Framing the Future

How lightweight cable-supported facades
are transforming urban architecture

TENSILE ARCHITECTURE

Image 1.

Cable-supported facades achieve structural efficiency through tension-based systems… This results in a significantly lower weight per square metre compared to traditional steel-framed facades.

Introduction

In response to growing climate pressures, architects are rethinking building envelopes with a focus on sustainability, performance and adaptability. The Brundtland Report's definition of sustainability—"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"—has become central to this shift. Within this context, facades are now seen as critical not only for aesthetic expression but also for delivering measurable environmental outcomes. In Australia, frameworks such as Green Star, NABERS and Section J of the National Construction Code increasingly link facade design to key sustainability metrics including energy use, thermal comfort and carbon emissions.

Today's commercial buildings account for roughly 24% of national electricity use and 10% of greenhouse gas emissions.[1] This has placed the facade at the centre of efforts to enhance building efficiency, occupant wellbeing and lifecycle sustainability. Yet architects must also contend with constraints including compressed construction timelines, material availability and cost pressures; all factors that demand buildable, adaptable systems without sacrificing performance or design freedom.

Cable-supported facades are emerging as a compelling alternative to traditional steel-framed systems, using lightweight tensioned cables in place of bulky structural elements to support the facade cladding and significantly reduce material use and embodied carbon. This approach enhances design flexibility, enabling expansive glazing, layered second-skin facades and seamless integration of passive strategies such as shading, daylighting and natural ventilation.

In this paper, we explore how cable-supported facades offer a compelling path forward on our way to a sustainable built environment. They enable architects to reconcile form, function and efficiency in a single, high-performance envelope.

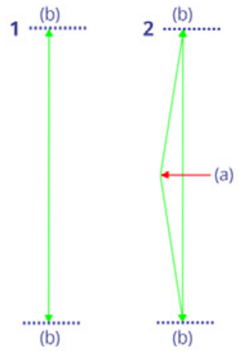
Understanding cable-supported facade systems

Cable-supported facades represent a distinct departure from traditional cladding support systems, replacing the deep, heavy steel members commonly used in shading structures and secondary frameworks with slender, high-tensile cables. These systems rely on the principles of tension rather than compression to resist deflection of the facade when it is subjected to superimposed loads like the facade weight, and transient or live loads like wind (a). Increasing the cable pre-tension provides the façade with additional stiffness but increases the loads at the cable ends where they anchor to the primary support structures (b). Since these reactions are different from those arising from conventional beams, they need to be considered at an early stage in the building design. There is a fine balance between cable tensions (and hence applied reactions on the building) and facade displacements (and hence design life).

Cables are typically made from stainless steel strands and the prestressing enables large spans and free-form geometries with minimal structural bulk. This approach not only reduces the embodied carbon of the facade system but also offers design flexibility and transparency not achievable with conventional framing.

Cable-supported facades are typically configured as vertical systems, horizontal systems, cable nets or hybrid systems. Vertical cables suit brise-soleil and green walls, while horizontal systems support shading elements or lightweight cladding. Cable nets, combining both orientations, span large areas and suit curved or expressive forms. Hybrid systems integrate cables with rods or struts for added structural flexibility. These configurations are used in second-skin facades, solar shading, green walls and aesthetic mesh installations.

Designers can deploy cable-supported facades to support both passive and active environmental systems. Passive configurations include fixed shading panels, ventilated cavities and screening elements that modulate daylight and airflow without mechanical intervention. More advanced, active solutions incorporate operable louvres or panels linked to building management systems (BMS), enabling dynamic responses to solar gain, wind or internal thermal loads.



Finding the balance between cable tension and facade displacement requires specialist services.

Enabling expressive architecture

Cable-supported facades function as more than just cladding systems; they enable buildings to breathe, adapt and express architectural intent with precision and elegance. By relying on tensioned cables rather than rigid frames, these systems unlock a new level of design freedom. Prestressed cable assemblies allow facades to adopt non-orthogonal geometries, including curved, twisted or wrapped forms that would be impractical or cost-prohibitive with traditional steel framing. This flexibility enables facades to respond visually and functionally to site-specific conditions.

These systems also support a high degree of customisation, making them well-suited for facades that convey identity or cultural narratives. For example, Canberra Hospital's new Critical Services Building has a 24-metre-wide tensile mesh facade comprised of 25,000 powder-coated sequins indivdually suspended on Carl Stahl X-Tend Mesh and Ronstan ACS2 structural cables. Together they transform the hospital entrance into a vibrant and meaningful artwork while delivering passive solar control through a lightweight, precision-engineered system.

At Mandurah Aquatic & Recreation Centre in Western Australia, a striking facade of suspended coloured panels brings energy and identity to the refurbished facility. Designed by Donovan Payne Architects in collaboration with Ronstan, the cable-supported system adds depth and vibrancy, complementing the opaquely transparent white cladding and integrating effortlessly with the existing structure.

From a structural standpoint, the benefits are equally compelling. Cable-supported facades replace bulky secondary steelwork with fine, high-strength cables, reducing structural depth and visual mass. Despite their small footprint, these systems can support a wide range of materials, including timber battens, stretched fabric, architectural mesh and perforated aluminium panels.

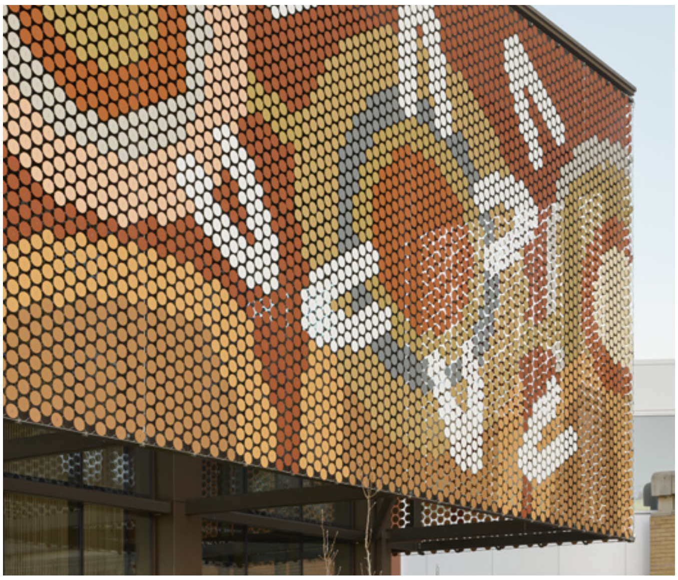
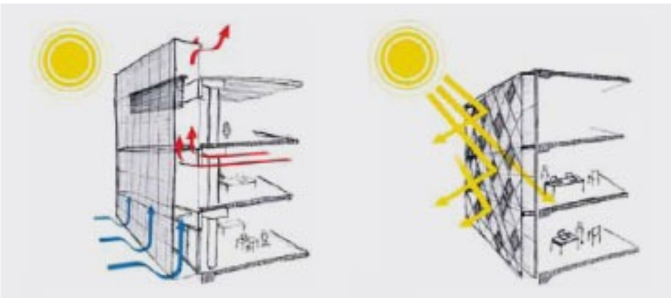


Image 3. Tensioned mesh facade at Canberra Hospital's Critical Services Building.

Image 2. Suspended on a discreet cable-supported system, colourful panels animate the facade of Mandurah Aquatic & Recreation Centre.

Creating a bioclimatic envelope

Cable-supported facades play a pivotal role in shaping bioclimatic building envelopes, systems designed to passively regulate solar heat gain, daylight, ventilation and thermal performance in response to climate and site conditions. Second-skin facades, a common form of bioclimatic envelope, consist of a ventilated double-layered structure where an outer screen is separated from the main facade by an air cavity. Cable-supported systems enable these facades by providing a lightweight structural framework to suspend shading elements independently from the primary envelope. This separation allows the outer layer to reduce solar heat gain, filter daylight and promote passive ventilation, creating a thermally buffered zone that improves energy performance while allowing for architectural freedom and expression.



Second-skin facade system illustrating solar shading and passive ventilation, with an outer layer blocking direct sunlight and a ventilated air cavity reducing heat transfer to the primary building envelope. Source: Ronstan.

By supporting shading systems, screens and translucent materials, these facades can effectively manage solar gain (the increase in thermal energy within a space resulting from sunlight passing through windows). External shading elements such as fixed or semi-fixed louvres can block high-angle summer sun, preventing spaces from overheating during the warmer months, while allowing low-angle winter sunlight to penetrate. This shading regulates indoor temperatures all year round, thus reducing the reliance on mechanical HVAC systems and cutting operational energy demands.

Daylighting is another key advantage of cable-supported systems. Their ability to hold transparent, perforated or mesh materials means facades can modulate sunlight while preserving views and maintaining a strong visual connection to the outdoors. This filtered light enhances natural illumination without overexposing interiors, minimising glare and improving occupant comfort. In office, healthcare and education settings, this level of daylight control supports circadian rhythms, reduces eye strain and can boost focus and wellbeing. Carefully oriented panels and screens can also be used to mitigate harsh glare in critical working environments, helping to meet visual comfort criteria in Green Star or WELL certification schemes.

Thermally, these systems create a buffer zone between the building's primary facade and the external environment. The cavity formed by the second-skin arrangement helps regulate heat transfer and can be naturally ventilated to promote stack effect cooling. In warm climates, this passive ventilation strategy can significantly reduce indoor temperatures and limit the need for air conditioning. The result is a breathable, high-performance facade system that maintains interior comfort through passive means.

Material efficiency and environmental performance

Sustainable material selection

Cable-supported facades commonly use stainless steel for structural cables and aluminium for cladding elements such as folded panels. Both materials offer significant sustainability advantages.

Stainless steel is highly durable, corrosion-resistant and fully recyclable. Globally, stainless steel products typically contain up to 60% recycled content.[2] Recycling steel saves 72% of the energy required for primary production and significantly reduces raw material demand, saving 1.4 tonnes of iron ore, 0.8 tonnes of coal and 1.67 tonnes of CO_2 per tonne recycled.[3]

Aluminium is valued for its lightweight, corrosion resistance and high recyclability. Recycling aluminium saves 95% of the energy required for primary production and reduces CO_2 emissions by up to 92%.[4] Each tonne of recycled aluminium avoids the use of 8 tonnes of bauxite, 14,000 kWh of energy and 7.6 cubic metres of landfill space.[5]

At end of life, both stainless steel and aluminium are fully recyclable, supporting circular construction and reducing demand for virgin materials. In fact, approximately 75% of all aluminium ever produced remains in use today, thanks to its ability to be recycled indefinitely without any loss of quality or performance.[6]

Structural efficiency

Cable-supported facades achieve structural efficiency through tension-based systems, using high-strength stainless steel cables to support thin-walled folded aluminium panels. This results in a significantly lower weight per square metre compared to traditional steel-framed facades.

The reduced structural mass of cable-supported facades offers significant advantages in both material efficiency and structural design. By relying on high-tensile cables to carry loads in tension, these systems eliminate the need for bulky steel framing and can span large areas with minimal material input. This reduction in material not only lowers embodied carbon but also simplifies logistics, handling and installation; benefits that can lead to cost savings across procurement and construction phases.

Longevity and lifecycle efficiency

Both stainless steel cables and coated aluminium panels are well-suited to architectural applications with extended service life expectations. In typical environmental conditions, high-grade austenitic stainless steels (such as 316) can achieve service lives exceeding 50 years with minimal degradation, particularly when properly specified, installed and maintained. Similarly, architectural-grade aluminium panels with high-performance powder coatings or anodised finishes are resistant to UV exposure, moisture and atmospheric pollutants, ensuring long-term visual and functional performance with limited maintenance.

This extended lifespan offers critical sustainability benefits. The environmental impacts associated with the extraction, processing and fabrication of these materials, including embodied carbon, are distributed across several decades of use, reducing the system's annualised carbon footprint.

Functional performance and energy savings

As we discussed earlier, cable-supported facades contribute directly to a building's energy performance by enabling passive environmental control strategies that reduce reliance on mechanical systems. A leading example of this strategy in action is the Atmosphere™ system by Webforge Locker Group, developed with assistance from Ronstan Tensile Architecture. Atmosphere combines tensioned stainless-steel cables with folded perforated aluminium panels to form lightweight, breathable building envelopes that act as a high-performance shading layer.

Independent testing based on a typical building in Melbourne has shown that Atmosphere can reduce solar heat gain by up to 78%, resulting in annual energy cost savings of up to 45%.[7] These reductions translate to lower HVAC demand, decreased peak loads and improved operational efficiency, particularly important in commercial and institutional buildings where cooling loads dominate energy use. For the same installation, carbon emission savings were measured at 44% per annum.[8]

Image 5.

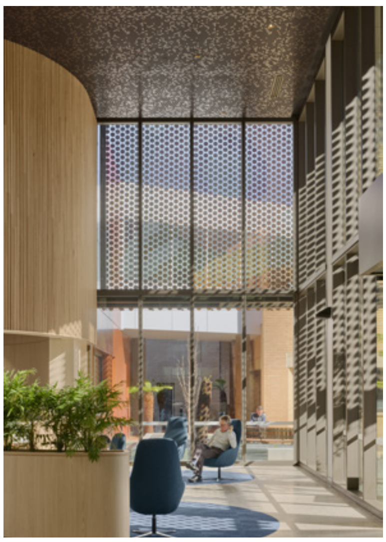


Image 6.

Image 4. Second skin Atmosphere facade of perforated aluminium panels supported by tensioned cables at St. Patrick's College in Strathfield.

How Ronstan is reframing facade design

Cable-supported façades represent a transformative evolution in architectural envelope design, offering a powerful combination of material efficiency, visual expression and environmental performance. At the forefront of this shift is Ronstan Tensile Architecture, whose extensive expertise in tensile cable systems has redefined what is structurally possible at the building scale. By replacing heavy, rigid frameworks with high-strength stainless steel cables and precision-engineered connection systems, Ronstan delivers facades that are lightweight, visually dynamic and structurally refined. These systems enable architects to explore free-form geometries, integrate passive environmental strategies and realise bold architectural narratives, all while meeting the increasing performance demands of contemporary projects.

The Atmosphere™ system, developed in collaboration with Webforge Locker Group, exemplifies Ronstan's commitment to innovation. As a proprietary cable-supported facade solution, Atmosphere combines tensioned stainless-steel cables with folded perforated aluminium panels to create modular, climate-responsive facades that function as a second skin.

A prime example of Atmosphere's application is the Scientia Building at St. Patrick's College in Strathfield. Designed by BVN, this four-storey structure introduces a new civic heart to the historic school campus, transforming a simple rectilinear form into a landmark through the use of wraparound aluminium shade screens. While visually striking, these screens are also highly technical; engineered as a second-skin facade supported by Ronstan's tensioned cable system. Their design demanded deep expertise in tensile behaviour, vibration resistance and structural tuning, which Ronstan delivered through its end-to-end involvement, including structural design of the facade, the design and supply of cables, clamps, guides, anchorages and full system installation.

Extensive R&D, commissioned by the Webforge Locker Group during the development of Atmosphere™, including wind tunnel testing and sustainability modelling by GHD, ensured the system met stringent performance criteria, resisting vibration, reducing resonance and enabling operable glazed sections behind to support natural ventilation. The result is a passive solar shading system that reduces energy demand while creating a distinctive architectural identity. As BVN noted, the "concertina-like screens provide an ephemeral veil," bringing movement and lightness to the facade without visual heaviness.

With more than 20 Atmosphere projects delivered, Ronstan has proven the scalability and reliability of this system. Their broader portfolio, spanning cable net facades, green wall supports, kinetic installations and tension structures, reflects a deep, evolving expertise in tensile architecture. In a built environment increasingly defined by sustainability, adaptability and expressive minimalism, Ronstan is not just reframing facades—they are reshaping the future of architectural performance.

Image 7.

Cable-supported facades function as more than just cladding systems; they enable buildings to breathe, adapt and express architectural intent with precision and elegance.

Reference

[1] Australian Government. "Commercial Building Baseline Study 2022." DCCEEW. https://www.dcceew.gov.au/energy/publications/commercial-building-baseline-study-2022 (accessed 8 May 2025).

[2] Speciality Steel Industry of North America. "Recycling." SSINA. https://www.ssina.com/value-propositions/recycling (accessed 8 May 2025).

[3] European Recycling Industries' Confederation. "Metal Recycling Factsheet." European Union. https://circulareconomy.europa.eu/platform/sites/default/files/euric_metal_recycling_factsheet.pdf (accessed 8 May 2025).

[4] Ibid.

[5] Ibid.

[6] Australian Aluminium Council. "Recycling." AAC. https://aluminium.org.au/about-aluminium/how-aluminium-is-made/recycling (accessed 8 May 2025).

[7] Webforge Locker. "Atmosphere." Webforge Locker. https://locker.com.au/pdfs/Atmosphere_2024.pdf (accessed 8 May 2025).

[8] Ibid.

Images

All information provided correct as of July 2024

RONSTAN TENSILE ARCHITECTURE