BUILD RIGHT

Concrete slab edge insulation

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ALTHOUGH THE BUILDING CODE MAY NOT REQUIRE CONCRETE FLOOR SLABS TO BE INSULATED, BRANZ CONSIDERS THEY SHOULD BE. WE LOOK AT THE VARIOUS WAYS TO DO THIS.

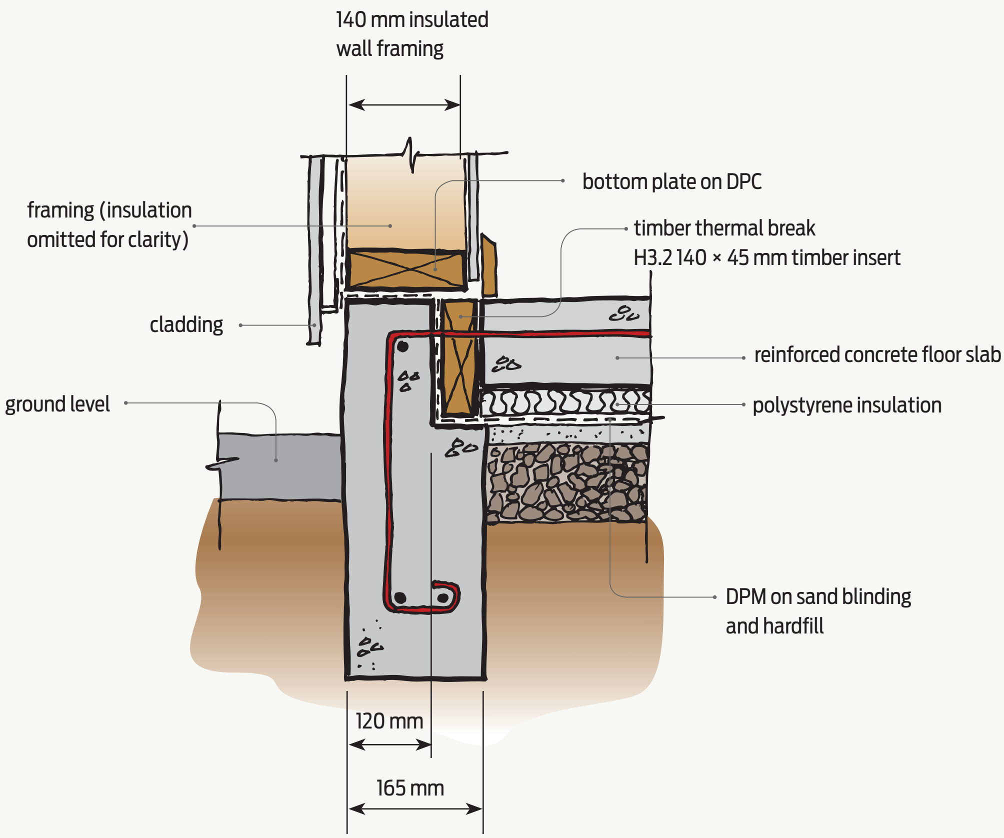

Figure 1 **Floor slab insulation – single storey.**

WHEN A CONCRETE FLOOR SLAB is insulated, the insulation is typically laid under the entire slab. However, modelling has shown that approximately 80% of the heat lost from a concrete floor slab is at the edge and that the thermal resistance does not significantly improve by fully extending the insulation under the slab or by increasing the thickness of the insulation under the slab (see *Build* 109, pages 28–29). This suggests that insulating slab edges is far more effective for preventing heat loss than insulating the underside of the slab.

Slab edge heat loss ratio

The amount of heat loss from the slab edges depends on the ratio of area (A) to perimeter length (P) of the slab. The higher the A/P ratio, the greater the thermal resistance of the slab.

Clause H1 requirements

Building Code clause H1 *Energy efficiency* requires a minimum R-value of R1.3 for floors, which is achieved by an uninsulated concrete slab on round. Under-slab insulation is only required by clause H1 when the floor is heated and an R-value of 1.9 is needed.

The BRANZ *House insulation guide* provides R-values for uninsulated concrete floor slabs with different A/P ratios. For example, a floor slab with a foundation width of 150 mm or more and an A/P ratio of 2.5 (for example, a 10 × 10 m slab where A/P (100/40) = 2.5), achieves the minimum floor R-value of R1.3 required by clause H1.

Insulation is better

Regardless of the Building Code requirements, installing perimeter under-slab and edge slab insulation in all concrete floors is good practice.

The two most commonly used options for slab edge insulation are:

- a thermal break between the slab and the perimeter footing (see Figure 1)
- insulation to the exterior face of the footing (see Figure 2).

Both options have some disadvantages, and continuity of insulation is essential to avoid thermal, or cold, bridging.

Adding thermal break between slab and footing

A thermal break between slab and footing can be achieved by inserting timber or polystyrene between the slab and the perimeter footing. Although polystyrene is a better insulating material than timber, it is vulnerable to point loads on the floor unless it is protected.

For all construction, the floor slab reinforcing must be tied to the footing reinforcing.

Beating the thermal bridges

The gaps where the thermal break is notched over the reinforcing provide a pathway or thermal bridge where heat loss can occur. To reduce the effect of thermal bridging, cut slots into the insulation to fit over the reinforcing and fill the slots with expanding foam (see Figure 3).

Heat loss may also occur between the wall plate and the edge of the floor (see Figure 4). In single-storey construction with 90 mm framing, a 165 mm wide footing and a 45 mm thick thermal break (see Figure 4a), there will be a 30 mm wide thermal bridge between the wall plate and the edge of the floor.

Similarly, if 140 mm framing is used in two-storey construction with a 200 mm thick footing (see Figure 4b), there will be a 15 mm

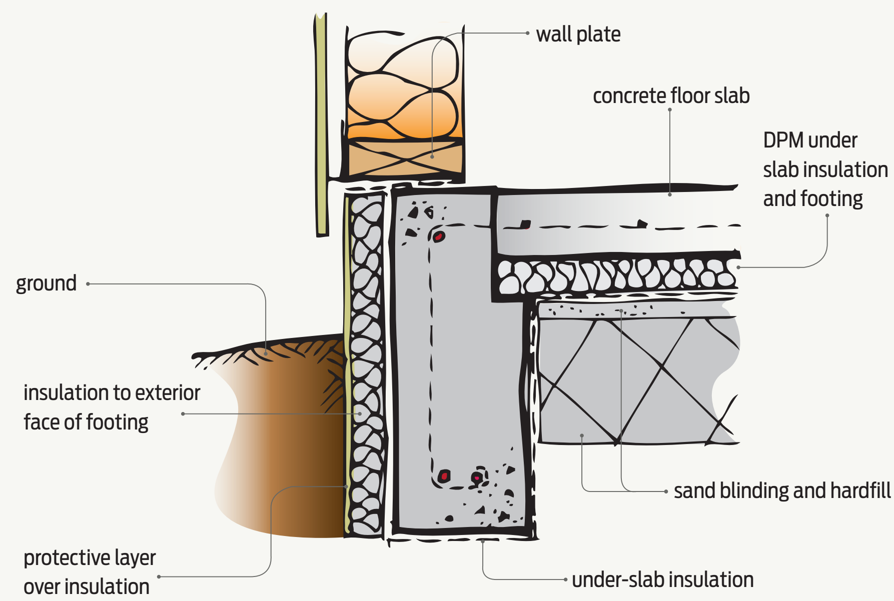

Figure 2 **Insulation to exterior face of footing.**

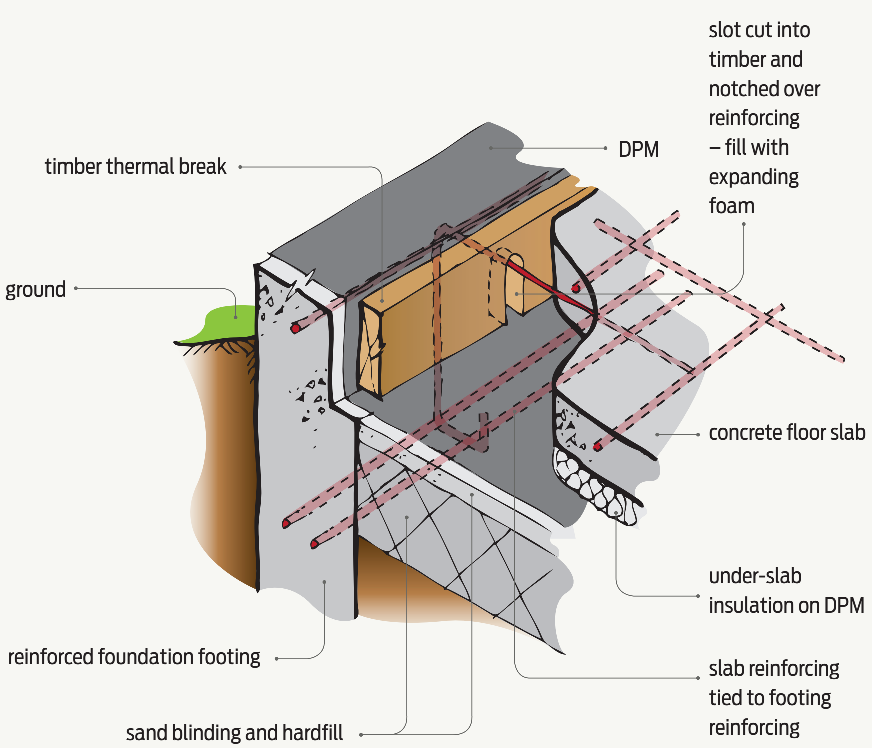

Figure 3 **Thermal break slotted and notched over reinforcing.**

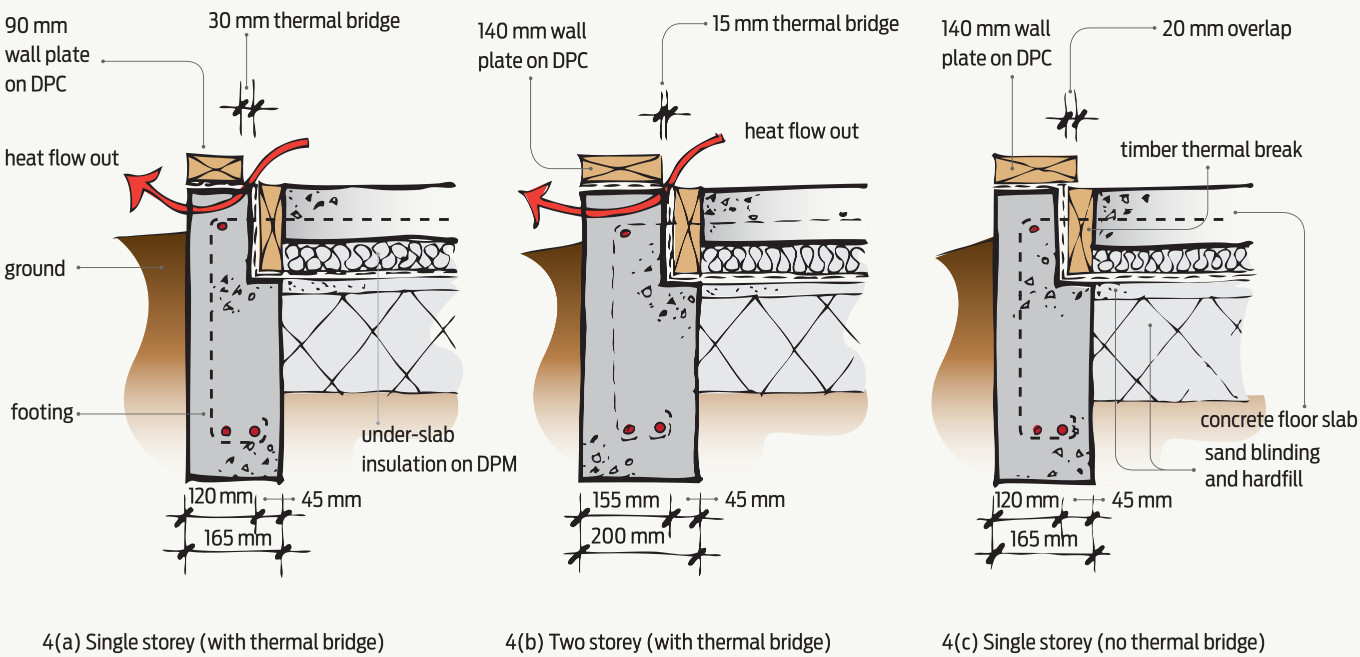

Figure 4 **Heat loss between wall plate and edge of floor.**

thermal bridge between wall plate and the edge of the floor.

The thermal bridges can be eliminated by using 140 mm framing for single-storey construction (see Figure 4c) or 190 mm framing for two-storey construction.

Insulating the footing's exterior face

Alternatively, insulating the exterior face of the footing eliminates the problem of thermal bridging. However, polystyrene is vulnerable to UV exposure and physical damage, and expanded polystyrene (EPS) can also absorb some water, reducing its insulation R-value.

Extruded polystyrene (XPS) should *always* be used for below-ground insulation. It's denser than EPS and therefore more water resistant and has a better level of thermal performance.

To protect the polystyrene from UV exposure and physical damage, it should be covered with an acrylic or cement-based plaster finish, low-absorbency ceramic tiles or extruded uPVC sheet. (Note that fibre-cement sheet should not be used in situations where it is continually wet.) If necessary, additional protection should be provided by fitting a purpose-made durable Z flashing under the cladding and over the insulation.

Insulating concrete formwork or polystyrene

Another option for slab edge insulation is to construct footings using insulating concrete formwork or polystyrene blocks.

The principal disadvantage of polystyrene block footings is that the blocks are manufactured from EPS polystyrene, which means the R-value may be compromised by the water uptake in the polystyrene. The external face of the footings must also be protected from UV exposure and physical damage.

Getting the required edge distances for the bottom plate fixings can be difficult with EPS foundation walls.

Secondary slab

A third option to address the issue of slab edge insulation, which is common overseas but seldom used in New Zealand, is to lay insulation over the structural slab, then place a 75 mm thick topping slab over the insulation. This readily achieves a complete thermal break between topping slab and structural slab.