Roofing underlay and moisture

A recently completed major BRANZ research project has improved understanding of how roofing underlays handle moisture in roofs and led to the development of a new test suitable for a wider range of roofing underlays.

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In the past, asphalt-impregnated Kraft paper was the commonly used underlay in New Zealand residential dwellings. Test methods for Kraft underlays are called up in the current standards NZS 2295:2006 *Pliable, permeable building underlays*, AS/NZS 4200: *Pliable building membranes and underlays* and Table 23 of the compliance document to the New Zealand Building Code clause E2 *External moisture*. It is difficult for some synthetic roof underlays, widely used overseas and now appearing on the New Zealand market, to pass these tests and be acceptable here.

Multi-roof test building at BRANZ

BRANZ recently completed a major investigation into how roofing underlays perform in practice, using field and laboratory studies and heat and mass transfer computer models. A multi-roof field test building (see Figure 1) located at the BRANZ Judgeford site simultaneously examined up to 10 roofs – five pitched and five skillion – under identical indoor and outdoor climates.

Current absorption test not useful

All but one of the underlay tests in the current standards were found to serve a useful purpose. The absorption test, which is found nowhere else in the world, did not. It consists of soaking the underlay in water for 24 hours and measuring how much moisture is absorbed. To pass, it must exceed more than 150 g of absorbed moisture per m^2 of roofing underlay. This is supposed to ensure that roofing underlays are able to absorb condensation dripping from the underside of metal roofs, preventing it dripping deeper into the roof structure.

No dripping from roof cladding

However, investigations found that condensation does not drip off from under a metal roof but rather runs to the lowest point of the metal profile where it only transfers to the underlay if the underlay and the roof cladding are touching. When this happens, the water sits as droplets on the underlay and must not be allowed to pass through and drip into the structure below.

All roofing underlays have to pass existing 'head of water' tests, which is more than sufficient to guarantee that moisture sitting on top of the underlay does not pass through.

Most moisture under underlay, not under roof cladding

When underlay is present, it was found that most of the condensation in the roof structure appears under the underlay, rather than under the metal cladding – the underlay is shielding the cladding. This shielding is higher as the vapour resistance of the underlay increases.

The key concern is that condensation hanging in drops from the bottom of the underlay must not drip into the structure below, degrading the effectiveness of any insulation and threatening the durability of the other roof components.

New test

This improved understanding led to a new test on the ability of the roofing underlay to hold condensation and not allow it to drip into the roof structure below.

The test simulates condensation hanging beneath the underlay and notes how much condensation is present when this condensation begins to drip. Figure 2 shows the test set-up with the underlay suspended above a tank of warm water. The water condenses underneath the underlay while the balance on which the underlay hangs gives the total weight of the underlay plus condensation. As condensation accumulates, the total weight increases at a steady rate until the condensation starts dripping. If the weight of the accumulated condensation is greater than the critical figure (about 100 g/m^2), the underlay is deemed to have passed. (The final figure is not yet settled but will be in the range of 80–150 g/m^2).

In practice, this means that even under quite severe condensation situations, underlays that pass this test will not let any condensation drip into the roof structure below.

Figure 1: BRANZ multi-roof test building.

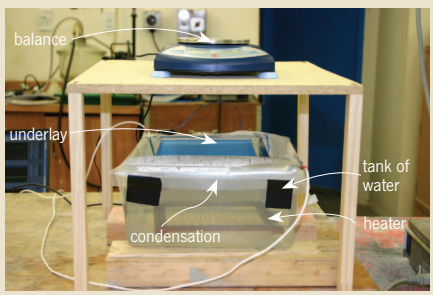

Figure 2: The test set-up. The blue square on the top of the tank of water is the roofing underlay under test.