, several factors make composite cladding a highly sustainable option.

Material makeup

As manufacturers of WPCs continue to move closer toward zero waste, they have incrementally increased the amount of recycled material in their products—some are made with upwards of 94 per cent pre- and post-consumer recycled material—which prevents materials from being sent to waste streams and landfills, while also preserving valuable natural resources. This makes WPC much more sustainable than many other building envelope materials.

Wood flour is recycled from sawdust, planer shavings, or other scrap material from window

Manufacturing process

Working toward zero waste, WPC manufacturers have been increasing process efficiency for some time now. These improvements are yet another reason WPC is widely considered highly sustainable.

Composite cladding manufacturers with dedicated recycling facilities can recycle both post-consumer and post-industrial polyethylene (PE), the most common form of plastic waste. Thanks to automated material shredding and sorting, it is becoming faster and less expensive for manufacturers to incorporate recycled materials into building products.

Since these plastics should not enter the waste stream, some manufacturers ensure 100 per cent of the material is reclaimed in the

Composite cladding enables designers to combine the warm look of wood with improved durability while embracing the trend toward mixed-material exteriors.

manufacturing process. When the PE arrives at a recycling facility, for example, it undergoes a battery of tests—including thermal, moisture, and infrared analyses—to confirm the molecular structure of the polymers and provide insight into the sample's history. Inspectors examine the individual physical properties of the samples, check for degradation, and determine whether any contaminants are present. If the samples meet strict quality requirements, they are staged in a warehouse for further inspection. If the samples fail, they are sent to alternate recycling operations with less stringent requirements.

While manufacturing composite cladding requires a constant water supply, some manufacturers use a closed-loop system to maintain sustainability. A closed-loop system uses a reservoir to store and recycle the same water every day, preventing billions of gallons—enough to fill 5,300 Olympic-size swimming pools—from entering the waste stream.[2]

For project teams pursuing green building certification, it is worth noting that leading composite cladding products have been confirmed in conformance with ISO 14025, 14040, 14044, and 21930, all of which are required for products used in LEED v4-certified builds.[5]

Performance and lifecycle

Doubling a building's lifespan halves its construction-related environmental impacts, which is why the durability of a material, along with its long-term performance, is crucial to its sustainability.

WPCs combine the best qualities of recycled wood—such as strength and low cost—with the long-lasting resilience of recycled plastic, which is less prone to water absorption and insect infestation. Blending these two materials is what makes WPCs last so long and why they are sustainable from start to finish.

Unlike solid wood, the durable composite core of WPC cladding ensures exceptional resistance to rotting, cracking, insects, and decay. A three-sided cap layer protects against fading and staining common with solid wood cladding, and it has a finished surface on both the top and bottom to prevent water absorption further.

Composite cladding also never needs sanding, staining, painting, or sealing. There are environmental dangers associated with volatile organic compounds (VOCs) released by stains and paints. VOCs are a leading contributor to ground-level air pollution and poor indoor air quality (IAQ), which can adversely impact the health of building occupants—a concern recognized by both Health Canada and the Canada Green Building Council (CAGBC) as a key factor in healthy building design.[6] When solid wood is stained or painted to maintain its durability, it will then need to be refinished with more stain or paint every couple of years, which creates a continual cycle of chemical emissions. The chemicals used in treated wood are generally not good for humans, either. Since composite cladding is highly durable and never needs to be stained or painted, it is free of these toxic chemicals and preservatives.

Further, once the WPC has finished serving as cladding, the material can be recycled into something new. Wood treated with chemicals, on the other hand, cannot be burned or recycled when its use as cladding is complete.

Performance of composite cladding

Compared with other building envelope materials, WPC stands apart as one of the most sustainable options, both in terms of durability and material makeup.[7]

Wood cladding

Appearance

Wood siding—including shiplap, tongue-and-groove, and board-and-batten—offers a timeless, authentic esthetic that is difficult to replicate. Its

Composite cladding is available in a range of different lengths and colours, which can be mixed and matched to create a unique, custom look.

natural grain variation, warmth, and character have made it a preferred choice in residential design for centuries, and it remains a benchmark against which other cladding materials are measured. That said, it is prone to fading, chipping, and staining. It can also develop mould and mildew stains.

Installation

Wood is widely available, easy to cut and work with using standard tools, and familiar to most trades, making it one of the more straightforward materials to source and install in most markets. That said, Wood siding requires multiple trades (carpenters, painters, etc.) to install and finish. The siding will need to be refinished (and sometimes repaired) every few years, which is a time-consuming process that entails scraping, sanding, pressure washing, and re-staining or re-painting.

Durability

Wood splits, splinters, and is particularly affected by freeze-thaw cycles. Water absorption depends on the finish quality and its age. If the siding is not maintained, its durability will be compromised.

Recycled content

Wood cladding contains no recycled content if purchased new. Some wood cladding is made from endangered hardwood species, resulting in negative environmental impacts.

Fire performance

Untreated wood is combustible and can contribute to fire spread. Pressure-treated or fire-retardant-treated (FRT) wood offers improved resistance, but FRT chemicals can release toxic gases during combustion, raising concerns for occupant safety and emergency responders.

Engineered cladding products (*e.g.* fibre cement)

Appearance

Fibre cement is a versatile and widely trusted cladding option, offering good dimensional stability and a consistent finish. It is available in

Wood-plastic composites (WPCs) can be used for many different components in the built environment, including decking, soffits, screen facades, rainscreen cladding, and even trim elements when cut to size.

a range of profiles and can be factory-primed or pre-finished, giving installers flexibility across a variety of project types and budgets. While engineered cladding products may be embossed with a woodgrain pattern, they lack the natural colour variation found in wood (*i.e.* the subtle shifts in tone across the grain that give wood its depth and visual richness). As a result, the appearance tends to be more uniform and less naturalistic than composite or solid wood cladding. Engineered cladding products are also prone to fading and cracking.

Installation
Fibre cement is available in a wide range of profiles—including lap siding, panels, and trim—giving installers and designers flexibility to achieve different looks within a single product system. On the downside, since engineered cladding releases silica when cut, the Canadian Centre for Occupational Health and Safety (CCOHS) requires exposure controls and protective equipment for all installers.[8] A specialized blade is also needed to reduce silica dust. The material can break under its own weight, so it requires careful handling to avoid product loss. Installation can vary depending on climate and wind conditions, making scheduling more difficult.

Durability
Engineered cladding products tend to be brittle and can fracture if nailed close to the edge. The finish and face can spall (flake or break off) in cold environments. Like wood, the amount of water that engineered cladding absorbs depends on the quality and age of the finish, so it must be effectively maintained to prevent deterioration. Engineered cladding is highly susceptible to impact damage and freeze-thaw cycles.

Recycled content
Engineered cladding contains little to no recycled content.

Fire performance
Fibre cement is noncombustible and carries a Class A fire rating, making it one of the stronger performers in this category. It does not contribute to flame spread and does not release toxic gases during a fire, which is a meaningful advantage in high-risk fire zones or where building codes mandate noncombustible cladding.

Stucco

Appearance
Stucco offers a seamless, monolithic finish that suits a wide range of architectural styles. Its ability to be tinted in virtually any colour and applied over curved or irregular surfaces gives it a design flexibility that few other cladding materials can match.

Installation
Stucco is very labour-intensive to install, requiring a two- to three-step application, plus painting (dash, scratch, brown, and finish coats), by a concrete contractor. All layers of stucco must be uniform to perform well; improper installation can result in extensive damage to interior walls and structures.

Durability
Stucco is resistant to rot, mould, fire, and insects. However, it is prone to cracking due to its brittle

Made almost entirely from recycled wood and recycled plastic, composite cladding prevents materials from being sent to waste streams and landfills, while also preserving valuable natural resources.

nature, especially when the building's foundation settles. Stucco is also porous and absorbs water more readily than other materials, which can cause dark spots or mould growth. The material is sometimes affected by freeze-thaw cycles. Because stucco is prone to these moisture-related issues, it is best suited for drier climates.

Recycled content

Stucco typically does not contain recycled content, although some may use post-consumer recycled sand aggregate from crushed, screened waste concrete.

Fire performance

Stucco is non-combustible and contributes to a Class A fire-rated wall assembly when properly installed. It does not release toxic gases during a fire and is frequently specified in Wildland Urban Interface (WUI) zones for this reason.

Brick and stone masonry

Appearance

Both brick and stone have a classic look often seen on more traditional homes. These materials have a wide range of esthetics beyond typical red brick and field stone. Brick is available in assorted colours and coarse patterns, and can be painted, while stone can be laid in a variety of patterns. Manufactured brick and stone veneers offer another option.

Installation

Brick and stone installations are quite labour intensive since the products are heavy. Exterior brick and stone require a wider foundation wall to support their own weight and accommodate the required 25-mm (1-in.) air space. They also require steel support lintels over windows, doors, and gable-ends, as well as brick ties, through-wall flashings, and weep holes for water drainage.

Durability

Masonry is one of the most proven long-term cladding systems available, with well-documented lifespans exceeding 100 years. Though brick is a durable product, it absorbs water and can spall when exposed to excess moisture. Depending on the brick's water absorption rate and saturated coefficient, it can be affected by freeze-thaw cycles. Brick is also subject to efflorescence, the development of crystalline deposits of water-soluble salt on the brick's surface.

Recycled content

Some bricks may contain pre-consumer recycled materials, such as overburden from mining, washings from aggregate processing, grog, sawdust, and metallic oxides. This pre-consumer recycled content is generally low, around only 15 per cent.

Composite cladding

Appearance

Composite cladding has an authentic wood grain and colour variation that gives it an appearance similar to natural solid wood—but without the fading, cracking, and decay that is typically associated with wood cladding.

Installation

Installation is safer and easier than most other cladding options. Composite cladding is available in longer board lengths than wood or fibre cement, which reduces splices and labour. Since the boards are pre-finished, they require no additional finishing steps or excessive ongoing maintenance, further reducing labour time and expense. Unlike fibre cement, no potentially harmful substances are released during cutting.

Durability

Composite cladding will not crack, splinter, peel, rot, decay, or suffer insect infestation, like wood. Composite cladding may absorb a negligible amount of water but is not affected by freeze-thaw cycles.

Recycled content
Composite cladding is made almost entirely of recycled content and is manufactured without toxic chemicals. In addition, it can be recycled at the end of its life, unlike treated wood.

Fire performance
Leading composite cladding products carry a Class B fire rating and meet NFPA 268, *Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source*, requirements, helping to satisfy fire code regulations for exterior wall assemblies. While WPC is not noncombustible, it does not contain the chemical preservatives found in pressure-treated wood, which can release toxic gases during combustion. Specifiers should verify the fire classification of specific products when working on projects with elevated fire code requirements.

Design benefits of composite cladding

Beyond its sustainability and performance attributes, composite cladding allows designers to provide the warm look of wood with a more durable material, while also staying on-trend with a mixture of exterior materials. While monolithic expanses of synthetic stucco (exterior insulation finishing systems or EIFS), brick, wood, or fibre cement were once the norm, today's buildings typically feature a combination of materials. Organic-looking products with warm wood tones are now placed alongside poured-in-place concrete and glass or EIFS and stone. This approach is widely adopted in both single-family homes and commercial structures, offering a quick and straightforward method to achieve an esthetic nearly identical to that of newer buildings. It also adds a touch of warmth to the design.

WPCs can be used for many different components in the built environment, including decking, soffits, screen facades, rainscreen cladding, and even trim elements when cut to size. WPCs can also be manufactured in many different shapes, colours, and textures. Lengths and colours can be mixed and matched to create a unique, custom look, and boards can be installed vertically, horizontally, or diagonally.

Composite cladding has an authentic wood grain and colour variation that gives it an appearance similar to solid wood—but without the fading, cracking, and decay that is typical of wood cladding.

With these design options, architects and specifiers can achieve a variety of styles, from subtle and rustic to bold and modern.

The embossing technology for WPCs has advanced to the point that the material now closely mimics the appearance of solid wood, making it almost indistinguishable. Further, colour options are abundant and not constrained by the regional availability of particular wood species. Rich colour palettes and varied grain patterns are available in a range of browns and greys. Classic browns range from rich mid-tones to the deepest brown, adding depth and drama. The darker choices are especially well-suited to Craftsman-style or Mediterranean homes. Reddish browns are timeless and classic, yet still unique. The colours evoke the warm hues of cinnamon, the rich depth of rosewood, and the vibrant tones of red cedar. Reddish tones provide warmth, energy, and a pop in the landscape. Blonde oak tones have established a strong foothold in the industry, offering a subtle sandy hue for those drawn to the natural, Scandinavian-inspired look. At the other end of the spectrum, deep charcoals and rich espresso tones are gaining significant ground in both residential and commercial applications, lending drama and sophistication to contemporary facades. Greys, with their undercurrents of blue or sandy beige, continue to evoke thoughts of rocky shorelines and weathered wood, making them a natural fit for coastal homes while adding quiet sophistication to urban spaces. Increasingly, designers are pairing WPC boards

Wood-plastic composites (WPCs) can be used for many different components in the built environment, including decking.

across multiple tones within a single facade to create the layered, mixed-material exteriors that define today's most compelling building designs.

The future of composite cladding

When it comes to performance, ease of maintenance, and design capabilities, composite cladding outperforms many alternative materials. It is durable and sustainable, and thanks to its nature-inspired embossing, composite cladding emulates natural wood better than alternative materials.

The numbers tell the story: the global WPC market, valued at approximately CAD $12.7 billion in 2025, is projected to nearly double to CAD $20.7 billion by 2031[9]—a trajectory driven by building professionals who are choosing durability, sustainability, and long-term value over short-term material costs. This momentum is validation of what the material has always offered: the warm beauty of wood, without the vulnerabilities that come with it.

Looking further ahead, the evolution of WPC technology could take the material's most compelling attribute—its wood-like appearance—to an entirely new level. New advanced image-capture technologies recently seen in composite decking[10] could also make their way to cladding. These new advancements bring photorealistic wood appearances to WPCs, capturing the authentic grain and tone of exotic hardwoods with a precision that even trained eyes could struggle to distinguish from the real thing. For specifiers, that possibility could reframe the conversation entirely, delivering not just a sustainable, low-maintenance alternative to wood, but one that is visually indistinguishable from it.

Notes

[1] Download the United Nations Global Compact–Accenture 2025 CEO study, "Turning the Key: Unlocking the next era of sustainability leadership," https://info.unglobalcompact.org/ceo-study-2025.

[2] For more information, visit https://balance.fiberondecking.com.

[3] Also see National Geographic 2018: Fast facts about plastic pollution, www.nationalgeographic.com/science/article/plastics-facts-infographics-ocean-pollution.

[4] See "Degradation Rates of Plastics in the Environment," by ACS Publications 2020, pages 3,495, 3,499–3,500, and 3503: https://pubs.acs.org/doi/10.1021/acssuschemeng.9b06635.

[5] An independently verified Environmental Product Declaration (EPD) for Fiberon Wildwood, conducted by SCS Global Services, is publicly available for review at https://www.fiberoncladding.com/pages/testing-certification-documents.

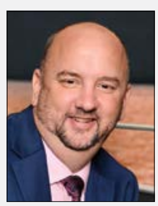
[6] Refer to Health Canada, Indoor Air Quality, www.canada.ca/en/health-canada/services/air-quality/indoor-air-contaminants.html. See also the Canada Green Building Council, LEED in Canada, https://www.cagbc.org/certification/leed/.

[7] See "Fiberon Wildwood Composite Cladding," pages 26–27, at fiberon.widen.net/s/npdt7xjgf6/lit_clad_brochure_wildwood-composite-cladding.

[8] Learn more at https://www.ccohs.ca/oshanswers/diseases/silicosis.html#section-5-hdr

[9] Estimated market size and projected growth according to Mordor Intelligence's 2026 "Wood Plastic Composites Market Size & Share Report" (https://www.mordorintelligence.com/industry-reports/wood-plastic-composites-wpc-market). USD figures converted to CAD at an approximate rate of 1.42, per the Bank of Canada as of June 2026.

[10] Read more at https://www.fiberondecking.com/pages/novus-decking



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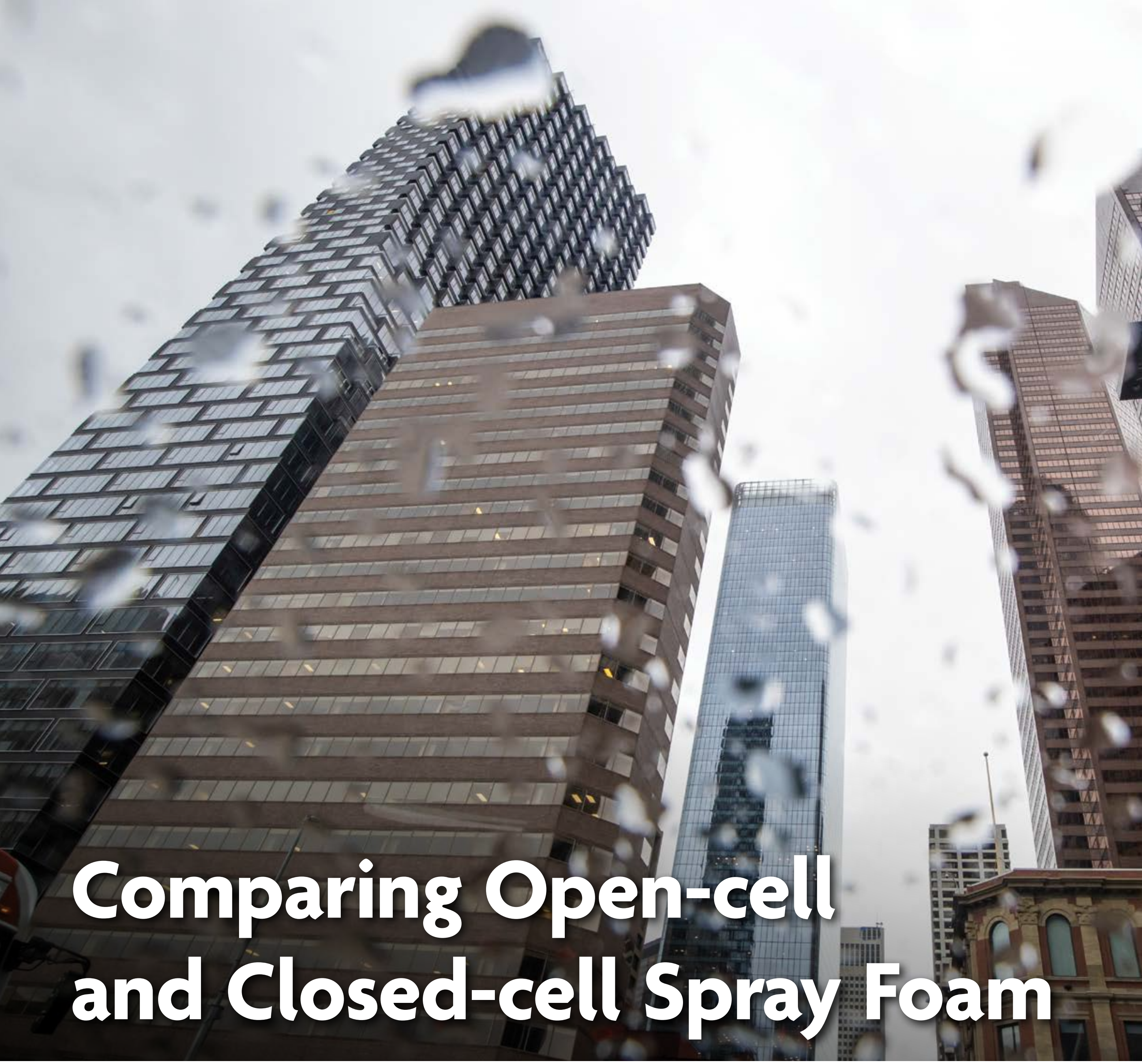


Comparing Open-cell and Closed-cell Spray Foam

By Rockford Boyer
B.Arch. Sc., MBSc, BSS,
and Betsy Cosper

PHOTO © ISTOCK/COURTESY ELASTOCHEM

Spray polyurethane foam (SPF) insulation represents a different approach to building enclosure performance compared to traditional fibrous or board-based insulation materials. Rather than relying solely on thermal resistance, spray foam is applied as a liquid that expands in place, conforming to substrates and sealing gaps as it cures. This in-situ application enables it to function not only as insulation but also as a key component of the air-control layer within an assembly.

This dual role—thermal insulation combined with air sealing—is central to its performance. In many buildings, uncontrolled air leakage is a primary driver of energy loss and moisture movement. By adhering directly to framing members, sheathing, and penetrations, spray foam minimizes unintended air pathways, reducing convective heat transfer and limiting the transport of moisture-laden air into vulnerable parts of the assembly. As a result, SPF systems often deliver performance exceeding expectations based solely on R-value.

Beyond air sealing, spray foam also contributes to the overall continuity of the building enclosure. As it is applied as a continuous layer,

it can reduce reliance on multiple materials and transitions to achieve effective control of heat, air, and, in some cases, moisture. This can simplify detailing and improve constructability, particularly in complex geometries or assemblies with numerous penetrations.

However, not all spray foams perform the same way. The term "spray foam" encompasses two distinct material types, open-cell and closed-cell, each defined by its internal cellular structure. As the foam expands during application, it forms millions of tiny cells. In closed-cell foam, these cells remain intact and fully enclosed, creating a dense, rigid material with low permeability to air and moisture. In open-cell foam, the cell walls rupture during expansion, forming an interconnected network of air-filled pockets that results in a lighter, softer, and more vapour-permeable material.

These structural differences are fundamental. They influence not only density and thermal resistance, but also how each material interacts with air, vapour, and water within the building enclosure. Closed-cell foam tends to resist the movement of heat, air, and moisture, while open-cell foam allows assemblies to remain more vapour open, supporting drying under the right conditions.

Understanding these distinctions is critical when specifying spray foam systems. While both materials provide effective air sealing and insulation, their roles within an assembly and impact on long-term durability can differ significantly.

Designing with open-cell spray foam insulation

Open-cell spray foam is often mischaracterized as a lower-performance alternative to closed-cell insulation. It serves a fundamentally different role within the building enclosure. Rather than functioning as a vapour barrier, open-cell foam is intentionally vapour permeable, enabling assemblies to manage and release incidental moisture over time. When understood and applied correctly, it becomes a powerful tool for improving durability not by resisting all moisture, but by allowing assemblies to tolerate and recover from it.

One of the defining characteristics of open-cell spray foam is its high vapour permeability. Depending on thickness, it can exceed 10 perms, placing it firmly within the category of vapour-open materials. This permeability allows moisture vapour to move through the assembly, enabling drying in response to changing environmental conditions. In practice, small amounts of moisture intrusion are inevitable whether introduced through minor air leakage, seasonal vapour drives, or incidental wetting during construction. The critical question is not whether moisture enters the assembly, but whether it can dissipate.

Closed-cell spray foam installed within a curved steel assembly, demonstrating the material's ability to conform to irregular geometries while maintaining all control layers.

PHOTOS COURTESY ELASTOCHEM

In this context, open-cell foam supports a more resilient approach to enclosure design. Rather than relying solely on impermeable layers to prevent moisture movement, a strategy that can be difficult to execute perfectly in the field, it allows assemblies to recover when moisture is introduced. This drying potential reduces the risk of accumulation at critical interfaces, where mould growth, material degradation, and loss of thermal performance often originate.

A key distinction must be made between air control and vapour control, two functions that are often confused in practice. Open-cell spray foam can perform effectively as an air barrier when installed with sufficient thickness and continuity. This is a critical attribute, as air leakage remains the dominant mechanism for moisture transport in buildings, often moving significantly more moisture than vapour diffusion alone. By restricting air movement, open-cell foam addresses one of the primary drivers of moisture-related risk within assemblies.

At the same time, its vapour permeability ensures this control does not compromise drying. This combination of being airtight yet vapour open makes open-cell foam particularly valuable in assemblies where both control and resilience are required. It allows designers to manage the primary moisture transport mechanism while maintaining a drying pathway when moisture is introduced.

From an application standpoint, open-cell foam is well-suited for assemblies where drying potential is beneficial or necessary, particularly in Canadian climates characterized by long heating seasons and seasonal reversals in vapour drive. In these conditions, assemblies must be able to respond to changing moisture gradients throughout the year. As a result, material selection is often less about geographic location alone and more about the assembly's configuration and drying strategy.

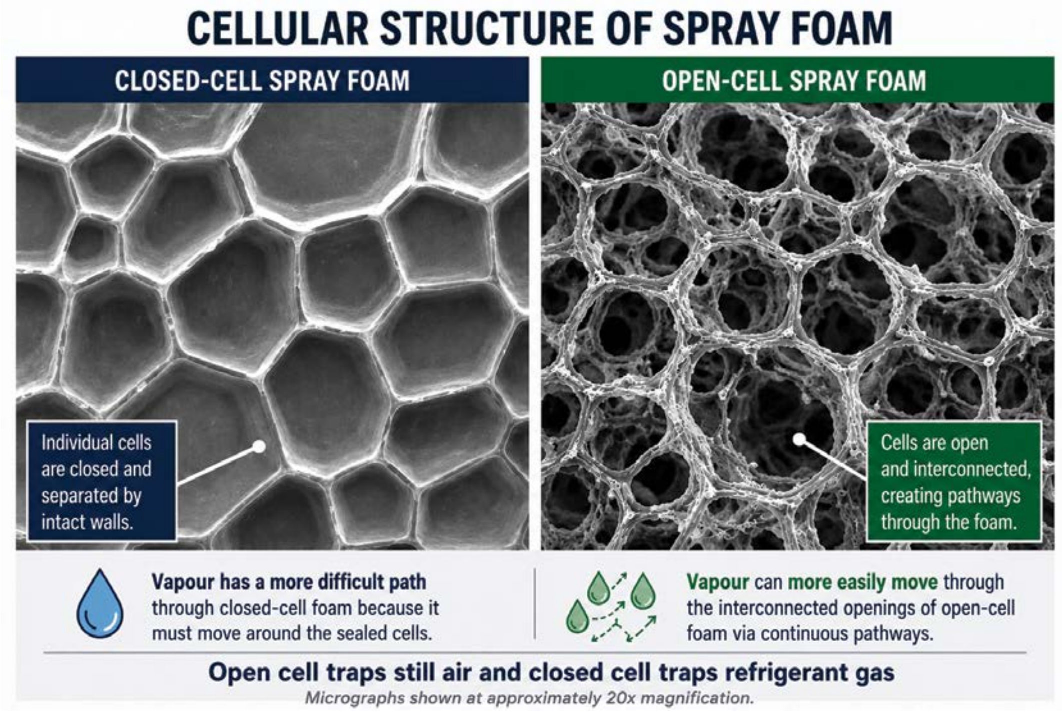
For example, in unvented roof assemblies such as cathedral ceilings, insulated along the underside of the roof deck, open-cell foam supports inward drying, reducing the risk of long-term moisture accumulation. This is especially relevant where roofing materials or membranes limit exterior drying.

Another common application is in wall assemblies incorporating vapour-impermeable exterior components, such as certain sheathings or claddings. In these cases, maintaining inward drying potential becomes critical, and open-cell foam helps provide a pathway for moisture to dissipate toward the interior, provided appropriate interior finishes and ventilation strategies are in place.

In addition to its moisture-related benefits, open-cell foam offers strong acoustic performance. Its lower density and interconnected cellular structure enable effective sound absorption, making it well-suited for interior partitions, multi-unit residential construction, and spaces where acoustic separation is a design priority. While often considered a secondary attribute, this performance can significantly enhance occupant comfort.

Despite these advantages, open-cell foam is not a universal solution. Its lower R-value per inch, typically in the range of R-3.5 to R-4, means that thicker assemblies may be required to meet energy code requirements compared to closed-cell alternatives. More importantly, its vapour permeability means it cannot function as a vapour control layer where one is required by code or climate conditions. In colder Canadian climates, additional vapour control strategies may be necessary to limit outward vapour diffusion during winter months.

It is also important to recognize that open-cell foam does not provide bulk water resistance. It should not be relied upon as a drainage plane or water-control layer, and must be integrated into a broader enclosure system that includes



Electron micrographs illustrating the cellular structure of closed-cell and open-cell spray polyurethane foam.

appropriate water management strategies. As with any material, its performance is highly dependent on how it is detailed and co-ordinated within the assembly.

Ultimately, the value of open-cell spray foam lies in its ability to contribute to a more balanced enclosure strategy, one recognizing both control and recovery as essential to long-term performance. Rather than attempting to eliminate all moisture movement, it enables assemblies to manage and release moisture in a controlled manner.

By combining effective air control with vapour permeability, open-cell foam supports assemblies that are more adaptable to real-world conditions. This shift from resistance to resilience is central to improving durability, reducing risk, and maintaining performance throughout the building's lifespan. When used in the appropriate context, open-cell spray foam becomes not a compromise, but a deliberate design choice.

Designing with closed-cell spray foam insulation

If open-cell spray foam is the building enclosure equivalent of "letting the assembly breathe," then closed-cell spray foam is the more defensive approach, controlling moisture movement and limiting its intrusion before it ever reaches the assembly's interior components. Both open- and closed-cell insulation have their place; both can perform exceptionally well. But they solve building science problems in two very different ways. The industry often makes the mistake of treating spray foam as a single category, when open-cell and closed-cell products operate with almost opposite strategies. The open-cell foam strategy emphasizes drying potential, whereas the closed-cell foam strategy emphasizes control.

Closed-cell spray polyurethane foam (ccSPF) has become one of the most misunderstood insulation types in the design and construction community. Depending on who is asked, it is either the greatest advancement in modern insulation technology or the villain responsible for every building science issue since the invention of vinyl wallpaper. The reality, as usual, is somewhere in the middle and mostly comes down to understanding the second law of thermodynamics and the four control layers, rather than LinkedIn opinions and recommendations.

ccSPF is a medium-density insulation material combining thermal resistance, air control, vapour control, and moisture resistance into a single monolithic layer. At approximately 0.91 kg (2 lb) density, the spray-applied material contains millions of tiny, closed cells filled with a refrigerant gas, allowing it to achieve a higher thermal performance value, typically around R-6 to R-7 per inch, depending on the location of the thermal test. The true benefit of ccSPF is not simply the high-performing R-value—plenty of materials can insulate. The real strength lies in its ability to control multiple environmental forces simultaneously (air, vapour, moisture, thermal, and dynamic loading).

One of the most important characteristics of closed-cell spray foam is its low vapour permeance. At sufficient thicknesses, typically between 25.4 and 50.8 mm (1 and 2 in.), depending on the product or manufacturer, it can function as a Class II vapour retarder or even approach vapour barrier performance. This reduces vapour movement through the assembly in cold Canadian climates. For a significant portion of the heating season, interior conditions are warmer and more humid than the exterior environment. Vapour naturally wants to migrate outward (exterior relative humidity [RH] is lower than interior RH most of the time). If that moisture reaches a condensing plane within the enclosure, problems begin. Wet sheathing, mould growth, corrosion, reduced thermal performance, and, eventually, durability issues all stem from the same basic mechanism.

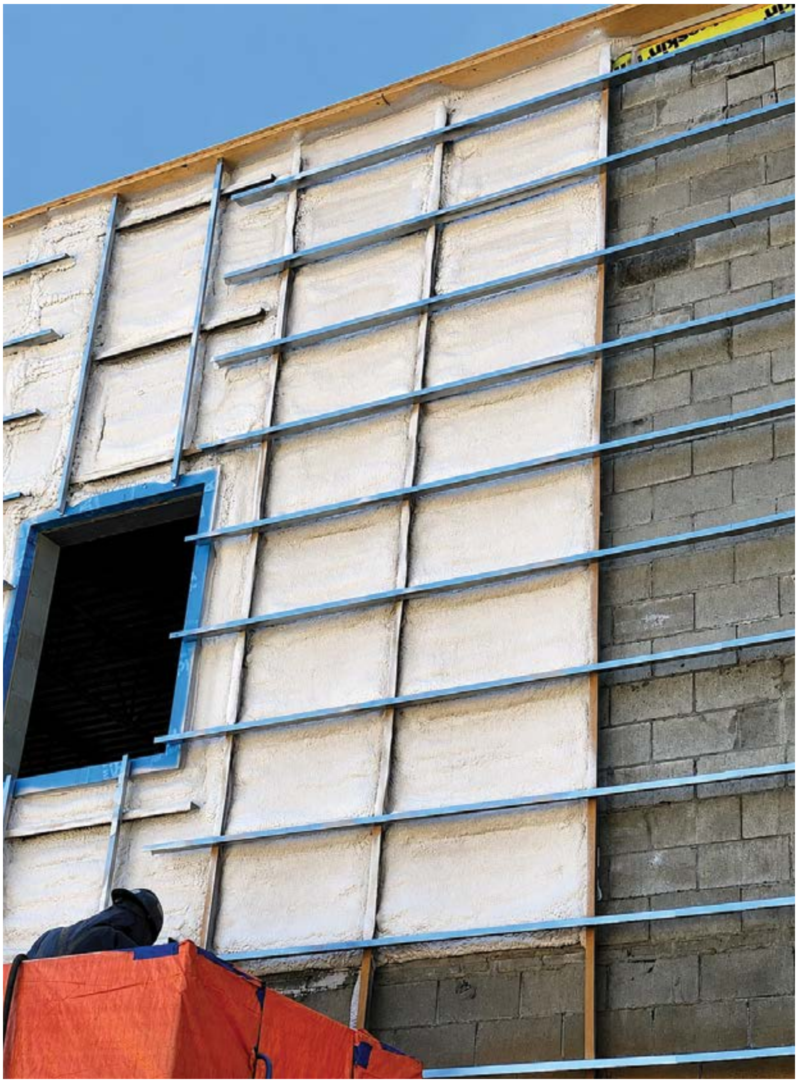
Closed-cell foam can reduce this moisture risk by restricting vapour movement directly at the monolithic insulation layer. Additionally, it also functions as an air barrier when installed continuously and at the proper thickness. This distinction is critical because while vapour diffusion gets most of the attention in conversations, air leakage is usually the real problem. A small air leak can transport far more moisture into an assembly than vapour diffusion alone. A small gap around a penetration or an imperfect transition detail can allow significant amounts of warm, humid air to enter cold assemblies over the course of a winter.

The spray-applied nature of the material allows it to conform to irregular substrates, seal transitions, and reduce uncontrolled air movement in ways that board-stock materials and membranes often cannot. Architectural details always look beautiful on a screen or drafting table; however, they can look like a jumbled mess on the jobsite. This is why constructability matters just as much as theoretical performance, aligning realistic performance with realistic construction.

Closed-cell foam continues to perform well in difficult applications because it reduces the number of materials required for multiple control functions. In many assemblies, it can reduce the need for separate vapour retarders, separate air barriers, or additional transition detailing complexity. This is particularly valuable in retrofit projects, where existing conditions are often unpredictable, and space limitations become critical.

Application of closed-cell spray foam within a tall industrial enclosure, highlighting constructability and continuity in a complex and humid environment.

Many older buildings were never designed with modern air barriers or vapour control strategies. They rely heavily on mass, drying potential, and thermal storage. Introducing interior insulation into these assemblies dramatically alters the wall temperature profile. Suddenly, the original masonry becomes colder during winter months, increasing the risk of condensation and freeze-thaw cycling. In these situations, ccSPF is often used specifically for its ability to limit interior moisture transport toward the masonry while providing high thermal resistance at a minimal thickness. In many retrofit scenarios, every inch counts. Adding 152.4 and 203.2 mm (6 to 8 in.) of insulation inward may not be feasible due to window transitions, floor space loss, structural limitations, or architectural constraints. Closed-cell foam allows designers to achieve higher effective thermal resistance with reduced assembly thickness.



Exterior continuous closed-cell spray foam insulation applied directly to a commercial concrete block backup wall.

Of course, like every material in building science, ccSPF is not magic. It does not eliminate the need for proper detailing and sequencing. It does not compensate for bad water management, and despite what some sales presentations may imply, it still simply cannot violate the second law of thermodynamics.

Bulk water intrusion remains the largest threat to the building enclosure's durability. Closed-cell foam should never be used as an excuse to ignore flashing design, drainage strategies, or proper sequencing. If rainwater is repeatedly entering the assembly, it will eventually become very apparent to everyone involved. Another common misconception is that vapour impermeable assemblies are automatically "bad" because they reduce drying potential. Just like storytelling, there are two sides to every wall. If drying occurs in one direction, the enclosure can be very effective.

Drying potential is important, but so is moisture loading. An assembly experiencing minimal moisture intrusion in the first place may not require significant drying capacity. Conversely, highly vapour-open assemblies can still fail if moisture accumulation exceeds the system's drying capacity. Good enclosure design is always about moisture balance.

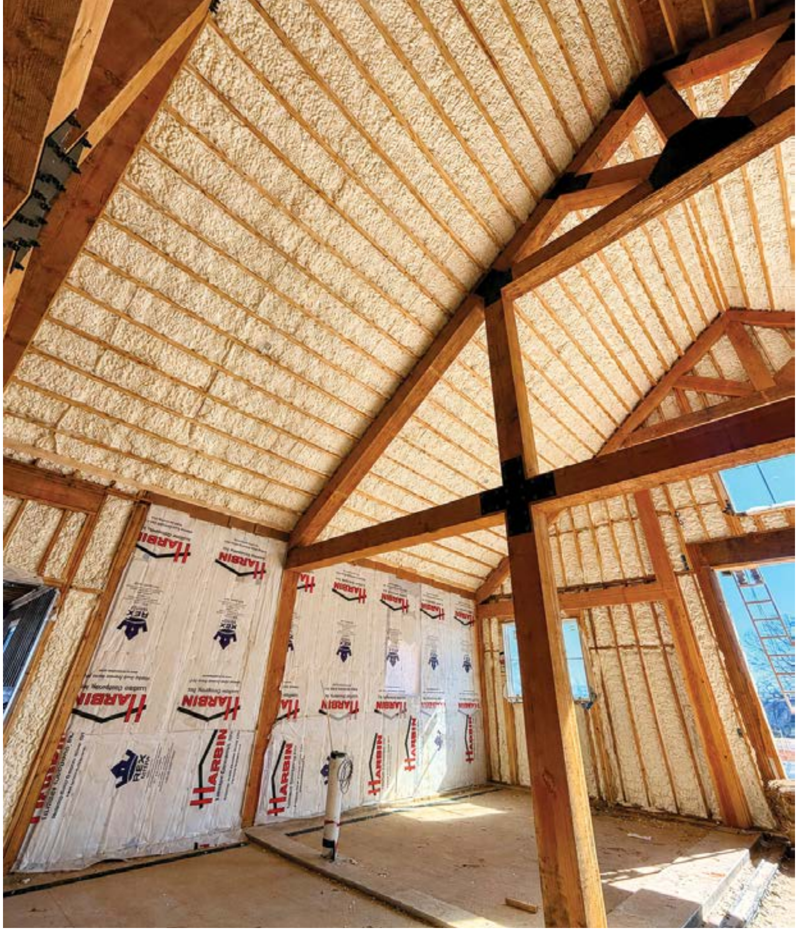
In many Canadian climate zones, particularly those with long heating seasons, limiting interior-to-exterior vapour transport remains a highly effective moisture management strategy. Closed-cell foam can provide exceptional control when used appropriately. This becomes even more important in buildings with elevated interior humidity, such as natatoriums, hospitals, food processing facilities, or high-occupancy residential buildings. In these environments, vapour drives can be significant, and controlling moisture movement becomes critical to long-term performance.

Closed-cell foam also offers additional benefits, including its moisture resistance. Unlike fibrous insulation materials, ccSPF does not readily absorb or retain bulk water. Its closed cellular structure limits water absorption and maintains thermal performance even in demanding environments. This characteristic has made it particularly valuable for below-grade applications, crawlspaces, foundation walls, and areas with elevated moisture.

There is also a structural component that often gets overlooked. Due to its density and adhesion characteristics, ccSPF can contribute to assembly stiffness and substrate reinforcement in certain applications (it has been shown to increase racking strength up to 300 per cent). While it should never replace structural engineering, its ability to bond continuously to substrates can improve overall assembly rigidity and reduce air movement pathways within assemblies.

Of course, no conversation about closed-cell foam can avoid the topic of carbon. The industry has evolved significantly over the past decade. Earlier generations of closed-cell spray foam used blowing agents with high global warming potential, raising legitimate concerns about embodied carbon. Today, many formulations have transitioned to hydrofluoroolefin-based (HFO) blowing agents, which have dramatically reduced global warming potential.

The carbon conversation surrounding insulation materials also needs to move beyond



Open-cell spray foam applied along the underside of a cathedral roof assembly.

simplistic "good material versus bad material" arguments. Operational carbon, durability, resilience, transportation, assembly thickness, service life, and control layer integration all influence a building's real-world environmental performance. Sometimes, the lowest embodied carbon material on paper may require significantly thicker assemblies, additional membranes and fastening systems, increased transportation volume, or more complicated installation sequencing.

Ultimately, closed-cell spray foam remains one of the most effective tools available for controlling heat, air, vapour, and moisture within a single material layer. When used appropriately, detailed correctly, and integrated into a well-designed enclosure strategy, it can significantly improve durability, energy performance, and resilience.

Conclusion

Ultimately, the discussion surrounding SPF should move beyond simplified debates about whether open-cell or closed-cell products are inherently "better." Both materials can contribute to high-performing building enclosures when their properties are aligned with the specific needs of the assembly, climate, and occupancy conditions.

For designers, the more important consideration is understanding how each material manages heat, air, vapour, and moisture within the enclosure system. Some assemblies benefit from drying potential and vapour permeability, while others require greater control and resistance to moisture transport. In many cases, durability does not depend on maximizing a single performance characteristic, but on achieving the appropriate balance between control and resilience.

As building enclosures continue to evolve in response to energy efficiency targets, carbon reduction goals, and increasing climate variability, material selection will require a more nuanced understanding of long-term performance. When specified thoughtfully, installed by qualified professionals, and integrated correctly, both open-cell and closed-cell spray foam can serve as effective tools within durable, high-performing enclosure strategies. In Canada, SPF installers must be trained and licensed in accordance with CAN/ULC-S705.2 and follow the manufacturer's installation requirements.

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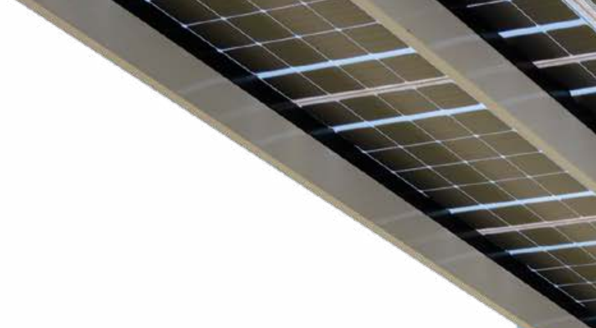
As the vice-president of marketing at Elastochem, Betsy Cosper combines her expertise in building science, product commercialization, and sustainability to bring innovative insulation technologies to market. She has held international leadership roles across the construction, horticulture, and advanced material sectors and holds a BSc (Hons.) and an MBA.



Building Better with Metal

Sustainable, Resilient Design Solutions

By Alan Scott, FAIA, LEED Fellow, LEED AP BD+C, O+M, WELL AP, CEM

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The demands placed on buildings have never been greater. Owners, architects, engineers, contractors, and product manufacturers are addressing an expanding list of priorities, including reducing carbon emissions, improving resilience to natural hazards, enhancing occupant health and comfort, supporting renewable energy generation, minimizing waste, and delivering long-term value.

Historically, building materials were often selected based on limited criteria such as structural performance, durability, esthetics, or cost. Today, project teams increasingly seek products and systems capable of supporting multiple objectives simultaneously. The emergence of frameworks such as LEED v5, along with growing concerns about climate adaptation and resilience, has accelerated this shift toward multi-attribute decision-making.

This evolution reflects a broader change in how building performance is understood. For decades, sustainability efforts focused primarily on reducing energy consumption and environmental impacts. While these goals remain important, project teams are increasingly recognizing that high-performance buildings must also withstand natural hazards, support occupant well-being, adapt to changing needs, and retain value over extended service lives.

A single design decision may now influence carbon emissions, resilience, occupant comfort, maintenance costs, resource consumption, and operational performance. As a result, architects and specifiers are increasingly evaluating products through a broader lens that considers lifecycle impacts and long-term outcomes.

Metal building systems are an instructive example of this evolution. Long valued for their strength, durability, and versatility, metal products are increasingly being leveraged to support a wide range of sustainability and performance goals. From reducing embodied and operational carbon to enabling circularity, improving resilience, enhancing occupant comfort, and supporting renewable energy integration, modern metal components help project teams address some of the most pressing challenges facing the built environment.

The future of building materials is not about excelling in a single category. It is about delivering multiple performance outcomes simultaneously. This article explores seven performance outcomes increasingly shaping building design and examines how metal building systems can contribute to each.

Outcome 1: Lower carbon

Reducing greenhouse gas emissions remains one of the defining challenges facing the building industry. While operational energy consumption has historically received the greatest attention, embodied carbon has become an increasingly important consideration. Embodied carbon includes emissions associated with material extraction, manufacturing, transportation, installation, maintenance, replacement, and end-of-life processing.

As buildings become more energy-efficient, embodied carbon increasingly accounts for a growing proportion of their total lifecycle emissions. Consequently, architects and specifiers are increasingly evaluating products through whole-building lifecycle assessments

and relying on Environmental Product Declarations (EPDs) to better understand material impacts. Traditional metal extraction, milling, and manufacturing processes can result in relatively high embodied-carbon impacts.

Metal manufacturers are responding by investing in higher recycled content, process efficiency, renewable energy procurement, and improved environmental transparency. Steel remains one of the most recycled materials in the world, and many structural and architectural metal products contain significant recycled content while maintaining high levels of strength and durability.

Yet carbon reduction extends beyond material manufacturing. Building enclosure performance plays a critical role in reducing operational emissions throughout

Many commercial and institutional buildings possess substantial rooftop solar potential.

PHOTO © THIANCHAI SITTHIKONGSAK/ GETTY IMAGES

a building's life. High-performance metal roof and wall assemblies can help reduce heating and cooling loads by providing continuous insulation (c.i.), improved air sealing, reduced thermal bridging, and enhanced moisture management.

Cool roofing systems provide another example of a multi-benefit strategy. Reflective roofing can reduce heat absorption, lower energy demand, improve occupant comfort, and help mitigate urban heat island effects. In warmer climates, these benefits can contribute to both energy savings and resilience during extreme heat events.

Importantly, low-carbon design rarely relies on a single material, and no material can meet all construction needs in all locations. As a result, successful projects employ hybrid strategies combining the strengths of multiple materials. For example, mass timber buildings still require concrete foundations and often incorporate steel connections, metal roofing, and metal wall systems. Rather than competing with other materials, metal products often complement broader carbon reduction strategies.

As whole-building lifecycle assessment becomes more common, project teams are increasingly evaluating materials based not only on their initial environmental impacts but also on how they influence operational performance over time.

Future advances in low-carbon steel production, increased renewable energy in manufacturing, and improved lifecycle assessment tools may strengthen the role of metal products in decarbonization strategies.

Outcome 2: Circularity and resource stewardship

For most of the modern building era, the construction industry has operated according to a linear economic model. Extract resources, manufacture products, and construct buildings, which are used and eventually discarded. This approach has contributed to significant waste generation and resource consumption.

Growing concerns about environmental impacts, material shortages, and embodied carbon have prompted renewed interest in circular economy principles. Unlike a linear model, a circular economy aims to keep materials, components, and assemblies in productive use for as long as possible while minimizing waste and preserving value.

Although recycling remains an important strategy, circularity extends far beyond this

alone. The highest-value circular approaches prioritize durability, adaptability, repairability, refurbishment, and reuse before recycling becomes necessary.

This distinction is particularly important for architects and specifiers. Selecting materials with recycled content is valuable, but a truly circular approach raises additional questions. Can the product be disassembled? Can components be replaced independently? Can the building adapt to future uses? Can materials be recovered at the end of service life?

Metal products work well in this framework because many can be reused, repurposed, or recycled without significant performance degradation. Structural steel has demonstrated the value of material recovery and recycling, while mechanically fastened roof and wall systems can facilitate maintenance, replacement, and eventual recovery.

Adaptability represents another important aspect of circularity. The most sustainable building may not have the lowest initial carbon footprint. It is the one that remains useful for decades longer than anticipated because it accommodates changing functions and occupant needs. Durable and adaptable systems help extend building service life while reducing the need for resource-intensive demolition and reconstruction.

Emerging technologies may further strengthen circular practices. Digital twins, material passports, and advanced building information models provide new ways to document material characteristics, maintenance histories, and recovery potential. These tools support the concept of buildings as material banks, where components retain future value rather than becoming waste.

As circular economy principles continue to gain traction, architects and specifiers will increasingly be challenged to think beyond product selection and consider how materials contribute to long-term stewardship of resources.

Outcome 3: Resilience

Climate change is reshaping expectations for building performance. Across North America, communities are experiencing more frequent and severe heat waves, wildfires, hurricanes, storms, flooding events, and other climate-related hazards. These events are prompting building owners to ask a new question: How well will this building perform under the worst conditions?

Traditionally, sustainability and resilience were often treated as separate objectives. Today, they are increasingly viewed as complementary. A highly efficient building that cannot withstand foreseeable hazards may fail to deliver long-term environmental, social, or economic value.

The building enclosure plays a particularly important role in resilience because it serves as the first line of defense against external hazards.

Wildfire resilience has become a growing concern across many regions of North America. Post-fire investigations consistently identify embers as a leading cause of structure ignitions. Windborne embers can travel significant distances ahead of a fire front and ignite vulnerable building components. Noncombustible roof and wall systems can reduce vulnerability, particularly when combined with careful detailing of vents, soffits, roof edges, and other openings.

Wind resilience presents another challenge. Hurricanes, tornadoes, derechos (straight-line winds), and severe convective storms can impose significant loads on building systems. Failures frequently occur not because of the primary structure, but because of weaknesses in roof coverings, wall systems, attachments, or connections. Properly engineered metal roof and wall systems can contribute to wind resistance while supporting long-term durability.

Extreme heat is another growing hazard and highlights the increasing overlap between resilience and occupant safety.

Perhaps most importantly, resilience is being measured not only by whether a building survives a hazard, but by how quickly it can return to service afterward. Recovery time has significant implications for business continuity, community stability, and economic performance. Durable materials that

Few material categories can simultaneously support life-cycle carbon reduction, resilience, circularity, occupant comfort, constructability, and renewable energy integration to the extent that many metal systems can.

PHOTO © EGUENESERGEEV/GETTY IMAGES

can be repaired, cleaned, or restored to service quickly may help reduce downtime following disruptive events.

This broader understanding of resilience aligns with emerging frameworks such as ASTM E3429-24, *Standard Guide for Property Resilience Assessments,* and the *National Building Code of Canada* (*NBC*), which encourage building owners to evaluate both hazard exposure and vulnerability across a range of natural hazards. Increasingly, resilience is not simply about surviving disasters; it is about maintaining functionality, supporting occupant health and safety, and accelerating recovery when disruptions occur.

As resilience considerations become more integrated into codes, insurance requirements, financing decisions, and voluntary rating systems, demand for multi-hazard design strategies is likely to increase.

Outcome 4: Thermal safety and occupant comfort

Extreme heat is one of the most significant threats to public health worldwide. Heat waves already claim more lives annually than any other weather-related hazard, and climate projections indicate both the frequency and intensity of extreme heat events will continue to increase in many regions.

Historically, buildings have relied heavily on mechanical cooling systems to maintain occupant comfort. While these systems remain essential, growing concerns about power outages, grid reliability, and emergency preparedness have renewed interest in passive survivability, the ability of a building to maintain habitable conditions when mechanical systems are unavailable.

Thermal resilience begins with the building enclosure. Roofs, walls, windows, and shading systems all influence how quickly heat enters a building and how long acceptable indoor temperatures can be maintained during disruptions. A high-performance enclosure can reduce peak cooling loads during normal operations, saving on utility costs, while simultaneously protecting occupants during emergency situations.

Reflective roofing systems provide a clear example of multi-attribute performance. By reducing solar heat absorption, cool roofs can lower cooling energy consumption, improve occupant comfort, reduce urban heat-island effects, and enhance thermal resilience during heat events.

These benefits become particularly important in schools, healthcare facilities, community centres, and other buildings serving vulnerable populations every day.

Exterior shading devices offer another powerful strategy. Properly designed metal overhangs, louvers, screens, canopies, and sunshades can significantly reduce solar heat gain while preserving access to daylight and views. Unlike interior blinds, exterior shading intercepts solar radiation before it enters the building, making it one of the most effective passive cooling strategies available.

The benefits extend beyond energy performance. A thoughtfully designed shading system may simultaneously improve visual comfort, reduce glare, support daylighting goals, enhance architectural expression, and increase occupant satisfaction. Few building components contribute to as many performance outcomes with a single intervention.

Thermal resilience is also becoming an increasingly important component of green building programs. LEED v5, administered by the Canada Green Building Council (CAGBC), introduces new resilience-focused concepts related to thermal safety, extreme heat, and occupant protection during disruptions.

These provisions reflect a growing recognition that energy-efficient buildings must also remain safe and functional under changing climate conditions.

For architects and specifiers, the challenge is no longer simply minimizing energy use. It is now designing buildings that support occupant health, safety, and comfort during both normal operations and periods of stress. Building enclosure systems and the metal components comprising them play a central role in achieving that objective.

Outcome 5: Occupant experience and well-being

Ultimately, building performance exists to serve people. As research continues to strengthen the connection between the built environment and human health, designers are paying greater attention to how buildings affect occupant experience, productivity, learning, and people's overall well-being.

Daylighting provides one of the clearest examples of this evolution. Numerous studies have linked access to quality daylight with improved academic performance, increased workplace productivity, enhanced patient recovery rates, and greater occupant satisfaction. Yet effective daylighting design involves far more than simply maximizing the amount of glass in a building.

In fact, excessive glazing can often undermine both energy and occupant performance goals by increasing glare, overheating interior spaces, and creating thermal discomfort. The challenge for designers is to provide useful daylight while managing its unintended consequences.

As noted previously, exterior metal shading systems can play an important role in achieving this balance, supporting daylighting strategies while simultaneously reducing cooling loads.

Occupant experience is influenced not only by comfort and daylight but also by esthetics. The wide range of finishes, profiles, perforation patterns, and graphic treatments available for metal panels allows designers to create distinctive visual identities that contribute to a building's character and sense of place.

Thermal comfort represents another critical aspect of occupant well-being. Occupants are more sensitive to comfort conditions than to energy performance metrics. Even highly efficient buildings can generate complaints if indoor temperatures fluctuate significantly or occupants experience excessive solar gain.

Building enclosure performance directly influences these outcomes. Well-designed wall assemblies, roofing systems, and shading devices can help create more stable indoor environments while reducing reliance on mechanical systems.

Although discussions of occupant well-being often focus on interior finishes and indoor air quality (IAQ), exterior building systems also play a significant role. The building envelope influences access to daylight and views, thermal comfort, acoustics, and the overall occupant experience. As a result, architects and specifiers increasingly evaluate enclosure systems not only for technical performance but also for their contributions to human-centred design.

As organizations compete to attract employees, students, residents, and customers, occupant experience is becoming an increasingly important measure of building value. Materials and systems that support comfort, health, and satisfaction can contribute to both building performance and organizational success.

Outcome 6: Constructability and industrialized construction

The construction industry continues to face significant challenges, including labour shortages, productivity constraints, schedule pressures, and rising costs. These factors are accelerating interest in industrialized

Modern metal components help project teams address some of the most pressing challenges currently facing the built environment.

PHOTO © ZIGA PLAHUTAR/GETTY IMAGES

Many metal building systems are particularly well-suited to industrialized construction.

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construction methods that improve efficiency while maintaining quality.

Prefabrication, modular construction, panelized enclosure systems, and Design for Manufacturing and Assembly (DfMA) approaches are increasingly being adopted across a wide range of building types. These strategies shift portions of construction from the jobsite to controlled manufacturing environments, where processes can be standardized, quality improved, and waste reduced.

Many metal building systems are particularly well-suited to industrialized construction. Structural framing systems, wall panels, roofing systems, facade components, and shading devices can often be manufactured off-site and assembled efficiently in the field. Because metal is tough and elastic, the transport of large metal assemblies is more likely to occur without the damage that might happen with more brittle materials like glass and ceramics. This approach can reduce installation time while improving consistency and quality control.

The sustainability implications are significant. Factory fabrication often results in more efficient material use, reduced waste, and fewer construction-related impacts. Controlled manufacturing environments can also improve worker safety and reduce weather-related delays.

Modular and panelized approaches can provide additional benefits by reducing transportation requirements, minimizing site disturbance, and accelerating project schedules. In sectors such as healthcare, education, hospitality, and multifamily housing, schedule compression can create substantial economic value.

Digital technologies are accelerating this transformation further. Building information modeling (BIM), digital fabrication, and digital twins are strengthening connections between design, manufacturing, construction, and operations. These tools improve co-ordination and help reduce errors, enabling more efficient project delivery.

Industrialized construction also closely aligns with broader performance goals by reducing waste, improving quality control, increasing predictability, and enabling more efficient project delivery. As labour and productivity challenges continue to affect the industry, architects and specifiers will evaluate materials not only on how they perform in service but also on how effectively they support construction and delivery processes.

Outcome 7: Renewable energy readiness

Buildings are increasingly expected to not only consume less energy but also to generate, store, and manage energy more effectively. Electrification, renewable energy, battery storage, and grid modernization are transforming expectations for building performance.

The building enclosure plays a central role in many of these strategies. Roof systems, in particular, have evolved from passive protective elements into active energy platforms capable of supporting photovoltaic (PV) arrays. Many commercial and institutional buildings possess substantial rooftop solar potential. Metal roofing systems are frequently selected for solar installations due to their durability, longevity, and compatibility with a variety of mounting methods.

Long service lives can be particularly valuable when PV systems are expected to operate for decades.

Beyond rooftop installations, metal structures are increasingly used to support solar canopies, carports, and other renewable energy applications. These systems can provide multiple benefits, including renewable energy generation, weather protection, reduced heat-island effects, and enhanced user comfort.

The combination of solar generation and battery storage is also creating new opportunities for resilience. Schools, community centers, healthcare facilities, and emergency response facilities are being designed as resilience hubs capable of supporting occupants during disasters and extended power outages. Renewable energy systems can help maintain critical functions while reducing dependence on centralized infrastructure.

Electrification of buildings further strengthens the connection between building design and energy systems. As electric alternatives replace fossil fuel-based systems, the ability to generate and manage renewable electricity becomes paramount. High-performance enclosures help support this transition by reducing overall energy demand and improving efficiency.

The future may bring even greater integration between buildings and the electrical grid. Concepts such as grid-interactive efficient buildings, vehicle-to-building technologies, and distributed energy networks are beginning to reshape how buildings integrate into broader energy systems.

Viewed through this lens, roofs and facades are no longer simply protective barriers. They are active contributors to decarbonization, resilience, and energy performance. Materials capable of supporting these evolving functions will play an important role in the next generation of high-performance buildings.

Looking beyond individual attributes

The future of high-performance buildings will be shaped by how effectively designers and specifiers balance multiple objectives, including carbon reduction, resilience, occupant well-being, circularity, constructability, and energy performance. Increasingly, these priorities are interconnected, and decisions that support one outcome often influence several others.

Metal building systems are not the sole answer to these challenges, nor should they be viewed in isolation. The most successful projects employ integrated strategies combining the strengths of multiple materials and systems. A combination of metal, concrete, wood, and other materials is often needed to create a complete building that meets unique performance requirements and location-based parameters. Likewise, resilient facilities often depend on combinations of enclosure, structural, mechanical, and renewable energy strategies.

Yet the versatility, durability, adaptability, and evolving environmental performance of modern metal products make them important contributors to this future. Few material categories can simultaneously support life-cycle carbon reduction, resilience, circularity, occupant comfort, constructability, and renewable energy integration to the extent that many metal systems can.

As buildings are asked to do more, the materials that comprise them must do more as well. The most valuable products of the future may not be those that excel in a single category, but those that help buildings deliver multiple outcomes simultaneously.

Materials and systems that support comfort, health, and satisfaction can contribute to both building performance and organizational success.

PHOTO © ADAMKAZ/GETTY IMAGES

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Recognizing the Expertise Behind Better Construction Documents

Abigail MacEachern, Architect, RSW, LEED AP, CDT

In an industry where clarity, co-ordination and accountability are essential to project success, the value of skilled specification professionals cannot be overstated. Construction Specifications Canada (CSC) is proud to recognize two national certifications that strengthen Canadian construction documentation: the Registered Specification Writer (RSW) and the Certified Specification Practitioner (CSP).

While both designations reflect excellence in specification practice, each represents a distinct role on the the project team. Together, they support project delivery from concept through construction and contract administration.

The CSP designation recognizes professionals who prepare and interpret technical specifications but may not yet meet the experience requirements to co-ordinate an entire project manual. CSPs often bring deep subject-matter expertise in disciplines, such as mechanical, electrical, envelope systems, or specialty products. They play a key role in supporting quality control, co-ordinating technical sections with design intent, interpreting codes and standards, and collaborating with design professionals and RSWs to keep technical requirements clear, current, and aligned with the project goals.

Learn more about the CSP designation here: https://csc-dcc.ca/Certifications/csp/

The RSW designation represents the highest level of certification for specification professionals in Canada. RSWs have demonstrated extensive project experience across the full spectrum of construction documentation, including specifications, drawings co-ordination, and contract administration. They develop and manage the project manual, co-ordinate Division 00 and 01 documents, mitigate risk, support the design professional of record, and help ensure documents are clear, enforceable, and aligned with project delivery methods and contractual obligations.

Learn more about the RSW designation here: https://csc-dcc.ca/Certifications/rsw/

As CSC members and industry leaders, I encourage you to recognize these designations, support their development, and celebrate the expertise they bring. Strong specifications lead to stronger projects, and these professionals make that possible.

Reconnaître l'expertise derrière de meilleurs documents de construction

Dans une industrie où la clarté, la coordination et la responsabilité sont essentielles à la réussite d'un projet, la valeur des professionnels qualifiés de la spécification ne peut être surestimée. Devis de construction Canada (DCC) est fier de reconnaître deux certifications nationales qui jouent un rôle essentiel dans le renforcement de la documentation canadienne sur la construction : Rédacteur de devis agréé (RDA) et Praticien certifié en devis (PCD).

Bien que les deux désignations se concentrent sur l'excellence dans la pratique des spécifications, chacune reflète une contribution distincte et importante à l'équipe de projet.

La désignation PCD reconnaît les professionnels qui préparent et interprètent activement les spécifications techniques, mais qui ne répondent pas encore aux exigences d'expérience nécessaires pour coordonner un manuel de projet complet. Les PCD apportent souvent une expertise approfondie dans des disciplines spécifiques, telles que la mécanique, l'électricité, les systèmes d'enveloppe ou les produits spécialisés. Ils jouent un rôle clé dans le soutien au contrôle de la qualité, la coordination des sections techniques avec l'intention de conception, l'interprétation des codes et des normes, et la collaboration étroite avec les professionnels de la conception et les RDA.

Pour en savoir plus sur la désignation PCD, cliquez ici : https://csc-dcc.ca/Certifications/csp/

La désignation RDA représente le plus haut niveau de certification pour les professionnels de la spécification au Canada. Les RDA font preuve d'une vaste expérience et de compétences en matière de projets dans l'ensemble de la documentation relative à la construction, y compris les spécifications, la coordination des dessins et l'administration des contrats. Ils sont responsables de l'élaboration et de la gestion du manuel de projet, de la coordination des documents des Divisions 00 et 01, de l'atténuation des risques et du soutien au professionnel responsable de la conception.

Pour en savoir plus sur la désignation RDA, cliquez ici : https://csc-dcc.ca/Certifications/rsw/

La reconnaissance des PCD et des RDA apporte une valeur ajoutée mesurable aux projets grâce à une meilleure coordination, à une réduction des risques et à des résultats plus prévisibles. En tant que membres de DCC et leaders de l'industrie, je vous encourage à reconnaître ces désignations, à soutenir leur développement et à célébrer l'expertise qu'elles représentent. Des spécifications solides mènent à des projets plus solides.