

SLAB EDGE DAMPNESS and Moisture Ingress

GENERAL

The majority of houses incorporating well-constructed and well-detailed concrete slabs and footings experience no problems with slab edge dampness. Where problems do occur, there may be one or more of several causes. A thorough investigation is required to determine the most appropriate course of action to rectify the problem.

Most slab edges are occasionally damp due to rain, garden watering or by contact with the ground. In some cases this dampness is able to permeate from the outside to the inside and affect the internal walls and/or finishes such as the floor coverings.

Preventative measures are far more effective than facing the often difficult and costly repairs required to remedy problems caused by slab edge dampness and moisture ingress.

This data sheet explains why slab edge dampness occurs and provides recommendations to reduce the risk of moisture ingress and thus avoid the associated problems.

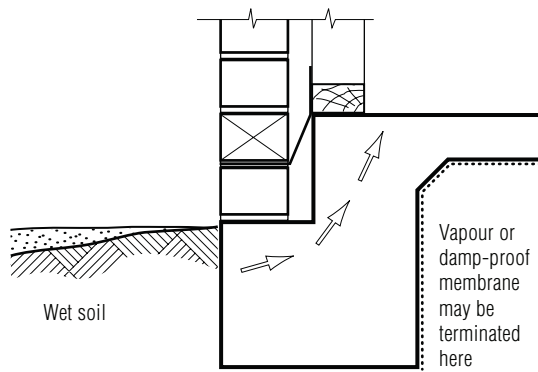
INDICATIONS OF SLAB EDGE DAMPNESS

The initial indication of a problem is usually persistent dampness of the exposed face of the concrete slab/footing, often resulting in associated efflorescence (a build up of a white coloured powdery substance) below the damp-proof course (DPC). It may also result in the development of:

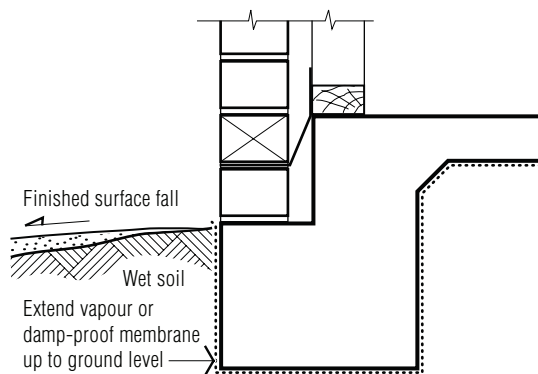
- pungent odours in floor coverings ie damp carpets;
- watermark stains on wall linings and/or joinery;
- mould growth;
- rusting, surface corrosion or oxidisation of metal near or adjacent to the edge of the slab/footing;
- loss of bond of adjacent wall and floor tiles;
- external paint blistering/peeling below the DPC;
- delaminating (drummy) render below the DPC.



THE INITIAL INDICATION of a problem is usually persistent dampness of the exposed face of the concrete slab/footing.



(a) NOT RECOMMENDED – SLAB EDGE IN DIRECT CONTACT WITH SOIL



(b) RECOMMENDED – EXTEND VAPOUR BARRIER TO GROUND LEVEL

Figure 1: Slab edge dampness caused by contact with the wet soil

WHY SLAB EDGE DAMPNESS OCCURS

Moisture is absorbed into concrete by capillary suction through the minute pores or air voids within the concrete. Generally, for concrete exposed to intermittent wetting, only the surface layer is affected. Prolonged exposure to a source of moisture, combined with poor quality concrete is the usual cause of slab edge dampness and moisture ingress.

Problems may not become evident for some time after construction (often when the house is occupied) possibly due to factors such as abnormally dry weather conditions during building. Also, problems may be caused by post-construction landscaping or stormwater alterations that inadvertently change the site drainage conditions. These may include installation of garden beds or paving above the level of the damp-proof course, flashing or bottom of the cavity within the external wall.

Four major factors give rise to the conditions that promote slab edge dampness and moisture ingress. Acting either in isolation or, more typically, in combination, viz:

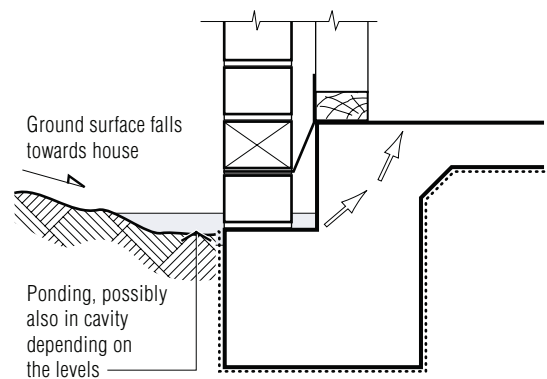
- The concrete slab/footing is in direct contact with the soil, providing a possible source of moisture.
- The concrete slab/footing has been poorly constructed resulting in increased permeability, which allows water to penetrate more easily.

- Poor site drainage or stormwater discharge allowing water to pond against the slab/footing, or keeping the soil adjacent to the slab/footing wet.
- Inadequate detailing and/or installation of moisture barrier systems around the slab edge and external walls.

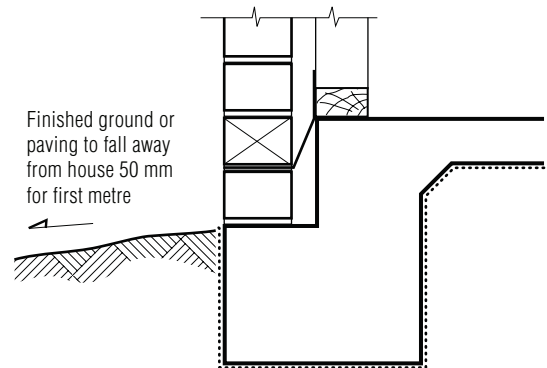
Figures 1 to 6 show the most common sources of moisture leading to slab edge dampness and moisture ingress. The figures also demonstrate good detailing practices that assist in preventing moisture ingress.

MOISTURE INGRESS

The Building Code of Australia (BCA) requires that houses 'be constructed to provide resistance to moisture from the outside and moisture rising from the ground'. While requirements for stormwater and subsoil drainage are given, other factors may also impact on the ability of a type of construction to satisfy this performance requirement. For example with single-leaf walling systems, moisture may not need to travel as far to affect the walling materials or internal finishes.

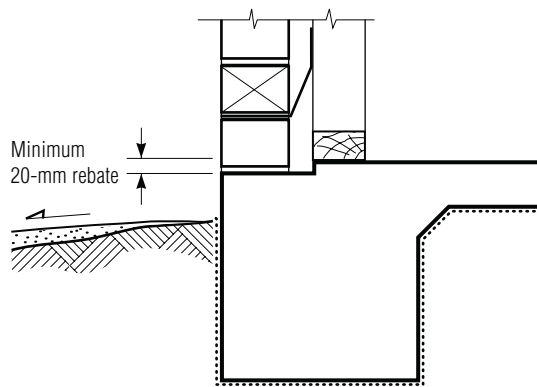


(a) NOT RECOMMENDED – INADEQUATE DRAINAGE

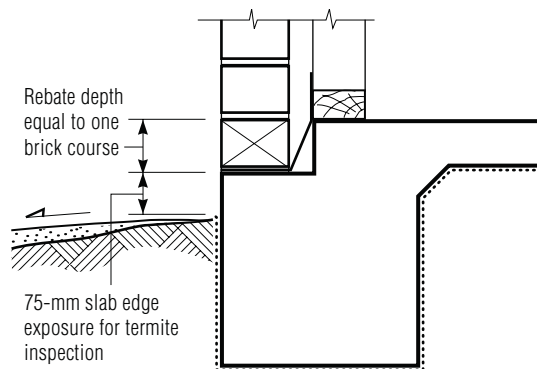


(b) RECOMMENDED – FREE-DRAINING CAVITY AND SURROUNDS

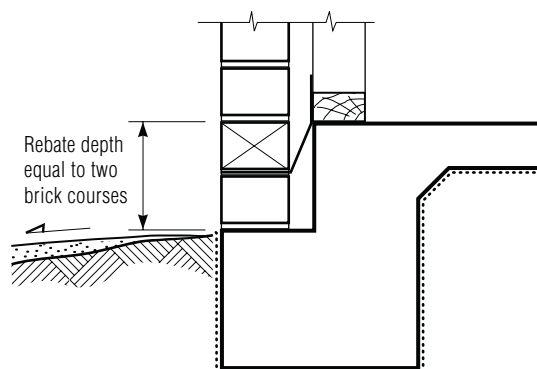
Figure 2: Slab edge dampness caused by water ponding against footing



(a) MINIMUM REQUIREMENT – FOR SLAB EDGE EXPOSURE



(b) RECOMMENDED – FOR SLAB-EDGE EXPOSURE



(c) RECOMMENDED – FOR NO SLAB-EDGE EXPOSURE

Figure 3: Slab edge rebate details

The following conditions could lead to moisture ingress and should be avoided to ensure that the BCA requirements are satisfied.

Moisture ingress from below the DPC/flashing and migrating through the concrete, can be attributed to one or more of the following:

- Overall poor site drainage, especially areas adjacent to walls and with insufficient fall away from the building **Figure 2 (a)**.
- Soils such as clays which retain moisture and/or draw moisture up from below **Figure 1 (a)**.

- Leaking downpipes or plumbing services. Note that in highly and extremely reactive clay sites, stormwater drains should be provided with flexible connections to avoid breakage (from ground movement) and leakage adjacent to walls.
- Changes to surface water flow due to landscaping and gardening or as a result of construction on a neighbouring property **Figure 5 (b)**.
- Over-watering adjacent to the slab/footing.
- Plant roots blocking stormwater outlets.

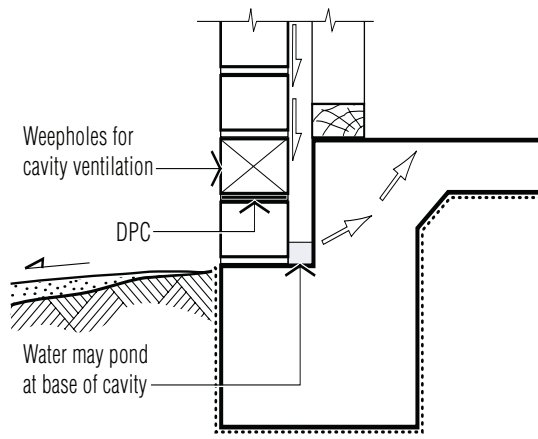
Moisture ingress above the DPC/flashing which is not fully discharged from the cavity for one or more of the following reasons:

Note that the BCA requires the DPC or flashing serving as a DPC to be located a minimum distance above the adjacent ground or paving level

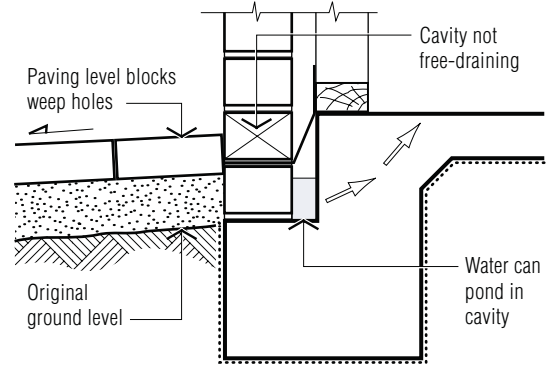
- Overly porous masonry construction exposed to high rainfall (exacerbated by inadequate or no eaves overhang) allowing moisture penetration that exceeds the capacity of the discharge system, ie flashing and weep holes.
- Lack of effective flashing in the cavity to direct moisture to weep holes for discharge **Figure 4 (a)**.
- Inappropriate, damaged or inadequately installed DPC.
- Inadequate drainage and ventilation of the cavity through blocked or non-existent weep holes **Figure 4 (c)**.
- Excess mortar from masonry construction, which has not been cleaned out of the cavity or from above the flashing **Figure 4 (c)**.
- Poorly installed brick ties which direct moisture inward.
- Poorly installed roofing and flashings permitting moisture entry that exceeds the capacity of the discharge system.
- Leaking downpipes or plumbing services.

Construction Issues Adequate planning and good construction practices should prevent slab edge dampness and moisture ingress in the majority of cases. The following measures are recommended:

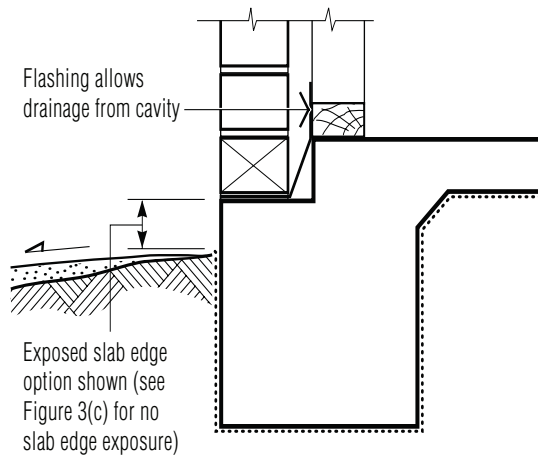
- Ensure that the finished slab level complies with the relevant building regulations.
- Ensure adequate drainage of water at the base of the cut, in cut-and-fill situations.
- Ensure no excess water is added to the concrete at the time of placing. Excess water produces a more permeable and less-durable concrete.
- Ensure adequate compaction of the concrete. This reduces the amount of air voids within the concrete and hence the permeability.
- Ensure adequate curing of the concrete. This will decrease the permeability near the surface and also the risk of cracking, reducing direct access for moisture.



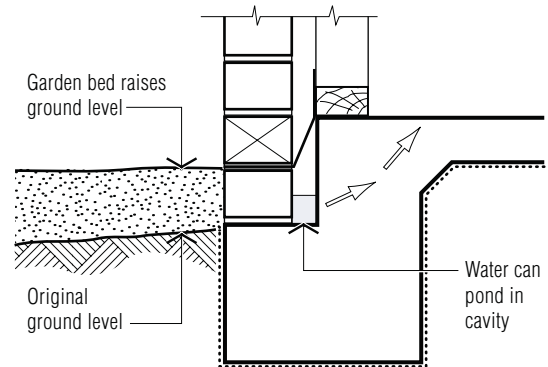
(a) NOT RECOMMENDED – NO FLASHING



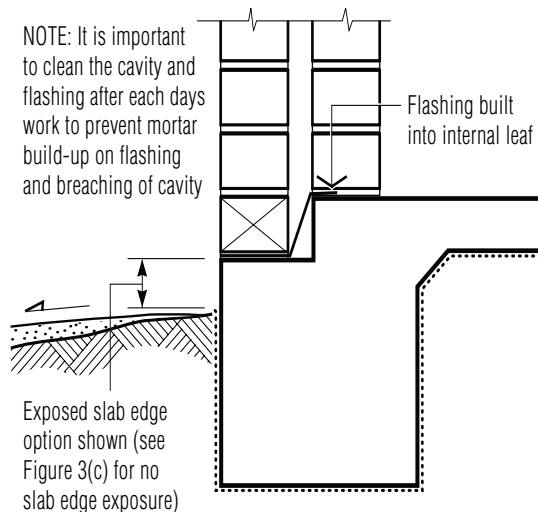
(a) NOT RECOMMENDED – INADEQUATE CAVITY DRAINAGE DUE TO RAISED PAVING LEVEL



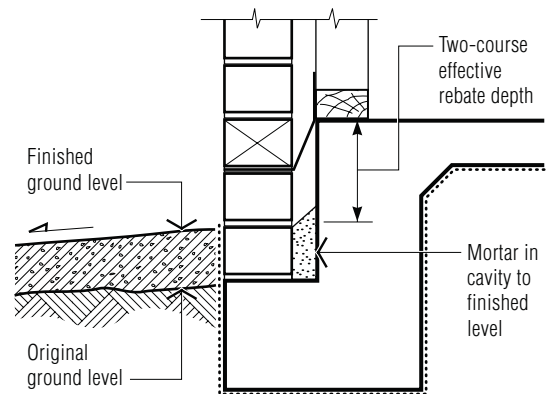
(b) RECOMMENDED – FOR BRICK VENEER



(b) NOT RECOMMENDED – INADEQUATE CAVITY DRAINAGE DUE TO RAISED GARDEN BED



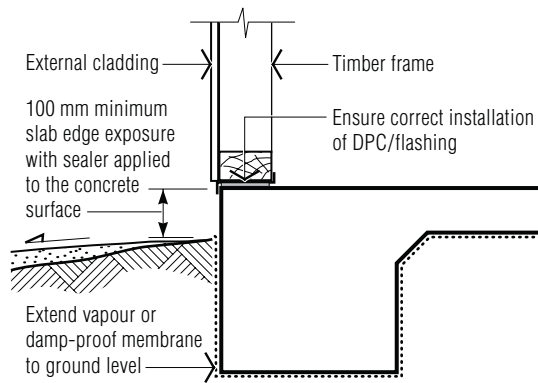
(c) RECOMMENDED – FOR FULL MASONRY



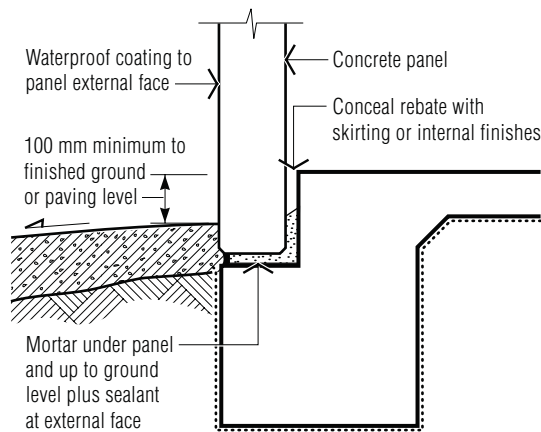
(c) RECOMMENDED – MORTAR-FILLED CAVITY TO FINISHED GROUND LEVEL

Figure 4: Moisture ingress and flashing

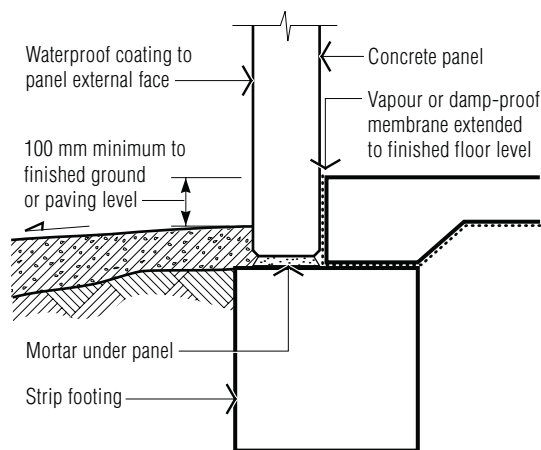
Figure 5: Slab edge dampness/moisture ingress related to changes in ground levels



(a) RECOMMENDED – FOR CLAD FRAME



(b) RECOMMENDED – FOR CONCRETE PANEL WALLS ON STIFFENED RAFT FOOTING



(c) RECOMMENDED – FOR CONCRETE PANEL WALLS ON STRIP FOOTING

Figure 6: Details for single-leaf (concrete panel) walling to minimise moisture ingress

- Ensure the face of the slab/footing is smooth and unable to retain water.
- Ensure a granular, well-draining fill is used under the slab to prevent the rise of moisture.
- Ensure any voids left from the removal of formwork pegs are adequately filled to avoid pockets which can retain water.
- Ensure sub-surface drains are free draining and able to be inspected and maintained
- Ensure plumbing trenches slope away from the house so as not to direct moisture towards the footings. For the same reason, they should also be backfilled with non-granular material.
- Ensure vapour or damp-proof membrane is correctly installed and lapped, and protected during construction to avoid damage.
- Ensure that the ground behind steps in slabs is properly drained and a damp-proof membrane is provided.

Post-Construction Issues The provision of paths, driveways, patios, turf and other landscaping features like garden beds after the house is occupied should be undertaken in such a way as not to cause moisture ingress. With all these items it is essential to direct surface stormwater and subsoil water away from the slab/footing to ensure no water build up occurs around the house. The following measures are recommended to avoid moisture build up against the footing:

- Provide adequate falls to all surfaces surrounding the house (including paths, driveways, other paved areas, turf, etc) to direct water runoff away from the slab/footing. Both the BCA and the Australian Standard for residential slabs and footings, AS 2870, require a minimum fall of 50 mm over the first metre width adjacent to the house. **Figure 2 (b).**
- Do not raise the adjacent ground level above the DPC and/or flashing level **Figure 5 (a) and (b).**
- If the ground level is above the edge of the slab/footing, always mortar fill the cavity up to ground level so that moisture in the cavity can drain freely **Figure 5 (c).**

RECOMMENDATIONS

All aspects of planning, site excavation, construction and post-construction landscaping must be considered to minimise the risk of slab edge dampness and moisture ingress. The following measures are recommended:

- Cut the site with adequate falls away from the building and to the drainage system to avoid water ponding adjacent to the house, or the soil becoming waterlogged.

- Always provide a rebate at the slab edge. If 75 mm of the slab edge is exposed as part of the termite barrier system, a one-brick-course-deep rebate is satisfactory. If the ground level is at the base of the brickwork to conceal the slab edge, then a two-course-deep rebate is recommended **Figure 3**.
- Avoid damage to the vapour or damp-proof membrane, DPC and/or flashing during construction.
- Extend the membrane around the perimeter footing and up to ground level **Figure 1**.
- Use granular, free-draining fill under the slab to prevent moisture reaching the vapour barrier.
- Ensure edge forms are firmly secured to the subgrade to facilitate thorough compaction of the concrete.
- Adequately compact all concrete elements to reduce air voids.
- Do not add water to the concrete on site as this may increase cracking and lead to a less durable concrete.
- Adequately cure the concrete for at least 3 days to improve its performance. Leaving the edge formwork in place or extending the plastic vapour barrier up to the top edge are satisfactory ways of curing the slab edge.
- Consider using a higher strength concrete, adequate compaction and curing to reduce the permeability of the concrete, especially with single-leaf walling systems where a shorter distance to internal finishes may exist.
- Install sufficient downpipes and stormwater drainage to reduce possible overflow of gutters adjacent to walls.
- Consider applying a waterproofing compound to the slab edge below the DPC for additional protection (if the plastic membrane has not been extended up to the ground level).
- Do not raise the level of the outside ground above the recommended heights and ensure weep holes, DPCs and flashings are not covered **Figure 5**.
- Ensure adequate falls away from the slab/footing for all subsequently constructed paved areas.

FURTHER INFORMATION

- AS 2870 *Residential Slabs and Footing*, Standards Australia, 1996.
- *The Housing Concrete Handbook*, Cement & Concrete Association of Australia, 2000.
- *Guide to Residential Floors*, Cement & Concrete Association of Australia, 2003.
- *Slab Edge Dampness*, Current Practice Note 30, Concrete Institute of Australia, 1998.
- *BCA Class 1 and 10 Buildings – Housing Provisions*, 2004

CCAA OFFICES

SYDNEY OFFICE:

Level 6, 504 Pacific Highway
St Leonards NSW Australia 2065

POSTAL ADDRESS:

Locked Bag 2010
St Leonards NSW 1590

TELEPHONE: (61 2) 9437 9711

FACSIMILE: (61 2) 9437 9470

BRISBANE OFFICE:

Level 14, IBM Building
348 Edward Street
Brisbane QLD 4000

TELEPHONE: (61 7) 3831 3288

FACSIMILE: (61 7) 3839 6005

MELBOURNE OFFICE:

2nd Floor, 1 Hobson Street
South Yarra VIC 3141

TELEPHONE: (61 3) 9825 0200

FACSIMILE: (61 3) 9825 0222

PERTH OFFICE:

45 Ventnor Avenue
West Perth WA 6005

TELEPHONE: (61 8) 9389 4452

FACSIMILE: (61 8) 9389 4451

ADELAIDE OFFICE:

Greenhill Executive Suites
213 Greenhill Road
Eastwood SA 5063

POSTAL ADDRESS:

PO Box 229
Fullarton SA 5063

TELEPHONE: (61 8) 8274 3758

FACSIMILE: (61 8) 8373 7210

EXTRACTIVE INDUSTRIES OFFICE

PO Box 243
Henley Beach SA 5022

TELEPHONE: (61 8) 8353 8151

FACSIMILE: (61 8) 8353 8151

TASMANIAN OFFICE:

EXTRACTIVE INDUSTRIES OFFICE
PO Box 246
Sheffield TAS 7306

TELEPHONE: (61 3) 6491 2529

FACSIMILE: (61 3) 6491 2529

WEBSITE: www.concrete.net.au

EMAIL: info@ccaa.com.au

LAYOUT: Helen Rix Design

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