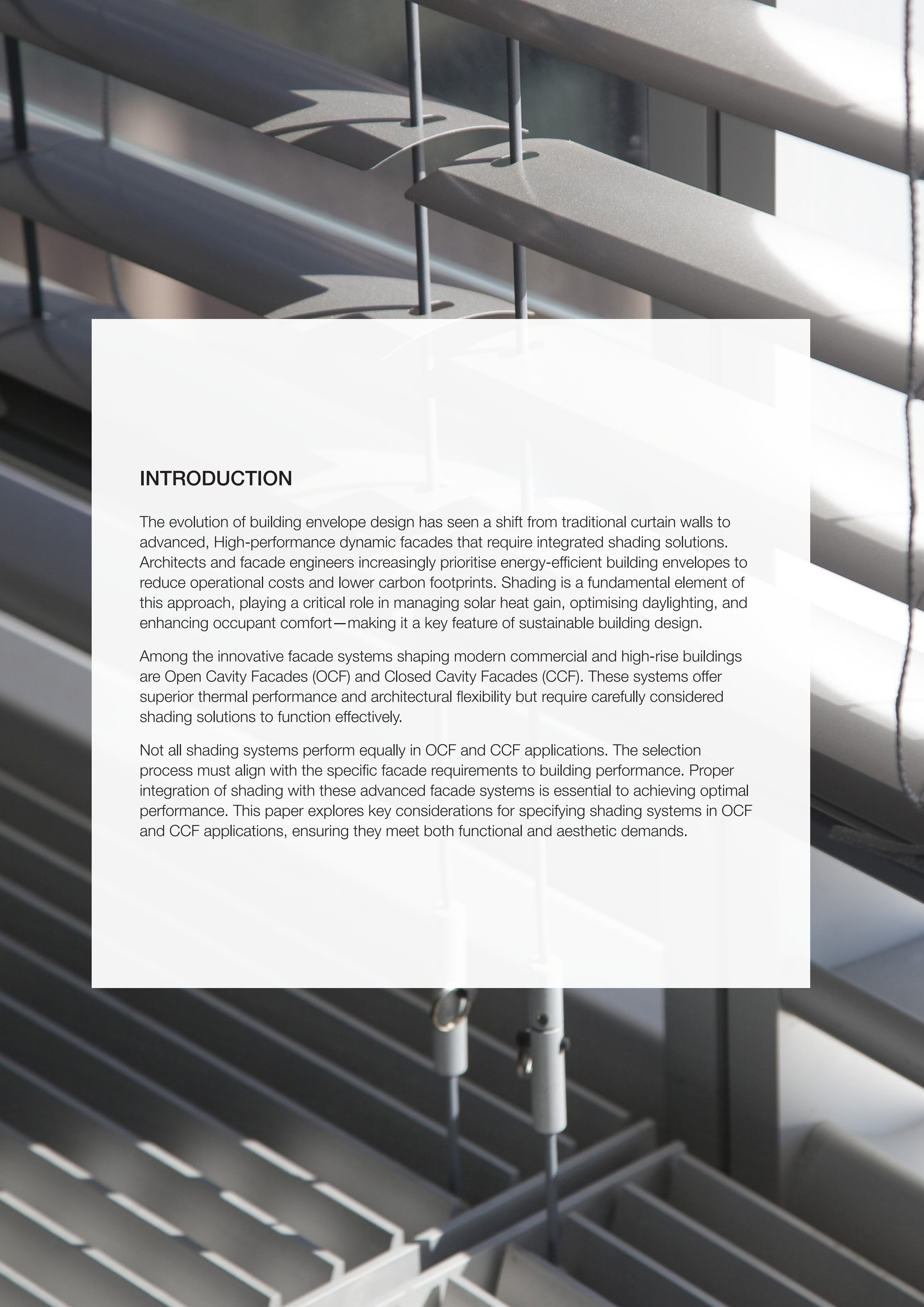
Specifying Shading Systems for Open & Closed Cavity Facades

Key Design Considerations & Real-World Applications

horiso®



INTRODUCTION

The evolution of building envelope design has seen a shift from traditional curtain walls to advanced, High-performance dynamic facades that require integrated shading solutions. Architects and facade engineers increasingly prioritise energy-efficient building envelopes to reduce operational costs and lower carbon footprints. Shading is a fundamental element of this approach, playing a critical role in managing solar heat gain, optimising daylighting, and enhancing occupant comfort—making it a key feature of sustainable building design.

Among the innovative facade systems shaping modern commercial and high-rise buildings are Open Cavity Facades (OCF) and Closed Cavity Facades (CCF). These systems offer superior thermal performance and architectural flexibility but require carefully considered shading solutions to function effectively.

Not all shading systems perform equally in OCF and CCF applications. The selection process must align with the specific facade requirements to building performance. Proper integration of shading with these advanced facade systems is essential to achieving optimal performance. This paper explores key considerations for specifying shading systems in OCF and CCF applications, ensuring they meet both functional and aesthetic demands.

UNDERSTANDING FACADES

Open Cavity Facades (OCF), also known as ventilated facades, are an advanced glazing system designed to enhance thermal performance and energy efficiency in buildings. They consist of a double-glazed assembly with a ventilated air gap between the inner and outer glass layers. The cavity allows outside air to flow through it in a controlled manner, helping to regulate indoor temperatures by carrying away excess heat in warm conditions and adding an insulating buffer in cooler climates

A notable example of an OCF system in Australia and the first of its kind in the country is **One Sydney Harbour**, a luxury residential development in Barangaroo, Sydney, designed by renowned architect Renzo Piano and completed in December 2024. The OCF system used in One Sydney Harbour enables residents to control natural ventilation within their apartments, incorporating an external fabric blind within the cavity for solar shading. Strategically placed top and bottom vents regulate airflow, balancing wind pressure against windows and blinds while ensuring optimal ventilation.

Closed Cavity Facades (CCF) represent an evolution in curtain wall technology, offering superior thermal performance and energy efficiency. Unlike OCFs, CCFs feature a fully enclosed cavity between two glass layers, which is typically filled with dry, filtered air or inert gases to enhance insulation and prevent condensation. This sealed design ensures better climate control, reducing heat loss in winter and heat gain in summer.

A prominent example of a CCF system in Australia is **200 George Street** in Sydney, designed by Francis-Jones Morehen Thorp. Also known as the EY Centre, the building features a sealed double-skin glass facade with automated timber blinds housed within a clean, pressurised cavity.

For further details on One Sydney Harbour and 200 George Street, refer to the “Real-world applications” section below.

> **While internal shading systems offer convenience when it comes to installation, facade-integrated solutions provide a more seamless, high-performance approach suited to modern building envelopes.**

CONSIDERATIONS IN SPECIFYING SHADING SYSTEMS FOR OCFS AND CCFS

Specifying shading systems for OCFs presents unique challenges due to their direct exposure to external weather conditions. OCF shading solutions must endure fluctuating environmental factors such as wind loads, rain, and UV exposure. High wind pressures can affect the stability and longevity of external blinds, requiring robust materials and secure anchoring systems to prevent damage. Additionally, prolonged exposure to sunlight can cause UV degradation, leading to discoloration and material deterioration over time. Effective shading in OCFs must balance durability with performance, ensuring that systems provide sufficient glare reduction and solar heat control without compromising facade aesthetics or operational efficiency.

CCFs, while offering greater protection from external elements, present their own set of challenges, particularly in thermal management. Because the cavity is sealed, there is a risk of heat buildup within the facade, which can impact overall building performance. Shading systems housed within this enclosed space must be designed to withstand elevated temperatures without warping, degrading, or causing mechanical failures. The choice of materials and coatings for blinds or louvres is crucial to ensuring longevity and maintaining consistent functionality.

Additionally, shading mechanisms in CCFs are often motorised, which can introduce noise concerns. Multiple shading units operating simultaneously may create unwanted sound levels, affecting occupant comfort.

Serviceability is a key consideration for both OCF and CCF shading systems, albeit for different reasons. In OCFs, external shading components must be accessible for routine maintenance and replacement, necessitating designs that facilitate safe and efficient servicing. In contrast, CCFs pose challenges due to the difficulty of accessing the sealed cavity. Any failure of internal shading components, such as blinds or motors, requires careful planning for repairs without compromising the airtight integrity of the facade. Ensuring that maintenance strategies are incorporated into the early design phases is essential for both systems, allowing for long-term functionality and minimising disruptions to building operations.

INTERNAL VS. FACADE-INTEGRATED SHADING

Definitions

Internal shading is installed inside the building, behind the glazing, and includes blinds, curtains, and roller shades that control glare and provide privacy but allow some solar heat to enter before being mitigated.

Facade-integrated shading is built into the building envelope, often positioned externally or within double-skin facades, effectively blocking solar radiation before it reaches the interior, improving thermal performance and energy efficiency.

Internal and facade-integrated shading systems each have distinct advantages in terms of installation and maintenance. Internal shading is widely used due to its relatively simple installation process and ease of access for repairs and adjustments. It provides flexibility for retrofits and can be easily replaced or upgraded as needed. In contrast, facade-integrated shading systems require more coordination during the design and construction phases. However, advancements in prefabrication allow certain shading components to be installed in the factory before the facade reaches the site, streamlining construction timelines. While internal shading systems offer convenience when it comes to installation, facade-integrated solutions provide a more seamless, high-performance approach suited to modern building envelopes.

Thermal and energy performance are key factors in comparing these shading solutions. Internal shading can effectively control glare and improve occupant comfort, but because it sits inside the glass, it allows more solar heat to penetrate before taking effect. This can increase cooling loads and reduce overall energy efficiency. Studies show that external or facade-integrated shading systems perform better in preventing heat gain, as they intercept solar radiation before it reaches the building's interior. By blocking heat at the source, these systems enhance thermal efficiency and contribute to a more stable indoor climate.

Serviceability and occupant interaction further differentiate these shading strategies. Internal shading systems are easier to maintain and adjust, but they are also more prone to damage or interference from occupants. Items such as furniture, bags, or umbrellas placed under windows can obstruct blinds, leading to jamming or misalignment, which increases maintenance requirements. Facade-integrated shading, on the other hand, is protected from direct occupant interaction, ensuring consistent performance over time.

PRACTICAL DESIGN CONSIDERATIONS

Shading in OCF systems

Key performance criteria

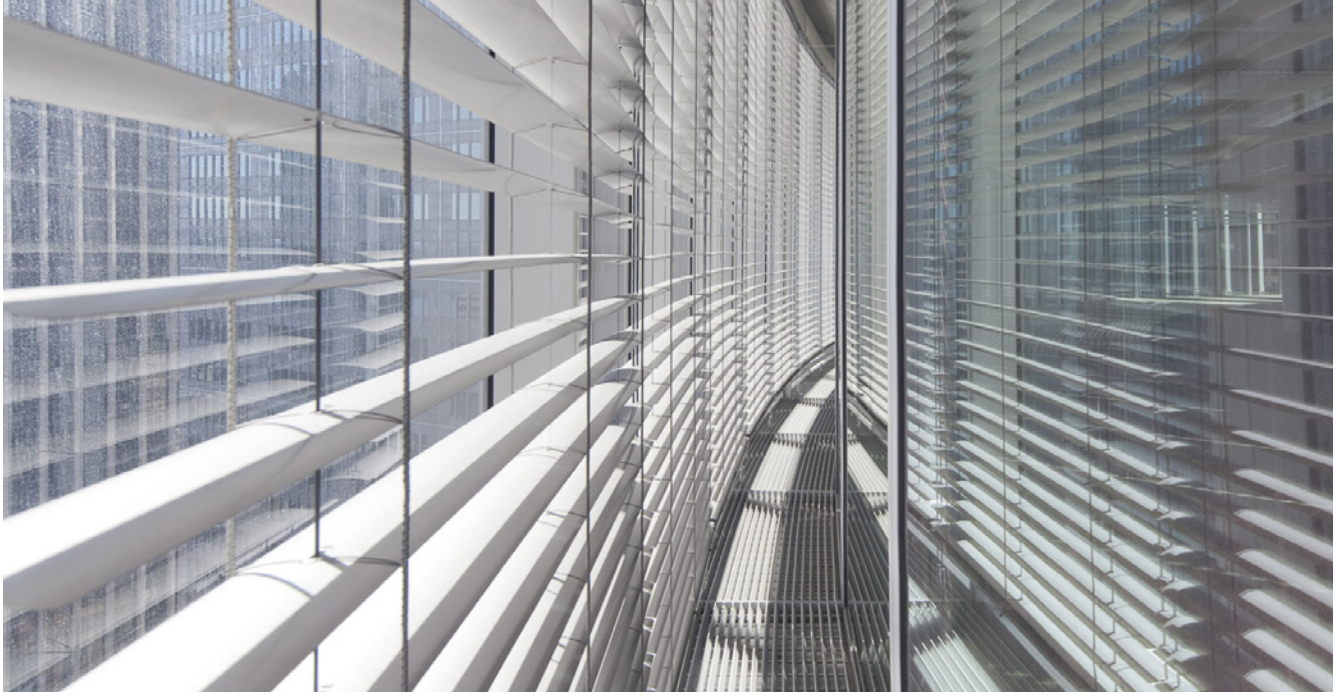
- **Wind resistance:** OCF shading systems must be designed to withstand fluctuating wind pressures to prevent excessive movement that could damage both the shading system and the facade itself.
- **Material durability:** Selected materials should be highly weather-resistant, capable of withstanding prolonged exposure to sun, wind, and rain without degradation.
- **Heat control:** Fabrics and materials should feature reflective coatings or inherent thermal properties to minimise heat absorption and improve energy efficiency.
- **Longevity:** UV-resistant materials must be prioritised to prevent fading, warping, or loss of structural integrity over time.

Placement considerations

- **Inside the facade cavity (preferred placement):** Shading systems positioned within the cavity are better protected from extreme weather conditions, ensuring greater durability while maintaining effective solar control.
- **External shading (less ideal):** Fully external shading is exposed to high wind loads, requiring reinforced components and increased maintenance to prevent damage or instability.
- **Internal shading (least effective):** Shading installed inside the building is the least efficient at reducing heat gain, as solar radiation has already passed through the glazing before the shading takes effect.

Suitable shading options

- **Tensioned shading systems:** Designed for high wind loads, these systems keep fabric taut, preventing excessive movement and ensuring stability.
- **Specialty venetian blinds:** Engineered with reinforced slats and secure guide cables, these blinds resist wind forces while allowing adjustable light control.



Studies show that external or facade-integrated shading systems perform better in preventing heat gain, as they intercept solar radiation before it reaches the building's interior.

Shading in CCF systems

Key performance criteria

- **Thermal stability:** Shading materials must withstand elevated temperatures within the closed cavity without degrading or warping.
- **Automated solar control:** Motorised shading should be responsive to temperature fluctuations, adjusting automatically to minimise overheating and optimise daylight use.
- **Heat reduction strategies:** High-performance coatings for aluminium products or high-performance fabrics can help mitigate heat buildup inside the cavity, improving overall thermal efficiency.
- **Noise reduction for motorised systems:** Low-decibel motors and staggered control sequences prevent excessive noise disruption, particularly in office or residential environments.
- **Vibration dampening:** Integrating vibration-dampening components extends motor lifespan and reduces operational noise, ensuring quiet and smooth function over time.

Placement considerations

- **Inside the facade cavity (preferred placement):** Placing shading within the cavity protects it from external weather conditions while maximising energy efficiency and improving thermal performance.
- **Internal shading (less effective):** Shading systems installed inside the occupied space allow heat to enter before mitigation, reducing overall effectiveness and increasing cooling demands.

Suitable options

- **Roller blinds:** A simple yet effective solution for ventilated CCFs, requiring heat-resistant fabrics to withstand elevated temperatures.
- **Tensioned shading systems:** Ideal for both ventilated CCFs and OCFs, these systems maintain taut positioning within the cavity and help regulate solar gain.
- **Specialty venetian blinds:** Best suited for both ventilated and non-ventilated CCFs, adjustable slats provide precise control over light and heat within the enclosed space.

Smart automation features

Suitable for all installations, intelligent shading controls can prevent overheating by adjusting in real time based on sun exposure and temperature conditions. Incorporating an automation system is essential and a must for optimising the performance of shading systems.

Among other benefits the automation system ensures effective heat control, glare reduction, decreased HVAC and electricity usage and aesthetic consistency for the whole building.

REAL-WORLD APPLICATIONS

The principles of shading system design for OCFs and CCFs are exemplified in landmark projects like One Sydney Harbour and 200 George Street, where innovative shading solutions were seamlessly integrated into high-performance facades. These projects highlight the importance of collaboration between architects, engineers, and shading specialists to ensure optimal solar control, durability, and occupant comfort.

At **One Sydney Harbour**, designed by renowned architect Renzo Piano, shading played a critical role in achieving both aesthetic and functional goals for this luxury residential development. Specifying an effective shading system for this OCF required overcoming significant environmental challenges, particularly wind loads and solar heat gain. Horiso, in collaboration with Guthrie Douglas and Climate Ready Engineering, developed a bespoke external tensioned shading system to operate reliably under extreme conditions.

Extensive prototyping, including wind tunnel and thermal testing, ensured that the shading system met stringent performance criteria. The use of metallised performance fabric CR88 enhanced solar reflectivity while maintaining durability and tensile strength. This carefully engineered solution seamlessly integrated into the tight facade spaces, demonstrating how advanced shading technology can complement high-end architectural design while supporting sustainability objectives.

At **200 George Street** in Sydney, an innovative timber CCF plays a central role in the building's sustainability strategy. Designed by Francis-Jones Morehen Thorp, the facade consists of a high-performance sealed inner glazing unit, an outer glass layer and a cavity housing automated timber blinds that adjust according to external conditions. This dynamic shading system helps regulate internal temperatures, reduce glare and maximise daylighting, all while maintaining a warm, natural aesthetic.

Horiso, in collaboration with its partner company Climate Ready Engineering, is currently involved in a major retrofit of the shading system to extend its sustainability benefits. While retaining the original timber blades, all other system components are being upgraded, including the control infrastructure that manages the blinds' automated responses. This enhancement enables even greater precision in solar control, reinforcing 200 George Street's position as a benchmark for responsive facade design.

About Horiso

Horiso is a specialised solutions provider of solar shading systems for architects, developers and builders with proven expertise in the commercial, hospitality, government, and residential sectors. The company is committed to supplying innovative design and sustainable technology through our energy-efficient product range.

Horiso's solar control shading systems are installed throughout the globe in Australia, New Zealand, Asia and the USA.

Horiso has been manufacturing solar shading in our Sydney facility since 2001 and is a member of the Window Shading Association of Australia (WSAA).