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Under the weather

In response to industry questions, BRANZ recently launched a research project into corrosion rates in vented roof spaces. Two roof spaces have been built in an unforgiving coastal environment and will be monitored.

BRANZ test structure at Oteranga Bay.

OTERANGA BAY on the rough, southwest coast of Wellington is not well known or easy to get to. Accompanied by Transpower staff, it takes about 20 minutes on gravel roads from the last inhabited outskirts of Makara village, dodging goats, cattle and sheep, through fields of elegant-looking wind turbines, before descending into the barren little bay.

This remote bay plays an important role in the electricity infrastructure of New Zealand - it is here that the high voltage direct current (HVDC) cable comes on shore, delivering hydro power from the mainland to centres in the North Island.

Ideal location to test material degradation

The site is also important from a building research point of view. Supported by Transpower, BRANZ has maintained a test facility here for many years. The close proximity to the sea with its heavy salt deposition and the high wind speeds make it ideal for investigating environmental degradation of a range of building materials.

Usually, metallic samples are mounted on exposure racks and left for years to see how well they can cope with this extremely corrosive environment - classified as zone D according to NZS 3604:2011 *Timber-framed buildings*.

The infrastructure to conduct the latest Building Research Levy-funded project was more involved. The challenge was to construct two nearly identical roof spaces to investigate corrosion in vented and unvented roof spaces.

Eliminating excess roof moisture

Excess moisture in residential roof spaces has been a topic of interest for BRANZ and the wider industry for several years, and the reasons behind these issues have been summarised in several BRANZ publications.

Essentially, the first response is to minimise moisture from accumulating in the living areas of a building. Minimising indoor moisture sources, such as clothes drying and unflued gas heaters, and using good ventilation practices are key.

Secondly, moisture transfer into the roof space, where it may condense on cold surfaces, needs to be suppressed by an airtight ceiling.

Vented roof space (bottom) with plastic battens on the purlins and at the soffit.

Metal corrosion samples placed inside the four compartments of the vented and non-vented roof spaces.

BRANZ Bulletin 630 *Roof space ventilation* published in December 2018 gives a more detailed overview of the causes and remedies.

Adding passive roof venting

Another strategy to add resilience against possible moisture problems under the roof is installing passive ventilation openings to the roof space. These vent elements enable an air exchange. Mixing the moist air in the roof space with the outside air, which is often drier, lowers the overall moisture content of the air in the roof space.

The air exchange is mostly driven by wind action across the envelope of the building. Stack effect movement, based on thermal and thus density differences of parcels of air, can also play a role.

Could vents be creating issues?

However, opening the roof space more to the outside environment might have unintended consequences. The openings themselves need to be designed to avoid insect, bird and water entry. Sand blowing into the roof space might also be an issue in coastal regions.

This research project aims to answer another particular issue that the industry has raised. Do vented roof spaces, especially in marine climates, exhibit higher corrosion rates on nail plates and other metal fixtures in comparison to non-vented spaces?

Roofs built to test corrosion rates on fixings

To draw some firm conclusions on this question, BRANZ constructed two roof spaces that come close to what an ordinary skillion-type roof would look like. The roof, with a trapezoidal profile, is a low-angle, monopitch type roof.

The two roof spaces are identical in size, approximately 4 m long and 1.2 m wide. The vented roof space has commercially available vented battens installed on top of the purlins underneath the roofing underlay.

At the lower end of the roof, ventilation is provided by an over-fascia opening. At the front end, facing the sea, another vented batten is mounted underneath a barge flashing. The non-vented roof space is made to be conservatively airtight.

It is envisaged that the front vents especially will clog up with sand. While this phenomenon is worth documenting, we are mainly trying to establish the corrosion rates on the inside, so we will keep the vents as open as possible during the experiment.

Mild, galvanised and stainless steel samples

Twenty-eight exposure samples are mounted in the four compartments of each of the vented and non-vented spaces. They are mild and galvanised steel positioned at 0°, 45° and 90° angles as well as a stainless steel sample included as a reference.

These three installation arrangements represent the most common in-service conditions for metallic components in buildings. Also, they provide very different conditions for salt accumulation and deposition and therefore for atmospheric corrosion-induced failure.

An identical set of samples is mounted on the outside with direct exposure to this severe marine environment, again as a reference.

The metallic samples will be removed for laboratory analysis after 12 months. Their first-year corrosion rates will also be measured according to relevant national and international standards.

First step to providing guidance

The data and information collected will help to compare the corrosivity of the environments:

- inside a vented roof space and an unvented roof space
- inside a roof space and fully exposed outside.

The experimental derived results will then enable us to provide recommendations and guidance as to what level of corrosion protection is needed. The results will be published in future editions of *Build* over the next 12–18 months.