DESIGN RIGHT

Down and dirty

Basements can be a handy part of any home. Ensuring they will be dry and warm throughout their life can be a significant challenge for both the designer and the builder.

BY TREVOR PRINGLE,
ANZIA, BRANZ PRINCIPAL WRITER

RESIDENTIAL BASEMENTS are common in houses built on sloping ground and can be valuable and useful spaces if they are dry and warm. In many cases, the use of a basement varies over time as household size, lifestyle and interests change.

In this article, we look at basement walls of residential buildings on sloping sites that are no more than 1 storey in height below natural ground and not subject to hydrostatic pressure.

Factors affecting basements

When designing or retrofitting basements, consider the:

- groundwater, which may:
  - be a free-flowing liquid
  - move by wicking (capillary flow)
  - move by diffusion through the soil or an unprotected or leaking basement wall
- slope
- ground conditions – rock, sand, loam
- proximity to adjacent structures, roadways or banks
- access for machinery
- removal of wastewater.

Significant challenges to address

Developing spaces below ground significantly increase the challenges for both the designer and the builder. It adds the need to ensure:

- groundwater is excluded
- excavated earth or sand banks are temporarily retained
- the work below natural ground can be carried out safely without risk to workers from collapse
- sufficient space is provided behind the wall to carry out essential tasks such as wall construction and damp-proofing

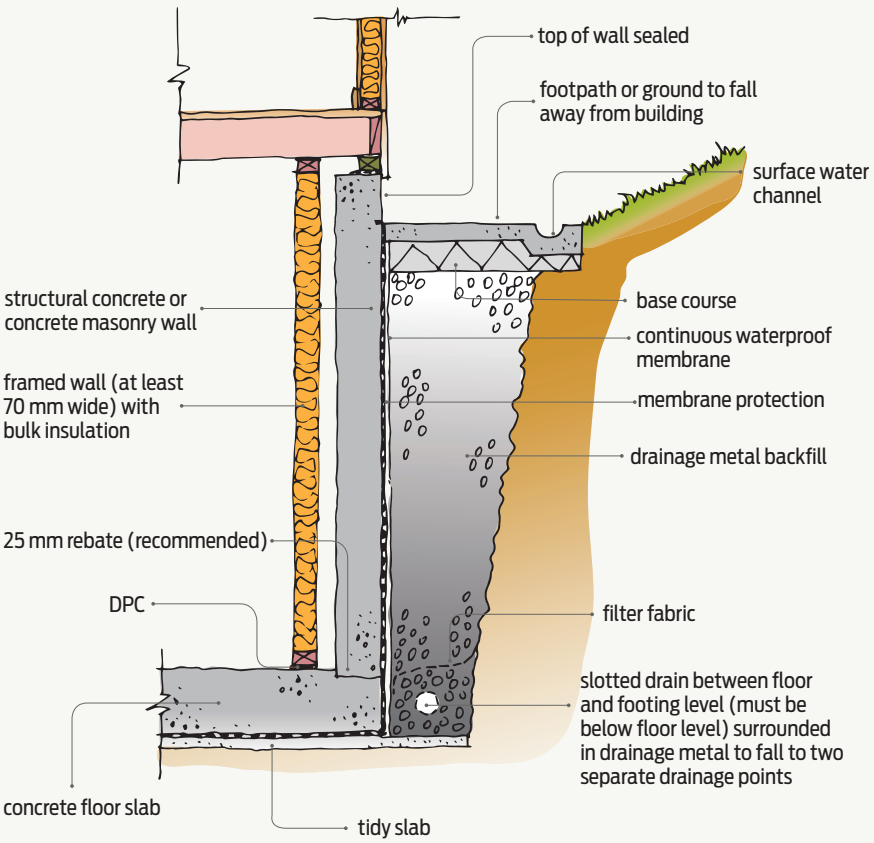

Figure 1 **Constructing an insulated framed wall inside the basement wall.**

- any hydrostatic pressure is managed – a wall subject to hydrostatic pressure requires a specifically designed tanking solution
- the complete wall has sufficient thermal insulation
- any surcharge applied to the wall (from adjacent foundations, driveways etc) is allowed for
- any services installed are well thought out, for example, a pumped system is typically required to lift waste to the council sewer lines.

Critical to get right first time

If we don't get it right at design and during construction, any leaks through basement walls are likely to be extremely difficult and expensive to repair.

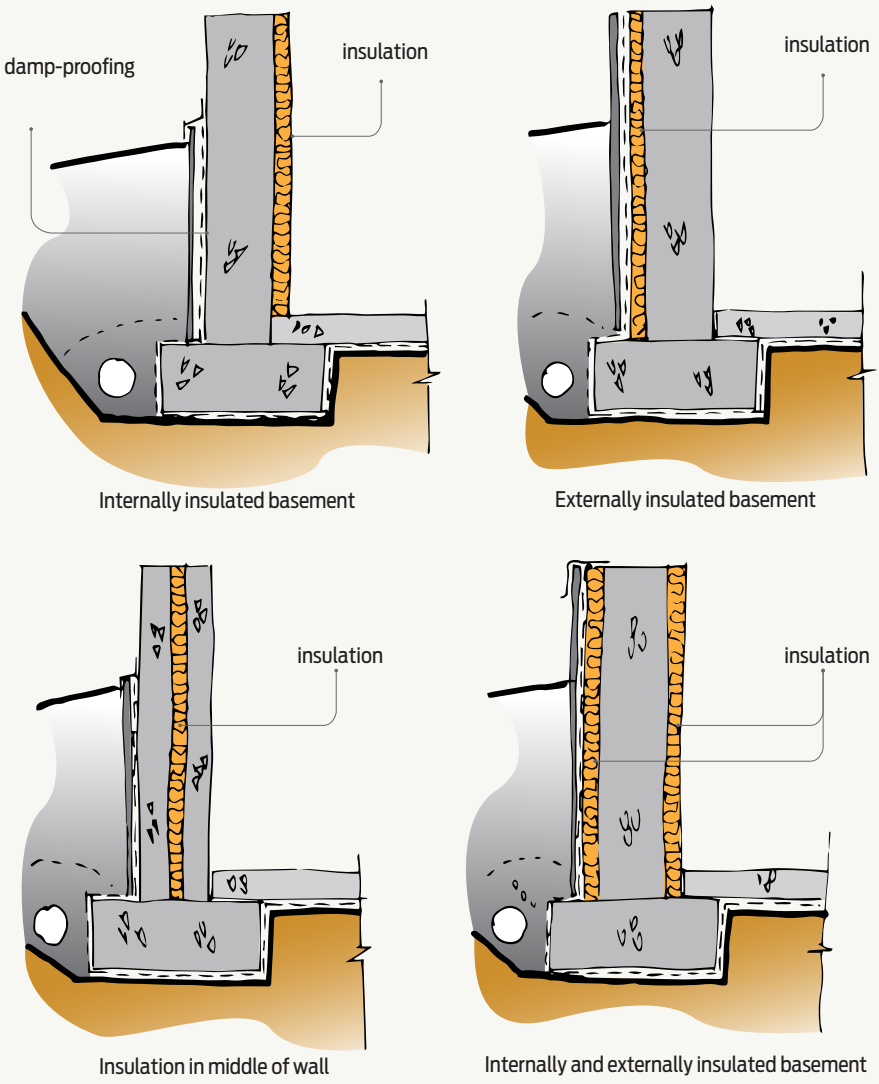

Figure 2 **Insulation options for a concrete or concrete masonry wall.**

So what do we need to consider at the design stage and then on site?

Design considerations

If possible, provide a separation between the excavated bank and the basement wall. This will make it easier to keep the wall dry, and the wall can then be constructed using timber framing.

Always check the potential stability of the excavated bank.

Where the wall retains the soil:

- drainage must be provided behind the wall and located below the level of an adjacent floor
- the wall must be damp-proofed
- the damp-proofing must be integral with that of the slab.

Damp-proofing needs 50-year durability

Clearly specify the damp-proofing system. Check that the specified system is suitable for the situation and substrate and that the damp-proofing membrane is sufficiently durable. Under clause B2 *Durability,* the damp-proofing must remain durable for not less than 50 years.

Options include:

- liquid-applied bituminous coatings — brushed, rolled or sprayed on:
  - epoxy
  - bitumen emulsion
  - polyurethane
  - torch-on modified bitumen sheet
- self-adhesive modified or rubberised bitumen or asphalt sheet with self-adhering laps
- trowel or spray-applied cementitious (sometimes resin-modified) slurry.

Integrate the under-slab damp-proofing with the wall damp-proofing.

Get the thermal insulation right

Detail how the required level of thermal insulation will be achieved. Options are to:

- construct a 70 mm minimum wide framed wall on the inside of the masonry wall (see Figure 1)
- install 50 mm minimum thickness polystyrene over the wall before the installation of a base sheet and the damp-proofing.

There are a few guidelines when considering thermal insulation in basement walls (see Figure 2):

- Interior insulation is the most common and least expensive but has the most moisture problems.
- Exterior insulation is best from a physics perspective. There are practical problems with protection, thermal bridging and insects that often make it impractical and ➤

more expensive to use. The key is to ensure the insulation is protected during construction and then protected and kept dry during its service life. The cost of a protection layer is often more expensive than the insulation itself.

- Insulation in the middle of the wall is the most expensive approach. It has fewer moisture and insect problems but is the most difficult to construct.
- Insulation on both sides has similar problems to the exterior insulation approach with the additional cost of the interior layer.

Always avoid significant thermal bridges (see Figure 3).

At construction stage

During construction, ensure:

- the installation instructions are to hand and followed
- the work area and particularly all surfaces being waterproofed remain as clean and as dry as possible
- quality control is maintained during installation
- completed damp-proofing is protected from damage before and during backfilling.

Damp-proofing needs consent

There are no solutions given in Acceptable Solution E2/AS1, so all damp-proofing systems for basement walls need to be submitted for consent as an alternative method.

However, an Acceptable Solution for basement waterproofing details is given in Appendix A of NZS 4229:2013 *Concrete masonry buildings not requiring specific engineering design*.

Repairing existing walls

For existing walls that are letting in water, the options are to:

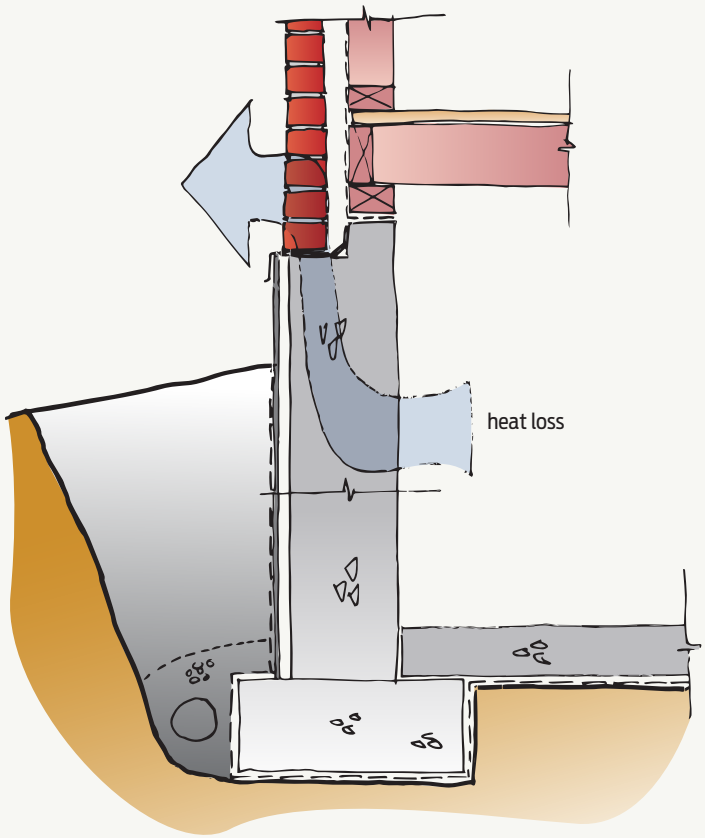

Figure 3 **Thermal bridge with brick veneer.**

- add surface water interceptor drainage channels around the outer perimeter of the wall if this is possible
- excavate behind the wall, clean and reapply damp-proofing
- apply a proprietary solution to the inside of the wall (the success rate with such repairs is variable)
- build a new wall on the inside of the existing and incorporate drainage, a sump and a pump within the void space to remove the water coming through the wall.

For more More information on repairing existing leaking basements is given in BRANZ Good Repair Guide *Leaking Basement Walls* available from www.branz.co.nz/shop.