MOISTURE CONTROL IN BUILDINGS

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INTRODUCTION

Across Australia, condensation and improperly managed moisture are major causes of damage to residential and commercial structures alike, with potentially disastrous consequences: in many cases, moisture-related damage starts long before it becomes visible.[1] It is on the opposite end of the risk spectrum to fire, an obvious risk for which appropriate measures are taken.

The Australian Building Codes Board (ABCB) recognises that condensation is a pressing, industry-wide problem, and has committed to the ongoing review of the ABCB 'Condensation in Buildings' handbook. In Australia, the ABC predicts increased frequency and intensity of rain weather events,[2] which may worsen the rate of moisture ingress into poorly constructed buildings.

Out of date Standards, along with the prevalence of outdated, inadequate construction materials (and methodologies) mean that condensation remains a major threat to buildings across the country. A ventilated cavity system that incorporates an impervious air barrier (e.g. metal) restricts the traditional movement of air so that the risk of condensation is increased. In this white paper, we take a closer look at condensation and some design considerations that can help improve moisture management.

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WHAT IS CONDENSATION?

Condensation is the result of a complex network of interactions between the environment, buildings, and any occupants. Specifically, the term refers to when a building reveals the presence of atmospheric moisture. When that moisture cannot escape it condenses, or pools, on a surface.

Moisture is present in the air. It also comes from a variety of other sources found in buildings. Pipes (new and old), drains, tanks and microscopic pores of building materials all contribute to the building atmosphere.

In itself, condensation is not inherently problematic. Issues only arise when condensation accumulates and is unable to dry as readily as it forms. As such, air must be allowed to travel freely in and out of a building.

CAUSES OF CONDENSATION

GENERAL

The Building Code requires that waterproof membranes and interior linings are installed to prevent moisture leaking into buildings through holes for light fittings, light switches, power outlets, pipes, windows and doors. If membranes aren't properly installed and maintained, it's easy for excess water to form condensation and cause damage to buildings. Buildings should be designed so that outdoor air is deliberately circulated through the roof, wall cavities and subfloors. Water vapour then has a constant pathway through those spaces, which keeps them dry. During construction, if that circulation is blocked it means humidity can't be controlled and water vapour levels can rise, forming condensation.

Any occupants within a building contribute to condensation. They release water vapour in two ways: by breathing and through water-centric activities such as cooking, washing, showering, bathing and laundering.

CONTEXT-SPECIFIC

In residential buildings there are two major sources of water vapour that contribute to condensation. When new types of materials are used or construction is completed using an untested method, the waterproofing seal may not be sufficient to prevent excess water from entering or becoming trapped in structures. Renovations can also compromise the ability of the original building as existing seals may be altered or damaged, rendering them ineffective.

Commercial projects suffer from the same causes as residential buildings, with two further, major vapour sources. Commercial buildings usually have a higher occupancy level. More people means more facilities such as bathrooms and kitchens are required. With that, comes additional water that contributes to the overall water vapour level in the air. If the excess water isn't managed, condensation will form.

Specialised buildings such as commercial kitchens, swimming pools, cool and cold storage and steam generating processes naturally have higher water vapour levels. Optimum humidity levels are between 40% - 60%[3], but items such as commercial dishwashers increase the air moisture because of the hot water and heaters that are constantly in use.[4] The Work Health and Safety Regulation (2011) requires a safe environment for works, and this includes humidity.[5]

Relative humidity is the amount of water vapour in the air. This is typically less than the amount of vapour that is required to saturate the air. For example, if relative humidity is 75%, it means the air is holding three quarters of its water vapour capacity.

In an enclosed space, temperature and humidity should be carefully controlled to minimise the risk of condensation. A build-up of condensation can lead to high relative humidity within buildings, which in turn may cause dust mites, allergens and microbial infestations. Dust mites can be found in bedding, carpets and soft furnishings.

According to the National Asthma Council of Australia, approximately 45% of Australians suffer from allergies: of this, about 80% are allergic to dust mites. Dr Matthew Colloff, an entomology researcher from the CSIRO says: "humid environments are well-suited as breeding grounds[6]." In 1968, The Tasmanian Longitudinal Health Study[7] commenced an asthma and respiratory disorders study on school children. The study yielded evidence to support the link between people who suffer from asthma and allergens in buildings.[8] The risk of asthma was increased by 26% when mould was found in the home. Removing condensation can reduce this risk.

Fungi and mould growth occurs when spores are present, temperatures sit between four degrees and forty degrees, and humidity is above 70%.[9] This is also true in areas of poor ventilation, even if they are not humid.[10] In extreme cases such as water damaged buildings, toxic black mould (Stachybotrys Chartarum) can create a long list of health problems for anyone exposed to them.[11] Symptoms such as a stuffy nose, wheezing and red eyes may occur, along with more serious conditions such as asthma. People with weakened immune systems are more likely to develop infections if exposed to mould.[12]

DESIGNING FOR IMPROVED MOISTURE MANAGEMENT

Condensation management is a complex problem and can occur under a variety of conditions, not just in cold or tropical climates. There are many design considerations including local climate, building use and orientation, material selection and insulation R-value performance as well as the degree and location of ventilation. Regardless of the context, buildings must be built for reliability and for the optimum safety of occupants. Ventilated cavity solutions are becoming a more popular method in Australia, where the structural frame of the house is separated from the cladding to reduce the risk of water ingress to the frame.

Ventilated cavity systems, or rain screens as they are also commonly known (such as a pressure equalised cavity system), are where air circulation and drainage is facilitated by openings around the base and top of the wall. This reduces the risk of moisture penetration and prevents moisture build up, allowing the building shell to dry out, creating a healthier, more breathable building. This system generally requires an air barrier in the form of either a wall wrap/sarking or a rigid air barrier.

Air barriers prevent the movement of air through gaps in materials such as wall holes, sub-floor spaces, ceiling fans and window joins. They are a pre-cladding product that sit behind the final building cladding material and form the primary enclosure boundary that separates indoor conditioned air from outdoor, unconditioned air. Air barriers prevent air from leaking out of the building and moisture from gaining access, and are an integral component of an effective pressure-equalised facade system. In cooler climates, permeable air barriers can be used to reduce condensation build up by allowing warm, moisture-laden indoor air to move through building materials and exit via a wall system's ventilated cavity.

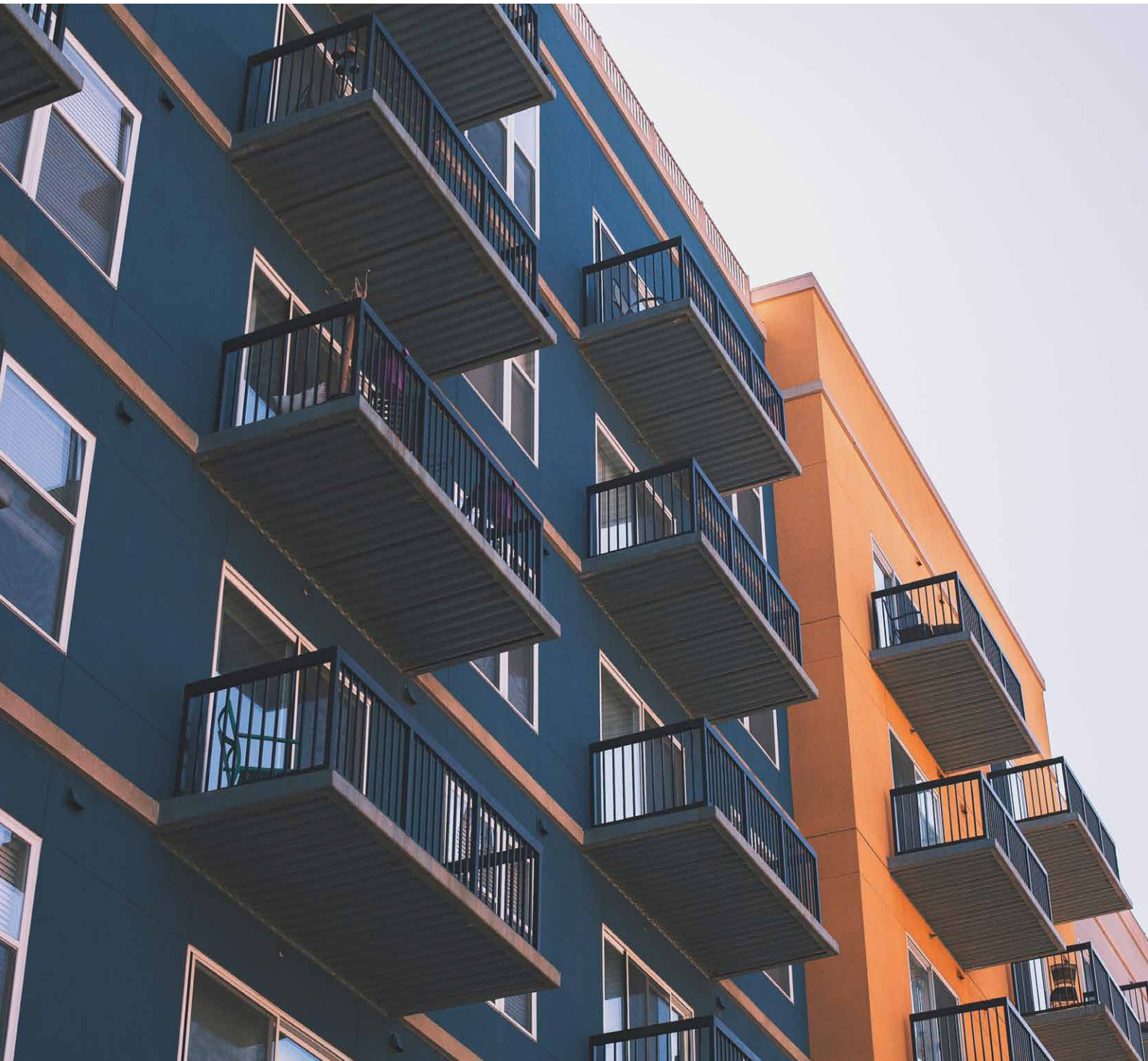
In warmer/humid climates, impermeable air barriers can be used to prevent warm moisture-laden outdoor air from moving in through the building materials towards cooler, air conditioned spaces, thereby reducing internal condensation.

Air barriers come in many forms. Regardless of whether they are a flexible wall wrap or rigid sheeting such as fibre cement, plywood, or metal, barriers must be durable and provide a reliable seal. Failure to provide a proper weatherproof barrier can cause air leakage, which may have considerable impact.

Air flow in and out of a building can put a strain on the energy sources used to heat and cool a building. This increases pressure on mechanical solutions, which in turn consumes more energy, resulting in elevated operational costs. External air sources such as exhaust openings, boilers, vehicle exhaust systems or loading docks can create unstable levels in the building air, which affects the building environment.

Buildings that have heating, air-conditioning and ventilation networks are prone to microbe growth that can cause health problems for occupants.[13] Small openings in the building seal also allow access for insects and rodents to contaminate the space and change the air quality.

Mechanical ventilation, or fans or ducted air-conditioning systems, ensure the constant movement of air and water vapour through a space. Not only does this help to prevent the build up of condensation by creating a tight building envelope, but it also improves sound insulation and reduces energy loss. Mechanical systems allow for a stable environment with reduced air contaminants. In colder climates, condensation can be reduced by ensuring there is a higher exhaust flow than air flow. In hot and humid climates, it is the opposite. The airflow must be greater than exhaust to avoid condensation building up. Variable airflow rates can be problematic, causing condensation levels to fluctuate.[14]



ABOUT CEMINTEL

Cemintel is a subdivision of CSR, one of Australasia's most widely specified and trusted building products companies. Their focus on sustainability is coupled with a strong, intelligent research and development team that is committed to producing innovative, high performance products that balance style, functionality, and flexibility. Cemintel's product portfolio meets the needs of commercial and residential environments alike.

CEMINTEL RIGID AIR BARRIER

Cemintel's Rigid Air Barrier is a high performance fibre cement barrier which unlike metal sheeting, permits the transmission of vapour in and out of the building envelope, allowing the building to "breathe" and reducing the risk of moisture ingress. The non-corrosive barrier also offers superior resistance to moisture and weather conditions.

Lightweight and durable, Cemintel Rigid Air Barrier is resistant to tearing, and withstands construction site traffic with ease. Its superior strength offers significant advantages in comparison with flexible wall wraps, which are prone to flapping and sustaining damage when left exposed on construction sites and inadequately sealed with tape: true to their name, Rigid Air Barriers are highly rigid, making them suitable for high wind environments and in scenarios in which a project is unclad for an extended period.

In line with growing industry concerns regarding fire performance, Rigid Air Barrier is approved for use where non-combustible materials are required by the Deemed to Satisfy provisions of the BCA. This offers a marked advantage over typical wall wraps, which are combustible, or metal rigid barriers, which heat up during a fire and exacerbate heat transfer. Rigid Air Barrier's high performance is matched by rapid and easy installation. Panels are free of a dangerous sharp edge and are simply screwed to the framing system and then taped up to provide a seal. The panels are coated with Cemintel's proven Ceminseal® embedded micro waterblock technology, which repels water and prevents it from penetrating into the panel. When correctly installed, the Rigid Air Barrier will not warp, swell, or rot.

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