The reason for cavities

Constructing drained cavities behind wall cladding is standard practice these days, although it is still possible to build with direct-fixed cladding in some lower-risk situations. So why do we build with cavity (rainscreen) construction?

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IN THE EARLY 2000S when weathertightness problems shook the industry, installing cladding systems over a battened cavity was a prudent measure to reduce the risk of water penetration.

Cavities provide resilience

While weathertightness failures were not limited to direct-fixed claddings, installing battened cavities was a practical step that provided many benefits.

An engineered drainage path is key to increasing the resilience of construction to external moisture (see *Build* 157, *C is for cavities*). While cavity construction was not new in New Zealand or internationally, it was historically limited to claddings like brick veneer.

Research established performance limits

While the shift to cavity construction was an urgent response to an industry need, considerable effort went into understanding the limitations of this approach. Research at BRANZ underpinned the performance of various options by performing drying experiments in an experimental building (see *Build* 89, *Letting air into buildings helps keep them dry*).

These experiments allowed us to understand how quickly different cavity-cladding configurations could dry out after water entry as a function of where the water was in the wall. Drying rates were measured at the back of the cladding, the back of the building wrap and in the timber frame itself.

Ten times longer to dry with each layer

A key finding from this work was that, for every layer deeper that water penetrated, it took about 10 times longer for the wall to dry out. Painting the backs of claddings could have an influence on moisture absorption, and there were variations with orientation and season as well.

Ventilation varies by cladding and cavity size

The amount of ventilation behind the cladding was an important component in the drying rates, so BRANZ performed a set of experiments to determine the amount of ventilation provided by different cladding and cavity options.

This work was then used to create the ventilation function in the WUFI® 2D software in collaboration with the Fraunhofer Institute for Building Physics. This allowed us to simulate the walls in different regions of New Zealand and to establish how robust the solution would be over many different climate zones. A lot of this work was incorporated in the BRANZ educational tool Walldry-NZ (see *Build* 110, *Ventilation drying in cavities*).

20 mm cavities just the right size

While the choice of cavity depth for brick veneer was set by trade practice - including the need to be able to clear mortar droppings -

there needed to be some science behind the depth for cavities in typical lightweight claddings.

The main consideration was to ensure that the building wrap did not create a capillary bridge across the cavity, thereby allowing water to pass from the wet cladding to the dry building wrap.

A deeper cavity would maximise the amount of incident water that could drain down the back of the cladding. A narrowed cavity would restrict ventilation rates behind the cladding.

The bulging of underlay caused by installing insulation in stud cavities meant that narrow cavity options like 6 mm or 10 mm were too small to reliably minimise the risk, given tolerances in the real world. Deeper cavities had no more drainage capacity, and the increased ventilation was not significant.

This led to nominally 20 mm cavities being chosen as the most pragmatic solution.

Cavity systems important in 4Ds

The 4Ds philosophy - deflection, drainage, drying and durability (see *Build* 119, *The 4Ds principles*) - highlights the role of cavities in managing water (see Figure 1):

- Deflection is provided by the design of the building itself. Think overhangs or flashings that deflect water away from critical junctions.
- Drainage is a critical function of cavities and the cladding face. Water that penetrates the cladding should be able to drain out.
- Drying is a secondary function of the cavity. Water will inevitably be absorbed by the materials forming the cavity, and surface tension will help hold water in liquid form on the surfaces as well. Allowing sufficient air movement (ventilation) will help to rid the wall of this moisture when conditions allow, particularly when a cladding is heated by solar gain that helps to evaporate moisture.
- Durability - a well-performing cavity will contribute to the system meeting the durability requirements of the Building Code. It will prevent enough water being retained to cause degradation of the construction materials.

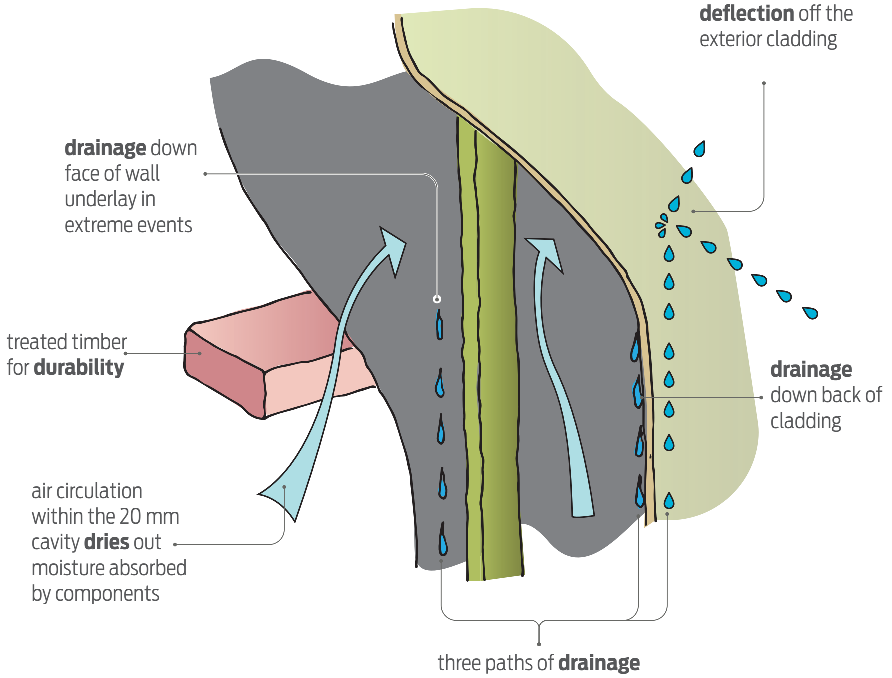

Figure 1: Cavities play a significant role in managing any water that gets behind claddings.

Key points

- Cavities behind claddings improve the ability of water that penetrates the cladding to escape by draining down the open cavity.
- Cavities significantly enhance the drying rate of moisture that remains in the cavity or is absorbed into the cladding or building wrap.
- Cavities slightly enhance rates for the removal of moisture from behind the building wrap, though this is limited by the permeability of the wrap and other variables (see *Build* 100, *Examining drying rates in walls*).