BUILD WITH WARM ROOFS

New Zealand loves our metal, tile and membrane roofs; however, most people who own these homes or even designers of these homes, don't fully understand the complications that arise with these systems. For many years we've been told that if we insulate the ceilings, we will keep the interior space warm. While this is correct, there are a wide array of other considerations. Adding ceiling insulation has an impact on moisture movement or vapour diffusion and transport via air leakage.

There are only two ways to reduce interstitial condensation in your roof cavity:

– Cold roof with a vapour control layer fully taped around every penetration and sealed to the adjacent wall assemblies
– Warm roof

With either design, you would still require an indoor environment quality that is comfortable to humans (20-25 degrees C, 40-60% Relative Humidity). This is only possible with mechanical ventilation and heating controlling the moisture levels inside the building.

Advantages

– Roof can be closed in early to allow for internal linings to be installed
– Cost competitive to a cold roof built properly
– Temperature of internal surfaces remains above the dewpoint temperature of the interior air, mitigating condensation potential
– Water sheading layer can be membrane or metal

The advantages of a cold roof with a vapour control layer:

– Doesn’t increase building height
– Builder can often install it themselves without having to be licensed

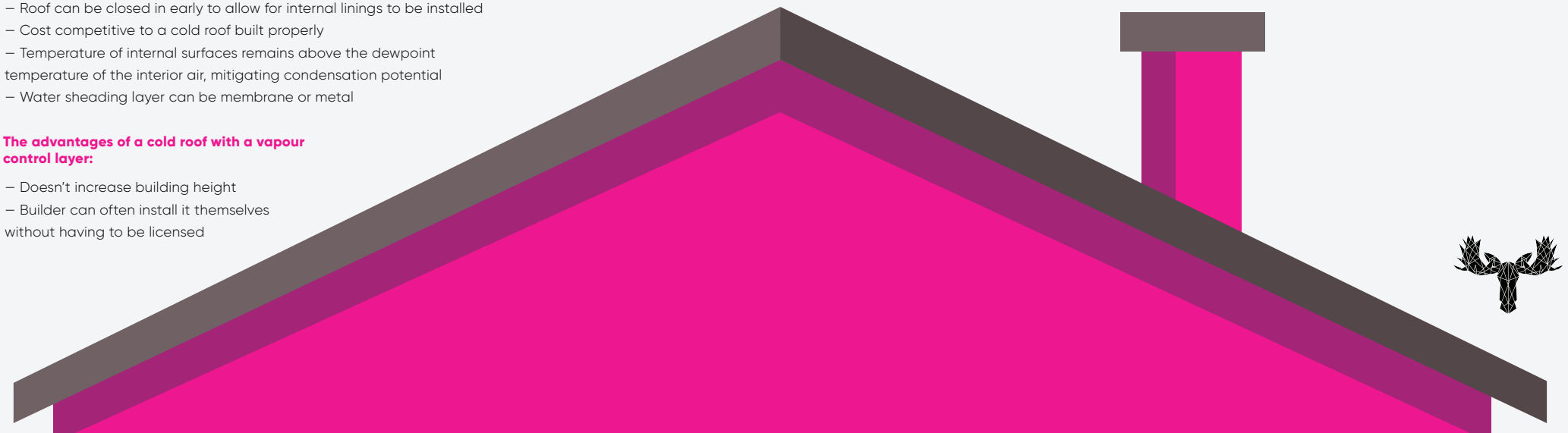
Unfortunately, New Zealand does not follow international best practice when it comes to the most significant asset most Kiwi's will ever own - their house. The minimum standard for NZ homes would not be acceptable in any other equivalent country. The minimum standard designed house in NZ is a mould and asthma breeding ground.

Ideally, traditional cold roofs should be eliminated and instead design for a warm roof assembly. Alternatively, it is possible to design a cold roof to manage condensation and mould growth with a vapour control layer using Hygrothermal analysis. WUFI is a software package that can do this type of analysis. A study by BRANZ and published in Canada showed that WUFI replicated real-world findings very accurately.

The designer needs to fully understand building science to be able to design the roof assembly correctly to mitigate the potential for interstitial condensation. One simple way of mitigating risk is to design a warm roof which keeps the interior surface temperature of the roof assembly above the dew point temperature. In other words, condensation is not possible.

The cold roof system has "worked" in New Zealand for decades, mostly by accident. Newly constructed or retrofitted attics are typically better insulated and more airtight than older lofts. As a result, these attics experience less leakage of warm and humid air into the attic. By keeping this space warm, it reduces the condensation risk of interior moisture within the attic. Modern and retrofitted lofts experience significantly less conductive heat transfer from the rooms below and create cooler attic spaces. However, without a vapour control layer, the moisture from the habitable spaces below finds its way into the roof space. If an attic space has similar conditions to outdoors with increased ambient moisture, there is an increased likelihood that night sky radiation can lead to condensation.

Research shows that mould growth associated with vented attic spaces in New Zealand is commonplace. Wetting of the underside of the roof sheathing or purlins due to exposure to moist outdoor ventilation air can cause visible surface mould growth. Ventilated attics can work in summer when there is potential for the radiative heating of the sun. However, the scales tip in the winter months when relative humidity is generally higher, far less solar drying potential and night sky radiation causing cold surfaces in the roof.



OCULUS

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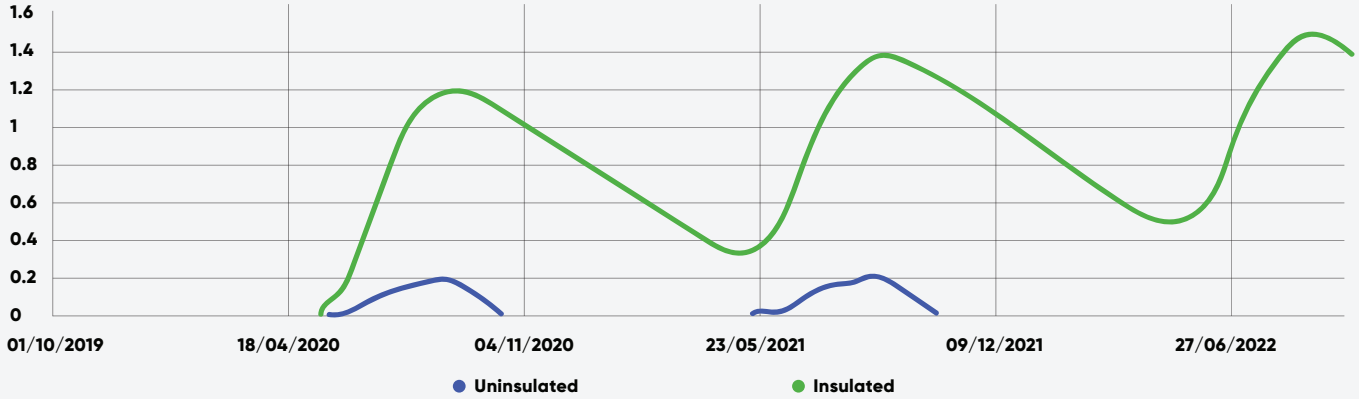
This graph shows that over years mould continues to grow but because the roof space has now been insulated the warm summer months are not countering the winter mould growth.

BRANZ's most recent House Condition Survey found that visible mould was present in over half of the housing stock. We need to reduce risk by taking the requirement away from the home owner and providing them with a solution where they don't have to ventilate a roof or living space in winter by opening windows and doors.

The common belief that "warm roofs are too expensive" do not take into account the true costs of creating a cold roof that prevents condensation occurring. Warm roofs that are designed correctly can not only be more affordable to build than a cold roof, but the long term benefits of thermal efficiency are greatly enhanced making a warm roof by far the smarter, healthier and cost effective solution. One thing is for sure, knowledge is key. Make sure your designer or architect fully understands building science to ensure the design of your roof assembly mitigates any potential for interstitial condensation.



Assembly 1 (the blue line) is the old-style roof with no insulation and good ventilation.
Assembly 2 (the green line) is the new style cold roof with insulation at ceiling level – there is ventilation provided equivalent to 1m2 of ventilation to 150m2 .

The Y axis of the graph is the mould growth rating, 1-2 is only visible under a microscope, 3 is where it begins to become visible and 4 – 5 serious visible mould. In the case of the modern cold roof the model predicts visible mould will be evident after 5 years.

Research gathered from the following sources:

- BRANZ Study Report SR289
- MRM Ventilation of attic spaces
- Niwa
- RDH – State of the art review of unveted sloped wood framed roofs in cold climates
- BRANZ - Keeping your home warm and dry

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