



build right

by Malcolm Cunningham,
BRANZ Principal Scientist

Roof spaces

— do you ventilate them or not?



| A roof with a moisture problem, but is lack of ventilation the cause?

Only a very few types of roof require deliberate ventilation if all potential sources of moisture have been dealt with adequately. The BRANZ helpline still receives queries about whether to ventilate or not; so it's time to have another look at this question.

The roof shown here has a moisture problem. The foil is corroded, the building paper has delaminated and the insulation and battens are very wet. Is insufficient ventilation in the roof space the cause of the problem?

In this particular case, inadequate ventilation was not the problem. BRANZ has found over the years that many roof moisture problems attributed to lack of ventilation actually have other causes.

The roof in the photograph has problems because moisture absorbed

into the fibre-reinforced cement tiles from rain has later been driven into the roof space by solar radiation. Moisture problems can also be caused by closing in wet construction materials or by moisture sourced from elsewhere, notably moist air from the sub-floor space being vented into the roof space via the wall cavity (as can happen in brick veneer houses).

When is ventilation necessary in roof spaces, and how much is required? The answer needs a closer look at how ventilation actually works.

Driving forces — warmth and wind

Natural ventilation is governed by two forces — temperature and air-pressure differences. Air inside a roof space tends to be warmer and less dense than outside air and will therefore rise up the roof space (the 'stack effect').

Wind flowing over a structure causes differences in air pressure. Air is driven through the structure from high-pressure to low-pressure zones.

Air flowing through a roof comes from three main sources — outdoors, indoors and other building cavities, e.g. the sub-floor space via wall cavities. Air from outdoors is usually desirable because once it has warmed up, it can, except in very humid climates, pick up extra moisture from the roof space and vent it outside. >>

Air entering the roof space from indoors or from other building cavities often carries a lot of moisture with it and is therefore less desirable.

Where the air comes from, how much moves through the roof space and how effective that natural ventilation is in controlling any potential moisture problems depends on the roof design.

Pitched roofs

BRANZ has never seen a moisture problem caused solely by inadequate ventilation in a pitched roof.

New Zealand's relatively windy climate provides plenty of driving force for air movement through the large volume of roof space. The height of the roof from ceiling to ridge provides for further air movement via the stack effect.

If moisture problems are experienced in these roofs, look for an alternative source, e.g. sub-floor moisture, appliances venting into the roof space, open header tanks and leaking roofs.

Skillion roofs

Skillion roofs (where the ceiling lining and roof cladding are near parallel and less than 300 mm apart) are commonly thought to pose more of a problem because their tight construction and narrow cavities provide little opportunity for air entry and movement. In fact, research has shown that most New Zealand skillion roofs have no problems, including those not deliberately ventilated. Where problems do exist they can usually be traced to solar-driven moisture, leaks or construction moisture.

A surprising amount of air does move through a skillion roof, except perhaps for very air-tight roofs, such as those clad with long-run, trough-section metal roofing, fibre-reinforced cement tile roofs with interleavement (to prevent solar-driven moisture) and rubber membrane on plywood roofs.

It is important with skillion roofs to avoid enclosing too much construction moisture. No skillion roof with a timber moisture content above

25% (preferably much less) should be enclosed. In all such roofs, a gap of at least 10 mm should be left above the insulation to ensure it does not come into contact with the building paper, which would cause intermittent moisture on these surfaces to wick into the insulation. Such a gap also provides an air path in and out of the roofing structure. Building paper should always be used in skillion roofs as it provides an important storage place for the intermittent condensation that will occur in frosty conditions when the cladding is cold and air movement very low.

Flat roofs

The key issue with rubber membrane-clad flat roofs is to ensure that no construction moisture is enclosed, as these structures are generally slow drying because of their impermeable cladding. Timber should be below 20% moisture content before being enclosed because even if the roof cavity is deliberately ventilated, it is not likely to be able to cope with the moisture from the drying timber. These roofs often become very hot and at times the timber can dry very rapidly. The moisture driven off from the timber can accumulate elsewhere and pose quite a problem.

Many roofs of this type have been built without deliberate ventilation and, providing no construction moisture has been enclosed, have no problems. However, all manufacturers of rubber membranes recommend ventilation and there is an argument that any small amount of moisture that might collect in these roofs, perhaps from condensation or minor leaks, needs to be dealt with by having some form of ventilation.

Manufacturers provide details of various roof vent types, installation and spacings, which should all be adhered to. Ridge vents running the full width of the roof can also be built. To be genuinely effective, soffit ventilation of some sort should be provided, to ensure a flow of air from soffit to roof-top ventilation. However, the placement of soffit ventilators must be thought out carefully to make sure they are well away from gutters, which can provide a source of moisture.

Natural ventilation of flat roofs is totally inadequate to provide cooling of these roofs. If over-heating is a potential problem, consider painting the membrane white, to reflect some of the heat of the sun away from it.

Key points to remember

- Address all possible moisture sources that may cause problems before worrying about ventilation issues.
- Timber moisture contents should be well below 25% (or below 20% for rubber membrane roofs) before being enclosed.
- No amount of ventilation will cope with moisture problems caused by ignoring these issues. However, once they are dealt with, only a few types of roofs will require deliberate ventilation.
- Products must be installed according to manufacturers' specifications, e.g. interleavement must be used with fibre-reinforced cement tiles to avoid solar-driven moisture transfer.
- Other possible moisture sources must be properly dealt with, e.g. header tanks must be covered and vents from indoor appliances must open to the outside air.
- There must be no connection between the roof cavity and any other building cavity, e.g. the sub-floor space. ><