How weathertight are junctions?

BRANZ is studying the properties of junctions to understand how they perform in wet conditions. The aim is to see if a performance basis for junction design is possible.

BY MARK BASSETT, BRANZ PRINCIPAL SCIENTIST

THERE IS NO DOUBT that junctions in claddings are the weak link in the weathertight defence of buildings. This was confirmed in early surveys of leaking homes, so it is no surprise that the Building Code Acceptable Solution for external moisture - E2/AS1 - places considerable emphasis on joints, junctions and associated flashings.

You might expect, therefore, that junction design would be well supported scientifically. In fact, junction designs have evolved over time and are more a product of field experience than science.

Routine testing provides a useful check but does not show how junction designs might be optimised or modified for application on taller or more wind-exposed buildings.

Is a performance-based design possible?

The weathertightness research programme at BRANZ is now looking into the properties of junctions to see if a performance basis for junction design is possible.

The project began by studying residential window head junctions in cavity walls (see Figure 1) and the apron flashings between wall and roof sections (see Figure 2). These junctions are similar in principle, but they have quite different flashing upstand heights and rainscreen cover provided by the cladding. A range of flashing upstand heights are offered to cater for wind exposure classes between sheltered and extra high.

As might be expected, the weathertight properties of these junctions depend on:

- the wind pressure difference across the junction
- the water run-off rate over the junction
- the gap between cladding and head flashing
- the airtightness of the junction.

Head junctions and apron flashings

In the laboratory, it was found that the window head junction did not handle run-off as well as the apron flashing. However, the apron flashing, with its larger cladding to flashing clearance, appeared to rainscreen against wind-driven rain less effectively.

This suggests there may be opportunities to improve the performance of window head junctions with a head facing to deflect water more effectively. Work still needs to be done to show where this would be necessary in terms of building height and wind exposure.

Impact of run-off and wind pressure

Figure 3 shows run-off partially blocking the window head junction and allowing airflows to carry spray through the cavity. However, the pressures required for this to occur are very high and therefore rare for low-rise buildings (see Figure 4). The ventilation paths in the cavity closer that allow this to happen provide ventilation

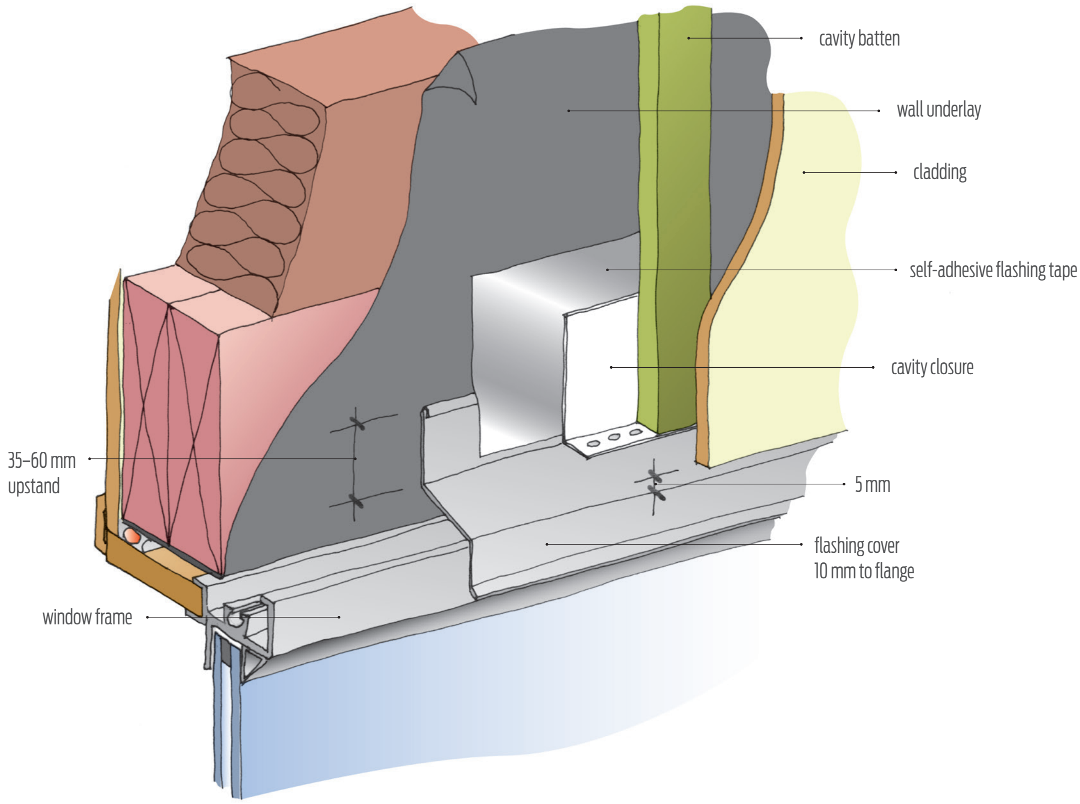

Figure 1: E2/AS1 window head detail.

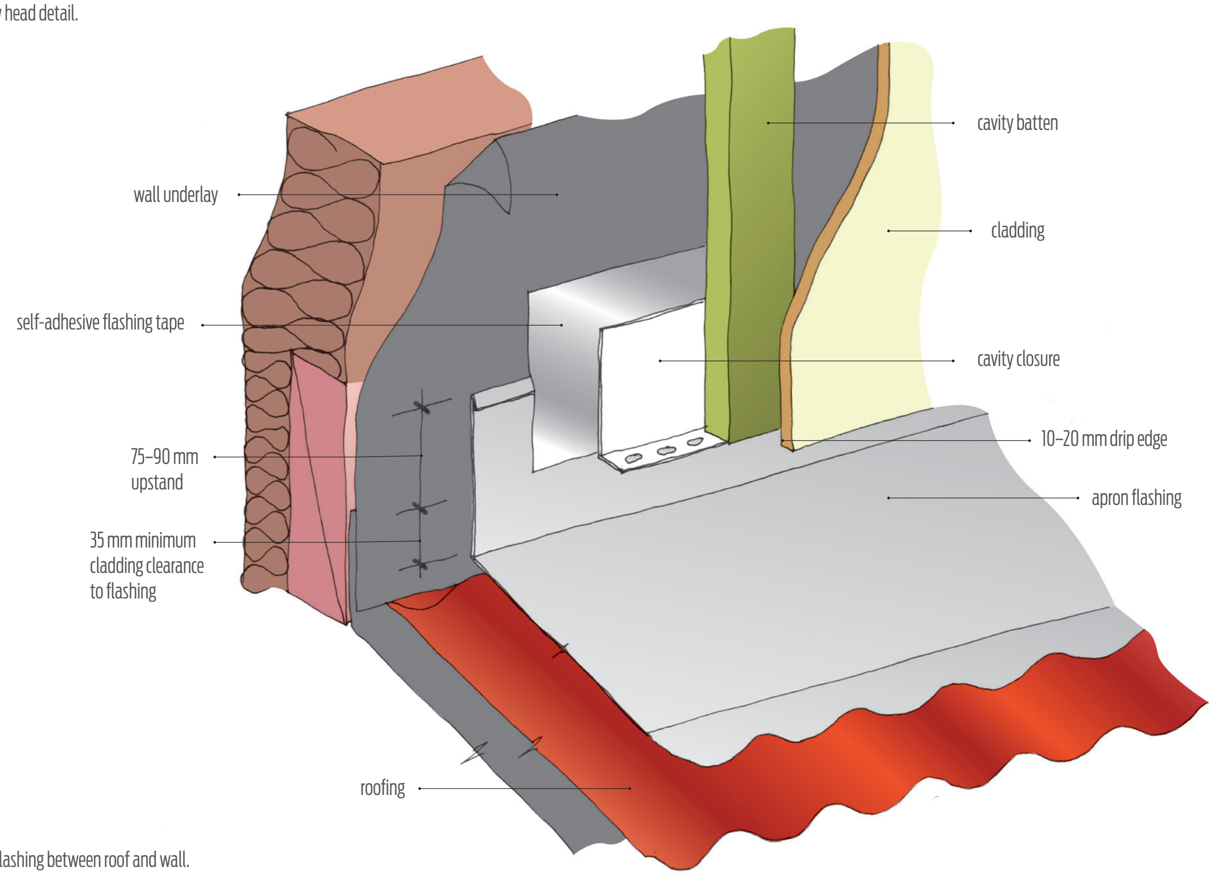

Figure 2: E2/AS1 apron flashing between roof and wall.

drying, which will easily deal with a little air-carried spray.

The pressure at which air-carried spray starts to occur depends on the gap between cladding and head flashing (see Figure 5). This is part of the information that might allow optimisation of these dimensions in the future.

At even higher run-off rates, the window head junction is totally blocked and at risk of filling with water and flooding in the unlikely event that wind pressures hold up for long enough.

The wind pressure differences needed for leakage to occur are somewhat lower than for the case where run-off does not totally close the junction. However, because wind pressures rise and fall in a dynamic way, it's possible for water to drain out of the junction between gusts and not rise to a dangerous level during gusts.

May extend to taller buildings

It's early days in this study of the weathertightness of junctions, but it is clear that useful relationships between the geometry of junctions and the rain load on the building and wind exposure can be developed in the laboratory.

These should add to field experience and the pool of testing data to help understand the range of application of junctions and the scope for extending the range of application to taller buildings.

A complete picture is not available at this stage, but the WAVE (Weathertightness, Air quality and Ventilation Engineering) team at BRANZ is planning a more extensive project.

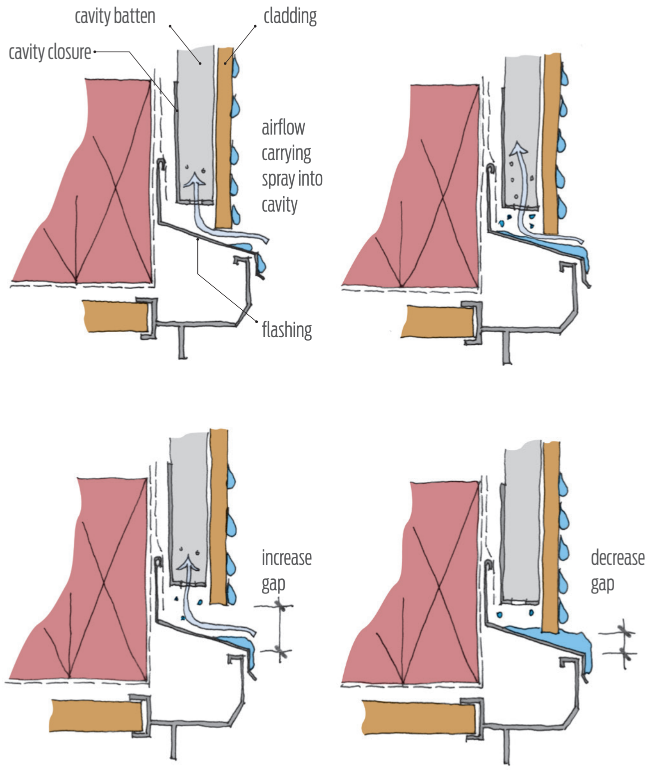

Figure 3: Leakage through a window head junction with varying surface run-off rates and gap dimension between cladding and head flashing.

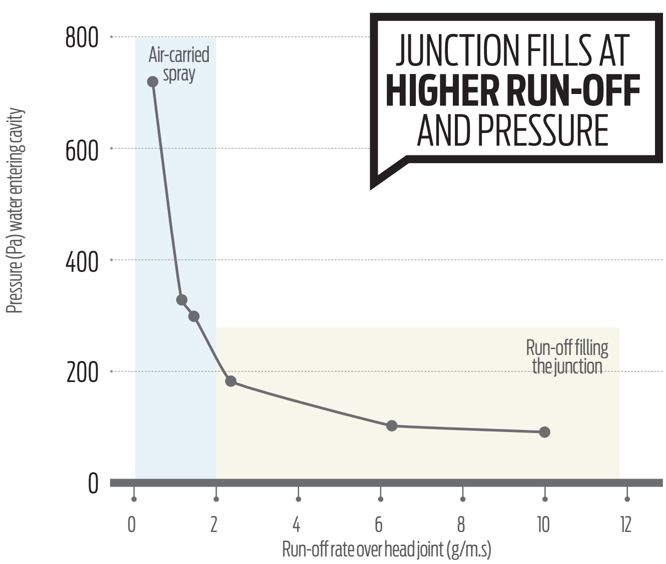

Figure 4: Laboratory measurements illustrating the significance of run-off rate.

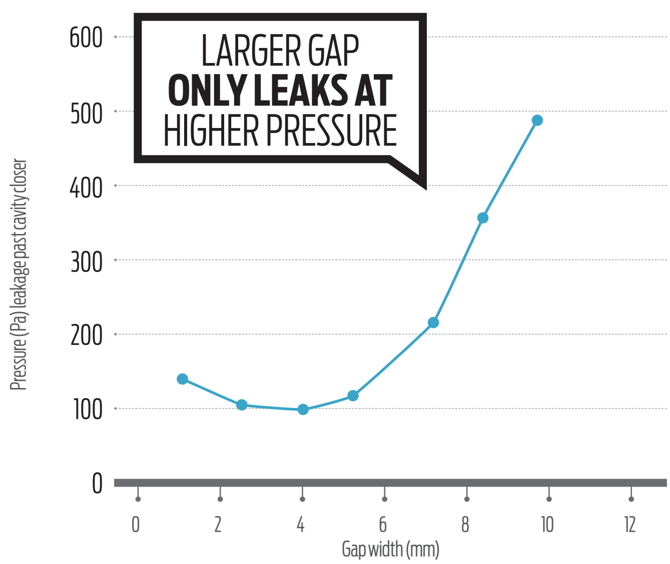

Figure 5: The significance of run-off rate and the gap between cladding and flashing in laboratory testing.