New homes dripping

Modern building practices often result in more airtight dwellings. BRANZ looked at two new builds with internal moisture problems and found issues could have been avoided with efficient ventilation.

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Disconnected duct in the apartment ceiling.

LAST WINTER, BRANZ was contacted by two building owners who were finding it difficult to control the internal moisture in their properties. One was a single-level standalone 4-bedroom house, and the other was a 2-storey block of single-bedroom apartments.

In both instances, the buildings were less than a year old, and despite having double glazing, they were experiencing an almost continuous layer of condensation on the window framing and the glass (see cover). The occupants were having to mop up moisture on the window sills daily and were finding some mould growth on walls and ceilings.

Double-glazed but wet windows

BRANZ scientists were given the opportunity to measure the airtightness of the buildings and to monitor the temperatures and relative humidity to help understand what might be causing the moisture issues.

As well as displaying similar symptoms of water running down the windows, both buildings had virtually the same set of ventilation issues. The major difference was that the spacious 4-bedroom house had plenty of openable windows (although these weren't opened often), whereas the 60 m² apartments had only one or two openable windows and smaller air volume per person.

Less air infiltration in new homes

In both cases, the airtightness measurements were as expected for new construction with no additional airtightness construction practices incorporated other than those inherent in modern house building methods.

Modern construction tolerances generally mean much less air infiltration compared with houses from the 1980s and earlier. The air change rate that results from the measurement of airtightness does not represent the air infiltration rate that occurs in practice. Typically, it represents a worst-case ➤

Condensation on the double-glazed window framing and glass.

situation that occurs for only short periods of time, and the actual infiltration is significantly lower.

For the apartments, most of the infiltration, if any, would have been occurring at the aluminium joinery of the windows and glass doors. Since that is also where the moisture was condensing and accumulating, it would seem to indicate that infiltration was negligible.

Likewise in the house, where there seemed to be no exfiltration loss of moisture. Any reduction in moisture was directly linked to the use of mechanical ventilation.

For the periods when the house was unoccupied, the temperature and relative humidity decreased relatively slowly with time.

Moisture trapped inside

In both these cases, the moisture was accumulating because there was a continuous daily cycle of condensation on the windows at night and evaporation back into the internal air during the day.

A lot of the condensation was spilling over into the carpet where it would have been difficult to mop up each morning.

Lessons in BRANZ findings

The most obvious shortcoming with the moisture control process in both cases was the ventilation of the laundry area and the absence of sheltered areas to dry clothes outside. Clothes dryers can give off 5 kg of water per load into the indoor air.

There were several points worth noting:

- The house had a clothes dryer that vented directly into a laundry alcove that was open to the main living area. The ventilation fan in the laundry area seemed to be too small and the ducting either kinked or not connected.
- For the apartments, the single laundry vent was used for the dual purpose of venting both the dryer and the laundry area and had an inadequate partial connection to the dryer.
- The air being extracted by the bathroom fans was in most cases so low that it was difficult to detect at the outlet. That, and finding a disconnected duct in the ceiling of one apartment, suggests there was no commissioning step following installation of the fans and ducting. With no access to the ceiling of the house and some ceilings in the apartments, it would have been very difficult to rectify mistakes discovered after the buildings were completed.
- A particularly noisy and relatively ineffective extraction hood in the kitchen of the house would have discouraged its use.
- Long runs of relatively small-diameter flexible ducting connecting extraction fans to the outside increase the potential of moisture condensing.
- The relatively small drop in temperature when the heating systems were turned off points to there being minimal heat loss associated with air leakage.
- Unreliable drainage of window and glass door sill channels.
- There were clearly some periods, albeit short, when open windows and doors or the use of mechanical ventilation tipped the balance in favour of there being no condensation on the windows.

Efficient ventilation systems a priority

Attempts to reduce energy use by making houses even more airtight than they currently are need to factor in additional costs for improvements to the design and commissioning of the mechanical ventilation systems.

Building a house or apartment so it is significantly more airtight is relatively easy, even without resorting to specialist airtightness products. The design and maintenance of a comprehensive ventilation and heat recovery system is much more difficult.

Using specialist airtightness products and systems to further reduce the infiltration or completely eliminate it can add considerably to the building cost and may result in an unjustifiably extreme and unmaintainable airtightness.

These two cases seem to indicate that the impact of heat loss associated with infiltration is of secondary importance, and improvements to the ventilation should be the higher priority. Options include passive vents, opening windows or properly designed effective mechanical ventilation.

Remove most moisture at source

The $1,000+ cost of two airtight tests for a new house might well be better spent on the design, implementation and commissioning of an efficient ventilation system. This would run for short periods, removing most of the moisture at source and the rest - such as moisture from exhaled breath - through passive trickle venting and ventilation fans in background mode.

The need, or otherwise, for expensive heat recovery can then be made in the full knowledge of how much infiltration and ventilation heat loss there is to recover.