R-values in new floor details

The recently released draft of *PHINZ High-Performance Construction Details Handbook* requires some explanation for floor elements as the R-values it uses are different to those most designers will be familiar with.

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THE METHODS used in the draft PHINZ *High-Performance Construction Details Handbook* for calculating the performance and properties of floor elements are based on ISO standards but modified for consistency with the Passive House Planning Package (PHPP) approach.

What the modifications mean

Those modifications mean the R-value charts in the PHINZ handbook for floor elements do not represent the R-value charts for floor systems in the BRANZ *House insulation guide (HIG)*.

While the BRANZ HIG charts are based on NZS 4214:2006 *Methods of determining the total thermal resistance of parts of buildings* and can be used directly to provide floor system R-values for Building Code compliance, the charts in the PHINZ handbook require further calculation to determine the complete floor system R-value.

ISO 10211 and NZS 4214 approach

The ISO 10211 method for calculating the thermal performance of slab floors requires three boundaries (see Figure 1):

- A vertical symmetry plane in the middle of the slab.
- A point on the external ground surface a suitable distance from the slab edge (about 5 m).
- A point a short distance up the wall from the slab surface.

This results in a floor R-value that represents the entire floor system but includes a small contribution from the bottom part of the wall's junction with the floor slab.

The principle behind floor slab calculations in NZS 4214:2006 is similar but goes further. It separates the floor system entirely from the wall, defining the third boundary as the point where the wall joins the floor (Figure 1). This is usually an adiabatic boundary with no heat lost or gained.

Performing the calculation or modelling that way results in an R-value for the entire floor system, and just the floor system, that can be used directly for Building Code compliance.

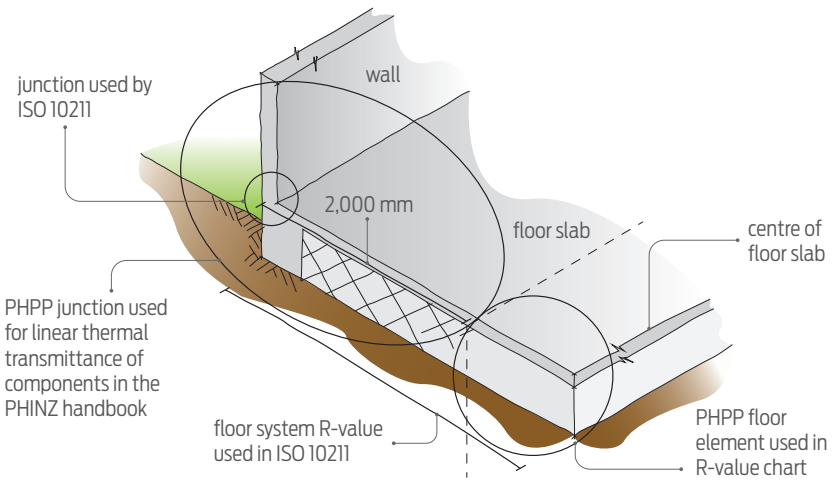

Figure 1: The two different approaches to junctions.

Compared to PHINZ handbook method

The methods used for calculating the element R-values of slab floor systems in the PHINZ

handbook are based on ISO 10211, but the boundary points are defined differently.

While the symmetry plane in the middle of the slab is still used, another boundary is set 2 m in from the outer edge of the slab. This separates the slab into two parts – the centre area and the outer perimeter.

For consistency with the rest of the PHINZ handbook, the perimeter part is treated as the wall-to-floor junction. However, it essentially represents the performance of the slab edge and perimeter rather than just the junction where the wall meets the floor (see Figure 1).

Steps to get floor R-value from handbook

Because of the PHPP approach, the R-values in the handbook represent the centre area and not the R-values of the whole floor system.

To find the floor R-value:

1. Determine the centre of slab R-value using the element R-value chart in the handbook and the area-to-perimeter ratio for the slab, then convert that to a heat loss.
2. Calculate the floor perimeter length and multiply by the associated psi value from the handbook. This determines the heat loss through the slab edge and perimeter – including a contribution from the bottom part of the wall.
3. Add together the junction (edge/perimeter/lower wall) and centre of slab heat losses to get the complete floor system heat loss.
4. Convert that to the floor system R-value.

The floor system R-value is what should be used for direct performance comparison between floor systems and for Building Code compliance. The resulting R-value should be close to the R-values in the BRANZ HIG.

Slab edge is different to other junctions

For most junction types, heat loss is a modest correction. However, for overall floor performance, heat loss from the junction is significant – sometimes more than half the floor system heat loss.

Note BRANZ will publish the *High-performance construction details handbook* later this year.