
Condensation in Large-Cavity, Steel-Framed Roof Spaces: Causes and Cures

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In recent years, attention has been drawn to excessive condensation occurring in what can be described as institutional buildings in New Zealand. These types of building share some common design features such as large roof cavities, metal framing and profiled metal roofs with standard underlay, fibreglass bat insulation and suspended ceilings.

In order to elucidate these condensation mechanisms a test structure was designed where four roof specimens with different insulation specifications could be characterised experimentally. The experimental findings gathered during a New Zealand winter were also used to underpin the development of a numerical model.

Key findings are that the common practice of simply inserting thermal breaks in between the steel elements and the roof is not always sufficient to prevent condensation and a full cover board insulation may be necessary. It is also shown that condensation events did not happen in the predicted pattern during frosty nights early in the morning.

Ventilation rates for these roofs can vary by an order of magnitude and are shown to be dominant over moisture diffusion and hygroscopic storage processes. Utilising the modelling approach design guidelines are given on how to limit the amount of condensation by optimising insulation thickness and roof ventilation or indoor climate modification.

These findings are presently extended to residential skillion roofs.