Ventilated Facade Systems & Rigid Air Barriers

An Effective Strategy For Weather Protection & Energy Efficiency

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Research studies consistently highlight the energy efficiency benefits of the system, with one study finding 20–55% of energy saving can be achieved by using opaque ventilated facades.

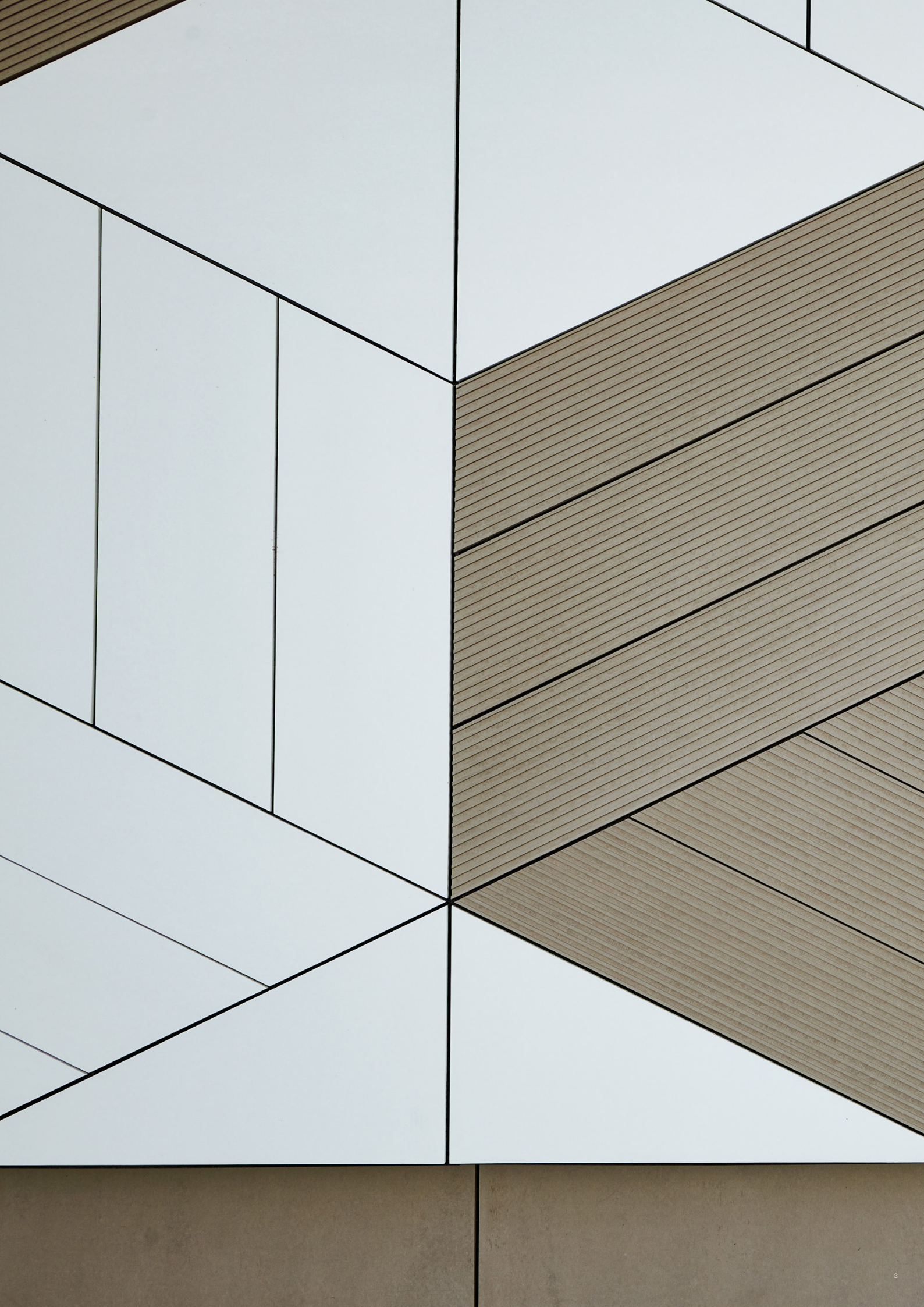
INTRODUCTION

Australia is a diverse country, with different climate zones and harsh, often unpredictable weather. The building facade plays a critical role as the first line of defense against environmental factors that could affect the structure. But the facade is more than that—it helps regulate thermal comfort, protects against water intrusion, blocks out unwanted noise, and establishes the style and aesthetic of the building.

To meet stringent requirements for weathertightness, energy performance and fire protection, innovative approaches to building facade design and construction are required. This is why ventilated facades are rapidly gaining traction within the industry; they offer significant improvements in energy efficiency, greater comfort for tenants, and an extra layer of protection for the building structure.

Ventilated facades, also known as double-skin facades or rainscreens, are robust, multi-layered systems that protect the underlying structure from the weather and infiltration of moisture and enhance thermal performance through a ventilated air gap. There is growing awareness of the advantages of ventilated facade systems, but some confusion around optimising performance and ensuring compliance particularly in relation to vapour-permeable weather barriers still exists.

To maximise the potential of ventilated facades in modern construction, it is important for architects, designers and specifiers to understand how its different components work. Below we examine the design of ventilated facades in more detail with a special focus on why rigid air barriers are the best choice for this type of facade system.



HOW DO VENTILATED FACADES WORK?

A ventilated facade is a type of building envelope technology with its main feature being the air cavity separating the outer and inner layers. This gap allows for continuous airflow (by means of the “chimney effect”), which sets up natural ventilation that effectively removes heat and moisture.

A ventilated facade system, which is anchored onto the building’s external walls, typically consists of the following main components:

- **Outer cladding.** This is the external facing element, usually made of cladding materials such as fibre cement, metal, glass, ceramics or timber. This layer protects the building’s structure from weather and also defines its visual aesthetic.
- **Air cavity.** Between the outer cladding and inner insulation layer is the air cavity. As a result of the heat radiated by the cladding, the density of the air inside the air gap changes, forcing the air to move upward and initiating a natural airflow of ventilation from the bottom to the top. Due to this “chimney effect”, the air cavity in a ventilated facade facilitates three main functions: the evacuation of water vapour coming from inside the building; the removal of heat by the upward motion of the air; and reduction of the heat flow from the outside to the inside of the building.
- **Weather barrier.** To protect the supporting structure from water intrusion, a weather-resistant, vapour-permeable membrane or barrier is almost always added to the exterior of the insulating product. Vapour-permeable products that block water entry but encourage vapour release are best for this application.
- **Insulation layer.** The innermost part of the system is made up of thermal insulating material with variable thickness and density depending on the project's thermal specifications. By limiting heat transfer between the interior and exterior of the building, this layer ensures thermal comfort and energy efficiency.

WHY ARE VENTILATED FACADES GAINING POPULARITY?

Every building's exterior walls should be designed and constructed using the fundamental design principles for managing moisture. These principles are often referred to as the “Four Ds”: Deflection, Drainage, Drying and Durability.[1] A well-designed ventilated facade balances these factors to create weathertight buildings.

A ventilated facade provides two layers of defence for a building: the first line of defence is the outer cladding, which provides the primary barrier or rain screen. This can be considered as the primary deflection device that reduces the risk of water penetration by keeping water off the building structure.

Rain can bypass the cladding at small holes or construction imperfections, especially in combination with high wind. A well-designed ventilated facade includes drainage channels to let water drain to the outside should it bypass the first protective layer.

A well-sealed, vapour-permeable secondary barrier, combined with a drained and ventilated cavity, prevents external moisture from penetrating through to the building structure. Vapour permeability is an important characteristic for this barrier as it allows internal water vapour to escape from the structure into the cavity rather than building up as condensation.

The ventilation cavity adds the drying element to the system. Any remaining moisture that has accumulated in the cavity is dried by the airflow that transports heat from the cavity out through high level exhausts.

All components of a ventilated facade must meet durability requirements and be appropriate for the project location. The durability of materials and ease of maintaining the outside of a building helps ensure that the system stays weathertight.

Due to these properties, ventilated facades enhance the overall weathertightness of a building, resulting in the following benefits:

- Natural convection in the cavity brings on potential energy savings. One of the key advantages of a ventilated facade is heat dissipation as the chimney effect helps push warm air out the facade.[2] Several studies note that a ventilated facade is an effective energy strategy for climates with warm summers and mild winters.[3]
- A ventilated facade system's air cavity prevents moisture buildup. The cumulative effects of moisture buildup can significantly degrade building materials over time. By reducing water damage and corrosion, a ventilated facade can increase the lifespan of building materials, and reduce the need for upgrades and maintenance.[4]

- Ventilated facades can improve indoor air quality and thermal conditions by providing control of temperature and humidity and by protecting the insulation layer.[5] Insulation materials can be moisture sensitive. An effective weather barrier will protect insulation from any moisture that bypasses the outer layers of the system, ensuring it performs to expectations.
- Ventilated facades can significantly reduce noise pollution with the inclusion of sound-reducing materials in the facade system. A case study on double-skin facades demonstrated that the multi-layered construction provides a barrier to both outdoor pollutants and noise.[6] However, it is important to assess the acoustic performance of the selected system to ensure it meets design requirements.
- Utilising ventilated facades can improve a building's overall sustainability by minimising energy use and decreasing emissions. The use of recyclable materials, or materials with low embodied carbon in the cladding, insulation or weather barriers of the facade can improve the sustainability performance of the system. By improving the durability of the building structure another sustainability benefit can be achieved.

CHOOSING THE RIGHT WEATHER BARRIER

As noted earlier, a weather-resistant, vapour-permeable barrier is almost always added to protect the insulation layer and inner building structure. Vapour-permeable barriers serve two purposes in a ventilated facade system: first, they provide a temporary weather barrier during construction, and second, after the building's exterior has been finished, they enable water vapour to escape from the system.

For ventilated facades, the choice is often between a flexible wall wrap or membrane, or a rigid air barrier.

Common issues with building wraps

Most buildings and climates in Australia benefit from a vapor-permeable wall wrap that stops air and keeps liquid water out. For some climates and buildings in hot and humid environments, a less vapour-permeable wall wrap is better for controlling the ingress of water vapour. Some wall wraps use aluminium foil for reducing vapour permeability but to make them suitable for cold to moderate climates (vapour permeable) they need to be perforated which reduces their ability to function as a barrier to water.

Ensuring airtightness, which is essential for energy-efficient buildings, is a recurring challenge for building wrap installation. Wraps need to have all their joints taped, increasing the risk of installation errors, such as edges not being airtight, and penetrations not being sealed. Any lack of airtightness can result in wind washing through the insulation material, greatly reducing thermal performance. In hot and humid climates, any air that enters the building will carry moisture, increasing the chances of mould, rust or rot in the wall cavity.

Other issues with some wall wraps include the way the air pushes them into the wall cavity, compressing the insulation material and making it thinner and less effective over time.

New rigid air barriers: Design benefits

For modern construction, vapour-permeable rigid air barriers are a superior choice in terms of performance and durability.

Rigid air barriers are typically sheathing boards made of fibre cement or gypsum. The boards are strong, long-lasting, and water-resistant, adding an extra layer of protection against moisture that might seep through the cladding while also containing the insulation inside the framing cavity. Unlike traditional flexible wall wraps, they offer sufficient strength to withstand extremely high wind pressures and equalise pressure inside the wall cavity.

In addition, rigid air barriers offer several construction benefits. They are easier to install than flexible wall wraps with no air gaps, and more resilient, and can therefore be used to create a weathertight barrier to protect the building’s interior spaces. This allows internal trades to start before the building exterior is finished and avoids construction delays.

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Build safer, quicker and smarter with Siniat Weather Defence

External sheathing board options have evolved. Siniat Weather Defence™ is an NCC-compliant rigid air barrier board used behind facade cladding systems to create a pressure equalised cavity for rainscreen and ventilated facade systems.

Designed to be installed on lightweight steel stud framing, modular buildings and timber frame buildings, it is the quickest way to achieve a weathertight building and offers an array of design benefits.

The design benefits include:

- Compliant for facades requiring non-combustible construction.
- Class 4 vapour permeable and the only compliant rigid air barrier in Climate Zones 6, 7 and 8.
- Helps to create an airtight building.
- Easy to cut and shape, offering more options for design detailing.
- Up to 50% quicker to install than cement-based boards or metal sheets.
- Makes the building weathertight for internal trades, reducing the construction cycle.
- Simply score and snap, no need for specialist cutting equipment or segregated areas.
- No additional wall wrap may be needed.
- Weather Defence is water, weather and mould resistant and can be left exposed on the frame for up to 12 months.

Weather Defence installations can achieve airtightness targets that contribute to a building's energy efficiency and allow glasswool insulation in the cavity to perform as intended by avoiding wind washing.

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